The relationship between social media use and adolescent health-risk behaviours

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Abstract

Background: Social media may offer several benefits for adolescent development, including facilitating collaborative learning, communication and social relationships. Yet, concerns have been voiced over its impact on adolescent health-risk behaviours. Given existing inequalities in health-risk behaviours, understanding how social media's effects may differ across socioeconomic groups and may influence inequalities is required. This thesis, therefore, explores the potential impact of social media on health-risk behaviours and associated inequalities.

Methods: Following an essay exploring social media's role as a determinant of health (Chapter 3), a systematic review investigated the relationship between social media use (frequency of use, time spent and exposure to health-risk behaviour content) and adolescent health-risk behaviours (Chapter 4). The longitudinal relationship between time spent on social media and adolescent cigarette use, e-cigarette use, dual use (Chapter 5), and alcohol use and binge drinking (Chapter 6) was then investigated using the UK Millennium Cohort Study, with effect modification by parental education also assessed.

Results: Social media offers several benefits for adolescent health, but its increasing marketing of unhealthy commodities and ability to spread dis/misinformation can undermine public health messages. The systematic review found social media use is adversely associated with alcohol, drug, tobacco, e-cigarette use, gambling, sexual risk, anti-social, unhealthy dietary and multiple risk behaviours, with limited subgroup analysis by socioeconomic circumstances. Millennium Cohort Study analyses demonstrated time spent on social media was associated with increased risk of cigarette use, e-cigarette use, dual use, alcohol use and binge drinking in a dose-response manner. Adolescents with highly educated parents had a larger absolute risk difference for cigarette use and binge drinking than adolescents of less educated parents.

Conclusions: Risk-taking behaviours and arguably, social media use are now inherent parts of adolescence. Social media's ability to promote adolescent health-risk behaviours past the point of experimentation strengthens calls for guidance and legislation securing adolescent online safety, which includes improved regulation of social media content displaying health-risk behaviours.

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Publications and other outputs

The following publications (either provisionally accepted, under peer-review or submitted), conference presentations, statistical analysis plan, and review protocols have resulted from the research described in this thesis. My specific contribution to each element of the project is described in detail on pages 14-15.

Publications

Purba AK, Pearce A, Henderson M, McKee M, Katikireddi SV (2023) Social media as a determinant of health. *The BMJ* (under submission)

Purba AK, Thomson R, Henery P, Pearce A, Henderson M, Katikireddi SV (2023) Social media use and adolescent health-risk behaviours: A systematic review and meta-analysis. *The BMJ* (provisionally accepted, subject to minor revisions)

Purba AK, Thomson R, Henery P, Pearce A, Henderson M, Katikireddi SV (2023) Social media use and adolescent health-risk behaviours: A systematic review and meta-analysis. *medRviv (Preprint)*. DOI: 10.1101/2023.02.24.23286415

Purba AK, Henderson M, Baxter A, Pearce A, Katikireddi SV (2023) The relationship between time spent on social media and adolescent cigarette, e-cigarette, and dual use: A longitudinal analysis of the UK Millennium Cohort Study. *Tobacco Control* (under peer-review)

Purba AK, Henderson M, Baxter A, Katikireddi SV, Pearce A (2023) The relationship between time spent on social media and adolescent alcohol use: A longitudinal analysis of the UK Millennium Cohort Study. *Addiction* (under peer-review)

Conference presentations

Purba AK, Henderson M, Baxter A, Katikireddi SV, Pearce A. To what extent does time spent on social media influence adolescent alcohol use: A longitudinal analysis of the UK Millennium Cohort Study. *Society for Social Medicine and*

Population Health Annual Scientific Meeting and International Epidemiology Association European Congress of Epidemiology, 6th September 2023 (under submission)

Purba AK, Henderson M, Baxter A, Pearce A, Katikireddi SV. To what extent does time spent on social media influence adolescent cigarette, e-cigarette, and dual use: A longitudinal analysis of the UK Millennium Cohort Study. *University College London, Centre for Longitudinal Studies, Children of the Noughties Conference,* 13th June 2023

Purba AK, Henderson M, Baxter A, Pearce A, Katikireddi SV. To what extent does time spent on social media influence adolescent cigarette, e-cigarette, and dual use: A longitudinal analysis of the UK Millennium Cohort Study. *UK Lancet Public Health Science,* 25th November 2022

Purba AK, Henery PM, Thomson RM, Pearce A, Henderson M, Katikireddi SV. Social media use and adolescent engagement in health-risk behaviours: A systematic review and meta-analysis. *UK Lancet Public Health Science*, 26th November 2021

Purba AK, Henery PM, Thomson RM, Pearce A, Henderson M, Katikireddi SV. Does social media influence adolescent engagement in health-risk behaviours? Findings from a systematic review. *Society for Social Medicine and Population Health Annual Scientific Meeting and International Epidemiology Association European Congress of Epidemiology,* 16th September 2021

Purba AK, Henery PM, Thomson RM, Pearce A, Henderson M, Katikireddi SV. Does social media influence adolescent engagement in health-risk behaviours? Findings from a systematic review. *Sheffield Alcohol Research Group Early Career Alcohol Research,* 7th July 2021

Statistical analysis plan

Purba AK, Henderson M, Baxter A, Pearce A, Katikireddi SV (2022) To what extent does time spent on social media influence adolescent cigarette, e-

cigarette, and alcohol use: A longitudinal analysis of the UK Millennium Cohort Study. *Open Science Framework (OSF)*. Available from: https://osf.io/ytkbz/

Systematic review protocols

Purba AK, Henery PH, Thomson RM, Pearce A, Henderson M, Katikireddi SV (2020) Does social media influence adolescent engagement in health-risk behaviours? A protocol for a systematic review and meta-analysis. International Prospective Register of Systematic Reviews (PROSPERO) Identifier (ID): CRD42020179766). Available from: www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020179766

Purba AK, Henery PM, Thomson RM, Pearce A, Henderson M, Katikireddi SV (2020) Does social media influence adolescent engagement in health-risk behaviours? A protocol for a systematic review and meta-analysis. Available from: https://www.gla.ac.uk/media/Media_718614_smxx.pdf

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The work submitted in this thesis and my general thinking about the research topic have benefited considerably from collaboration with several researchers whom I would like to thank for their thought-provoking insights, advice, time and patience.

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Author's declaration

I declare that I am the sole author of this thesis, except where the contribution of others has been acknowledged, as below. The work in this thesis has not been submitted in any form for another degree or professional qualification at The University of Glasgow or any other institution.

Contribution statements

Chapter 3

I was responsible for conceptualising and developing the essay (with support from S. Vittal Katikireddi and Martin McKee); reviewing existing literature; defining the scope; and leading the interpretation, with input from co-authors (Anna Pearce, Marion Henderson, Martin McKee and S. Vittal Katikireddi). In addition, co-authors provided feedback on the essay during the preparation of the manuscript.

Chapter 4

I was responsible for conceptualising and developing the research question, writing the first draft of the protocol, and revising the protocol after feedback from co-authors. I liaised with information specialist Valerie Wells to develop and implement search strategies and co-ordinated screening of titles/abstracts and full-texts by myself and co-authors (Rachel Thomson, Paul Henery, Anna Pearce, Marion Henderson, and S. Vittal Katikireddi). I undertook data extraction and risk of bias (RoB) assessments for all studies, and co-authors independently assessed RoB and checked data extraction. Hilary Thomson and Michele Hilton Boon (members of the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) Public Health Group) supported the adaptation of the Newcastle Ottawa Scale (NOS) for cross-sectional and cohort studies to incorporate insights from the Cochrane Risk of Bias in Non-randomised studies (ROBINS-I) tool and provided guidance on the use of GRADE. I completed narrative synthesis and meta-analysis and wrote the first draft of the manuscript. Co-authors and advisory group members contributed to protocol development and provided feedback on the interpretation of results and

appropriate dissemination. Co-authors additionally contributed to revising the manuscript and responding to reviewers' comments.

Chapters 5 and 6

I was responsible for conceptualising, designing and developing these studies (with support from Anna Pearce, S. Vittal Katikireddi and Marion Henderson), data access, and drafting the statistical analysis plan with feedback from co-authors and advisory group members. I undertook all data cleaning and analyses. Anna Pearce and Andrew Baxter reviewed the analyses and analytical code. All co-authors and advisory group members assisted with the interpretation of results. I drafted the two manuscripts and revised them following feedback from co-authors. Co-authors and advisory group members provided input on the appropriate dissemination of findings.

Competing interests

I, Amrit Kaur Purba, have no competing interests to declare.

Acronyms and abbreviations

AIDS	Acquired immunodeficiency syndrome
AMSTAR	Assessing the Methodological Quality of Systematic Reviews
AOR	Adjusted odds ratio
APA	American Psychological Association
ARD	Adjusted risk difference
ARR	Adjusted risk ratio
ARRR	Adjusted relative risk ratio
ASA24	Automated Self-Administered Dietary Assessment Tool
AUDIT-C	Alcohol Use Disorders Identification Test
AVG	Average
BAS	British Ability Scales
BBM	Blackberry Messenger
BMI	Body mass index
CAGI/GPSS	Gambling Problem Severity Subscale of the Canadian Adolescent Gambling Index
CAT	Categorical
CDC	Centers for Disease Control and Prevention
CGT	Cambridge Gambling Task

CI	Confidence interval
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CONT	Continuous
COVID	Coronavirus disease
DAG	Directed acyclic graph
DALY	Disability-adjusted life years
DESC	Descriptive
DSM-IV-MR-J	Diagnostic and Statistical Manual of Mental Disorders-IV-Multiple Response- Adapted for Juveniles (assessment of adolescent gambling)
EMBASE	Excerpta Medica Database
ENDS	Electronic nicotine delivery system(s)
ESP	Spain
EXCL	Excluding
FANTA	Food and Nutrition Technical Assistance 2016 version of the woman's minimum dietary diversity measurement tool
FCTC	Framework Convention on Tobacco Control
FIN	Finland
FoMO	Fear of missing out
FREQ	Frequency

FU	Follow-up
GCSE	General Certificate of Secondary Education
GRADE	Grading of Recommendations, Assessment, Development and Evaluations
GYTS	Global Youth Tobacco Survey
HBSC	Health Behaviour in School Aged Children
HEI	Healthy Eating Index
HH	Household
HIC/s	High-income country/countries
HIV	Human immunodeficiency virus
HR/s	Hour/s
ICMJE	International Committee of Medical Journal Editors
ID	Identifier
INCL	Including
IM	Instant messaging
IMD	Indices of Multiple Deprivation (England Index of Multiple Deprivation (IMD), Northern Ireland Multiple Deprivation Measure (IMD), Wales Index of Multiple Deprivation (WIMD) and Scottish Index of Multiple Deprivation (SIMD))
ISCED	International Standard Classification of Education

KOR	South Korea
LGBTQ+	Lesbian, gay, bisexual, transgender, queer +
LMIC/s	Low-middle income country/countries
MARKETER-GEN	Marketer-generated
MCS	Millennium Cohort Study
MEDLINE	Medical Literature Analysis and Retrieval System Online
MIN/s	Minute/s
N/n	Number of study participants
NA	Not applicable
NCD	Non-communicable disease
NHS	National Health Service
NOS	Newcastle Ottawa Scale
NR	Not reported
NS-SEC	The National Statistics Socio-economic Classification
NVQ	National Vocational Qualification
OECD	Organisation for Economic Co-operation and Development
ONS	Office for National Statistics
OR	Odds ratio

OSF	Open Science Framework
PAQ-C/A	Physical Activity Questionnaire for Children and Adolescents
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO	The International Prospective Register of Systematic Reviews
RCS	Repeat cross-sectional study
RCT	Randomised control trial
RD	Risk difference
REF	Reference category
RERI	Relative excess risk due to interaction
RO	Research objective
RoB	Risk of bias
RoB-2	Cochrane Risk of Bias Tool for Randomised Trials
ROBINS-E	Cochrane Risk of Bias in Non-randomised Studies of Exposures
ROBINS-I	Cochrane Risk of Bias in Non-randomised Studies of Interventions
RR	Risk ratio
RRR	Relative risk ratio

SBS	Sexting Behaviour Scale
SD	Standard deviation
SDQ	Strengths and Difficulties Questionnaire
SEC/s	Socioeconomic circumstance/s
SM	Social media
SMD	Standardised mean difference
SNS	Social networking sites
SPHSU	Social and Public Health Sciences Unit
SOGS-RA	South Oaks Gambling Screen-Revised for Adolescents
SSRN	Social Science Research Network
STD	Sexually transmitted disease
STD.	Standardised
STI	Sexually transmitted infection
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
SWiM	Synthesis Without Meta-analysis
T	Timepoint
TV	Television
UK	United Kingdom

UN	United Nations
UNICEF	United Nations Children's Fund
US	United States of America
USER-GEN	User-generated
WHO	World Health Organisation
YRBSS	Youth Risk Behaviour Surveillance System
YSR	Youth Self-Report

Chapter 1 Introduction and structure of the thesis

1.1 Overview of chapter and a note on definitions

In this introductory chapter, I briefly describe the background of the project, including my background as a practitioner and prior work in public health. I then outline the project's origins and development over time before concluding with a guide to the overall thesis and its structure.

For this thesis, social media is defined as web-based services that enable the collaboration, connection, interaction and building of communities by facilitating the creation, co-creation, modification, sharing and engagement with user and marketer (including influencer) generated readily accessible content (Sloan and Quan-Haase, 2017). Section 2.3.2 provides a broader discussion on defining social media.

1.2 Background to the thesis

Globally, widespread concerns surrounding the harmful influence of traditional mass media on health-risk behaviours gave rise to a substantial body of evidence (Himmelweit, 1958; Wagoner, 1975; Liebert and Schwartzberg, 1977; McQuail, 1977). This evidence was used to inform the development of effective individual and population-level interventions aimed at reducing/countering these harmful effects (e.g., the United Kingdom (UK) watershed that was implemented to protect children from harmful content on the television/radio) (Ofcom, 2023).

As with traditional mass media, the advent of social media brought numerous concerns over its impact and ability to reshape population health. These concerns have prompted discussions around social media as a major determinant of health (as will be discussed in Chapter 3) and the role of policy in tackling any risks related to its use (Zenone *et al.*, 2022). For example, the UK Online Safety Bill (2023) (UK Parliament, 2023a), the European Commission's Digital Services Act (2022) (European Commission, 2022b) and the German Network Enforcement Act (2017) (German Bundestag, 2021) all aim to tackle aspects of social media considered harmful to health. These aspects include exposure to illegal content

and, in the case of the UK Online Safety Bill (2023), legal but 'harmful' content (e.g., content on self-harm).

Relative to adults who grew up with traditional mass media, today's adolescents have grown up in a social media saturated world. They, thus, are often the target audience of social media policy. This world is new, marks unchartered territory and evolves at a speed that research has, arguably, struggled to maintain pace with. Although social media can present multiple benefits to adolescent health (Reid and Weigle, 2014; Uhls *et al.*, 2017), concerns have been raised regarding social media's ability to influence adolescents' perceived norms surrounding health-risk behaviours and their implications for uptake (Vannucci *et al.*, 2020). These concerns extend to whether social media's potential influence on adolescent engagement in health-risk behaviours may differ across socioeconomic groups and potentially contribute to widening inequalities (Huang *et al.*, 2014; Livingstone *et al.*, 2017; Marino *et al.*, 2018).

This lack of understanding, partly due to the infancy of social media research, suggests that proposed and implemented policy may lack the high-quality, relevant, up-to-date information required to make evidence-informed decisions about adolescent social media use. There is a lack of systematic review evidence, and that which does exist relies largely on low-quality, cross-sectional studies, with early measures relying on umbrella measures of social media use, such as 'internet use' or 'screen time' (Stiglic and Viner, 2019; Orben, 2020; Vannucci *et al.*, 2020). The currently limited access to real-time objective data on social media use from social media corporations means that research is reliant on self-reported questionnaire measures of use (Orben, 2020). Importantly, evidence for causality remains limited (Stiglic and Viner, 2019; Orben, 2020; Vannucci *et al.*, 2020).

Collectively, all of these methodological limitations hinder the production of high-quality evidence and the implementation of effective policy action aimed at keeping adolescents safer online (Orben, 2020). Further, policy has not always supported efforts to increase understanding of social media's impacts on health. For example, within the UK Online Safety Bill (2023), a significant omission is the lack of mandated access to social media data for independent researchers and

auditors to investigate the health effects of social media use (UK Parliament, 2023a).

This thesis will critically evaluate the available evidence, identify gaps in current understanding and enrich these gaps with high-quality, targeted research. The primary aim is to better support decision-making and future research on adolescent social media use and health-risk behaviours.

1.3 Research motivation and journey

This section provides background to the original inspiration for this thesis and how it has developed over time.

At the start of the PhD (end of 2019), I made provisional plans to conduct public engagement activities with adolescents within school settings to inform the research. This was to ensure the adolescent voice was captured when setting thesis objectives alongside concerns raised by other relevant stakeholders (including policymakers, experts and academics). Unfortunately, this was not possible due to the COVID-19 (coronavirus disease 2019) pandemic; however, efforts were made to counter this, as described in Chapter 7.

The original plan for this PhD was to investigate the relationship between time spent on social media and one or more adolescent health-risk behaviours using the UK-representative Millennium Cohort Study (MCS), adopting causal methodology where possible. Prior to commencement, following a scoping search of the literature, I discovered no systematic review (completed or registered) which explicitly addressed this topic. Several reviews investigated college/university populations or the impact of 'screen time', 'internet use' or 'digital technology', but none explicitly examined social media and adolescent health-risk behaviours (Smith *et al.*, 2016; Stiglic and Viner, 2019; Guerra *et al.*, 2020).

When I was due to enter Year 2 of the PhD, a relevant systematic review was published, but it left several questions unanswered, which are discussed in detail in Section 2.6.3 and Chapter 4 (Vannucci *et al.*, 2020). Thus, the requirement for a systematic review addressing this topic remained. The purpose

of the systematic review was two-fold: it would ensure the PhD best-addressed gaps in the existing evidence base and assist with developing policy addressing adolescent online safety. Therefore, the decision was made to incorporate a systematic review into the thesis before commencing the MCS analyses.

I returned to clinical practice during Year 2 of the PhD as senior health protection nurse lead for the Public Health Approach to Scotland's COVID-19 Contact Tracing Programme (Public Health Scotland). This experience reinforced the challenges of understanding the health needs of vulnerable groups and the crucial role digital technology, including social media, can play in health information exchange between health professionals and the general public. Subsequently, I led two publications; the first outlined how the nursing workforce could optimise their contributions to tackle COVID-19 (Purba, 2020a), and the second highlighted the importance of inclusive COVID-19 mitigation strategies to ensure the reduction of existing inequalities instead of amplification (Purba, 2020b). Central to both publications was the requirement to strengthen the UK health system by tackling inequalities in access to health information. Further, recommendations presented in both publications were later considered by nursing advocates within the UK and France (Mental Health Nurses Association, 2020; Renauld, 2020).

This interest in inequalities in information exchange added value to the MCS analyses and supported the interpretation of findings. It became a topic of discussion with my supervisory team, resulting in the conceptualisation of the essay, which explores social media as a determinant of health (Chapter 3).

Whilst I led the conceptualisation, conduct, and writing up of the thesis, I was fortunate to receive invaluable contributions from a range of collaborators and stakeholders; for example, advisory group members, second reviewers for the systematic review, and academics in the field of social media and/or adolescent health or with relevant methodological expertise. Their contribution is acknowledged in the author's declaration that prefaces the thesis (pages 14-15) and in the authorship statement for each article.

The overall thesis has been led by myself, and I take full responsibility for it.

1.4 Structure of the thesis

Given the rapidly evolving nature of social media, how secondary data can fast become outdated, and the requirement for high-quality evidence to inform current policy discussions surrounding social media use in adolescents, I have pursued a 'journal format' structure for the thesis.

Following the guidance from the School of Health and Wellbeing (2018), adopting this structure provided several benefits, including the rapid translation of research into practice; timeliness of outputs, as I was keen to publish each element as it was completed; the provision of concrete milestones which supported overall motivation; and it allowed me to avoid the inefficiencies of condensing thesis chapters into publishable research. The thesis is therefore built around four chapters, each corresponding to a provisionally accepted or submitted article.

It begins with this introduction (Chapter 1), which outlines publications and other outputs arising from the PhD, contributions, and competing interests. This is followed by a background to the thesis, a brief discussion on the research motivation for the project, and a note on geographical scope. Chapter 2 describes the role of the PhD advisory group; summarises underpinning concepts pertaining to social media (including a broader discussion on its definition) and adolescent health-risk behaviour research; introduces social media as a determinant of health; describes the evidence on social media and associations with health-risk behaviours; provides the rationale for this thesis; and summarises the gaps in the literature that the thesis seeks to address. This provides the foundation for the thesis aims and objectives outlined at the end of Chapter 2.

Chapters 3 to 6 each comprise an article describing the work conducted to address the thesis objectives, prefaced by a foreword. The foreword sets the articles in the broader context of the thesis by describing their relationship to the other chapters and providing further methodological detail (where relevant). As each article is also intended to be a stand-alone output, there is inevitably some duplication with content discussed in other thesis sections. In line with the guidance for thesis submission, minor formatting changes have been made to the

provisionally accepted and submitted versions, including the numbering of figures and tables. Supplementary material for all articles, regardless of publication status, is included in the thesis appendices.

Chapter 3 introduces the overarching theme of the thesis - social media's influence on health. It reports an essay that explores social media's role as a determinant of health, drawing attention to the key influences and the potential mechanisms through which they may manifest.

Chapter 4 comprises a systematic review and meta-analysis synthesising existing evidence on social media (e.g., time spent on social media, frequency of use, exposure to health-risk behaviour content) and the health-risk behaviours: alcohol use, tobacco use, use of electronic nicotine delivery systems (ENDS), drug use, anti-social behaviour, sexual risk behaviour, unhealthy dietary behaviour, inadequate physical activity, gambling and multiple risk behaviours.

Chapters 5 and 6 aim to address key gaps in the literature identified by the systematic review. These chapters undertake a longitudinal analysis of the MCS to examine the relationship between social media use and adolescent cigarette, e-cigarette and dual use (Chapter 5) and alcohol use and binge drinking (Chapter 6) overall and by socioeconomic circumstance (SEC).

Chapter 7 marks the end of the thesis, where I summarise the key findings in the context of evidence previously published and the strengths and limitations of the thesis overall. Following this, I offer reflections on the work conducted in this thesis, present recommendations for future research, and implications for policy, practice and industry.

1.5 A note on geographic scope

The chapters of this thesis differ in geographical scope; as with other methodological decisions described in this section, this was informed by theoretical and practical considerations.

The essay (Chapter 3) explores the role of social media as a determinant of health within the global population. This allowed for a broader understanding of concepts such as the 'digital divide' and the reach of social media platforms.

Similarly, within Chapter 4, no geographical limits were set when conducting systematic review searches. This was to facilitate the inclusion of all relevant articles, appropriately assess potential publication bias, and show (where possible) the potential differential impacts of social media use on adolescent health-risk behaviours within low-middle (LMICs) and high-income (HICs) countries. Further, no language limits were set to determine the potential implications of language exclusions.

The analysis of longitudinal cohort studies (Chapters 5 and 6) were restricted to UK adolescents (the MCS is a UK-representative cohort).

Therefore, the literature review immediately following this chapter considers all available evidence, with a particular focus on studies and policies from the UK.

Chapter 2 Literature review

2.1 Overview of chapter

This chapter sets the scene for the thesis by describing underpinning concepts and summarising the existing evidence, including key relevant gaps.

In Section 2.2, the role of the PhD advisory group is described. Section 2.3 explores social media prevalence and trends. Following this, social media definitions, measurement and data collection in the context of research are described. Section 2.4 introduces social media use in adolescence, considering factors promoting use and challenges to understanding social media use in adolescents. Section 2.5 defines adolescence and explores adolescent health-risk behaviours and their immediate and long-term impacts to health. Section 2.6 explores the potential mechanisms underpinning the relationship between social media use and adolescent health-risk behaviours. Following this, inequalities in social media harms are discussed, and the role of social media as a potential determinant of health is introduced. To conclude, the rationale for the thesis and the key gaps it aims to address are described (Section 2.7).

2.2 Advisory group

An advisory group of experts and policymakers in the field of social media and adolescent health-risk behaviours was convened to inform the research. To minimise bias in member selection and ensure diversity within the advisory group, members were recruited via expert stakeholders and included policymakers, non-governmental organisations, experts and academics. Overall, advisory group members contributed to this thesis in three key ways:

1. Members advised on the thesis objectives to maximise alignment with current gaps in the existing evidence and relevance of the research for policy development

2. Members provided guidance on conceptual and methodological issues throughout the research, drawing upon their professional expertise and

perspective, as well as that of patient/public representatives they work with

3. Members supported the interpretation and dissemination of findings

Formal meetings were arranged with advisory group members on a biannual basis, hosted either in-person or using Zoom software. Mentimeter software was used to collect real-time feedback from members and informal communications were had with members via email.

The specific contributions of the advisory group to the thesis are described in detail within the relevant chapters.

2.3 Introduction to social media

This section describes social media use prevalence, trends, and conceptual issues relevant to the thesis, including what constitutes social media, how it is measured and how social media usage data are commonly collected.

2.3.1 Prevalence and trends

As of 2022, there were 4.62 billion active social media users worldwide (58% of the global population), with the platforms Facebook, YouTube and WhatsApp most frequently accessed (Kepios, 2022a). Most users reported using multiple platforms, with the mean number of social media platforms used each month being 7.5 (Kepios, 2022a). Compared to low-middle income countries (LMICs; e.g., Ghana, Kenya and Nigeria), high-income countries (HICs; e.g., Sweden, New Zealand, Canada and the UK) reported more active users (Kepios, 2022a; World Bank, 2023).

Within the UK, 84% of the population reported social media use (57.6 million users), an increase from 53 million in the previous year (Kepios, 2022b). The mean number of platforms used each month (6.3) was less than other HICs (United States of America (US): 6.6 and Hong Kong: 7.1), and the global average (7.5) (Kepios, 2022a). The messaging services WhatsApp, Facebook and the media-sharing site Instagram were the most frequently accessed (Kepios, 2022b).

2.3.2 Defining social media

Few formal definitions of social media exist due to its nascent and constantly evolving nature (Ellison and Boyd, 2013). Those definitions which exist in the academic literature generally encompass three main themes: what activities social media allows (facilitates communication, collaboration and the creation, modification and sharing of content); how it enables these activities (through web-based services and applications); and the type of content it contains (e.g., user-generated, marketer-generated content) (Sloan and Quan-Haase, 2017). Following a critical analysis of definitions used in the literature, Sloan and Quan-Haase (2017), authors of *The SAGE Handbook of Social Media Research Methods*, proposed the following definition:

> "Social media are web-based services that allow individuals, communities and organisations to collaborate, connect, interact and build community by enabling them to create, co-create, modify, share and engage with user-generated content that is easily accessible." (Sloan and Quan-Haase, 2017, p.17)

Despite this definition's focus on user-generated content, the general consensus is that content hosted on social media can be either user or marketer-generated (Kaplan and Haenlein, 2010; Xiang and Gretzel, 2010; Gruzd *et al.*, 2012). Numerous definitions of user-generated content exist across disciplines in social science and beyond (Kaplan and Haenlein, 2010; Susarla, Oh and Tan, 2011; Östman, 2012). However, all existing definitions encapsulate the following dimensions:

- *User* considers the notion of an 'ordinary' user as a role

- *Generated* refers to the digital creative process, considering both individual or collective, intentional or unintentional content, which has meaning to someone or somebody in some form

- *Content* does not solely refer to the file uploaded but incorporates all metadata which accumulates around it (e.g., likes, shares, emojis and comments)

Following the advent of social media, Luis Barbosa dos Santos (2022) critically reviewed existing definitions of user-generated content and their application and operationalisation, proposing an updated and unifying definition stated below. This definition acts as a starting point and may require updating in line with future socio-technical disruptions:

> "User-generated content is any kind of text, data or action performed by online digital systems users, published and disseminated by the same user through independent channels, that incur an expressive or communicative effect either on an individual manner or combined with other contributions from the same or other sources." (Luis Barbosa dos Santos, 2022, p.108)

While user-generated content considers actions performed by an online digital systems user (ordinary individual), marketer-generated content refers to the actions (e.g., creation of marketing and promotional messages) generated by brand owners (Hudders *et al.*, 2021; Luis Barbosa dos Santos, 2022; Zhao *et al.*, 2022). This type of content arguably extends to the inclusion of influencer-generated content.

In the past decade, many 'ordinary' social media users have established a strong online identity by sharing their opinions and interests, resulting in a significant number of 'followers' (Hudders *et al.*, 2021). Often referred to as social media influencers, stars or micro-celebrities, these individuals have been suggested to strongly impact their followers' decision-making (Zak and Hasprova, 2020; Hudders *et al.*, 2021). Consequently, in return for compensation, advertisers commonly approach them to endorse products, brands, organisations or ideas on their social media profiles (Hudders *et al.*, 2021).

Content posted by influencers is often deemed user-generated content within the marketing discipline. In contrast, a brand owner sharing influencer content on their own channels (e.g., reposting an influencer's post) is considered marketer-generated (Noguti, 2022). Within the public health discipline, influencer-generated content is commonly distinguished as marketer-generated due to the inherent marketing-driven nature of influencer-generated content (Adriana *et al.*, 2022). Therefore, for this thesis, as introduced in Section 1.1, the definition of social media proposed by Sloan and Quan-Haase (2017), considering both user-generated and marketer-generated content (including

influencer-generated), will be used. The broad nature of this definition accounts for the dynamic nature of social media and its potential to include different types of technology and content, with social interaction at its core.

Considering previous literature, Table 1 presents the main categories of social media as outlined in *The SAGE Handbook of Social Media Research Methods* and includes examples and definitions of each (Nicholas and Rowlands, 2011; Grahl, 2013; Sloan and Quan-Haase, 2017). This categorisation allows researchers to explicitly state what category of social media and platform they are examining, supports literature searches, and, importantly, helps identify commonalities and differences across types of social media. This is of importance, as evidence suggests different social media categories may have varying impacts on adolescent health behaviours. For example, media-sharing based social media platforms (such as Snapchat), have been shown to promote upward social comparison, which can present harmful effects to health behaviours (Massey et al., 2021). Conversely, social networking site platforms (such as WhatsApp) can facilitate health communications, which can positively influence adolescent health behaviours (Yusriani and Acob, 2020).

Thus, the categorisation outlined in Table 1 will be used to differentiate between the types of social media within this thesis. However, many of the features of social media platforms overlap; therefore, it is acknowledged that some social media platforms may fall into several categories. For example, Instagram possesses features central to social networking sites (e.g., direct messaging) and is also considered a media-sharing site.

Given the continuous introduction of new devices that facilitate social media access and new platforms and features that enable more sophisticated and diverse ways of interacting with others, setting boundaries on what constitutes social media has proved problematic (Dyer, 2020). As the categorisation outlined in Table 1 was published in 2017, it was essential to consider the technological developments that may have occurred since then and revise/add to this categorisation as required. For example, online (social) gaming is arguably social media since it involves a network of individuals with a common interest who interact online (Kuss and Griffiths, 2017; Kapoor *et al.*, 2018). Much like social media, online (social gaming) has the potential to increase social capital (Ryan

et al., 2017; Kim *et al.*, 2022). Further, social media corporations frequently employ gaming within their platforms to engage users (Aburahmah *et al.*, 2016).

Similarly, online (social) gambling has been posited as a form of social media due to its inclusion of core social media functionalities, namely user interaction (Parke *et al.*, 2012; Kaakinen *et al.*, 2020). Moreover, like online (social) gaming, social media platforms, particularly Facebook, frequently host social gambling games on their platforms (James, 2021). Thus, within this thesis, online (social) gaming and online (social) gambling were also considered social media categories.

Table 1. Social media categories

Social media category	Definition	Example platforms
Social networking sites	Web-based services which facilitate construction of a public/semi-public profile within a bounded system, the composition of a list of other users with a shared connection, and the ability to view and traverse composed lists of connections and those created by others within the system (Boyd and Ellison, 2007).	Facebook, Instagram, WhatsApp, Twitter, chat rooms & instant messaging
Microblogging sites	Services which are centred on short updates forwarded to anyone subscribed to receive the updates (Sloan and Quan-Haase, 2017).	Twitter & Tumbler
Blogs & forums	Online forums which allow forum members to have conversations by posting messages. Blogs where comments are attached to blogs with discussion focussed on the topic of the blog post (Sloan and Quan-Haase, 2017).	LiveJournal & WordPress
Media-sharing sites	Services which facilitate the uploading and sharing of media including pictures and video. The majority of services have other social features such as profiles, commenting, etc (Sloan and Quan-Haase, 2017).	YouTube, TikTok, Instagram & Snapchat
Geo-location-based sites	Services which allow users to connect and exchange messages based on their location (Quercia *et al.*, 2010).	Foursquare
Bookmarking sites	A website which ranks references (bookmarks) to other websites contributed by users who use the site. Users can add comments to the bookmarks and make then private or public. The act of bookmarking indicates to others that an individual is interested in a given resource (Millen *et al.*, 2007).	Delicious, StumbleUpon & Twitter
Social news sites	Services that allow individuals to post news items or links to outside articles and then facilitates user voting of the items. The voting is the primary social aspect, as items with the most votes are displayed the most prominently. The community of users decide which news items are seen by more people (Sloan and Quan-Haase, 2017).	Reddit & Digg
Collaborative authoring sites	Web-based services which allow users to create content and allow individuals with access to the service to modify, edit or review that content (Archambault *et al.*, 2013).	Wikipedia & Google Docs
Web conferencing	An umbrella term for types of online collaborative services including web-seminars (webinars), webcasts, and peer-level web meetings (Techopedia, 2021)	Skype & Zoom
Scheduling & meeting	Web-based services which facilitate group-based decisions regarding event (Sloan and Quan-Haase, 2017).	Doodle & Google Calendar
Online (social) gaming	A video game which offers online interactions with other players (e.g., multiplayer role-playing games and social instant games) (Internet Matters, 2021).	World of Warcraft & Candy Crush
Online (social) gambling	Any kind of gambling conducted on web-based platforms, which have social game features (e.g., social networking sites real money/fremium gambling, app fremium gambling, and simulated gambling via social networking site applications) (Parke *et al.*, 2012).	CityVille, BetDash & Bingo Appy via Facebook

2.3.3 Social media use measurement and data collection

In the absence of a single universal inventory, there is a lack of consensus on how best to measure social media use, particularly given its multifaceted nature (Sigerson and Cheng, 2018; Mieczkowski *et al.*, 2020). Consequently, findings on the relationship between social media use and health are largely inconsistent (Orben and Przybylski, 2019b; Petropoulos Petalas *et al.*, 2021). This is partly due to the different ways social media use is operationalised and differences in data collection methods (Orben and Przybylski, 2019b; Petropoulos Petalas *et al.*, 2021).

2.3.3.1 Operationalising the measurement of social media

Two broad approaches exist when measuring social media use - the channel-centred approach and the communication-centred approach (Petropoulos Petalas *et al.*, 2021). Most evidence examining the link between social media use and health has relied on the channel-centred approach, measuring constructs such as screen time or time spent on social media (Stiglic and Viner, 2019). This approach primarily focuses on the use of a platform without considering a user's communication behaviours and activities when using that platform (Meier and Reinecke, 2021). Depending on a platform's specific features (e.g., liking, sharing, consuming media-related content), the channel-centred approach may extend to measuring behaviours related to a specific platform's technological aspects (Bayer *et al.*, 2020).

The communication-centred approach focuses on the possible communication and message exchange process that occurs when using social media (Petropoulos Petalas *et al.*, 2021). Often this involves researchers distinguishing between active or passive forms of social media use (Valkenburg *et al.*, 2021). Active use involves focused one-on-one exchanges (e.g., sending a private message or posting a status update). In contrast, passive use refers to monitoring the online life of other users without directly engaging with them (e.g., browsing or looking at other user profiles) (Verduyn *et al.*, 2020). The importance of distinguishing between these types of activity rests in the potential differential effects they have on health (Thorisdottir *et al.*, 2019). For example, active social media use may positively affect health by increasing opportunities for positive social

interaction and support (Thorisdottir *et al.*, 2019). Nevertheless, this may result in difficulty disengaging from social media. Conversely, passive social media use can reduce health due to its ability to provoke upward social comparison (Verduyn *et al.*, 2017). However, passive use has also been suggested to lead to enjoyment (Krasnova *et al.*, 2015) and inspiration (Meier *et al.*, 2020), which can result in positive effects on health (Schueller and Seligman, 2010; Meier *et al.*, 2020).

2.3.3.2 Data collection methods

In the absence of real-time objective data from social media corporations, existing evidence relies heavily on retrospective estimates of social media use obtained via self-report questionnaires (Miller *et al.*, 2014; Larm *et al.*, 2019; Ng Fat *et al.*, 2021). Self-report measures have the benefit of capturing the psychological-perceptual element of a user's interaction with social media content - an element that is often not captured by more technology-centred measures (e.g., digital tracking) (Meier and Reinecke, 2021), however, are susceptible to recall or social desirability bias.

Time-use diaries offer a useful alternative, potentially subject to less recall and some types of response bias (Naab *et al.*, 2019; Orben and Przybylski, 2019a). This method acts to build a detailed picture of a participant's daily life by asking them to record the activities they engaged in on pre-specified days during small time windows (e.g., every 10 minutes) (Naab *et al.*, 2019; Orben and Przybylski, 2019a). As highlighted by Orben and Przybylski (2019a), time-use diaries could extend and complement more frequently used self-report measures of social media. However, it is important to note that ensuring all days under analysis are representative of everyday life when using time-use diaries is challenging (Orben and Przybylski, 2019a). Furthermore, time-use diaries may not always accurately record uses of social media concurrent with other more dominant activities (i.e., multi-tasking), resulting in a potential underestimation of time spent on social media (Orben and Przybylski, 2019a).

2.4 Introduction to adolescent social media use

Social media has revolutionised how individuals interact by facilitating social interactions at any time of day in solitary and sedentary environments (Booker *et al.*, 2018). This is especially relevant for today's adolescent generation, who are growing up in a media-saturated world where the option of 24/7 online social connection is embedded as part of everyday life (Crone and Konijn, 2018). As with previous generations, today's adolescents value peer connection and acceptance (Blakemore and Mills, 2014). During a period of intense psychosocial development, these peer experiences provide a crucial context for the acquisition of developmental competencies and potential risks for a range of adjustment difficulties (Nesi *et al.*, 2018).

Social media has fundamentally reshaped the landscape of adolescent peer interactions, offering considerable benefits for connecting with others (Uhls *et al.*, 2017). However, its potential negative impact on adolescent health has received considerable attention (Uhls *et al.*, 2017). Parents/caregivers, educators, practitioners, policymakers, and adolescents have voiced concerns about the possible harmful effects of social media on adolescent health (European Commission, 2022a; UK Parliament, 2022b). This has led to the introduction of policy intended to improve online safety internationally (Jones *et al.*, 2019; US Congress, 2020; European Commission, 2022b; Ofcom, 2022b; UK Parliament, 2023a).

Evidence could help inform these discussions and the implementation of policy. However, there are important gaps in our current understanding that could be addressed through further research. Therefore, the next section will describe the literature surrounding this thesis's primary exposure of interest, social media use in adolescents, highlighting research gaps.

2.4.1 Social media use in adolescence

According to findings from Ofcom published in 2022, 91% of 12-15 year old UK adolescents used social media, increasing to 97% in adolescents aged 16-17 years, with the majority of users accessing social media via their mobile phone (94% and 98% respectively) (Ofcom, 2022b). YouTube was most frequently

accessed, followed by WhatsApp and TikTok (Ofcom, 2022b). A similar picture presents within other HICs, such as the US (Vogels *et al.*, 2022).

Adolescents use social media for a diverse range of reasons. In the UK, adolescents' reported reasons include the desire to access news (57%) and follow activists or campaigners who discuss issues they care about (23%) (Ofcom, 2022b). In the US, reasons similarly include the desire to show support for causes or issues (66%), the ability to engage in online discussions about health and wellness (15%) (Pew Research Center, 2018), and the desire to access fitness related information and health issues considered 'harder to discuss' - like sexual health (Plaisime *et al.*, 2020).

Social media platforms can host content and facilitate interactions that promote adolescent health and wellbeing. However, there are concerns that warrant attention, especially when considering social media's influence on adolescents. For example, Ofcom recently revealed that a key risk factor for adolescent online harm was bypassing age assurance measures in social media platforms (Ofcom, 2022a). For example, providing a false date of birth to access a specific platform when under the minimum age requirement for that platform (Information Commissioners Office, 2021). This study revealed that nearly half of 8-12 years olds set up their profile on most platforms (with a minimum age of 13 years) using a false date of birth (Ofcom, 2022a).

Alongside concerns related to age assurance, harmful content, including content displaying underage alcohol use (which often violates a social media communities' rules of service), can be presented to adolescents on social media platforms (Cookingham and Ryan, 2015; 5Rights Foundation, 2022a). This is of concern, given the increasing evidence which suggests viewing online content depicting risk behaviours is associated with offline risk behaviours (Moreno and Whitehill, 2014; Lin *et al.*, 2020; Donaldson *et al.*, 2022). Social media algorithms (discussed in detail in Section 2.4.3) work by exposing users to content similar to that viewed previously. Thus, if an adolescent accidentally views inappropriate or harmful content, or their viewing is a result of general curiosity (an experience heightened during adolescence), they may subsequently be exposed to more of the same content (Hidi and Renninger, 2006; Renninger and Hidi, 2019; Fandakova and Gruber, 2021).

However, harms are not limited to the user. For example, research has demonstrated the 'peer group effect', where adolescents are more inclined to share risk behaviour content online to obtain peer approval and acceptance (Brown *et al.*, 2008; Ofcom, 2014). These findings align with the *Facebook Influence Model,* which hypothesises that peer influence processes are amplified by the social media context (Moreno and Koff, 2016). Therefore, an adolescent's active sharing of content or even an accidental/curiosity-driven 'click' might influence their social norms and behaviour and that of their online peer group (Moreno *et al.*, 2009; Cookingham and Ryan, 2015).

2.4.2 Factors promoting adolescent social media use

It is important to consider the factors that promote adolescent social media use that are often, arguably, out of their locus of control. This includes considering the business model underpinning social media corporations.

It is now well established that social media corporations design their platforms to elicit addictive behaviours (Harris, 2016a; Alter, 2017; Lewis, 2017; Morgans, 2017; UK Parliament, 2019). For example, social media corporations have suggested that they introduced the 'infinite scroll' functionality, which removed stopping cues on social media newsfeeds, to enhance user experience (Harris, 2016a; Alter, 2017). However, as argued by the 5Rights Foundation (2022b), an organisation that puts children's needs and rights at the heart of digital design, this feature was created with the primary objective of maximising engagement. It operates by exploiting the human desire for intermittent variable rewards (Galla *et al.*, 2021), a desire which is particularly salient during adolescence (Galvan, 2010).

Intermittent variable rewards in the context of social media might also take the form of rewards delivered on a schedule that appears random to the user but is designed to keep them active for longer, much like slot machines (Galla *et al.*, 2021). For example, 'likes' might appear when a social media algorithm has identified that the user may be likely to leave the platform. This can result in an endless search for the next 'reward', leading to habitual behaviour and increased time on social media, as well as making adolescents more vulnerable

to frequent and extreme upward social comparison (5Rights Foundation, 2022b). This is discussed in Section 2.5.2.

Social media has also brought forth new norms around 24/7 availability. Consequently, adolescents may feel an increased expectation to respond promptly to any messages received (Weinstein, 2018). These properties of social media can promote engagement but can also result in adolescents developing a Fear of Missing Out (FoMO) on online activities. This may, in turn, motivate them to remain in continuous virtual communications with peers (Fox and Moreland, 2015; Bloemen and De Coninck, 2020).

Przybylski *et al.* (2013, p.1,841) define FoMO as a "pervasive apprehension that others might be having rewarding experiences from which one is absent, FoMO is characterised by the desire to stay continually connected with what others are doing". It is a phenomenon adolescents are particularly susceptible to, given their heightened sensitivity to the social context (Barry *et al.*, 2017). Moreover, research has demonstrated a strong reciprocal relationship between FoMO and social media use (Przybylski *et al.*, 2013; Blackwell *et al.*, 2017; Kuss and Griffiths, 2017). Adolescents may experience FoMO due to viewing social media (e.g., seeing friends at a party they were not invited to), which may stimulate a sense of anxiety and unworthiness. At the same time, adolescents may suffer from anxiety as a result of the FoMO experienced when not able to access social media.

2.4.3 Challenges to understanding social media use in adolescents

From a research perspective, one challenge to fully understanding the implications of social media on adolescent health is the lack of accurate, high-quality longitudinal data which allows the causal effects of social media over more extended time periods to be traced (Carson *et al.*, 2016; Dickson *et al.*, 2019; Orben, 2020). A second challenge is the frequent adoption of a techno-centric approach where social media is categorised under the umbrella terms of 'screen time' or 'digital technology', limiting its relevance to social media specifically (Scharkow, 2016; Stiglic and Viner, 2019; Orben, 2020). These challenges partly stem from a lack of ethical, transparent and controlled access to real-time objective social media data held by social media corporations. Yet,

as explored in Section 2.4.1, even when real-time objective data are available, poor age assurance measures may inhibit the identification of the true age of users, which may severely affect any reported findings.

A third challenge raised, commonly referred to as the 'Black Box Problem', pertains to social media ranking and recommendation algorithms (Cotter, 2021). It is argued that social media corporations have been intentionally vague about how these algorithms work to protect proprietary technology and avoid scrutiny (Pasquale, 2015; Burrell, 2016; Cotter, 2021; Pew Research Centre, 2022). Some have even suggested that social media corporations no longer fully understand how these complex algorithms work (Kramer, 2017). Thus, publicly available research that can accurately describe the nature of this problem is sparse (Cotter, 2021).

What we do currently know is that these algorithms use micro-targeted advertising via psychological profiling tools to expose users to similar content based on their previous online behaviour (Barbu, 2014). The algorithms generate personalised content, which often includes high levels of advertising, where differentiating between user-generated and marketer (or influencer) generated content is difficult (Perloff, 2014). As a result, users may believe that content viewed on their feed is 'news' or factual instead of content curated explicitly for them. This, combined with the human tendency to engage with those who have similar beliefs (referred to as ideological homophily; Boutyline and Willer, 2016), can result in the 'echo chamber' effect (Takikawa and Nagayoshi, 2017). Formally, 'echo chambers' are defined as environments in which the opinions or beliefs of users on a topic are reinforced due to repeated interactions with individuals or sources with similar attitudes and tendencies (Cinelli *et al.*, 2021). Chapter 3 provides a broader discussion on the detrimental effects of such echo chambers in the context of social media.

These challenges to understanding social media use in adolescence are exacerbated by the constantly evolving and personalised nature of social media platforms, features and algorithms, which can result in heterogeneity in effects across individuals as well as over time.

2.5 Introduction to adolescence and adolescent health-risk behaviours

2.5.1 Defining adolescence

The lay definition of *adolescence* is the developmental period wherein one transitions from childhood into adulthood (Cambridge Dictionary, 2023). It is the period between childhood and adulthood wherein an individual undergoes rapid physical, cognitive and psychosocial development (World Health Organisation, 2020a). During this phase, adolescents experience tension between an increased capacity for autonomous decision-making and the need for protection and oversight from adults (Patton *et al.*, 2016; Teuber, 2022).

Formally defining the period between childhood and adulthood has proved troublesome, especially when considering different countries, cultures and contexts. Although age-based definitions are useful, chronological age is not the sole defining characteristic of this development period. For example, there seems to be consensus that the starting point of adolescence is biologically defined at pubertal onset (Sawyer and Azzopardi, 2018). Pubertal onset is influenced considerably by lifestyle factors (e.g., physical activity and diet) and psychological factors (e.g., the experience of stress and family conflict) (Soliman *et al.*, 2014; Jansen *et al.*, 2018; Hamlat *et al.*, 2022). Both lifestyle and psychological factors vary by culture and socioeconomic context and are, to some degree, socially defined (Hiatt *et al.*, 2021; Oelkers *et al.*, 2021; Hamlat *et al.*, 2022).

Most academics in the field of adolescent development agree that the endpoint of adolescence is socially defined and is when an individual adopts a stable, autonomous role in society (Blakemore, 2018; Sawyer and Azzopardi, 2018). However, refinements in brain structure and function which influence peer affiliation, behaviour, and decision-making, extend into the third decade of life (Crone and Dahl, 2012; Goddings *et al.*, 2014). This suggests that biological growth affects the start of adolescence and when it ends.

Initially defined as 14 to 23 years of age (Hall, 1904), this age-based definition of adolescence has been continuously revised to account for changes in elements of

biological growth (e.g., earlier puberty) and social role transitions (e.g., later completion of education and parenthood) (Sawyer and Azzopardi, 2018). Both the World Health Organisation (WHO) and United Nations (UN) now define adolescence as the period between 10 to 19 years of age (World Health Organisation, 2015, 2020a; UNICEF, 2022). Thus, this thesis uses the WHO age-range of 10-19 years to approximate adolescence (World Health Organisation, 2015, 2020a).

2.5.2 Adolescence as a sensitive period to social influence

As discussed, adolescence begins with unique neurobiological, social and cognitive changes which occur with pubertal onset (Sawyer *et al.*, 2012). It serves as a second period of heightened plasticity in the brain (the first occurring during the first five years of life) (Sawyer *et al.*, 2012). During this period, neural systems are at increased susceptibility to the influence of environmental factors, including social influence, comparison and acceptance (Larsen and Luna, 2018). The social realm of adolescents encompasses relationships with family, peers, teachers and individuals in any other physical or virtual community (e.g., social media) (Mitic, 2021). However, throughout this period, adolescents experience a period of social re-orientating, resulting in increased time with peers and a shift towards valuing peer opinions and acceptance more than that of family members (Blakemore and Mills, 2014). Hence, adolescence marks the shift in exposure from the norms of the supervised adult world (e.g., through interactions with parents/caregivers and teachers) to the norms of the adolescent world (e.g., through interactions with peers).

Life-course epidemiology demonstrates the more acute role of peer relationships and acceptance in an adolescent's development and maturation of life-long behavioural skills and social-emotional regularity functions relative to other stages of the life-course (Blakemore and Mills, 2014; Viner *et al.*, 2015). For example, positive peer relationships support adaptive behaviour to health stressors, serving as a 'buffer' against poor health (Forgeron *et al.*, 2010). Furthermore, they can contribute to the sense of self (Meuss *et al.*, 2002; Ragelienė, 2016) and support academic performance (Schwartz *et al.*, 2008; Wentzel, 2017) and social competence (Laible, 2007). On the other hand,

negative peer relationships (e.g., bullying at school) can result in social withdrawal (Bond *et al.*, 2007), increased risk of long-term mental health consequences (Lereya *et al.*, 2015; Brunstein Klomek *et al.*, 2019), and the propensity to engage in risk-taking behaviours including substance use (Bond *et al.*, 2007), anti-social behaviour, and early commencement of sexual relationships (Kipping *et al.*, 2012).

An important parallel development in adolescence is the formation of parasocial relationships. Described as secondary attachments, parasocial relationships are one-way, non-reciprocal, socio-emotional connections with media figures, for example, celebrities or influencers (Hoffner and Bond, 2022). They have been argued to play a transitional role during adolescence (Erikson, 1968), where parental figures become de-idealised and parasocial relationships take over functions commonly fulfilled by parents in childhood (Giles and Maltby, 2004; Brunick *et al.*, 2016). These relationships can provide adolescents with a secondary group of pseudo-friends and share similarities with actual social relationships (Gleason *et al.*, 2017). Further, they can support adolescents in addressing the tasks of this development period, such as identity formation (Gleason *et al.*, 2017). For example, media figures offer a variety of possible 'identities' an adolescent may wish to adopt, and they can provide cultural resources which influence an adolescent's development of values, beliefs and behaviours (Giles and Maltby, 2004).

The complexities of parasocial relationships are evident when considering the different 'identities' adolescents may be exposed to in the digital realm and may subsequently adopt. For example, adolescents have been suggested to imitate the actions of online characters they admire or aspire to be like (Gibbons *et al.*, 1998; Gerrard *et al.*, 2008; Branley and Covey, 2018), such as media figures who openly discuss mental illness. This can decrease stigma and influence an adolescent's perceived efficacy in managing mental illness (O'Reilly *et al.*, 2019). Conversely, exposure to media figures who demonstrate unhealthy behaviours (e.g., tobacco and alcohol use) may encourage the adoption of these behaviours in adolescents through their influence on social norms (Curtis *et al.*, 2018; Jackson *et al.*, 2018; Donaldson *et al.*, 2022).

Relative to adults, adolescents are more impulsive, and their increased sensitivity to environmental rewards means they are less likely to consider the potential life-long consequences of their behaviours (Jackson *et al.*, 2018; Donaldson *et al.*, 2022). Thus, sometimes adoption of risk-taking behaviours may extend past experimentation considered developmentally appropriate in adolescence and lead to adverse long-term consequences that span into adulthood (Jackson *et al.*, 2018; Donaldson *et al.*, 2022; Marino *et al.*, 2022).

Social comparison is an innate part of adolescence; it offers a necessary means of gathering information about the social world and can therefore influence adolescent decision-making behaviour (Hu *et al.*, 2021). Festinger (1954) recognised that individuals turn to others to gain knowledge about themselves. They hold a "unidirectional drive upward", where they compare themselves to those they believe are perceived to be or are performing better than they are. Alongside the advent of social media came the increase in available content showcasing media figures fitting this description (Folkvord and de Bruijne, 2020). It is possible that upward social comparison to media figures can motivate self-improvement in adolescents, yet research in this field is limited (Gibbons and Buunk, 1999; Guo *et al.*, 2022).

In contrast, research has more commonly demonstrated the adverse outcomes that can result, in part, from upward social comparison to media figures, including depression and low self-esteem (Polce-lynch *et al.*, 2001; Nesi and Prinstein, 2015; Appel *et al.*, 2016). Some adolescents may lack the cognitive capacity to differentiate the reality portrayed in media from real-life experiences (Meier, 2011; Ofcom, 2022b). As media figures frequently present unrealistic images of their lived experience, this may exacerbate any adverse outcomes experienced (Hoffner and Bond, 2022). Therefore, social influence (both real and symbolic) holds the potential to influence adolescent health and wellbeing, both in the immediate and long-term.

The increased sensitivity to the social context experienced during adolescence has been documented throughout human history (Blakemore, 2018), across different cultures and contexts (Steinberg *et al.*, 2018). Thus, arguably nothing is novel about today's adolescents valuing social interactions, acceptance, and approval. However, what is important, is how this amplified sensitivity to social

influence may confer an increased propensity for adolescent risk-taking (Casey, 2015; Shulman *et al.*, 2016), as will be discussed in the next section.

2.5.3 Adolescent risk-taking

Risk-taking behaviour is initially low in childhood, increases around puberty, peaks in late adolescence, and decreases in adulthood (Romer *et al.*, 2017). An adolescent's increased propensity for risk-taking may be explained by their tendency to underestimate potential harms and overestimate potential benefits, as well as their still developing understanding of the immediate and long-term consequences of their behaviours (Smith *et al.*, 2014; van den Bos and Hertwig, 2017). Moreover, while most adults generally avoid risk-taking behaviour by engaging in gist-based reasoning (based on intuition derived from experience and education), adolescents tend to employ emotion-based reasoning (Beck *et al.*, 1985; Reyna, 2012). Emotion-based reasoning introduces a form of interpretation bias wherein adolescents use their feelings to validate their thoughts, resulting in greater emphasis on the social consequences of their decisions (Blakemore and Robbins, 2012).

Risk-taking is not a construct restricted to unhealthy or unsafe behaviours. Healthy risk-taking can include both constructive and socially acceptable risk behaviours. For example, asking someone out on a date is considered a normative part of adolescence (Duell and Steinberg, 2019). In contrast, unhealthy risk-taking refers to behaviours that may result in adverse consequences which outweigh potential benefits and have the potential to delay or harm an adolescent's development (e.g., engaging in unprotected sex, or alcohol, drug and tobacco use) (Kahn and Graham, 2019).

Key drivers for adolescent engagement in unhealthy risk-taking include impulsivity, lack of self-regulation/impulse control, sensation-seeking and response inhibition (Hartley and Somerville, 2015; Maria Roditis *et al.*, 2016; Duell and Steinberg, 2019). These neurobiological drivers develop within the wider social context of an adolescent's caregivers, peers, and community (both physical and virtual), which can encourage or discourage unhealthy risk-taking (Kahn and Graham, 2019), as will be discussed in Sections 2.5.5 and 2.6.2.

2.5.4 Defining adolescent health-risk behaviours

This thesis focuses on risk behaviours that may be considered unhealthy (due to the potential for immediate or longer-term harms), hereafter referred to as *health-risk behaviours*. As discussed in the previous section, health-risk behaviours are defined as those behaviours that raise the probability of adverse health outcomes (Kahn and Graham, 2019).

There is a lack of universal agreement on what constitutes a health-risk behaviour, partly because they are context and circumstance dependent. The US National Youth Risk Behaviour Surveillance System (YRBSS) (Centers for Disease Control and Prevention, 2018) and the Health Behaviour in School Aged Children (HBSC) (a WHO collaborative cross-national study conducted across Europe and North America) (World Health Organisation, 2023) agree that health-risk behaviours include: those which contribute to unintentional injuries and violence (e.g., anti-social behaviour); sexual behaviours related to unintended pregnancy and sexually transmitted infections (STIs) including HIV (human immunodeficiency virus) infection; alcohol and other drug use; tobacco use; e-cigarette use; unhealthy dietary behaviours; inadequate physical activity and gambling (Centers for Disease Control and Prevention, 2018; World Health Organisation, 2023).

During thesis development, health-risk behaviour selection was guided by preliminary evidence documenting the health-risk behaviours potentially influenced by social media and those which contribute to the leading causes of death and disability among adolescents (Akasaki *et al.*, 2019; Murray *et al.*, 2020; Vogel *et al.*, 2020). Selection was also supported via discussion and completion of an online survey with advisory group members (see Appendix A, Section A5). Five out of seven members identified the following health-risk behaviours as important in the context of adolescent social media use: multiple risk behaviours, alcohol use, drug use, tobacco use, use of electronic nicotine delivery systems (ENDS), sexual risk behaviour, gambling, anti-social behaviour, inadequate physical activity and unhealthy dietary behaviour.

Therefore, within the systematic review (Chapter 4), all health-risk behaviours identified as important by advisory group members are examined. In keeping

with the literature, two out of seven members agreed that social media's influence may extend to other behaviours, including mental-health related outcomes (e.g., eating disorders/disordered eating, self-harm and suicide). However, a decision was made not to include these health-risk behaviours within the thesis due to their extensive examination in existing research (Dyson *et al.*, 2016; Sidani *et al.*, 2016; Marchant *et al.*, 2017; Sedgwick *et al.*, 2019).

Arguably, all health-risk behaviours are worthy of investigation, given the detrimental effects they can present to adolescent health. However, health-risk behaviours examined in Millennium Cohort Study (MCS) analyses were informed by several factors including:

1. Evidence gaps identified in the systematic review (e.g., a lack of evidence investigating e-cigarette use)

2. Knowledge on those behaviours (e.g., alcohol and tobacco use) which contribute to the leading causes of death and disability among adolescents

3. An awareness of social media's ability to promote content displaying unhealthy commodities, including alcohol, tobacco and e-cigarettes

Thus the following sections will describe the three behaviours considered of greatest priority following a review of the available literature and discussion with advisory group members, and were therefore examined in MCS analyses: tobacco use, e-cigarette use and alcohol use.

2.5.4.1 Tobacco use

Globally, among addictive behaviours, tobacco use is considered one of the most likely behaviours to be established during adolescence (National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health, 2012; Reitsma *et al.*, 2021). Despite the global decrease in the prevalence of tobacco use among adults in recent years, tobacco use among adolescents remains a major public health concern (Ng *et al.*, 2014). The most recent Global Youth Tobacco Survey (2018; GYTS), which assessed 530,234

adolescents from 143 countries, reported that 17.9% of males and 11.5% of females aged 13-15 years used tobacco globally (Ma *et al.*, 2021). However, its prevalence has decreased modestly (Ma *et al.*, 2021). Tobacco prevalence was two-to-three times higher in older adolescents (15 years) compared to younger adolescents (13 years) in most countries (Ma *et al.*, 2021). The study findings were consistent with previous studies, which demonstrate a rapid increase in the uptake of tobacco products as adolescents get older (Jarvis *et al.*, 2008; Xi *et al.*, 2016; Rachiotis *et al.*, 2020). This is in part due to the increased risk-taking (Wu *et al.*, 2006) and peer-pressure which occurs during this developmental stage, as well as adolescents' economic ability to purchase tobacco products (Guindon *et al.*, 2019).

Immediate health effects of tobacco use include increased respiratory symptoms and reduced lung function (Bird *et al.*, 2016). The long-term effects, which generally become apparent after many years of tobacco use, include an increased lifetime risk of developing cancers, cardiovascular diseases, and respiratory illnesses (Bird *et al.*, 2016). Of concern, the earlier tobacco use is initiated, the greater the mortality risk (Thomson *et al.*, 2020). Furthermore, in line with the *Gateway Hypothesis*, adolescent tobacco use may subsequently lead to abuse of other addictive substances (Kandel, 1992; National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health, 2012; Bell and Keane, 2014; Kleinig, 2015; Ren and Lotfipour, 2019). For example, previous studies have identified associations between tobacco use and use of alcohol (Chen *et al.*, 2002) and cannabis (Korhonen *et al.*, 2010).

The GYTS, as mentioned above, identified that tobacco use prevalence decreased more in those countries that had endorsed the WHO Framework Convention on Tobacco Control (FCTC) when compared to those that had not (Ma *et al.*, 2021). The FCTC encourages price and tax measures to reduce tobacco demand and comprehensive smoke-free policies and calls for a partial or total ban on "tobacco advertising, promotion, and sponsorship on radio, television, print media, and, as appropriate, other media, such as the internet" (World Health Organisation, 2005, p.12). Social media is not explicitly mentioned within the FCTC; thus, extending this ban to new media, such as social media, may be challenging (Freeman, 2012; Dunlop *et al.*, 2016). Nevertheless, awareness of

the ability of such frameworks to reduce tobacco use prevalence, combined with the recognition that social media content may influence adolescent behaviour, warrants attention (Pollay, 2000; Mirza, 2019). Importantly, frameworks such as the FCTC illustrate the potential role regulation of tobacco-related content on social media may present in reducing the public health challenge that is adolescent tobacco use (Pollay, 2000; Mirza, 2019).

2.5.4.2 E-cigarette use

The introduction of nicotine vaping products, including e-cigarettes, has provided a potential harm-reduction alternative to tobacco smoking for adult smokers (Aledeokin and Haighton, 2019). However, increased adolescent e-cigarette use globally (O'Brien *et al.*, 2021; Yoong *et al.*, 2021) has prompted concern that e-cigarettes are creating a new generation of nicotine-dependent individuals (Walker *et al.*, 2020). Findings from the 2019 GYTS revealed that the global prevalence of past 30 day e-cigarette use in adolescents aged 12-16 years from 68 countries was 9% (Bovet, 2022). Similarly, a recent meta-analysis synthesising data from 69 countries reported a pooled prevalence of 8% in adolescents younger than 20 years (Sreeramareddy *et al.*, 2022). Although this presents a picture of adolescent e-cigarette use, it has been highlighted that estimates of e-cigarette use may quickly become outdated due to the rapidly evolving "aggressive" (and often unregulated) marketing strategies employed by tobacco companies (Sreeramareddy *et al.*, 2022, p.6).

In a recent international systematic review of young people (9-25 years old), substance use, poor academic performance, and sensation-seeking were identified as individual-level risk factors of e-cigarette use (Kim *et al.*, 2022). Parental smoking was identified as a family-level risk factor, and peer smoking as a peer-level risk factor. At the community-level, the presence of retailers near schools and exposure to online advertisements on e-cigarettes and/or cigarettes were associated with increased risk of e-cigarette use (Kim *et al.*, 2022).

When we consider the health effects of these products, reviews based on short-term human, animal and in-vitro studies suggest an association exists between use of e-cigarettes and increased inflammatory responses and adverse respiratory outcomes (Gotts *et al.*, 2019; Yoong *et al.*, 2021). Evidence from animal and in-vitro studies demonstrates that nicotine, a key component of the liquid contained within most e-cigarettes, is damaging to the developing brain of adolescents (Goniewicz *et al.*, 2014). Meta-analyses of prospective cohort studies suggest e-cigarettes in non-smoking adolescents may act as a gateway to future tobacco smoking (Soneji *et al.*, 2017; Khouja *et al.*, 2020), as well as other addictive substances (Audrain-McGovern *et al.*, 2018; Chadi *et al.*, 2019;

Fadus and Smith, 2019; Rothrock *et al.*, 2020; Chan *et al.*, 2021). Increased e-cigarette use might therefore slow or even reverse the decrease in tobacco use observed in recent years in some countries (Soneji *et al.*, 2017; Chapman *et al.*, 2019). Evidence has also suggested that e-cigarettes may have adverse effects on attention, memory and learning skills (National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health, 2016).

In their analysis of the 2019 GYTS, Sreeramareddy *et al.* (2022) explored the effect of country e-cigarette regulatory status on adolescent e-cigarette use. Of the 75 countries investigated, 15 had the most restrictive policies in place (total ban of e-cigarettes), 28 restrictive (regulations on nicotine/and or other contents only), nine least restrictive (allowed selling of e-cigarettes but had sales restrictions/regulations) and 23 countries had no reliable information about e-cigarette regulatory policies. The study identified countries with the most restrictive policies had decreased odds of e-cigarette use (adjusted odds ratio (AOR) 0.6 [95% confidence interval (CI) 0.6 to 0.7]) when compared to those with no regulatory policies.

The balance of the harms and benefits of e-cigarettes for established smokers remains under debate (Green *et al.*, 2018). However, their toxicological profile, the recognised impact of nicotine on the developing adolescent brain, and the increased (often unregulated) marketing of these products to adolescents warrant the investigation of their use and potential risk factors for use in this population (Action on Smoking and Health, 2021; O'Brien *et al.*, 2021; Wang *et al.*, 2022).

2.5.4.3 Alcohol use

Alcohol use is a major risk factor for disability-adjusted life-years (DALYs) lost among adolescents (Murray *et al.*, 2020). Consumption often begins during adolescence and increases as adolescents age (Murray *et al.*, 2020). Globally, more than 26.5% of 15-19 year olds are current drinkers (World Health Organisation, 2018). Prevalence is highest in the WHO European Region (43.8%), Americas (38.2%) and Western Pacific Region (37.9%), with little differences observed between males and females (World Health Organisation, 2018).

The complex association between alcohol use and health is well established; not only is it a leading risk factor for disease burden (Global Burden of Disease 2016 Alcohol Collaborators, 2018), but research has shown its association with 60 acute and chronic diseases (Rehm, Room, Graham, *et al.*, 2003; Rehm, Room, Monteiro, *et al.*, 2003; Ezzati *et al.*, 2006). The complexity of this relationship is demonstrated via the multiple mechanisms through which alcohol use influences health. For instance, cumulative consumption can adversely affect both organs and tissues; acute intoxication can lead to poisoning and injuries; and dependent drinking can result in impairments, violence, or self-harm (Global Burden of Disease 2016 Alcohol Collaborators, 2018). All of these may present detrimental effects on educational performance, work and relationships (UK Department for Education, 2010; Khaddouma *et al.*, 2016).

The salience of any effects is influenced by consumption volume and drinking patterns (Rehm, Room, Graham, *et al.*, 2003). For example, adolescent binge drinking generally demonstrates a dose-response relationship with acute negative alcohol-related harms, such that higher frequency binge drinking episodes and greater consumption volume are associated with heightened risk for several adverse consequences (Miller *et al.*, 2007). Though many of the acute adverse consequences of binge drinking are not limited to adolescents, evidence has documented an increased risk in this population for certain acute alcohol-related harms (e.g., alcohol poisoning) due to their relative inexperience with alcohol's effects (Chung *et al.*, 2018).

There has been a recent decline in adolescent alcohol use globally, asserted to result from shifts in parenting practices (Vashishtha *et al.*, 2019). Despite this, the prevalence of binge drinking remains high (Chung *et al.*, 2018). Binge drinking is defined as the consumption of six or more units of alcohol for women and eight or more units for men on one occasion (UK Government, 2021) and is common among adolescents in Western countries (Archie *et al.*, 2012; Welty *et al.*, 2017; Lees *et al.*, 2018). Within the UK, although adolescents are less likely to drink alcohol than in previous years, when they do drink, they are more likely to consume alcohol at high levels (Office for National Statistics, 2018). Similarly, in the US, more than 90% of alcohol consumed by adolescents is via binge

drinking (Chung *et al.*, 2018; National Institute on Alcohol Abuse and Alcoholism, 2022).

Several developmental factors are associated with increased binge drinking behaviours during adolescence. These include increased independence in daily routines and activities (e.g., acquiring a driving licence) (Brown *et al.*, 2008), reduced parental monitoring (Clark *et al.*, 2015; Brown and Zucker, 2016), anti-social behaviour, stressful life events, and lower task persistence (some of which may be associated with gender, e.g., males may have an increased likelihood of engaging in anti-social behaviour) (Tucker *et al.*, 2003; Windle *et al.*, 2005; Modecki *et al.*, 2013). Further, school transitions and changes in peer affiliations, which often provide increased opportunities to engage in alcohol use, have been shown to influence binge drinking initiation (Brown *et al.*, 2008; Martino *et al.*, 2009; Hahm *et al.*, 2012; Mundt, 2013; Leung *et al.*, 2014).

Factors shown to reduce the effect of peers on adolescent alcohol use and binge drinking include parental attachment and disapproval of substance use (Martino *et al.*, 2009; Mundt, 2013; Meldrum *et al.*, 2022). Alcohol regulatory policies and enforcement have also been highlighted to play a role in adolescent alcohol use and binge drinking (Chung *et al.*, 2018). For example, there is persuasive evidence that exposure to alcohol marketing in all forms has a negative impact on adolescent alcohol use, including both early onset and binge drinking (World Health Organisation, 2022b).

2.5.5 Epidemiology of health-risk behaviours in adolescence

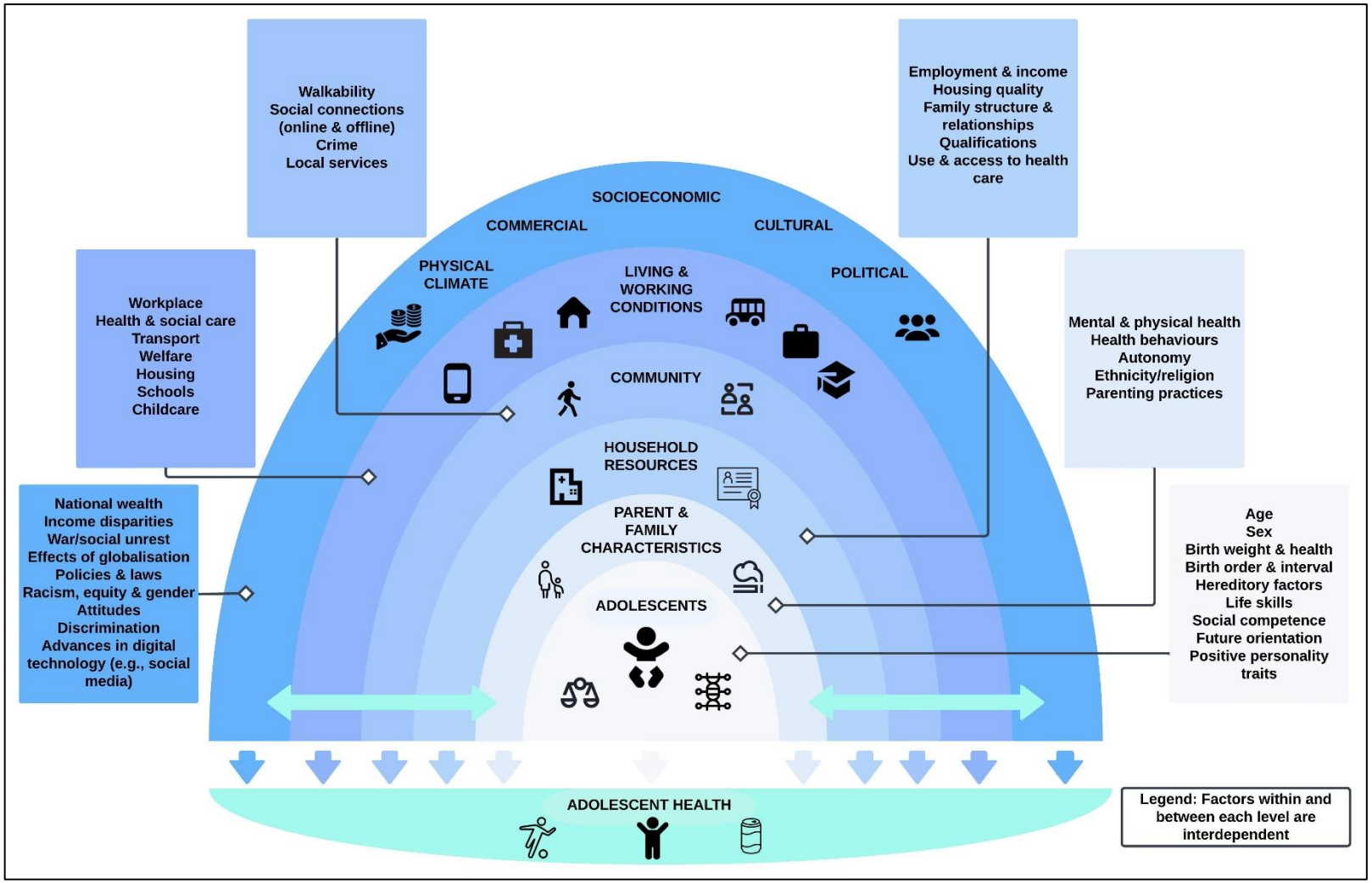
Non-communicable diseases (NCDs) are responsible for approximately 38 million out of 57 million adolescent deaths (World Health Organisation, 2014a). They are primarily a consequence of underlying and modifiable risk factors (e.g., health-risk behaviours), which often surface during adolescence (Beaglehole *et al.*, 2011; Akseer *et al.*, 2020; Murray *et al.*, 2020). In the 2019 Global Burden of Diseases, Injuries, and Risk Factors Study, which examines all WHO member states, health-risk behaviours, including alcohol use (2.6% of DALYs), unsafe sex (2.1%) and drug use (1.8%) were identified as major risk factors for DALYs lost among adolescents (Murray *et al.*, 2020). The detrimental health effects of these behaviours include increased risk of STIs, juvenile delinquency, and, as

mentioned, other NCDs associated with physical and mental health (Patton *et al.*, 2016). As health-risk behaviours can shape health and wellbeing across the life-course (Burge *et al.*, 2006; Wills, 2017; Kahn and Graham, 2019), understanding what places adolescents at an increased risk of engagement in these behaviours is critical to prevent future disease development.

As discussed, the neurobiological developments that occur during adolescence place adolescents at an increased propensity to engage in health-risk behaviours. However, these biological changes take place in a broader social context. The determinants of health are factors that may influence the health of an individual, community or population. When considering the determinants of health over and above the inherent characteristics of an individual (e.g., age, genetic inheritance), the term 'social determinants of health' is typically used (Marmot and Wilkinson, 2006; Dahlgren and Whitehead, 2007). As defined by the landmark Commission on the Social Determinants of Health, the social determinants of health are "the circumstances in which people grow, live, work, and age" (Commission on Social Determinants of Health, 2008). These social determinants include wider forces and systems, such as social and economic policies and political systems (World Health Organisation, 2021).

Figure 1 illustrates the social determinants of adolescent health and development, which can serve as risk or protective factors for health (World Health Organisation, 2014a).

Figure 1. Social determinants of adolescent health and development
Adapted from Dahlgren and Whitehead (1993); Kahn and Graham (2019); Pearce *et al*. (2019), and World Health Organisation (2014a)



At the individual-level, life skills, social competence, positive personality traits, and future orientation can protect against engagement in health-risk behaviours (Judd, 2019; Kahn and Graham, 2019). For example, the development of socio-emotional skills pertaining to self-management, self-awareness and communication can support adolescents in making positive choices related to their health and wellbeing (Kahn and Graham, 2019). Similarly, future orientation can protect against engagement in health-risk behaviours as this often requires adopting a strategic mindset when selecting risks to ensure those chosen pose the least threat to potential future plans (Maslowsky *et al.*, 2019). Section 2.5.2 discussed how interpersonal factors (e.g., parents, peers and teachers) influence adolescent behaviour. Although not commonly included in the above framework, advances in digital technology, specifically social media, may influence adolescent health-risk behaviours at the macro-level and will be discussed in Section 2.6.2.

2.6 Social media use and adolescent engagement in health-risk behaviours

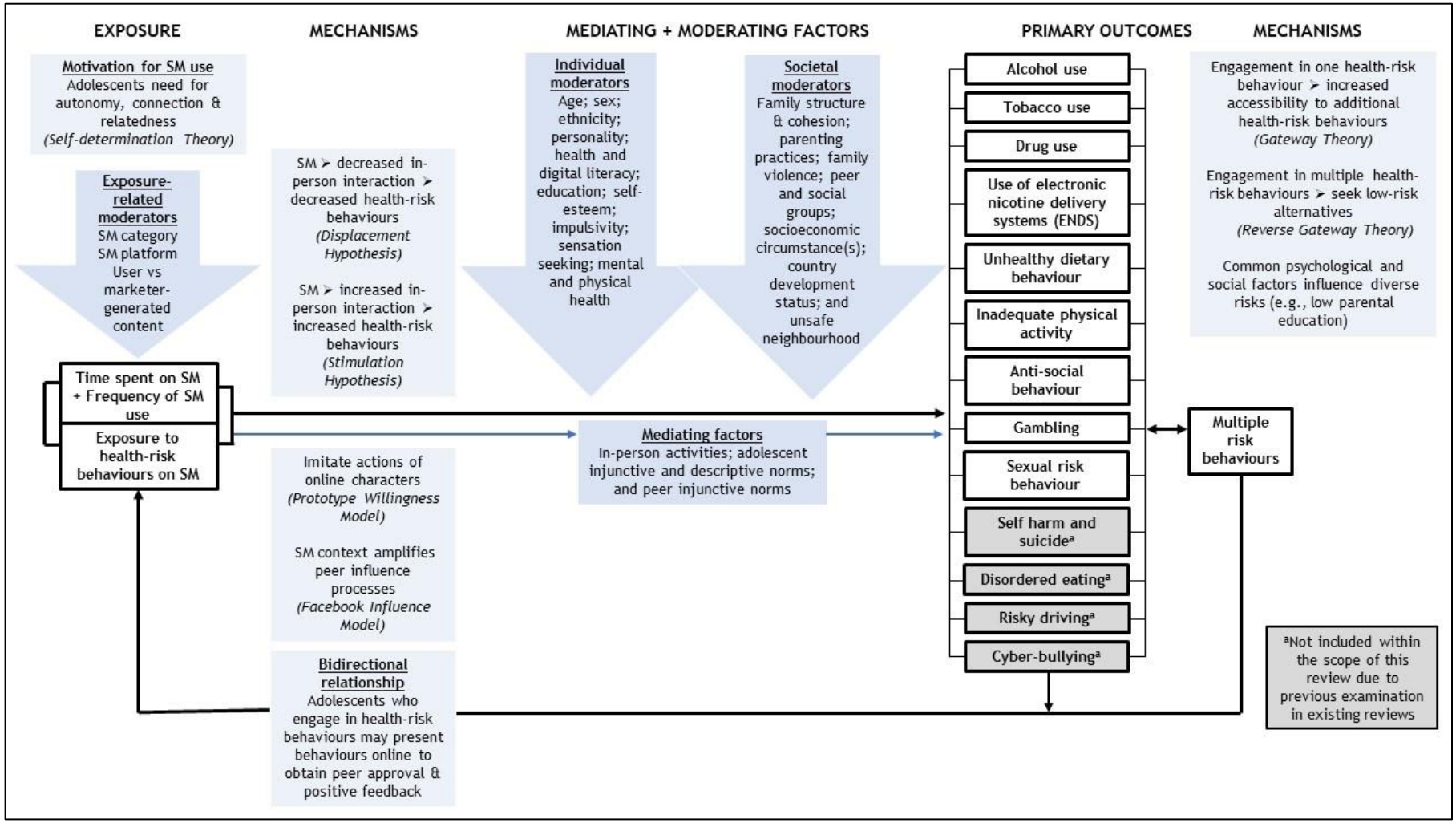
Researchers have suggested that the aforementioned trends of increased social media use and changes in health-risk behaviours among adolescents, which have occurred in recent decades, may be related (Crone and Konijn, 2018; Vannucci *et al.*, 2020). The behavioural manifestation of adolescent sensation-seeking and risk-taking has been shown to change in response to broader social and cultural factors which have occurred throughout history (Crone and Konijn, 2018; Vannucci *et al.*, 2020). Thus, this section will describe the possible mechanisms underpinning the potential relationship between social media use and adolescent engagement in health-risk behaviours. Following this, potential inequalities in the relationship between social media use and adolescent health-risk behaviours are explored.

2.6.1 Potential mechanisms underpinning the relationship between social media use and adolescent health-risk behaviours

This section will draw upon the logic model presented in Figure 2 to explore the potential mechanisms underpinning the relationship between social media use and adolescent health-risk behaviours. Logic models are particularly useful when

the mechanisms between an exposure and outcome(s) are predicted to be complex (Kneale *et al.*, 2015; Rehfuess *et al.*, 2018). They can be used to demonstrate hypotheses for how a particular exposure will work whilst additionally considering how external factors may interact with the hypothesised mechanisms of action (Kneale *et al.*, 2015; Rehfuess *et al.*, 2018). The logic model was developed following scoping of relevant literature and advice from subject experts and advisory group members.

Figure 2. Logic model illustrating the pathways between social media and adolescent health-risk behaviours



Legend: Abbreviation(s): SM=Social media.

The logic model (Figure 2) commences with a consideration of adolescent *motivations for social media use*. Intrinsic motivations for adolescent social media use are centred around their desire to meet psychosocial needs, including autonomy, competence and relatedness (Deci and Ryan, 1985). Social media can promote a sense of autonomy, as adolescents can be selective about what platforms and profiles to access (e.g., following specific profiles they value) and exert control over what personal information they wish to present. Event notifications and educational content on social media are a few of the many ways social media might promote a sense of competence. Communication and social contacts are central to social media platforms; therefore, social media can also support an adolescent's desire for relatedness and consequently enhance wellbeing (Lin, 2016). Moreover, positive relationships on social media can support connection and a sense of inclusion (Lin, 2016).

The different aspects of social media use (e.g., social media platforms) are recognised as *exposure-related moderators* in the logic model due to their potential to modify the relationship between social media use and adolescent engagement in health-risk behaviours. For example, considering social networking site based platforms, several studies have demonstrated how WhatsApp-based health communications can positively influence adolescent behaviours, including smoking (Yusriani and Acob, 2020) and physical activity (Ceylan and Erol, 2022). In contrast, media-sharing based social media platforms, such as Snapchat, have been shown to present harmful effects to adolescent engagement in health-risk behaviours by promoting upward comparison (Massey *et al.*, 2021). It is also possible that social media's influence on adolescent health-risk behaviours may vary by age and sex (*individual moderators*) and socioeconomic circumstance (SEC), and country income-level (*societal moderators*), yet there is limited evidence investigating these potential moderating factors (Huang *et al.*, 2014; Livingstone *et al.*, 2017; Marino *et al.*, 2018).

It is plausible that increased social media use may displace engagement in health-risk behaviours (in line with the *Displacement Hypothesis*), such as alcohol and drug use, due to reduced time spent in social environments which may promote these behaviours (Kraut *et al.*, 1998; Lewycka *et al.*, 2018; Ball *et*

al., 2023). However, it may also displace time in activities beneficial to health such as physical activity (Viner *et al.*, 2019). Conversely, as posited by the *Stimulation Hypothesis*, social media can support the enhancement of existing relationships and provide opportunities to form new ones, which may result in increased time in social environments which offer opportunities to engage in health-risk behaviours (Best *et al.*, 2015; Nowland *et al.*, 2018).

How social media use may amplify peer influence processes (*Facebook Influence Model*) and subsequently lead to increased adolescent engagement in health-risk behaviours was described in Section 2.4.1 (Moreno and Whitehill, 2014; Moreno and Koff, 2016). How exposure to the behaviours of online characters, such as social media influencers, may influence adolescent behaviour due to their greater reach and desirability (*Prototype Willingness Model*) was explored in Section 2.5.2 (Gibbons *et al.*, 1998; Gerrard *et al.*, 2008; Branley and Covey, 2018).

The mechanism explaining the transition from engagement in one health-risk behaviour to a second or multiple, as proposed by the *Gateway Theory*, was discussed in Section 2.5.4. However, it is also possible that adolescents who engage in multiple health-risk behaviours or more severe health-risk behaviours (e.g., cannabis use) may seek to identify low-risk alternatives (e.g., e-cigarette use) in line with *Reverse Gateway Theory* (Patton *et al.*, 2005; Agrawal *et al.*, 2008). The impact of common psychological and social factors, for example, greater socioeconomic disadvantage, on adolescent engagement in health-risk behaviours will be explored in Section 2.6.2.

Although this thesis focuses on the ability of adolescent social media use to influence subsequent engagement in health-risk behaviours, it is also plausible that a *bidirectional relationship* exists (Ruggiero, 2000; Sundar and Limperos, 2013). For example, in the case of adolescents who are more susceptible to engagement in health-risk behaviours, their needs may include presenting their risk behaviours online to obtain approval and positive feedback from peers, monitoring peer engagement in health-risk behaviours, seeking information on health-risk behaviours, organising opportunities to engage in offline health-risk behaviours, and securing connections with others who engage in similar health-risk behaviours (Vannucci *et al.*, 2020).

2.6.2 Inequalities in social media use and adolescent health-risk behaviours

This section describes the inequalities in access to and use of social media and in prominent health-risk behaviours (tobacco, e-cigarette and alcohol use). This is followed by a discussion on the potential for social media to widen or reduce inequalities in adolescent health-risk behaviours, thereby offering an introduction to Chapter 3, which discusses the role of social media as a potential determinant of health. To conclude, a brief explanation of the choice of indicator used to represent adolescent socioeconomic circumstances (SECs) in this thesis is provided.

2.6.2.1 The 'digital divide'

Despite the near ubiquitous use of social media, internet access varies and subsequently introduces inequalities in access to social media. The 'digital divide' is the unequal access to digital technology and the digital literacy to use these technologies, leading to inequality in access to information and resources (World Health Organisation, 2020b). These inequalities can exist between countries or between individuals living within them. The 'digital divide' became particularly relevant during the COVID-19 pandemic, when social media and the internet played pivotal roles in facilitating access to health services, education, and social connection (Ramsetty and Adams, 2020). As more aspects of life moved online, those not digitally enabled (due to a lack of access to social media and/or the skills required to use it) were at a health disadvantage due to their inability to harness the benefits these online pathways offered (Brown, 2022).

In January 2019, in the low/low-middle income region of Middle Africa, only 12% of the regional population reported having internet access (Kepios, 2019). Whilst in Oceania, a high-income region, 69% reported having internet access (Kepios, 2019). The 'digital divide' is not confined to LMICs, nor are the resultant effects of this inequality confined to the ability to access health information and services, but extend to employment, housing and educational opportunities (Brown, 2022; Cheshmehzangi *et al.*, 2022). All of which contribute to health indirectly (Brown, 2022).

2.6.2.2 Inequalities in health-risk behaviours

Health inequalities are defined as the preventable differences in health outcomes which exist between different groups (McCartney *et al.*, 2019). SEC, defined as the "social and economic factors that influence what positions individuals or groups hold within the structure of society" (Krieger *et al.*, 1997), is the product of all determinants of health. SEC is often divided into two distinct types: objective aspects of SEC, which include household income, occupation and parental education (and will be the focus of this thesis), and subjective SEC, which refers to the perception an individual has of their own SEC relative to others (Kraus *et al.*, 2011).

A large body of evidence demonstrates the increased propensity for substance use (Bersamin *et al.*, 2017; Lee *et al.*, 2018), unhealthy dietary behaviours (Zarnowiecki *et al.*, 2014), sexual risk behaviours (Vukovic and Bjegovic, 2007), anti-social behaviours (Piotrowska *et al.*, 2015), and gambling behaviours (Calado *et al.*, 2017) in adolescents with greater socioeconomic disadvantage. It has been suggested that this is explained by the greater economic and psychological pressures experienced by parents with lower SEC (Conger and Elder, 1994; Conger *et al.*, 2010). For example, they could have fewer resources to invest in educating their children and may be more likely to adopt more negative parenting styles, which may result in more behavioural and psychological problems (Conger *et al.*, 2010).

Tobacco use is a leading behavioural contributor to socioeconomic inequalities in health (Moor *et al.*, 2015). Although there has been a general decline in tobacco use prevalence among adolescents in many Western countries (as mentioned in Section 2.5.4.1), socioeconomic differences in the prevalence of adolescent tobacco use persist (Moor *et al.*, 2015). This is demonstrated within UK, US, French and Danish adolescents, where the prevalence of adolescent tobacco use is highest among those with greater socioeconomic disadvantage (Green *et al.*, 2016; Pérez *et al.*, 2018; Holstein *et al.*, 2020; Janssen *et al.*, 2020; Usidame *et al.*, 2022). Similar to the well-established SEC gradient in tobacco use, greater socioeconomic disadvantage is associated with greater frequency of e-cigarette use in UK adolescents (Babineau *et al.*, 2015; Green *et al.*, 2020), with a similar picture in US adolescents (Simon *et al.*, 2017; Wills *et al.*, 2017).

When considering the SEC gradient in alcohol use, evidence is mixed. For example, research from the UK and Finland has shown a higher prevalence of alcohol use in adolescents with greater socioeconomic disadvantage (Currie *et al.*, 2005; Liu *et al.*, 2016). However, a large body of evidence suggests the opposite - that those with greater socioeconomic disadvantage consume similar or less alcohol on average as those more socioeconomically advantaged (Kendler *et al.*, 2014; Boyd *et al.*, 2021). Although increased alcohol use is associated with harms in all socioeconomic groups, individuals with greater socioeconomic disadvantage are disproportionately affected - a finding commonly referred to as the 'alcohol harms paradox' (Institute of Alcohol Studies, 2020). Specifically, the rate of alcohol-attributable harms and 'harms per litre' is markedly higher in those at greater socioeconomic disadvantage than those of lower disadvantage, even after accounting for differences in binge drinking and consumption (Katikireddi *et al.*, 2017).

The differences in the consumption patterns or consequences of the aforementioned health-risk behaviours across SECs can lead to health inequality which may widen throughout the life-course. Ultimately this may result in socioeconomic inequalities in violence, social and emotional wellbeing, cancers, infectious diseases, life expectancy and mortality (Vallejo-Torres *et al.*, 2014; World Health Organisation, 2018b; Currie and Bray, 2019).

There is a need for evidence-based and cost-effective policy interventions which target tobacco, e-cigarette and alcohol availability (e.g., reducing the disproportionate density of alcohol/tobacco outlets in deprived neighbourhoods) and affordability (e.g., the implementation of minimum unit pricing in Scotland and Wales; Wyper *et al.*, 2023). Additionally, addressing the marketing of these products is important. Regarding health inequalities, there is a need for stronger, more consistent policy which tackles the cross-border marketing of health-risk behaviours to adolescents on all media channels, especially when such marketing is aimed at those more disadvantaged with fewer resources (World Health Organisation, 2022b).

2.6.2.3 Inequalities in the health consequences of social media

Section 2.5.5 introduced the social determinants which can influence adolescent engagement in health-risk behaviours. Digital technology, specifically the introduction of social media, is one social determinant which has received less attention. Positioned as a macro-level determinant (Figure 1), social media is inextricably linked to other macro-level (e.g., political and commercial) and micro-level (e.g., household resources) determinants (World Health Organisation, 2014a). For example, the political and commercial determinants, to some degree, influence adolescent exposure to unhealthy commodities on social media. These, in turn, may influence adolescents' social norms surrounding health-risk behaviours and their subsequent engagement in these behaviours (Sherman *et al.*, 2016). Conversely, assertive and interactive social media (e.g., behaviour change interventions via social media platforms) can facilitate healthy risk-taking through the provision of educational information and enabling engagement with broader social support networks (O'Dea and Campbell, 2011; O'Keeffe and Clarke-Pearson, 2011; Goodyear *et al.*, 2021; Gunther *et al.*, 2021). However, the above requires access to the internet and a degree of digital literacy, which is determined in part by household resources such as access to devices that enable social media use.

The potential role of social media in widening or reducing inequalities is largely overlooked. This is despite recent discussions arguing that social media is a determinant of health, as will be discussed in Chapter 3 (Marmot *et al.*, 2020; The Lancet Public Health, 2020; Sieck *et al.*, 2021; World Health Organisation, 2021; Brown, 2022). Conceptually, there are two possible mechanisms through which social media could contribute to health inequalities: differential exposure and differential susceptibility (Diderichsen *et al.*, 2019). If social media use negatively impacts health, higher use in those more socioeconomically disadvantaged could contribute to health inequalities (differential exposure). In contrast, if social media use positively influences health, lower use in those more socioeconomically disadvantaged could potentially contribute to health inequalities (differential exposure). The second way considers if social media effects on health vary by SEC (differential susceptibility) (Diderichsen *et al.*, 2001) and is investigated in Chapters 5 and 6. For example, it is theoretically plausible that if social media use produces greater harms to health in those more

socioeconomically disadvantaged compared to those more advantaged, this could result in a widening of health inequalities (Diderichsen *et al.*, 2001; Pearce *et al.*, 2019).

2.6.2.4 Measuring socioeconomic circumstance (SEC)

Health inequalities exist across multiple dimensions including gender and ethnicity; however, there is a major focus on SEC within academic literature and public health policy. To some extent, this stems from SECs influence on health behaviours (e.g., tobacco, e-cigarette and alcohol use) and in turn socioeconomic inequalities in health and mortality (Steel *et al.*, 2018; Marteau *et al.*, 2021). As a result, public health policy has attempted to shift from tackling the behavioural causes of health inequalities in isolation to tackling both behaviour and social causes (e.g., SEC) in parallel (Marteau *et al.*, 2021).

As discussed, SECs are multifaceted and vary across the life-course (Arcaya *et al.*, 2015). At the individual level, measuring inequalities in adolescents often involves using parental measures of SEC. This is partly because SEC generally comprises factors not fully formed in adolescence (e.g., occupation, income) (Vukojević *et al.*, 2017; Hammond *et al.*, 2021). Of the parental measures which exist (e.g., occupation, income), educational qualifications are of particular importance when considering adolescent health behaviours, as they are potentially more strongly correlated with health behaviours (Currie and Goodman, 2020) while also being related to other measures of SEC (Erola *et al.*, 2016; Okamoto, 2021). Moreover, it is considered a stable measure, as it is commonly established at an early age, and is fairly constant over time (Sirin, 2005).

Therefore, when assessing if social media's influence on cigarette use, e-cigarette use (Chapter 5) and binge drinking (Chapter 6) differs by SEC, parental educational qualifications are used as the indicator of SEC.

2.6.3 Rationale for research

Social media use has arguably reshaped population health. However, a holistic understanding of its role as a potential determinant of health is lacking. Essays offer the opportunity to raise awareness on current advances in a field and

speculate on future directions for policy and research (Berterö, 2016). As the potential impact of social media on health warrants attention from health professionals, educators, policymakers, and the academic community, this thesis commences with an essay that makes an argument for the investigation of social media's influence on health (Chapter 3).

Decisions in health policy and practice require the best available evidence, often in the form of systematic reviews and, where possible, meta-analyses (Lasserson *et al.*, 2022). Given the current discussions regarding policy to secure adolescent safety online, there is a need for transparent and reproducible systematic reviews, reporting high-quality, relevant and accessible up-to-date information (Haddaway and Pullin, 2014). To date, only two systematic reviews exist which assess the influence of social media use on adolescent health-risk behaviours (Curtis *et al.*, 2018; Vannucci *et al.*, 2020). This may be, in part, due to the infancy of this field of research, limiting the available evidence which can be used to guide policy development.

The most recent and significant review conducted by Vannucci *et al.* (2020) left several questions needing to be answered. Firstly, this review synthesised electronic media use with social media use, inhibiting the generalisation of findings specific to social media. Secondly, due to the infancy of social media and health research, the review could only synthesise 29 cross-sectional studies, assessing only four health-risk behaviours (alcohol use, tobacco use, violence-related behaviours and sexual risk behaviours). Thirdly, this review relied on pooled correlations, preventing any conclusions about the magnitude of associations, nor did it incorporate adjusted estimates. Moreover, given that the body of evidence assessing this relationship is largely observational, the potential for reverse causation and risk of confounding is high; thus, the absence of a formal risk of bias (RoB) and certainty of evidence assessment in this review should be noted. Therefore, the key limitations identified in this review provides the basis for the systematic review and meta-analysis described in Chapter 4.

One of the primary advantages of systematic reviews is their ability to identify gaps in an existing body of evidence (Haddaway and Pullin, 2014; Lasserson *et al.*, 2022). The systematic review and meta-analysis presented in Chapter 4 identified a need for studies which:

- Assess social media use using time-use diary data as well as self-report questionnaires
- Investigate social media impacts on under-researched health-risk behaviours
- Assess if social media effects differed across socioeconomic groups
- Are population-based and representative
- Are longitudinal rather than cross-sectional in design
- Adjust for a wide range of confounding factors identified via transparent, strong theoretical principles and ideally directed acyclic graphs
- Investigate the potential for reverse causation to identify the size of any potential health harm resultant of social media use or whether an effect exists at all

The gaps identified in the systematic review and meta-analysis provide the impetus for this thesis's investigation of the influence of social media use on adolescent engagement in cigarette, e-cigarette and dual use (Chapter 5) and alcohol use and binge drinking (Chapter 6), and particularly for considering if effects differ by SEC.

2.7 Thesis aim and objectives

2.7.1 Thesis aim

This thesis aimed to explore the relationship between social media use and adolescent health-risk behaviours. A secondary aim was to identify if relationships differ by SEC.

2.7.2 Thesis objectives and hypotheses

The research objectives (ROs) and hypotheses (where relevant) guiding this thesis are outlined below.

RO1: To examine social media's role as a determinant of health (Chapter 3)

RO2: To systematically review and synthesise existing evidence on the association between social media use (time spent on social media, frequency of use of social media, exposure to health-risk behaviour content on social media or other social media activities) in adolescents aged 10-19 years and their engagement in health-risk behaviours (described in Section 2.5.4) (Chapter 4)

RO3: To estimate the effects of time spent on social media in adolescents on the risk of cigarette, e-cigarette and dual use, using UK-representative data from the MCS, and explore if the effects of social media use on cigarette and e-cigarette use differ by SEC (Chapter 5)

I hypothesise that increased time spent on social media will increase risk of cigarette, e-cigarette and dual use, and any reported effects will be greater among those more socioeconomically disadvantaged (compared to those less disadvantaged)

RO4: To estimate the effects of time spent on social media in adolescents on the risk of alcohol use and binge drinking, using UK-representative data from the MCS and explore if the effects of social media use on binge drinking differ by SEC (Chapter 6)

I hypothesise that increased time spent on social media will increase risk of alcohol use and binge drinking, and any reported effects will be greater among those more socioeconomically disadvantaged (compared to those less disadvantaged)

Chapter 3 Social media as a determinant of health

3.1 Foreword

In this section, I provide some background on the rationale for the article, which follows.

To set the scene for the work conducted in the thesis, I felt it was important to provide a holistic overview of how social media design features, combined with user actions and decisions, can influence health in the wider global population. To do this, I developed a logic model with input from co-authors to illustrate the potential mechanisms through which social media design features, and individual user actions, may influence health. In the article that follows, drawing upon the logic model, I provide an introductory argument that posits social media as a determinant of health, acting in multiple ways.

Of importance, as outlined in Section 1.3, this section did not start from an *a priori* assumption. The knowledge acquired throughout the development of the systematic review (Chapter 4), combined with insight from my return to clinical practice during the COVID-19 pandemic, heightened my awareness of social media's role in health information exchange and the resultant health inequalities which may arise. Following this insight, in terms of co-authors, I prioritised wider input from key academics in the field of the determinants of health to ensure all possible influences and mechanisms were considered. Moreover, the evidence base reviewed during the development of this article supported the identification of the indicator of socioeconomic circumstances (SECs) used to represent the effect modifier investigated in the analyses presented in Chapters 5 and 6. I recognise that the pathways I present in this article for social media acting as a determinant of health are tentative, and thus further exploration is required.

3.2 Title, authorship and publication details

This manuscript is under submission with *The BMJ*.

Purba AK, Pearce A, Henderson M, McKee M, Katikireddi SV (2023) Social media as a determinant of health. *The BMJ* (under submission)

3.3 Social media as a determinant of health

Key messages

- Social media has fundamentally reshaped population health.
- There is an urgent need for health professionals to increase their understanding of social media as a determinant of health to help harness the opportunities and minimise its risks.

Standfirst

Purba *et al*. argue that social media is fundamentally reshaping population health, with health professionals and researchers neglecting its impact for too long. A holistic understanding of social media as a major determinant of health is needed.

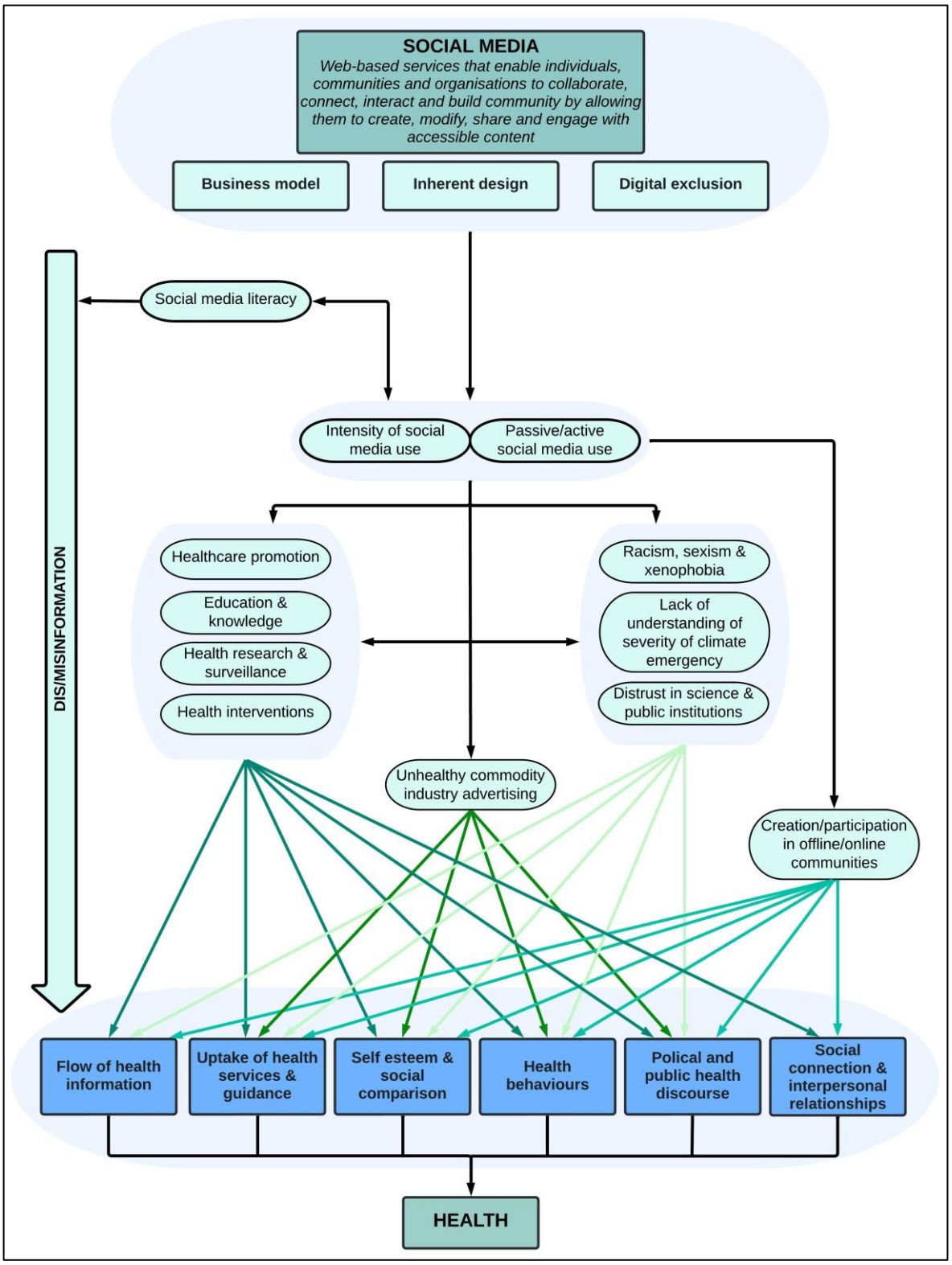
Background

The ways we communicate have changed in unprecedented ways. Couples sit at restaurant tables looking not into each other's eyes but into their screens. New phenomena, like 'influencers' and 'fake news', have entered our daily lives, often with profound political consequences. By 2022, an estimated 4.62 billion people used social media, approximately 58% of the global population (Kepios, 2022a). Users can choose from a dizzying array of platforms, some global (e.g., Facebook and Twitter), and some local (e.g., China's Weibo). However, despite the spread of social media, there is a persisting 'digital divide' in internet access, with many, even in high-income countries (HICs), suffering from 'digital exclusion' preventing social media access.

For those on the ‘right side’ of the digital divide, the benefits of social media, from a health perspective, are obvious. It can offer opportunities to share information among health professionals and the public, enhancing understanding of illness, from treatment options to the lived experiences of patients (Mendoza-Herrera *et al.*, 2020). But social media may not always be beneficial, and, as seen throughout the COVID-19 pandemic, not everyone uses social media with the desire to support health. Most obviously, unhealthy commodity industries use social media to promote products such as tobacco, alcohol and unhealthy food, thereby increasing their consumption and associated adverse health consequences (Lyons and McCreanor, 2018). Then there are those individuals who, for diverse reasons, seek to undermine health messaging and promote dis/misinformation (Broniatowski *et al.*, 2018). Measures that involve collective action by governments to protect the health of their populations are often portrayed as an attack on their liberty.

Drawing upon the logic model presented in Figure 3 we argue that social media is, itself, a major determinant of health and that health professionals must understand and engage with social media, harnessing its benefits while countering its risks. Figure 3 illustrates how the business model of social media corporations, social media’s inherent design features, and digital exclusion can influence social media use, as well as the activities performed on social media. Both social media use and activities performed may consequently influence the impacts of, for example, social media health interventions, the education and knowledge an individual can acquire from social media, and exposure to unhealthy commodity advertising on social media. All of these may influence health through, for example, the uptake of health services and guidance and health behaviours. Thus, this paper offers a primer on the potential mechanisms through which social media may impact health (Figure 3).

Figure 3. Logic model illustrating pathways between social media and health



Improving the flow of health information

Social media has democratised the production and supply of information. More accessible than traditional information sources (e.g., health facilities or libraries), it provides a vehicle for disseminating diverse content on health

conditions/services, with many health professionals and the public accessing Twitter or WhatsApp for the latest research during the pandemic. This content may be adapted to the contexts, languages, and the cultural backgrounds of its users, an approach endorsed by the World Health Organisation (WHO) and the United Nations Children's Fund (UNICEF), who increasingly use social media for health promotion (Mendoza-Herrera *et al.*, 2020). By being able to access and share health information, the wider public can more easily engage with health professionals to co-develop management regimes which meet their needs (Mendoza-Herrera *et al.*, 2020). Social media's benefits also extend to research: assisting in the recruitment of study participants and those with lived experience to co-design studies, facilitating data collection, or as a vehicle for an intervention (Sinnenberg *et al.*, 2016).

The potential for two-way communication on social media platforms also supports public health monitoring. The Centers for Disease Control and Prevention (CDC) FluSight Challenge identified flu-related tweets to model epidemic levels, facilitating the development of accurate weekly regional-level illness predictions (Aiello *et al.*, 2019). Moreover, geo-located tweets have enabled the modelling of disease spread as a function of human movement, as with the Chikungunya virus in 2017 (Aiello *et al.*, 2019).

Social media data have served a vital role in disease surveillance and help to overcome the lack of representativeness inherent in many traditional surveillance systems that are often limited to individuals who obtain care, thereby missing unmet need and underestimating the total disease burden (Aiello *et al.*, 2019). Yet, there must be concerns about failures to capture those who do not have access to social media, as well as issues of privacy, accuracy, and risks of revealing personal data to operators of digital platforms or governmental surveillance agencies (Aiello *et al.*, 2019).

Social connectedness and interpersonal relationships

There is considerable evidence that 'social capital' – the network of relationships between individuals that allow them to function in society – can improve health, particularly amongst those in minority groups (e.g., lesbian, gay, bisexual, transgender, queer (LGBTQ+) populations, and those with

disabilities) (Goryakin *et al.*, 2014). The social resources an individual can obtain through close networks can be increased by strengthening the intensity of relationships between individuals and institutions (Goryakin *et al.*, 2014). This became clear during the pandemic, where social media allowed individuals with shared problems or interests to engage even though separated geographically. However, there is a downside as these networks can become 'echo chambers' for those spreading polarised, extreme, and health-damaging messages. Social media can also increase isolation in those who move their social life online and reduce in-person physical interactions. The contribution of social media to social capital is thus determined by how it is used and how intensively (Winstone *et al.*, 2021). Passive use (e.g., browsing/scrolling without direct engagement) is unlikely to have the same social benefits as active use (e.g., liking or sending messages). While excessive use can result in increased loneliness and reduced social connection, the opposite might happen at low-moderate levels of use (Winstone *et al.*, 2021).

Self-esteem and social comparison

Social media use is linked to several mental health conditions, including anxiety and depression (Kelly *et al.*, 2018; Alonzo *et al.*, 2021). This can, in part, be explained by its attention-economy business model and inherent design features, which drive use and elicit addictive behaviours. The 'infinite scroll' functionality was created to "maximise addictiveness" and operates by exploiting the human desire for intermittent variable rewards, leaving users on an endless search for their next fix (Harris, 2016b; Bhargava and Velasquez, 2020). This impulse to search endlessly produces habitual behaviour, so that social media monopolises time and renders users vulnerable to frequent upward social comparison. The detrimental effects include erosion of self-esteem and obsessive-compulsive behaviours. It is unlikely that Instagram's 'Take A Break' tool, designed to nudge users to take a break during scrolling (5Rights Foundation, 2022b), or TikTok's opt-out 60-minute screen time limit for users aged 13-18 years, will address this problem.

A more calculated effort to harness user attention is Instagram's variable-ratio reward schedule. Instagram's notification algorithms withhold 'likes' on photos posted, delivering them later in large bursts. Consequently, when a user posts a

photo, they experience dissatisfaction at having received fewer ‘likes’ than expected. These initial negative effects prime human dopamine centres to respond vigorously to the sudden influx of appraisal (received when ‘likes’ are later delivered in large bursts), leading to more time spent on the platform and potentially more harmful effects to health (Schultz, 2016).

Health behaviours

There is a wealth of research documenting the detrimental effects of digital marketing on the consumption of unhealthy commodities (e.g., tobacco and unhealthy foods), which underpin the bulk of global disease (Lyons and McCreanor, 2018). Emerging evidence globally has shown how unhealthy commodity industries have leveraged the pandemic for commercial gain. McDonalds offered a free ‘thank you’ meal to healthcare workers if they shared a ‘selfie’ with the franchise, the irony of which is clear (Gerritsen *et al.*, 2021).

Digital marketing increasingly involves influencers and celebrities who endorse products. The willingness of manufacturers to pay these celebrities vast sums illustrates how they affect purchasing decisions, exploiting their knowledge, position, or relationship with their audience, which admires and perhaps wishes to emulate them. Beyond that, users are exposed to the behaviours of friends in their network, which we know influences engagement in health-related behaviours.

Exposure to such content, combined with the ever-evolving ranking algorithms used by social media to drive advertising, is a matter of concern. These algorithms determine which content to deliver to users in their ‘feed’ based on their previous online behaviour, maximising engagement and advertising revenue (Zenone *et al.*, 2022). Thus, if one was to ‘like’ a post showing alcohol, one would subsequently see similar content proliferate on one’s feed.

When faced with calls to protect children and other vulnerable groups, unhealthy commodity industries have promoted voluntary codes of conduct to forestall statutory measures (Lencucha and Thow, 2020), consistent with their lobbying to minimise regulation (Carah and Brodmerkel, 2021; Hinchliffe, 2022). Most legislation addressing influencer marketing falls within the scope of general

advertising regulation, which calls for content to be visibly labelled (e.g., sponsored) (Michaelsen *et al.*, 2022). Yet, influencers frequently fail to disclose any contractual relationship between themselves and brands endorsed (Michaelsen *et al.*, 2022). Users may, therefore, not realise the conflicts of interest underlying influencer recommendations.

Uptake of health services and guidance

Ranking algorithms have also created an ecosystem that encourages the spread of dis/misinformation (Törnberg, 2018). These algorithms have learnt to prioritise controversial issues that attract the most attention, some manipulated by bots. In this way, they shape the information that users are exposed to, thereby influencing individual thinking and, in some cases, undermining trust in science and public institutions. This can translate into lower adherence to public health recommendations and disengagement from services. This was demonstrated with the proliferation of misinformed content on vaccine effectiveness and non-pharmacological interventions during the pandemic, labelled an "infodemic" by the WHO (World Health Organisation, 2022a). Dis/misinformation can also amplify racism, sexism and xenophobia, all of which have direct and persistent health consequences, weakening global efforts to advance the right to healthcare and other human rights. With an awareness of the far-reaching effects of the climate emergency on health, the ability of dis/misinformation to undermine necessary action also raises cause for concern (Zenone *et al.*, 2022).

Political and public health discourse

The potential of social media to alter civic engagement and destabilise democracy was clear during the 2016 and 2020 US presidential elections. Despite initial hopes that social media would provide a decentralised and democratic forum to identify and discuss societal problems freely, it has often revealed the worst of human instincts. The clustering of opinions in online 'echo chambers' has promoted confirmation biases, reinforced extreme/polarised views, and reduced exposure to other opinions. Unsurprisingly, there is a link between engagement with 'echo chambers' (that is, having narrower and more insular, polarised networks) and the spread of misinformation (Törnberg, 2018). Thus, an

‘echo chamber’ can provide an initial platform from which diffusion of misinformation can occur when misinformation resonates with the views of members of the ‘echo chamber’ (Törnberg, 2018).

Platforms run by Meta promoted self-regulation as a response to this rapid spread of misinformation (Carlson and Rousselle, 2020). However, this response lacks transparency, is of dubious effectiveness, and ignores the organisations that produce and promote misleading information (Carlson and Rousselle, 2020). This tendency for social media platforms to avoid responsibility is demonstrated by the update of Twitter’s Violent Speech Policy (Merchant, 2023). As with most social media platforms, threats and incitements to violence have long been prohibited. In Twitter’s updated policy, the mere act of hoping or wishing that an individual experiences harm (e.g., expressing a desire for a friend to get a paper cut) has now also been banned (Merchant, 2023). This policy was posited as a means to protect the health of Twitter’s community (Merchant, 2023), while critics argue it was to police violent/hate speech against Twitter’s new and arguably controversial owner, Elon Musk. This demonstrates the way social media corporations may not only promote self-regulation but also a self-preservation discourse, acting to promote their own interests (Merchant, 2023).

Amplification, an online disinformation strategy, creates impressions of false consensus through the use of non-human bots (accounts that automate content promotion and simulate user behaviour) and trolls (users who misrepresent their identities to promote discord) (Broniatowski *et al.*, 2018). Both are involved in the online public health discourse, skewing discussions on, for example, vaccine effectiveness. They retweet/modify content from human users, and consequently, well-intentioned posts containing factual information may unintentionally ‘feed the trolls’ (Broniatowski *et al.*, 2018). Without specialised knowledge and tools, it can be difficult to identify bots or trolls. This raises concerns about who is really behind these activities and the failure of social media corporations to accept any responsibility for undermining public health messaging.

Conclusions and recommendations

Social media is fundamentally reshaping population health and should be considered a major determinant of it. Social media offers many benefits, making information on health and disease more readily available. Yet, it also creates risks, in particular from aggressive marketing of unhealthy commodities and the spread of dis/misinformation that undermines public health messaging.

Health professionals will need new skills in this rapidly changing environment. As with any novel determinant of health, there is a need for more research into how it is evolving and what it means for health. This will require multi-disciplinary teams that include expertise in psychology, informatics, and media studies, among others. Beyond this, it will require greater practitioner awareness of the opportunities and challenges, including the importance of tackling dis/misinformation and those who promulgate it. Importantly, advocacy by public health organisations to strengthen regulation and enact legislation, where required, to tackle threats to health is paramount.

Contributors and sources

Amrit Kaur Purba is a PhD doctoral researcher examining the relationship between social media use and adolescent engagement in health-risk behaviours. She was responsible for writing the first draft of the manuscript, drawing upon UK and international research and policy. She revised the manuscript to incorporate feedback from co-authors. Co-authors included members of her PhD supervisory team: S. Vittal Katikireddi, Anna Pearce and Marion Henderson. To ensure the manuscript incorporated a broader perspective of social media's implications to health, Martin McKee acted as a co-author, providing feedback on manuscript revisions and contributing to the information sources cited in this manuscript.

Patient involvement

PhD advisory group members (including policy, non-governmental, and academic stakeholders), some of whom are in patient/public facing roles, provided guidance during development of the essay.

Conflicts of interest

Amrit Kaur Purba, Anna Pearce, Marion Henderson, and Martin McKee, have no conflicts of interest to declare. S. Vittal Katikireddi is on the steering group for Obesity Action Scotland.

Chapter 4 Social media use and adolescent health-risk behaviours: A systematic review and meta-analysis

4.1 Foreword

This section reflects on the rationale for the systematic review which follows, as well as some methodological considerations.

As discussed in Chapter 2, the purpose of a systematic review is to synthesise all available evidence on a specific research question in a manner which is structured, transparent and reproducible (Krnic Martinic *et al.*, 2019). Such reviews offer a summary of the nature and quality of evidence in a given area which can subsequently be used to inform decision-making and support the identification of gaps in need of further research. As well as a 'narrative' or descriptive synthesis of study findings (e.g., textual descriptions of reported findings and non-meta-analytic synthesis methods including sign tests and effect direction plots; Popay *et al.*, 2006; Campbell *et al.*, 2020), systematic reviews often use meta-analysis to obtained pooled effect estimates (Deeks *et al.*, 2021).

I chose to undertake a systematic review of the existing evidence on social media use and adolescent health-risk behaviours for two reasons. First, the discussions regarding the implementation of policy focused on securing adolescent safety online highlighted the urgent need for high-quality, relevant and accessible up-to-date information on the potential harms/benefits of social media use on adolescent health-risk behaviours. Second, the systematic review would offer an enhanced understanding of the research landscape in this area, which could inform the subsequent Millennium Cohort Study (MCS) analyses.

The conceptualisation and planning of the review protocol and review itself drew upon two previous reviews (Curtis *et al.*, 2018; Vannucci *et al.*, 2020), which examined social media use and a limited number of health-risk behaviours in adolescents/young adults. I aimed to build on these reviews as described in Section 2.6.3.

4.2 Title, authorship and publication details

This article has been provisionally accepted for publication by *The BMJ,* subject to minor revisions.

Purba AK, Thomson R, Henery P, Pearce A, Henderson M, Katikireddi SV (2023) Social media use and adolescent health-risk behaviours: A systematic review and meta-analysis. *The BMJ*.

4.3 Abstract

Objective(s)

To examine the association between social media use and health-risk behaviours: alcohol use, drug use, tobacco use, electronic nicotine delivery systems (ENDS) use, unhealthy dietary behaviour, inadequate physical activity, gambling, anti-social behaviour, sexual risk behaviour, and multiple risk behaviours in adolescents aged 10-19 years.

Design

Systematic review and meta-analysis.

Data sources

Excerpta Medica Database (EMBASE), Medical Literature Analysis and Retrieval System Online (MEDLINE), American Psychological Association (APA) PsycINFO, SocINDEX, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Social Science Research Network (SSRN), SocArXic, PsyArXiv, medRxiv, and Google Scholar (01.1997-06.2022).

Methods

Included studies reported a social media exposure (time spent, frequency of use, exposure to health-risk behaviour content or other social media activities) and ≥1 relevant outcome. Screening and risk of bias (RoB) assessments were completed independently by two reviewers. Synthesis Without Meta-analysis

(SWiM) based on effect direction and random-effects meta-analyses were used. Effect modification was explored using meta-regression and stratification. Certainty of evidence was assessed using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) approach.

Results

Of 17,077 studies screened, 126 were included (76 meta-analysed). The final sample included 1,431,534 adolescents (mean age: 15.0 years).

SWiM indicated harmful associations between social media and all health-risk behaviours in most included studies, except inadequate physical activity where beneficial associations were reported in 63.6% of studies. Frequent (vs infrequent) social media use was associated with increased alcohol consumption (odds ratio (OR) 1.48 [95% CI 1.32 to 1.62]; n=383,670), drug use (OR 1.28 [1.05 to 1.56]; n=117,646), tobacco use (OR 1.78 [1.45 to 2.19]; n=424,326), sexual risk behaviour (OR 1.78 [1.49 to 2.13]; n=47,325), anti-social behaviour (OR 1.73 [1.44 to 2.06]; n=54,993), multiple risk behaviours (OR 1.75 [1.30 to 2.35]; n=43,571), and gambling (OR 2.84 [2.04 to 3.97]; n=26,537).

Exposure to health-risk behaviour content on social media (vs no exposure) was associated with increased odds of ENDS use (OR 1.73 [1.34 to 2.23]; n=721,322), unhealthy dietary behaviour (OR 2.12 [1.87 to 2.39]; n=9,424), and alcohol consumption (OR 2.43 [1.25 to 4.71]; n=14,731). For alcohol consumption, stronger associations were identified for exposure to user-generated content (OR 3.21 [2.37 to 4.33]) vs marketer-generated content (OR 2.18 [0.96 to 4.97]).

For time spent on social media, use for ≥2 hours (vs <2 hours/day) increased odds of alcohol consumption (OR 2.13 [1.56 to 2.92]; n=12,390).

GRADE certainty was moderate for unhealthy dietary behaviour, low for alcohol use and very low for other investigated outcomes.

Conclusions

Social media use is associated with adverse adolescent health-risk behaviours, but further high-quality research is needed to establish causality, understand effects on health inequalities, and determine which aspects of social media are most harmful. Given the pervasiveness of social media, efforts to understand and reduce the potential risks adolescents face may be warranted.

Systematic review registration

PROSPERO ID: CRD42020179766.

What is already known on this topic

- Social media use has rapidly expanded, and it is now recognised as a powerful platform to promote health, but concerns exist over its potential impact on adolescent health-risk behaviours.

- Previous reviews have identified harmful associations between social media and some risk behaviours. Yet, they have focused on college and university populations, do not investigate social media explicitly (e.g., examine internet use) or consider the different aspects of social media use (e.g., time spent, exposure to health-risk behaviour content), and do not critically appraise included studies.

What this study adds

- Our systematic review demonstrates social media use is associated with several adverse health-risk behaviours in adolescents, though evidence for causality remains limited.

- Exposure to content showing health-risk behaviours has stronger evidence for adverse effects, particularly in relation to an unhealthy diet (which had the best quality evidence) and alcohol use.

4.4 Introduction

Social media has revolutionised the communication landscape, with approximately 139 million adolescents using Instagram and 120.2 million using Facebook globally in 2022 (Kemp, 2022a, 2022b). It can be defined as websites and applications which host numerous user activities, including the creation and sharing of content, social networking, and microblogging. Social media's diverse and inherently social nature has supported adolescents' need for autonomy, social connectedness, and relatedness (Chou *et al.*, 2009; Gebremeskel *et al.*, 2014; Aichner *et al.*, 2021; Boniel-Nissim *et al.*, 2022). Recognised by the World Health Organisation (WHO) as a powerful medium to promote health, the use of social media to elicit positive behaviour change is well documented, including increased physical activity and healthy diets through increased interaction, increased accessibility to health information, and peer/social/emotional support (Hamm *et al.*, 2014; World Health Organisation, 2018a; Goodyear *et al.*, 2021).

Despite its ubiquitous use and potential benefits, harmful effects on adolescent health-risk behaviours (e.g., substance use, sexual risk behaviour) at least partly due to aggravated peer-pressure and social norms are possible (Gebremeskel *et al.*, 2014; Pew Research Centre, 2018; Internet Matters, 2021). Numerous pathways may exist between social media and health-risk behaviours, as illustrated in Figure 4. Social media use might displace more traditional in-person interactions, thereby increasing physical inactivity. It can host marketer-generated (e.g., advertisements, influencers) (Moreno and Whitehill, 2014; Winpenny *et al.*, 2014; Qutteina *et al.*, 2019; Alruwaily *et al.*, 2020; Sacks and Looi, 2020), and user-generated (e.g., user and peer posts) content displaying consumption of unhealthy commodities (Moreno *et al.*, 2007; Laestadius and Wahl, 2017). Exposure to such content on traditional media has been shown to influence adolescent health-risk behaviours (including substance use and unhealthy diet) (Jackson *et al.*, 2018; Stiglic and Viner, 2019), with experimental and longitudinal research suggesting online content also influences behaviours offline (Moreno *et al.*, 2009; Litt and Stock, 2011; Papasolomou and Melanthiou, 2012; Sawyer *et al.*, 2012; Huang *et al.*, 2014; Nesi *et al.*, 2017).

Adolescence is a sensitive period for the adoption of lifelong behaviours – health consequences are, therefore, potentially immediate and lifelong (Gopinath *et*

al., 2010; Mokdad *et al.*, 2016; Murray *et al.*, 2020). Immediate consequences include (but are not limited to) alcohol/drug-related injury, low educational attainment and depression (for alcohol and drug use), and STIs and teenage pregnancy (for sexual risk behaviour) (UK Cabinet Office, 2020). Yet, these represent relatively extreme outcomes and for most adolescents, these behaviours, if experimental and short-lived, will have limited harms and can be considered a normal part of adolescent development. However, some health behaviours, such as poor diet, inadequate physical activity and alcohol consumption, can be set in adolescence and carry lifelong consequences (Gopinath *et al.*, 2010; Mokdad *et al.*, 2016; Murray *et al.*, 2020). For anti-social behaviour, shown to be associated with adverse consequences such as criminality and psychosocial malfunctioning, the long-term effects extend to causing significant distress for others, emphasising the public health relevance of this risk behaviour (Otto *et al.*, 2021).

Existing reviews focus on college/university populations (and are therefore not representative of all adolescents); assess social media under the broad scope of digital media/internet use; do not assess RoB; and examine few health-risk behaviours (namely substance use and sexual risk behaviour) (Frost and Rickwood, 2017; Curtis *et al.*, 2018; Lanthier-Labonté *et al.*, 2019; Stiglic and Viner, 2019; Orben, 2020; Fs *et al.*, 2021). Differential effects by socioeconomic circumstance (SEC), specifically whether more disadvantaged groups are more susceptible to harm from social media, consequently resulting in a widening of health inequalities (Diderichsen *et al.*, 2001), and between high-income countries (HICs) and low-middle income countries (LMICs), have also not been explored (Huang *et al.*, 2014; Livingstone *et al.*, 2017; Marino *et al.*, 2018). Prior research investigating social media's influence on adolescent mental health suggests age and sex differences, where greater negative effects exist for females and younger adolescents (compared to males and older adolescents), yet these potential differences are yet to be examined in relation to health-risk behaviours (Kelly *et al.*, 2018; Keles *et al.*, 2019).

The most recent review by Vannucci *et al.* (2020) explored social media's association with adolescent substance use and risky sexual behaviour. The review's synthesis of electronic media use (defined as "electronic media with a

direct component involving social interactions with others"; Vannucci, 2022) with social media and reliance on pooled correlations inhibits any explicit conclusions about the magnitude of associations resulting from social media use specifically (Vannucci *et al.*, 2020). Due to the high risk of confounding and reverse causation in studies in this area (which largely rely on observational data), it is also important to assess the quality of evidence, which has been limited in other reviews (Curtis *et al.*, 2018; Vannucci *et al.*, 2020)

Given the above, we aim to systematically review the evidence on social media use and adolescent health-risk behaviours, addressing the following objectives:

1. Explore how social media use is measured in studies examining its relationship with adolescent health-risk behaviours (alcohol use, drug use, tobacco use, ENDS use, unhealthy dietary behaviour, inadequate physical activity, gambling, anti-social behaviour, sexual risk behaviour, and multiple risk behaviours)

2. Investigate the association between time spent on social media and frequency of use on adolescent health-risk behaviours

3. Explore the association between exposure to health-risk behaviour content on social media and adolescent health-risk behaviours, and if any relationship differs by content viewed (user/marketer-generated)

4. Investigate if any relationships differ by social media platform/category used, age, sex, SEC, and development status of study setting

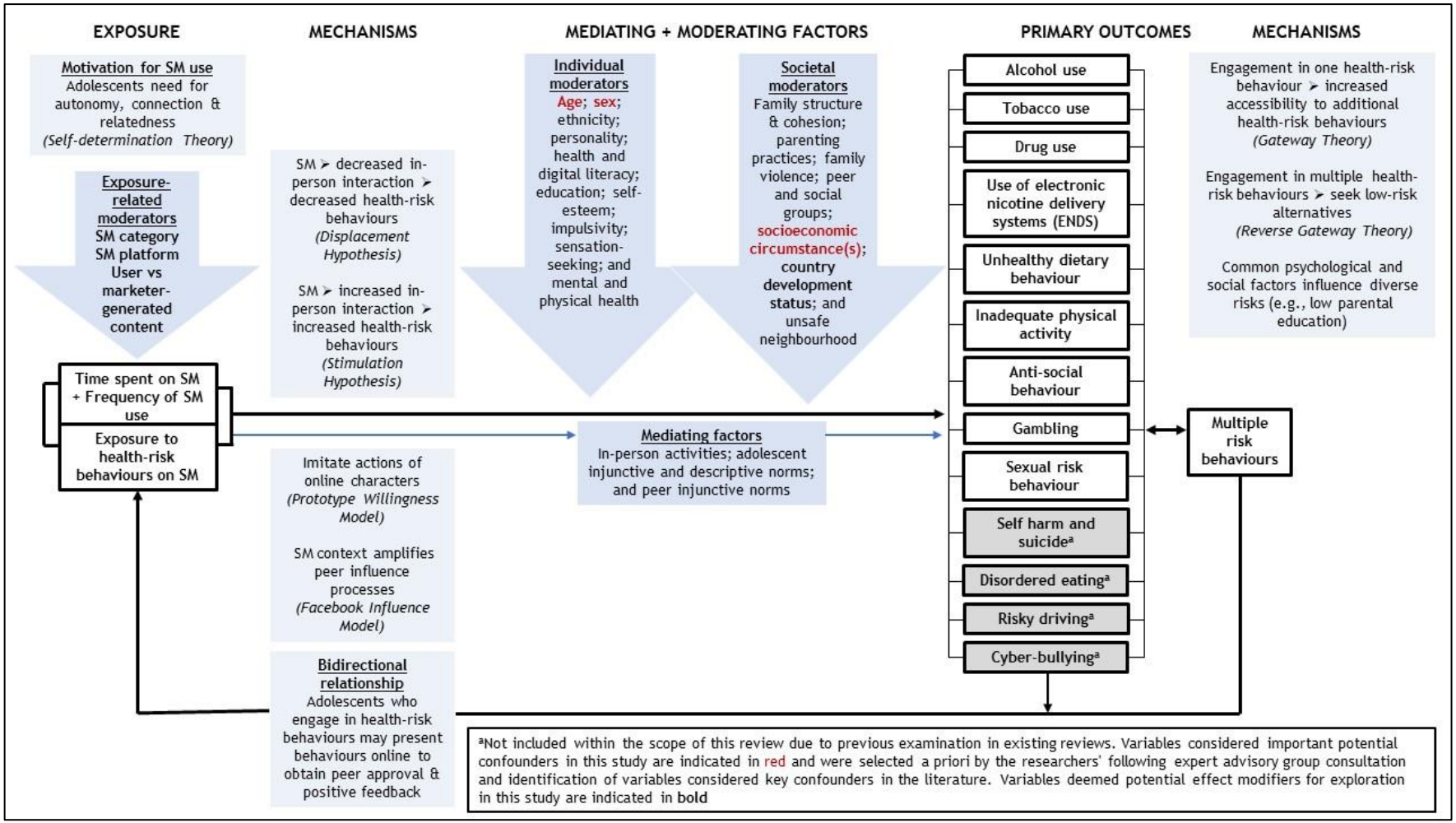
5. Evaluate the certainty of evidence using GRADE

4.5 Methods

We follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and SWiM reporting guidance (Campbell *et al.*, 2020; Page *et al.*, 2021). We published a pre-specified protocol (Purba *et al.*, 2020b), including a logic model (Figure 4; further background provided in the protocol), which was used to identify important confounders and effect modifiers. This study is

registered with PROSPERO (ID: CRD42020179766) (Purba *et al.*, 2020a). Protocol deviations are reported in Appendix A, Section A1.

Figure 4. Logic model illustrating the pathways between social media and adolescent health-risk behaviours – presenting important confounders and effect modifiers



Legend: Abbreviation(s): SM=Social media.

4.5.1 Search methods for identification of studies

EMBASE, MEDLINE, APA PsycINFO, SocINDEX, CINAHL, SSRN, SocArXic, PsyArXiv, and medRxiv were searched from 1st January 1997 (first recognisable social media site 'Six Degrees' launched) to 6th June 2022, using a comprehensive strategy developed with an information scientist (Appendix A, Section A2). We scrutinised the first thirty hits in Google Scholar, reference lists of included studies and relevant systematic reviews were screened, and subject experts contacted to identify additional, planned, ongoing, or unpublished studies. Filters for study types and geographical location/language limits were not applied (Lefebvre *et al.*, 2021). It was not possible to translate non-English language studies; these are reported in Appendix A, Section A3 (Lefebvre *et al.*, 2021).

4.5.2 Study inclusion and exclusion criteria

The precise age-range adolescence encompasses is debated. Following the WHO's definition, our population of interest was aged 10-19 years inclusive (Sawyer and Azzopardi, 2018; World Health Organisation, 2020a). Studies focusing on college or university participants (of all ages) were excluded due to the differing nature of social media use and health-risk behaviours in these groups. Studies including some non-college/university participants alongside college/university participants were included if relevant data on non-college/university participants could be extracted (Litt and Stock, 2011; Qutteina *et al.*, 2019).

The exposure of interest was use of any social media category in *The SAGE Social Media Categorisation* presented in Table 1 (Sloan and Quan-Haase, 2017). Online (social) gambling (e.g., simulated gambling via Facebook) and online (social) gaming were eligible due to their inclusion of core social media functionalities, namely user interaction (Parke *et al.*, 2012; Aburahmah *et al.*, 2016; Kaakinen *et al.*, 2020). Social media dating platforms were excluded as most are restricted to users ≥18 years (Grindr, 2020; Bumble, 2021; Tinder, 2021).

Social media exposures were classified into time spent (e.g., hours/day), frequency of use (e.g., daily, weekly, or general use), exposure to health-risk

behaviour content (e.g., alcohol advertising on Facebook), and other social media activities (e.g., strategies to manage online presence). The process used to classify the social media category, platform, and type of health-risk behaviour content (user-generated/ marketer-generated) of reported exposures is provided in Appendix A, Section A4.

The comparator group was those with no or differing levels of time spent/frequency of use/exposure to health-risk behaviour content.

Outcome selection was guided by preliminary evidence, the logic model (Figure 4), and an advisory group (see Appendix A, Section A5) (Guyatt *et al.*, 2011; Macarthur *et al.*, 2018). Eligible outcomes were alcohol use, drug use, tobacco use, ENDS use, sexual risk behaviour, gambling (not via social media, e.g., lottery, scratch cards), unhealthy dietary behaviour, inadequate physical activity, anti-social behaviour, and multiple risk behaviours (≥2 of the aforementioned behaviours). Appendix A, Section A6 provides definitions and illustrative examples of included outcomes.

Studies reporting quantitative data from primary research were eligible.

4.5.3 Selection of studies

Records were de-duplicated in Mendeley and imported to Covidence for screening (Mendeley Ltd, 2020; Veritas Health Innovation, 2020). Eligibility criteria were piloted on 100 studies, and all titles/abstracts and full-texts were independently screened by AKP and a second reviewer (PMH, RT, AP, and MH), with conflicts resolved via consensus and/or discussion with a third reviewer (SVK). Where eligible studies contained overlapping or duplicate data, a set of decision rules (presented in Appendix A, Section A7) considered alignment with our Population/Exposure/Comparator/Outcome criteria to select unique data for synthesis.

4.5.4 Data extraction and risk of bias (RoB) assessment

Data were extracted in Excel (version 2025) by AKP and checked by a second reviewer (PMH, RT, AP, and MH). Data extraction form templates can be found in Appendix A, Section A8. RoB assessment was conducted independently at

datapoint/outcome level by AKP and a second reviewer using an adapted version of the Newcastle Ottawa Scale (NOS), and the Cochrane Risk of Bias Tool for Randomised Trials (RoB-2) (Wells *et al.*, 2000; Cochrane, 2019). The NOS was adapted to incorporate insights from the Cochrane ROBINS-I RoB tool, with assistance from GRADE Public Health Group members (Sterne *et al.*, 2016). This included assessing adjustment for pre-identified critical confounding domains (e.g., sex, age, and any measure of SEC (e.g., parental academic qualifications)), other justifiable confounders, attrition and missing data. The adapted NOS and associated guidance for use are displayed in Appendix A, Section A9. Conflicts were resolved via consensus and/or discussion with a third reviewer (SVK). The RoB assessments informed data synthesis and certainty, assessed using GRADE (Guyatt *et al.*, 2011).

4.5.5 Data synthesis

Synthesis Without Meta-analysis (SWiM)

Within SWiM, effect direction was coded as beneficial or harmful for each outcome at the study level, with findings categorised as inconsistent if <70% of extracted datapoints reported a consistent effect direction (Campbell *et al.*, 2020; Boon and Thomson, 2021). As per Cochrane guidance, statistical significance was not taken into account (McKenzie and Brennan, 2021). Sign tests assessed evidence of effect where there were ≥3 studies within a synthesis. Modified effect direction plots (created using *RStudio.V1.2.5)* displaying RoB results were produced (RStudio Team, 2020; Boon and Thomson, 2021).

Primary meta-analyses

Meta-analyses were performed by outcome for time spent on social media, frequency of social media use, and exposure to health-risk behaviour content, but not for other social media activities due to heterogeneity. Given anticipated heterogeneity in study designs, settings and measures, we used random-effect models using the DerSimonian and Laird estimator (Veroniki *et al.*, 2016). Heterogeneity was assessed with the I^2 statistic (Deeks *et al.*, 2021). Continuous exposures (exposures assessed on a continuous scale) were analysed separately from binary exposures (Deeks *et al.*, 2021) (Appendix A, Section A10). For binary

exposures, ORs were estimated (Deeks *et al.*, 2021). For continuous exposures, data were pooled to produce standardised beta coefficients (Std. Beta) or standardised mean differences (SMDs) for continuous outcomes and ORs for binary outcomes.

Where ≥10 studies were included in a meta-analysis, meta-regression explored heterogeneity by the following characteristics identified *a priori*: health-risk behaviour content viewed on social media (user vs marketer-generated), social media category (e.g., social networking sites), social media platform (e.g., Facebook), sex, average SEC of participants, development status of study setting (HIC vs LMIC) and average age of participants (<16 vs ≥16 years, as existing evidence demonstrates risk behaviours tend to peak at age 16 years, and the majority become acceptable (albeit not necessarily legal) from a societal perspective) (Harden *et al.*, 2017; World Bank, 2021). Statistical analysis was performed using *Stata.V16* (StataCorp, 2019).

Subgroup/sensitivity analyses

We stratified meta-analyses by the above characteristics if at least one subgroup had ≥2 studies and investigated potential bias by examining results by study design (cross-sectional vs cohort/randomised control trial (RCT)); adjustment for pre-identified critical confounding domains (age, sex, and SEC); RoB; and excluding datapoints with samples containing individuals outside our eligible age-range (10-19 years).

4.5.6 Publication bias

Publication bias/small study effects were assessed using funnel plots and the Egger's test when ≥10 studies were meta-analysed (Ioannidis and Trikalinos, 2007; Peters *et al.*, 2008).

4.5.7 Certainty of the evidence

Certainty was assessed using GRADE, which combines information on RoB, imprecision, inconsistency, indirectness, and publication bias (Guyatt *et al.*, 2011). As per GRADE, advisory group members ranked the importance of outcomes via an online survey (shown in Appendix A, Section A5), and certainty

for the top seven ranked outcomes (alcohol use, drug use, tobacco use, ENDS use, sexual risk behaviour, gambling, and multiple risk behaviours) assessed using a four-category system (very low-high) (Guyatt *et al.*, 2011). Observational evidence automatically started at low with the ability to upgrade/downgrade (Guyatt *et al.*, 2011; McMaster University, 2020).

4.5.8 Patient and public involvement

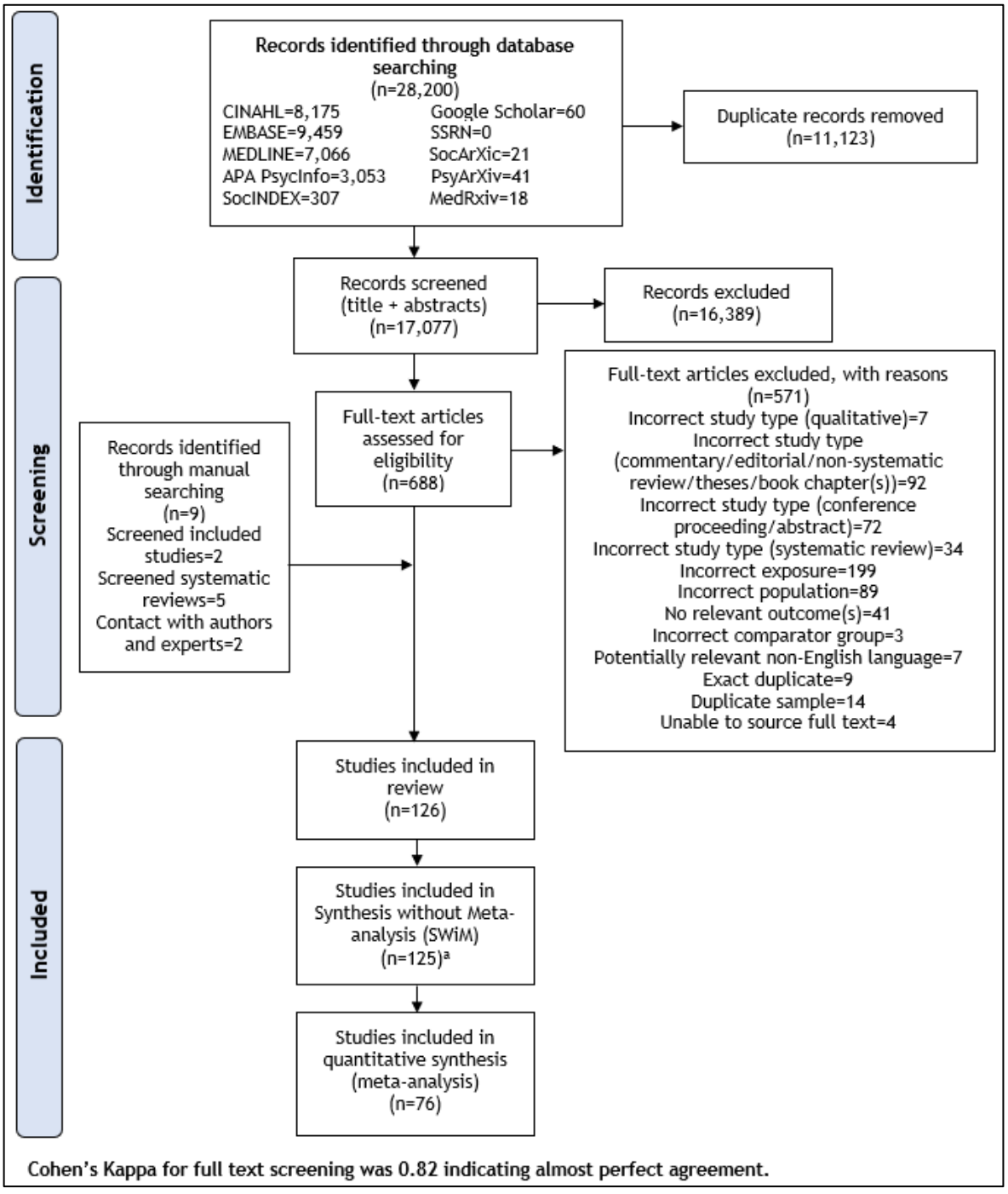
Advisory group members included policy, non-governmental, and academic stakeholders who provided guidance during protocol development and the review stages (see Appendix A, Section A5). Public and policymaker-facing summaries will be co-produced with additional public representatives and advisory group members.

4.6 Results

4.6.1 Description of studies

Of 17,077 studies screened, 688 full-text studies were assessed, with 126 included (76 meta-analysed) (Figure 5). The final sample included 1,431,534 adolescents (mean age: 15.0 years). Most included studies were cross-sectional (n=99; 78.6%), and investigated HICs (n=113; 89.7%) (World Bank, 2021), with 44 studies investigating US adolescents. Appendix A, Figure A11.1 shows the geographical distribution of included study populations. Included and excluded study characteristics are presented in Appendix A, Section A12 and Section A13, respectively.

Figure 5. PRISMA flow diagram



Legend: [a] One study (Geusens and Beullens, 2017a) was not included in the Synthesis Without Meta-analysis (SWiM) as this resulted in double counting of study participants; we were able to include estimates from this study in meta-analyses stratified by outcome where this issue did not occur. Abbreviation(s): APA=American Psychological Association; CINAHL=Cumulative Index to Nursing and Allied Health Literature; EMBASE=Excerpta Medica Database; MEDLINE=Medical Literature Analysis and Retrieval System Online; and SSRN=Social Science Research Network.

For included cross-sectional and cohort studies (n=122), 46.7% (n=57) of studies were graded high RoB, 25.4% (n=31) moderate, and 27.9% (n=34) low. Of the four RCTs included, two were graded some concerns and two low RoB. RoB grades for all included datapoints and studies are presented in Appendix, Section A14. Reviewer RoB agreement was strong (κ=0.91)(McHugh, 2012).

4.6.2 Social media measures reported in included studies

Within included studies, many social media exposure measures were reported, with most investigating multiple measures (see Appendix A, Section A15). All were incorporated in our exploration of how social media use is measured; therefore, the number of datapoints reported differs across syntheses.

In total, 253 social media measures were reported: 53.4% (n=135) assessed frequency, 24.1% (n=61) exposure to health-risk behaviour content, 17.8% (n= 45) time spent, and 4.74% (n=12) other social media activities. Despite our broad definition of social media, most included studies assessed a narrow range of social media categories (or themselves adopted a broad definition). Social networking sites was the most common category investigated (55.7%; n=141). Of those social media measures investigating a specific platform (n=86), Facebook was most commonly investigated (n=40), followed by Twitter (n=10).

Of those measures assessing exposure to health-risk behaviour content, 59.0% (n=36) assessed marketer-generated, 26.2% (n=16) assessed user-generated content, and 14.8% (n=9) assessed both types of content. In total, 134 of the 253 social media measures provided sufficient information to differentiate between active (e.g., posting and commenting on posts; n=90) and passive (e.g., observing others, content or watching videos; n=44) use. Exposure ascertainment primarily used unvalidated adolescent self-report surveys (n=221), with a minority using data-driven codes, validated adolescent self-report questionnaires and/or clinical records (n=32).

4.6.3 Social media use and health-risk behaviours

Appendix A, Section A16 shows the exposure and outcome combinations amenable to meta-analysis, subgroup analysis/meta-regression or sensitivity analysis. Effect direction plots, forest plots (for meta-analyses and subgroup analyses), and meta-regression results not presented in this section can be found in Appendix A, Section A17. The relevant sections to access in Appendix A are signposted below.

Alcohol use (see Section A17.1)

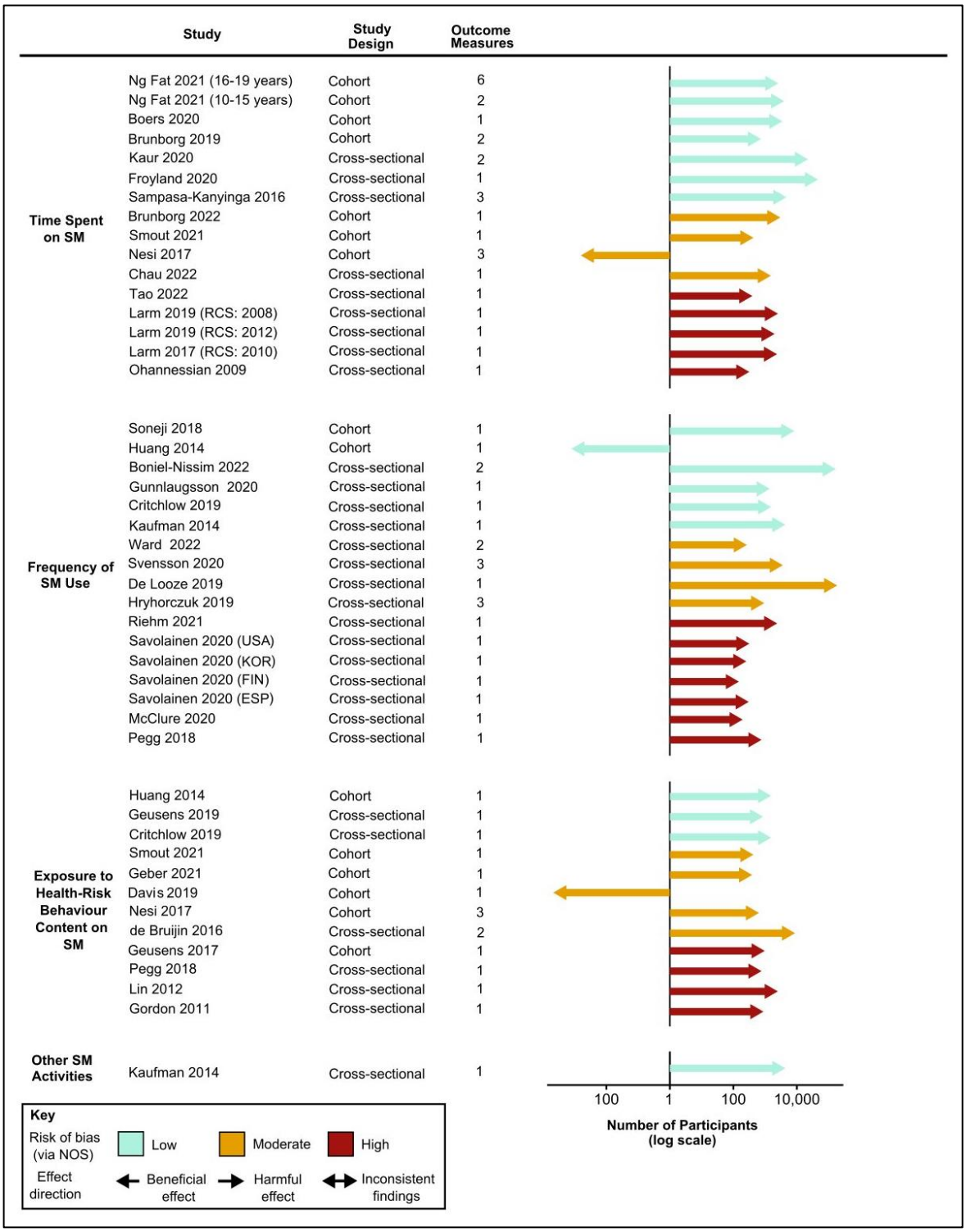
Alcohol use was the most extensively studied outcome. Figure 6 shows the effect direction plot for alcohol use. For time spent, 15/16 studies (93.8%) reported harmful associations (95% CI 71.7 to 98.9%; n=100,354; sign test p<0.001), 16/17 studies (94.1%) for frequency (73.0 to 99.0%; n=391,445; sign test p<0.001), and 11/12 studies (91.7%) for exposure to health-risk behaviour content (64.6 to 98.5%; n=24,451; sign test p=0.006). Other social media activities (had a Facebook account) was investigated by one study, which reported a harmful association (20.7 to 100%; n=4,485).

In meta-analyses, frequent/daily (vs infrequent/non-daily) social media use was associated with increased alcohol consumption (OR 1.48 [1.36 to 1.62]; I^2=40.5%; n=383,670; Figure 7). In stratified analyses, effect sizes were larger for adolescents ≥16 years (OR 1.80 [1.46 to 2.22] vs 1.35 [1.26 to 1.44] for those <16 years; p<0.01 for test of differences; Appendix A, Figure A17.1.3). Social networking sites were associated with increased alcohol consumption, whilst microblogging or media-sharing sites had an unclear relationship (p=0.03; Appendix A, Figure A17.1.4).

Social media use for ≥2 hours (vs <2 hours/day) was associated with increased alcohol consumption (OR 2.13 [1.56 to 2.92]; I^2=81.6%; n=12,390; Appendix A, Figure A17.1.8), as was exposure (vs not exposed) to health-risk behaviour content (OR 2.43 [1.25 to 4.71]; I^2=98.0%; n=14,731; Appendix A, Figure A17.1.9). Stratified analyses for time spent generally did not reveal important differences by age and social media category (Appendix A, Figures A17.1.10 - A17.1.11). For exposure to health-risk behaviour content, no important differences were observed when stratifying by social media category (Appendix A, Figure A17.1.12), although associations were slightly stronger for user-generated (OR 3.21 [2.37 to 4.33]) vs marketer-generated content (OR 2.18 [0.96 to 4.97]; p=0.39; Appendix A, Figure A17.1.13). Meta-analyses for frequency, time spent, and exposure to health-risk behaviour content (assessed on a continuous scale) demonstrated similar findings (Appendix A, Figures A17.1.14 – A17.1.17). On stratification, for exposure to health-risk behaviour content, associations were larger for adolescents ≥16 years (Std. Beta 0.35 [0.29 to 0.42] vs 0.09 [0.05 to 0.13] for those <16 years; p<0.001), indicating for every

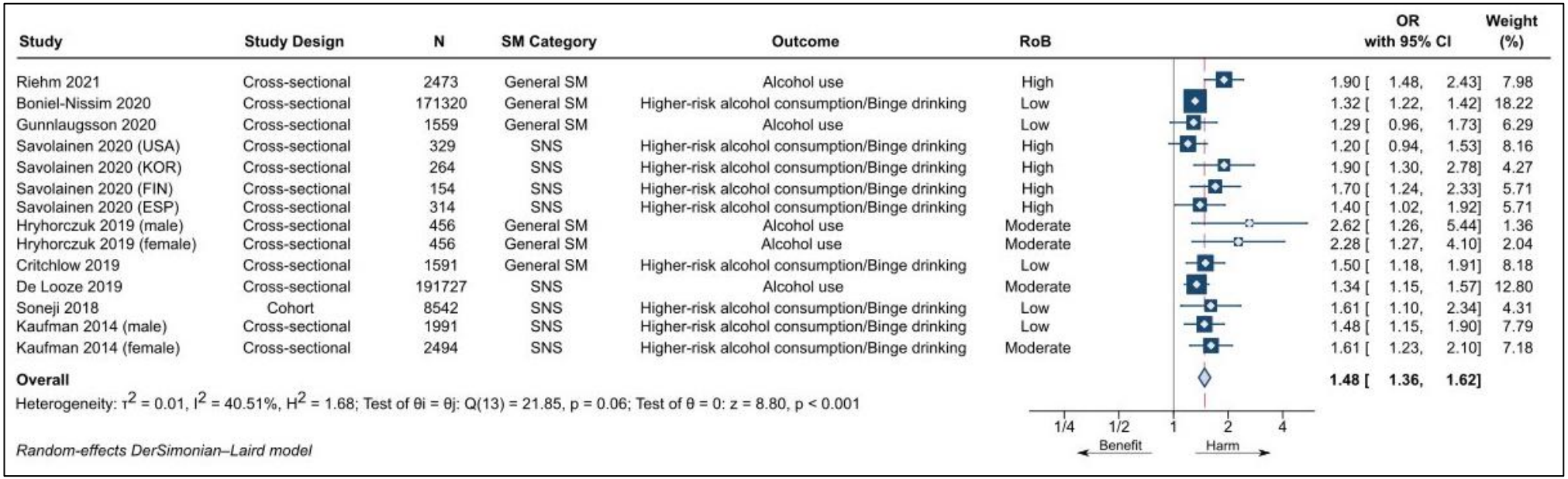
one standard deviation (SD) increase in exposure to health-risk behaviour content, alcohol consumption increased by 0.35 SD for older compared to 0.09 SD for younger adolescents (Appendix A, Figure A17.1.18).

Figure 6. Effect direction plot for studies of the association between social media use and adolescent alcohol use by social media exposure
Arrow size indicates sample size; arrow colour indicates study risk of bias



Legend: Sample size: represented by the size of the arrow, measured on a log scale. Outcome measure: number of outcome measures synthesised within each study. Studies organised by risk of bias grade, study design, and year of publication. Repeat cross-sectional studies, multiple study populations from different countries, and age subsets originating from the same study reported as separate studies. Abbreviation(s): ESP=Spain; FIN=Finland; KOR=South Korea; NOS=Assessed via adapted Newcastle Ottawa Scale; RCS=Repeat cross-sectional study; SM=Social media; and USA=United States of America.

Figure 7. Forest plot for association between frequency of social media use and alcohol use



Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=383,670. Abbreviation(s): CI=Confidence interval; ESP=Spain; FIN=Finland; KOR=South Korea; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and USA=United States of America.

Drug use (see Section A17.2)

For drug use, across all exposures investigated, 86.6% of studies (n=13/15; 53.3% low/moderate RoB) reported harmful associations (see Appendix A, Figure A17.2.1 for effect direction plot). The pooled OR for frequent/daily use (vs infrequent/non-daily) was 1.28 (1.05 to 1.56; I^2=73.2%; n=117,646; Figure 8). Stratification showed no clear differences (Appendix A, Figures A17.2.3 – A17.2.5). Few studies (n=3) assessed time spent, with estimates suggestive of harm (OR 1.58 [0.91 to 2.75]; I^2=88.1%; n=7,357 for ≤1 hour vs >1 hour/day; Appendix A, Figure A17.2.6).

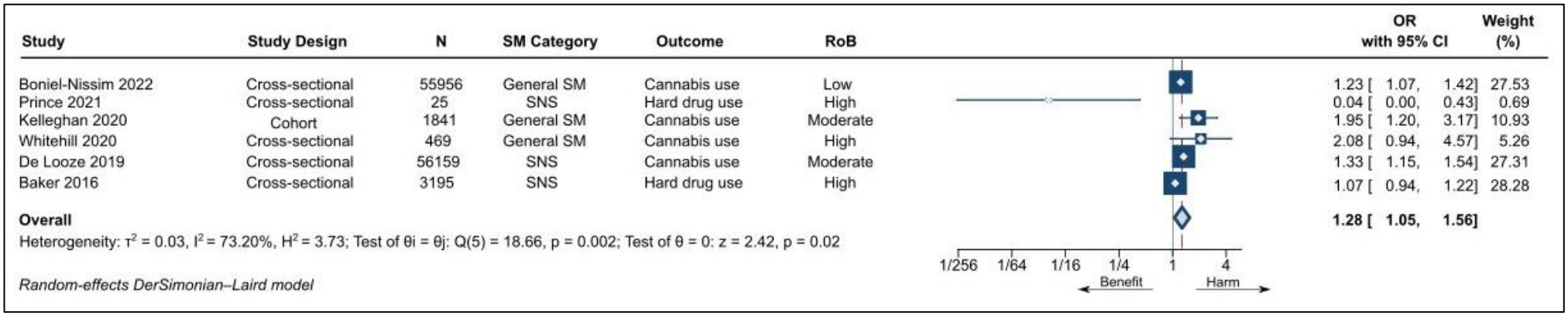
Tobacco use (see Section A17.3)

For tobacco use, 88.9% (n=16/18; 50.0% low RoB) studies reported harmful associations of social media use (see Appendix A, Figure A17.3.1 for effect direction plot). Frequent (vs infrequent) use was associated with increased tobacco use (OR 1.78 [1.45 to 2.19]; I^2=95.7%; n=424,326; Figure 9), as was exposure to health-risk behaviour content (specifically marketer-generated content) (vs not exposed) (OR 1.79 [1.63 to 1.96]; I^2=0.00%; n=22,882; Appendix A, Figure A17.3.3). In stratified analyses, for frequency of use, stronger associations were observed for LMICs (OR 2.47 [1.56 to 3.91] vs 1.64 [1.31 to 2.06]; p=0.12 for HICs; Appendix A, Figure A17.3.5), and for use of social networking sites (OR 1.90 [1.57 to 2.30] vs 1.42 [1.06 to 1.90] for general social media; p=0.10; Appendix A, Figure A17.3.6).

Use of electronic nicotine delivery systems (ENDS) (see Section A17.4)

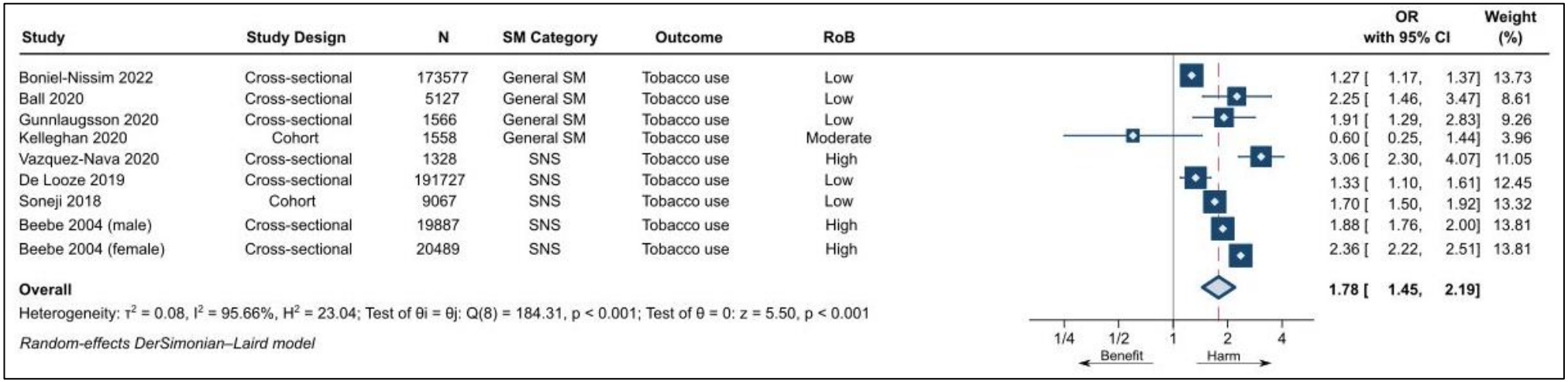
Across all exposures investigated, 88.9% of studies (n=8/9; 77.8% low/moderate RoB) reported harmful associations on ENDS use (see Appendix A, Figure A17.4.1 for effect direction plot). Exposure to health-risk behaviour content (specifically marketer-generated content) (vs not exposed) was associated with increased ENDS use (OR 1.73 [1.34 to 2.23]; I^2=63.4%; n=721,322; Appendix A, Figure A17.4.2). No clear differences were identified on stratification (Appendix A, Figures A17.4.3 – A17.4.4).

Figure 8. Forest plot for association between frequency of social media use and drug use



Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=117,645. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure 9. Forest plot for association between frequency of social media use and tobacco use



Legend: Figure presents forest plot for binary exposure (frequent vs infrequent) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=424,326. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Sexual risk behaviour (see Section A17.5)

After excluding one study with inconsistent findings, across all exposures investigated, 90.3% (n=28/31; 67.7% high RoB) reported harmful associations on sexual risk behaviours (see Appendix A, Figure A17.5.1 for effect direction plot). Frequent/at all use (vs infrequent/not at all) was associated with increased sexual risk behaviours (e.g., sending a 'sext', transactional sex, and inconsistent condom use) (OR 1.78 [1.49 to 2.13]; I^2=77.8%; n=47,325; Figure 10). Meta-regression (coefficient -0.36 [-0.68 to -0.04]; p=0.03) and stratified analyses suggested stronger associations for adolescents <16 years vs those ≥16 years (Appendix A, Figure A17.5.3 and Table A17.5.1), but no moderation effects were seen for social media category (p=0.12; Appendix A, Figure A17.5.4 and Table A17.5.1) or study setting (p=0.52; Appendix A, Figure A17.5.5 and Table A17.5.1). Few studies assessed associations for time spent (Appendix A, Figures A17.5.12 - A17.5.13).

Gambling (see Section A17.6)

After excluding one study demonstrating inconsistent findings, across all exposures investigated, all six studies investigating gambling reported harmful associations (see Appendix A, Figure A17.6.1 for effect direction plot). Frequent/at all use (vs infrequent/not at all) was associated with increased gambling (not via social media) (OR 2.84 [2.04 to 3.97]; I^2=85.6%; n=26,537; Figure 11). On differentiation by social media category, a relatively large association was found for online gambling via social media (OR 3.22 [2.32 to 4.49]); however, associations were not present for social networking sites and general social media (Appendix A, Figure A17.6.4).

Anti-social behaviour (see Section A17.7)

Across all exposures investigated, all sixteen studies (43.8% low/moderate RoB) investigating anti-social behaviour demonstrated harmful associations (see Appendix A, Figure A17.7.1 for effect direction plot). Frequent/at all use (vs infrequent/not at all) was associated with increased anti-social behaviour (e.g., bullying, physical assault, and aggressive/delinquent behaviour) (OR 1.73 [1.44 to 2.06]; I^2=75.0%; n=54,993; Figure 12), with time spent similarly associated

with increased risk (Appendix A, Figure A17.7.3). No clear subgroup differences were seen (Appendix A, Figures A17.7.4 – A17.7.7).

Inadequate physical activity (see Section A17.8)

For inadequate physical activity, after excluding three studies with inconsistent findings, 36.4% of studies (n=4/11; 72.7% low/moderate RoB) reported harmful associations across all exposures investigated (see Appendix A, Figure A17.8.1 for effect direction plot). No association between time spent (assessed on a continuous scale) and adolescent engagement in physical activity was seen (Std. Beta -0.00 [-0.02 to 0.01]; I^2=59.8%; n=37,417; Appendix A, Figure A17.8.2), with no important differences across subgroups (Appendix A, Figures A17.8.3 – A17.8.5).

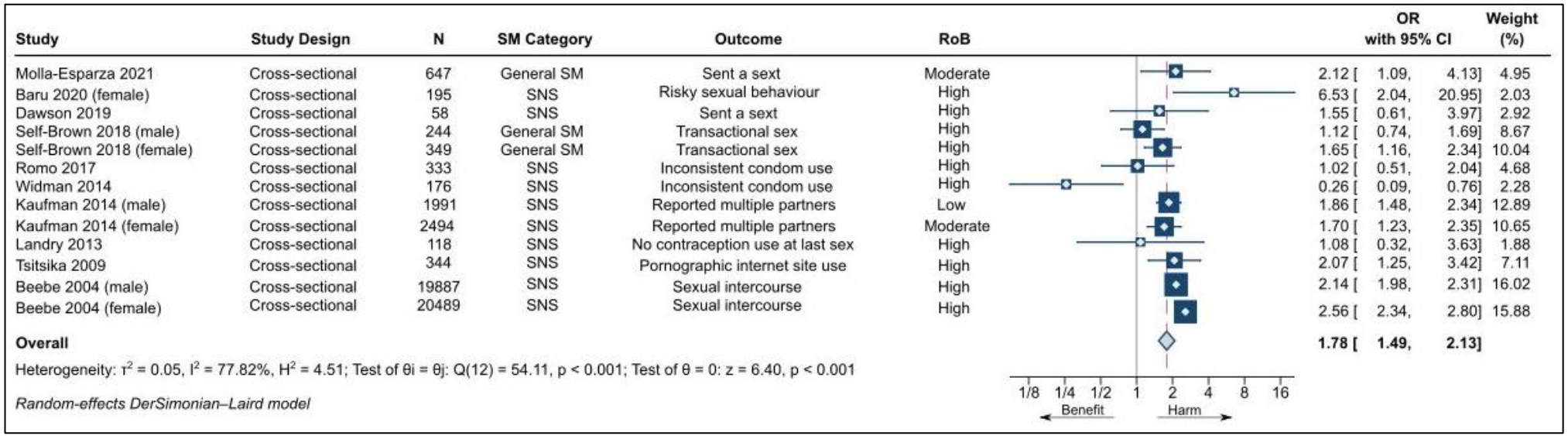
Unhealthy dietary behaviour (see Section 17.9)

Across all exposures investigated, all thirteen studies investigating unhealthy dietary behaviour demonstrated harmful associations, with most at low RoB (61.5%) (incl. four RCTs: two rated low RoB and two some concerns; Appendix A, Figure A17.9.1). Exposure to health-risk behaviour content (specifically marketer-generated content) was associated with increased unhealthy food consumption (OR 2.12 [1.87 to 2.39]; I^2=0.00%; n=9,424) when compared to those not exposed (Appendix A, Figure A17.9.2).

Multiple risk behaviours (see Section A17.10)

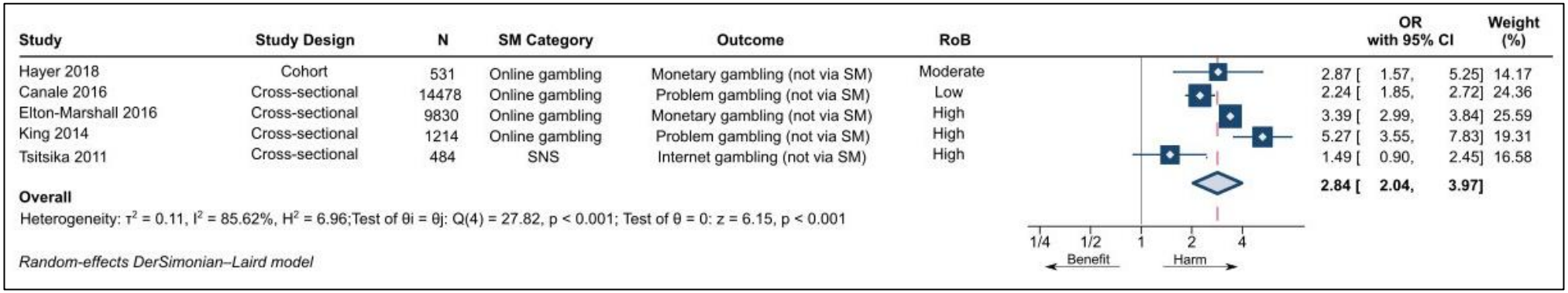
For multiple risk behaviours, all nine studies demonstrated harmful associations across all exposures investigated (Appendix A, Figure A17.10.1). The pooled OR for frequent/at all social media use (vs infrequent/not at all) was 1.75 (1.30 to 2.35; I^2=96.3%; n=43,571; Figure 13), but the small number of studies precluded stratification.

Figure 10. Forest plot for association between frequency of social media use and sexual risk behaviour



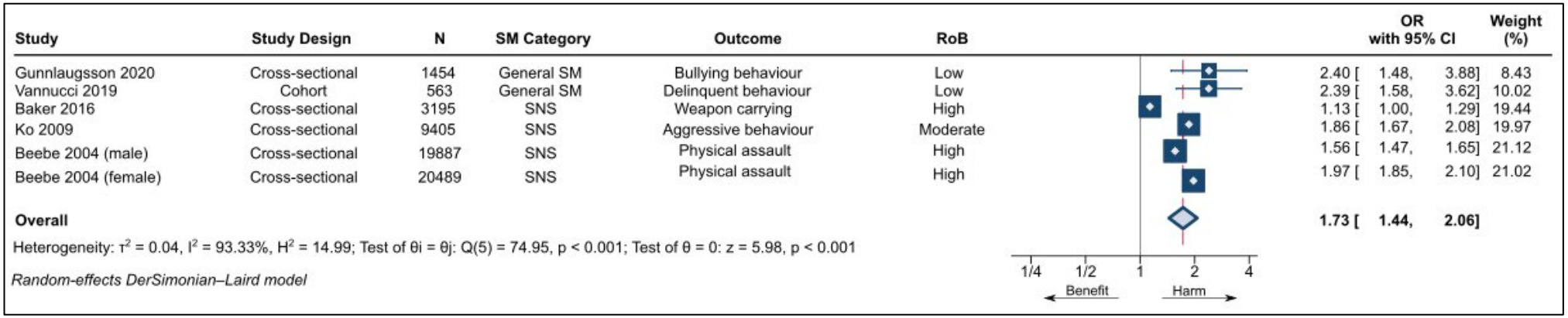
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=47,325. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure 11. Forest plot for association between frequency of social media use and gambling



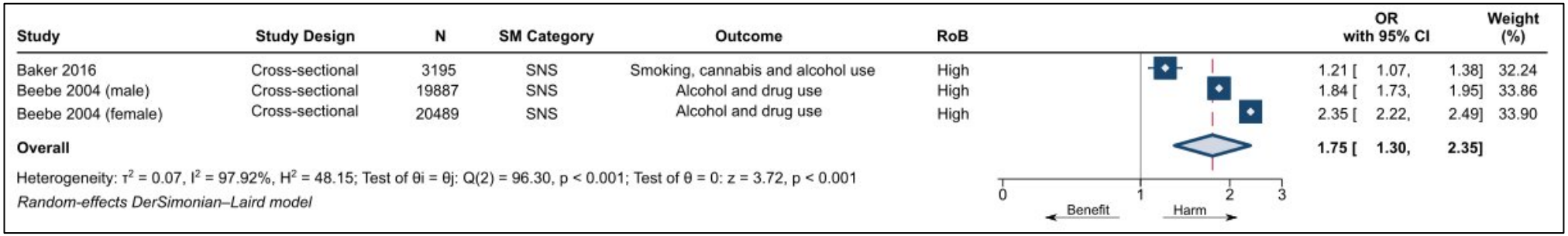
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=26,537. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure 12. Forest plot for association between frequency of social media use and anti-social behaviour



Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome meta-analysis, with odds (OR) used as common metric. Total number of study participants=54,993. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure 13. Forest plot for association between frequency of social media use and multiple risk behaviours



Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=43,571. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

4.6.4 Sensitivity analyses

Forest plots for all sensitivity analyses conducted are presented in the order they are discussed in Appendix A, Section A17.11.

For ENDS use, associations were stronger for cohort study datapoints (OR 2.13 [1.72 to 2.64] vs 1.43 [1.20 to 1.69] for cross-sectional datapoints; p=0.004; Appendix A, Figure A17.11.1), but no clear differences were seen for other outcomes (Appendix A, Figures A17.11.2 – A17.11.13). Although based on few studies, for unhealthy dietary behaviour, a stronger association was found for the RCT datapoint (OR 3.21 [1.63 to 6.30] vs 2.08 [1.84 to 2.37] for cross-sectional datapoints; p=0.22; Appendix A, Figure A17.11.14).

When stratifying by adjustment for critical confounding domains, no clear differences were identified (Appendix A, Figures A17.11.15 – A17.11.25), with some exceptions. Associations were stronger for unadjusted vs adjusted datapoints for exposure to health-risk behaviour content and alcohol use (Std. Beta 0.28 [0.14 to 0.43] vs 0.07 [0.03 to 0.12]; p=0.008; Appendix A, Figure A17.11.26) and for frequent use (vs infrequent) and tobacco use (OR 2.11 [1.73 to 2.58] vs 1.51 [1.23 to 1.85]; p=0.02), though this was based on few studies (Appendix A, Figure A17.11.27).

For alcohol use, effect sizes were generally stronger for moderate/high RoB datapoints (vs low), excluding time spent (≥2 hours vs <2 hours/day) and exposure to health-risk behaviour content (vs not exposed) where low (compared to moderate/high) RoB datapoints displayed stronger associations (Appendix A, Figures A17.11.28 – A17.11.31). For drug use, sexual risk and anti-social behaviour, no differences were detectable or low/moderate RoB datapoints showed stronger associations (compared to high) (Appendix A, Figures A17.11.32 – A17.11.36). For tobacco use and gambling, stronger associations were found for high RoB datapoints or no clear differences were identified (Appendix A, Figures A17.11.37 – A17.11.39). No clear differences by RoB were observed for the remaining outcomes (Appendix A, Figures A17.11.40 – A17.11.41).

On exclusion of datapoints which overlapped the age-range of 10-19 years, there was a marginal reduction in effect size or no important differences were seen (Appendix A, Figures A17.11.42 – A17.11.47).

4.6.5 Publication bias

The funnel plot and Egger's test result suggested some publication bias in the meta-analysis investigating frequent/at all social media use (vs infrequent/not at all) and sexual risk behaviour (p=0.02; bias toward the null; Appendix A, Figure A18.1). Insufficient data precluded investigation of other outcomes.

4.6.6 Certainty of the evidence

As frequency was the most commonly investigated exposure and continuous and binary exposures reported similar effects, we focused the GRADE assessment on the binary exposure, frequency of use. Where we report harmful effects on alcohol use with low certainty, and with drug, tobacco, ENDS use, sexual risk behaviours, gambling, and multiple risk behaviours with very low certainty (Table 2). We conducted a post-hoc GRADE assessment for exposure to health-risk behaviour content (vs no exposure) and unhealthy dietary behaviour due to the substantial difference in the quality of evidence observed (four RCTs), where we report moderate GRADE certainty (Table 3) (Guyatt *et al.*, 2011). Summary of findings tables describing the reasons for upgrading and downgrading bodies of evidence are displayed in Appendix A, Tables A19.1 - A19.2.

Table 2. Condensed summary of findings and certainty of evidence (as per GRADE)

Certainty of evidence for frequency of social media use (frequent vs infrequent) and seven priority outcomes					
Outcome	**Number of participants (studies)**	**Anticipated absolute effects[a] (95% CI)**		**Effect estimate (95% CI)**	**Certainty of evidence (GRADE)**
		Risk with infrequent social media use (control)	**Risk with frequent social media use (exposed)**		
Alcohol use	383,670 (9 observational studies)	48.9% of participants used alcohol	58.6% of participants used alcohol (56.6 to 60.8%)	OR 1.48 (1.36 to 1.62)	Low
Drug use	117,645 (6 observational studies)	17.0% of participants used drugs	20.8% of participants used drugs (17.7 to 24.2%)	OR 1.28 (1.05 to 1.56)	Very low[b]
Tobacco use	424,326 (8 observational studies)	12.1% of participants used tobacco	19.6% of participants used tobacco (16.6 to 23.1%)	OR 1.78 (1.45 to 2.19)	Very low[c]
ENDS use (effect direction)	18,047 (3 observational studies)	66.7% of studies report a harmful effect of social media use on participant ENDS use (20.8 to 93.9%)			Very low[d]
Sexual risk behaviour	47,325 (10 observational studies)	37.0% of participants engaged in sexual risk behaviours	51.1% of participants engaged in sexual risk behaviours (46.6 to 55.5%)	OR 1.78 (1.49 to 2.13)	Very low[e]
Gambling	26,537 (5 observational studies)	21.4% of participants engaged in gambling	43.6% of participants engaged in gambling (35.7 to 52.0%)	OR 2.84 (2.04 to 3.97)	Very low[b]
Multiple risk behaviours	43,571 (2 observational studies)	41.3% of participants engaged in multiple risk behaviours	55.2% of participants engaged in multiple risk behaviours (47.8 to 62.3%)	OR 1.75 (1.30 to 2.35)	Very low[f]

Legend: [a] The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI). Abbreviation(s): CI=Confidence interval; ENDS=Electronic nicotine delivery systems; GRADE=Grading of Recommendations Assessment, Development and Evaluation; and OR=Odds ratio. For full GRADE results, see Appendix A, Table A19.1. [b] Downgraded by 1 level for risk of bias of included studies. [c] Downgraded by 2 levels for inconsistency and risk of bias of included studies. [d] Downgraded by 2 levels for imprecision and risk of bias of included studies. [e] Downgraded by 2 levels for publication bias and risk of bias of included studies. [f] Downgraded by 2 levels for inconsistency and risk of bias of included studies.

Table 3. Post-hoc assessment - condensed summary of findings and certainty of evidence (as per GRADE)

Certainty of evidence for exposure to health-risk behaviour content on social media (exposed vs not exposed) and unhealthy dietary behaviour			
Outcome	**Number of participants (studies)**	**Effect direction (95% CI)**	**Certainty of evidence (GRADE)**
Unhealthy dietary behaviour (effect direction)	521 (4 RCTs)	All studies report a harmful effect of social media use on participant unhealthy dietary behaviour (51.0 to 100.0%)	Moderate[a]

Legend: Abbreviation(s): CI=Confidence interval; GRADE=Grading of Recommendations Assessment, Development and Evaluation; OR=Odds ratio; and RCT=Randomised control trial. For full GRADE results, see Appendix A, Table A19.2. [a] Downgraded by 1 level for indirectness.

4.7 Discussion

Our systematic review suggests social media use is adversely associated with several adolescent health-risk behaviours, including increased alcohol use, drug use, tobacco use, ENDS use, gambling, sexual risk behaviour, anti-social behaviour, unhealthy dietary behaviour and multiple risk behaviours. Exposure to health-risk behaviour content on social media has the strongest evidence of harm, particularly in relation to alcohol use and unhealthy dietary behaviour (moderate GRADE certainty).

Review strengths include its comprehensive scope, inclusion of RCTs and adjusted estimates, assessment of RoB and certainty of the evidence using GRADE, and its explicit focus on social media specifically (rather than digital technologies) (Guyatt *et al.*, 2011). To our knowledge, no other review has synthesised the evidence of adolescent health-risk behaviours associated with social media categories, platforms, and content and considered whether social media impacts vary across social groups. Generally, for alcohol use, larger associations were seen for adolescents ≥16 years (vs <16 years) and for exposure to user-generated content (vs marketer-generated content). Whilst for tobacco use, larger associations were observed for LMICs (vs HICs). We followed a pre-registered protocol, with decisions about critical confounding domains and stratified analyses informed by a comprehensive literature review, logic model (Figure 4), and advisory group consultation (Purba *et al.*, 2020a). Searches covered the period 1997 to 2022. The nature of social media use has changed dramatically across this period, but the majority of data collection (66.9% of studies) occurred in the last eight years, and so should be generalisable to the current social media environment.

However, objective social media measures were rare, with self-report most common. When assessing frequency of use, most studies compared frequent vs infrequent, some daily vs non-daily, and some any use vs none. These exposure categories were combined in meta-analyses due to limited data availability, but frequency (assessed via continuous scale) reported similar findings. Some meta-analyses were based on few studies, yielding more uncertain estimates. However, meta-analysis is feasible even with two studies, and there is an argument that meta-analysis should be conducted where possible (Ioannidis *et*

al., 2008; McKenzie and Brennan, 2021). Meta-analysis was performed when three or more studies were available for a given synthesis, and this was complemented with a narrative synthesis using the SWiM reporting guideline and effect direction plots (Ioannidis *et al.*, 2008; Campbell *et al.*, 2020; Boon and Thomson, 2021). As recommended by Cochrane, adjustments for multiple tests were not conducted (Higgins and Green, 2011). Instead, effect sizes were the focus of interpretation where possible. Outcomes and analyses of interest were pre-specified in the published protocol, subgroup analyses were interpreted with caution, and results were not selected for emphasis on the basis of a statistically significant *p-value*, with all conducted analyses presented (Purba *et al.*, 2020a). Moreover, although the review focus is harmful risk behaviours, social media may have positive or negligible harmful influences on some outcomes, such as physical activity and drug use; thus, a holistic view should be taken when interpreting the review findings.

Our sensitivity analysis, by confounder adjustment, focused on critical confounding domains (age, sex, and SEC). We acknowledge other shared risk factors may exist between social media and health-risk behaviours (e.g., parental health-risk behaviours). Cross-sectional studies are subject to reverse causation, as reflected in the logic model (Figure 4). A bidirectional relationship may therefore exist, with adolescents who engage in health-risk behaviours more inclined to use social media to obtain peer approval and positive feedback. However, we identified harmful associations across study designs, including longitudinal studies, which adjusted for baseline measures of outcomes and RCTs.

Included RCTs involved random assignment of study participants to existing or manipulated social media posts (where all authors stipulated the means by which they tried to mimic the actual social media environment). For example, De Jans *et al.* (2021) identified a harmful association between exposure to manipulated Instagram posts showing a fictitious influencer promoting a snack low in nutritional value (vs high) and unhealthy snack consumption. A limitation of this study was its use of a fictitious influencer, which may limit its validity. Folkvord and de Bruijne (2020) overcame this limitation through use of existing Instagram posts demonstrating a popular social influencer consuming energy-

dense snacks (vs vegetables), finding participants exposed to the 'energy-dense snack condition' consumed less vegetables when compared to those participants exposed to the 'vegetable condition'. The use of existing Instagram posts from a popular social influencer among the target group of participants helped improve external validity. Thus, the moderate GRADE certainty for included RCTs suggests a causal effect of health-risk behaviour content on unhealthy dietary behaviour, although these studies still had limitations (e.g., a lack of real-time exposure to social media).

Previous reviews have focused on social media use to deliver behaviour change interventions, finding this avenue has potential (Chau *et al.*, 2018; Goodyear *et al.*, 2021; Gunther *et al.*, 2021). Less attention has been paid to the implications of social media itself for health. Vannucci *et al.* (2020) identified cross-sectional correlations between social media use and substance use, and risky sexual behaviour in adolescents, however, were unable to separate out general electronic media use ("electronic media with a direct component involving social interactions with others") from social media use, although they did include some exploratory sensitivity analyses of potential differences by type of social media assessment (Vannucci *et al.*, 2020; Vannuci, 2022). Curtis *et al.* (2018) reported correlations between alcohol-related social media content and alcohol consumption and alcohol-related problems in young adults; however, did not explore if associations differed between exposure to user or marketer-generated content. Importantly, both reviews did not incorporate adjusted estimates or identify RCT evidence and did not formally assess the RoB of the underlying evidence (Curtis *et al.*, 2018; Vannucci *et al.*, 2020).

As social media reaches diverse populations, reporting of population characteristics and disaggregating results by socio-demographic groups should be prioritised. With most research conducted in the global North, research in LMICs is needed (Orben, 2020). SWiM findings suggested social media use may present beneficial effects on adolescent engagement in physical activity, though meta-analysis (based on four cross-sectional studies) did not substantiate this conclusion. Further research on this outcome would allow health policymakers to potentially harness the benefits social media use could present on adolescent health. Moreover, many of the risk behaviours investigated can be experimental

during adolescence, and the extent to which these behaviours affect health may vary. Longitudinal research tracking adolescents into adulthood would help study this. Well-conducted randomised trials studying risk behaviours over and above unhealthy dietary behaviour would yield more robust evidence than currently available and have been shown to be feasible. Addressing the limitations of existing RCTs and use of real-time monitoring data of social media use would allow for more definitive causal conclusions on the effects of social media activity on adolescent health-risk behaviours.

The methodological limitations in the evidence may reflect limited access to data required to investigate social media's health implications, adding weight to calls to compel social media corporations to share data with researchers (Senate of the United States, 2021; UK House of Lords and House of Commons, 2021). In the absence of real-time objective data, the development of generalisable, validated measures of social media use (considering social media activities performed, e.g., active/passive use) would facilitate comparability across studies. Awareness of the aspects of social media most harmful to adolescents (e.g., user/marketer-generated content) could support development and expedite introduction of the delayed UK Online Safety Bill, aimed at securing adolescents' online safety (Carah and Brodmerkel, 2021; UK House of Lords and House of Commons, 2021). The importance of exposure to marketer-generated content identified in this review in potentially promoting health-risk behaviours highlights gaps in the Bill which largely focuses on user-generated content, and the unmet need for legislation targeting influencer marketing (Department for Digital Culture Media and Sport, 2021a; UK House of Lords and House of Commons, 2021; Michaelsen *et al.*, 2022). Further research in this area could prove fruitful for informing regulation.

In adopting a multi-sector approach to securing adolescent online safety, digital-literacy school education and resource provision to parents, educators and health professionals to improve understanding of the different aspects of social media use (e.g., time spent, exposure to health-risk behaviour content) and the potential risks/benefits they present to adolescent health may be warranted (Jones *et al.*, 2019).

4.8 Conclusion

Our review finds predominantly harmful associations between social media use and adolescent health-risk behaviours. However, this is based on a largely cross-sectional body of evidence, using self-report measures of social media use, and at risk of residual confounding due to many confounders remaining unadjusted for. Experimental and risk-taking behaviours are an inherent part of adolescence; however, as safeguards for a digital world are still evolving, application of the precautionary principle suggests action across academic, governmental, health and educational sectors to understand and reduce the risks adolescents may face from use of social media may be warranted.

Contributors

AKP, SVK, AP and MH drafted the study protocol. AKP conducted literature searches, and all authors contributed to the screening process and selection of included studies. AKP conducted data extraction and RoB assessments; data were checked, and independent RoB scoring undertaken by SVK, AP, MH, RT, and PMH. AKP completed all data analysis, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. All authors critically reviewed and approved the manuscript. The corresponding author attests that all listed authors meet authorship criteria and that no other meeting the criteria have been omitted.

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Competing interests

All authors have completed the International Committee of Medical Journal Editors (ICMJE) uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Ethical approval

No ethics approval was requested, as the research solely extracted non-disclosive data from previously published studies in which informed consent was obtained by the primary investigators.

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Data sharing

Data analysed were based on published data. Template data forms, the data extracted from included studies and data used for analyses are available from the corresponding author on reasonable request. The study protocol is published on PROSPERO (ID: CRD42020179766): www.crd.york.ac.uk/prospero/display_record.php?RecordID=179766

Transparency

The lead author (AKP) affirms that the manuscript is an honest, precise, and transparent account of the review reported, with no important aspects of the review omitted. Any discrepancies from the review as planned (and, registered) have been explained.

Dissemination to participants and related patient and public communities

The review findings will be disseminated via conference presentations, press releases, and social media outlets. The authors will disseminate findings to media organisations and press councils, and also national health organisations that are instrumental in the development of social media recommendations for adolescents. Additionally, the review findings will be disseminated via advisory group members working across academic, governmental and charity sectors.

Open access/Copyright statement

Chapter 5 The relationship between time spent on social media and adolescent cigarette, e-cigarette, and dual use: A longitudinal analysis of the UK Millennium Cohort Study

5.1 Foreword

This section provides some additional detail on the article which follows.

Chapter 4 highlighted the requirement for longitudinal studies which assessed social media use using measures over and above commonly used self-report questionnaires, which investigate the potential causal relationship between social media use and under-researched health-risk behaviours (in particular use of e-cigarettes), and assess the potential for social media effects to differ across socioeconomic groups.

The increased marketing of tobacco-related products and e-cigarettes and the detrimental immediate and long-term health effects which can result from the use of these products were described in Chapter 2 (Bird *et al.*, 2016; Soneji *et al.*, 2017; Khouja *et al.*, 2020). This knowledge, combined with the recognition that e-cigarette use may act as a gateway to tobacco use (Soneji *et al.*, 2017; Khouja *et al.*, 2020) and use of e-cigarettes and tobacco may lead to abuse of other addictive substances (Chen *et al.*, 2002; Korhonen *et al.*, 2010; Audrain-McGovern *et al.*, 2018; Chadi *et al.*, 2019; Fadus and Smith, 2019; Rothrock *et al.*, 2020; Chan *et al.*, 2021), highlights the importance of their examination in adolescents. As discussed previously, there is a need to understand if the effects of social media use on adolescent tobacco and e-cigarette use differ across socioeconomic groups.

Therefore gaps identified in the systematic review (Chapter 4), input from advisory group members, knowledge on the detrimental effects tobacco and e-cigarette use can present to adolescent health and inequalities, and awareness of social media's ability to promote tobacco and e-cigarette related content, provided the rationale for the article which follows.

5.2 Title, authorship and publication details

This article is currently under peer-review with *Tobacco Control*.

Purba AK, Henderson M, Baxter A, Pearce A, Katikireddi SV (2023) The relationship between time spent on social media and adolescent cigarette, e-cigarette, and dual use: A longitudinal analysis of the UK Millennium Cohort Study. *Tobacco Control*.

5.3 Abstract

Objective(s)

To estimate the effect of social media use in 14 year olds on risk of and inequalities in cigarette, e-cigarette and dual use at 17 years, using the UK-representative Millennium Cohort Study (MCS) (born 2000-2002).

Methods

The relationship of time spent on social media on a normal weekday (using questionnaires; n=8,987) and average time spent on social media across a normal weekday and weekend day (using time-use diaries; n=2,520) with cigarette, e-cigarette and dual use was estimated using adjusted odds ratios (AORs) or relative risk ratios (ARRRs). Effect modification was examined by comparing adjusted risk differences (ARDs) within low and high parental education groups. Analyses accounted for pre-specified confounders (identified via directed acyclic graphs), baseline outcome measures (to address reverse causality), sample design, attrition and item-missingness (through multiple imputation).

Results

Time spent on social media was associated with increased risk of cigarette, e-cigarette, and dual use in a dose-response manner. Social media use for ≥2 hours (vs 1-<30 minutes) was associated with increased cigarette (AOR 2.76 [95% CI 2.19 to 3.48]), e-cigarette (AOR 3.24 [2.59 to 4.05]), and dual use (ARRR 4.11 [2.77 to 6.08]). Risk of cigarette use among 30 minutes-<1 hour users (vs non-users) with low parental education was smaller than those with high (ARDs 1.4%

vs 12.4%). Similar findings were observed across the higher time categories. Analyses using time-use diaries, in complete case samples, and with additional adjustment for baseline outcome measures revealed consistent findings.

Conclusions

After accounting for observed confounders and potential reverse causality, findings suggest social media use increases risk of cigarette, e-cigarette and dual use in a dose-response manner. Guidance addressing adolescent online safety should be prioritised.

Key words

Social media, adolescents, cigarette use, and e-cigarette use

What is already known on this topic

- Social media has fundamentally reshaped the adolescent communication landscape, offering considerable benefits for adolescent interactions, knowledge exchange and health (e.g., online health interventions). Yet, its potential negative impact on adolescent health-risk behaviours has received considerable attention.

- Existing evidence suggests an association between social media use and cigarette and e-cigarette use but is predominately based on studies of US adolescents. The degree to which this relationship is causal or differs by socioeconomic circumstance (SEC) (and thus might widen health inequalities) is unclear.

What this study adds

- Accounting for observed confounders and reverse causality, social media use for ≥30 minutes daily increases risk of cigarette, e-cigarette and dual use, in a dose-response manner.

- For traditional cigarette (but not e-cigarette) use, considerably larger absolute effects were identified for adolescents with high parental education compared to those with low parental education.

How this study might affect research, practice or policy

- This study's identification of a dose-response relationship and differential effects across socioeconomic groups, could assist in the development of guidance on time spent on social media.

- The adverse effects of social media use on adolescent cigarette, e-cigarette and dual use supports legislation aimed at promoting adolescent online safety and strengthens calls to prohibit social media marketing of nicotine-related products.

5.4 Introduction

Tobacco use generally commences in adolescence (National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health, 2012; Reitsma *et al.*, 2021). The higher prevalence of tobacco use in adolescent populations with greater deprivation is a key driver of health inequalities (Marmot, 2006; National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health, 2012; Bird *et al.*, 2016; Ren and Lotfipour, 2019; Jackson *et al.*, 2021). While e-cigarettes have provided a potential harm-reduction alternative to adult tobacco smoking (Aledeokin and Haighton, 2019), increased adolescent e-cigarette use has prompted concern that e-cigarettes are creating a new generation of nicotine-dependent individuals, and may offer a gateway to future tobacco smoking (Hilton *et al.*, 2016; Soneji *et al.*, 2017; Aledeokin and Haighton, 2019; Chadi *et al.*, 2019; Chapman *et al.*, 2019; Fadus and Smith, 2019; Walker *et al.*, 2020; Khouja *et al.*, 2020; Rothrock *et al.*, 2020; Yoong *et al.*, 2021; Chan *et al.*, 2021; O'Brien *et al.*, 2021).

Social media use has become almost ubiquitous among adolescents (Gebremeskel *et al.*, 2014). Its ability to encourage personal expression, improve information access, and strengthen connections, can present several benefits to adolescent

health and development (Uhls *et al.*, 2017). In contrast, social media may also influence adolescents' attitudes toward cigarette and e-cigarette use, resulting in their increased uptake (Cavazos-Rehg *et al.*, 2014, 2021; Emery *et al.*, 2014; Huang *et al.*, 2014; Camenga *et al.*, 2018; Sampasa-Kanyinga and Hamilton, 2018; Soneji, Pierce, *et al.*, 2018; Soneji, Yang, *et al.*, 2018; Lee *et al.*, 2019; Vannucci *et al.*, 2020; Vrinten *et al.*, 2022). Yet, the majority of evidence examines US populations, and causality remains unclear (Vogel *et al.*, 2020), with the potential for reverse causation (where those who use cigarettes/e-cigarettes may be more inclined to use social media) remaining unaddressed (Soneji, Pierce, *et al.*, 2018; Cavazos-Rehg *et al.*, 2021). In the absence of real-time objective social media data from social media corporations, research has relied on retrospective estimates of time spent via self-report questionnaires. Time-use diaries, which may be subject to less recall and response bias, offer an alternative approach (Naab *et al.*, 2019; Orben and Przybylski, 2019a).

For policymakers to make informed decisions on social media regulation and guidance, more accurate assessments of these relationships are required. Given the preventable inequalities in tobacco use, related diseases and deaths, an understanding of how these relationships may vary across different socioeconomic groups is needed.

We aimed to estimate the effect of time spent on social media at 14 years on the risk of cigarette, e-cigarette and dual use at 17 years using the UK-representative MCS. We also examine if the effects of social media differ by SEC.

5.5 Methods

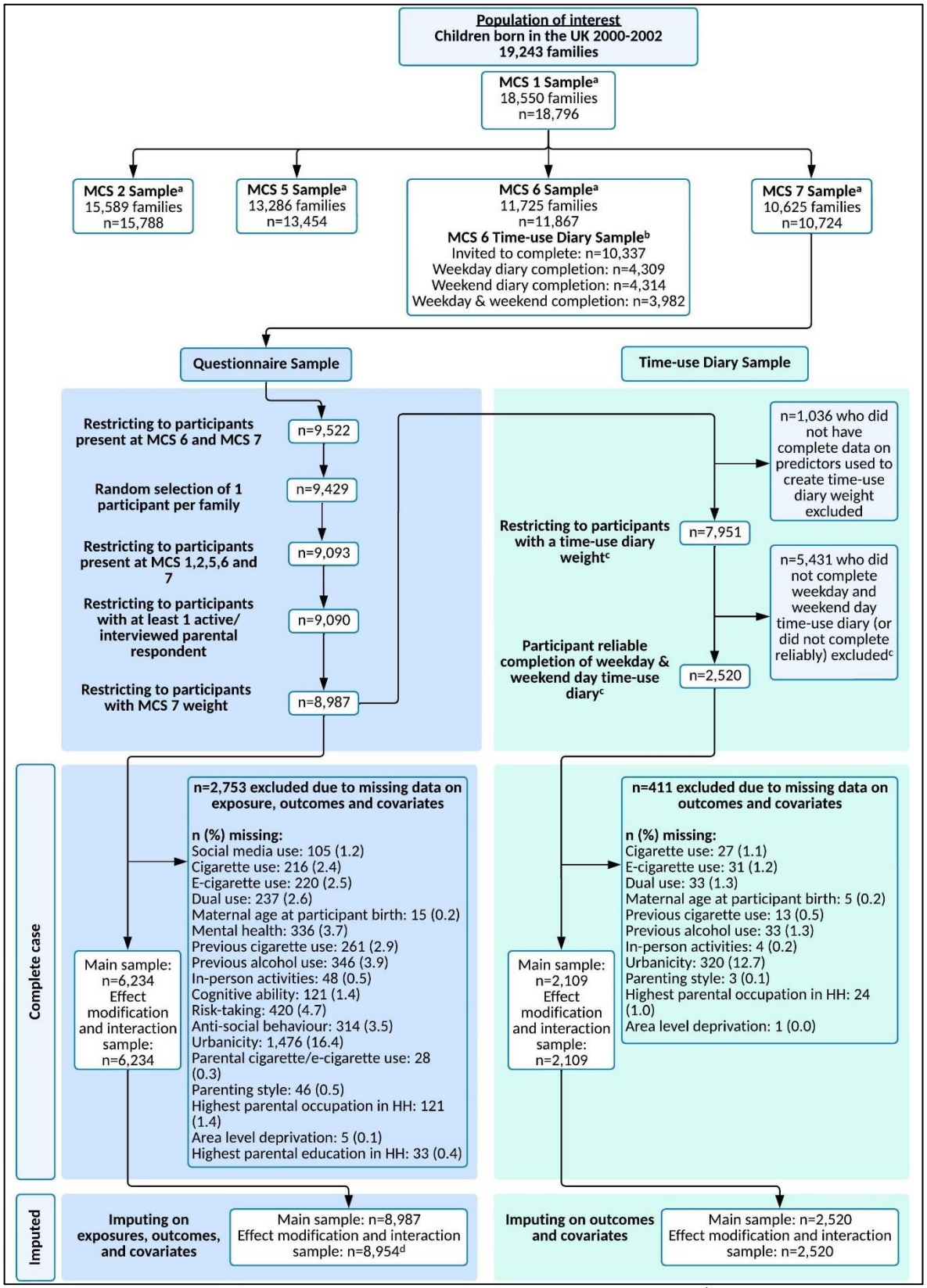
We follow the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidance (Vandenbroucke *et al.*, 2007) and a published statistical analysis plan developed with input from advisory group members (Purba *et al.*, 2022). Appendix B, Section B1 details advisory group input, and Section B2 reports deviations from the published statistical analysis plan.

5.5.1 Study characteristics

The MCS is a UK-representative cohort study of children born between September 2000 and January 2002 (Centre for Longitudinal Studies, 2020). Families were selected through Child Benefit Records and contacted via opt-out letters from the Department for Work and Pensions. To over-represent children living in Wales, Scotland and Northern Ireland, disadvantaged areas, and areas with high proportions of ethnic minority groups (in the case of England), a disproportionately stratified clustered sampling design was used (Centre for Longitudinal Studies, 2019). Study contact with the cohort child (hereafter 'participant') first occurred at around nine months (n=18,796). This study uses data for participants and their caregivers who were present in the initial survey and subsequently at ages 3, 11, 14, and 17 years. Triplet households were excluded. Where households contained two participants, one was randomly selected for inclusion in the analysis (see Figure 14. STROBE study flow diagram).

Data were downloaded from the UK Data Service, Universities of Essex and Manchester (October 2021-January 2022). Ethics approval was granted for the MCS surveys; no further approval was required for the current analysis (Centre for Longitudinal Studies, 2020; Fitzsimons, 2020; Fitzsimons *et al.*, 2020). Further information on the MCS is available from: http://www.cls.ioe.ac.uk/mcs.

Figure 14. STROBE study flow diagram



Legend: [a] MCS weights used to extrapolate back to population of interest. [b] Time-use diary weight created to extrapolate back to MCS 6 entire sample and combined with MCS 7 weight to extrapolate to population of interest. All predictors used to create time-use diary weight were existing confounders to be used in analysis. [c] Participants who had ≥5 'no activity recorded' slots on a weekday, weekend or both days deemed as having unreliable diary accounts. [d] To facilitate inclusion of interaction between social media use and highest parental education in the imputation model for the effect modification and interaction sample, n=33 with missing data on highest parental education were excluded prior to imputation. Abbreviation(s): HH=Household; n=Number of participants; and MCS=Millennium Cohort Study.

5.5.2 Measures

Outcomes

Cigarette use

At 17 years, participants were asked to select one of six statements which best described their smoking status ranging from 'I have never smoked cigarettes' to 'I smoke more than six cigarettes a week'. Due to low frequencies in some categories, a dichotomous outcome variable was generated: 'never smoked or tried cigarettes once' and 'current or former cigarette use'.

E-cigarette use

Similar to the variable recording cigarette use, responses were collapsed into a dichotomous variable with categories: 'never used an e-cigarette or tried once' and 'current or former e-cigarette use'.

Current dual use of cigarettes and e-cigarettes

A composite variable was generated with categories: 'never used both cigarettes or e-cigarettes or tried once', 'current or former cigarette or e-cigarette user', and 'current dual user'.

Data collection for all investigated outcomes occurred in 2018.

Exposures

Time spent on social media on a normal weekday during term time (assessed via self-report questionnaire)

At 14 years, participants were asked, 'on a normal weekday during term time, how many hours do you spend on social networking or messaging sites or apps on the internet such as Facebook, Twitter and WhatsApp?' and given eight options to select from, ranging from 'no social media use' to '≥7 hours'. Due to low frequencies in the higher time categories, data were collapsed into the following: 'no social media use', '1-<30 minutes', '30-<1 hour, '1-<2 hours', and

‘≥2 hours’. ‘1-<30 minutes’ was used as the reference category based on the threshold of potential harm in comparable studies (Ng Fat *et al.*, 2021) and because non-users are likely to be highly atypical.

Average time spent on social media on a normal weekday and weekend day (assessed via time-use diary)

The time-use diary was completed by participants for two 24-hour periods (one randomly selected weekday and weekend day, either during term-time or during school holidays) when participants were 14 years. Participants could select one of 44 activities for each 10-minute activity slot; thus, the diary did not allow for multi-tasking. Social media use was assessed via the activity code ‘browsing and updating social networking sites (e.g., Twitter, Facebook, BBM (Blackberry Messenger) and Snapchat)’. Adopting a similar approach to Atkin *et al.* (2021) diaries with ≥5 10-minute activity slots with ‘no activity’ were excluded as these were deemed unreliable, as were participants who did not provide data on both a weekday and weekend day. Average time spent on social media across a weekday and weekend day was categorised as: ‘no social media use’, ‘1-<30 minutes’ (reference category), ‘30-<1 hour, ‘1-<2 hours’, and ‘≥2 hours’.

Data collection for all investigated exposures occurred in 2015.

Confounders

We prepared directed acyclic graphs (DAGs) with support from our advisory group, subject knowledge and the existing evidence base to highlight our assumptions regarding the causal relationship between variables of interest and to inform our statistical approach. The DAG presented in Figure 15 shows the minimally sufficient adjustment set identified using DAGitty software (original DAGs produced via DAGitty are presented in Appendix B, Section B3). Confounders included parental pre-birth, early life, early adolescence and mid-adolescence circumstances:

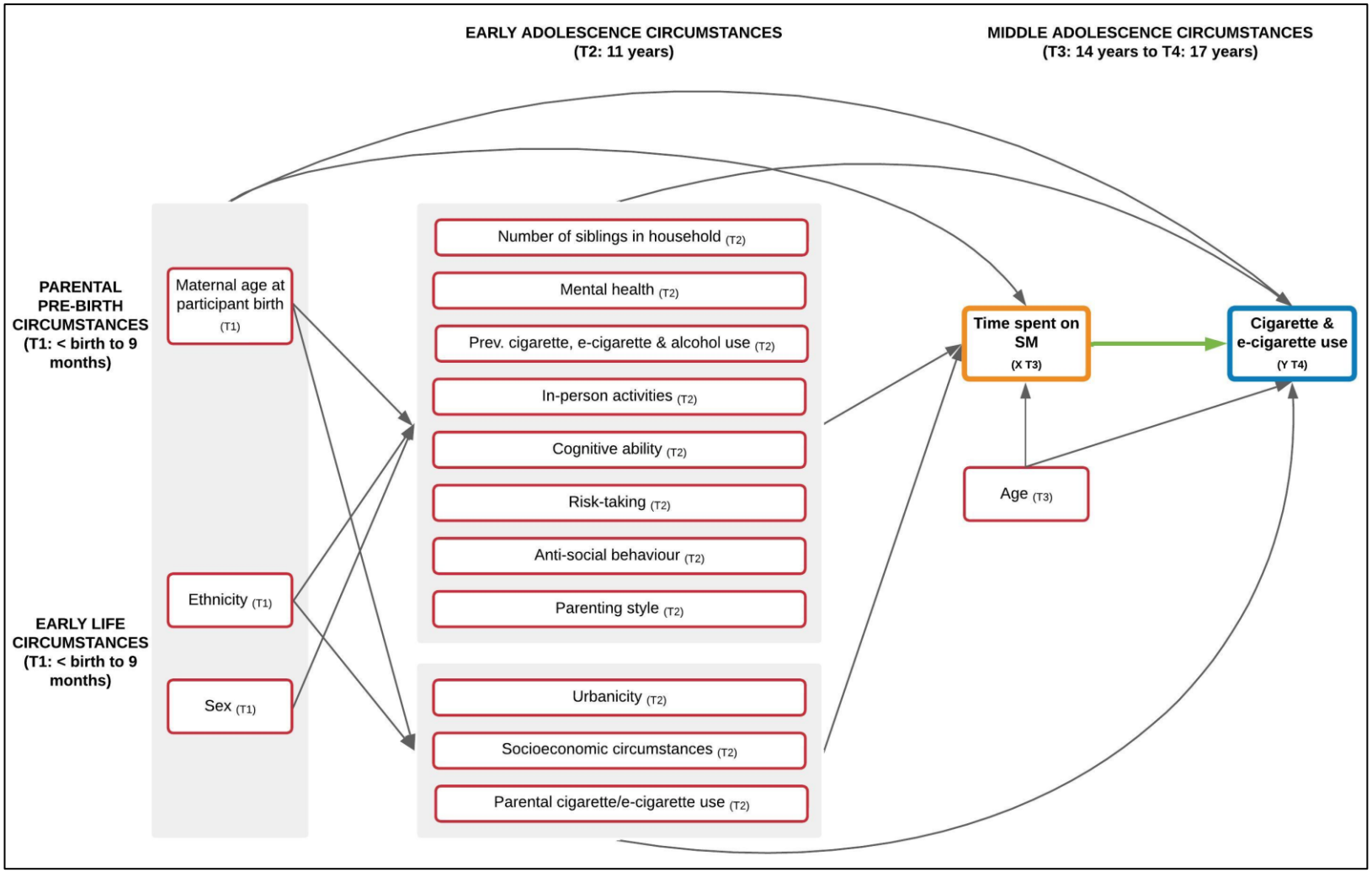
- **Parental pre-birth and early life circumstances (T1: < birth to 9 months):** maternal age at participant birth, ethnicity (6-category Census class), and sex

- **Early adolescence circumstances (T2: 11 years):** number of siblings of the participant in the household, mental health (Strengths and Difficulties Questionnaire Total Difficulties), previous alcohol, cigarette, e-cigarette use, in-person activities, cognitive ability (British Ability Scales II Verbal Similarities), risk-taking (Cambridge Gambling Task), anti-social behaviour, urbanicity (Office for National Statistics Rural Urban Classification), parenting style, parental cigarette/e-cigarette use, and SEC (household income (Organisation for Economic Co-operation and Development Income Equivalised Quintiles), family structure, highest parental occupation in the household (National Statistics Socio-economic Classification), area-level deprivation (Indices of Multiple Deprivation), and highest parental education in the household (National Vocational Qualification))

- **Middle adolescence circumstances (T3: 14 years):** age.

Appendix B, Section B4 details all variables, their original format, and treatment within this study.

Figure 15. Saturated directed acyclic graph (DAG) illustrating the hypothesised relationship between social media use at 14 years and cigarette and e-cigarette use at 17 years - and the minimal sufficient adjustment set



Legend: Observed confounders-rectangular red node (includes confounders where proxy variables are used). Exposure X-orange node. Outcome Y-blue node. Green arrow indicates focal relationship under investigation. Inward and outward arrows from grey-shaded areas pertain to all nodes within the shaded area. Not shown-baseline cigarette use (T3: 14 years), baseline e-cigarette use (T3: 14 years) and previous social media use (T2: 11 years) adjusted for in sensitivity analyses. Socioeconomic circumstances not included in adjustment set for effect modification and interaction analysis models. Abbreviation(s): SM=Social media and T=Timepoint.

Socioeconomic circumstance as an effect modifier

Using the highest National Vocational Qualification (NVQ) level of both parents in the household (where relevant) when the participant was 11 years, a dichotomous variable was generated representing 'high parental education' (i.e., International Standard Classification of Education (ISCED) 3 or English A/AS/S levels or higher) and 'low parental education' (i.e., ISCED 2 or English O level/General Certificate of Secondary Education (GSCE) grades A-C or lower).

5.5.3 Statistical analysis

Descriptive statistics explored the association between social media (14 years) and cigarette, e-cigarette and dual use (17 years), and confounders. MCS weights accounted for the clustered sampling design and attrition. Weights were created and included for the time-use diary analyses (see Appendix B, Section B5). Statistical analysis was performed using *Stata.V16*.

5.5.4 Imputation

Multiple imputations by chained equations were performed in 20 datasets under a missing-at-random assumption (Lee *et al.*, 2016). Estimates were combined using Rubin's rules (Rubin, 1987). Imputation models were performed separately for each exposure, as they have different samples and to accommodate different weights (Appendix B, Section B5). Models included relevant outcomes, confounders, and variables used to account for sample design and attrition to 17 years. For the effect modification and interaction analyses, the imputation models included an interaction between social media use and parental education. Appendix B, Section B6 details the regression models used for imputation.

5.5.5 Effect of social media use on cigarette, e-cigarette and dual use

Within imputed samples, ORs were estimated using logistic regression to examine the association between social media use and the binary outcomes cigarette and e-cigarette use, before and after adjusting for confounding.

Relative risk ratios (RRRs) were estimated using multinomial logistic regression for dual use.

Additional/sensitivity analyses

Analyses were repeated in complete case samples and stratified by sex. We conducted sensitivity analyses using 3-category cigarette and e-cigarette use variables, with current and former users separated. We compared findings from the time-use diary to the questionnaire exposure variables by limiting it to social media use on a normal weekday. To account for possible reverse causation, we adjusted for cigarette and e-cigarette use at 14 years. These were not included in the primary analysis since they may also sit on the causal pathway and therefore represent an overadjustment.

5.5.6 Differential effect of social media use on cigarette and e-cigarette use by socioeconomic circumstance

Within imputed samples, to examine if parental education might buffer against the risk of social media use on cigarette and e-cigarette use, effect measure modification was assessed by calculating risk differences (RD's; absolute differences in cigarette/e-cigarette use between time categories) using linear regression with robust standard errors, which accurately estimates RDs when modelling binary outcomes (Cheung, 2007). Measures of effect modification on the additive scale represent the size of the absolute difference in RDs for cigarette/e-cigarette use by social media use between the high and low parental education groups (baseline: high parental education) (Knol *et al.*, 2011). RDs examined effect measure modification on an additive scale and are considered of greater public health relevance (Knol and VanderWeele, 2012).

Additional/sensitivity analyses

To complement the examination of additive effects, the relative excess risk due to interaction (RERI) was investigated for imputed adjusted estimates (Andersson *et al.*, 2005). As per recommendations from Knol and VanderWeele (2012) and the STROBE guidance (Vandenbroucke *et al.*, 2007) interaction was also assessed; in an unadjusted analysis, an interaction is statistically equivalent to

effect modification, only presents the results in a different way. Analyses were repeated using risk ratios (RRs; estimated in Poisson regression models, with robust standard errors), which assess effect modification and interaction on the multiplicative scale (Vanderweele and Knol, 2014) and were repeated using complete case samples. See Appendix B, Section B7 for further detail on the effect measure modification and interaction analyses conducted.

5.6 Results

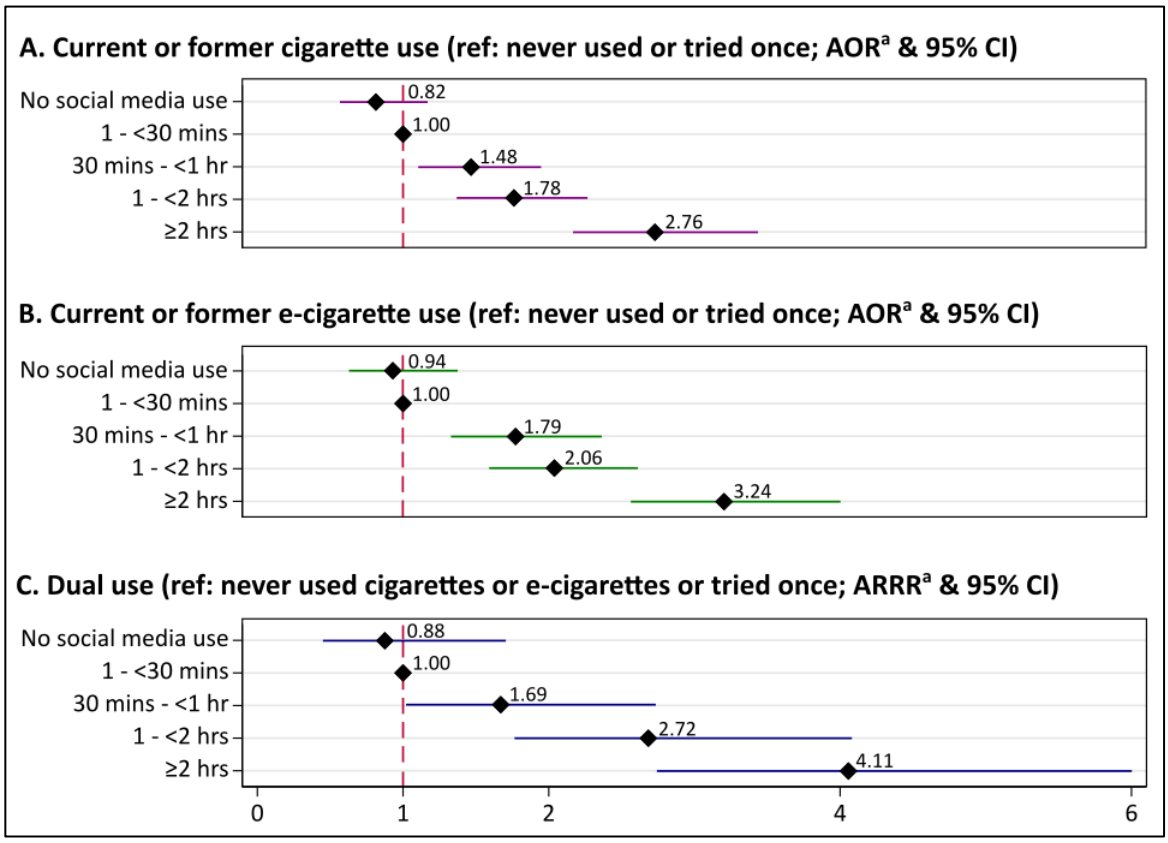
The final imputed questionnaire sample consisted of 8,987 participants (69.4% [n=6,234] complete data), and the final imputed time-use diary sample consisted of 2,520 participants (83.7% [n=2,109] complete data).

In the questionnaire imputed sample, 28.9% of participants were cigarette users, 23.7% e-cigarette users, and 8.2% dual users. Appendix B, Section B8 presents the characteristics of complete case and imputed samples. Prevalences were similar in the time-use diary imputed sample (25.3%, 21.0%, and 7.2% respectively). Generally, prevalence of cigarette use was similar for males and females, though males were more likely to report e-cigarette and dual use. The proportion of social media non-users was considerably smaller for the questionnaire measure (8.4%) compared to the time-use diary measures (weekday use: 63.8% and average use across weekday and weekend: 49.0%). This could be a result of failure of the time-use diaries to capture multi-tasking, which may have overestimated the proportion of social media non-users.

5.6.1 Effect of social media use on cigarette, e-cigarette and dual use

Questionnaire-reported time spent on social media on a normal weekday was associated with increased risk of cigarette, e-cigarette and dual use in a dose-response manner (Figure 16 and Appendix B, Table B9.1). Those in the highest social media category (≥2 hours/day) (vs 1-<30 minutes) were at a greater risk for cigarette (AOR 2.76 [95% CI 2.19 to 3.48]), e-cigarette (AOR 3.24 [2.59 to 4.05]), and dual use (ARRR 4.11 [2.77 to 6.08]). No meaningful sex differences were identified (Appendix B, Table B9.2).

Figure 16. The relationship between time spent on social media on a normal weekday with (A) cigarette, (B) e-cigarette (adjusted odds ratios), and (C) dual use (adjusted relative risk ratios) within the questionnaire imputed sample (n=8,987)

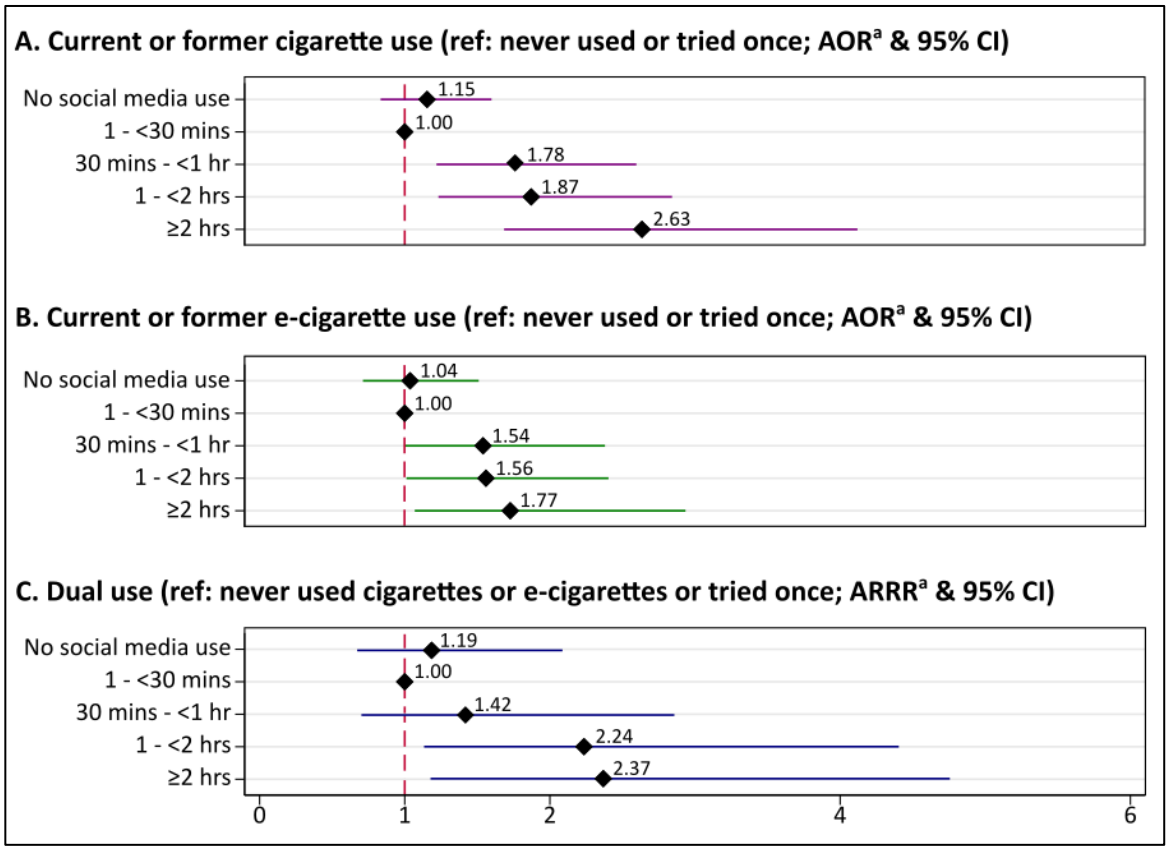


Legend: Questionnaire imputed sample: n=8,987 (weighted sample: n=6,175). [a] Adjusted for sex, ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; and Ref=Reference category.

Considering time-use diary data, average time spent on social media across a weekday and weekend day was associated with increased risk of cigarette and e-cigarette use in a dose-response manner, though estimates were slightly weaker when compared to questionnaire data (Figure 17 and Appendix B, Table B9.3). Those who used social media for ≥2 hours (vs 1-<30 minutes) were at a greater risk of cigarette (AOR 2.63 [1.68 to 4.12]) and e-cigarette use (AOR 1.77 [1.07 to 2.93]). The effect of time spent on social media on risk of dual use was confined to the higher time categories; social media use for 30 minutes-<1 hour was not associated with an elevated risk of dual use (ARRR 1.42 [0.71 to 2.86]), whilst use for 1-<2 hours (ARRR 2.24 [1.14 to 4.41]) and ≥2 hours (ARR 2.37 [1.18 to 4.76]) was.

For cigarette and e-cigarette use associations were potentially stronger for females (Appendix B, Table B9.4). For example, females who used social media for ≥2 hours had a greater risk of cigarette (AOR 3.62 [2.13 to 6.18] vs 1.69 [0.63 to 4.51]) for males) and e-cigarette use (AOR 2.21 [1.21 to 4.05] vs 1.50 [0.58 to 3.88] for males). For dual use, generally estimates were stronger for females, with one exception - the effect of social media use for 1-<2 hours was considerably higher in males (ARRR 3.60 [1.24 to 10.4] vs 1.71 [0.67 to 4.34] for females), albeit with wide confidence intervals.

Figure 17. The relationship between average time spent on social media across a normal weekday and weekend day with (A) cigarette, (B) e-cigarette (adjusted odds ratios), and (C) dual use (adjusted relative risk ratios) within the time-use diary imputed sample (n=2,520)



Legend: Time-use diary imputed sample: n=2,520 (weighted sample: n=5,005). [a] Adjusted for sex, ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; and Ref=Reference category.

Analyses repeated in complete case samples showed similar estimates to those in imputed samples; however, on occasion were slightly larger (Appendix B, Tables B9.5 - B9.6). When separating current and former cigarette and e-cigarette users, generally, the patterning of results was similar to when examining current and former users jointly (Appendix B, Table B9.7).

A comparison of questionnaire and time-use diary measures of time spent on social media on a normal weekday revealed smaller estimates for the time-use diary measure compared to the questionnaire (Appendix B, Table B9.8). This implies that the difference in effect sizes between questionnaire and time-use

diary-recorded social media use was not explained by the inclusion of weekends in the time-use diaries.

Following additional adjustment for baseline outcome measures, estimates were similar or only slightly weaker than those without baseline adjustment, with dose-response relationships generally persisting (Appendix B, Tables B9.9 - B9.10).

5.6.2 Differential effect of social media use on cigarette, e-cigarette use by socioeconomic circumstance

The effects of questionnaire-reported social media use were generally larger in the higher parental education groups (vs lower), despite non-users in high parental education groups reporting a lower baseline prevalence of cigarette and e-cigarette use (Table 4 and Appendix B, Table B10.1). For example, the risk of cigarette use among 30 minute-<1 hour users (vs non-users) with low parental education was smaller than those with high (ARD 1.4% [-9.2 to 11.9%] vs 12.4% [6.9 to 18.0%]). In other words, the absolute difference in the ARDs between these two groups (i.e., the measure of effect measure modification) was -11.1% (-22.7 to 0.5%). Similar findings were observed for those who used social media for 1-<2 hours (effect modification measure: -11.6% [-23.0 to 0.1%]) and ≥2 hours (effect modification measure: -10.5% [-21.3 to 0.3%]).

Patterns for e-cigarette use in the higher time categories also showed greater effects in the high parental education groups; however, they were considerably less pronounced with wide confidence intervals (Table 5 and Appendix B, Table B10.2).

Although the impact of questionnaire-reported social media use on cigarette use appeared greater in those with high parental education vs low, this is driven by differences in the prevalence of cigarette use in non-users (high parental education: 10.1% and low parental education: 22.1%) as opposed to the higher time categories where risk of cigarette use was very similar in the high and low parental education groups (36.8% and 38.6%). This implies that the *protective effects* of low/no social media use are greater in the high parental education

groups, as opposed to the *harmful effects* of high social media use. For the time-use diary data, it was a mixture of the two.

The risk of cigarette use for 1-<30 minute users (vs non-users), based on time-use diary data (Table 6 and Appendix B, Table B10.1), were 20.4% (-31.1 to -9.8%) lower among those with low parental education vs high. For ≥2 hours use, the opposite was seen – effects were larger for those with low parental education vs high (13.9% [-1.2 to 29.1%] vs 10.2% [-1.7 to 22.0]; effect modification measure: 3.7% [-14.8 to 22.3%]). For e-cigarette use, the direction of effects across social media time categories was similar (Table 7 and Appendix B, Table B10.2).

Analyses repeated using RRs showed no evidence of effect modification on the multiplicative scale (Appendix B, Tables B10.5 - B10.6).

Table 4. Participant cigarette use according to time spent on social media, within strata of parental education (risk differences) within the questionnaire imputed sample (n=8,954)

	High parental education	Low parental education
Weighted prevalence % (observed n with outcome/without outcome)		
No social media use	10.1 (43/391)	22.1 (49/246)
1 - <30 mins	13.0 (95/617)	23.4 (78/352)
30 mins - <1 hr	23.7 (173/651)	22.8 (99/402)
1 - <2 hrs	26.8 (237/701)	27.0 (154/465)
≥2 hrs	36.8 (768/1,484)	38.6 (677/1,272))
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	2.9 (-1.9 to 7.8; 0.239)	1.3 (-12.1 to 14.7; 0.848)
30 mins - <1 hr	13.6 (7.7 to 19.4; <0.0001)	0.6 (-11.8 to 13.0; 0.921)
1 - <2 hrs	16.7 (12.1 to 21.3; <0.0001)	4.9 (-7.6 to 17.4; 0.442)
≥2 hrs	26.7 (22.0 to 31.4; <0.0001)	16.4 (5.0 to 27.8; 0.005)
Unadjusted measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	-1.6 (-15.8 to 12.6; 0.823)	
30 mins - <1 hr	-12.9 (-26.3 to 0.5; 0.059)	
1 - <2 hrs	-11.8 (-25.1 to 1.4; 0.081)	
≥2 hrs	-10.3 (-22.4 to 1.9; 0.097)	
Adjusted[b] RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	2.0 (-2.6 to 6.6; 0.386)	2.6 (-8.4 to 13.5; 0.646)
30 mins - <1 hr	12.4 (6.9 to 18.0; <0.0001)	1.4 (-9.2 to 11.9; 0.799)
1 - <2 hrs	14.9 (10.5 to 19.3; <0.0001)	3.4 (-7.5 to 14.3; 0.541)
≥2 hrs	24.6 (20.0 to 29.2; <0.0001)	14.2 (3.9 to 24.5; 0.007)
Adjusted[b] measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	0.5 (-11.2 to 12.2; 0.929)	
30 mins - <1 hr	-11.1 (-22.7 to 0.5; 0.061)	
1 - <2 hrs	-11.6 (-23.0 to -0.1; 0.048)	
≥2 hrs	-10.5 (-21.3 to 0.3; 0.057)	

Legend: Questionnaire imputed sample: n=8,954 (weighted sample: n=6,976). [a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant current or former cigarette use by time spent on social media, within the low parental education group compared with baseline (high parental education group).
[b] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; RD=Risk differences; and Ref=Reference category

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Table 5. Participant e-cigarette use according to time spent on social media, within strata of parental education (risk differences) within the questionnaire imputed sample (n=8,954)

	High parental education	Low parental education
Weighted prevalence % (observed n with outcome/without outcome)		
No social media use	9.4 (43/391)	18.0 (42/253)
1 - <30 mins	9.6 (75/636)	20.4 (81/349)
30 mins - <1 hr	19.3 (152/672)	25.3 (109/393)
1 - <2 hrs	19.3 (188/751)	25.1 (160/459)
≥2 hrs	27.8 (590/1,662)	31.7 (607/1,343)
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	0.3 (-4.3 to 4.8; 0.913)	2.5 (-8.3 to 13.2; 0.652)
30 mins - <1 hr	9.9 (4.9 to 14.9; <0.0001)	7.4 (-3.5 to 18.2; 0.182)
1 - <2 hrs	10.0 (5.2 to 14.7; <0.0001)	7.2 (-3.9 to 18.3; 0.203)
≥2 hrs	18.5 (14.2 to 22.8; <0.0001)	13.8 (3.6 to 23.9; 0.008)
Unadjusted measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	2.2 (-9.1 to 13.5; 0.701)	
30 mins - <1 hr	-2.5 (-14.2 to 9.1; 0.669)	
1 - <2 hrs	-2.8 (-14.7 to 9.2; 0.647)	
≥2 hrs	-4.7 (-15.7 to 6.3; 0.399)	
Adjusted[b] RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	-0.6 (-5.0 to 3.7; 0.772)	3.0 (-5.8 to 11.9; 0.501)
30 mins - <1 hr	9.6 (4.6 to 14.6; <0.0001)	9.8 (0.4 to 19.3; 0.041)
1 - <2 hrs	10.4 (5.6 to 15.2; <0.0001)	8.1 (-1.6 to 17.9; 0.101)
≥2 hrs	21.6 (17.4 to 25.8; <0.0001)	18.0 (9.0 to 27.0; <0.0001)
Adjusted[b] measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	3.7 (-5.7 to 13.0; 0.441)	
30 mins - <1 hr	0.2 (-9.8 to 10.3; 0.965)	
1 - <2 hrs	-2.3 (-12.4 to 7.9; 0.662)	
≥2 hrs	-3.6 (-13.2 to 6.1; 0.463)	

Legend: Questionnaire imputed sample: n=8,954 (weighted sample: n=6,976). [a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant current or former cigarette use by time spent on social media within the low parental education group compared with baseline (high parental education group).
[b] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; RD=Risk differences, and Ref=Reference category.

Table 6. Participant cigarette use according to time spent on social media, within strata of parental education (risk differences) within the time-use diary imputed sample (n=2,520)

	High parental education	Low parental education
Weighted prevalence % (observed n with outcome/without outcome)		
No social media use	20.3 (149/666)	30.4 (90/273)
1 - <30 mins	25.4 (75/279)	11.7 (19/124)
30 mins - <1 hr	26.6 (66/199)	30.9 (29/96)
1 - <2 hrs	25.7 (39/134)	36.2 (34/68)
≥2 hrs	31.0 (34/70)	44.3 (24/51)
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	5.1 (-0.7 to 10.9; 0.082)	-18.8 (-28.7 to -8.8; <0.0001)
30 mins - <1 hr	6.3 (-0.5 to 13.1; 0.071)	0.5 (-16.6 to 17.5; 0.957)
1 - <2 hrs	5.4 (-5.2 to 16.0; 0.318)	5.8 (-8.3 to 19.9; 0.423)
≥2 hrs	10.7 (-1.1 to 22.5; 0.074)	13.8 (-4.0 to 31.6; 0.127)
Unadjusted measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	-23.9 (-34.6 to -13.1; <0.0001)	
30 mins - <1 hr	-5.8 (-24.2 to 12.6; 0.534)	
1 - <2 hrs	0.4 (-17.4 to 18.2; 0.967)	
≥2 hrs	3.1 (-18.0 to 24.2; 0.770)	
Adjusted[b] RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	5.5 (-0.4 to 11.4; 0.067)	-14.9 (-24.7 to -5.2; 0.003)
30 mins - <1 hr	6.0 (-0.9 to 13.0; 0.089)	4.2 (-11.4 to 19.8; 0.598)
1 - <2 hrs	4.2 (-5.7 to 14.1; 0.405)	4.7 (-8.2 to 17.5; 0.476)
≥2 hrs	10.2 (-1.7 to 22.0; 0.092)	13.9 (-1.2 to 29.1; 0.072)
Adjusted[b] measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	-20.4 (-31.1 to -9.8; <0.0001)	
30 mins - <1 hr	-1.9 (-18.7 to 15.0; 0.829)	
1 - <2 hrs	0.5 (-15.3 to 16.2; 0.953)	
≥2 hrs	3.7 (-14.8 to 22.3; 0.691)	

Legend: Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727).[a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant current or former cigarette use by time spent on social media within the low parental education group compared with baseline (high parental education group).
[b] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; RD=Risk differences; and Ref=Reference category.

Table 7. Participant e-cigarette use according to time spent on social media, within strata of parental education (risk differences) within the time-use diary imputed sample (n=2,520)

	High parental education	Low parental education
Weighted prevalence % (observed n with outcome/without outcome)		
No social media use	16.1 (118/697)	27.8 (86/277)
1 - <30 mins	17.4 (51/303)	20.9 (22/121)
30 mins - <1 hr	21.5 (44/221)	20.6 (27/98)
1 - <2 hrs	13.8 (31/143)	30.1 (30/72)
≥2 hrs	15.7 (21/83)	40.3 (25/50)
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	1.3 (-4.8 to 7.5; 0.670)	-6.8 (-22.7 to 9.1; 0.400)
30 mins - <1 hr	5.4 (-2.5 to 13.3; 0.182)	-7.2 (-18.2 to 3.8; 0.201)
1 - <2 hrs	-2.3 (-10.0 to 5.4; 0.559)	2.4 (-10.5 to 15.3; 0.716)
≥2 hrs	-0.5 (-9.5 to 8.6; 0.922)	12.6 (-6.0 to 31.1; 0.184)
Unadjusted measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	-8.2 (-25.0 to 8.7; 0.343)	
30 mins - <1 hr	-12.6 (-26.4 to 1.2; 0.074)	
1 - <2 hrs	4.7 (-11.7 to 21.0; 0.574)	
≥2 hrs	13.0 (-8.2 to 34.2; 0.228)	
Adjusted[b] RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	2.6 (-3.7 to 8.9; 0.417)	-4.6 (-17.2 to 8.1; 0.477)
30 mins - <1 hr	7.2 (-1.0 to 15.5; 0.085)	-0.4 (-10.5 to 9.7; 0.935)
1 - <2 hrs	-1.0 (-9.2 to 7.1; 0.804)	3.4 (-8.1 to 15.0; 0.556)
≥2 hrs	1.9 (-7.5 to 11.3; 0.689)	13.2 (-3.4 to 29.7; 0.118)
Adjusted[b] measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	-7.2 (-21.3 to 7.0; 0.319)	
30 mins - <1 hr	-7.6 (-21.0 to 5.7; 0.260)	
1 - <2 hrs	4.5 (-10.0 to 19.0; 0.543)	
≥2 hrs	11.3 (-7.9 to 30.4; 0.248)	

Legend: Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727). [a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant current or former cigarette use by time spent on social media within the low parental education group compared with baseline (high parental education group).
[b] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; RD=Risk differences; and Ref=Reference category.

5.7 Discussion

Summary of findings

In a UK-representative cohort, adolescent social media use at 14 years increases risk of cigarette, e-cigarette and dual use at 17 years in a dose-response manner. These findings persisted in a series of analyses to examine a range of biases including from missing data and reverse causation.

The influence of social media use on cigarette use was especially strong for social media users (vs non-users) with high parental education than those with low. However, this mainly appeared to be because of the greater protective effects of low social media use in the higher parental education group. Levels of smoking were similar among very frequent users of social media use, regardless of parental education. These associations were robust to adjustment for confounders, and while the patterning of results for e-cigarette use was relatively similar, the degree of modification was smaller.

Comparison with other findings

The current analysis corroborates the finding that increased social media use is associated with cigarette and e-cigarette use (Emery *et al.*, 2014; Huang *et al.*, 2014; Camenga *et al.*, 2018; Sampasa-Kanyinga and Hamilton, 2018; Soneji, Pierce, *et al.*, 2018; Soneji, Yang, *et al.*, 2018; Lee *et al.*, 2019; Vannucci *et al.*, 2020; Cavazos-Rehg *et al.*, 2021; Vrinten *et al.*, 2022). A recent systematic review identified that frequent social media use (n=8) and exposure to tobacco marketer-generated content on social media (n=3) increased the likelihood of tobacco use (Purba *et al.*, 2023). Whilst exposure to e-cigarette marketer-generated content was associated with increased use of e-cigarettes (n=4) (Purba *et al.*, 2023). Limitations highlighted, and addressed in our study, include failure to assess dual use, insufficient adjustment for confounding and a lack of longitudinal analyses, hindering the ability to assess the potential for reverse causality (Purba *et al.*, 2023). Moreover, no study explored if relationships differed by SEC and, thus, whether social media may widen inequalities (Purba *et al.*, 2023).

Existing research, mainly conducted in the US, demonstrates increased cigarette and e-cigarette use among adolescents who spend time on social media and/or report exposure to social media cigarette or e-cigarette-related marketing (Cavazos-Rehg *et al.*, 2014; Camenga *et al.*, 2018; Soneji, Yang, *et al.*, 2018), with similar findings observed in China, France, New Zealand and Thailand (Huang *et al.*, 2012; Suwanwong *et al.*, 2021; Ball *et al.*, 2022; Chau *et al.*, 2022). The generalisability of these studies to the UK is impeded by differences in cigarette/e-cigarette social media marketing regulations, the legal age of consumption, and cigarette, e-cigarette and social media use prevalence (Institute for Global Tobacco Control, 2020).

UK-based research is limited to the cross-sectional analysis of data from multiple countries participating in the Health Behaviour in School Aged Children (HBSC) survey, where UK-specific estimates are not reported (De Looze *et al.*, 2019; Boniel-Nissim *et al.*, 2022). One study explicitly examines UK adolescents (Vrinten *et al.*, 2022). Using the MCS, it found social media use for ≥1-<5 hours/day and ≥5 hours/day (vs <1 hour/day) at 14 years was associated with increased odds of smoking at 17 years (AOR 1.38 [1.05 to 1.81] and 1.91 [1.41 to 2.59] respectively; Vrinten *et al.*, 2022). This study did not investigate e-cigarette use or the potential for reverse causation. Given the growing body of evidence illustrating the positive associations between dual use and illicit substance use, alcohol use, truancy and poor academic performance (Kristjansson *et al.*, 2015; McCabe *et al.*, 2017; Azagba, 2018), an understanding of social media's role as a potential risk factor for dual use is needed.

In our analysis of the same dataset, we adjusted for a wider range of confounding factors not considered in this previous study, including in-person activities, risk-taking and parenting style, estimated impacts on e-cigarette and dual use, explored the potential for reverse causation and considered potential impacts on health inequalities.

Strengths and limitations

Given that adolescents from less disadvantaged backgrounds are at greater risk of cigarette and e-cigarette use (Green *et al.*, 2016; Simon *et al.*, 2017), our novel investigation of parental education as an effect modifier is crucial to

understand the inequalities in social media harms. We followed a published statistical analysis plan and examined the impact of social media use assessed via two measurement modes (Purba *et al.*, 2022). Weights were used to adjust for attrition, additional weights were created to ensure representativeness of the time-use diary sample, and multiple imputation accounted for item-missingness. We adjusted for a comprehensive range of confounders, informed by the creation of DAGs. The potential for reverse causality was investigated, finding effects persisted when accounting for baseline measures of our outcomes. We report multiple sensitivity analyses to consider bias in our methods and provide comparisons with traditional analysis approaches.

While we aimed to implement the best possible analyses, there are issues intrinsic to the data which must be considered. Although we used time-use diaries to address the potential recall bias in the questionnaire measure, time-use diary completion was low (38.5%), resulting in a small but representative (based on observed characteristics) sample. The failure of the time-use diary to capture multi-tasking and its potential completion during the school holidays may have influenced actual time spent on social media and its reporting, thus potentially underestimating social media use. This underestimation may, in part, explain the weaker associations observed in the time-use diary data. However, it is impossible to verify this in the absence of a gold standard measure. Using multiple devices to holistically track social media use over multiple days could help to overcome these issues, though achieving this with population-representative cohorts could be resource-intensive (Orben and Przybylski, 2019b). Exposure and outcome measures, although completed individually with confidentially emphasised, were self-report; thus, social-desirability bias remains possible (Bowling, 2005).

Although we adjusted for numerous confounders, the potential for residual or unmeasured confounding remains. Despite including indicators for all proposed confounders as far as the data allow, there may be some not fully represented by our set of measured variables and others which we have not identified. This could lead to bias of unclear direction, substantially affecting the results. Further, we recognise that although dose-response relationships were observed, their presence may have arisen from confounding (Shimonovich *et al.*, 2021).

Implications for policy, practice and further research

Our findings suggest that parental education modifies the association between social media use and cigarette use. However, confidence intervals were wide, reducing the ability to draw definitive conclusions. Unmeasured or residual confounding may be a concern here. For example, we found cigarette use prevalence among social media non-users was far lower in those whose parents had high (vs low) academic qualifications. The reasons behind non-use of social media may range from parenting strategies to the availability of relevant resources (e.g., device access). These reasons likely vary across socioeconomic groups and may also have implications for health behaviours. Future research should explore this further.

The use of more accurate social media measures to determine the degree to which causal relationships between the different aspects of social media use (e.g., exposure to nicotine-related products) and cigarette, e-cigarette, and dual use exist and differ by social media activities (e.g., active/passive use), should be considered.

Due to the rapid adoption of social media in adolescents and the benefits it can present (e.g., increased social capital, identity and aspirational development; Uhls *et al.*, 2017), it may be a critical environment in which to intervene through online health interventions. For example, nicotine-prevention messages to prevent or stop nicotine product use may help tobacco control in adolescents. Overall, our findings strengthen calls to prohibit social media marketing of nicotine-related products (including influencer content) (Royal College of Physicians, 2022).

5.8 Conclusion

Adolescent social media use for ≥30 minutes daily increases risk of cigarette, e-cigarette and dual use and this risk increases in a dose-response manner. Guidance on time spent on social media, legislation securing adolescent online safety, including regulation of nicotine-related marketing on social media should be prioritised.

Contributors

AKP, SVK, and AP led the conceptualisation and design of the study, and MH contributed to the conceptualisation and design. AKP, SVK, AP, and MH drafted the statistical analysis plan (Open Science Framework (OSF) registration: https://osf.io/ytkbz/). AKP was responsible for data access, formal analysis, interpretation, and visualisation of results. AP and AB provided support and reviewed the analytical code and formal analysis. All authors assisted with the interpretation of results. AKP subsequently wrote the first draft of the manuscript. All authors critically reviewed and approved the manuscript. The corresponding author attests that all listed authors meet authorship criteria and that no other meeting the criteria have been omitted.

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Competing interests

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Ethical approval

Ethics approval was granted for each of the MCS surveys; no approval was required for the current analysis (Centre for Longitudinal Studies, 2020; Fitzsimons, 2020; Fitzsimons *et al.*, 2020).

Acknowledgements

We thank the participants in the MCS for their time, and the Centre for Longitudinal Studies, University College London Social Research Institute and UK Data Service for their work in preparing the data. However, neither Centre for Longitudinal Studies nor the UK Data Service bear any responsibility for the analysis or interpretation of these data. We also thank the study funders: Medical Research Council (MC_UU_00022/2), Chief Scientist Office (SPHSU17), an NHS Research Scotland Senior Clinical Fellowship (SCAF/15/02), Wellcome Trust (205412/Z/16/Z), and the U.S. National Institute on Alcohol Abuse and Alcoholism (AA019606).

We additionally extend sincere thanks to advisory group members for supporting the development of the statistical analysis plan and interpretation of study findings, as well as Dr Daniel Kopasker and Dr Theocharis Kromydas for their advice on creating the time-use diary weights.

Data sharing

Original MCS data are held by the UK data Service and are available on request from (https://ukdataservice.ac.uk/). Datasets accessed are listed below:

- Millennium Cohort Study: First Survey, 2001-2003- DOI: 10.5255/UKDA-SN-4683-5
- Millennium Cohort Study: Second Survey, 2003-2005- DOI: 10.5255/UKDA-SN-5350-5
- Millennium Cohort Study: Fifth Survey, 2012- DOI: 10.5255/UKDA-SN-7464-5

- Millennium Cohort Study: Sixth Survey, 2015- DOI: 10.5255/UKDA-SN-8156-7

- Millennium Cohort Study: Seventh Survey, 2018- DOI: 10.5255/UKDA-SN-8682-2

The analytic code is available in an online public repository:

- https://doi.org/10.5281/zenodo.7664236

- https://github.com/AmritKPurba/Social_media_healthrisk_behaviours

Transparency

The lead author (AKP) affirms that the manuscript is an honest, precise, and transparent account of the study reported, with no important aspects omitted. Any discrepancies from the study as planned (and, published in the statistical analysis plan) have been explained.

Dissemination to participants and related patient and public communities

The study findings will be disseminated via conference presentations, press releases, and social media outlets. The authors will disseminate findings to media organisations and press councils, and also national health organisations that are instrumental in the development of social media recommendations for adolescents. Additionally, the study findings will be disseminated via advisory group members working across academic, governmental and charity sectors.

Open access/copyright statement

Chapter 6 The relationship between time spent on social media and adolescent alcohol use: A longitudinal analysis of the UK Millennium Cohort Study

6.1 Foreword

This section provides some additional detail on the article which follows.

The increased marketing of alcohol-related products to adolescents (World Health Organisation, 2022b), the multiple mechanisms through which alcohol use can negatively influence adolescent health (Rehm, Room, Graham, *et al.*, 2003; Rehm, Room, Monteiro, *et al.*, 2003; Ezzati *et al.*, 2006), and inequalities (Institute of Alcohol Studies, 2020) were discussed in Chapter 2. This knowledge, combined with the gaps identified in the systematic review (presented in Chapter 2 and Section 5.1) and input from advisory group members, provided the impetus for the article that follows.

6.2 Title, authorship and publication details

This article is currently under peer-review with *Addiction*.

Purba AK, Henderson M, Baxter A, Katikireddi SV, Pearce A (2023) The relationship between time spent on social media and adolescent alcohol use: A longitudinal analysis of the UK Millennium Cohort Study. *Addiction*.

6.3 Abstract

Aim(s)

To estimate the effect of social media use in 14 year olds on risk of and inequalities in alcohol use and binge drinking at 17 years.

Design

The Millennium Cohort Study.

Setting

United Kingdom.

Participants

8,987 adolescents assessed in infancy and modal ages 11,14 and 17 years.

Measurements

Questionnaire (n=8,987) reported time spent on social media on a normal weekday and time-use diary (n=2,520) reported average time spent on social media across a normal weekday and weekend day (non-user/1-<30 minutes/30-<1 hour/1-<2 hours/≥2 hours), past month frequency of alcohol use (never/1-2/3-5/≥6 times), and binge drinking (yes/no). Pre-specified confounders (identified via directed acyclic graphs (DAGs)) included demographic characteristics, in-person activities, parenting style, peer alcohol use and risk-taking.

Methods

The relationship between time spent on social media with alcohol use outcomes was estimated using adjusted odds ratios (AORs) or adjusted relative risk ratios (ARRRs). Associations within low and high parental education groups were compared to examine effect modification. Analyses accounted for confounders, baseline outcome measures (to address reverse causality), sample design, attrition and item-missingness (through multiple imputation).

Findings

Questionnaire-reported time spent on social media was associated with increased risk of alcohol use and binge drinking in a dose-response manner. Compared to 1-<30 minute social media users, 30 minute-<1 hour users were more likely to report alcohol use ≥6 times/month (ARRR 1.62 [95% CI 1.20 to 2.20]) and binge drinking (AOR 1.51 [1.22 to 1.87]), as were 1-<2 hour users (ARRR 2.61 [1.90 to 3.58]; AOR 2.06 [1.69 to 2.52]) and ≥2 hour users (ARRR 4.80

[3.65 to 6.32]; AOR 3.07 [2.54 to 3.70]). Social media measured by time-use diary was associated with higher risks, although not always demonstrating a dose-response relationship. The effect of social media use (vs no-use) on binge drinking was generally larger in the higher (vs lower) parental education groups. Analyses repeated in complete case samples and with additional adjustment for baseline outcome measures revealed consistent findings.

Conclusion

Findings suggest social media use increases risk of alcohol use and binge drinking. Regulation protecting adolescents from harmful alcohol-related social media content should be prioritised.

Keywords

Social media, adolescents, alcohol use, binge drinking, and inequalities.

6.4 Introduction

Alcohol use is a leading cause of poor health in adolescents and can lead to adverse outcomes which extend into adulthood, including substance use disorders, poor mental health, and reduced labour-market prospects (Global Burden of Disease Pediatrics Collaboration, 2016). These health outcomes contribute to inequalities in mortality and morbidity between socioeconomic groups (Global Burden of Disease Pediatrics Collaboration, 2016; Boyd *et al.*, 2021). Alcohol use is generally established during adolescence, a period of increased risk-taking and peer and social influence. Yet, in recent decades, a decline in adolescent drinking has been observed, suggested to result from the increased uptake and centrality of social media platforms in adolescents' lives (Ng Fat *et al.*, 2021; Caluzzi *et al.*, 2023). However, the relationship between social media and adolescent alcohol use is complex, and despite a notable decline in adolescent alcohol use, risky drinking behaviours (e.g., binge drinking) remain high (Inchley *et al.*, 2018).

Social media may offer adolescents opportunities to express and preserve intimacy without drinking alcohol with peers (Caluzzi *et al.*, 2023). Yet, although

online activities may displace in-person interactions, the online environment may also facilitate drinking (Caluzzi *et al.*, 2023). For example, social media affords greater opportunity for in-person socialising through its ability to maintain friendship networks, which consequently may facilitate collective drinking (Caluzzi *et al.*, 2022). Adolescents may use social media as a means to present their drinking behaviour, thereby exposing other adolescents to content which potentially promotes alcohol use. It can also provide an online drinking context where social drinking may not have been possible (e.g., COVID-19 restrictions; Caluzzi *et al.*, 2023). Social media has created a new (poorly regulated) space for commercial and social marketing of alcohol practices (and other unhealthy commodities), opening up new opportunities for adolescents to be exposed to pro-alcohol messages, resulting in increased consumption (Caluzzi *et al.*, 2022).

Consequently, this entanglement of social media and adolescent drinking cultures may contribute to the normalisation of alcohol use (Lyons *et al.*, 2017). This is consistent with empirical evidence from Norway, the US and the UK, which show increased time spent on social media is associated with frequent alcohol use (Boers *et al.*, 2020; Ng Fat *et al.*, 2021; Brunborg *et al.*, 2022). However, causality and the potential for reverse causation (where those who use alcohol may be more inclined to use social media or seek out certain social media content) remains largely unaddressed (Boers *et al.*, 2020; Brunborg *et al.*, 2022). Moreover, previous research has relied on retrospective estimates of time spent via self-report questionnaires (Boers *et al.*, 2020; Ng Fat *et al.*, 2021; Brunborg *et al.*, 2022). When access to real-time objective social media data is limited, time-use diaries offer a useful alternative to retrospective reports, being potentially subject to less recall and response bias (Naab *et al.*, 2019; Orben and Przybylski, 2019a). For policymakers to make informed decisions on social media regulation, more accurate estimates of these relationships are needed. Given the preventable inequalities which exist in alcohol-related diseases and deaths, an understanding of how the relationship between social media and alcohol consumption may vary across different socioeconomic groups is required.

We aimed to estimate the effect of time spent on social media at age 14 years on the risk of alcohol use and binge drinking at age 17 years using the UK-representative Millennium Cohort Study (MCS). We also examine if the effects of social media differ by socioeconomic circumstance (SEC), with the potential to widen inequalities.

6.5 Methods

We follow the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidance (Vandenbroucke *et al.*, 2007) and a published statistical analysis plan developed with input from advisory group members (Purba *et al.*, 2022). Advisory group input is described in Appendix C, Section C1; deviations from the published statistical analysis plan are reported in Section C2.

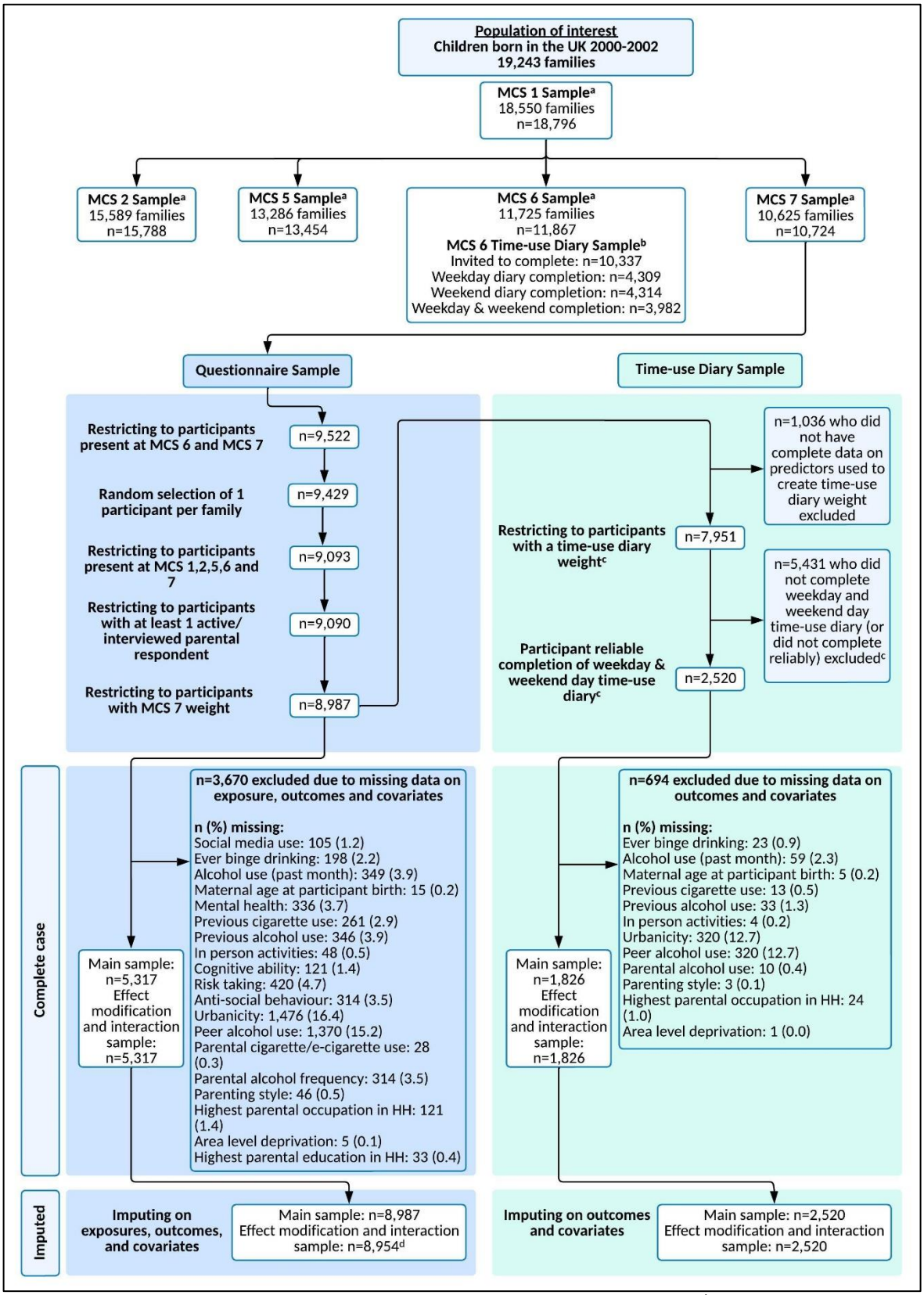
6.5.1 Study characteristics

The MCS is a UK nationally representative prospective cohort study of children born between September 2000 and January 2002 (Centre for Longitudinal Studies, 2020). Families were identified through Child Benefit Records and contacted via opt-out letters from the Department for Work and Pensions. A disproportionately stratified clustered sampling design was used to over-represent children living in Wales, Scotland and Northern Ireland, disadvantaged areas, and areas with high proportions of ethnic minority groups (in the case of England) (Centre for Longitudinal Studies, 2020). Study contact with the cohort child (hereafter referred to as 'participant') first occurred at approximately age nine months, where data were collected from 18,796 participants. This study uses data for participants, and their caregivers present in the initial survey and at ages 3, 11, 14 and 17 years. Triplet households were excluded. Where households contained two participants, one was randomly selected for inclusion in the analysis. Figure 18 presents the STROBE study flow diagram.

Data were downloaded from the UK Data Service, University of Essex and University of Manchester (October 2021-January 2022). Ethics approval was granted for each of the MCS surveys; no approval was required for the current analysis (Centre for Longitudinal Studies, 2020; Fitzsimons, 2020; Fitzsimons *et*

al., 2020). Information on the MCS is available from: http://www.cls.ioe.ac.uk/mcs.

Figure 18. STROBE study flow diagram



Legend: [a] MCS weights used to extrapolate back to population of interest. [b] Time-use diary weight created to extrapolate back to MCS 6 entire sample and combined with MCS 7 weight to extrapolate to population of interest. All predictors used to create time-use diary weight were existing confounders to be used in analysis. [c] Participants who had ≥5 'no activity recorded' slots on a weekday, weekend or both days were deemed as having unreliable diary accounts. [d] To facilitate inclusion of interaction between social media use and highest parental education in the imputation model for the effect modification and interaction analyses, n=33 with missing data on highest parental education were excluded prior to imputation. Abbreviation(s): HH=Household; n=Number of participants; and MCS=Millennium Cohort Study.

6.5.2 Measures

Outcomes

Binge drinking

At 17 years, participants were asked, 'have you ever had five or more alcoholic drinks at a time?' resulting in a dichotomous outcome variable with categories: 'yes' and 'no'.

Frequency of alcohol use in the past month

Participants were asked, 'how many times have you had an alcoholic drink in the last 4 weeks?' at 17 years, with categories ranging from 'never' to '40 or more times.' Due to low frequencies in some categories, a 4-category variable was generated: 'never', '1-2 times/month', '3-5 times/month' and '≥6 times/month'.

Data collection for all investigated outcomes occurred in 2018.

Exposures

Time spent on social media on a normal weekday during term time (assessed via self-report questionnaire)

At 14 years, participants were asked, 'on a normal weekday during term time, how many hours do you spend on social networking or messaging sites or apps on the internet such as Facebook, Twitter and WhatsApp?' and given eight options to select from, ranging from 'no social media use' to '≥7 hours'. Due to low frequencies in the higher time categories, data were collapsed into the following: 'no social media use', '1-<30 minutes', '30-<1 hour, '1-<2 hours', and '≥2 hours'. The reference category was '1-<30 minutes', based on the threshold of potential harm in comparable studies (Ng Fat *et al.*, 2021), and because non-users are likely to be highly atypical.

Average time spent on social media across a normal weekday and weekend day (assessed via time-use diary)

When participants were 14 years they completed the time-use diary for two 24-hour periods (one randomly selected weekday and weekend day occurring either during term-time or during school holidays). For each 10-minute activity slot, participants could select one of 44 activities; thus, the diary did not account for multi-tasking. Social media use was assessed via the activity code 'browsing and updating social networking sites (e.g., Twitter, Facebook, BBM (Blackberry Messenger) and Snapchat)' (Centre for Longitudinal Studies, 2016). Adopting a comparable approach to Atkin *et al.* (2021), diaries with ≥5 10-minute activity slots with 'no activity' were deemed unreliable accounts of a complete day's activity and were excluded from the analysis, as were participants who did not provide data on both a weekday and weekend day. Average time spent on social media across a weekday and weekend day was categorised as: 'no social media use', '1-<30 minutes', '30-<1 hour, '1-<2 hours', and '≥2 hours'. The reference category was '1-<30 minutes'.

Data collection for all investigated exposures occurred in 2015.

<u>Confounders</u>

With support from our advisory group, subject knowledge and the existing evidence base, we prepared DAGs to highlight our assumptions surrounding the causal relationship between variables of interest, and to inform our statistical approach. Confounders included parental pre-birth and early life, early and middle adolescence circumstances:

- **Parental pre-birth and early life circumstances (T1: < birth to 9 months):** maternal age at participant birth, ethnicity (6-category Census class), sex, and religion

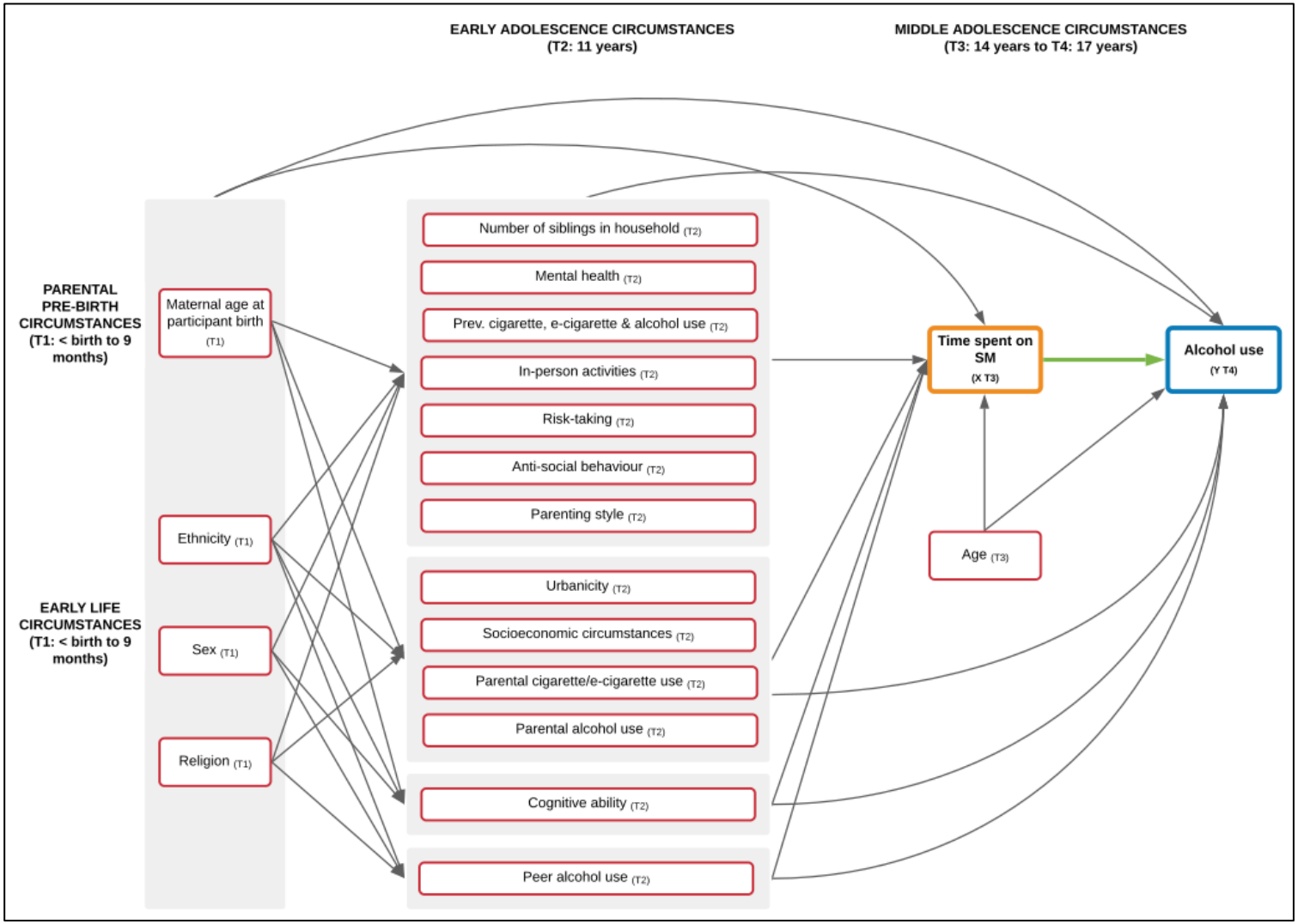
- **Early adolescence circumstances (T2: 11 years):** number of siblings of the participant in the household, mental health (Strengths and Difficulties Questionnaire Total Difficulties), previous alcohol, cigarette, e-cigarette use, in-person activities, risk-taking (Cambridge Gambling Task), anti-

social behaviour, urbanicity (Office for National Statistics Rural Urban Classification), parenting style, parental cigarette/e-cigarette use, parental alcohol use, cognitive ability (British Ability Scales II Verbal Similarities), peer alcohol use and socioeconomic circumstances (household income (Organisation for Economic Co-operation and Development Income Equivalised Quintiles), family structure, highest parental occupation in the household (National Statistics Socio-economic Classification), area-level deprivation (Indices of Multiple Deprivation), and highest parental education in the household (National Vocational Qualification))

- **Middle adolescence circumstances (T3: 14 years):** age

The DAG shown in Figure 19 presents the minimally sufficient adjustment set identified using DAGitty software. The original DAGs produced using DAGitty software are presented in Appendix C, Section C3. Detail on all variables, their original format, and treatment within this study is provided in Appendix C, Section C4.

Figure 19. Saturated directed acyclic graph (DAG) illustrating the hypothesised relationship between social media use at 14 years and alcohol use at 17 years - and the minimal sufficient adjustment set



Legend: Observed confounders- rectangular red node (includes confounders where proxy variables are used). Exposure X- orange node. Outcome Y- blue node. Green arrow indicates focal relationship under investigation. Inward and outward arrows from grey-shaded areas pertain to all nodes within the shaded area. Not shown- baseline binge drinking and frequency of alcohol use in past month (T3: 14 years) and previous social media use (T2: 11 years) adjusted for in sensitivity analyses. Socioeconomic circumstances not included in adjustment set for effect modification and interaction analysis models. Abbreviation(s): SM=Social media and T=Timepoint.

Socioeconomic circumstance as an effect modifier

Using the highest National Vocational Qualification (NVQ) level of both parents in the household (where relevant) when the participant was age 11, a dichotomous variable was generated representing 'high parental education' (International Standard Classification of Education (ISCED) 3 or A/AS/S levels or higher) and 'low parental education' (ISCED 2 or O level/General Certificate of Secondary Education (GSCE) grades A-C or lower).

6.5.3 Statistical analysis

Following a published statistical analysis plan (Purba *et al.*, 2022), descriptive statistics explored the association between social media and alcohol use and binge drinking and confounders. MCS weights accounted for the clustered sampling design and attrition. Weights were created and also included for the time-use diary analyses, as described in Appendix C, Section C5. Statistical analysis was performed using *Stata.V16.*

6.5.4 Imputation

Under a missing-at-random assumption, multiple imputations by chained equations were carried out in 20 datasets. Estimates were combined using Rubin's rules (Rubin, 1987). Imputation models were conducted separately for each exposure, as they have different samples and to accommodate different weights (Appendix C, Section C5). Each imputation model included relevant outcomes, confounders, and variables used to account for sample design and attrition to age 17 years. Imputation models for effect modification and interaction analyses included an interaction between social media use and parental education, so that models were compatible with the analyses. Appendix C, Section C6 describes the regression models used to impute each included variable.

6.5.5 Effect of social media use on frequency of alcohol use and binge drinking

Odds ratios (ORs) were estimated using logistic regression to examine the association between social media use and the binary outcome binge drinking,

before and after adjusting for confounding. Relative risk ratios (RRRs) were estimated using multinomial logistic regression for frequency of alcohol use.

Additional/sensitivity analyses

Analyses were repeated in complete case samples and stratified by sex. We adjusted for binge drinking and frequency of alcohol use, measured at 14 years, to account for possible reverse causation. These were not included in the primary analysis as they may also sit on the causal pathway and consequently represent an overadjustment. We additionally investigated questionnaire-reported social media use, replacing the reference category '1 to <30 minutes' with 'no social media use', to aid compatibility with existing evidence (Kaur *et al.*, 2020). We compared findings from the time-use diary to the questionnaire exposure variables by limiting it to social media use on a normal weekday.

6.5.6 Differential effect of social media use on binge drinking by socioeconomic circumstance

To examine if socioeconomic advantage might buffer against the potential risk of social media use on binge drinking, effect measure modification was examined by calculating risk differences (RDs; absolute differences in binge drinking prevalence between social media time categories), stratified by parental education, using linear regression with robust standard errors. Measures of effect modification on the additive scale represent the size of the absolute difference between RDs for binge drinking by social media use, within the high and low parental education groups, compared with the baseline (low parental education) (Knol *et al.*, 2011). This method accurately estimates RDs when modelling binary outcomes (Cheung, 2007). RDs assess effect measure modification on an additive scale and were our preferred approach, a priori, due to their greater relevance for public health (Knol and VanderWeele, 2012).

Additional/sensitivity analyses

As per recommendations from the STROBE guidance (Vandenbroucke *et al.*, 2007) and Knol and VanderWeele (2012), interaction was examined in addition to effect measure modification (the two are statistically equivalent but present

results in a different way). To allow for comparisons with other research, we repeated analyses using risk ratios (RRs; estimated in Poisson regression models, with robust standard errors), which assess effect modification and interaction on the multiplicative scale (Vanderweele and Knol, 2014). Analyses were repeated using complete case samples. For imputed adjusted estimates only, the relative excess risk due to interaction (RERI; an alternative method for examining additive interactions) was examined using the methodology of Andersson *et al*. (2005). Appendix C, Section C7 provides information on effect measure modification and interaction analyses conducted.

6.6 Results

The questionnaire imputed sample consisted of 8,987 participants (59.2% [n=5,317] complete data), and the time-use diary imputed sample consisted of 2,520 participants (72.5% [n=1,826] complete data). Table 8 and Table 9 report exposure and outcome prevalences for the complete case and imputed samples. The proportion of social media non-users in the questionnaire measure was 8.4%. This was considerably smaller compared to the time-use diary measures, where 63.8% reported no social media use on weekdays, and 49.0% reported no social media use when averaged out across weekdays and weekend days. These differences could be a consequence of the time-use diaries' inability to capture multi-tasking, resulting in a potential overestimation of social media non-users. In the questionnaire imputed sample, 13.7% of participants reported alcohol use ≥6 times/month, and 57.5% reported binge drinking. Prevalences were similar in the time-use diary imputed sample (12.7% and 54.5%, respectively).

Appendix C, Section C8 presents the characteristics of complete case and imputed samples. Imputed samples included older and more non-white, urban, socioeconomically disadvantaged adolescents.

Table 8. Prevalence of exposures and outcomes in the complete case and imputed questionnaire samples

	Questionnaire complete case sample (n=5,317)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n**	**Weighted % (95% CI)[a]**	**n**	**Weighted % (95% CI)[a]**
Time spent on social media on a normal weekday (questionnaire)				
No social media use	382	7.5 (6.6 to 8.4)	734	8.4 (7.6 to 9.1)
1 - <30 mins	671	12.7 (11.7 to 13.8)	1,147	12.8 (12.0 to 13.6)
30 mins - <1 hr	811	15.3 (14.2 to 16.3)	1,330	14.9 (13.9 to 15.8)
1 - <2 hrs	925	17.5 (16.3 to 18.7)	1,562	17.3 (16.4 to 18.3)
≥2 hrs	2,528	47.1 (45.5 to 48.8)	4,214	46.6 (45.4 to 47.8)
Time spent on social media on a normal weekday (time-use diary)				
No social media use	-	-	-	-
1 - <30 mins	-	-	-	-
30 mins - <1 hr	-	-	-	-
1 - <2 hrs	-	-	-	-
≥2 hrs	-	-	-	-
Average time spent on social media across a normal weekday and weekend day (time-use diary)				
No social media use	-	-	-	-
1 - <30 mins	-	-	-	-
30 mins - <1 hr	-	-	-	-
1 - <2 hrs	-	-	-	-
≥2 hrs	-	-	-	-
Frequency of alcohol use in the past month				
Never	1,776	29.8 (28.2 to 31.5)	3,455	32.8 (31.2 to 34.4)
1 - 2 times	1,745	34.5 (32.9 to 36.1)	2,804	33.6 (32.1 to 35.0)
3 - 5 times	1,063	21.0 (19.7 to 22.4)	1,615	19.9 (18.7 to 21.0)
≥6 times	733	14.7 (13.5 to 16.1)	1,112	13.7 (12.8 to 14.7)
Binge drinking				
No	2,312	39.7 (37.9 to 41.5)	4,299	42.5 (40.9 to 44.2)
Yes	3,005	60.3 (58.5 to 62.1)	4,688	57.5 (55.8 to 59.1)

Legend: [a] Weighted to account attrition and sample design at the MCS 7 (17 year survey). Values may not add up due to rounding. Abbreviation(s): -=Not measured; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; and n=Number of participants.

Table 9. Prevalence of exposures and outcomes in the complete case and imputed time-use diary samples

	Time-use diary complete case sample (n=1,826)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n**	**Weighted % (95% CI)[a]**	**n**	**Weighted % (95% CI)[a]**
Time spent on social media on a normal weekday (questionnaire)				
No social media use	-	-	-	-
1 - <30 mins	-	-	-	-
30 mins - <1 hr	-	-	-	-
1 - <2 hrs	-	-	-	-
≥2 hrs	-	-	-	-
Time spent on social media on a normal weekday (time-use diary)				
No social media use	1,110	62.7 (60.2 to 65.2)	1,548	63.8 (61.7 to 65.9)
1 - <30 mins	168	8.4 (7.2 to 9.8)	230	8.3 (7.2 to 9.5)
30 mins - <1 hr	195	9.7 (8.3 to 11.3)	269	9.9 (8.6 to 11.1)
1 - <2 hrs	197	10.1 (8.8 to 11.7)	277	10.2 (8.9 to 11.5)
≥2 hrs	156	9.0 (7.4 to 11.0)	196	7.8 (6.5 to 9.1)
Average time spent on social media across a normal weekday and weekend day (time-use diary)				
No social media use	831	47.2 (44.6 to 49.9)	1,178	49.0 (46.8 to 51.2)
1 - <30 mins	355	18.8 (16.7 to 21.1)	497	18.8 (17.1 to 20.6)
30 mins - <1 hr	294	14.5 (12.9 to 16.3)	390	14.3 (12.7 to 15.8)
1 - <2 hrs	200	11.1 (9.4 to 13.1)	276	10.7 (9.2 to 12.2)
≥2 hrs	146	8.4 (6.9 to 10.1)	179	7.2 (5.9 to 8.5)
Frequency of alcohol use in the past month				
Never	607	32.7 (30.0 to 35.5)	895	34.6 (32.1 to 37.0)
1 - 2 times	639	35.1 (32.5 to 37.9)	849	34.2 (32.1 to 36.4)
3 - 5 times	347	18.7 (16.8 to 20.9)	472	18.5 (16.8 to 20.3)
≥6 times	233	13.4 (11.6 to 15.5)	304	12.7 (11.0 to 14.3)
Binge drinking				
No	840	43.9 (41.2 to 46.7)	1,190	45.5 (43.1 to 48.0)
Yes	986	56.1 (53.3 to 58.8)	1,330	54.5 (52.0 to 56.9)

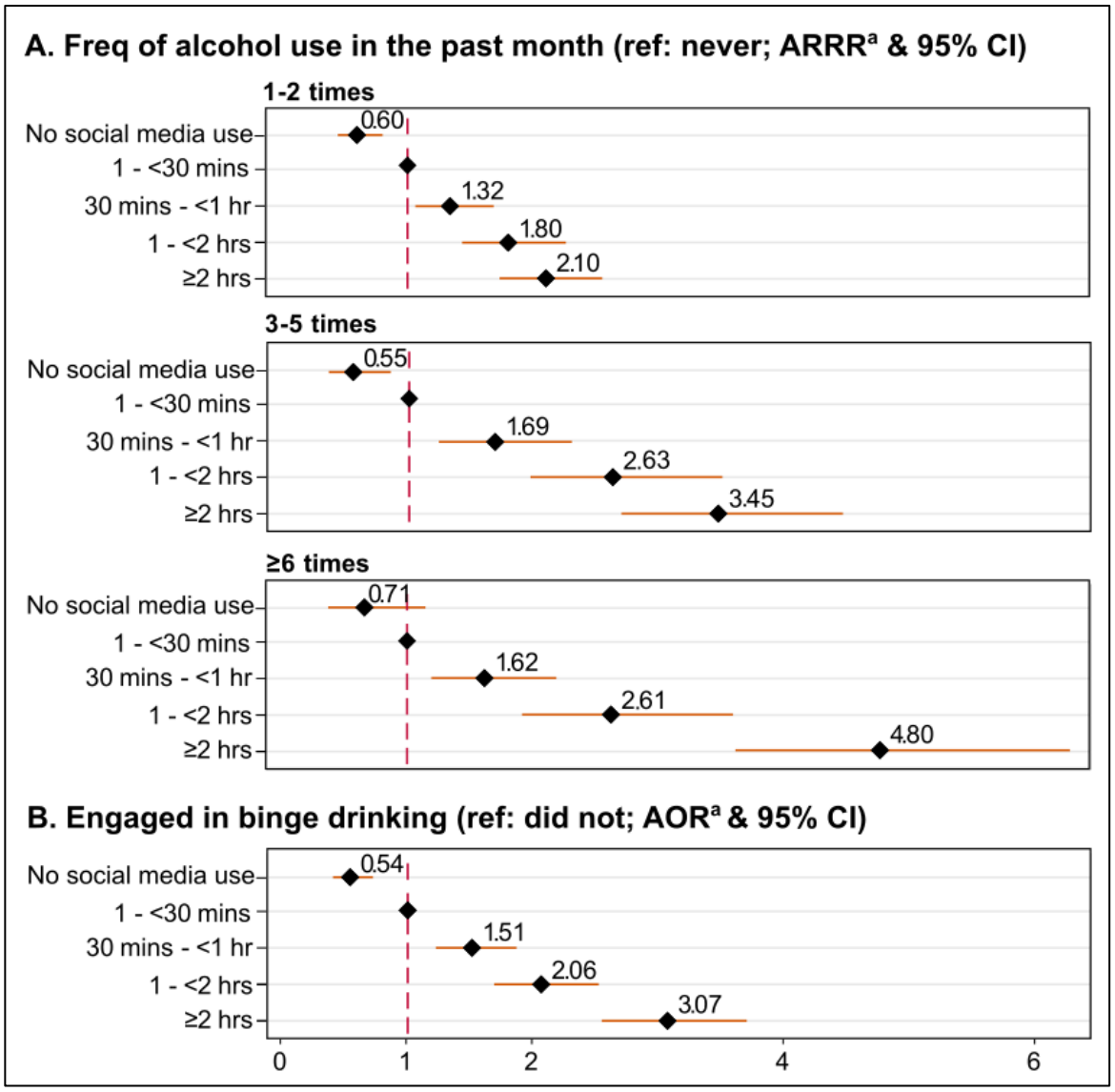
Legend: [a] Weighted to account for time use diary non-response at MCS 6 (14 year survey) and for attrition and sample design at the MCS 7 (17 year survey). Values may not add up due to rounding. Abbreviation(s): -=Not measured; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; and n=Number of participants.

6.6.1 Effect of social media use on frequency of alcohol use and binge drinking

Questionnaire-reported time spent on social media on a normal weekday was associated with an increased risk of alcohol use and binge drinking in a dose-response manner, with higher risks seen for the more extreme outcomes (Figure 20 and Appendix C, Table C9.1). For example, among those using social media for ≥2 hours a day, the risk of alcohol use 1-2 times/month (vs 1-<30 minutes users) was 2.10 [ARRR, 95% CI 1.73 to 2.55]). Risks were greater still for more extreme levels of drinking: ARRR 3.45 [2.68 to 4.45] and 4.80 [3.65 to 6.32] for those drinking 3-5 times/month and ≥6 times/month, respectively. For binge drinking, the AOR among those using social media for ≥2 hours a day was 3.07 [2.54 to 3.70]). Associations were potentially stronger for females (Appendix C, Table C9.2). For example, females who used social media for ≥2 hours had a greater risk of binge drinking (AOR 3.62 [2.70 to 4.87] vs 2.67 [2.11 to 3.38] for males), and alcohol use ≥6 times/month (ARRR 6.01 [3.60 to 10.0] vs 4.34 [3.05 to 6.16] for males), though estimates were relatively imprecise.

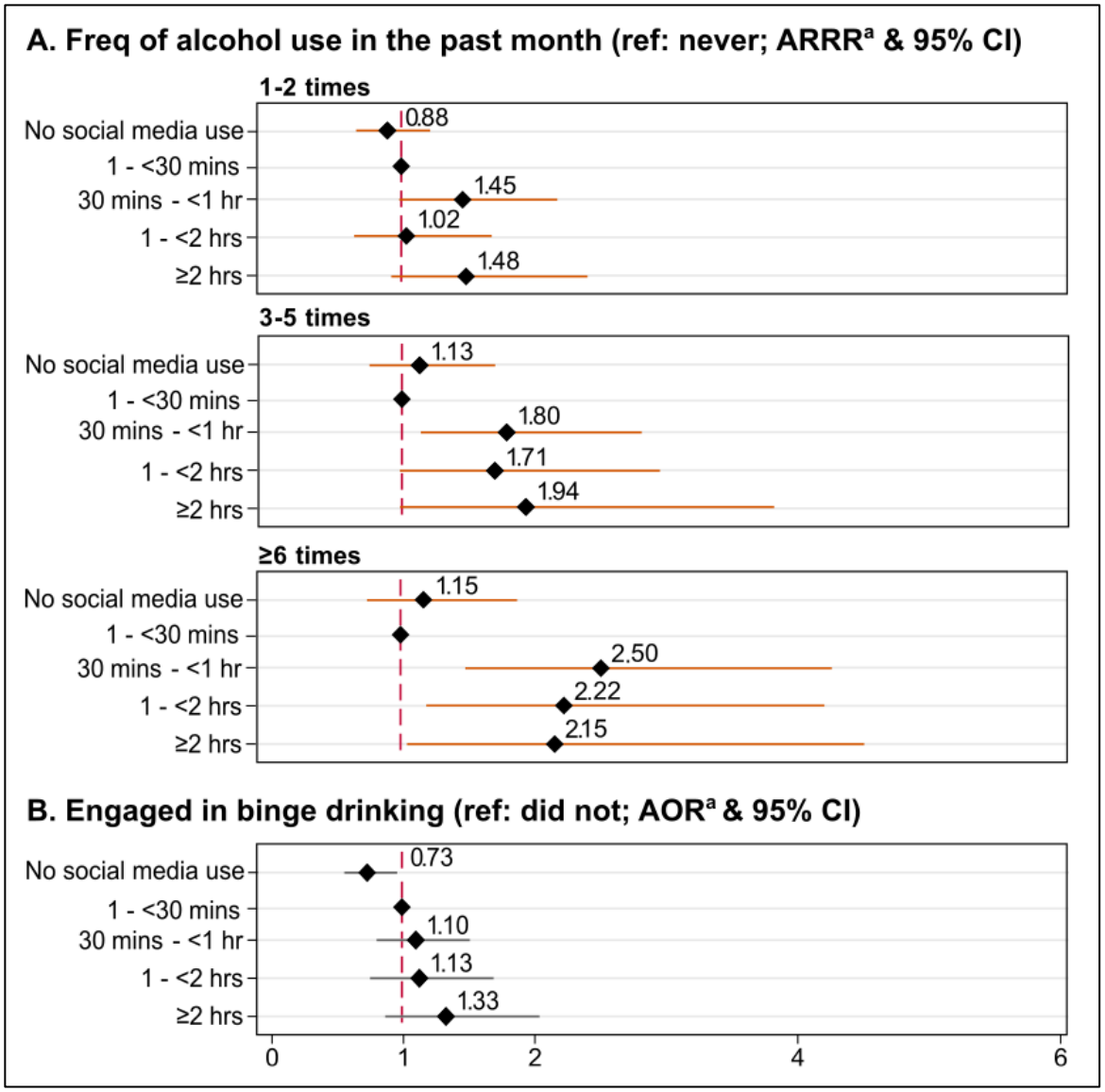
Considering frequency of alcohol use in time-use diary data, there appeared to be a threshold effect, where any social media use for ≥30 minutes was associated with increased risk of alcohol use. For binge drinking, there was evidence of a weak dose-response relationship with average time spent on social media across a weekday and weekend day (Figure 21 and Appendix C, Table C9.3). No meaningful sex differences were identified, with one exception (Appendix C, Table C9.4). Social media for 1-<2 hours (vs 1-<30 minutes) presented a potential harmful effect on male alcohol use 1-2 times/month (ARRR 1.46 [0.56 to 3.80]), compared with a protective effect for females (ARRR 0.89 [0.53 to 1.50]), although confidence intervals were wide.

Figure 20. The relationship between time spent on social media on a normal weekday with (A) frequency of alcohol use in the past month (adjusted relative risk ratios) and (B) binge drinking (adjusted odds ratios) within the questionnaire imputed sample (n=8,987)



Legend: Questionnaire imputed sample: n=8,987 (weighted sample: n=6,175). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): Avg.=Average; AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Freq=Frequency; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; and Ref=Reference category.

Figure 21. The relationship between average time spent on social media across a normal weekday and weekend day with (A) frequency of alcohol use in the past month (adjusted relative risk ratios) and (B) binge drinking (adjusted odds ratios) within the time-use diary sample (n=2,520)



Legend: Time-use diary imputed sample: n=2,520 (weighted sample: n=5,005). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): Avg.=Average; AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Freq=Frequency; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; and Ref=Reference category.

Estimates from analyses repeated in complete case samples were similar to those from imputed samples (Appendix C, Tables C9.5 - C9.6). In additional analyses, comparing questionnaire and time-use diary measures of time spent on social media on a normal weekday, there was evidence of a dose-response relationship between the time-use diary measure of social media and binge drinking and alcohol use ≥6 times/month (Appendix C, Table C9.7). This suggests the difference in effect sizes between questionnaire-reported time spent on a normal weekday and time-use diary recorded average time spent across a normal weekday and weekend day in primary analysis may be explained by the inclusion of weekends in the time-use diary measure. When additionally adjusting for baseline outcome measures, dose-response relationships persisted, and estimates were similar or only slightly weaker (Appendix C, Tables C9.8 - C9.9).

6.6.2 Differential effect of social media use on binge drinking by socioeconomic circumstance

The effect of questionnaire-reported social media use on binge drinking was generally larger in the higher (compared to lower) parental education groups (Table 10 and Appendix C, Table C10.1). For example, the risk of binge drinking among 1-<30 minute users (vs non-users) with high parental education was greater than those with low (adjusted risk difference (ARD) 15.2% [8.3 to 22.1%] vs 3.4% [-7.8 to 14.7%]). In other words, the absolute difference in the ARDs between these two groups was 11.8% (-0.6 to 24.2%), indicating effect measure modification on the additive scale. Similar findings were identified for social media for 30 minutes-<1 hour (effect modification measure: 15.3% [3.2 to 27.5%]), 1-<2 hours (effect modification measure: 17.5% [5.6 to 29.3%]) and ≥2 hours (effect modification measure: 16.2% [5.2 to 27.2%]).

For the effects of social media use reported via the time-use diaries no discernible patterns were observed (Table 11 and Appendix C, Table C10.1).

Table 10. Participant binge drinking according to time spent on social media, within strata of parental education (risk differences) within the questionnaire imputed sample (n=8,954)

	High parental education	Low parental education
Weighted prevalence % (observed n with outcome/without outcome)		
No social media use	28.1 (124/310)	31.5 (64/232)
1 - <30 mins	46.4 (296/415)	36.6 (135/295)
30 mins - <1 hr	57.1 (430/394)	47.6 (198/303)
1 - <2 hrs	63.4 (575/364)	52.7 (278/341)
≥2 hrs	69.2 (1,478/774)	61.6 (1,092/857)
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	18.3 (11.1 to 25.4; <0.0001)	5.1 (-8.1 to 18.3; 0.45)
30 mins - <1 hr	28.9 (22.3 to 35.6; <0.0001)	16.1 (4.0 to 28.1; 0.009)
1 - <2 hrs	35.3 (29.5 to 41.0; <0.0001)	21.2 (9.0 to 33.5; 0.001)
≥2 hrs	41.0 (35.8 to 46.3; <0.0001)	30.1 (19.2 to 41.0; <0.0001)
Unadjusted measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	13.2 (-1.3 to 27.7; 0.074)	
30 mins - <1 hr	12.8 (-0.8 to 26.5; 0.064)	
1 - <2 hrs	14.0 (0.7 to 27.4; 0.040)	
≥2 hrs	10.9 (-1.0 to 22.9; 0.073)	
Adjusted[b] RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	15.2 (8.3 to 22.1; <0.0001)	3.4 (-7.8 to 14.7; 0.55)
30 mins - <1 hr	27.4 (21.2 to 33.7; <0.0001)	12.1 (1.1 to 23.1; 0.031)
1 - <2 hrs	33.0 (26.9 to 39.2; <0.0001)	15.6 (4.7 to 26.4; 0.005)
≥2 hrs	40.0 (34.7 to 45.3; <0.0001)	23.8 (13.6 to 34.0; <0.0001)
Adjusted[b] measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	11.8 (-0.6 to 24.2; 0.063)	
30 mins - <1 hr	15.3 (3.2; 27.5; 0.014)	
1 - <2 hrs	17.5 (5.6 to 29.3; 0.004)	
≥2 hrs	16.2 (5.2 to 27.2; 0.004)	

Legend: Questionnaire imputed sample: n=8,954 (weighted sample: n=6,976. [a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant binge drinking by time spent on social media within the high parental education group compared with baseline (low parental education group). [b] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; RD=Risk differences; and Ref=Reference category.

Table 11. Participant binge drinking according to time spent on social media, within strata of parental education (risk differences) within the time-use diary imputed sample (n=2,520)

	High parental education	Low parental education
Weighted prevalence % (observed n with outcome/without outcome)		
No social media use	53.3 (408/407)	47.9 (172/191)
1 - <30 mins	60.8 (201/153)	51.6 (69/75)
30 mins - <1 hr	63.1 (157/108)	49.7 (61/64)
1 - <2 hrs	61.1 (107/67)	51.6 (54/48)
≥2 hrs	52.5 (58/46)	57.3 (41/34)
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	7.4 (0.5 to 14.4; 0.037)	3.6 (-10.7 to 18.0; 0.62)
30 mins - <1 hr	9.7 (2.7 to 16.8; 0.007)	1.8 (-12.5 to 16.2; 0.80)
1 - <2 hrs	7.8 (-5.4 to 21.0; 0.25)	3.7 (-10.1 to 17.4; 0.60)
≥2 hrs	-0.9 (-14.1 to 12.3; 0.90)	9.4 (-8.8 to 27.6; 0.31)
Unadjusted measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	3.8 (-11.9 to 19.4; 0.64)	
30 mins - <1 hr	7.9 (-7.6 to 23.4; 0.32)	
1 - <2 hrs	4.1 (-16.3 to 24.6; 0.69)	
≥2 hrs	-10.3 (-32.0 to 11.4; 0.35)	
Adjusted[b] RD (95% CI; *p-value*) for time spent on social media within strata of parental education		
No social media use	Ref	Ref
1 - <30 mins	7.4 (0.8 to 14.0; 0.029)	2.4 (-9.7 to 14.4; 0.70)
30 mins - <1 hr	10.0 (3.1 to 16.9; 0.005)	1.9 (-11.2 to 15.1; 0.77)
1 - <2 hrs	8.4 (-4.4 to 21.2; 0.20)	4.6 (-8.8 to 18.0; 0.50)
≥2 hrs	6.4 (-5.9 to 18.8; 0.31)	11.7 (-2.8 to 26.2; 0.11)
Adjusted[b] measure of additive effect modification (95% CI; *p-value*)[a]		
No social media use	Ref	
1 - <30 mins	5.0 (-8.6 to 18.6; 0.47)	
30 mins - <1 hr	8.0 (-6.4 to 22.5; 0.27)	
1 - <2 hrs	3.8 (-14.8 to 22.5; 0.69)	
≥2 hrs	-5.3 (-22.7 to 12.1; 0.55)	

Legend: Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727). [a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant binge drinking by time spent on social media within the high parental education group compared with baseline (low parental education group). [b] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; RD=Risk differences, and Ref=Reference category.

Investigation of interaction effects (in addition to effect modification) and conducting analyses on complete case samples produced the same conclusions (Appendix C, Tables C10.1, C10.2 and C10.4). Analyses repeated using RRs showed no evidence of effect modification/interaction on the multiplicative scale (Appendix C, Tables C10.3 and C10.5).

6.7 Discussion

In a UK-representative, contemporary cohort, we show adolescent social media use at age 14 years increases risk of alcohol use and binge drinking in a dose-response manner. These findings generally persisted in analyses examining a range of possible biases including missing data and reverse causation. We found the influence of social media use on binge drinking was stronger for social media users (vs non-users) with high parental education than with low when considered on the additive scale, with associations robust to adjustment for confounders.

The current analysis corroborates existing findings (Boers *et al.*, 2020; Ng Fat *et al.*, 2021; Brunborg *et al.*, 2022) and marks a step forward in indicating the relationship between increased time spent on social media and alcohol use and binge drinking may be causal, through adjustment for a more comprehensive set of confounders including baseline outcomes. To our knowledge, no study has explicitly investigated the role of SEC as a potential effect modifier of the relationship (Purba *et al.*, 2023).

Of the limited longitudinal research investigating this relationship, among Norwegian adolescents, increased time spent on social media was associated with increased alcohol use over time (Std. Beta 0.33 [0.26 to 0.40]; n=3,096; Brunborg *et al.*, 2022). Similarly, among US adolescents, an increase in social media use by one hour in a given year was associated with an increase in alcohol consumption frequency within that same year (Unstandardised Beta 0.06 [0.04 to 0.08]; n=3,612; Boers *et al.*, 2020). UK research is limited to one study, which analyses the UK Household Longitudinal Study (Ng Fat *et al.*, 2021). In an analysis of 16-19 year olds, users of social media ≥4 hours/day were more likely to report an increase in binge drinking at follow-up, following adjustment for baseline drinking frequency (AOR 1.89 [1.01 to 3.53]; n=1,057; Ng Fat *et al.*, 2021). However, there was insufficient evidence of a relationship among those

who used social media for 1-3 hours/day and when investigating social media use for ≥1 hours/day with increased past month alcohol use. The weaker effects, when compared with our study findings, could be the result of the study's use of an exposure definition which did not account for passive use of social media and instead focused on active use (defined as "chatting or interacting with friends through social web-sites" within the study; Ng Fat *et al.*, 2021).

At the time social media use was measured in this aforementioned study (2011-2013; Ng Fat *et al.*, 2021), many now commonly used social media platforms did not exist. For example, TikTok (originally known as Musical.ly, launched in 2014) is now commonly used for influencer campaigns and has been shown to positively portray health-harming products such as alcohol (e.g., through alcohol brand accounts, drink making videos), which may result in increased consumption (Bagenal *et al.*, 2023). Our study investigated the relationship using slightly more contemporary social media data (collected 2015-16), potentially capturing greater use of new social media platforms. It also adds to existing evidence by assessing both active and passive use, adjusting for a wider range of confounding factors, and considering the potential impacts on health inequalities.

We followed a published statistical analysis plan and investigated the impact of social media use assessed via two measurement modes (Purba *et al.*, 2022). Multiple imputation accounted for item-missingness, weights were used to account for attrition, and additional weights were created to ensure representativeness of the time-use diary sample. The creation of DAGs informed adjustment for a comprehensive range of confounders, and the potential for reverse causality was examined, finding effects persisted when accounting for baseline measures of our outcomes. We report multiple sensitivity analyses which offer comparisons with more traditional approaches to analysis and consider bias in our methods, which our results were robust to.

Despite aiming to implement the best possible analyses for addressing the study research questions, there are factors intrinsic to the data which should be considered. Whilst we used one of the most contemporary datasets available, the rapidly evolving nature of social media platforms means that further research should seek to identify if this relationship changes with advances in social media technology. Time-use diary completion was low (38.5%), and

although weights were used to increase representativeness, the sample size was small, increasing uncertainty around presented estimates. The inability of the time-use diary to capture multi-tasking and its potential completion during the school holidays may have underestimated social media use and overestimated non-use. This misclassification may, in part, explain the weaker associations observed for social media assessed via time-use diary compared to the questionnaire. Yet, it is impossible to verify this in the absence of a gold standard measure. These issues could be addressed by holistically tracking social media use over multiple days across multiple devices; however, this could be a resource-intensive undertaking with population-representative cohorts (Orben and Przybylski, 2019b).

Although completed individually with confidentiality emphasised, all exposure and outcome measures were self-reported; thus, there is potential for social desirability bias (Bowling, 2005). Despite adjusting for a range of potential confounders, the potential for unmeasured or residual confounding remains. Although we included indicators for all proposed confounders as far as the data permit, there may be some we have not identified and some not fully represented by our set of measured variables, which may lead to bias of unclear direction.

Adolescents from less deprived backgrounds are more likely to consume alcohol (Boyd *et al.*, 2021), while those from more deprived backgrounds are more likely to suffer the harms of alcohol (Katikireddi *et al.*, 2017). Our novel investigation of parental education as an effect modifier is vital to understand how social media may contribute to this complex picture. Our findings suggest that the impacts of social media use on binge drinking are potentially higher in young people from more advantaged households.

Future research should test these findings using more accurate social media measures, larger datasets, and diverse populations. It should also seek to identify the degree to which causal relationships between the different aspects of social media use (e.g., exposure to alcohol-related content) and social media activities (e.g., passive/active) with alcohol use exist. Social media can present a multitude of benefits to adolescent health, especially when adopted as a means to deliver online health interventions (e.g., substance use prevention

messages). However, the current lack of appropriate regulation of user and marketer-generated alcohol-related content may severely undermine positive public health messaging around alcohol-related harms. Our study strengthens calls to enhance understanding of social media algorithms which drive adolescent exposure to alcohol-related content on social media (UK Parliament, 2022a), and to ensure appropriate regulation of this content.

6.8 Conclusion

Social media use for more than half an hour a day increases frequency of alcohol use and risk of alcohol binge drinking, with evidence of dose-response relationships. Regulation addressing adolescent exposure to alcohol-related content on social media is necessary, along with guidance around social media use in young people and tailored education supporting safe navigation of the social media environment.

Contributors

AKP, SVK, and AP led the conceptualisation and design of the study, and MH contributed to the conceptualisation and design. AKP, SVK, AP, and MH drafted the statistical analysis plan (OSF registration: https://osf.io/ytkbz/). AKP was responsible for data access, formal analysis, interpretation, and visualisation of results. AP and AB reviewed the analytical code and formal analysis. All authors assisted with the interpretation of results. AKP subsequently wrote the first draft of the manuscript. All authors critically reviewed and approved the manuscript. The corresponding author attests that all listed authors meet authorship criteria and that no other meeting the criteria have been omitted.

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interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

Competing interests

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Ethical approval

Ethics approval was granted for each of the MCS surveys; no approval was required for the current analysis (Centre for Longitudinal Studies, 2020; Fitzsimons, 2020; Fitzsimons *et al.*, 2020).

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Data sharing

Original MCS data are held by the UK data Service and are available on request from (https://ukdataservice.ac.uk/). Datasets accessed are listed below:

- Millennium Cohort Study: First Survey, 2001-2003- DOI: 10.5255/UKDA-SN-4683-5
- Millennium Cohort Study: Second Survey, 2003-2005- DOI: 10.5255/UKDA-SN-5350-5
- Millennium Cohort Study: Fifth Survey, 2012- DOI: 10.5255/UKDA-SN-7464-5
- Millennium Cohort Study: Sixth Survey, 2015- DOI: 10.5255/UKDA-SN-8156-7
- Millennium Cohort Study: Seventh Survey, 2018- DOI: 10.5255/UKDA-SN-8682-2

The analytic code is available in an online public repository:

- https://doi.org/10.5281/zenodo.7664236
- https://github.com/AmritKPurba/Social_media_healthrisk_behaviours

Transparency

The lead author (AKP) affirms that the manuscript is an honest, precise, and transparent account of the study reported, with no important aspects omitted. Any discrepancies from the study as planned (and, published in the statistical analysis plan) have been explained.

Dissemination to participants and related patient and public communities

The study findings will be disseminated via conference presentations, press releases, and social media outlets. The authors will disseminate findings to

media organisations and press councils, and also national health organisations that are instrumental in the development of social media recommendations for adolescents. Additionally, the study findings will be disseminated via advisory group members working across academic, governmental and charity sectors.

Open access/copyright statement

Chapter 7 Discussion

This chapter brings together the introductory literature review and empirical chapters to provide an overarching synthesis of the work conducted. The chapter commences with a summary of the key findings of the thesis as a whole and highlights how they add to the existing literature. This is followed by a description of the strengths and limitations of the thesis as a combined body of work before concluding with a reflection on decisions made throughout the thesis, a discussion of its recommendations for research, and its implications for policy, practice, and industry.

7.1 Summary of key contributions in the context of existing evidence

This thesis aimed to identify and fill gaps in current understanding of adolescent social media use and its relationship with health-risk behaviours. The thesis complements and builds on existing evidence by providing new understanding of the implications of social media for adolescent engagement in health-risk behaviours, therefore enriching the evidence available to support meaningful, informed decision-making.

Chapters 1 and 2 outlined the context and rationale for examining adolescent social media use and health-risk behaviours, highlighting the gaps in the existing evidence that this thesis addresses. This included the requirement for a systematic review and meta-analysis to consider the quality of the underlying evidence. Chapter 3 introduced the overarching theme of the thesis - social media's influence on health. Chapter 4 (systematic review) highlighted further gaps in the evidence, including the need for population-based representative longitudinal studies, investigation of social media impacts on under-researched health-risk behaviours, assessment of social media using multiple measures, enhanced understanding of potential causal relationships, and assessment of whether social media effects differ across socioeconomic groups. The Millennium Cohort Study (MCS) analyses presented in Chapters 5 and 6 seek to address these gaps and provide recommendations in each of these areas. Table 12 summarises the research gaps addressed within each study and their key findings.

Table 12. Summary of research gaps addressed in the thesis studies and their key findings

Chapter 3 (RO1): To examine social media's role as a determinant of health	
Evidence gaps addressed	**Key findings**
• A holistic overview of the impact social media design features and user actions/decisions can present on health in the general population	• Social media has fundamentally reshaped population health through the influence it exerts on the flow of health information, uptake of health services and guidance, self-esteem and social comparison, health behaviours, the political and public health discourse, social connection and interpersonal relationships • Health professionals should increase their understanding of social media as a determinant of health to harness the opportunities it presents and minimise its risks
Chapter 4 (RO2): To systematically review and synthesise existing evidence on the association between social media use and engagement in health-risk behaviours	
Evidence gaps addressed	**Key findings**
• Focus on the adolescent population instead of university/college/young adult populations • Explicit investigation of social media use instead of digital media/internet use/screen time • Consideration of the different aspects of social media use (e.g., time spent, exposure to health-risk behaviour content) • Consideration of social media characteristics (e.g., social media category, platform and type of content viewed)	*Synthesis without Meta-analysis:* Harmful associations were identified between all aspects of social media use (e.g., time spent, frequency of use) and all health-risk behaviours assessed in most included studies, except inadequate physical activity, where beneficial associations were reported (63.6% of studies) *Meta-analyses:* • Time spent on social media was associated with increased alcohol use (social media use for ≥2 hours vs <2 hours/day: OR 2.13 [95% CI 1.56 to 2.92]), and anti-social behaviour (SMD 0.12 [0.10 to 0.14]) • Frequent (vs infrequent) social media use was associated with increased alcohol use (OR 1.48 [1.36 to 1.62]), drug use (OR 1.28 [1.05 to 1.56]), tobacco use (OR 1.78 [1.45 to 2.19]), sexual risk behaviour (OR 1.78 [1.49 to 2.13]), anti-social behaviour (OR 1.73 [1.44 to 2.06]), multiple risk behaviours (OR 1.75 [1.30 to 2.35]), and gambling (OR 2.84 [2.04 to 3.97]). Stronger effects were identified for adolescents ≥16 vs <16 years (alcohol use), for adolescents <16 vs ≥16 years (sexual risk behaviour), and

• Assessment of under-researched health-risk behaviours (e.g., unhealthy dietary behaviour, inadequate physical activity, use of ENDS and multiple risk behaviours) • Assessment of whether effects differ across social groups • Synthesis of effect size estimates • Analyses based on estimates adjusted for confounding • Assessment of the quality and certainty of the underlying evidence	for LMICs vs HICs (tobacco use). Social networking sites were associated with increased alcohol use, whilst microblogging and media-sharing sites showed an unclear relationship (alcohol use) • Exposure to health-risk behaviour content on social media (vs no exposure) was associated with increased use of ENDS (OR 1.73 [1.34 to 2.23]), unhealthy dietary behaviour (OR 2.12 [1.87 to 2.39]), tobacco use (OR 1.79 [1.63 to 1.96]) and alcohol use (OR 2.43 [1.25 to 4.71]). Stronger associations were identified for exposure to user vs marketer-generated content and for adolescents ≥16 vs <16 years (alcohol use) *Quality and certainty of the evidence:* • 57/126 of included studies were rated high RoB, primarily due to a lack of objective/validated measures of social media and failure to adjust for relevant confounders • GRADE certainty was moderate for unhealthy dietary behaviour (4 RCTs) and low for alcohol use (9 observational studies). Certainty was very low for other investigated outcomes due to high RoB and considerable heterogeneity
Chapter 5 (RO3): To estimate the effects of time spent on social media in adolescents on risk of cigarette, e-cigarette and dual use, using UK-representative data from the Millennium Cohort Study and explore if the effects of social media use on cigarette and e-cigarette use differ by SEC	
Evidence gaps addressed	**Key findings**
• Assessment of social media use using time-use diary data as well as self-report questionnaires • Investigation of social media impacts on under-researched health-risk behaviours • Assessment of the potential for social media effects to differ across socioeconomic groups • Studies which are population-based and representative	*Social media use assessed via self-report questionnaire:* • Social media use for ≥30 minutes daily at 14 years increased risk of cigarette (AORs ranged from 1.48 to 2.76), e-cigarette (AORs 1.79 to 3.24) and dual use (ARRRs 1.69 to 4.11) at 17 years in a dose-response manner. No meaningful sex differences were identified *Social media assessed via time-use diary:* • Average time spent on social media across a weekday and weekend day was associated with increased risk of cigarette (AORs ranged from 1.78 to 2.63) and e-cigarette use (AORs 1.54 to 1.77) in a dose-response manner, though estimates were slightly weaker when compared to questionnaire data. The effect of social media on risk of dual use was confined to the higher-time categories (1-<2 hours and ≥2

• Studies which are longitudinal rather than cross-sectional in design • Adjustment for a wide range of confounders • Investigation of potential reverse causation	hours), where ARRRs were 2.24 (95% CI 1.14 to 4.41) and 2.37 (95% CI 1.18 to 4.76), respectively. For all outcomes, effects were generally stronger for females *Estimation of causal relationships:* • With support from advisory group members, subject knowledge, and the existing evidence base, DAGs were prepared to inform confounder selection • Adjustment for baseline outcome measures (to consider potential reverse causality) revealed similar or slightly weaker estimates than those without baseline adjustment, with dose-response relationships generally persisting *Differential effects of social media by socioeconomic circumstance:* • For traditional cigarette use, considerably larger absolute effects were identified for adolescents from more socioeconomically advantaged households compared to those from less socioeconomically advantaged households • Patterns for e-cigarette use in the higher social media time categories showed greater effects in adolescents from more socioeconomically advantaged households, however, they were less pronounced, with wide confidence intervals
Chapter 6 (RO4): To estimate the effects of time spent on social media in adolescents on risk of alcohol use and binge drinking, using UK-representative data from the Millennium Cohort Study and explore if the effects of social media use on binge drinking differ by SEC	
Evidence gaps addressed • Evidence gaps addressed in this Chapter are similar to those in Chapter 5	**Key findings** *Social media use assessed via self-report questionnaire:* • Time spent on social media was associated with an increased risk of alcohol use (1-2 times: ARRRs ranged from 1.32 to 2.10, 3-5 times: 1.69 to 3.45, and ≥6 times: 1.62 to 4.80) and binge drinking (AORs 1.51 to 3.07) in a dose-response manner, with associations potentially stronger for female compared to male adolescents *Social media assessed via time-use diary:*

	• For frequency of alcohol use in the past month, there appeared to be a threshold effect, where any social media use for ≥30 minutes was associated with increased risk of alcohol use. There was evidence of a weak dose-response relationship when investigating binge drinking (AORs ranged from 1.10 to 1.33). Generally, no meaningful sex differences were identified *Estimation of causal relationships:* • With support from advisory group members, subject knowledge, and the existing evidence base, DAGs were prepared to inform confounder selection • Adjustment for baseline outcome measures (to consider potential reverse causality) revealed similar or slightly weaker estimates than those without baseline adjustment, with dose-response relationships generally persisting *Differential effects by socioeconomic circumstance:* • The effect of social media use on binge drinking was generally larger in adolescents from more socioeconomically advantaged households

Legend: Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; DAGs=Directed acyclic graphs; ENDS=Electronic nicotine delivery systems; HICs=High-income countries; LMICs=Low-middle income countries; RCT=Randomised control trial; RO=Research objective; RoB=Risk of bias; and SEC=Socioeconomic circumstance.

Using the research objectives (ROs) set out in Chapter 2 and Table 12 as a broad structure, this section describes the key contributions made by this thesis in the context of existing literature. As Chapters 5 and 6 addressed similar evidence gaps, these are discussed collectively.

***RO1**: To examine social media's role as a determinant of health (Chapter 3)*

To set the scene for the work conducted in this thesis, Chapter 3 provided a holistic overview of how social media design features, combined with user actions and decisions, may influence health in the wider global population. To date, existing evidence has explored the role of digital technology as a determinant of health (The Lancet Digital Health, 2021). However, it is limited in its generalisability to social media explicitly. Similarly, others have positioned social media as a 'commercial' determinant of health, highlighting the similarities between social media corporations and other health-harming industries in their drive to safeguard profit (e.g., limiting access to data and promoting a self-regulation discourse) (Zenone *et al.*, 2022). Although useful, there is limited evidence which explicitly illustrates the key social media influences on health and the potential mechanisms through which they may manifest (e.g., through improving the flow of health information). Therefore, Chapter 3, drawing upon a logic model developed with experts in the field of inequalities and the social determinants of health, provided an introductory argument positing social media as a determinant of health.

***RO2**: To systematically review and synthesise existing evidence on the association between social media use (time spent on social media, frequency of use of social media, exposure to health-risk behaviour content on social media or other social media activities) in adolescents aged 10-19 years and their engagement in health-risk behaviours (Chapter 4)*

The systematic review and meta-analysis described in Chapter 4 is the first to investigate the potential benefits or harms of social media use on adolescent health-risk behaviours in the context of the underlying quality of the evidence. The review's approach also enhanced existing literature in four key ways:

1. Providing evidence specific to social media rather than screen time/digital technology/internet use

2. Examining under-researched health-risk behaviours

3. Explicitly examining the adolescent population

4. Examining if relationships differed across social groups

Overall, the review indicated that social media use is adversely associated with several health-risk behaviours in adolescents, including increased alcohol use, drug use, tobacco use, electronic nicotine delivery system (ENDS) use, gambling, sexual risk behaviour, anti-social behaviour, unhealthy dietary behaviour and multiple risk behaviours. Considering the different aspects of social media use (e.g., time spent), exposure to health-risk behaviour content on social media had the strongest evidence of harm, particularly in relation to alcohol use and unhealthy dietary behaviour. Forty-five per cent of included studies were rated high risk of bias (RoB). GRADE (Grading of Recommendations, Assessment, Development, and Evaluations) certainty was moderate for unhealthy dietary behaviour, low for alcohol use, and very low for drug use, tobacco use, ENDS use, sexual risk behaviour, gambling and multiple risk behaviours.

Two systematic reviews exist which broadly address this topic. Curtis *et al.* (2018) investigated the association between alcohol-related social media use with alcohol consumption and alcohol-related problems in adolescents and young adults. Most included studies were focused on college students, and estimates specific to adolescents were not reported. The second systematic review examined the relationship between social media use and adolescent substance use, sexual risk behaviour and violence-related behaviours (Vannucci *et al.*, 2020).

Due to the infancy of social media and health research during the search periods of both reviews (<January 2017 and January 2000-2019, respectively), they are limited to the synthesis of a small body of cross-sectional estimates (Curtis *et al.*, 2018; Vannucci *et al.*, 2020). Through having a more recent search period (1997-June 2022) and a wider range of outcomes, Chapter 4 synthesises 126

studies, both observational (n=23 longitudinal) and experimental (n=4) in nature, and therefore includes higher quality, and more up-to-date, adjusted estimates.

As the reviews conducted by Curtis *et al.* (2018) and Vannucci *et al.* (2020) synthesised correlations (as opposed to associations, adjusting for confounding), findings should be interpreted with caution. Correlation measures can be severely affected by confounding variables and reverse causality, and importantly they can occur by chance (Altman and Krzywinski, 2015). This is of particular importance within the field of social media and adolescent health, where concerns have been raised regarding the frequent use of correlational evidence (given the lack of robust evidence) to inform policy (Mahase, 2019). Within Chapter 4, although based on few studies, stratification by adjustment for critical confounding domains revealed stronger estimates for unadjusted (vs adjusted datapoints) for alcohol and tobacco use. This suggests that the lack of adjustment in the reviews conducted by Curtis *et al.* (2018) and Vannucci *et al.* (2020) may have potentially resulted in an overestimation of effects. As Chapter 4 synthesised adjusted effect sizes, this enabled quantification of the magnitude of effects (accounting for confounders) (Craig *et al.*, 2017). This therefore allowed for robust findings generalisable to the present-day social media environment - making it better placed to inform decision-making relative to existing reviews.

As recognised by the Assessing the Methodological Quality of Systematic Reviews (AMSTAR) guidelines, a critical step within a systematic review is assessing the RoB of included studies (Shea *et al.*, 2017). In contrast to previous reviews, which did not conduct a formal RoB assessment (Curtis *et al.*, 2018; Vannucci *et al.*, 2020), Chapter 4 includes both a RoB assessment and GRADE certainty assessment (Guyatt *et al.*, 2011). As discussed, forty-five per cent of included studies were high RoB and GRADE certainty was very low for most outcomes examined, the exceptions being unhealthy dietary behaviour (graded moderate) and alcohol use (graded low). These very low levels of certainty were primarily a result of high RoB due to poor measures of social media use, failure to adjust for relevant confounders, and considerable heterogeneity. Given the current discussions and implementation of policy securing adolescent online safety, explicit consideration of the quality of the current research base is particularly

important as it reflects the degree to which there is confidence in the effect estimates presented (Guyatt *et al.*, 2008).

***RO3-4**: To estimate the effects of time spent on social media in adolescents on the risk of cigarette, e-cigarette and dual use (RO3, Chapter 5) and alcohol use and binge drinking (RO4, Chapter 6), using UK-representative data from the Millennium Cohort Study. Additionally, exploring if the effects of social media use on cigarette and e-cigarette use (RO3, Chapter 5) and binge drinking (RO4, Chapter 6), differ by socioeconomic circumstance*

The MCS analyses in Chapters 5 and 6 are the first to investigate potential social media impacts on health inequalities. The analytical approaches adopted in these analyses addressed further gaps in the evidence highlighted in Chapter 4. These include:

1. The use of multiple social media measures

2. Adjustment for an extensive range of confounders, identified via directed acyclic graphs (DAGs)

3. Investigation of the potential for reverse causation

Chapter 4 identified self-report questionnaire measures as the most commonly adopted measure of social media. Given that these measures are prone to recall bias, a time-use diary measure of social media use complemented the questionnaire measure in MCS analyses (Naab *et al.*, 2019; Orben and Przybylski, 2019a). Providing support for the study hypothesis outlined in Section 2.7.2, Chapter 5 found that time spent on social media (assessed via both a questionnaire and time-use diary) was generally associated with an increased risk of cigarette, e-cigarette use and dual use in a dose-response manner. Similarly, in supporting the study hypothesis (see Section 2.7.2), Chapter 6 found that questionnaire-reported time spent on social media was associated with increased risk of alcohol use and binge drinking in a dose-response manner. For the time-use diary data, any social media use for ≥30 minutes was associated with an increased risk of alcohol use, suggesting a threshold effect. At the same time, there was only evidence of a weak dose-response relationship for binge

drinking. These findings generally persisted in analyses examining a range of possible biases, including missing data and reverse causation. As discussed, the time-use diary measure of social media use was employed to help address measurement issues inherent in self-report questionnaire measures. However, findings from Chapters 5 and 6, combined with limitations in time-use diary measurement, highlight the need for more objective measures of social media use to drive current understanding forward on potential social media harms, as will be discussed further in Sections 7.2.3.2 and 7.4.3.

The impact of increased time spent on social media on increased adolescent cigarette and alcohol use has been documented in adolescent populations in the US (alcohol use; Boers *et al.*, 2020), China (cigarette use; Huang *et al.*, 2012), New Zealand (cigarette use; Ball *et al.*, 2022), Thailand (cigarette use; Suwanwong *et al.*, 2021) and Norway (alcohol use; Brunborg *et al.*, 2022). Internationally, there is limited evidence documenting the relationship between time spent on social media and adolescent e-cigarette use. Yet, recent research investigating frequency of use and exposure to nicotine-related content on social media has demonstrated associations with increased e-cigarette use in US adolescents (Vassey *et al.*, 2022). The cross-country differences in the marketing of alcohol and nicotine-related products, the legal age of consumption and prevalence of social media, cigarette, e-cigarette and alcohol use, hinders the generalisability of these findings to the UK adolescent population (Institute for Global Tobacco Control, 2020; World Health Organisation, 2022b).

UK-based longitudinal research is scarce and is limited to two studies, one examining the association between social media and alcohol (Ng Fat *et al.*, 2021) and one investigating social media use in relation to tobacco smoking (Vrinten *et al.*, 2022). Vrinten *et al.* (2022), using the MCS, identified an association between increased time spent on social media (assessed via self-report questionnaire) and increased odds of smoking; however, they did not examine the potential for reverse causation. Assessing the potential for reverse causality is important when attempting to estimate causal effects (Pearl and Mackenzie, 2018). In addressing a limitation in Vrinten *et al's.* (2022) study, sensitivity analyses adjusting for baseline measures of cigarette and e-cigarette use was conducted in Chapter 5. However, this assessment revealed similar or only

slightly weaker estimates than those without baseline adjustment, with dose-response relationships generally persisting.

Chapter 5's identification of social media use as a risk factor for adolescent e-cigarette use is of importance given the limited evidence investigating social media impacts on e-cigarette use (i.e., there are no studies explicitly assessing UK adolescents) and the increased (often unregulated) marketing of e-cigarettes on social media (Action on Smoking and Health, 2021; O'Brien *et al.*, 2021; Wang *et al.*, 2022). Further, by considering both cigarette and e-cigarette use, Chapter 5 presents a more accurate estimation of nicotine-containing product use in UK adolescents.

Only one UK-based study considers the longitudinal relationship between time spent on social media and adolescent alcohol use. Using the UK Household Longitudinal Study, Ng Fat *et al*. (2021) found that time spent on social media (self-reports of "chatting or interacting with friends through social web-sites") was associated with an increase in binge drinking (but not past month drinking frequency), following adjustment for baseline drinking frequency. This study generally found weaker effects of social media compared to the findings reported in Chapter 6. This may partly be the result of the differences in exposure definition between the studies – the UK Household Longitudinal Study only captured active use, whilst the exposure definition in the MCS analyses considered both active and passive use.

Importantly, no UK-based studies have considered potential impacts on health inequalities. In our MCS analyses, effect measure modification and interaction analyses were conducted to identify if socioeconomic circumstance (SEC; using parental educational qualifications as a marker) modified the relationship between time spent on social media and outcomes. Overall, we found limited evidence to support our initial hypotheses (see Section 2.7.2) that the effect of time spent on social media on cigarette use, e-cigarette use and binge drinking would be greater in those more socioeconomically disadvantaged, compared to those less disadvantaged.

Chapter 5 indicated that increased time spent on social media would be unlikely to widen inequalities in cigarette use. As social media increased harm overall,

this resulted in greater increases in cigarette use prevalence in those more socioeconomically advantaged, resulting in a more similar prevalence of cigarette use across both socioeconomic groups. Thus, although this suggests the potential for a narrowing of inequalities, it does not appear to be in a manner that is beneficial to health. Adolescents are exposed to many different environments which can affect their cigarette use (e.g., parental and peer smoking and offline advertising) - all of which come together in complex ways to influence inequalities. For example, it is possible, more socioeconomically disadvantaged adolescents experience greater offline exposure to tobacco use and tobacco-related content/outlets (Caryl *et al.*, 2020), as well as potential exposure via social media. In contrast, those more socioeconomically advantaged may experience limited exposure to offline tobacco use and tobacco-related content/outlets but experience exposure via social media. Thus, it is possible the protective effects of no social media use could be greater in those who are more socioeconomically advantaged, given their potential limited offline exposure to tobacco use and tobacco-related content/outlets.

In Chapter 6, across both socioeconomic groups, as social media use increased, so did the prevalence of binge drinking. Considering inequalities in binge drinking, increased social media use appeared to narrow inequalities. However, similar to cigarette use, by producing greater increases in more socioeconomically advantaged groups. A potential explanation for this increased exposure could be the combination of increased exposure to social media alcohol-related content and limited exposure to offline alcohol use or alcohol-related content/outlets in those more socioeconomically advantaged (Caryl *et al.*, 2022). Concerning inequalities in alcohol harms, where those more socioeconomically disadvantaged are more likely to suffer the harms of alcohol (Katikireddi *et al.*, 2017), findings suggest increased social media use has the potential to narrow inequalities in alcohol harms between socioeconomic groups, however not in a manner beneficial to health (instead through increasing harms in those more socioeconomically advantaged).

This novel investigation suggests SEC has the potential to modify the association between social media use and adolescent cigarette use, and binge drinking and is therefore vital to support understanding of inequalities in social media harms.

7.2 Strengths and limitations

The strengths and limitations of each analysis have been considered in their respective articles; therefore, this section considers the strengths and limitations of the thesis as a unified body of work.

7.2.1 Thesis scope

As discussed in Chapter 1, the chapters narrow in geographical scope when moving through the thesis. Chapter 3 sets the scene for the thesis by exploring the role of social media as a determinant of health. To effectively consider the key influences of social media to health, as well as concepts such as the 'digital divide', it was important to consider how social media access differed across countries. Therefore, this chapter focused on the global population.

Within Chapter 4, no geographical limits were set to ensure retrieval of all relevant articles, an accurate assessment of potential publication bias and to facilitate examination of whether social media impacts varied across social groups. Although this chapter identified that most research investigating social media and adolescent health-risk behaviours was conducted in high-income countries (HICs), there was sufficient data to investigate the differential impacts of social media use on some health-risk behaviours within low-middle income countries (LMICs) and HICs. Furthermore, no language limits were applied to the search to establish the potential implications of language exclusions (Lefebvre *et al.*, 2021). Although it was not possible to translate non-English language studies due to resource issues, most articles were published in English. Of the seven articles excluded on the basis of language, four were written in Spanish, one in Norwegian, one in German, and one in Croatian. Thus, there was no substantial exclusion of LMICs (see Appendix A, Table A3.1 for information on non-English language studies excluded).

Chapters 5 and 6 used data from the MCS combined with statistical techniques (survey weighting and multiple imputation to address item-missingness) that maximised the generalisability of the findings to the UK adolescent population. Therefore, findings presented in Chapters 5 and 6 are particularly suited to

inform UK policy and practice considerations and may or may not be generalisable to other countries (Ghai *et al.*, 2022).

We only examined three health-risk behaviours in MCS analyses (namely cigarette, e-cigarette and alcohol use). This was despite Chapter 4's recognition of the need for studies assessing more under-researched health-risk behaviours, including inadequate physical activity. During development of the statistical analysis plan, input from advisory group members was prioritised to ensure that health-risk behaviours that were most relevant to policy were considered (Purba *et al.*, 2022). A collective decision was made to focus on cigarette, e-cigarette and alcohol use. This was in light of current discussions on the decline in adolescent alcohol use and potential factors influencing this trend (Vashishtha *et al.*, 2019), increased awareness of the potential harms arising from adolescent e-cigarette use (Action on Smoking and Health, 2021), and the ongoing public health challenge adolescent tobacco use presents (Reitsma *et al.*, 2021).

7.2.2 Stakeholder engagement

As discussed in Chapter 2, an advisory group of experts and policymakers in the field of social media and adolescent health-risk behaviours was convened to inform the research. This resulted in several benefits, which strengthened this thesis. For example, regular meetings and communications with advisory group members facilitated knowledge exchange throughout the thesis. The PhD findings were shared, and members offered unique perspectives drawing upon their professional expertise and experience working with adolescents. Not only did advisory group member input support the interpretation of findings, but their contribution to methodological aspects was invaluable. For example, discussion and online surveys conducted with members were used to support the selection of the indicator used to assess SEC in effect measure modification and interaction analyses and supported identification of confounders to be adjusted for within the analyses presented in Chapters 5 and 6.

Although efforts were made to ensure thesis objectives reflected concerns raised by all relevant stakeholders (including policymakers, experts and academics), the adolescent voice was lacking. At the start of the PhD (end of 2019), discussions and provisional plans were made to conduct public engagement

activities directly with adolescents within school settings. It was anticipated this would ensure the thesis objectives aligned with the current dialogue amongst policymakers, academics and parents, and with the perspectives of adolescents themselves. Unfortunately, due to the COVID-19 pandemic, this was not possible. To counter this, advisory group members who worked directly with adolescents played a key role in communicating the adolescent perspectives.

Work by the 5RightsFoundation (5Rights Foundation, 2023), Sonia Livingstone (Professor of Social Psychology at London School of Economics Department of Media and Communication) (Livingstone, 2023), as well as seminars held by the Westminster eForum (Westminster e-forum, 2021) and Internet Governance Forum (Internet Governance Forum, 2020e, 2020g, 2020f, 2020d, 2020a, 2020c, 2020b), among others, served as invaluable resources to qualitatively understand adolescent perspectives on social media use and its harms - something this thesis was unable to capture directly. For example, the resources above provided insight into adolescent motivations for using social media and their understanding of the risks social media may present to health relative to and combined with existing offline risks. These insights informed the development of the thesis, including (but not limited to) the logic models presented in Chapters 2 and 4 and confounder adjustment in Chapters 5 and 6.

7.2.3 Challenges with researching social media

7.2.3.1 Defining social media

A conceptual challenge when researching social media use pertains to how it is defined in studies (Ellison and Boyd, 2013). This thesis adopted the definition of social media outlined in *The SAGE Handbook of Social Media Research Methods*, initially proposed in 2017 (Sloan and Quan-Haase, 2017). However, to accommodate the different types of content hosted on social media, it was adapted to account for marketer-generated content (including influencer content) and user-generated content. Similarly, the social media categorisation proposed by Sloan and Quan-Haase (2017) was revised to account for more recent technological developments (e.g., the recognition that online (social) gaming is a form of social media).

Although the broad nature of this definition is useful as it accounts for the dynamic nature of social media, when used against the backdrop of definitions adopted in existing literature, its use may have been limited. For example, within Chapter 4, efforts were made to distinguish the effects of different aspects of social media (e.g., time spent, exposure to health-risk behaviour content), as well as characteristics of social media (e.g., platforms, categories and type of content) assessed in included studies. This is of importance, given the potential differential impacts different aspects of social media and its characteristics may have on adolescent health behaviours, as discussed in Section 2.3.2. However, due to the inconsistent nature of social media definitions adopted in included studies (with most assessing a narrow range of social media categories/platforms), this limited subgroup analysis and, in some instances, resulted in considerable heterogeneity.

As illustrated in Chapter 4, studies frequently define social media by providing examples of popular current platforms, as with the exposure definition used within MCS analyses. This approach assumes an understanding of social media based on current technologies; however, it can sometimes leave room for interpretation on what is included under 'social media', which can subsequently influence participant response.

The inconsistent nature of social media definitions limits subsequent studies in their ability to corroborate, validate and advance previous research, limiting progress in this field (Keles *et al.*, 2019; Griffioen *et al.*, 2020). As discussed, this issue was particularly pertinent when synthesising studies in Chapter 4. Thus, to enable replicability and application of findings, there is a need to consolidate best practice methodologies (Keles *et al.*, 2019; Griffioen *et al.*, 2020). The detailed listing of social media measures used across studies in Chapter 4's systematic review (see Appendix A, Section A15) may serve as a helpful starting point for understanding and monitoring the types of measures used going forward.

7.2.3.2 Measuring social media use

A concern in the literature highlighted to contribute to the low-quality and conflicting state of the existing evidence investigating social media's influence

on health pertains to social media measurement practices (Orben, 2020). Chapter 4 highlighted that most social media measures adopted in existing evidence were retrospective self-report. However, retrospective self-report measures, although convenient and sometimes the only available option in the context of large-scale representative secondary data, are vulnerable to biased reporting and may not be representative of actual social media use (Keles *et al.*, 2019; Griffioen *et al.*, 2020; Valkenburg, 2022).

Research has suggested inaccuracies in retrospective self-reported social media use are random rather than systematic (Johannes *et al.*, 2021). However, more recent literature comparing objective and retrospective social media adolescent reports found that adolescents are more likely to overestimate use in self-report measures, suggesting systematic measurement error (Boyle *et al.*, 2022). In investigating factors which contribute to this error, Boyle *et al.* (2022) highlighted the 'cognitive bleed' (the difficulty experienced when remembering usage over different platforms specifically instead of collectively), which may occur when asking adolescents to recall time spent engaging in individual platforms, across multiple devices, instead of recalling collective use.

In Chapters 5 and 6, a retrospective self-report questionnaire assessed time spent on social media. Thus, findings from these chapters should be interpreted within the context of this measure's limitations. However, given that the exposure definition adopted within MCS analyses pertained to the assessment of multiple platforms collectively (instead of individual platforms), the extent of recall bias may be reduced, in line with the findings reported by Boyle *et al.* (2022),

Time-use diaries could be used to extend and complement more commonly used self-report questionnaire measures, as discussed in Chapter 2 (Orben and Przybylski, 2019a; Barthorpe *et al.*, 2020). Therefore, in the studies presented in Chapters 5 and 6, social media use was measured using a time-use diary and a self-report questionnaire. Although the time-use diary measure was anticipated to be less susceptible to recall bias than the questionnaire measure, weaker associations were observed in the time-use diary data when compared to the questionnaire. These weaker associations may have resulted from the time-use diaries' failure to capture multi-tasking (Orben and Przybylski, 2019a). As social

media use is often paired with a more dominant activity (e.g., watching the television), this could have resulted in an underestimation of social media use and an overestimation of non-use. This is demonstrated within the MCS analyses, where the proportion of social media non-users was substantially greater in time-use diary data relative to self-reported questionnaire data. Further, the potential completion of the time-use diary during the school holidays may have also contributed to this difference in findings, as the questionnaire measure assessed normal weekday social media use during term time. Thus findings from Chapters 5 and 6, combined with the limitations mentioned above in time-use diary measurement, suggest the need for more objective social media use measures, which would help to corroborate the findings presented.

7.2.4 Use of secondary data

A key strength of this thesis was its use of the UK-representative MCS. The MCS is the first cohort study to include all four UK countries and has followed the lives of people born in 2000-02 (Centre for Longitudinal Studies, 2020). Advantages of this data source include its detailed collection of longitudinal information on early life circumstances, as well as the wealth of data it collects on topics including parenting, child behaviour and cognitive development, child and parental health, and socioeconomic factors (Institute of Education University of London, 2011). Such information is important when determining the potential influence of social media on adolescent health-risk behaviours.

Despite making use of the most recently available cohort data, the analyses presented in Chapters 5 and 6 only provide a snapshot of adolescent social media use, where social media use was assessed in 2015. Thus, an understanding of the impacts of more contemporary platforms, such as TikTok (one of the top platforms used for influencer campaigns and shown to portray health-harming products such as alcohol; Bagenal *et al.*, 2023), is limited. A common challenge for studies researching social media use is maintaining pace with the rapidly evolving social media landscape (The Lancet, 2019). This is particularly challenging for large-scale national cohort studies such as the MCS. Thus, the findings presented in Chapters 5 and 6 (as well as Chapter 4), although relatively recent, will likely fast become outdated as advances in social media technology occur. For example, as social media platforms and algorithms become more

personalised, this may result in heterogeneity in effects across individuals and over time.

Although secondary data can be advantageous from an economic perspective, a primary limitation is researcher's lack of control over what data are collected and can therefore be analysed (Pederson *et al.*, 2020). The MCS limited its assessment of social media to time spent and did not consider other aspects (e.g., exposure to health-risk behaviour content) or social media characteristics (e.g., platform, type of content exposed to). Moreover, the available MCS social media measures assess both passive and active use collectively, limiting the ability to differentiate between types of use. The importance of distinguishing between these types of use rests in the potential differential effects they may have on health, as discussed in Chapter 2 (Thorisdottir *et al.*, 2019). Large-scale population surveys often cover a multitude of topics as discussed. Thus, it is acknowledged that there may not be resource to measure everything, and respondents may not have the capacity to give the time this would require of them.

Recognition of shortcomings in the MCS measure of social media use, combined with the aforementioned limitations in existing reviews, provided the impetus for Chapter 4's investigation of the different aspects of social media use and its characteristics. This ensured the thesis presented a holistic understanding of potential social media harms.

A strength of the MCS is its provision of sample non-response weights (in an attempt to address representativeness). However, at the time of analysis, weights were unavailable for the time-use diary (Research Data Manager Centre for Longitudinal Studies University College London, 2022). Existing studies that have used the time-use diary data have either used the MCS entire sample non-response weights (Barthorpe *et al.*, 2020; Winstone, 2022) or no weights at all (Atkin *et al.*, 2021).

Using no weights can result in biased estimates and findings that are not representative (Bell *et al.*, 2012). For example, the time adolescents spend on social media and their cigarette, e-cigarette and alcohol use may influence their completion of the time-use diary reliably/at all; thus, completion of the diary

may be deemed a 'collider'. Collider bias can occur when an analysis selects a sample based on a variable (a collider), caused by both the exposure and the outcome under study (Hernán *et al.*, 2004; Hernán, 2017; Tennant *et al.*, 2021). Therefore, sample selection based on completion of the diary (in the absence of weights) may result in a distortion of the association between time spent on social media and the health-risk behaviours of interest.

Use of the existing MCS entire sample non-response weights arguably does not consider factors which may influence time-use diary completion, as well as its completion reliably. Therefore, a strength of the thesis was the creation of time-use diary specific weights, which helped to ensure representativeness and mitigate against the impact of collider bias by removing or minimising the impact of biases in time-use diary sample selection (Tattan-Birch *et al.*, 2021).

7.2.5 Establishing causality

Causal inference in this context is challenging for several reasons. First, the exposure of interest, social media use, is closely associated with other factors independently associated with health-risk behaviours which may confound the observed relationships. These factors include age, sex, and childhood SEC (Bozzini *et al.*, 2021; You *et al.*, 2023). Second, there is the potential for reverse causality, where engagement in health-risk behaviours may result in increased social media use. Finally, limitations of secondary data datasets – in terms of variables collected and/or time periods available – means there is the potential for unmeasured or residual confounding to influence findings (Hernán and Robins, 2019). Thus, this section will discuss how the thesis aimed to address the above challenges, among others, and thus enhanced understanding of the potential causal relationship between social media use and adolescent health-risk behaviours.

Chapter 4 adapted the commonly used Newcastle Ottawa Scale (NOS) (Wells *et al.*, 2000) to incorporate insights from the ROBINS-I tool. The Risk of Bias in Non-randomised Studies of Exposures (ROBINS-E) tool is arguably the most structured approach to assessing RoB in observational studies in a systematic review (ROBINS-E Development Group, 2022). However, at the time of systematic review completion, the ROBINS-I tool was the only Cochrane recommended for

assessing RoB in observational studies; thus, it was used to inform modifications made to the NOS (Sterne *et al.*, 2016, 2021).

ROBINS-I is considered a significant methodological innovation due to the way in which it incorporates an understanding of causal inference based on counterfactual reasoning (Robins and Hernan, 2006; Huffman and Thomas, 2018; Pearl and Mackenzie, 2018; Thomson *et al.*, 2018; Schünemann *et al.*, 2019; Igelström *et al.*, 2021). However, it is often challenging to use and frequently misapplied (Thomson *et al.*, 2018; Jeyaraman *et al.*, 2020; Igelström *et al.*, 2021). In areas of public health where low-quality evidence from observational studies is relatively common, such as with social media and health research, concerns have also been raised about the inability of ROBINS-I to adequately discriminate among higher levels of RoB (Humphreys *et al.*, 2017; Thomson *et al.*, 2018; Igelström *et al.*, 2021). Considering the above, with input from systematic review experts and members of the GRADE Public Health Group and Cochrane Public Health Group (Thomson *et al.*, 2021), the NOS was modified to include an assessment for pre-identified critical confounding domains (e.g., age, sex and SEC) and other justifiable confounders, attrition and missing data (Sterne *et al.*, 2016).

Moreover, analogous to Cochrane RoB tools (Sanderson *et al.*, 2007; Higgins *et al.*, 2011; Whiting *et al.*, 2011; Sterne *et al.*, 2016), modifications also included the replacement of the existing numerical scoring system with a set of algorithms which informed domain-based assessments. This allowed for the prioritisation of RoB domains considered particularly important when assessing the overall quality of included studies, namely the exposure and comparability domains. There was recognition that this approach required the use of the NOS to be accounted for in any subsequent GRADE assessments (Sterne *et al.*, 2016). This was achieved by ensuring the certainty of the evidence was automatically set at ‘low’ in the first instance, with the ability to upgrade or downgrade (Sterne *et al.*, 2016; Schünemann *et al.*, 2019). A primary strength of this approach was its ability to assess the quality of studies, incorporating elements which underpin a study’s ability to make causal inferences.

A limitation in existing evidence is the lack of transparency regarding confounder selection and the use of theory-free statistical criteria and

algorithms to inform selection (Heinze *et al.*, 2018). Few of these conventional approaches specifically consider each variable's role in relation to the exposure and outcome, and it is often unclear why certain variables were selected for consideration and others not (Heinze *et al.*, 2018). Thus, reported associations are uninterpretable (Arnold *et al.*, 2020). Therefore, a series of DAGs were prepared with development supported via subject knowledge, the existing evidence base (including Chapter 4), and advisory group input. These DAGs allowed for the explicit illustration of the hypothesised causal pathways between social media use and the health-risk behaviours of interest. As with all causal observational analyses, there exists potential for unmeasured or residual confounding to influence the study findings. Unmeasured confounders were highlighted, where possible, within the DAGs (see Appendix B, Section B3 and Appendix C, Section C3).

To examine the potential for reverse causation in the MCS analyses, sensitivity analyses adjusting for baseline measures of respective health-risk behaviours were conducted. Estimates were similar or slightly weaker than those without baseline adjustment, with dose-response relationships generally persisting. Although this method mitigates the possibility of reverse causation, it does not eliminate it (VanderWeele *et al.*, 2016; Vanderweele *et al.*, 2020).

7.3 Thesis reflections

On consideration of my own personal reflections on the thesis, there are several lessons I have identified that I will carry forward in future work. For example, the scope of the systematic review (Chapter 4) regarding exposures and outcomes was extremely broad. As a result, this restricted my ability to explore the review findings in more depth and resulted in rather broad-brush findings, encompassing considerable heterogeneity. Despite seeking independent advice on the scope of the review during protocol development, both from advisory group members and systematic review experts (Boon, 2020), in future, I would consider spending more time on the refinement of the question, particularly exposure and outcome selection. The protocol was published on PROSPERO and The University of Glasgow website (Purba *et al.*, 2020a, 2020b). However, in the future, I would consider seeking independent peer-review of the protocol, which

would be achieved through the process of publishing the protocol as a stand-alone output.

Reflections on the MCS analyses presented in Chapters 5 and 6 pertain to the time-use diary. Addressing a gap in the existing evidence, I used a time-use diary recorded measure of time spent on social media to complement the available self-report questionnaire measure. I anticipated that the time-use diary measure of social media use would help address limitations pertaining to recall bias inherent within self-report questionnaire measures (Naab *et al.*, 2019). However, the time-use diary and questionnaire measures reported markedly different proportions of social media non-users. As discussed, these differences could be a result of the time-use diaries' failure to capture multi-tasking, given that social media use is often paired with another more dominant activity (e.g., watching the television). Ideally, if a gold standard time-use diary measure was available, I would have been able to verify findings; however, due to its absence, this was not possible.

7.4 Recommendations for research

This section will describe the potential directions for future research to support scientific understanding on the impacts of social media use on adolescent engagement in health-risk behaviours.

7.4.1 Inequalities in social media harms

Chapter 4 found that few studies examined whether social media effects varied in different population groups. Social media reaches diverse populations, and it is possible for population-level estimates to obscure impacts for subgroups. Reporting of population characteristics (e.g., age, gender, ethnicity and SEC) and disaggregating results by these characteristics, when appropriate, should therefore be prioritised (Odgers *et al.*, 2020). For example, in Chapters 5 and 6, stratification by gender revealed increased time spent on social media generally had a stronger impact on female (compared to male adolescents) for all health-risk behaviours investigated. These findings are consistent with research investigating social media impacts on wellbeing (where reported effects are larger for females compared to males; Booker *et al.*, 2018). The gender

differences identified in Chapters 5 and 6 could be, in part, a result of increased upward social comparison in female adolescents (relative to males) which may subsequently result in increased engagement in health-risk behaviours. Thus, future studies should prioritise the examination of gender differences, as well as factors potentially driving these differences to facilitate the provision of tailored guidance on social media use.

Further, Chapter 4 identified a striking lack of sample diversity between countries, with most research conducted in the Global North. When compared to the Global North, areas of the Global South may have unique neighbourhood, cultural and linguistic factors which may impact adolescent engagement in health-risk behaviours (Athauda *et al.*, 2020; Wiafe *et al.*, 2021; Amoadu *et al.*, 2022). Therefore, the potential contextual similarities or differences should be examined in future research. This would act to support understanding of potential inequalities in social media harms in these understudied contexts (Ghai *et al.*, 2022).

Chapters 5 and 6 suggest that social media impacts on cigarette use and binge drinking are potentially greater in adolescents from socioeconomically advantaged households. If taken at face value, these findings imply that social media is unlikely to further widen inequalities in health-risk behaviours and, if anything, may reduce them. However, unmeasured or residual confounding may play a role here. For example, the prevalence of cigarette use in social media non-users was greater in socioeconomically disadvantaged adolescents than advantaged adolescents. Reasons for non-use of social media may range from parenting strategies to device access (Lee *et al.*, 2022; Ofcom, 2022b), the latter of which we were unable to adjust for. Importantly, these reasons likely differ across socioeconomic groups and may have implications for health behaviours. Future research should explore this further, adopting more accurate social media measures, larger datasets and more diverse populations to understand potential inequalities in social media harms fully. Moreover, qualitative work could complement the approaches mentioned above, which would support the interpretation of study findings.

7.4.2 Understudied health-risk behaviours

Chapter 4 identified the need for more representative longitudinal research investigating the relationship between social media use and inadequate physical activity. Findings from Synthesis Without Meta-analysis (SWiM) suggested that social media use may positively influence adolescent engagement in physical activity. More recent evidence in the adult population has demonstrated that exposure to trustworthy social media fitness influencers can be effective in increasing physical activity in adults (Durau *et al.*, 2022). Therefore, future research should explore this relationship further in the adolescent population to harness the potential benefits social media use may have for physical activity and health.

Chapter 4 found few studies assessing multiply occurring risk behaviours. Evidence has increasingly demonstrated that health-risk behaviours, such as tobacco use, alcohol use, drug use and sexual risk behaviours, often cluster within adolescents (Akasaki *et al.*, 2019; Whitaker *et al.*, 2021). The harms from engaging in multiple risk behaviours have been suggested to be synergistic (Meng *et al.*, 1999). For example, the effects of unhealthy dietary behaviours, physical inactivity and excessive alcohol use on liver disease are synergistic (Hart *et al.*, 2010). Research assessing social media's influence on multiple risk behaviours would support an understanding of the potential need for public health practice to target multiple health-risk behaviours within adolescents (Akasaki *et al.*, 2019).

7.4.3 A holistic and universal approach to social media measurement

The thesis has demonstrated the requirement for more sophisticated and consistent approaches to social media measurement. The unique implications of the different aspects of social media use (e.g., time spent on social media, exposure to health-risk behaviour content) and different types of social media use (e.g., passive and active use) have been described in the thesis (Pollay, 2000; Mirza, 2019; Thorisdottir *et al.*, 2019). Therefore, future steps to produce validated measures should integrate both channel-centred approaches and more user-centred communication-centred approaches to measurement (Petropoulos

Petalas *et al.*, 2021). This would facilitate comparison of effects across different platforms (e.g., Facebook), considering their unique features and across different types of activity (e.g., passive, active use). Furthermore, to maximise validity, mixed-methods assessments incorporating qualitative work would provide insight on how adolescents, including potentially vulnerable adolescent subgroups (e.g., LGBTQ+, racial minority, and neurodiverse youth), engage with social media (Ito, 2013; Odgers *et al.*, 2020).

The comparison of self-reported and time-use diary data in Chapters 5 and 6 identified the need for the time-use diaries to account for reflexive or brief uses of social media/digital technology concurrent with other activities. As discussed, the development of a gold standard approach to time-use diary measurement may be an avenue worth pursuing. It could support comparability amongst estimates by ensuring a consistent approach to what is deemed a slightly more objective measure than questionnaire-reported social media use.

A further challenge highlighted by researchers using time-use diary data, as discussed in Chapter 2, is ensuring all days under analysis are representative (Orben and Przybylski, 2019a). In addressing both issues, in the absence of real-time objective data held by social media corporations, an objective methodology that demonstrates potential involves holistically tracking an adolescent's social media use over multiple days across multiple devices (Orben and Przybylski, 2019a; Odgers *et al.*, 2020). Here, participants provide their own social media usage data (via the specific Android/iPhone screen time function) to study investigators (Johannes *et al.*, 2021).

The promise of exact tracking of adolescents in their own environments rests in its ability to track an adolescent's engagement in health-risk behaviours during specific time periods, and to differentiate between the different activities performed on social media (Orben, 2020). This emerging form of data collection could help to overcome issues pertaining to recall bias inherent in self-report measures (David *et al.*, 2018). Yet, it may also be subject to bias, as participants may be more wary of the time they spend on social media, given they have to feedback this information to study investigators at the end of the study period (Johannes *et al.*, 2021). Further, this method has so far been limited to small samples, is subject to technical, ethical and privacy issues (Orben and

Przybylski, 2019a; Johannes *et al.*, 2021), and can be challenging to obtain in large representative samples, especially when usage is collected across multiple devices (Barthorpe *et al.*, 2020).

Although this form of data collection presents one of the most fruitful avenues for future research, it comes with technological, ethical and legal challenges (Orben and Przybylski, 2019a; Johannes *et al.*, 2021). Similarly, accessing real-time objective usage data held by social media corporations is not straightforward. One of the most important omissions from the UK Online Safety Bill (2023) is the lack of mandated access to social media data for auditors and independent researchers (UK Parliament, 2023a). Researchers and policymakers, with cooperation from the social media industry, must prioritise the identification of transparent, ethical and controlled mechanisms to access granular user engagement data. Access to these data and subsequent linkage with survey data or data collected from other software applications capturing information on user demographics and health behaviour would support understanding of the specific aspects of social media content most harmful and beneficial to adolescent health, which could then be incorporated into future policy (Odgers *et al.*, 2020).

Consideration and endorsement of the above approaches (where possible) would build a more balanced and holistic view of the impact of social media – a view that recognises reducing social media use from a multifaceted range of experiences and interactions to a single number (in the context of time spent on social media) only presents one part of the picture. In increasing the focus of measurement on specific experiences/activities rather than merely time spent, the updating of these measures to account for advances in social media technology and policy would perhaps be less challenging.

7.4.4 Confirming causality

Chapter 4 highlighted the need for experimental studies which examine whether increased exposure to actual social media or different types of exposure to online content and experiences influence adolescent engagement in health-risk behaviours. Existing experimental evidence investigating the effects of social media use in adolescents is predominantly limited to unhealthy dietary

behaviours (Coates, 2018; Folkvord and de Bruijne, 2020; De Jans *et al.*, 2021). Improving on this small body of research would involve assessing exposure to actual (real life) social media profiles/platforms rather than those which are mock/fictitious, to improve external validity of findings. This approach was achieved by Folkvord and de Bruijne (2020), who randomly assigned participants to Instagram posts depicting a famous social media influencer consuming healthy and unhealthy foods to examine subsequent vegetable intake.

Considering the larger body of experimental evidence investigating social media impacts on health in the general population, the majority of studies tend to randomly assign participants to either continued social media use as normal (control) or reduced social media use (intervention) (Odgers *et al.*, 2020; Collis and Eggers, 2022; Lambert *et al.*, 2022). Due to difficulties in recruitment and attrition (especially in the case of large representative populations), intervention periods are often short (ranging from five days to four weeks; Vanman *et al.*, 2018; Hall *et al.*, 2021), thereby inhibiting understanding of the long-term effects of social media use. This is important, as longer intervention periods may lead to participants identifying substitutes which provide similar functions to social media, thus possibly affecting subsequent health behaviours (Collis and Eggers, 2022).

A second problem of experimental evidence, identified by Collis and Eggers (2022, p.9), is the salience of social media in individuals' lives, wherein they highlight that "you can take social networking away from the students, but you cannot take students away from their social network". In their experimental study, which is one of few adopting an objective measure of social media use, the effect of social media use on college student wellbeing was assessed. The intervention group was instructed to use social media (defined as use of Facebook, Instagram and Snapchat) for a maximum of 10-minutes per day – with service access blocked after the 10-minute period. Investigators found that those in the intervention group substituted social media (as defined) for instant messaging applications (WhatsApp); thus, total time on digital devices as tracked by software was not decreased. This adds to the calls for consensus on what constitutes social media. The study highlights the benefit of adopting a broad definition of social media use in experimental settings, similar to observational

settings, given its dynamic nature (Collis and Eggers, 2022). A less commonly addressed issue in this study pertains to the need to understand factors which may promote a divergence in social media use from normal levels in the control group (e.g., widespread messaging around taking a break from social media).

An avenue that shows potential is school-based cluster randomised control trials, wherein schools are allocated to intervention arms rather than adolescents themselves (Res *et al.*, 2021). For example, this form of trial could be used to assess the impact of social media bans within education and school settings. However, between-cluster variability may be a problem; thus, strategies such as matching and stratification may be required to reduce imbalances between intervention arms, considering school characteristics predictive of health behaviours under study that account for within-cluster correlation and influence intervention effectiveness (Hayes and Moulton, 2009; Res *et al.*, 2021)

Limitations in existing experimental evidence, combined with the ethical implications of experimentally investigating health-risk behaviours such as tobacco use in adolescents, suggest social media as an exposure in this context may not lend itself well to evaluation within a trial setting.

Natural experiment studies (a form of observational study) offer a useful alternative when randomisation is not possible or suitable (Craig *et al.*, 2017). This form of investigation uses naturally occurring variation in an exposure to divide a population into exposed and unexposed groups; thus, exposure assignment is not under the control of the researchers (Craig *et al.*, 2012). Endorsed by the UK Government as a means to evaluate the effects of digital health products/services (UK Government, 2020), finding credible natural experiments can be challenging but some do exist. For example, natural experiment studies could be used to investigate the impacts of changes in social media platforms' terms of service (for example, the introduction of TikTok screen time limits in adolescents under 18 years) on adolescent health-risk behaviours.

Thus, there is a clear need for well-conducted experimental studies, where possible, and use of observational data evaluating natural experiments, combined with access to real-time objective usage data from social media

corporations. Such approaches would further support scientific understanding of the potential causal relationship between social media use and adolescent health-risk behaviours.

7.4.5 Increasing transparency

As discussed in previous sections, analysis of observational data is essential for understanding the impacts of social media on health. There is a need for more transparent and robust analytic practices, for example, pre-registration of statistical analysis plans (Munafò *et al.*, 2017; Orben, 2020) and sharing of analytical code and data via repositories such as GitHub (Goldacre *et al.*, 2019). Such sharing would also facilitate code audits, thus increasing the likelihood of the identification of errors and subsequent corrections (Naudet *et al.*, 2015; Wood *et al.*, 2018).

In engaging with an Open Science approach, the systematic review protocols and statistical analysis plan for analyses presented in Chapters 5 and 6 were made publicly available in advance (Purba *et al.*, 2020a, 2020b, 2022). Similarly, the analytical code was made available for analyses, and in the case of the systematic review, the posting of a preprint allowed for wider peer-review of the work conducted (Purba *et al.*, 2023). Preprints can help tackle the challenge of maintaining pace with rapid social media advances and changes in social trends through their ability to minimise the delay between data collection and dissemination of findings (Sarabipour *et al.*, 2019).

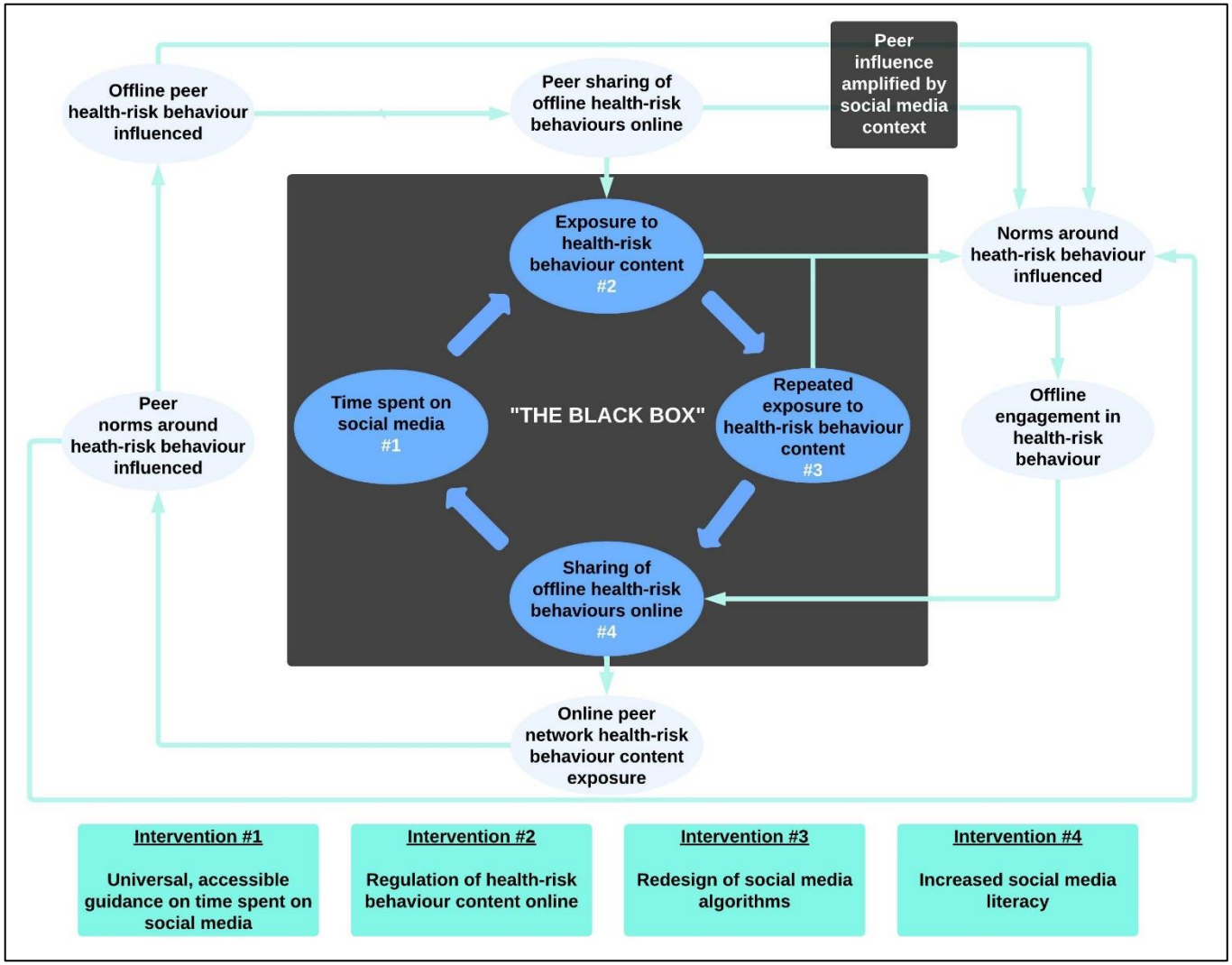
As future research explores this area, scientists must embrace transparency, circumspection and robust working methods to safeguard against analytical flexibility and bias, and increase accessibility throughout the research cycle (Orben *et al.*, 2019). Doing so will ensure parents/caregivers, educators, health professionals and policymakers are provided with the accurate and reliable insights they need on a topic frequently characterised by unfounded media publicity (Orben *et al.*, 2019).

7.5 Implications for policy, practice and industry

This section describes the implications of the work presented in the thesis for policy, practice and industry.

Considering the body of work as a whole, Figure 22 presents the hypothesised (albeit simplified) mechanisms which may, in part, explain the relationship between social media use and health-risk behaviours observed in this thesis, henceforth, referred to as a 'Vicious cycle'. The figure depicts a complex chain of events that reinforces itself through a positive feedback loop with detrimental effects, namely adolescent engagement in health-risk behaviours.

Figure 22. Vicious cycle of social media harms



The key components of the cycle are highlighted in dark blue oval nodes and comprise the following:

- Time spent on social media
- Exposure to health-risk behaviour content
- Repeated exposure to health-risk behaviour content
- Sharing of offline health-risk behaviours online

The light blue oval nodes, for example, 'peer norms around health-risk behaviour influenced', demonstrate how social media behaviours and offline behaviours at the individual and peer-level are inextricably linked. 'The Black Box' represents how social media algorithms collect data on usage habits (e.g., content viewed/time spent viewing particular content, tweets, likes, and shares) and then use this to promote subsequent engagement (e.g., through personalised recommendations). This cumulative process, referred to as algorithmic profiling ("the systematic and purposeful recording and classification of data related to individuals"; Büchi *et al.*, 2020, p.2), results in an individual algorithmically derived profile for all social media users - profiles which social media corporations then hold.

To explain the 'Vicious cycle' presented in Figure 22, the example of alcohol use will be used. Of importance, although the focus of this thesis is on social media harms, the types of activities performed on social media (e.g., exposure to exercise content vs exposure to unhealthy food and drink) dictate whether this cycle is 'vicious' and can result in harmful outcomes to health, or 'virtuous' and result in favourable outcomes to health.

The cycle commences with adolescents accessing and spending *time on social media*. As a result, they may be *exposed to alcohol-related content* (user-generated (e.g., peer content) or marketer-generated (e.g., influencer content)). Adolescents' time engaging with this content or their sharing of this content (e.g., to their online peer network) influences their *repeated exposure to more alcohol-related content* (via social media personalised algorithms - 'The

Back Box'). As a result of this exposure, their social norms surrounding alcohol use may be affected, thereby influencing offline alcohol use. To obtain peer approval, an adolescent may *share their offline drinking behaviours online*, which may impact the norms and drinking behaviours of their peers. In turn, this increases the *time an adolescent spends on social media* and restarts the cycle.

The following sections describe four interventions (e.g., policy implementation) which could be implemented to potentially break the cycle (green rectangular boxes in Figure 22):

1. Universal, accessible guidance on time spent on social media

2. Regulation of health-risk behaviour content on social media

3. Redesign of social media algorithms

4. Increased social media literacy

Figure 22 highlights the specific points at which implementation of the aforementioned interventions (denoted #) may be most effective; however, they may break the cycle at any point. As social media platforms move towards the metaverse (an extension of social media which builds personalised user experiences based on virtual and augmented reality), exposure to harmful behaviours will become even more immersive and social media use arguably more appealing (Koohsari *et al.*, 2023). Therefore, guidance on time spent, regulation of health-risk behaviour content, the redesign of social media algorithms, and social media literacy is crucial. However, it is recognised that the effectiveness of the interventions presented relies on further testing of the hypothesised mechanisms proposed in Figure 22 and the feasibility of the interventions themselves (Nuffied Council on Bioethics, 2023). This section will draw upon Figure 22 to highlight four complementary implications for policy, practice and industry identified from this thesis.

7.5.1 Intervention #1: universal, accessible guidance on time spent on social media

The causal analyses presented in Chapters 5 and 6 show that increased time spent on social media leads to increased risk of adolescent cigarette use, e-cigarette use, dual use, alcohol use and binge drinking. Restricting time spent on social media may offer a route to reducing the risk of engagement in these health-risk behaviours (potentially via limiting adolescent exposure to health-risk behaviour content on social media). Therefore intervention #1 stipulates the requirement for universal, accessible guidance on the time an adolescent spends on social media. This guidance could be analogous to general screen time guidance in the UK and US (Royal College of Paediatrics and Child Health, 2019; American Academy of Pediatrics, 2022). Existing guidance recognises the lack of robust evidence documenting specific time thresholds considered 'healthy' (Royal College of Paediatrics and Child Health, 2019; American Academy of Pediatrics, 2022). Thus, it recommends that adolescent screen time limits are set through negotiations with their own family.

Parents/caregivers often have a heightened understanding of the individual needs of their child, the way they use social media, and, importantly, how time spent on social media might displace their child's engagement in physical and social activities, as well as sleep (American Psychological Association, 2023). Therefore, this approach prioritises the role of the parent/caregiver in keeping their child safe online.

Social media corporations may also be in an ideal position to break the cycle at this point. For example, given the accelerated growth in screen time observed in adolescents as a result of the COVID-19 pandemic (Rideout *et al.*, 2021), TikTok recently announced a 60-minute daily screen time limit for users under 18 years (British Broadcasting Corporation, 2023; TikTok, 2023a). Following 60-minutes of use, adolescents would be prompted to enter a passcode to allow them to continue on the platform. There are several issues with this approach to limiting screen time for adolescents. Firstly, inadequate age assurance methods on social platforms (Ofcom, 2022a) may mean adolescents, the target audience of this approach, may not be reached. Second, although this approach raises awareness of regulating time spent on social media, it places a great amount of

responsibility on an adolescent's ability to make an active decision not to prolong use after 60-minutes, thus may be more suitable for older adolescents.

Given that during the period of adolescence, inhibitory control is still developing (Larsen and Luna, 2018), and there is less weight placed on the consequences of decisions (Jackson *et al.*, 2018; Donaldson *et al.*, 2022), the new 'Family Pairing' feature on TikTok may be more appropriate (especially in the case of younger adolescents). This feature allows a parent/caregiver to set the daily screen time limit for their child, mute notifications for certain times of the day, and access a dashboard allowing them to see how much their child is accessing the platform (TikTok, 2023b, 2023a).

However, considering findings from MCS analyses, reducing time spent on social media may have limited effectiveness in socioeconomically disadvantaged adolescent populations where offline exposure to health-risk behaviours may occur more frequently.

7.5.2 Intervention #2: regulation of health-risk behaviour content on social media

Chapter 4 identified that exposure to health-risk behaviour content had the strongest evidence for adverse effects, especially in relation to unhealthy dietary behaviour, which had the best quality evidence (4 RCTs). Therefore, a key focus for policy moving forward rests on the appropriate regulation of health-risk behaviour content (as well as unhealthy commodities) on social media, in addition to (frequently violated) platform specific self-imposed content regulation (Kong *et al.*, 2022). At the forefront of the global policy response aimed at securing adolescent online safety is the UK Online Safety Bill (2023) (UK Parliament, 2023a). The Bill introduces a new set of rules for search engines and services which host user-generated content. Once introduced, platforms will be required to actively remove illegal content and have a duty of care to ensure adolescents accessing their services are not exposed to legal but 'harmful' content (UK Parliament, 2023a). The US Countering Online Harms Act (2020) (US Congress, 2020) and the European Union Digitial Services Act (2022) (European Commission, 2022b) include similar measures.

Considering the UK Online Safety Bill (2023), there are areas pertinent to protecting adolescents online which remain largely unaddressed (UK Parliament, 2023a). For example, despite established evidence of the impact of exposure to marketer-generated media content on adolescent behaviour (Lapierre *et al.*, 2017; White *et al.*, 2017; Camenga *et al.*, 2018; Gupta *et al.*, 2018), further corroborated by the findings of this thesis, only 'fraudulent' advertisements are considered within the new UK regulatory requirements (UK Parliament, 2023a). Further, concerns have been raised about the Bill's wide, interpretive scope on what constitutes 'harmful' content (Trengove *et al.*, 2022). For example, most health-risk behaviour content is not explicitly stated as 'harmful' within the Bill, including e-cigarette and tobacco use content (UK Parliament, 2023a). Arguably, the explicit and clear addition of these and other health-risk behaviours to the Bill would facilitate faster enforcement action against social media corporations that fail to remove such content (Dawson and Smith, 2022).

7.5.3 Intervention #3: redesign of social media algorithms

Appropriate regulation of health-risk behaviour content would serve as a starting point for reducing adolescent exposure to harmful content on social media platforms. However, as illustrated in Figure 22, initial exposure and engagement with specific types of content can result in repeated exposure to such content, which can consequently affect an adolescent's social norms and offline health-risk behaviours. Chapter 2 described how social media algorithms generate personalised content and facilitate repeat exposure to similar content and the detrimental effects such exposure can have on adolescent engagement in health-risk behaviours. Chapter 2 also highlighted the difficulty in understanding precisely how these algorithms function, partly due to the difficulty in obtaining data from social media corporations. This lack of understanding can inhibit the auditing of these algorithms to ensure they function in a way that best serves adolescents (e.g., protecting them from repeated exposure to health-risk behaviour content). Thus, social media corporations should make efforts to ensure the algorithms employed are designed in such a way that protects adolescents from repeat exposure to health-risk behaviour content. This could be achieved through active interrogation of these algorithms by social media regulators to reduce the risks to adolescents that they can present- by default and design (5Rights Foundation, 2022a).

7.5.4 Intervention #4: increasing social media literacy

At the individual and community-level, there is a need for educators, health professionals and parents/caregivers to improve their own social media literacy to enhance their practice and, importantly, to empower adolescents to appraise information they view on social media critically and increase awareness of the potential consequences of the actions they perform on social media (Department for Digital Culture Media and Sport, 2021b). This could be achieved in three key ways:

1. Increased awareness of how social media platforms and underlying algorithms that present content and promote user engagement function

2. Increased awareness of how to identify the reliability of data sources, for example, distinguishing between personal recommendations and advertisements/sponsored/influencer content

3. Increased awareness of the impact specific interactions/content may have on an adolescent (and their wider online network) within the context of their individual circumstances and resources

This triangular approach to promoting social media literacy in authoritative figures (e.g., health professionals, educators, parents/caregivers) could support adolescent navigation of the social media environment by drawing upon existing supportive and trusting relationships an adolescent may have to deliver this education. The benefits of this approach are not limited to adolescents. For health professionals, increased social media literacy could support access to and communication of health-related information (Dailah and Naeem, 2021). For educators, increased social media literacy via programmes, like Scotland's Teacher Digital Literacy Framework (Education Scotland, 2023), would better place them to deliver social media literacy education as part of school-based programmes/curriculums (Polizzi, 2020; UK Parliament, 2023b). From the parent/caregiver perspective, increasing their social media literacy could help them develop healthy social media use habits. This would allow them to effectively model the behaviours they wish to see in their own children (Terras *et al.*, 2016).

This triangular approach would allow for a broader understanding of the harms of social media use, balanced against an understanding of the potential benefits it can present to adolescent health and development. Importantly, rather than face the challenges social media may present to adolescent health with over-protection and prohibition, these key authoritative figures could instead prepare adolescents for the realities of the social media landscape.

7.6 Conclusion

The work presented in this thesis provides novel understanding on the unique impact of social media use on adolescent engagement in health-risk behaviours and the potential inequalities which may result. By examining the different aspects of social media (e.g., time spent and exposure to health-risk behaviour content), the thesis highlights the adverse effects social media use can have on adolescent health-risk behaviours whilst being mindful of its potential benefits. As a result, this thesis enriches the evidence available to support future research, can be used to guide effective intervention and education strategies, and helps shape a more constructive narrative around the influence of social media use on adolescent health.

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Appendices

Appendix A Supplementary material accompanying Chapter 4

Section A1 Deviations from protocol

We made the following explanatory clarifications and minor protocol deviations to improve the interpretability and comparability of the review findings.

Clarifications to and deviations from the protocol as published:

- Updated the search to include all eligible studies from 01.1997-06.2022.
- Clarified online dating platforms were not included under the exposure social media use.
- Clarified randomised control trials (RCTs) were eligible for inclusion.
- Clarified the risk of bias (RoB) tool to be used for randomised control trials is the Cochrane Risk of Bias Tool for Randomised Trials (RoB-2).
- We did not include ethnicity as a critical confounding factor when assessing study adjustment as the potential role of ethnicity as a confounder was not deemed substantial given the likely homogenous populations investigated within many included studies.
- We included online (social) gaming and online (social) gambling within included exposures following discussions with advisory group members due to their emerging placement in social media platforms and the overlap in functionalities they share with social media.
- For planned subgroup analyses/meta-regression, we originally stated if two or fewer studies were found in a given sub-category of a binary/multi-categorical moderator, formal moderation analysis would not be conducted for that specific variable. Due to the limited number of included studies, we allowed for more leniency using the data available and the decision was made to perform subgroup analyses/meta-regression if at least one subgroup had two or more studies, noting the requirement to interpret any conclusions with caution. The same rule was applied when conducting sensitivity analyses.

- Where duplicate data were identified across multiple studies, we prioritised inclusion of studies which had the longest period of follow-up, followed by studies which had the largest, most representative sample size, and then by most recent. We did not anticipate there would be many cohort studies identified during protocol development; thus, we did not initially prioritise the inclusion of studies with longer follow-up periods.

- Following discussions with statistical experts post-publication of the protocol, the decision was made to combine binary exposure and binary/continuous outcomes in line with guidance provided by Cochrane expressed as odds ratios (Schünemann *et al.*, 2021). For continuous exposure measures, we stated estimates would be converted to standardised regression coefficients/correlations. Where possible, we converted regression coefficients to standardised regression coefficients. We used the recent method recommended by Mathur and Vanderweele (2020), which facilitates the conversion of a Pearson correlation coefficient to standardised mean difference.

- We conducted a post-hoc GRADE (Grading of Recommendations, Assessment, Development, and Evaluations) assessment for the exposure to health-risk behaviour content on social media and the outcome unhealthy dietary behaviour due to the substantial differences in the studies used to assess this exposure/outcome combination (specifically investigation by RCTs).

Section A2 Details of search strategies conducted

All searches outlined in Table A2.1 were initially conducted on 30.04.2020 and repeated on 06.06.2022.

Table A2.1. Sources searched and corresponding hits

Sources searched	Date of initial search	Number of hits	Date of updated search	Number of hits	Total number of hits
Electronic databases					
CINAHL	30.04.2020	6,740	06.06.2022	1,435	8,175
EMBASE	30.04.2020	6,896	06.06.2022	2,563	9,459
MEDLINE	30.04.2020	5,253	06.06.2022	1,813	7,066
APA PsychINFO	30.04.2020	2,545	06.06.2022	508	3,053
SocINDEX	30.04.2020	245	06.06.2022	62	307
Pre-print repositories					
SSRN	30.04.2020	0	06.06.2022	0	0
SocArXic	30.04.2020	11	06.06.2022	10	21
PsyArXiv	30.04.2020	6	06.06.2022	35	41
medRxiv	30.04.2020	18	06.06.2022	0	18
Internet search engine					
Google Scholar	30.04.2020	30	06.06.2022	30	60
Total number of hits					28,200
Total number of hits following removal of duplicates					**17,077**

Legend: Abbreviation(s): APA=American Psychological Association; CINAHL=Cumulative Index to Nursing and Allied Health Literature; EMBASE=Excerpta Medica Database; MEDLINE=Medical Literature Analysis and Retrieval System Online; and SSRN=Social Science Research Network.

Table A2.2. Cumulative Index to Nursing and Allied Health Literature (CINAHL) search strategy

String number	String
1	(MH "Adolescence+") OR (MH "Child+") OR (MH "Students+") OR (MH "Students, High School") OR (MH "Schools, Middle") OR (MH "Schools, Secondary")
2	TI ("young people" OR youth OR "school child*" OR teen* OR "young person*" OR "middle school" OR middle-school OR "secondary school" OR "high school"OR iGen OR "generation Z" OR "gen Z") OR AB ("young people" OR youth OR "school child*" OR teen* OR "young person*" OR "middle school" OR middle-school OR "secondary school" OR "high school" OR iGen OR "generation Z" OR "gen Z")
3	S1 OR S2
4	(MH "Social Networking+") OR (MH "Social Media+") OR (MH "Smartphone") OR (MH "Internet+") OR (MH "Screen Time") OR (MH "Instant Messaging")
5	TI ("screen time" OR "social media" OR "social network* site" OR "social networking" OR "social-networking" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch) N2 (usage OR use*)) OR AB ("screen time" OR "social media" OR "social network* site" OR "social networking" OR "social-networking" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch) N2 (usage or use*))
6	TI ("screen time" OR "social media" OR "social networking" OR "social-networking" OR "social network* site*" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch) OR AB ("screen time" OR "social media" OR "social networking" OR "social network* site*" OR "social-networking" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch)
7	S4 OR S5 OR S6
8	(MH "Risk Taking Behavior+") OR (MH "Substance Abuse+") OR (MH "Substance Abusers+")
9	TI ("substance use*" OR "substance misuse*" OR risk-behav* OR "risk behav*" OR "risky behav*" OR "risk-taking behav*" OR "multiple risk behav*") OR AB ("substance use*" OR "substance misuse*" OR risk-behav* OR "risk behav*" OR "risky behav*" OR "risk-taking behav*" OR "multiple risk behav*")
10	S8 OR S9
11	(MH "Tobacco+") OR (MH "Smoking+") OR (MH "Tobacco Products+")

12	TI ("adolescent smok*" OR "chewing tobacco" OR "tobacco dependence" OR "tobacco use" OR "tobacco consumption" OR "tobacco snuff" OR cigarette OR "smoking initiation" OR "smoking behav*") OR AB ("adolescent smok*" OR "chewing tobacco" OR "tobacco dependence" OR "tobacco use" OR "tobacco consumption" OR "tobacco snuff" OR cigarette OR "smoking initiation" OR "smoking behav*")
13	S11 OR S12
14	(MH "Electronic Cigarettes")
15	TI ("electronic nicotine delivery system*" OR e-cigarette* OR Juul OR vaping OR vape) OR AB ("electronic nicotine delivery system*" OR e-cigarette* OR Juul OR vaping OR vape)
16	S14 OR S15
17	(MH "Drinking Behavior+") OR (MH "Alcohol Abuse+") OR (MH "Alcoholic Intoxication+")
18	TI ("underage drinking" OR "under-age drinking" OR "under age drinking" OR temperance OR "alcohol use*" OR "alcohol intake" OR "problem drinking" OR "alcoholism" OR "alcohol abstinence" OR "drinking behaviour" OR "alcohol consumption" OR "binge drinking") OR AB ("underage drinking" OR "under-age drinking" OR "under age drinking" OR temperance OR "alcohol use*" OR "alcohol intake" OR "problem drinking" OR "alcoholism" OR "alcohol abstinence" OR "drinking behaviour" OR "alcohol consumption" OR "binge drinking")
19	S17 OR S18
20	(MH "Street Drugs+") OR (MH "Drugs") OR (MH "Cannabis") OR (MH "Cocaine+")
21	TI ("cannabis use*" OR "cannabis addict*" OR "illicit drug*" OR "drug abuse*" OR "drug use*" OR "drug misuse*" OR weed OR skunk OR marijuana OR "special k" OR crack OR methamphetamine* OR ecstasy OR heroin OR LSD OR steroid* OR ketamine OR MDMA OR GHB OR GBL) OR AB ("cannabis use*" OR "cannabis addict*" OR "illicit drug*" OR "drug abuse*" OR "drug use*" OR "drug misuse*" OR weed OR skunk OR marijuana OR "special k" OR crack OR methamphetamine* OR ecstasy OR heroin OR LSD OR steroid* OR ketamine OR MDMA OR GHB OR GBL)
22	S20 OR S21
23	(MH "Juvenile Delinquency") OR (MH "Theft+") OR (MH "Disruptive Behavior") OR (MH "Gangs") OR (MH "Violence+")
24	TI ("antisocial behav*" OR "anti-social behav*" OR "social problem*" OR assault OR fighting OR steal* OR shoplift* OR vandal* OR "public nuisance") OR AB ("antisocial behav*" OR "anti-social behav*" OR "social problem*" OR assault OR fighting OR steal* OR shoplift* OR vandal* OR "public nuisance")
25	S23 OR S24
26	(MH "Pregnancy in Adolescence+") OR (MH "Sexually Transmitted Diseases+") OR (MH "Pregnancy, Unwanted") OR (MH "Sex+") OR (MH "Unsafe Sex") OR (MH "HIV Infections+")
27	TI (sexting OR sex-text OR "sex text" OR "sexual behav*" OR "sexual intercourse" OR "sexually transmitted infection*" OR STIs OR STDs OR "teen* pregnancy" OR "unprotected sex" OR "first intercourse" OR "casual sexual relations*" OR "intimate sexual contact" OR "under age sex" OR "underage sex" OR "under-age sex" OR "underage pregnancy" OR "under-age pregnancy" OR "under age pregnancy") OR AB (sexting OR sex-text OR "sex text" OR "sexual behav*" OR "sexual intercourse" OR "sexually transmitted infection*" OR STIs OR STDs OR "teen* pregnancy" OR "unprotected sex" OR "first intercourse" OR "casual sexual relations*" OR "intimate sexual contact" OR "under age sex" OR "underage sex" OR "under-age sex" OR "underage pregnancy" OR "under-age pregnancy" OR "under age pregnancy")
28	S26 OR S27
29	(MH "Gambling")
30	TI (gambling OR betting) OR AB (gambling OR betting)

31	S29 OR S30
32	(MH "Sweetened Beverages") OR (MH "Fast Foods") OR (MH "Adolescent Nutrition") OR (MH "Eating Behavior+")
33	TI ("unhealthy diet*" OR "poor diet*" OR "dietary behav*" OR "sugary drink*" OR sweet*) OR AB ("unhealthy diet*" OR "poor diet*" OR "dietary behav*" OR "sugary drink*" OR sweet*)
34	S32 OR S33
35	(MH "Physical Activity") OR (MH "Exercise+") OR (MH "Physical Fitness+") OR (MM "Life Style, Sedentary")
36	TI ("physical inactiv*" OR "physical activ*" OR exercis* OR sport*) OR AB ("physical inactiv*" OR "physical activ*" OR exercis* OR sport*)
37	S35 OR S36
38	S10 OR S13 OR S16 OR S19 OR S22 OR S25 OR S28 OR S31 OR S34 OR S37
39	S3 AND S7 AND S38

Legend: Initial search: date of search-30.04.2020. Interface EBSCOhost. Database and coverage-Cumulative Index to Nursing and Allied Health Literature (CINAHL),1981 to present. Limits applied-01.01.1997 to 30.04.2020. Updated search: date of search-06.06.2022. Interface-EBSCOhost. Database and coverage-Cumulative Index to Nursing and Allied Health Literature (CINAHL),1981 to present. Limits applied - 01.04.2020 to 31.06.2022.

Table A2.3. Excerpta Medica Database (EMBASE) search strategy

String number	String
1	adolescent/ or child/ or juvenile/
2	middle school student/ or student/ or high school student/
3	("young people" or youth or "school child*" or teen* or "young person*" or "middle school" or middle-school or "secondary school" or "high school" or iGen or "generation Z" or "gen Z").ab,ti.
4	1 or 2 or 3
5	online social network/ or social media/ or smart phone/ or internet/ or screen time/
6	(("screen time" or "social media" or "social networking" or "social-networking" or "social network* site*" or "web 2.0" or "online game*" or "online gaming" or "online social gaming" or hashtag or "instant messag*" or instagram or "Whats App" or whatsapp or facebook or twitter or linkedin or youtube or "you tube" or tumblr or vine or snapchat or myspace or bebo or reddit or neknominate or myspace or wickr or telegram or whisper or "kik messenger" or "Tencent QQ" or wechat or meetup or tiktok or hinge or happn or bumble or grindr or Tinder or "inner circle" or periscope or twitch) adj2 (usage or use*)).ab,ti.
7	("screen time" or "social media" or "social networking" or "social-networking" or "social network* site*" or "web 2.0" or "online game*" or "online gaming" or "online social gaming" or hashtag or "instant messag*" or instagram or "Whats App" or whatsapp or facebook or twitter or linkedin or youtube or "you tube" or tumblr or vine or snapchat or myspace or bebo or reddit or neknominate or myspace or wickr or telegram or whisper or "kik messenger" or "Tencent QQ" or wechat or meetup or tiktok or hinge or happn or bumble or grindr or Tinder or "inner circle" or periscope or twitch).ab,ti.
8	5 or 6 or 7
9	high risk behavior/ or "substance use"/ or substance abuse/
10	("substance misuse*" or "substance use behav*" or "risk taking behav*" or "risk-taking behav*" or "risk behav*" or "risk-behav*" or "risky behav*" or "multiple risk behav*").ab,ti.
11	9 or 10
12	chewing tobacco/ or tobacco/ or smokeless tobacco/ or tobacco dependence/ or "tobacco use"/ or tobacco consumption/ or tobacco snuff/ or cigarette/ or cigarette smoking/ or adolescent smoking/ or smoking/
13	("smoking initiation" or "smoking behav*").ab,ti.
14	12 or 13
15	exp electronic cigarette/
16	("electronic nicotine delivery system*" or e-cigarette* or Juul or vaping or vape).ab,ti.
17	15 or 16
18	underage drinking/ or binge drinking/ or alcohol consumption/ or drinking behavior/ or alcohol abstinence/ or alcoholism/ or alcohol abuse/
19	("alcohol intoxication" or "problem drinking" or "alcohol intake" or "alcohol use*" or temperance or "under-age drinking" or "under age drinking" or "underage drinking").ab,ti.
20	18 or 19
21	"cannabis use"/ or cannabis addiction/ or illicit drug/ or drug abuse/

22	("street drug*" or "drug use*" or "drug misuse*" or weed or skunk or cannabis or marijuana or cocaine or "special k" or crack or methamphetamine* or ecstasy or heroin or LSD or steroid* or ketamine or MDMA or GHB or GBL).ab,ti.
23	21 or 22
24	antisocial behavior/ or social problem/ or assault/ or physical violence/ or gang/ or fighting/ or theft/ or juvenile delinquency/
25	(steal* or shoplift* or vandal* or "public nuisance" or "physical assault" or "anti-social behav*").ab,ti.
26	24 or 25
27	adolescent pregnancy/ or sexting/ or sexually transmitted disease/ or unwanted pregnancy/ or sexual behavior/ or sexual intercourse/ or acquired immune deficiency syndrome/ or Human immunodeficiency virus/
28	("unwanted pregnancy" or "sexually transmitted infection*" or STIs or STDs or "teen* pregnancy" or "unprotected sex*" or "first intercourse" or "casual sexual relations*" or "intimate sexual contact" or "under age sex" or "underage sex*" or "under-age sex*" or " underage pregnancy" or " under age pregnancy" or "under-age pregnancy" or sex-text or "sex text" or "sexual behav*" or "sexual risk").ab,ti.
29	27 or 28
30	gambling/
31	(betting or gambling).ab,ti.
32	30 or 31
33	unhealthy diet/ or sugar-sweetened beverage/ or fast food/ or adolescent nutrition/
34	("poor diet*" or "dietary behav*" or "eating behav*" or "sugary drink*" or sweet*).ab,ti.
35	33 or 34
36	physical inactivity/ or exercise/ or physical activity/ or fitness/ or sedentary lifestyle/
37	("physical inactiv*" or "physical activ*" or exercis* or sport*).ab,ti.
38	36 or 37
39	11 or 14 or 17 or 20 or 23 or 26 or 29 or 32 or 35 or 38
40	4 and 8 and 39
41	limit 40 to yr="1997 -Current"

Legend: Initial search: date of search-30.04.2020. Interface-Ovid. Database and coverage-Excerpta Medica Database (EMBASE) 1947 to present, updated daily. Limits applied-1997 to 30.04.2020. Updated search: date of search-06.06.2022. Interface-Ovid. Database and coverage-Excerpta Medica Database (EMBASE) 1947 to present, updated daily. Limits applied-2020 to 06.06.2022.

Table A2.4. Medical Literature Analysis and Retrieval System Online (MEDLINE) search strategy

String number	String
1	adolescent/ or child/ or students/
2	("young people" or youth or "school child*" or teen* or "young person*" or "middle school" or "middle-school" or "secondary school" or "high school" or iGen or "generation Z" or "gen Z").ab,ti.
3	1 or 2
4	online social networking/ or social media/ or smartphone/ or internet/ or screen time/
5	(("screen time" or "social media" or "social networking" or "social-networking" or "social network* site*" or "web 2.0" or "online game*" or "online gaming" or "online social gaming" or hashtag or "instant messag*" or instagram or "Whats App" or whatsapp or facebook or twitter or linkedin or youtube or "you tube" or tumblr or vine or snapchat or myspace or bebo or reddit or neknominate or myspace or wickr or telegram or whisper or "kik messenger" or "Tencent QQ" or wechat or meetup or tiktok or hinge or happn or bumble or grindr or Tinder or "inner circle" or periscope or twitch) adj2 (usage or use*)).ab,ti.
6	("screen time" or "social media" or "social networking" or "social-networking" or "social network* site*" or "web 2.0" or "online game*" or "online gaming" or "online social gaming" or hashtag or "instant messag*" or instagram or "Whats App" or whatsapp or facebook or twitter or linkedin or youtube or "you tube" or tumblr or vine or snapchat or myspace or bebo or reddit or neknominate or myspace or wickr or telegram or whisper or "kik messenger" or "Tencent QQ" or wechat or meetup or tiktok or hinge or happn or bumble or grindr or Tinder or "inner circle" or periscope or twitch).ab,ti.
7	4 or 5 or 6
8	Risk-Taking/ or exp Substance-Related Disorders/
9	("substance use*" or "substance abuse*" or "substance misuse*" or "risk taking behav*" or "risk-taking behav*" or "risk behav*" or "risk-behav*" or "risky behav*" or "multiple risk behav*").ab,ti.
10	8 or 9
11	exp "Tobacco Use"/ or exp Smoking/ or Tobacco/
12	("chewing tobacco" or "smokeless tobacco" or "tobacco dependence" or "tobacco consumption" or "tobacco snuff" or "cigarette smoking" or "adolescent smok*" or "smoking initiation" or "smoking behav*" or cigarette*).ab,ti.
13	11 or 12
14	Electronic Nicotine Delivery Systems/
15	("electronic cigarette*" or "e-cigarette*" or Juul or vaping or vape).ab,ti.
16	14 or 15
17	alcohol drinking/ or binge drinking/ or underage drinking/ or drinking behavior/ or alcohol abstinence/ or temperance/ or alcoholism/
18	("alcohol consumption" or "alcohol abuse*" or "alcohol intoxication" or "problem drinking" or "alcohol intake" or "alcohol use*" or "under-age drinking" or "under age drinking" or "underage drinking").ab,ti.
19	17 or 18
20	"Marijuana Use"/ or Marijuana Abuse/ or exp Illicit Drugs/ or exp Drug Misuse/
21	("cannabis use*" or "cannabis addict*" or "drug abuse*" or "street drug*" or "drug use*" or "drug misuse*" or weed or skunk or cannabis or marijuana or cocaine or

	"special k" or crack or methamphetamine* or ecstasy or heroin or LSD or steroid* or ketamine or MDMA or GHB or GBL).ab,ti.
22	20 or 21
23	social problems/ or juvenile delinquency/ or violence/ or theft/
24	("anti-social behav*" or "antisocial behav*" or assault or gang or fight* or steal* or shoplift* or vandal* or "public nuisance" or "physical assault").ab,ti.
25	23 or 24
26	pregnancy in adolescence/ or pregnancy, unwanted/ or sexual behavior/ or unsafe sex/ or exp Sexually Transmitted Diseases/ or exp HIV infections/
27	(sexting or sex-text or "sex text" or "sexual intercourse" or "unwanted pregnancy" or "sexually transmitted infection*" or STIs or STDs or "teen* pregnancy" or "unprotected sex*" or "first intercourse" or "casual sexual relations*" or "intimate sexual contact" or "under age sex" or "underage sex*" or "under-age sex*" or "underage pregnancy" or "under age pregnancy" or "under-age pregnancy" or "sexual behav*" or "sexual risk").ab,ti.
28	26 or 27
29	Gambling/
30	(betting or gambling).ab,ti.
31	29 or 30
32	Diet/ or Sugar-Sweetened Beverages/ or Fast Foods/
33	("unhealthy diet*" or "adolescent nutrition" or "poor diet*" or "dietary behav*" or "eating behav*" or "sugary drink*" or sweet*).ab,ti.
34	32 or 33
35	Sedentary Behavior/ or exp Exercise/ or exp Physical Fitness/
36	("physical inactiv*" or "physical activ*" or exercis* or sport*).ab,ti.
37	35 or 36
38	10 or 13 or 16 or 19 or 22 or 25 or 28 or 31 or 34 or 37
39	3 and 7 and 38
40	limit 39 to yr="1997 -Current"

Legend: Initial search: date of search-30.04.2020. Interface- Ovid. Database and coverage-Medical Literature Analysis and Retrieval System Online (MEDLINE)(R),1946 to present. Limits applied-1997 to 30.04.2020. Updated search: date of search-06.06.2022. Interface-Ovid. Database and coverage-Medical Literature Analysis and Retrieval System Online (MEDLINE)(R),1946 to present. Limits applied-2020 to 06.06.2022.

Table A2.5. American Psychological Association (APA) PsycINFO search strategy

String number	String
1	(DE "Middle School Students" OR DE "High School Students" OR DE "Students")
2	TI (adolescent* OR child* OR "young people" OR youth OR "school child*" OR teen* OR "young person*" OR "middle school" OR middle-school OR "secondary school" OR "high school" OR iGen OR "generation Z" OR "gen Z") OR AB (adolescent* OR child* OR "young people" OR youth OR "school child*" OR teen* OR "young person*" OR "middle school" OR middle-school OR "secondary school" OR "high school" OR iGen OR "generation Z" OR "gen Z")
3	S1 OR S2
4	(DE "Online Social Networks" OR DE "Internet" OR DE "Social Media" OR DE "Smartphones" OR DE "Screen Time")
5	TI ("screen time" OR "social media" OR "social network* site*" OR"social networking" OR "social-networking" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch) N2 (usage OR use*)) OR AB ("screen time" OR "social media" OR "social network* site*" OR "social networking" OR "social-networking" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch) N2 (usage OR use*))
6	TI ("screen time" OR "social media" OR "social network* site*" OR "social networking" OR "social-networking" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch) OR AB ("screen time" OR "social media" OR "social networking" OR "social network* site*" OR "social-networking" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch)
7	S4 OR S5 OR S6
8	(DE "Risk Taking" OR DE "Substance Use Disorder")
9	TI ("substance use*" OR "substance abuse*" OR "substance misuse*" OR "risk-behav*" OR "risk taking behav*" OR "risk-taking behav*" OR "risk behav*" OR "risky behav*" OR "multiple risk behav*") OR AB ("substance use*" OR "substance abuse*" OR "substance misuse*" OR "risk-behav*" OR "risk taking behav*" OR "risk-taking behav*" OR "risk behav*" OR "risky behav*" OR "multiple risk behav*")
10	S8 OR S9
11	(DE "Tobacco Smoking" OR DE "Smokeless Tobacco" OR DE "Tobacco Use Disorder")

12	TI ("adolescent smok*" OR "chewing tobacco" OR "tobacco dependence" OR "tobacco use" OR "tobacco consumption" OR "tobacco snuff" OR cigarette* OR "smoking initiation" OR "smoking behav*") OR AB ("adolescent smok*" OR "chewing tobacco" OR "tobacco dependence" OR "tobacco use" OR "tobacco consumption" OR "tobacco snuff" OR cigarette* OR "smoking initiation" OR "smoking behav*")
13	S11 OR S12
14	DE "Electronic Cigarettes"
15	TI ("electronic nicotine delivery system*" OR e-cigarette* OR Juul OR vaping OR vape) OR AB ("electronic nicotine delivery system*" OR e-cigarette* OR Juul OR vaping OR vape)
16	S14 OR S15
17	(DE "Underage Drinking" OR DE "Binge Drinking" OR DE "Drinking Behavior" OR DE "Alcohol Abuse" OR DE "Alcohol Drinking Patterns" OR DE "Alcohol Intoxication" OR DE "Sobriety" OR DE "Alcoholism" OR DE "Alcohol Use Disorder")
18	TI ("alcohol consumption" OR "alcohol abstinence" OR "alcohol abuse*" OR "alcohol use*" OR "problem drinking" OR "alcohol intake" OR temperance OR "under-age drinking" OR "under age drinking" OR "underage drinking") OR AB ("alcohol consumption" OR "alcohol abstinence" OR "alcohol abuse*" OR "alcohol use*" OR "problem drinking" OR "alcohol intake" OR temperance OR "under-age drinking" OR "under age drinking" OR "underage drinking")
19	S17 OR S18
20	DE "Cannabis" OR DE "Hashish" OR DE "Marijuana" OR DE "Cannabinoids" OR DE "Cannabis Use Disorder" OR DE "Drug Abuse" OR DE "Cocaine" OR DE "Drug Usage"
21	TI ("street drug*" OR"cannabis use*" OR "cannabis addict*" OR "illicit drug*" OR "drug abuse*" OR "drug use*" OR "drug misuse*" OR weed OR skunk OR marijuana OR "special k" OR crack OR methamphetamine* OR ecstasy OR heroin OR LSD OR steroid* OR ketamine OR MDMA OR GHB OR GBL) OR AB ("street drug*" OR "cannabis use*" OR "cannabis addict*" OR "illicit drug*" OR "drug abuse*" OR "drug use*" OR "drug misuse*" OR weed OR skunk OR marijuana OR "special k" OR crack OR methamphetamine* OR ecstasy OR heroin OR LSD OR steroid* OR ketamine OR MDMA OR GHB OR GBL)
22	S20 OR S21
23	DE "Antisocial Behavior" OR DE "Juvenile Delinquency" OR DE "Violence" OR DE "Gangs" OR DE "Social Issues" OR DE "Theft" OR DE "Vandalism"
24	TI ("anti-social behav*" OR shoplift* OR "social problem*" OR assault OR fighting OR steal* OR "public nuisance") OR AB ("anti-social behav*" OR shoplift* OR "social problem*" OR assault OR fighting OR steal* OR "public nuisance")
25	S23 OR S24
26	DE "Adolescent Pregnancy"OR DE "Sexting" OR DE "Sexually Transmitted Diseases" OR DE "Sexual Risk Taking" OR DE "Sexual Intercourse (Human)" OR DE "AIDS" OR DE "HIV"
27	TI ("unwanted pregnancy" OR "sexually transmitted infection*" OR STIs OR STDs OR "teen* pregnancy" OR "unprotected sex" OR "first intercourse" OR "casual sexual relations*" OR "intimate sexual contact" OR "underage sex" OR "under-age sex" OR "under age sex" OR "underage pregnancy" OR "under-age pregnancy" OR "under age pregnancy" OR sex-text OR "sex text") OR AB ("unwanted pregnancy" OR "sexually transmitted infection*" OR STIs OR STDs OR "teen* pregnancy" OR "unprotected sex" OR "first intercourse" OR "casual sexual relations*" OR "intimate sexual contact" OR "underage sex" OR "under-age sex" OR "under age sex" OR "underage pregnancy" OR "under-age pregnancy" OR "under age pregnancy" OR sex-text OR "sex text")
28	S26 OR S27
29	DE "Gambling"
30	TI ("betting OR gambling) OR AB ("betting OR gambling)
31	S29 OR S30
32	DE "Diets" OR DE "Eating Behavior" OR DE "Fast Food"

33	TI ("unhealthy diet*" OR "poor diet*" OR "dietary behav*" OR "sugary drink*" OR sweet* OR "sugar-sweetened beverage*" OR "sugar sweetened beverage*" OR "adolescent nutrition") OR AB ("unhealthy diet*" OR "poor diet*" OR "dietary behav*" OR "sugary drink*" OR sweet* OR "sugar-sweetened beverage*" OR "sugar sweetened beverage*" OR "adolescent nutrition")
34	S32 OR S33
35	(DE "Physical Activity" OR DE "Exercise" OR DE "Physical Fitness" OR DE "Sedentary Behavior")
36	TI ("physical inactiv*" OR "physical activ*" OR exercis* OR sport*) OR AB ("physical inactiv*" OR "physical activ" OR exercis* OR sport*)
37	S35 OR S36
38	S10 OR S13 OR S16 OR S19 OR S22 OR S25 OR S28 OR S31 OR S34 OR S37
39	S3 AND S7 AND S38

Legend: Initial search: date of search-30.04.2020. Interface-EBSCOhost. Database and coverage-American Psychological Association (APA) PsycINFO,1800s to present. Limits applied-01.01.1997 to 30.04.2020. Updated search: date of search- 06.06.2022. Interface-EBSCOhost. Database and coverage- American Psychological Association (APA) PsycINFO,1800s to present. Limits applied-01.04.2020 to 31.06.2022.

Table A2.6. SocINDEX search strategy

String number	String
1	DE "STUDENTS" OR DE "MIDDLE school students" OR DE "HIGH school students" OR DE "ADOLESCENCE" OR DE "CHILDREN" OR DE "TEENAGERS" OR DE "YOUTH"
2	TI ("young people" OR "school child*" OR teen* OR "young person*" OR "middle school" OR middle-school OR "secondary school" OR "high school" OR iGen OR "generation Z" OR "gen Z") OR AB ("young people" OR "school child*" OR teen* OR "young person*" OR "middle school" OR middle-school OR "secondary school" OR "high school" OR iGen OR "generation Z" OR "gen Z")
3	S1 OR S2
4	DE "SOCIAL media" OR DE "INTERNET" OR DE "SOCIAL networking mobile apps"
5	TI ("smart phone" OR smartphone OR "screen time" OR "social media" OR "social network* site*" OR "social networking" OR "social-networking" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch) N2 (usage or use*)) OR AB ("smart phone" OR smartphone OR "screen time" OR "social media" OR "social network* site*" OR "social networking" OR "social-networking" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch) N2 (usage or use*))
6	TI ("smart phone" OR "smartphone" OR "screen time" OR "social media" OR "social network* site*" OR "social networking" OR "social-networking" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch) OR AB ("smart phone" OR "smartphone" OR "screen time" OR "social media" OR "social network* site*" OR "social networking" OR "social-networking" OR "web 2.0" OR "online game*" OR "online gaming" OR "online social gaming" OR hashtag OR "instant messag*" OR instagram OR "Whats App" OR whatsapp OR facebook OR twitter OR linkedin OR youtube OR "you tube" OR tumblr OR vine OR snapchat OR myspace OR bebo OR reddit OR neknominate OR myspace OR wickr OR telegram OR whisper OR "kik messenger" OR "Tencent QQ" OR wechat OR meetup OR tiktok OR hinge OR happn OR bumble OR grindr OR Tinder OR "inner circle" OR periscope OR twitch)
7	S4 OR S5 OR S6
8	DE "RISK-taking behavior" OR DE "SUBSTANCE abuse"
9	TI ("substance misuse*" OR "substance use*" OR risk-behav* OR "risk behav*" OR "risky behav*" OR "risk-taking behav*" OR "risk taking behav*" OR "multiple risk behav*") OR AB ("substance misuse*" OR "substance use*" OR risk-behav* OR "risk behav*" OR "risky behav*" OR "risk-taking behav*" OR "risk taking behav*" OR "multiple risk behav*")
10	S8 OR S9
11	DE "SMOKING" OR DE "TOBACCO use" OR DE "CIGARETTE smokers" OR DE "CIGARETTES"

12	TI ("adolescent smok*" OR "chewing tobacco" OR "tobacco dependence" OR "tobacco consumption" OR "tobacco snuff" OR "smoking initiation" OR "smoking behav*") OR AB (("adolescent smok*" OR "chewing tobacco" OR "tobacco dependence" OR "tobacco consumption" OR "tobacco snuff" OR "smoking initiation" OR "smoking behav*")
13	S11 OR S12
14	TI ("electronic nicotine delivery system*" OR "electronic cigarette*" OR e-cigarette* OR Juul OR vaping OR vape) OR AB ("electronic nicotine delivery system*" OR "electronic cigarette*" OR e-cigarette* OR Juul OR vaping OR vape)
15	DE "UNDERAGE drinking" OR DE "BINGE drinking" OR DE "ALCOHOL drinking" OR DE "ALCOHOLIC intoxication" OR DE "DRINKING behavior" OR DE "ALCOHOLISM" OR DE "TEMPERANCE" OR DE "YOUTH & alcohol"
16	TI ("alcohol consumption" OR "alcohol abstinence" OR "alcohol abuse*" OR "under age drinking" OR "underage drinking" OR "under-age drinking" OR "alcohol use*" OR "alcohol intake" OR "problem drinking") OR AB ("alcohol consumption" OR "alcohol abstinence" OR "alcohol abuse*" OR "under age drinking" OR "underage drinking" OR "under-age drinking" OR "alcohol use*" OR "alcohol intake" OR "problem drinking")
17	S15 OR S16
18	DE "MARIJUANA abuse" OR DE "DRUG abuse" OR DE "MARIJUANA" OR DE "DRUGS of abuse" OR DE "DRUGS" OR DE "COCAINE" OR DE "COCAINE abuse"
19	TI ("drug use*" OR "drug misuse*" OR "drug abuse*" OR "illicit drug*" OR "cannabis use*" OR "cannabis addict*" OR "illicit drug*" OR weed OR skunk OR marijuana OR "special k" OR crack OR methamphetamine* OR ecstasy OR heroin OR LSD OR steroid* OR ketamine OR MDMA OR GHB OR GBL) OR AB ("drug use*" OR "drug misuse*" OR "drug abuse*" OR "illicit drug*" OR "cannabis use*" OR "cannabis addict*" OR "illicit drug*"OR weed OR skunk OR marijuana OR "special k" OR crack OR methamphetamine* OR ecstasy OR heroin OR LSD OR steroid* OR ketamine OR MDMA OR GHB OR GBL)
20	S18 OR S19
21	DE "JUVENILE delinquency" OR DE "SCHOOL violence" OR DE "GANGS" OR DE "SCHOOL vandalism" OR DE "YOUTH gangs" OR DE "SOCIAL problems"
22	TI ("antisocial behav*" OR "anti-social behav*" OR assault OR fighting OR steal* OR shoplift* OR vandal* OR "public nuisance") OR AB ("antisocial behav*" OR "anti-social behav*" OR assault OR fighting OR steal* OR shoplift* OR vandal* OR "public nuisance")
23	S21 OR S22
24	DE "TEENAGE pregnancy" OR DE "SEXUALLY transmitted diseases" OR DE "UNWANTED pregnancy" OR "SEXUAL intercourse" OR DE "AIDS"
25	TI ("adolescent pregnancy" OR "teen* pregnancy" OR sexting OR sex-text OR "sex text" OR "sexual behav*" OR "human immunodeficiency virus" OR HIV OR "sexually transmitted infection*" OR STIs OR STDs OR "unprotected sex" OR "first intercourse" OR "casual sexual relations*" OR "intimate sexual contact" OR "under age sex" OR "under-age sex" OR "underage sex" OR "under age pregnancy" OR "underage pregnancy" OR "under-age pregnancy") OR AB ("adolescent pregnancy" OR "teen* pregnancy" OR sexting OR sex-text OR "sex text" OR "sexual behav*" OR "human immunodeficiency virus" OR HIV OR "sexually transmitted infection*" OR STIs OR STDs OR "unprotected sex" OR "first intercourse" OR "casual sexual relations*" OR "intimate sexual contact" OR "under age sex" OR "under-age sex" OR "underage sex" OR "under age pregnancy" OR "underage pregnancy" OR "under-age pregnancy")
26	S24 OR S25
27	DE "GAMBLING behavior"
28	TI (betting OR gambling) OR AB (betting OR gambling)
29	S27 OR S28
30	TI ("unhealthy diet*" OR "sugar-sweetened beverage*" OR "sugar sweetened beverage*" OR "fast food" OR "adolescent nutrition" OR "poor diet*" OR "dietary

	behav*" OR "eating behav*" OR "sugary drink*" OR sweet*) OR AB ("unhealthy diet*" OR "sugar-sweetened beverage*" OR "sugar sweetened beverage*" OR "fast food" OR "adolescent nutrition" OR "poor diet*" OR "dietary behav*" OR "eating behav*" OR "sugary drink*" OR sweet*)
31	DE "PHYSICAL fitness" OR DE "EXERCISE"
32	TI ("physical inactiv*" OR "physical activ*" OR exercis* OR sport* OR sedentary) OR AB (("physical inactiv*" OR "physical activ*" OR exercis* OR sport* OR sedentary)
33	S31 OR S32
34	S10 OR S13 OR S14 OR S17 OR S20 OR S23 OR S26 OR S29 OR S30 OR S33
35	S3 AND S7 AND S34

Legend: Initial search: date of search-30.04.2020. Interface-EBSCOhost. Database and coverage-SocINDEX with Full Text, 1908 to present. Limits applied-01.01.1997 to 30.04.2020. Updated search: date of search-06.06.2022. Interface-EBSCOhost. Database and coverage-SocINDEX with Full Text, 1908 to present. Limits applied-01.04.2020 to 31.06.2022.

Table A2.7. Social Science Research Network (SSRN e-library vis SSRN) search strategy

String	Initial search	Updated search
	Records identified for screening	
(child* OR adolescent*) AND ("online social network*" OR "social media" OR "social network* site") AND risk behav*	0	0
(child* OR adolescent*) AND ("online social network*" OR "social media" OR "social network* site") AND (alcohol, OR drug*OR e-cigarette*OR smok* OR tobacco OR sex* OR diet* OR "physical inactiv*" OR antisocial OR anti-social OR gambl*)	0	0
(child* OR adolescent*) AND (facebook OR twitter OR instagram) AND risk behav*	0	0
(child* OR adolescent*) AND (facebook OR twitter OR instagram) AND (alcohol, OR drug*OR e-cigarette*OR smok* OR tobacco OR sex* OR diet* OR "physical inactiv*" OR antisocial OR anti-social OR gambl*)	0	0

Legend: Initial search: date of search-30.04.2020. Search/limits options-title, abstract and key words (no other limits available). Updated search: date of search-06.06.2022. Search/limits options-title, abstract and key words (no other limits available).

Table A2.8. SocArXic preprints search strategy

String	Initial search	Updated search
	Records identified for screening	
(child* OR adolescent* OR student* OR juvenile OR youth OR "young people" OR teen*) AND ("online social network*" OR "social media" OR internet OR "smart phone" OR "screen time" OR "social network* site" OR "social networking" OR "social-networking" OR facebook OR twitter OR instagram) AND (risk behav* OR "substance use" OR alcohol OR drink* OR tobacco OR smok* OR drug* OR e-cigarette* OR cannabis OR "antisocial behav*" OR "sexually transmitted disease*" OR "sexual behav*" OR sexting OR gambl* OR "unhealthy diet*" OR "physical inactiv*" OR sedentary)	11	10

Legend: Initial search: date of search-30.04.2020. Search/limits-no limit/filters/advance search option available. Updated search: date of search-06.06.2022. Search/limits-no limit/filters/ advance search option available.

Table A2.9. PsyArXiv preprints search strategy

String	Initial search	Updated search
	Records identified for screening	
(child* OR adolescent* OR student* OR juvenile OR youth OR "young people" OR teen*) AND ("online social network*" OR "social media" OR internet OR "smart phone" OR "screen time" OR "social network* site" OR "social networking" OR "social-networking" OR facebook OR twitter OR instagram) AND (risk behav* OR "substance use" OR alcohol OR drink* OR tobacco OR smok* OR drug* OR e-cigarette* OR cannabis OR "antisocial behav*" OR "sexually transmitted disease*" OR "sexual behav*" OR sexting OR gambl* OR "unhealthy diet*" OR "physical inactiv*" OR sedentary)	6	35

Legend: Initial search: date of search-30.04.2020. Search/limits-no limit/filters/advance search option available. Updated search: date of search-06.06.2022. Search/limits-no limit/filters/ advance search option available.

Table A2.10. medRxiv preprints search strategy

String	Initial search	Updated search
	Records identified for screening	
child* AND ("social network* site") AND risk behav*	18	0
child* AND ("social network* site") AND (alcohol, OR drug*OR e-cigarette*OR smok* OR tobacco OR sex* OR diet* OR "physical inactiv*" OR antisocial OR anti-social OR gambl*)	0	0
adolescent*AND ("social network* site") AND risk behav*	0	0
adolescent*AND ("social network* site") AND (alcohol, OR drug*OR e-cigarette*OR smok* OR tobacco OR sex* OR diet* OR "physical inactiv*" OR antisocial OR anti-social OR gambl*)	0	0
child* AND ("social media") AND risk behav*	0	0
child* AND ("social media") AND (alcohol, OR drug*OR e-cigarette*OR smok* OR tobacco OR sex* OR diet* OR "physical inactiv*" OR antisocial OR anti-social OR gambl*)	0	0
adolescent*AND ("social media") AND risk behav*	0	0
adolescent*AND ("social media") AND (alcohol, OR drug*OR e-cigarette*OR smok* OR tobacco OR sex* OR diet* OR "physical inactiv*" OR antisocial OR anti-social OR gambl*)	0	0

Legend: Initial search: date of search-30.04.2020. Search/limits-limited to 01.01.1997-30.04.2020; title, abstract and all terms. Updated search: date of search-06.06.2022. Search/limits-limited to 30.04.2020-06.06.2022; title, abstract and all terms.

Table A2.11. Google scholar via Google search strategy

String	Initial search	Updated search
	Records identified for screening	
(adolescent OR child) AND ("social media") AND ("risk behaviour" OR “risk behavior”)	First 30 records	First 30 records

Legend: Initial search: date of search-30.04.2020. Search/limits-limited to 1997-2020; advanced search function ‘find all words’ selected. Updated search: date of search-06.06.2022. Search/limits-limited to 2020-2022; advanced search function ‘find all words’ selected.

Section A3 Potentially relevant non-English reports

Table A3.1. Record of potentially relevant non-English records excluded at full-text screening

Citation	Language
Blasco V and Bernal S (2019) Patrón de uso de internet y control parental de redes sociales como predictor de sexting en adolescentes: Una perspectiva de género, *Revista de Psicología y Educación*, **14**(1), pp. 16-26	Spanish
Blazquez Barba M, Gomez Romero D, Frontaura Fernández I, Camacho Ojeda A, Rodriguez Salas FM, Toriz Cano H (2018) Use of new technologies by adolescents in the search for health information, *Atencion Primaria*, **50**(9), pp. 547-552	Spanish
González M, Fernández ME, Urturi A, Herrero Bregón B, Fe Muñoz M, Rodríguez Molinero L (2015) Use and risks of information and communication technologies in the adolescents from 13 to 18 years, *Acta Pediatrica Espanola*, **73**, pp. 146-151	Spanish
Marotta R, Rapetto U, Vismara MFM, *et al.* (2018) Impact and risks of new information technologies in adolescents: Results of a survey conducted on 1534 subjects, *Neuropsichiatr dell'Età Evol*, **38**(1), pp. 9–13	Spanish
Pedersen W (2004) Mobile phones, web chat, and sex among Norwegian adolescents, *Tidsskr Nor Laegeforen*, **1**;124(13-14), pp. 1756-1759	Norwegian
Richter M, Heilmann K, Moor I (2020) The good, the bad and the ugly: the relationship between social media use, subjective health and risk behavior among children and adolescents, *Gesundheitswesen*, **83**(3), pp. 198-207	German
Stulhofer A, Vukasović T, Perišić K, Sušac N, Marjanović B, Bauer M, *et al.* (2005) Internet and sexual compulsivity, *Socijalna Psihijatrija*, **33**, pp. 190-200	Croatian

Section A4 Process of social media categorisation

All social media categories outlined in *The SAGE Handbook of Social Media Research Methods* were eligible for inclusion (see Table 1; Sloan and Quan-Haase, 2017). Online (social) gambling and online (social) gaming were deemed eligible exposures due to their inclusion of core social media functionalities, namely interaction between users (Parke *et al.*, 2012; Aburahmah *et al.*, 2016; Kaakinen *et al.*, 2020).

As the functionalities of social media platforms overlap, social media platforms may fall into several social media categories; thus, we made efforts to categorise using the initial premise/purpose of the platform if stated. For example, the social media platform Instagram possesses functionalities central to social networking sites; however, its initial premise/purpose was to facilitate media-sharing. Therefore, where a study reported Instagram use, this was classified under the social media category media-sharing. Where an included study reported use of social media overall, this was classified as general social media use. Thus, we attempted to apply a consistent process to classification drawing upon the information reported within studies. This was conducted during data extraction by the lead author (AKP) and then reviewed by a second reviewer.

A similar process was applied when classifying the type of health-risk behaviour content (user-generated or marketer-generated content) for those datapoints investigating exposure to health-risk behaviour content on social media. Where the exposure pertained to exposure to advertisements, marketing, or influencer content, marketer-generated content was selected. Where the exposure pertained to user/peer posts displaying risk behaviour content, user-generated content was selected. Where insufficient information was reported to facilitate accurate classification, both marketer and user-generated content were selected, and the datapoint was not used in any subsequent stratified analyses or meta-regression.

We also made efforts to classify reported exposures into those assessing active social media use (online behaviours which facilitate direct exchange among

users, e.g., commenting, liking, sending messages and otherwise engaging with other users) and passive use (monitoring of others or content without direct engagement, e.g., browsing/scrolling) (Trifiro and Gerson, 2019).

Section A5 Advisory group

We established an advisory group of experts and policymakers in the field of social media and adolescent health-risk behaviours to provide guidance during protocol development and the review stages. Recruited via expert stakeholders, members included patient/public representatives and stakeholders from policy, non-governmental, and academic sectors (see Table A5.1). In line with the GRADE approach, the advisory group members ranked pre-selected outcomes according to their relative importance on a 9-point Likert scale (categories: 1-3 – of limited importance; 4 to 6 – importance; 7 to 9 – critical) completed via an online survey (see Table A5.2) (Guyatt *et al.*, 2011). The review advisory group members were provided with detailed background information on the review. At the protocol stage, group members were requested to give feedback on several factors, including the relevance of the review's question, population focus, search strategy, ongoing or published studies, and grey literature selection (Thomas *et al.*, 2021). Feedback was received during in-person meetings, via Zoom or email. During the review stage, advisory group members were contacted to identify relevant ongoing, planned, and unpublished studies.

Table A5.1. Advisory group members

Name	Organisation	Period of involvement
Kirsty Blenkins	UK Health Security Agency, Office for Health Improvement and Disparities, London, UK	2020 to present
Lee Carlton	Public Health Scotland, Glasgow, UK	2020 to present
Neil Coles	We Are With You, Kent, UK	2020 to February 2021
Nicholas Hickmott	We Are With You, Kent, UK	2020 to present
Professor John Holmes	Alcohol Policy, University of Sheffield, UK	2020 to present
Rachel Macpherson	Scottish Government, Edinburgh, UK	2020 to present
Dr Ross Whitehead	Public Health Scotland, Edinburgh, UK	2020 to July 2021
Dr Richard Purves	University of Stirling, Stirling, UK	2020 to present

Table A5.2. Feedback from advisory group members (online survey)

Rank outcomes according to their relative importance for the scope of the review and general public health decision-making in the context of social media use[a,b]			
Outcome	Mean score	Rank	Rating
Multiple risk behaviours	7.50	1	Critical
Alcohol use	7.16	2	Critical
Drug use	7.00	3	Critical
Tobacco use	6.50	4	Important
Use of ENDS	5.83	5	Important
Sexual risk behaviours	5.60	6	Important
Gambling	5.16	7	Important
Antisocial behaviour	5.00	8	Important
Inadequate physical activity	5.00	8	Important
Unhealthy dietary behaviours	5.00	8	Important
How well do the presented outcomes cover the review scope?			
Answers	Rating	Number of responses	
Important outcomes presented	71%	5	
Important outcomes missing	29%	2	
Comments on missing outcomes (2):	(1) Selling and advertising of illicit substances (2) Mental health-related outcomes and bullying		

Legend: [a] 9-point Likert scale (categories: 1 to 3-of limited importance; 4 to 6-important; and 7 to 9–critical). [b] Seven members of the advisory group responded to the survey. Abbreviation(s): ENDS=Electronic nicotine delivery systems.

Section A6 Included outcomes

Table A6.1. Definitions and illustrative examples of included outcomes

Outcome	Definition	Illustrative examples
Multiple risk behaviours	Two or more of the below outcomes	Substance use (alcohol, tobacco, and drug use)
Alcohol use	The drinking of beverages containing ethyl alcohol (Stoff *et al.*, 1997)	Weekly alcohol use Frequency of alcohol use Problem, binge, or hazardous drinking
Drug use	Use of drugs for psychotropic rather than medical purposes, potentially including both legal and illegal substances (Steiner, 2020)	Ever used cannabis Illicit drug use Frequency of drug use
Tobacco use	The practice of smoking tobacco and inhaling tobacco smoke (Hilton *et al.*, 2020)	Ever smoked a cigarette Frequency of tobacco use
Use of electronic nicotine delivery systems (ENDS)	Umbrella term for vapes, vaporisers, vape pens, e-cigarettes, and e-pipes. ENDS are non-combustible tobacco products which use an e-liquid, containing nicotine (US Food & Drug Administration, 2020)	Ever tried an e-cigarette Frequency of e-cigarette use
Sexual risk behaviour	Initiation of sexual activity at an early age, engaging in unnatural or unprotected sexual intercourse, having sexual intercourse with multiple partners, engaging in paid or irregular or incentive-driven sex or sexual intercourse with an injecting drug user or under the influence of psychoactive substances, which may result in sexually transmitted infections, unintended/early pregnancies/abortions or legal or interpersonal conflicts (Chawla and Sarkar, 2019)	Early age of sexual debut Transactional sex Unprotected sex Sexual intercourse with multiple partners Posting, sharing, or exchanging sexual content using social media
Gambling (not via social media)	Placing something of value (usually but not always money) in hope of acquiring something of greater value (Wilber and Potenza, 2006)	Problem gambling Pathological gambling Internet gambling (not via social media)
Unhealthy dietary behaviour	Umbrella term referring to all phenomena related to food choice, eating behaviour, and dietary intake/nutrition. Disordered eating not considered (Stok *et al.*, 2018)	Low level of fruit and vegetable consumption High fat/sugar/salt diet Low-fibre diet
Inadequate physical activity	Doing no or very little physical activity at work, at home, for transport or in discretionary time (Bull *et al.*, 2004)	Physically active for <60 minutes/day on <5 day/week Low levels of physical activity
Anti-social behaviour	Any action which violates social norms in ways which reflect disregard for others or which reflect the violation of another's rights (Stoff *et al.*, 1997)	Violence Criminal damage Graffiti/vandalism Aggregated assault Assault with or without injury Stealing/theft Carrying a weapon

Section A7 Meta-analyses and Synthesis Without Meta-analysis (SWiM) decision rules

The below guidance outlines the decision rules used when selecting datapoints/studies for inclusion in meta-analyses and Synthesis Without Meta-analysis (SWiM).

Duplicate studies (i.e., those looking at the same population, exposure(s), outcome(s) and during overlapping time period)

- Select study with longest follow-up period
- If studies have the same follow-up period, select largest (or most representative)
- If studies are the same size, choose the most recent

Where a study includes multiple repeat cross-sectional samples or investigates multiple study populations from different settings, these should be entered as separate datapoints, however, will be classified under the primary study from which they originate.

There may be instances of duplicate datapoints, but if some datapoints are unique (investigate different outcomes) between studies, the overall study should be retained, and individual duplicate datapoints will be removed at the next stage.

Duplicate/overlapping datapoints

Eight options:

1. Include in meta-analysis
2. Include in stratified analysis (sensitivity/subgroup analysis)
3. Include in meta-analysis and stratified analysis
4. Include in SWiM

5. Include in meta-analysis and SWiM

6. Include in stratified analysis and SWiM

7. Include in all analyses

8. Exclude from all analyses (where sex-stratified datapoints are selected for inclusion and whole sample datapoint is not used)

Selection of datapoints for meta-analysis

- In ensuring independence of data, only one effect size per outcome from each study should be used in each meta-analysis. However, datapoints not included in meta-analyses due to potential double counting of participants may be used within stratified analyses

- Meta-analysis should be performed for each exposure (time spent on social media, frequency of social media use and exposure to health-risk behaviour content on social media), by common metric (standardised beta, standardised mean difference, or odds ratio) and by outcome

- Meta-analysis should be conducted when ≥3 datapoints are available for a specific synthesis

- Meta-analyses should be conducted at the datapoint/outcome level, and all forest plots presented should report the RoB grade at the datapoint/outcome level

Exposure

Multiple comparison groups:

Select the largest comparator group unless this would affect the comparability of results within studies, in which case select the most common/unifying comparison group. Where a common/unifying comparison group cannot be identified for a datapoint, report in SWiM.

Same outcome assessed by multiple exposures:
The most used exposure should be selected (i.e., the exposure for which most studies contribute a result). The below criteria should additionally be considered, in order of importance:

1. Ways of measuring the same construct - select validated rather than subjective/self-report exposure measure

2. Analysis - select exposure pertaining to adjusted estimate (i.e., adjusted for pre-specified critical confounding domains) or estimate which can be meta-analysed

3. Timepoint - select exposure pertaining to datapoint assessing the longest/last occasion measured unless not relevant

Multiple exposure groups from a single datapoint:
Approach taken to overcome a unit of analysis error for a datapoint that could contribute multiple correlated comparisons, as per Cochrane guidance (Higgins, Eldridge, *et al.*, 2021):

1. Combine exposure groups to create a single pair-wise comparison comparable to other included datapoints in the meta-analysis

2. Select one pair of exposure groups and exclude the others, ensuring the groups selected are comparable with other included datapoints in the meta-analysis

Where a second datapoint originating from the same study, with the same exposure, is identified for inclusion in SWiM, the same groups used in the meta-analysis (via selection of one pair of exposure groups/combing exposure groups to create a single pair-wise comparison) should be used to enhance comparability.

Different exposure periods (e.g., past week, current):
Where possible, ensure exposure periods of datapoints to be included in meta-analysis align. Due to heterogeneity of exposures reported across studies, it is

anticipated this may not be possible and each meta-analysis will include datapoints with varying exposure periods.

Outcome

If an adjusted datapoint cannot be converted to a common effect, and summary data or an unadjusted datapoint can be converted to a common effect, use this within meta-analysis. If neither the adjusted/unadjusted datapoint or summary data reported by the study can be converted to a common effect (e.g., change scores, outcome trajectory) report using SWiM.

Multiple outcome measures for the same outcome:

Where studies report multiple measures of the same behaviour (e.g., weekly alcohol consumption, frequency of binge drinking), the most common outcome measure should be selected (i.e., the outcome for which most studies contribute a result). The below criteria should additionally be considered, in order of importance:

1. Ways of measuring the same construct - select validated rather than subjective/self-report outcome measure

2. Analysis - select outcome measure pertaining to adjusted estimate (i.e., adjusted for pre-specified critical confounding domains) or estimate which can be meta-analysed

3. Timepoint - select outcome pertaining to datapoint assessing the longest/last occasion measured unless not relevant

Different outcome periods (e.g., past week, past month use):

Where possible, ensure that outcome periods of datapoints to be included in meta-analysis align. Due to heterogeneity of outcomes reported across studies, it is anticipated this may not be possible, and each meta-analysis will include datapoints with varying outcome periods.

Varying timepoints of follow-up for an outcome:

- Use the longest timepoint/last occasion measured unless not relevant (e.g., sexual intercourse measured at Time 1 (study sample aged 15)

should be selected instead of sexual intercourse measured at Time 2 (study sample aged 16) where age of consent is 16 years in study setting)

- Where multiple timepoints are reported, these should be extracted separately, and sensitivity analysis conducted to explore any differences by study design (cross-sectional vs longitudinal)

Sex

- If sex-stratified datapoints reported, use both
- If whole sample estimate (male and female combined) alongside datapoint for a single-sex reported, use the whole sample estimate
- If only one datapoint is reported pertaining to a single-sex, use this

Selection of datapoints for SWiM (vote counting based on effect direction)

- Where effect estimates are incompletely reported or where study characteristics such as study design, exposures or outcomes are too diverse to provide a meaningful summary effect estimate, report datapoint using SWiM
- Where exposed and unexposed groups reported in a datapoint do not align with the meta-analysis exposed and unexposed group report using SWiM
- Datapoints reporting trajectory of outcome/change in outcome/change scores should not be used in meta-analyses and should be synthesised using SWiM
- Effect direction synthesis should be performed by exposure (time spent on social media, frequency of social media use, exposure to health-risk behaviour content and other social media activities) and by outcome
- Where multiple outcome measures are reported for the same exposure and same outcome, the direction of effects reported across outcome measures should be synthesised using the algorithm proposed by Cochrane based on the proportion of effects which are in a consistent direction

(Boon and Thomson, 2021; McKenzie and Brennan, 2021). Note it is possible for one study assessing one exposure and one outcome measure to demonstrate an unclear/conflicting/inconsistent effect (Boon and Thomson, 2021)

- Where age subsets, study populations from different countries, and repeat cross-sectional samples are reported in the same study, these should be entered as separate studies for purposes of SWiM to maximise use of the available data

- SWiM should be conducted at the study level, and all effect direction plots presented should report the study RoB grade

Exposure

Same outcome assessed by multiple exposures:

The most used exposure selected (i.e., the exposure for which most studies contribute a result). The below criteria will additionally be considered, in order of importance:

1. Ways of measuring the same construct - select validated rather than subjective/self-report exposure measure

2. Analysis - select exposure pertaining to adjusted estimate (i.e., adjusted for pre-specified critical confounding domains). If all datapoints fail to adjust for pre-specified critical confounders, consider adjustment for other justifiable confounders

3. Timepoint - select exposure pertaining to datapoint assessing the longest/last occasion measured unless not relevant

Multiple exposure groups from a single datapoint:

- Where a datapoint is reported in the meta-analysis, and a pairwise comparison is selected/exposure groups are combined, when reporting this datapoint in SWiM ensure the same comparison is used to enhance comparability

- If a datapoint is to be reported in SWiM, and similar datapoints (with the same multiple exposure groups) originating from the same study have not been reported in meta-analyses or SWiM, then select a specific pairwise comparison/combine exposure groups, ensuring efforts are made to maximise use of all data, and the comparison aligns with other datapoints reported in SWiM synthesis

Outcome

Multiple outcome measures reported for the same outcome:

- Where there are multiple outcome measures investigating the same outcome, aggregate these using the effect direction algorithm: report direction of effect where ≥70% of outcomes report similar direction. If <70% of outcomes report consistent direction of effect, then report inconsistent findings (Boon and Thomson, 2021)

- The largest sample size across all aggregated datapoints will be reported in the effect direction plot

Multiple timepoints presented for an outcome from the same study:

- Where there is a cross-sectional and cohort datapoint originating from same study investigating the exact same exposure and outcome, the direction of effect should be aggregated as above. The study design should be reported as a cohort study, and the associated cohort study RoB grade reported within the effect direction plot. The sample size reported should reflect that of the sample used in the cohort datapoint

- If datapoints, are reported for different follow-up periods (e.g., time 1- time 2 and time 1- time 3) aggregate the direction of effect for all datapoints as above and report the associated RoB grade and sample size for the longest follow-up period

Sex

If sex-stratified datapoints are reported, aggregate these when reporting effect direction and discard the whole sample estimate.

Section A8 Data extraction form exemplar (study and datapoint level variables)

Table A8.1. Data extraction form - study level variables

Field	Brief description	Guidance	Permissible entries
date	Date of data extraction by lead author	Not for completion by second-checker	
source	Where did we find the study?	If this is a relevant publication screened in Covidence	Cov
		If this is a relevant publication found via reference list of systematic review	SR
		If this is a relevant publication identified via manual searching of reference lists of included studies	M
		If this is a relevant publication identified via expert correspondence	E
study_ID	Internal reference number	Source=Covidence	#3343 use the number allocated within Covidence
		Source=Systematic Review	#SR
		Source=Reference list of included studies	#M
		Source=Expert correspondence	#E
second_checker	Name of person doing second checking	To be completed by second-checker	
second_checker_date	Date of second checking	To be completed by second-checker	
first_author	Surname of first author		
year_pub	Year of publication		
published	Where was the study published	If study published in journal	Name of the journal
title	Title of the study		
study_aim	Aim of study	Brief free-text description of the studies aim	
author_contact	Study corresponding author contact details	Insert email of corresponding author	

Field	Brief description	Guidance	Permissible entries
publication_cat	What type of publication is this?		Journal
			Preprint
Length	Was the study cross sectional or longitudinal?	No repeated measures	Cross-sectional
		At least two waves of data collection on the same individuals	Longitudinal
country	Country of study	Where was the study carried out? (including location and social context)	e.g., Toronto Canada (5 Southern Toronto High Schools)
setting	Was the setting classified as a high or middle- or low-income country at the time of the study?	See World Bank Classification. If a study is looking at a range of countries which are a mixture of high-, middle-, and low-income countries, select all options that apply	High-income
			Middle-income
			Low-income
study_years	When did the study run?	Years in which study ran, including any follow-up. Can be expressed either as a range or a list (if certain years were excluded)	
study_design	What kind of study?		Cross-sectional
			Cohort
			Randomised trial of intervention
			Non-randomised trial of intervention
			Cross-sectional analysis of cohort
			Cross-sectional analysis of intervention
			Natural experiment
			Panel study
			Repeat cross-sectional
			Systematic review (primary data unavailable)
data_source_cat	Was primary or secondary data used in this study?		Primary
			Secondary

Field	Brief description	Guidance	Permissible entries
data_source	If secondary data used, what is the name of the data source?	Insert name of data source	
recruitment_ strategy	Recruitment setting/strategy	Free-text description of how participants were reached and recruited into study (e.g., sampling frame, sampling technique, location)	
data_collection	Study data collection method	Free-text description of how and where data was collected from participants (e.g., online survey in home setting/paper survey conducted in classroom, telephone survey)	
response_rate_%	Response rate as percentage	Those who completed baseline/those invited to participate	
inc_criteria	Record study inclusion criteria	Description covering initial inclusion criteria for participation and analytical sample (if we are interested in a subset of the whole sample)	
total_ participants	Total number of study participants in whole sample and analytical sample (if available)	If not reported for analytical sample extract for whole sample	
average_age	Average age of whole sample and analytical sample (if available)	If not reported for analytical sample extract for whole sample	Report mean if available
age_range1	Age-range (indicator of spread) for whole sample and analytical sample (if available)	If not reported for analytical sample extract for whole sample	Report standard deviation if available
age_range2	Sample age-range covered in whole sample and analytical sample (if available)	If not reported for analytical sample extract for whole sample	Report range if available
percent_male	What percentage of the whole sample and analytical sample (if available) were male?	If not reported for analytical sample extract for whole sample	
ethnicity	What is the ethnicity of study participants in the whole sample and analytical sample (if available)	If not reported for analytical sample extract for whole sample	

Field	Brief description	Guidance	Permissible entries
sec	What is the socioeconomic circumstance(s) of the whole sample and analytical sample (if available)	Record the scale/measure used and the distribution amongst study participants in the analytical sample. If not reported for analytical sample extract for whole sample	
conflicts_of_ interest	Any possible conflicts of interest?		Yes
			No
			Not reported
funding_source	Was the study funded by an organisation?	If yes	Record the name of funding bodies
		If no	No
		If not reported	Not reported
ethical_approval	Was ethnical approval obtained for the study?	If yes	Yes
		If no	No
		If not reported	Not reported
		If not required (e.g., secondary data)	Not required
study_notes	Anything else worth recording in relation to study information		

Table A8.2. Data extraction form - datapoint level variables

Field	Brief description	Guidance	Permissible entries
dpID	Internal reference number for datapoint		
dpnum	Datapoint number		
fu_length	What was the length of follow-up for this specific datapoint?	If cross-sectional study	Not applicable
		For longitudinal studies, what was the length of follow-up for the specific datapoint?	Number of months/years
sg_gender/sex	For subgroup analysis, what is the gender/sex of the analytical sample this datapoint relates to?	If sex reported, select either Sex Male, Sex Female, Sex both. If gender reported, select either Gender Male, Gender Female, Gender Both	Gender Male
			Gender Female
			Gender Both
			Sex Male
			Sex Female
			Sex Both
sg_age	For subgroup analysis, what is the average age of the analytical sample this datapoint relates to?	If not available for analytical sample, report for whole sample	
sg_sec	For subgroup analysis, what is the socioeconomic circumstances (SEC) of the analytical sample this datapoint refers to?	If not available for analytical sample, report for whole sample	
		If only includes those with low baseline SEC	Low SEC
		If only includes those on high baseline SEC	High SEC
		If includes a mix of low and high baseline SEC	Mixed- general population
sg_setting	For subgroup analysis what is the World Bank grouping of the study setting country this datapoint refers to at the time of the study?	If not available for analytical sample, report for whole sample	High-income
			Middle-income
			Low-income

Field	Brief description	Guidance	Permissible entries
exp_def	How was the exposure defined within the study?	Authors' description of social media use as per methods	e.g., frequency of social media networking site use, daily time spent using social media (hours/day)
exp_duration	When did data collection for the exposure occur?	Record when data collection for exposure occurred	
time_period_exposure	What time period was the exposure measuring?	Record the time period for which the exposure measures	e.g., ever, current
sg_exp_cat	What social media category is under study for the datapoint?	- Record which social media category is examined for specific data point - A number of social media platforms will fall under several social media types, for example, Twitter is a social networking site and a microblogging site If study authors state the specific type of social media record this, if they do not, make an assessment and record the social media type you think best represents the social media platform(s) under study, considering the initial premise of the platform - Where it is impossible to determine which category is under study, select "Social Media" from the drop-down list	Social networking sites (e.g., Facebook, Whats App, Snapchat, Myspace, Instant messaging)
			Microblogging sites (e.g., Twitter, Tumblr)
			Blogs and forums (e.g., Wordpress, Live journal, discussion boards, pin boards)
			Media-sharing sites (e.g., YouTube, Pinterest, Instagram)
			Geo-location-based sites (e.g., Foursquare)
			Bookmarking sites (e.g., Delicious, Twitter)
			Social news sites (e.g., Reddit, Digg)
			Collaborative authoring sites (e.g., Wikipedia, Google Docs)
			Web-conferencing (e.g., Skype, zoom)
			Scheduling and meeting (e.g., Microsoft outlook, Doodle, Google Calendar)
			Online (social) gambling
			Online (social) gaming
			Social media
exp_platform	What social media platform is under study for the datapoint?	Record the specific social media platforms under study (e.g., Facebook, Reddit) for the specific datapoint or record the examples	

Field	Brief description	Guidance	Permissible entries
		provided in relation to the datapoint under investigation	
sg_exp_content	What type of social media content is understudy for the datapoint?	If user-generated content (e.g., content produced by the user, friends or others in the social media network)	User-generated
		If marketer-generated content (e.g., advertisements & influencer content)	Marketer-generated
		If content is both user-generated and marketer-generated content	User and Marketer-generated
		If social media content is not specifically under investigation (e.g., time spent on social media or frequency of social media use) and we cannot distinguish what type of content the participant is exposed to	Not applicable
exp_ascertain	How was social media use measured for the datapoint?	- Free-text description of measurement tool/instrument (e.g., specific scale, survey question, objective measures of social media usage tracked by mobile phones/electronic devices) - For a scale, provide the name of the scale, upper and lower limits, and whether a high or low score is favourable and state definitions of any thresholds if appropriate - For survey questions, state the name of the survey, question, if it is self-report (or if a proxy has been used state this), question response options, whether a high or low score is favourable, and definitions of any thresholds/categories created if appropriate - Record if objective/validated/self-report measure	

Field	Brief description	Guidance	Permissible entries
exp_measure_ type	What type of measurement is the exposure?		Binary
			Continuous
			Categorical
			Ordinal
exp_mean	Mean of exposure measure	Mean and/or proportion (n/%) of analytical sample or whole sample if not available If exposure is ordinal/categorical, record number of those exposed in each exposure group	
exp_SD	Standard deviation of exposure measure		
outcome_ domain	What outcome does the datapoint report on?	Note 'multiple risk behaviours' should only be used where the analysis has specifically looked at 'multiple risk behaviours' as a single outcome (2 or more of the individual risk behaviours under investigation)	Alcohol use
			Tobacco use
			Drug use
			Use of ENDS
			Unhealthy dietary behaviour
			Inadequate physical activity
			Antisocial behaviour
			Gambling
			Sexual risk behaviour
			Multiple risk behaviours
outcome_def	How was the outcome defined within the study?	Authors' description of outcome as per methods	e.g., frequency of drinking alcohol
outcome_ duration	When did data collection occur for the outcome?	Record when data collection occurred for outcome	e.g., 2004 (wave 2)

Field	Brief description	Guidance	Permissible entries
time_period_ outcome	What time period was the outcome measuring?	Record the time period for which the outcome measures	e.g., ever, current
outcome_ acertain	How was the outcome measured for the datapoint?	- Free-text description of measurement tool/instrument - For a scale, provide the name of the scale, upper and lower limits, and whether a high or low score is favourable and definitions of any thresholds if appropriate - For survey questions, state the name of the survey, question, if it is self-report (or if a proxy has been used state this), question response options, whether a high or low score is favourable, and definitions of any thresholds/ categories created if appropriate - Record if validated tool/medical records/self-report/independent blind assessment	e.g., AUDIT-C. Response categories...
outcome_ measure_type	What type of measurement is the outcome?		Binary
			Categorical
			Continuous
			Ordinal
outcome_mean	Mean of outcome measure	Mean and/or proportion (n/%) of analytical sample or whole sample if not available If exposure is ordinal/categorical, present number of those with outcome in each exposure group.	
outcome_SD	Standard deviation of outcome measure		

Field	Brief description	Guidance	Permissible entries
analytical_ sample	Number of participants in the analytical sample for the datapoint		
dp_measure	What effect measure is reported for the datapoint?	- Where possible record adjusted measures for data extraction purposes if unavailable record unadjusted estimates - Where both adjusted and unadjusted measures are presented, record adjusted estimates in data extraction form and state unadjusted estimates are available - If outcome measure is not listed, input as free text	Correlation coefficient (Pearson's)
			Correlation coefficient (Spearman's)
			Correlation coefficient (Point-biserial)
			Correlation coefficient (Phi)
			Standardised path coefficient (adjusted)
			Standardised path coefficient (unadjusted)
			Unstandardised path coefficient (adjusted)
			Unstandardised path coefficient (unadjusted)
			Standardised regression coefficient (adjusted)
			Standardised regression coefficient (unadjusted)
			Unstandardised regression coefficient (adjusted)
			Unstandardised regression coefficient (unadjusted)
			Standardised linear regression coefficient (adjusted)
			Standardised linear regression coefficient (unadjusted)
			Unstandardised linear regression coefficient (adjusted)
			Unstandardised linear regression coefficient (unadjusted)
			Odds ratio (adjusted
			Odds ratio (unadjusted)
			Risk Ratio (adjusted
			Risk Ratio (unadjusted)
			Mean
			Median

Field	Brief description	Guidance	Permissible entries
			Chi square
			F-statistic
			T-statistic
			Raw summary data extracted
dp_analysis_ type	What type of analysis was conducted?	Insert brief statement on analysis method	
analysis_desc	Describe the analysis used for investigation of the datapoint as per methods	Free-text description of analysis method used	
incomplete_ outcome_ data	Was there any missing data (e.g., unit & item missingness)? How was this managed? Were sampling/non-response weights used?	- Describe the completeness of outcome data for each data point, including attrition (e.g., loss to follow-up, withdrawn, non-response) and exclusions from the analysis - Record if missing data handled appropriately or if weights (e.g., non-response and selection) were employed	
dp_adjustment	If applicable, what confounders were adjusted for?	If adjusted estimates are presented, record all confounders adjusted for	
mediators_effect modifiers	Were mediators/effect modifiers investigated?	State if mediator/moderator investigated Record the name of the mediator/moderator	e.g., mediator: self-esteem
exp_group	What is the exposed group?		
dp_point_est	The datapoint estimate of interest		
n_numerator	Participants in numerator (with outcome) for group of interest	If available	n_numerator
n_denominator	Participants in denominator for group of interest	If available	n_denominator

Field	Brief description	Guidance	Permissible entries
other_denom	Other denominator	Use this to record the analytical sample or total number of participants exposed for continuous exposures	other_denom
lower_ci	Lower 95% CI of main point estimate (if applicable)		lower_ci
upper_ci	Upper 95% CI of main point estimate (if applicable)		
sd_se	SD/SE of point estimate (if applicable)	If SE provided, note and mark (e.g., SE=)	
t_z_stat	T or Z statistic (if applicable)		
p_value	p value of main point estimate		
sig_5%	Is the point estimate of interest significant at 5% level?	Record if significance level has been set at a level other than 5%	Yes
			No, significance level set at (XXX)
comp_group	Description of comparator group	If exposure measure is continuous or point estimate is a correlation, state 'Baseline' here to demonstrate the comparator group is those people with a different level of exposure than the exposed group	e.g., low social media use (<2 hours per day).
datapoint_notes	Location of data point extracted & study author reporting	- Report the location of datapoint, numerators and denominators extracted within each study - Record any issues regarding study author reporting	
comp_point_est	Point estimate for comparator group		
comp_ numerator	Participants in numerator (with outcome) for comparator group estimate	If available	
comp_denom	Participants in denominator for comparator group estimate	If available	

Field	Brief description	Guidance	Permissible entries
other_denom	Other denominator		
comp_lower_ci	Lower 95% CI of comparator estimate (if applicable)		
comp_upper_ci	Upper 95% CI of comparator estimate (if applicable)		
comp_sd_se	SD/SE of comparator estimate (if applicable)	If SE provided, note and mark (e.g., SE=)	
comp_t_z_stat	T or Z statistic if applicable of comparator estimate (if applicable)		
comp_pvalue	p value of comparator estimate		
comp_sig5%	Is p value significant at 5% level?	Record if significance level has been set at a level other than 5%	Yes No, significance level set at (XXX)
comp2…	Fields for second comparator group-replicate those for the first		
other_pot_ relevant_ datapoints	Were other potentially relevant estimates reported for the exposure-outcome combination (datapoint) investigated?	– If other relevant estimates recorded e.g., correlations/standardised estimates, record the estimates and state their location in paper - If unadjusted estimates provided state this	
correspondence_ required	Do you need to contact the study authors for any reason (e.g., accessing original data)?	Add information on required author correspondence	
leadauthor_notes		Insert any notes to aid interpretation	
secondchecker_notes		Insert any notes to aid interpretation	

Legend: Abbreviation(s): AUDIT-C=Alcohol Use Disorders Identification Test; CI=Confidence interval; SD=Standard deviation; SE=Standard error; and SEC=Socioeconomic circumstance(s).

Section A9 Newcastle-Ottawa Scale (NOS) risk of bias assessment

For cross-sectional and cohort studies, an adapted version of the Newcastle Ottawa Scale (NOS) for assessing RoB in non-randomised studies was used (Wells *et al.*, 2000). This section presents the adapted NOS used when assessing RoB of non-randomised studies and the algorithms used when assessing domain level and overall RoB of included datapoints. To ensure a standardised process to NOS RoB assessment, a detailed guidance document prepared by AKP was circulated to the review team. Those studies reporting baseline data from an interventional study were appraised as per cross-sectional studies. RoB assessment was conducted at the datapoint/outcome level. An overall RoB grade was assigned to each study through consideration of the most commonly reported RoB grade across included datapoints from a study, prioritising the overall grade assigned to datapoints which were investigated via the primary analysis conducted in a study.

Adapted Newcastle Ottawa Scale (NOS): Cross-sectional studies

Used when assessing cross-sectional studies, cross-sectional analysis of cohort studies, cross-sectional analysis of intervention studies and repeat cross-sectional studies.

Domain A - Selection (see Figure A9.1)

Selection - Representativeness of original sample

a) Good representativeness of the target population (e.g., all subjects, random sampling)
b) Selection process does not ensure representativeness, but it is clearly described (e.g., non-probability sampling)
c) Selected group of users, with the potential for selection bias
d) No description

Selection- Non-respondents

a) Comparability between respondents' and non-respondents' characteristics established and/or response rate ≥75% of original sample and (if applicable) those with and without missing data established and adjusted for

e) Comparability between respondents and non-respondents is unsatisfactory or response rate <75% or (if applicable) missing data addressed inappropriately
f) No description or unclear

Domain B - Exposure (see Figure A9.2)

Exposure - Ascertainment of exposure

a) Objectively recorded social media usage data, independent of user reports
b) Validated measurement tool
c) Non-validated measurement tool, but the tool is available or described
d) No description or unclear

Domain C- Comparability (see Figure A9.3)

Comparability - Based on analysis of interest - confounding factors are controlled

(a) The study controls for key confounders age, sex/gender, and socioeconomic circumstance(s) (e.g., parental educational attainment, employment, income, or area-level deprivation)
(b) The study controls for key confounders age, sex/gender, and socioeconomic circumstance(s) (e.g., parental educational attainment, employment, income, or area-level deprivation) **and** the study controls for an alternative set of justifiable confounders (e.g., sensation-seeking, peer influence or proxy measures for age, sex/gender, or socioeconomic circumstance(s))
(c) The study controls for an alternative set of justifiable confounders (e.g., sensation-seeking, peer influence or proxy measures for age, sex/gender, or circumstance(s))
(d) No adjustment for potential confounders, no description or unclear

Domain D - Outcome (see Figure A9.4)

Outcome - Assessment of outcome

(a) Independent clinical assessment or validated measurement tool
(b) Medical/administrative records
(c) Self-report

(d) No description, or other inadequate

Figure A9.1. Algorithm to assess the Selection domain of the adapted Newcastle Ottawa Scale for cross-sectional studies

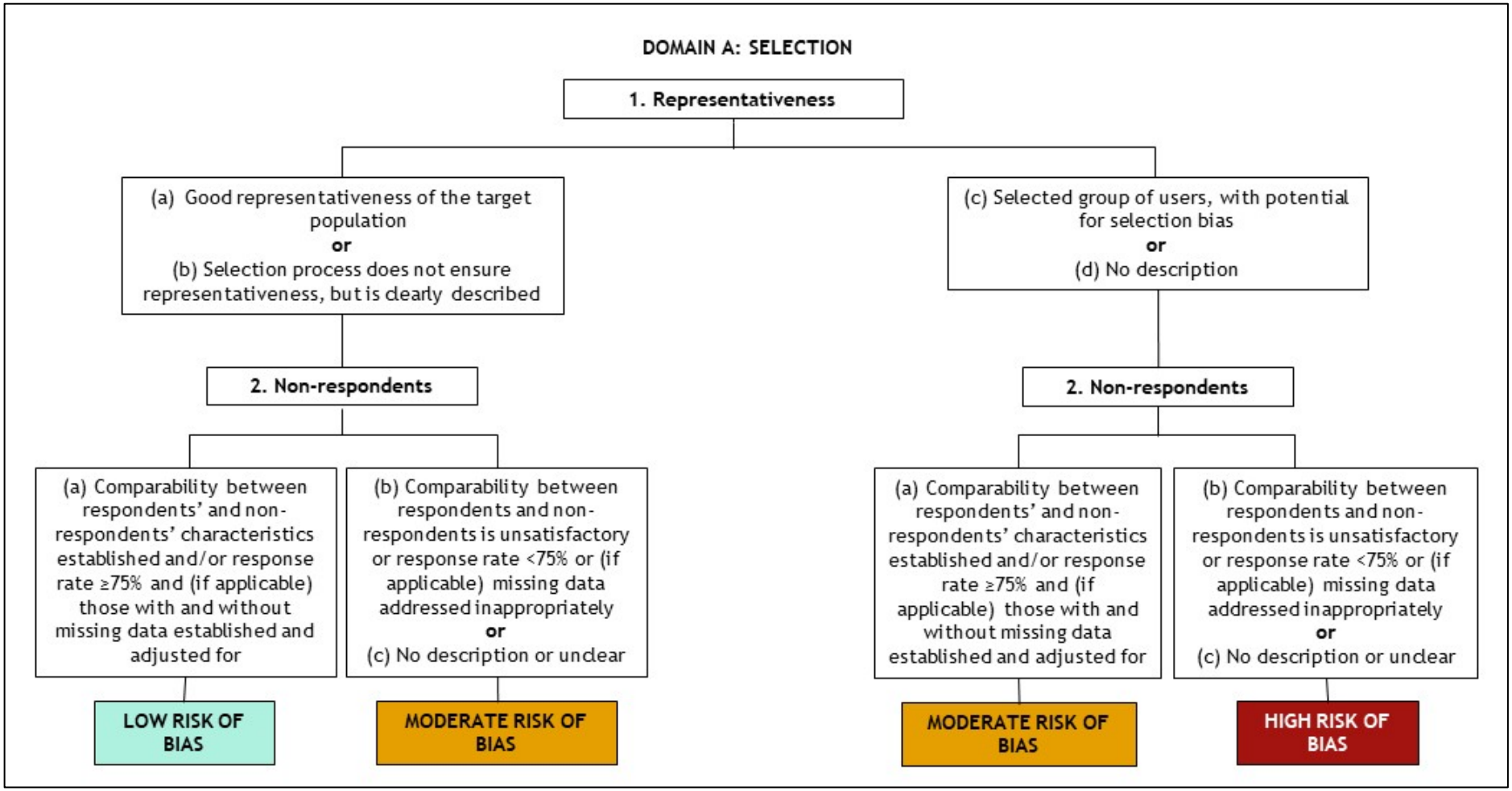


Figure A9.2. Algorithm to assess the Exposure domain of the adapted Newcastle Ottawa Scale for cross-sectional studies

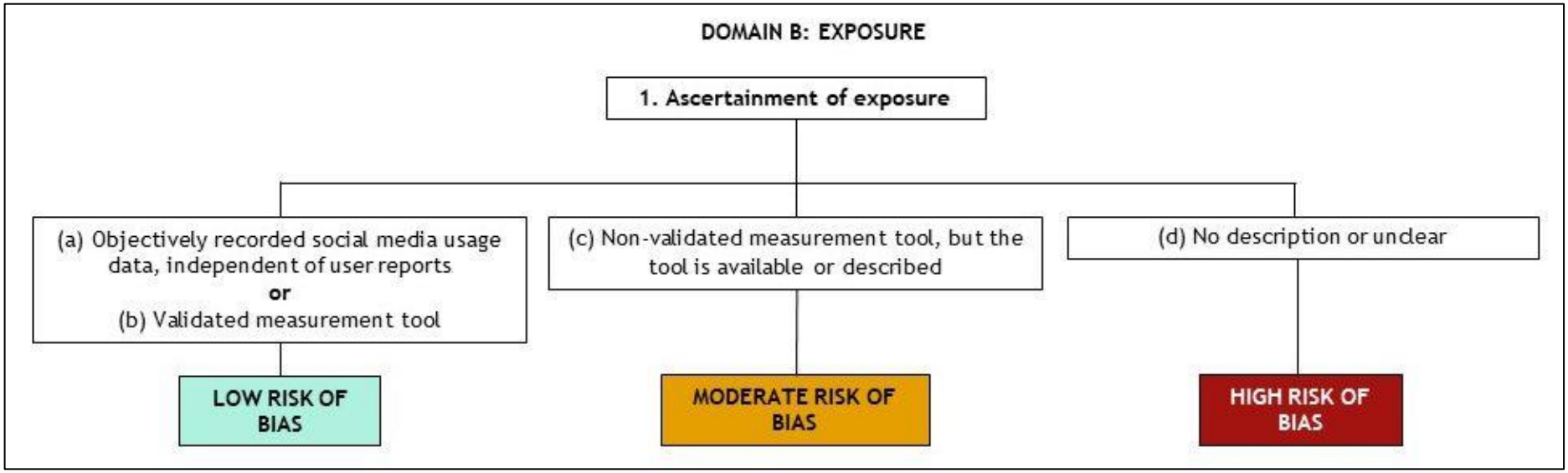


Figure A9.3. Algorithm to assess the Comparability domain of the adapted Newcastle Ottawa Scale for cross-sectional studies

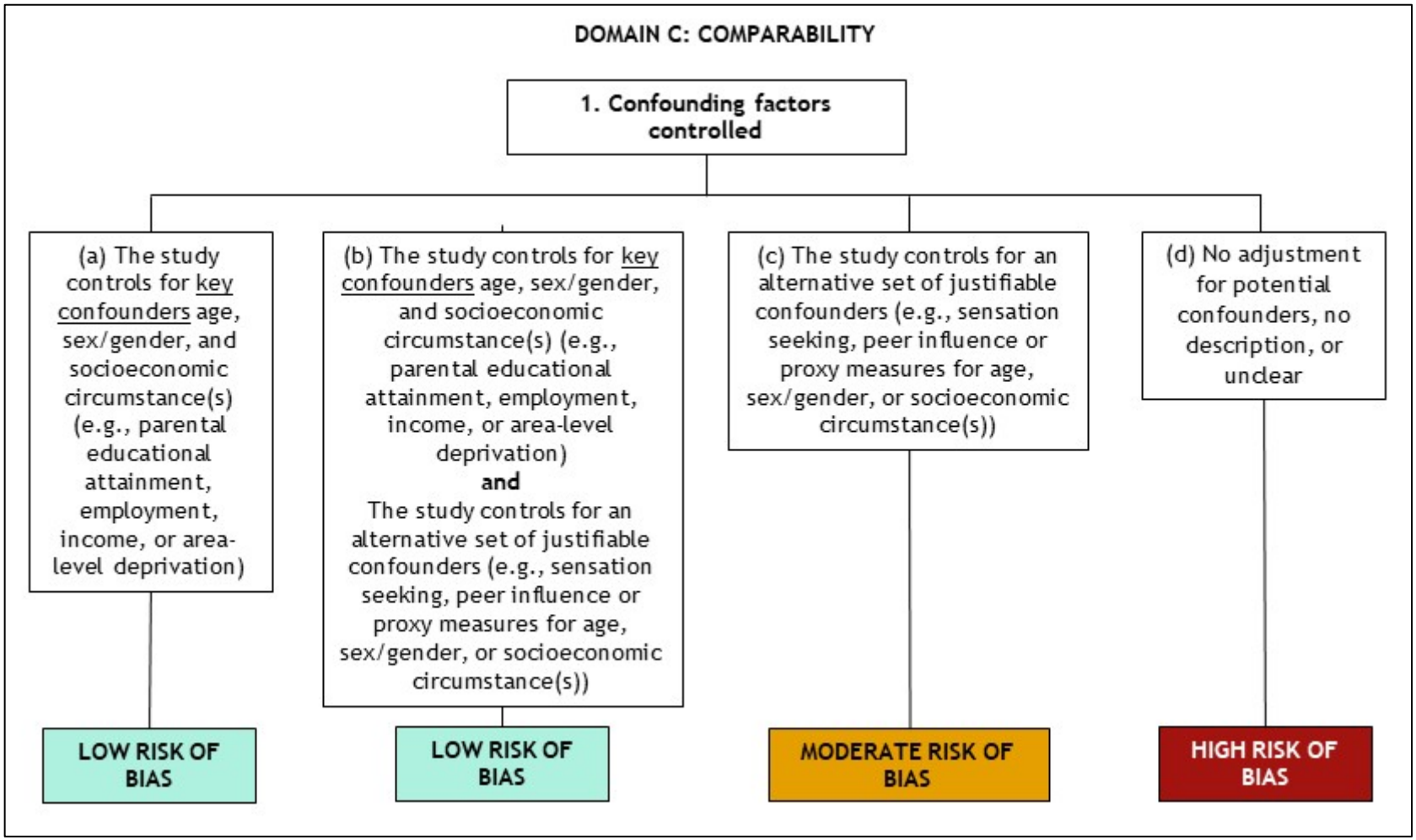
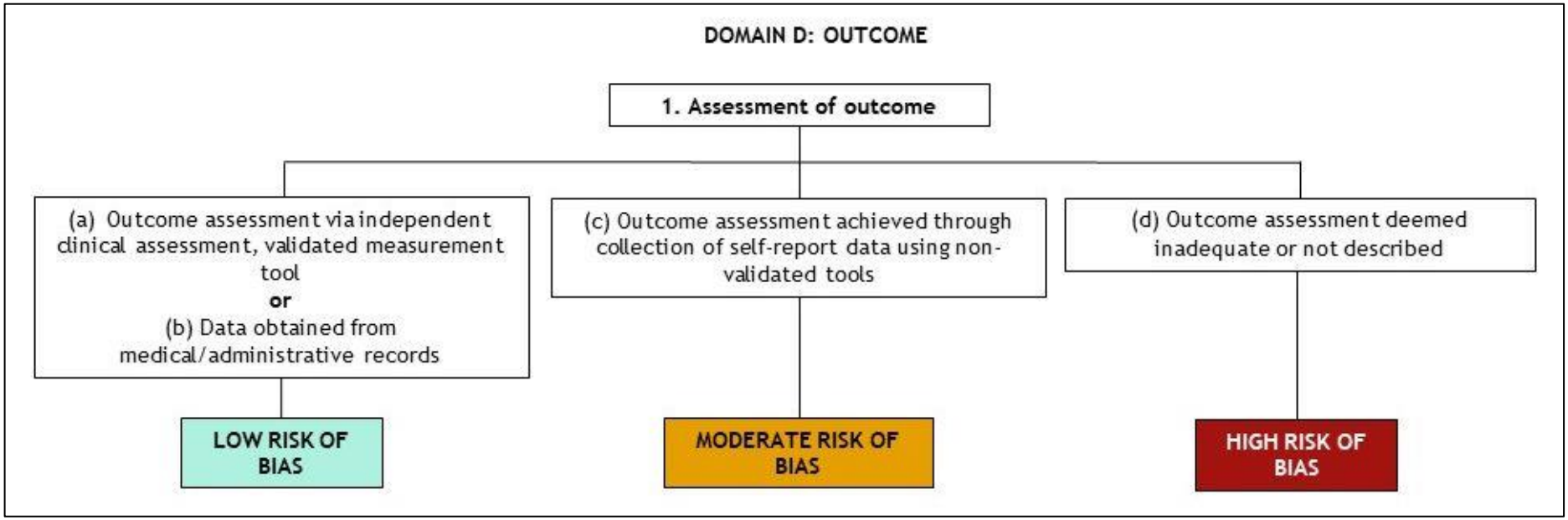


Figure A9.4. Algorithm to assess the Outcome domain of the adapted Newcastle Ottawa Scale for cross-sectional studies



Adapted Newcastle Ottawa Scale (NOS): Cohort studies

Used when assessing cohort and panel studies.

Domain A – Selection (see Figure A9.5)

Selection - Representativeness of the original sample

a) Good representativeness of the target population (e.g., all subjects, random sampling)
b) Selection process does not ensure representativeness, but it is clearly described (e.g., non-probability sampling)
c) Selected group of users, with the potential for selection bias
d) No description

Selection - Selection of the comparator group

a) Drawn from the same community as the exposed cohort
b) Drawn from a different source
c) No description of the derivation of the non-exposed cohort

Domain B – Exposure (see Figure A9.6)

Exposure - Ascertainment of exposure

a) Objectively recorded social media usage data, independent of user reports
b) Validated measurement tool
c) Non-validated measurement tool, but the tool is available or described
d) No description or unclear

Domain C – Comparability (see Figure A9.7)

Comparability- Based on analysis of interest - confounding factors are controlled

e) The study controls for key confounders age, sex/gender, and socioeconomic circumstance(s) (e.g., parental educational attainment, employment, income, or area-level deprivation)
f) The study controls for key confounders age, sex/gender, and socioeconomic circumstance(s) (e.g., parental educational attainment, employment, income, or area-level deprivation), and the study controls for an alternative set of justifiable confounders (e.g., sensation-seeking,

peer influence or proxy measures for age, sex/gender, or socioeconomic circumstance(s))

g) The study controls for an alternative set of justifiable confounders (e.g., sensation-seeking, peer influence or proxy measures for age, sex/gender, or socioeconomic circumstance(s))

h) No adjustment for potential confounders, no description or unclear

Comparability- Accounts for baseline measure of outcome

a) Yes

b) No

Domain D – Outcome (see Figure A9.8)

Outcome - Assessment of outcome

(a) Independent clinical assessment or validated measurement tool

(b) Medical/administrative records

(c) Self-report

(d) No description or other inadequate

Outcome - Adequacy of follow-up

a) Complete follow-up (on all relevant variables) - all subjects accounted for

b) Subjects lost to follow-up or due to missing data <25%, unlikely to introduce bias, or accounted for using weights, imputation etc

c) Loss to follow-up substantial (≥25%) and/or likely to introduce bias

d) Not described or unclear

Figure A9.5. Algorithm to assess the Selection domain of the adapted Newcastle Ottawa Scale for cohort studies

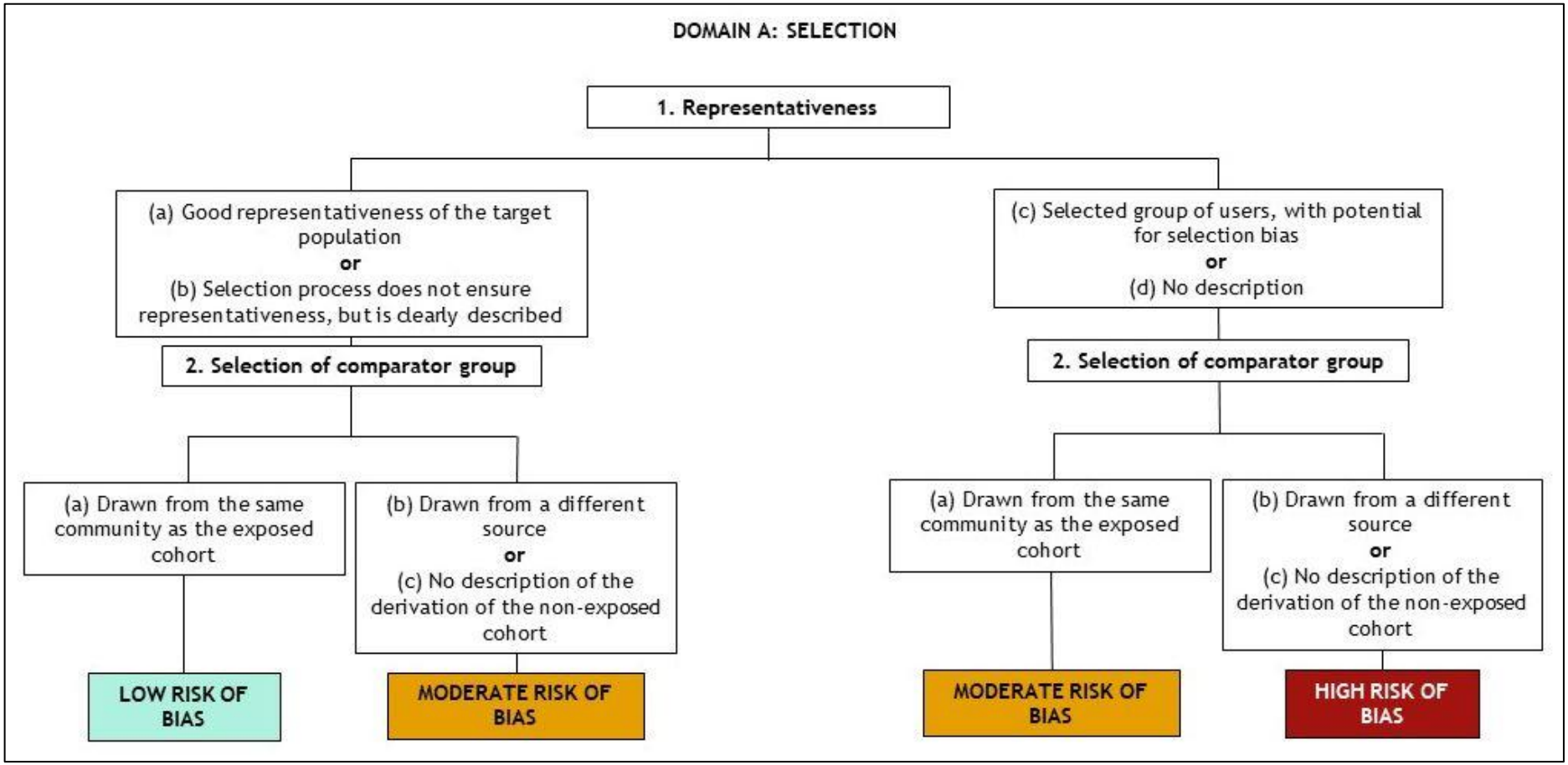


Figure A9.6. Algorithm to assess the Exposure domain of the adapted Newcastle Ottawa Scale for cohort studies

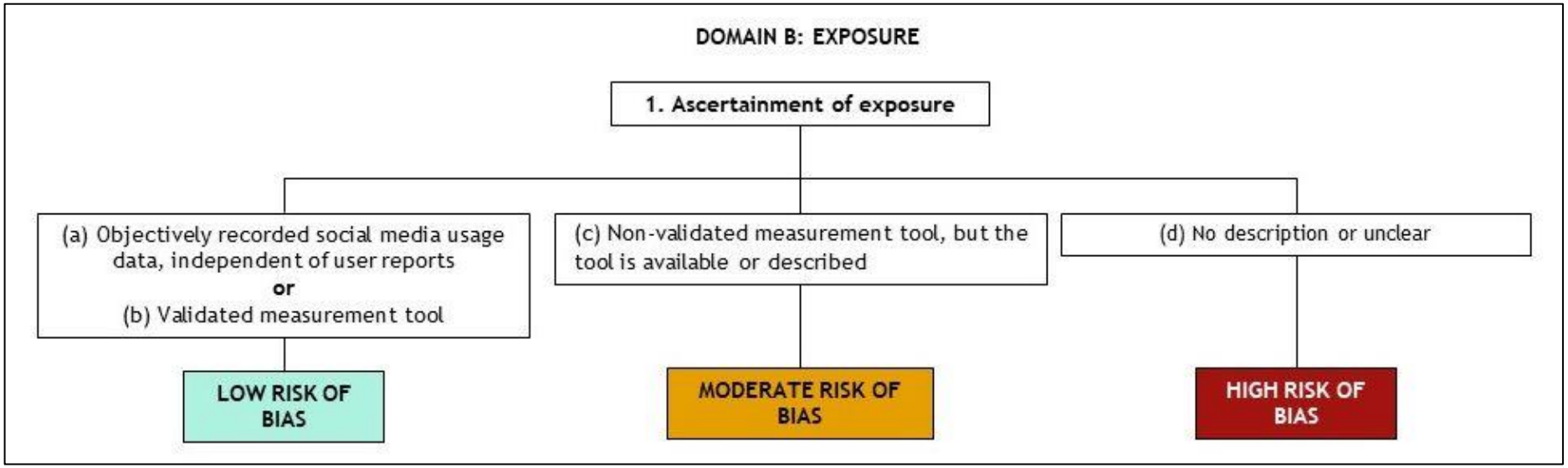


Figure A9.7. Algorithm to assess the Comparability domain of the adapted Newcastle Ottawa Scale for cohort studies

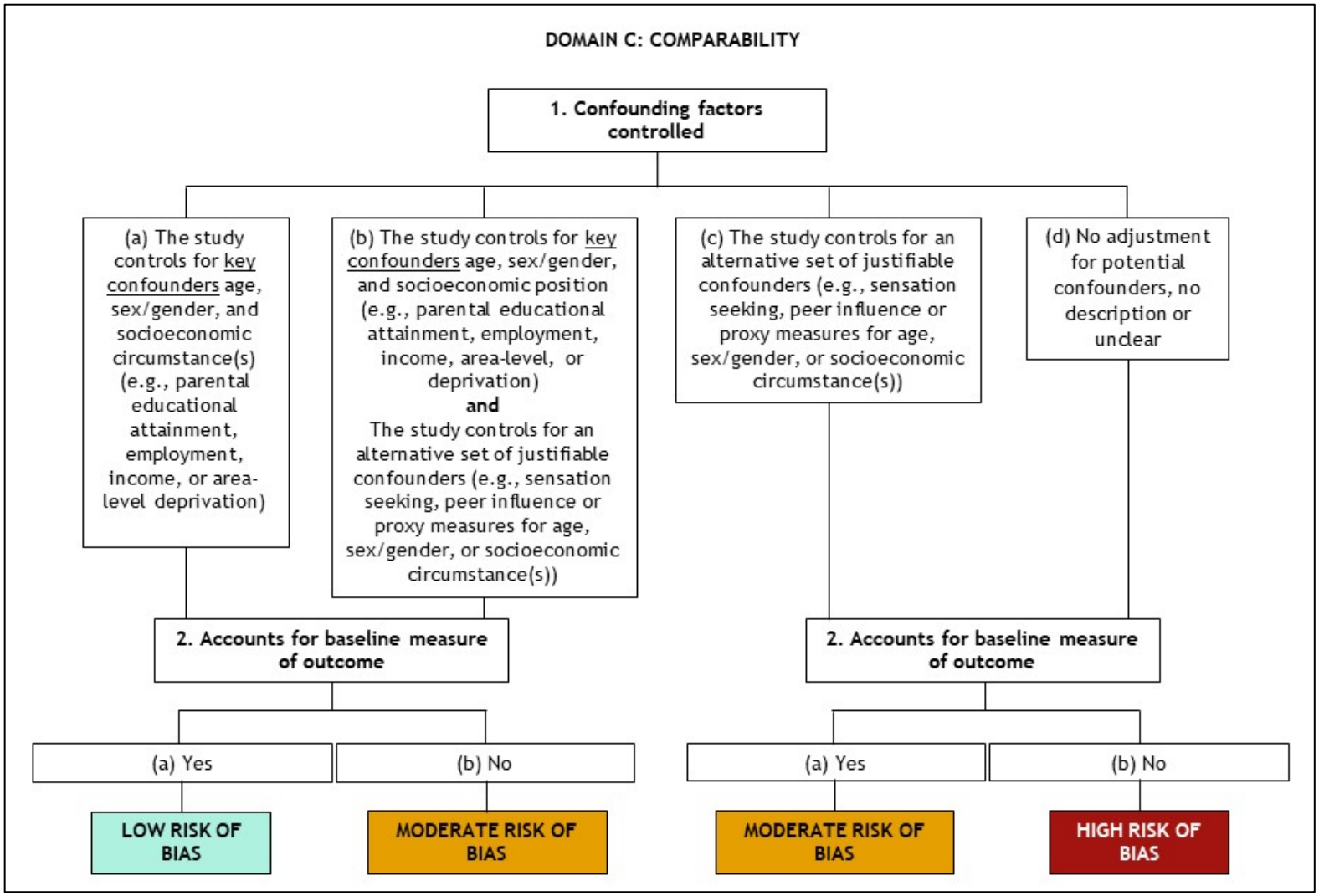
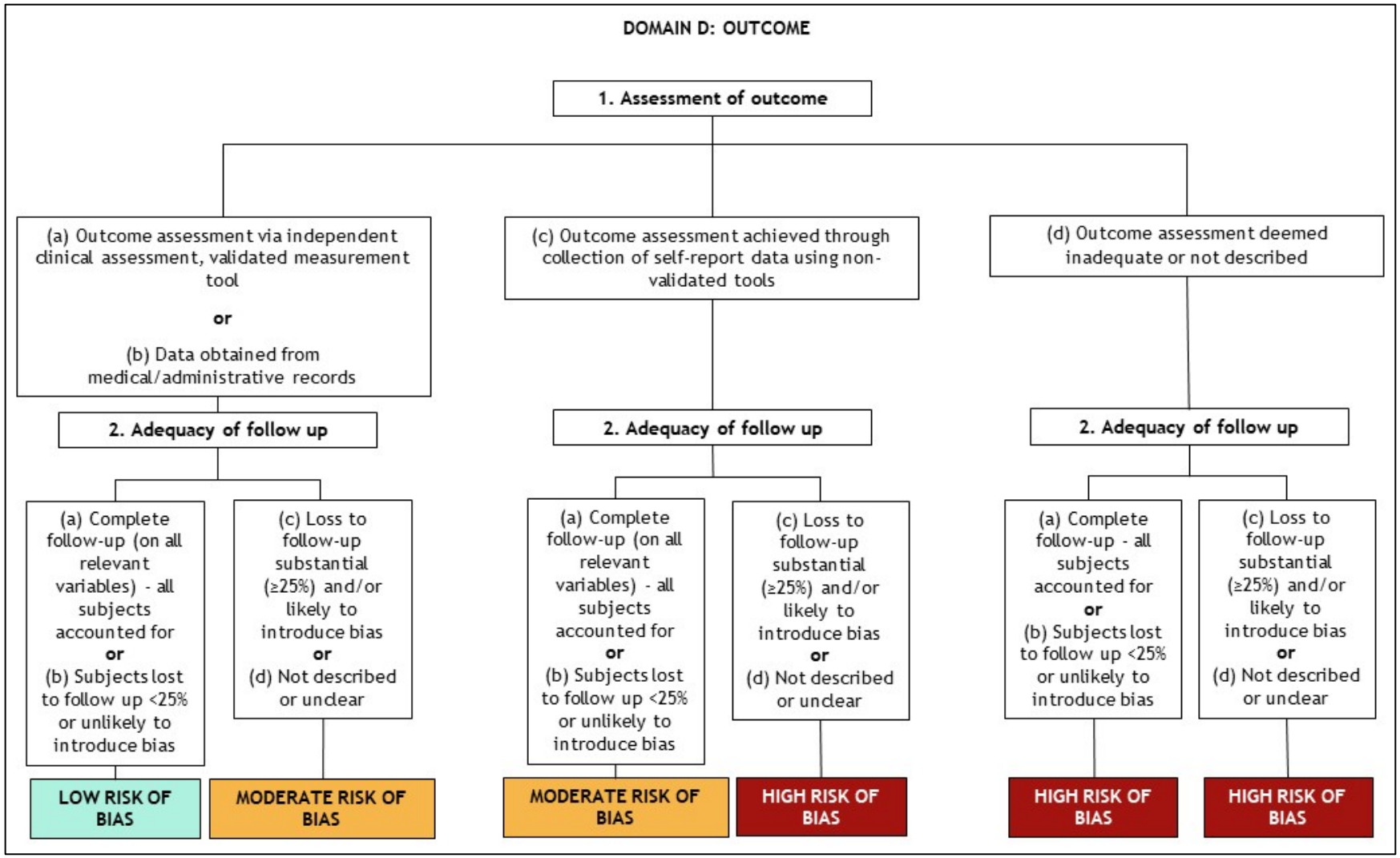


Figure A9.8. Algorithm to assess the Outcome domain of the adapted Newcastle Ottawa Scale for cohort studies



Assessing domain level and overall risk of bias for included datapoints

For both cross-sectional and cohort studies, the algorithms presented above in Figures A9.1 – A9.8 were used to grade each domain using the response options selected for each signalling question. Each domain was allocated either a low, moderate, or high RoB grade, as illustrated in Table A9.1.

Table A9.1. Available domain level risk of bias (RoB) grades

Domain	Risk of bias judgement		
Selection	Low RoB	Moderate RoB	High RoB
Exposure	Low RoB	Moderate RoB	High RoB
Comparability	Low RoB	Moderate RoB	High RoB
Outcome	Low RoB	Moderate RoB	High RoB

Once all domains were graded, Table A9.2 was used to reach an overall RoB judgement for each datapoint using the grades applied for each domain.

Table A9.2. Algorithm to classify overall risk of bias (RoB) grade

Overall risk of bias judgement	Criteria
Low RoB	Study is not judged to be at high risk of bias for any domain and is judged to be at low risk of bias for either the Exposure or Comparability domain
Moderate RoB	Study does not meet criteria for either High risk of bias or Low risk of bias
High RoB	Study is judged to be at high risk of bias in at least one domain

Section A10 Process for data transformations for meta-analysis

The majority of data transformations were conducted according to guidance within the Cochrane Handbook and using the Campbell Collaboration online effect size calculator (Deeks *et al.*, 2021; Higgins, Li, *et al.*, 2021; Wilson, no date).

For binary/dichotomous exposure measurements, continuous and dichotomous outcome data were combined. We opted to report these as odds ratios as most outcomes were originally reported on binary scales; therefore, fewer assumptions were made when completing the conversions. For continuous exposure measurements - which are infrequently reported in systematic reviews, meaning best practice recommendations are not available within the Cochrane Handbook – we opted *not* to combine continuous and binary outcome data (Higgins, Li, *et al.*, 2021). This decision was taken (after discussion with systematic review and statistical experts) because the common statistical approaches to combine these data are grounded on the ability to make direct comparisons between a distinct exposed and unexposed group, and we did not feel it was interpretable or appropriate to utilise these for continuous exposures. Instead, continuous exposure measurements and continuous outcome data were pooled separately as standardised beta coefficients or standardised mean differences, whilst continuous exposure and binary/dichotomous outcome data were pooled separately as odds ratios.

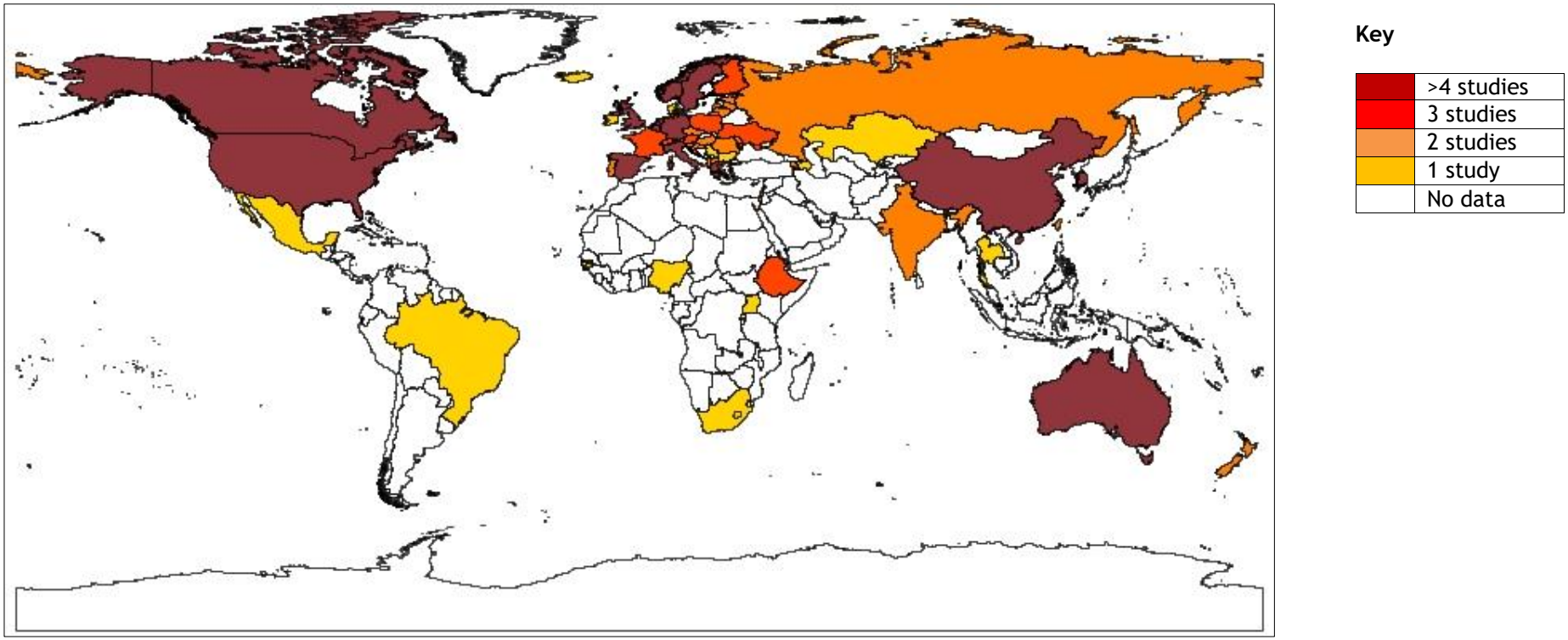
Beta coefficients were converted to standardised beta coefficients. Pearson correlation coefficients were converted to standardised mean differences adopting the method outlined by Mathur and Vanderweele (2020). Here, where studies failed to report the standard deviation of the exposure, efforts were made to contact study authors to obtain the information required for transformation. Where this was not possible, as recommended, a substitute estimate was extracted from a second comparable included study (n=1) or from a subsample of the study used to estimate *r* and the N term within the formula replaced with the size of the second sample used to estimate the exposure standard deviation (Mathur and Vanderweele, 2020).

Where multiple exposure groups were presented for a datapoint, in overcoming any potential unit of analysis errors for a datapoint which could contribute multiple, correlated comparisons, efforts were made to combine groups to create a single pairwise comparison, as recommended by Cochrane and following discussion with statistical experts (Higgins, Eldridge, *et al.*, 2021). Where this was not possible, one pair of exposure groups was selected, and the others excluded. Regardless of the option selected, groups were combined/selected, ensuring comparability with other included datapoints within the meta-analysis. For subgroup analysis, in some instances the analysis includes datapoints not used within primary meta-analysis due to potential double counting of study participants. For example, where multiple datapoints were reported within the same study assessing different social media categories/platforms/content, they were included within separate subgroups.

As per the Cochrane Handbook, where studies reported a *p-value* of <0.05 in the absence of the exact value and this was required to determine the standard error of an estimate, to facilitate inclusion in the meta-analysis, the *p-value* was assumed to be 0.05 (Higgins, Li, *et al.*, 2021). Where data were insufficiently reported for standardisation or transformation, study investigators were contacted by email (n=6 responses received).

Section A11 Geographical distribution of included study populations

Figure A11.1 Map of geographical distribution of included study populations



Legend: Studies undertaken in more than one country contribute multiple datapoints to the map (de Bruijn *et al.*, 2016; De Looze *et al.*, 2019; Savolainen *et al.*, 2020; Boniel-Nissim *et al.*, 2022).

Section A12 Characteristics of included studies

This section presents the characteristics of included studies (n=126 studies; 338 datapoints). Each study is presented in a separate table to aid readability. Where exposure ascertainment was via objectively recorded social media usage data, independent of user reports or via a validated measurement tool, this is stated in italics; where outcome ascertainment was via independent clinical assessment, a validated tool, or medical/administrative records, this is stated in italics. All remaining measures are self-report. An adapted NOS was used to assess RoB for cross-sectional and cohort studies, and the Cochrane RoB-2 was used for RCTs. All included studies were assessed using SWiM, excluding one study (Geusens and Beullens, 2017a), which was included due to potential double counting of study participants; we were, however, able to include estimates from this study in meta-analysis stratified by outcome where this issue did not occur.

Table A12.1. Characteristics of included study – Anastario 2020

Study author and year	Anastario 2020		
Study design	Cross-sectional		
Study period	Not reported		
Country	United States of America		
Equity	High-income country		
Participants	Youth attending 5 schools located on or near a tribal reservation in Montana		
Mean age [range]	15.7 [14-18]		
Risk of bias	Moderate		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of using Twitter to talk or learn about sex or any topic related to sex	No use of a condom at last sexual encounter	146
Frequency of use	Frequency of using Facebook to talk or learn about sex or any topic related to sex	No use of a condom at last sexual encounter	146

Table A12.2. Characteristics of included study - Baker 2016

Study author and year	Baker 2016		
Study design	Cross-sectional		
Study period	2009		
Country	United States of America		
Equity	High-income country		
Participants	Grade 6-12 urban school district students' part of a federally funded project on school-related initiatives		
Mean age [range]	Not reported		
Risk of bias	High		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of SNS use	Soft drug use (smoking, marijuana, or alcohol) in the past month	3,195
Frequency of use	Frequency of SNS use	Hard drug use (lifetime and past year)	3,195
Frequency of use	Frequency of SNS use	Weapon carrying in the past month	3,195

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.3. Characteristics of included study – Baldwin 2018

Study author and year	Baldwin 2018		
Study design	Cross-sectional		
Study period	2014		
Country	Australia		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Adolescents residing in New South Wales		
Mean age [range]	Not reported [10-16]		
Risk of bias	Low		
Number of datapoints	7		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Watched food/beverage brand YouTube videos	Frequency of unhealthy food consumption	417
Exposure to health-risk behaviour content	Seen favourite food advertised on social media	Frequency of unhealthy food consumption	417
Exposure to health-risk behaviour content	Liked a food/beverage brand on Facebook	Frequency of unhealthy food consumption	204
Exposure to health-risk behaviour content	Seen favourite food advertised on social media	Frequency of unhealthy drink consumption	417
Exposure to health-risk behaviour content	Seen favourite food advertised on social media	Frequency of unhealthy food & drink consumption	407
Frequency of use	Frequency of logging in, or checking Facebook account	Frequency of unhealthy food consumption	204
Frequency of use	Frequency of logging in, or checking Facebook account	Frequency of unhealthy drink consumption	204

Table A12.4. Characteristics of included study – Ball 2020

Study author and year	Ball 2020		
Study design	Repeat cross-sectional		
Study period	2016 & 2018		
Country	New Zealand		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Year 10 students' part of the Youth Insights Survey		
Mean age [range]	Not reported [14-15]		
Risk of bias	Low		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of using social media (status updates, uploading photos or videos) in the past week	Current smoking (defined as smoking at least monthly)	5,127
Frequency of use	Frequency of online gambling in the past week	Current smoking (defined as smoking at least monthly)	5,127

Table A12.5. Characteristics of included study – Baru 2020

Study author and year	Baru 2020		
Study design	Cross-sectional		
Study period	2019		
Country	Ethiopia		
Equity	Low-middle income country with mixed socioeconomic circumstance(s)		
Participants	Sexually active unmarried young female internal migrants residing in Barayu Town		
Mean age [range]	18.9 [15-24]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social media use	Risk sexual behaviour (including multiple sexual partners; sex without condoms or inconsistent condom use; initiation of sex before the age of 18 years; sexual intercourse under the influence of substances)	195

Table A12.6. Characteristics of included study – Baumgartner 2012

Study author and year	Baumgartner 2012		
Study design	Cohort		
Study period	2018		
Country	Netherlands		
Equity	High-income country		
Participants	Adolescents		
Mean age [range]	14.5 [12-18]		
Risk of bias	Moderate		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of online communication	Online sexual risk behaviours (including searching for someone on the internet to have sex with or sending a photo or video in which they were partly naked to someone they knew only online)	1,762

Table A12.7. Characteristics of included study – Bayraktar 2007

Study author and year	Bayraktar 2007		
Study design	Cross-sectional		
Study period	Not reported		
Country	Cyprus		
Equity	High-income country		
Participants	Elementary and high-school students residing in North Cyprus		
Mean age [range]	14.4 [not reported]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Online gaming (fighting games)	Anti-social aggression	686

Table A12.8. Characteristics of included study – Beebe 2004

Study author and year	Beebe 2004		
Study design	Cross-sectional		
Study period	2001		
Country	United States of America		
Equity	High-income country		
Participants	Grade 9 school students' part of the Minnesota Student Survey		
Mean age [range]	14.7 [13-17]		
Risk of bias	High		
Number of datapoints	12		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Presence of internet chat room use	Tobacco use in the past year	40,376
Frequency of use	Presence of internet chat room use	Alcohol/drug use in the past year	40,376
Frequency of use	Presence of internet chat room use	Sexual intercourse ever	40,376
Frequency of use	Presence of internet chat room use	Physical assault in the past year	40,376
Frequency of use	Presence of internet chat room use	Vandalism in the past year	40,376
Frequency of use	Presence of internet chat room use	Truant in the past month	40,376

Table A12.9. Characteristics of included study – Boers 2020

Study author and year	Boers 2020		
Study design	Cohort		
Study period	Not reported		
Country	Canada		
Equity	High-income country with low socioeconomic circumstance(s)		
Participants	Grade 7 school students part of the Co-Venture Preventure study		
Mean age [range]	12.7 [not reported]		
Risk of bias	Low		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media per day	Frequency of alcohol consumption	3,612

Table A12.10. Characteristics of included study – Boniel-Nissim 2022

Study author and year	Boniel-Nissim 2022		
Study design	Cross-sectional		
Study period	2017-2018		
Country	42 countries and regions across Europe, North America, and the Middle East		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	School students part of the Health Behaviour in School-aged Children Survey		
Mean age [range]	13.6 [11-15]		
Risk of bias	Low		
Number of datapoints	4		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of online contact with others via social media *(via validated tool)*	Smoking (≥1 × in the last month) *(via validated tool)*	173,577
Frequency of use	Frequency of online contact with others via social media *(via validated tool)*	Alcohol consumption (≥3 × in the last month) *(via validated tool)*	172,723
Frequency of use	Frequency of online contact with others via social media *(via validated tool)*	Drunkenness (≥1 × in the last month) *(via validated tool)*	171,320
Frequency of use	Frequency of online contact with others via social media *(via validated tool)*	Cannabis use (≥1 × in the last month) *(via validated tool)*	55,956

Table A12.11. Characteristics of included study – Booker 2015

Study author and year	Booker 2015		
Study design	Cross-sectional		
Study period	2009		
Country	UK		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Sample members of the youth panel of The UK Household Longitudinal Study		
Mean age [range]	Not reported [10-15]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent chatting on social websites on a normal school day	Sports participation	4,899

Table A12.12. Characteristics of included study – Brunborg 2019

Study author and year	Brunborg 2019		
Study design	Cohort		
Study period	2014-2015		
Country	Norway		
Equity	High-income country		
Participants	Grade 8-10 and 1-2nd year high-school students' part of the pilot Monitoring Young Lifestyles Project		
Mean age [range]	15.2 [13-17]		
Risk of bias	Low		
Number of datapoints	4		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Change in hours of social media use per day (Δ=T2–T1)	Change in episodic heavy drinking frequency	763
Time spent	Change in hours of social media use per day (Δ=T2–T1)	Change in conduct problems *(via SDQ)*	763
Time spent	Average number of hours spent on social media per day in the past year	Episodic heavy drinking frequency in the past year	763
Time spent	Average number of hours spent on social media per day in the past year	Conduct problems in the past year *(via SDQ)*	763

Legend: Abbreviation(s): SDQ=Strengths and Difficulties Questionnaire; T=Timepoint; and Δ=Change.

Table A12.13. Characteristics of included study – Brunborg 2022

Study author and year	Brunborg 2022		
Study design	Cohort		
Study period	2017-2020		
Country	Norway		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Middle school adolescents' part of the MyLife Study		
Mean age [range]	14.3 [12.8-16.8]		
Risk of bias	Moderate		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Average number of hours spent on social media per day	Change in alcohol use *(via AUDIT-C)*	3,096

Legend: Abbreviation(s): AUDIT-C=Alcohol Use Disorders Identification Test.

Table A12.14. Characteristics of included study – Camenga 2018

Study author and year	Camenga 2018		
Study design	Cohort		
Study period	2013-2014		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	High and middle school students' part of a longitudinal school-based cohort study		
Mean age [range]	14.1 [not reported]		
Risk of bias	High		
Number of datapoints	4		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to e-cigarette advertisements on Facebook	Ever e-cigarette use	1,742
Exposure to health-risk behaviour content	Exposure to e-cigarette advertisements on Twitter	Ever e-cigarette use	1,742
Exposure to health-risk behaviour content	Exposure to e-cigarette advertisements on YouTube	Ever e-cigarette use	1,742
Exposure to health-risk behaviour content	Exposure to e-cigarette advertisements on Pinterest/Google +	Ever e-cigarette use	1,742

Table A12.15. Characteristics of included study – Canale 2016

Study author and year	Canale 2016		
Study design	Cross-sectional		
Study period	2013		
Country	Italy		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	High-school students' part of the European School Survey Project on Alcohol and Other Drugs Italia		
Mean age [range]	17.2 [15-19]		
Risk of bias	Low		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of using internet for leisure activities (e.g., online chatting)	Problem gambling *(via SOGS-RA)*	14,478
Frequency of use	Frequency of online gambling in past year	Problem gambling *(via SOGS-RA)*	14,478
Frequency of use	Frequency of using internet for leisure activities (e.g., online chatting)	At-risk gambling *(via SOGS-RA)*	14,478

Legend: Abbreviation(s): SOGS-RA=South Oaks Gambling Screen - Revised for Adolescents.

Table A12.16. Characteristics of included study – Casaló 2022

Study author and year	Casaló 2022		
Study design	Cross-sectional		
Study period	2016-2017		
Country	Spain		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Secondary education students' part of the National Survey on Drug Use Among High School Students in Spain		
Mean age [range]	Not reported [14-18]		
Risk of bias	Low		
Number of datapoints	4		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on SNS per day	Sports frequency 1-3 days per year	35,369
Time spent	Time spent on SNS per day	Sports frequency 1-3 days per month	35,369
Time spent	Time spent on SNS per day	Sports frequency 1-4 days per week	35,369
Time spent	Time spent on SNS per day	Sports frequency 5-7 days per week	35,369

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.17. Characteristics of included study – Cavazos-Rehg 2014

Study author and year	Cavazos-Rehg 2014		
Study design	Cross-sectional		
Study period	2011		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 6-12 school students' part of the National Youth Tobacco Survey		
Mean age [range]	Not reported [11-17		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to tobacco ads/ promotions via Facebook/ Myspace in the past month	Used any form of tobacco in the past month	15,673

Table A12.18. Characteristics of included study – Chang 2016

Study author and year	**Chang 2016**		
Study design	Cohort		
Study period	2010-2011		
Country	Taiwan		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 10 students from 26 high-schools in Taipei City and New Taipei City		
Mean age [range]	Not reported		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of online game use during past week	Incidence of unwanted online sexual solicitation perpetration in the past year	1,981
Frequency of use	Frequency of chat room use during past week	Incidence of unwanted online sexual solicitation perpetration in the past year	1,981

Table A12.19. Characteristics of included study – Chapin 2018

Study author and year	Chapin 2018		
Study design	Cross-sectional		
Study period	2016-2017		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Middle and high-school students' part of the Empowering Latino Youth Project evaluation		
Mean age [range]	14.1 [12-18]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Other	Number of social media platforms used	Experience with electronic violence (perpetration) in the past month	1,167
Other	Number of social media platforms used	Experience with face-to-face violence (perpetration) in the past month	1,167

Table A12.20. Characteristics of included study – Chau 2022

Study author and year	Chau 2022		
Study design	Cross-sectional		
Study period	2010		
Country	France		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Students attending 3 middle schools (2 public and 1 private) in the Lorraine region of North-eastern France		
Mean age [range]	13.5 [10-18]		
Risk of bias	Moderate		
Number of datapoints	5		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on discussion forums and chatting online during a weekday	Alcohol use in the past month	1,559
Time spent	Time spent on discussion forums and chatting online during a weekday	Tobacco use in the past month	1,559
Time spent	Time spent on discussion forums and chatting online during a weekday	Cannabis use in the past month	1,559
Time spent	Time spent on discussion forums and chatting online during a weekday	Perpetrated violence *(via validated tool)*	1,559
Time spent	Time spent on discussion forums and chatting online during a weekday	Illicit drug use in the past month	1,559

Table A12.21. Characteristics of included study – Chen 2019

Study author and year	Chen 2019		
Study design	Cross-sectional		
Study period	2018		
Country	Belgium		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	School students' part of the New Media Study		
Mean age [range]	16.4 [15-18]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media on a regular weekday and weekend day	Experience with risky (anti-social) selfie behaviour	686
Exposure to health-risk behaviour content	Exposure to risky selfie descriptive norms	Experience with risky selfie (anti-social) behaviour	686

Table A12.22. Characteristics of included study – Coates 2019

Study author and year	Coates 2019		
Study design	Randomised control trial		
Study period	2017		
Country	UK		
Equity	High-income country		
Participants	School students without food allergies		
Mean age [range]	10.1 [9-11]		
Risk of bias	Some concerns		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to unhealthy mock Instagram influencer marketing *(objectively recorded)*	Caloric intake (kcal) - consumption of unhealthy snacks *(objectively recorded)*	117

Table A12.23. Characteristics of included study – Coyne 2013

Study author and year	Coyne 2013		
Study design	Cross-sectional		
Study period	2010		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Families with an adolescent aged 11-14 who used SNS who were part of a larger study on family life		
Mean age [range]	14.4 [11-14]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on SNS on a typical day	Delinquency *(via validated tool)*	491

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.24. Characteristics of included study – Coyne 2018

Study author and year	Coyne 2018		
Study design	Cohort		
Study period	2009-2014		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Families with an adolescent aged 11-14 who used SNS who were part of the Flourishing Families Project		
Mean age [range]	13.5 [10-14]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on SNS on a typical day	Physical aggression	457
Time spent	Time spent on SNS on a typical day	Relational aggression	457

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.25. Characteristics of included study – Critchlow 2019

Study author and year	Critchlow 2019		
Study design	Cross-sectional		
Study period	2017		
Country	UK		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Sample members of the UK Youth Alcohol Policy Survey		
Mean age [range]	15.2 [11-19]		
Risk of bias	Low		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Social media apps used at least weekly in the past week	Higher-risk alcohol consumption in current drinkers *(via AUDIT-C)*	1,591
Exposure to health-risk behaviour content	Participation with alcohol marketing on social media in the past month	Higher-risk alcohol consumption in current drinkers *(via AUDIT-C)*	1,591
Exposure to health-risk behaviour content	Participation with user-created alcohol promotion on social media in the past month	Higher-risk alcohol consumption in current drinkers *(via AUDIT-C)*	1,591

Legend: Abbreviation(s): AUDIT-C=Alcohol Use Disorders Identification Test.

Table A12.26. Characteristics of included study – da Costa 2021

Study author and year	da Costa 2021		
Study design	Cross-sectional		
Study period	2019		
Country	Brazil		
Equity	Low-middle income country with mixed socioeconomic circumstance(s)		
Participants	High-school students enrolled in high-school courses integrated to professional courses as part of the Longitudinal Study of the Lifestyle of Adolescents		
Mean age [range]	16.3 [14-18]		
Risk of bias	Low		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media on a typical weekday and weekend day	Sedentary behaviour in the last 4 days *(via Actigraph accelerometer)*	718
Time spent	Time spent on social media on a typical weekday and weekend day	Light intensity physical activity in the last 4 days *(via Actigraph accelerometer)*	718
Time spent	Time spent on social media on a typical weekday and weekend day	Moderate to vigorous physical activity in the last 4 days *(via Actigraph accelerometer)*	718

Table A12.27. Characteristics of included study – Dai 2022

Study author and year	Dai 2022		
Study design	Cross-sectional		
Study period	2019		
Country	China		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Junior, senior high and vocational high-school students in Shanghai		
Mean age [range]	13.7 [13-18]		
Risk of bias	Low		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to e-cigarette advertisements on social media *(via validated tool)*	Ever e-cigarette use *(via validated tool)*	708,765
Exposure to health-risk behaviour content	Exposure to e-cigarette advertisements on social media *(via validated tool)*	E-cigarette use in the past month *(via validated tool)*	708,765

Table A12.28. Characteristics of included study – Davis 2019

Study author and year	Davis 2019		
Study design	Cohort		
Study period	2010-2016		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 6-7 middle school students' part of the CHOICE United States of America Alcohol and Drug Use Prevention Program		
Mean age [range]	13.2 [12-15]		
Risk of bias	Moderate		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Substance related media exposure via social media in the past 3 months	Frequency of alcohol use in the past month	4,840

Table A12.29. Characteristics of included study – Dawson 2019

Study author and year	Dawson 2019		
Study design	Cross-sectional		
Study period	2016-2017		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Students with previous diagnosis of attention deficit hyperactivity disorder part of the BEST Project		
Mean age [range]	14.5 [not reported]		
Risk of bias	High		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Presence of SNS use	Ever sent a sext	58
Frequency of use	Number of participant posts on Facebook (posted by participant) over 2-month period *(objectively recorded)*	Ever sent a sext	34
Exposure to health-risk behaviour content	Percentage of participant posts sharing inappropriate content on Facebook over 2-month period *(objectively recorded)*	Ever sent a sext	34

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.30. Characteristics of included study – de Bruijn 2016

Study author and year	de Bruijn 2016		
Study design	Cross-sectional		
Study period	2012		
Country	Germany, Italy, Netherlands, and Poland		
Equity	High-income country		
Participants	Urban and rural school students		
Mean age [range]	14.1 [not reported]		
Risk of bias	Moderate		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Ever use of an alcohol branded social media page	Onset of drinking	9,032
Exposure to health-risk behaviour content	Ever use of an alcohol branded social media page	Binge drinking in the past month	9,032

Table A12.31. Characteristics of included study – De Jans 2021

Study author and year	De Jans 2021		
Study design	Randomised control trial		
Study period	2020		
Country	Belgium		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	School students from 3 primary schools		
Mean age [range]	10.0 [8-12]		
Risk of bias	Low		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to snack with low nutritional value (mini donut) on Instagram *(objectively recorded)*	Consumption of snack high in nutritional value (strawberries) *(objectively recorded)*	190

Table A12.32. Characteristics of included study – De Looze 2019

Study author and year	De Looze 2019		
Study design	Cross-sectional		
Study period	2002-2014		
Country	European and North American Countries		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Sample members of the Health Behaviour in School-aged Children Survey		
Mean age [range]	13.5 [13.1-13.8]		
Risk of bias	Moderate		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of electronic media communication with friends	Weekly alcohol use	191,727
Frequency of use	Frequency of electronic media communication with friends	Weekly smoking	191,727
Frequency of use	Frequency of electronic media communication with friends	Lifetime cannabis use	56,159

Table A12.33. Characteristics of included study – Doornwaard 2014

Study author and year	Doornwaard 2014		
Study design	Cross-sectional		
Study period	2012		
Country	Netherlands		
Equity	High-income country		
Participants	Elementary and high-school students' part of the Studies on Trajectories of Adolescent Relationships and Sexuality		
Mean age [range]	15.0 [11-18]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to displays of sexual references on Facebook over 3-month period *(objectively recorded)*	Experience with sexual behaviours *(via validated tool)*	104

Table A12.34. Characteristics of included study – Doornwaard 2015

Study author and year	Doornwaard 2015		
Study design	Cross-sectional		
Study period	2011		
Country	Netherlands		
Equity	High-income country		
Participants	Grade 7-10 students' part of the Studies on Trajectories of Adolescent Relationships and Sexuality		
Mean age [range]	14.0 [11-17]		
Risk of bias	Moderate		
Number of datapoints	4		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on SNS (most frequently used platform) per day	Ever experience with sexual behaviours	1,132
Time spent	Time spent on SNS (most frequently used platform) per day	Frequency of sex related online behaviours	1,132

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.35. Characteristics of included study – Elton-Marshall 2016

Study author and year	Elton-Marshall 2016		
Study design	Cross-sectional		
Study period	2012-2013		
Country	Canada		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 9-12 school students' part of the Canadian Youth Smoking Survey who responded to the Youth Gambling Survey supplement		
Mean age [range]	16.5 [13-19]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of playing free simulated gambling games on Facebook in the past 3 months	Frequency of gambling for money (not via social media)	9,830
Frequency of use	Frequency of online gambling participation in the past 3 months	Problem gambling severity *(via CAGI/GPSS)*	3,682

Legend: Abbreviation(s): CAGI/GPSS=Gambling Problem Severity Subscale of the Canadian Adolescent Gambling Index.

Table A12.36. Characteristics of included study – Erreygers 2017

Study author and year	Erreygers 2017		
Study design	Cross-sectional		
Study period	2015		
Country	Belgium		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 7 school students' part of a larger study		
Mean age [range]	13.6 [not reported]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of online gaming in the past 6 months	Performing online anti-social behaviours in the past month	1,720

Table A12.37. Characteristics of included study – Floros 2013

Study author and year	Floros 2013		
Study design	Cross-sectional		
Study period	2010		
Country	Greece		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	High-school students' part of the Hippocrates Study		
Mean age [range]	15.1 [12-19]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of using SNS in the past year	Internet gambling (not via social media) frequency in the past year	2,017
Frequency of use	Frequency of using SNS in the past year	Pathological gambling past year *(via DSM-IV-MR-J)*	2,017

Legend: Abbreviation(s): DSM-IV-MR-J=Diagnostic and Statistical Manual of Mental Disorders-IV-Multiple Response - Adapted for Juveniles (assessment of adolescent gambling) and SNS=Social networking site(s).

Table A12.38. Characteristics of included study – Folkvord 2020

Study author and year	Folkvord 2020		
Study design	Randomised control trial		
Study period	2018		
Country	Netherlands		
Equity	High-income country		
Participants	Grade 1-2 secondary school students		
Mean age [range]	14.1 [13-16]		
Risk of bias	Low		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to popular influencer Instagram post showing energy-dense foods *(objectively recorded)*	Vegetable intake *(objectively recorded)*	88

Table A12.39. Characteristics of included study – Froyland 2020

Study author and year	Froyland 2020		
Study design	Cross-sectional		
Study period	2015 & 2018		
Country	Norway		
Equity	High-income country		
Participants	All junior and senior high-school students in Oslo part of the Young in Oslo Surveys		
Mean age [range]	Not reported [13-18]		
Risk of bias	Low		
Number of datapoints	8		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media per day	Physical fighting (with and without weapons) in the past 12 months	47,655
Time spent	Time spent on social media per day	School truancy in the past 12 months	47,655
Time spent	Time spent on social media per day	Alcohol intoxication in the past 12 months	47,655
Time spent	Time spent on social media per day	Cannabis use in the past 12 months	47,655

Table A12.40. Characteristics of included study – Gascoyne 2021

Study author and year	Gascoyne 2021		
Study design	Cross-sectional		
Study period	2018		
Country	Australia		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Secondary school students' part of the National Secondary Students' Diet and Activity Survey		
Mean age [range]	Not reported [12-17]		
Risk of bias	Low		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Liked/shared posts related to a food or drink product or brand (e.g., soft drink, fast food)	High intake of unhealthy food	8,708
Exposure to health-risk behaviour content	Liked/shared posts related to a food or drink product or brand (e.g., soft drink, fast food)	High intake of unhealthy drinks	8,708

Table A12.41. Characteristics of included study – Gazendam 2021

Study author and year	Gazendam 2020		
Study design	Cross-sectional		
Study period	2018		
Country	Canada		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 9-10 students' part of the Canadian Health Behaviour in School-aged Children Survey		
Mean age [range]	15.4 [not reported]		
Risk of bias	Low		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media per day	Early sexual intercourse (≤ 15 years)	6,123

Table A12.42. Characteristics of included study – Geber 2021

Study author and year	Geber 2021		
Study design	Cohort		
Study period	2019-2020		
Country	Switzerland		
Equity	High-income country		
Participants	1st year students at 4 secondary schools		
Mean age [range]	15.1 [13-17]		
Risk of bias	Moderate		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to alcohol-related content on Instagram and Snapchat	Drinking behaviour	402

Table A12.43. Characteristics of included study – Geusens 2017

Study author and year	Geusens 2017		
Study design	Cross-sectional		
Study period	2015		
Country	Belgium		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	5th, 6th and 7th year secondary school students' part of the Flemish Alcohol and Media Survey Research Project		
Mean age [range]	17.2 [16-20]		
Risk of bias	Moderate		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Perceived number of friends sharing alcohol references online	Self-reported drinking behaviour *(via AUDIT)*	2,935

Legend: Abbreviation(s): AUDIT=Alcohol Use Disorders Identification Test.

Table A12.44. Characteristics of included study – Geusens 2017

Study author and year	Geusens 2017)		
Study design	Cohort		
Study period	2015-2016		
Country	Belgium		
Equity	High-income country		
Participants	5th, 6th and 7th year secondary school students' part of the Flemish Alcohol and Media Survey Research Project		
Mean age [range]	17.0 [16-20]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of sharing alcohol references on SNS	Binge drinking in the last 12 months	998

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.45. Characteristics of included study – Geusens 2019

Study author and year	Geusens 2019		
Study design	Cross-sectional		
Study period	2014		
Country	Belgium		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	3rd and 4th year secondary school students' part of a larger study		
Mean age [range]	14.9 [14-16]		
Risk of bias	Low		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Frequency of exposure to peer alcohol references on SNS	Alcohol consumption	886
Exposure to health-risk behaviour content	Frequency of sharing of alcohol references on SNS	Alcohol consumption	886

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.46. Characteristics of included study – Gomez 2019

Study author and year	Gomez 2019		
Study design	Cross-sectional		
Study period	2018		
Country	Spain		
Equity	High-income country		
Participants	Secondary and baccalaureate students		
Mean age [range]	14.4 [12-17]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Other	Signed up to more than 5 SNS	Online gambling & betting (not via social media)	3772

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.47. Characteristics of included study – Gordon 2011

Study author and year	Gordon 2011		
Study design	Cross-sectional		
Study period	2006-2007		
Country	UK		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	2nd year high-school students' part of the Assessing the Cumulative Impact of Alcohol Marketing on Youth Drinking Study		
Mean age [range]	13.0 [12-14]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Awareness of alcohol marketing on SNS	Drinking status	912
Exposure to health-risk behaviour content	Used SNS containing alcohol brands or logos	Drinking status	912

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.48. Characteristics of included study – Gregg 2018

Study author and year	Gregg 2018		
Study design	Cross-sectional		
Study period	2015		
Country	United States of America		
Equity	High-income country		
Participants	High-school students from 1 suburban high-school		
Mean age [range]	16.2 [not reported]		
Risk of bias	Moderate		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of electronic communication	Frequency of sending sexts *(via SBS)*	314

Legend: Abbreviation(s): SBS=Sexting Behaviour Scale.

Table A12.49. Characteristics of included study – Gunnlaugsson 2020

Study author and year	Gunnlaugsson 2020		
Study design **Study period** **Country** **Equity** **Participants** **Mean age [range]** **Risk of bias** **Number of datapoints** **Included in meta-analysis, subgroup or sensitivity analysis**	Cross-sectional 2017 Guinea-Bissau Low-middle income country with mixed socioeconomic circumstance(s) Students from 16 secondary schools in Bissau Not reported [14-19+] Low 3 Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social media use *(via validated tool)*	Participated in bullying behaviour in the past 12 months *(via validated tool)*	1,454
Frequency of use	Frequency of social media use *(via validated tool)*	Lifetime experience of smoking cigarettes *(via validated tool)*	1,566
Frequency of use	Frequency of social media use *(via validated tool)*	Lifetime experience of drinking alcohol *(via validated tool)*	1,559

Table A12.50. Characteristics of included study – Hamilton 2020

Study author and year	Hamilton 2022		
Study design	Cross-sectional		
Study period	2020		
Country	United States of America		
Equity	High-income country with high socioeconomic circumstance(s)		
Participants	Adolescent girls residing in Pennsylvania part of larger longitudinal study		
Mean age [range]	15.06 [12-17]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on SNS per day	Physical activity	93

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.51. Characteristics of included study – Hayer 2018

Study author and year	Hayer 2018		
Study design	Cohort		
Study period	2015-2016		
Country	Germany		
Equity	High-income country		
Participants	Grade 6-10 school students in Northern Germany		
Mean age [range]	13.4 [11-19]		
Risk of bias	Moderate		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of participation in any simulated gambling on social networks in the past year	Frequency of monetary gambling (not via social media) in the past year	531
Frequency of use	Frequency of participation in simulated gambling from home on social networks in the past year	Frequency of monetary gambling (not via social media) in the past year	531

Table A12.52. Characteristics of included study – Holtz 2011

Study author and year	Holtz 2011		
Study design	Cross-sectional		
Study period	2007		
Country	Austria		
Equity	High-income country		
Participants	Rural and urban school students		
Mean age [range]	12.7 [10-14]		
Risk of bias	Moderate		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of communicational internet use (e.g., chat rooms, social platforms like Myspace)	Delinquent and aggressive behaviours in the past 6 months *(via YSR)*	205

Legend: Abbreviation(s): YSR=Youth Self-Report.

Table A12.53. Characteristics of included study – Hryhorczuk 2019

Study author and year	Hryhorczuk 2019		
Study design	Cross-sectional		
Study period	2011		
Country	Ukraine		
Equity	Low-middle income country		
Participants	Sample members of the Family and Children of Ukraine Birth Cohort Study		
Mean age [range]	16.2 [15.1-18.2]		
Risk of bias	Moderate		
Number of datapoints	6		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social media use	Used alcohol in the past month	912
Frequency of use	Frequency of social media use	Used alcohol in the past year	917
Frequency of use	Frequency of social media use	Ever used alcohol	967

Table A12.54. Characteristics of included study – Hrywna 2020

Study author and year	Hrywna 2020		
Study design	Cross-sectional		
Study period	2018		
Country	United States of America		
Equity	High-income country		
Participants	Grade 9-12 school students' part of the New Jersey Youth Tobacco Survey		
Mean age [range]	Not reported		
Risk of bias	Moderate		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Liked/followed a tobacco brand on social media in the past year	Current use of e-cigarette or Juul (use on ≥1 day of the past month)	4,183
Exposure to health-risk behaviour content	Liked/followed a tobacco brand on social media in the past year	Frequent use of e-cigarette or Juul (use on ≥20 days of the past month)	4,183

Table A12.55. Characteristics of included study – Huang 2012

Study author and year	Huang 2012		
Study design	Cross-sectional		
Study period	2007		
Country	China		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 10 academic and vocational school students' part of the Trans-disciplinary Tobacco and Alcohol Use Research Centre Study		
Mean age [range]	15.8 [13-19]		
Risk of bias	Low		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social internet activity (online gaming, chatting with real friends, or chatting with online friends) in the past week	Cigarette smoking in the past month	2,931

Table A12.56. Characteristics of included study – Huang 2014

Study author and year	Huang 2014		
Study design	Cohort		
Study period	2010-2011		
Country	United States of America		
Equity	High-income country with low socioeconomic circumstance(s)		
Participants	Grade 10 school students' part of the Social Network Study		
Mean age [range]	15.1 [not reported]		
Risk of bias	Low		
Number of datapoints	4		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of Myspace use	Alcohol use in the past month	1,315
Frequency of use	Frequency of Facebook use	Ever smoking	1,315
Exposure to health-risk behaviour content	Number of friends who posted risky pictures partying/ drinking	Alcohol use in the past month	1,315
Exposure to health-risk behaviour content	Number of friends who posted risky pictures partying/ drinking	Ever smoking	1,315

Table A12.57. Characteristics of included study – Jeong 2022

Study author and year	Jeong 2022		
Study design	Cross-sectional		
Study period	2020		
Country	South Korea		
Equity	High-income country		
Participants	Adolescents part of the Consumer Behaviour Survey for Food conducted by the Korea Rural Economic Institute		
Mean age [range]	16.1 [not reported]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social media use	Eats food considering calories and nutrients *(via validated tool)*	622
Frequency of use	Frequency of social media use	Eats carefully selected food for one's own health *(via validated tool)*	622

Table A12.58. Characteristics of included study – Jiang 2018

Study author and year	Jiang 2018		
Study design	Cross-sectional		
Study period	Not reported		
Country	China		
Equity	High-income country		
Participants	Young in-patients enrolled at one of the largest addiction clinics in China		
Mean age [range]	16.8 [13-19]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of online gaming *(via clinical records)*	Involvement in risk behaviours (e.g., skipping school, smoking) (via clinical records)	467

Table A12.59. Characteristics of included study – Kaufman 2014

Study author and year	Kaufman 2014		
Study design	Cross-sectional		
Study period	2012		
Country	South Africa		
Equity	Low-middle income country with mixed socioeconomic circumstance(s)		
Participants	Grade 9 school students, part of a 2-year cluster-randomised trial		
Mean age [range]	Not reported [12-20]		
Risk of bias	Low		
Number of datapoints	8		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social media use	Hazardous alcohol use in the past year *(via AUDIT)*	4,485
Frequency of use	Frequency of social media use	Reported multiple partners in the past year	4,485
Other	Has a Facebook account	Hazardous alcohol use in past year *(via AUDIT)*	4,485
Other	Has a Facebook account	Reported multiple partners in the past year	4,485

Legend: Abbreviation(s): AUDIT=Alcohol Use Disorders Identification Test.

Table A12.60. Characteristics of included study – Kaur 2020

Study author and year	Kaur 2020		
Study design	Cross-sectional		
Study period	2018		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 8,10, and 12 school students' part of the Monitoring the Future Survey		
Mean age [range]	15.1 [not reported]		
Risk of bias	Low		
Number of datapoints	6		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on SNS per day	Binge drinking in the past 2 weeks	22,980
Time spent	Time spent on SNS per day	Drinking in the past month	23,150
Time spent	Time spent on SNS per day	Cannabis use in the past month	23,167
Time spent	Time spent on SNS per day	Flavour vaping in the past month in 8th and 10th grade students	6,967
Time spent	Time spent on SNS per day	Cannabis vaping in the past month in 8th and 10th grade students	7,003
Time spent	Time spent on SNS per day	Nicotine vaping in the past month in 8th and 10th grade students	6,980

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.61. Characteristics of included study – Kelleghan 2020

Study author and year	Kelleghan 2020		
Study design **Study period** **Country** **Equity** **Participants** **Mean age [range]** **Risk of bias** **Number of datapoints** **Included in meta-analysis, subgroup or sensitivity analysis**	Cohort 2015-2017 United States of America High-income country with mixed socioeconomic circumstance(s) High-school students' part of the Happiness & Health Study 16.5 [not reported] Moderate 6 Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social media posting (posting photos, video or statuses and sharing others content)	Any cannabis use initiation (including reported use of combustible cannabis, blunts, and edible, vaporised, or synthetic cannabis)	1,841
Frequency of use	Frequency of social media posting (posting photos, video or statuses and sharing others content)	Combustible cannabis use initiation	1,841
Frequency of use	Frequency of social media posting (posting photos, video or statuses and sharing others content)	Other cannabis use initiation (including reported use of edible, vaporized, or synthetic cannabis)	1,841
Frequency of use	Frequency of social media posting (posting photos, video or statuses and sharing others content)	Any tobacco use initiation (including reported use of a few puffs of a cigarette, a whole cigarette, e-cigarettes with tobacco, smokeless tobacco, big cigars, little cigars/ cigarillos, or hookah water pipe)	1,558
Frequency of use	Frequency of social media posting (posting photos, video or statuses and sharing others content)	Combustible cigarette use initiation (including reported use of a few puffs of a cigarette or a whole cigarette)	1,558
Frequency of use	Frequency of social media posting (posting photos, video or statuses and sharing others content)	E-cigarette use initiation	1,558

Table A12.62. Characteristics of included study – King 2014

Study author and year	King 2014		
Study design	Cross-sectional		
Study period	2012		
Country	Australia		
Equity	High-income country		
Participants	Secondary school students in Metropolitan region of Adelaide		
Mean age [range]	14.9 [12-17]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Ever use of simulated gambling via SNS applications (Facebook apps)	Frequency of problem gambling *(via DSM-IV-MR-J)*	1,214

Legend: Abbreviation(s): DSM-IV-MR-J=Diagnostic and Statistical Manual of Mental Disorders-IV-Multiple Response - Adapted for Juveniles (assessment of adolescent gambling) and SNS=Social networking site(s).

Table A12.63. Characteristics of included study – Ko 2009

Study author and year	Ko 2009		
Study design	Cross-sectional		
Study period	2004		
Country	Taiwan		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Junior high and senior high/vocational school students' part of the Project for Health of Adolescents		
Mean age [range]	14.6-14.9 [not reported]		
Risk of bias	Moderate		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Ever online gaming	Aggressive behaviours in the past year	9,405
Frequency of use	Ever online chatting	Aggressive behaviours in the past year	9,405
Frequency of use	Ever online gambling	Aggressive behaviours in the past year	9,405

Table A12.64. Characteristics of included study – Kontostoli 2022

Study author and year	Kontostoli 2022		
Study design	Cross-sectional		
Study period	2015-2016		
Country	UK		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Adolescents part of the Millennium Cohort Study		
Mean age [range]	14.2 [not reported]		
Risk of bias	Low		
Number of datapoints	6		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent browsing and updating SNS on a weekday	Moderate-to-vigorous physical activity *(via accelerometer)*	4,546
Time spent	Time spent browsing and updating SNS on a weekday	Overall physical activity *(via accelerometer)*	4,546
Time spent	Time spent browsing and updating SNS on a weekday	Sedentary behaviour	3,551

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.65. Characteristics of included study – Koutamanis 2015

Study author and year	Koutamanis 2015		
Study design	Cross-sectional		
Study period	2012		
Country	Netherlands		
Equity	High-income country		
Participants	Families with ≥2 adolescents aged 10-15 years		
Mean age [range]	12.6 [12-15]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of online social exploration on SNS	Frequency of risky online self-presentation	758

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.66. Characteristics of included study – Kwon 2022

Study author and year	Kwon 2022		
Study design	Cross-sectional		
Study period	2017		
Country	South Korea		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Middle and high-school students' part of the Korea Youth Health Risk Behaviour Web Based Online Survey		
Mean age [range]	15.0 [12-18]		
Risk of bias	Low		
Number of datapoints	4		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Frequency of SNS use in the past 30 days	Moderate to vigorous aerobic physical activity at least 5 days per week or vigorous physical activity at least 3 days per week in the past 7 days	53,133
Time spent	Frequency of SNS use in the past 30 days	Muscle-strengthening activity for at least 3 days per week in past 7 days	53,133

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.67. Characteristics of included study – Landry 2013

Study author and year	Landry 2013		
Study design	Cross-sectional		
Study period	2011-2012		
Country	United States of America		
Equity	High-income country		
Participants	Grade 9-10 Latino high-school students in Maryland		
Mean age [range]	15.7 [13-19]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Frequency of logging into social media sites	No contraception use at last sex	118
Other	Has a Facebook account	No contraception use at last sex	118

Table A12.68. Characteristics of included study – Larm 2017

Study author and year	Larm 2017		
Study design	Cross-sectional		
Study period	2010		
Country	Sweden		
Equity	High-income country		
Participants	Grade 9 primary school students' part of the Survey of Adolescent Life in Vastmanland		
Mean age [range]	Not reported [15-16]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Online social network chatting	Alcohol use *(via AUDIT-C)*	2,439

Legend: Abbreviation(s): AUDIT-C=Alcohol Use Disorders Identification Test.

Table A12.69. Characteristics of included study – Larm 2019

Study author and year	Larm 2019		
Study design	Repeat cross-sectional		
Study period	2008 & 2010 & 2012		
Country	Sweden		
Equity	High-income country		
Participants	Grade 9 students' part of the Survey of Adolescent Life in Vastmanland		
Mean age [range]	Not reported [15-16]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time	Time spent on social media/ chatting per day	Drinking in the past year *(via AUDIT-C)*	RCS 2008: 2,605 RCS 2012: 2,045

Legend: Abbreviation(s): AUDIT-C=Alcohol Use Disorders Identification Test and RCS=Repeat cross-sectional study.

Table A12.70. Characteristics of included study – Lee 2015

Study author and year	Lee 2015		
Study design	Cross-sectional		
Study period	2012		
Country	South Korea		
Equity	High-income country		
Participants	Grade 1-3 middle school and Grade 5-6 elementary school students residing in Incheon		
Mean age [range]	Not reported [11-16]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on SNS per day	Negative SNS behaviours (e.g., real money trading in SNS games, exposed to porn on SNS)	500

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.71. Characteristics of included study – Lee 2019

Study author and year	Lee 2019		
Study design	Cohort		
Study period	2013-2016		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Non-institutionalised adolescents' part of the Population Assessment of Tobacco and Health Study		
Mean age [range]	Not reported [12-17]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of visiting social networking account	Initiation of ENDS in the past year	8,704

Legend: Abbreviation(s): ENDS=Electronic nicotine delivery system(s).

Table A12.72. Characteristics of included study – Lee 2021

Study author and year	Lee 2021		
Study design	Cross-sectional		
Study period	2017-2018		
Country	China		
Equity	High-income country		
Participants	Students from 1 secondary school		
Mean age [range]	18.4 [not reported]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Daytime use of social networks *(objectively recorded)*	Number of steps in the past 7 days *(via accelerometer)*	32
Time spent	Daytime use of social networks *(objectively recorded)*	Moderate to vigorous physical activity in the past week *(via accelerometer)*	32

Table A12.73. Characteristics of included study – Lee 2021

Study author and year	Lee 2021		
Study design	Cross-sectional		
Study period	2019		
Country	United States of America		
Equity	High-income country		
Participants	Middle and high-school students' part of the Florida Youth Tobacco Survey		
Mean age [range]	Not reported [not reported]		
Risk of bias	Moderate		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of Facebook use	Experimental vaping (vaped but not in the past month)	10,475
Frequency of use	Frequency of Facebook use	Current vaping in the past month	10,475

Table A12.74. Characteristics of included study – Lin 2012

Study author and year	Lin 2012		
Study design	Cross-sectional		
Study period	Not reported		
Country	New Zealand		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Student's part of a larger study		
Mean age [range]	Not reported [13-14]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Awareness of alcohol marketing on SNS	Drinking status in the past year	2,538
Exposure to health-risk behaviour content	Used SNS containing alcohol brands or logos	Drinking status in the past year	2,538

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.75. Characteristics of included study – Lipsky 2017

Study author and year	Lipsky 2017		
Study design	Cohort		
Study period	2010-2014		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 10 school students' part of the NEXT Generation Health Study		
Mean age [range]	16.5 [not reported]		
Risk of bias	Low		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social networking per day	Healthy eating (conformance to United States of America Dietary Guidelines 2010) *(via HEI, ASA24)*	566
Time spent	Time spent on social networking per day	Intake of empty calories *(via HEI, ASA24)*	566
Time spent	Time spent on social networking per day	Intake of whole plant foods *(via ASA24)*	566

Legend: Abbreviation(s): ASA24=Automated Self-Administered Dietary Assessment Tool and HEI=Healthy Eating Index.

Table A12.76. Characteristics of included study – Longobardi 2021

Study author and year	Longobardi 2021		
Study design	Cross-sectional		
Study period	Not reported		
Country	Italy		
Equity	High-income country		
Participants	Grade 7-13 school students' part of a larger study on social media use		
Mean age [range]	15 [not reported]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media per day	Sexting and online exhibitionism *(via validated tool)*	229

Table A12.77. Characteristics of included study – McClure 2020

Study author and year	McClure 2020		
Study design	Cross-sectional		
Study period	2015- 2016		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Adolescents recruited from general paediatric clinics in New England		
Mean age [range]	14.5 [12-17]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social media use	Ever drinking	202

Table A12.78. Characteristics of included study – Merrill 2019

Study author and year	Merrill 2019		
Study design	Cross-sectional		
Study period	2015		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 9-12 school students' part of the Youth Risk Behaviour Surveillance System Survey		
Mean age [range]	Not reported [12-18+ older]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media per day	Risky sexual behaviours in sexually active participants	5,603

Table A12.79. Characteristics of included study – Michael 2016

Study author and year	Michael 2016		
Study design	Cross-sectional		
Study period	2015		
Country	Nigeria		
Equity	Low-middle income country		
Participants	Adolescents residing in Bayelsa State Capital		
Mean age [range]	15.1 [10-19]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Average time spent on social media per day	No use of contraception during sexual intercourse	262

Table A12.80. Characteristics of included study – Moitra 2022

Study author and year	Moitra 2022		
Study design	Cross-sectional		
Study period	2021		
Country	India		
Equity	Low-middle income country with mixed socioeconomic circumstance(s)		
Participants	Grade 6-10 students from 6 private schools and 4 government aided schools in Mumbai		
Mean age [range]	13.2 [10-15]		
Risk of bias	Low		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent using SNS on a typical weekend and weekday	Healthy eating habits	1,298
Time spent	Time spent using SNS on a typical weekend and weekday	Physical activity level *(via PAQ-C/-A)*	1,298

Legend: Abbreviation(s): PAQ-C/A=Physical Activity Questionnaire for Children and Adolescents and SNS=Social networking site(s).

Table A12.81. Characteristics of included study – Mojica 2014

Study author and year	Mojica 2014		
Study design	Cross-sectional		
Study period	2010		
Country	United States of America		
Equity	High-income country		
Participants	Female adolescents recruited via Girls Scouts of Southwest Texas as part of an intervention planning grant		
Mean age [range]	Not reported [11-14]		
Risk of bias	High		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Average time spent on SNS per week	5+ days of physically activity in the past week	110
Time spent	Average time spent on SNS per week	Daily physical education class in an average week	110
Time spent	Average time spent on SNS per week	Played on 1+ sports team in the past year	110

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.82. Characteristics of included study – Molla-Esparza 2021

Study author and year	Molla-Esparza 2021		
Study design	Cross-sectional		
Study period	2015		
Country	Spain		
Equity	High-income country		
Participants	Adolescents from 2 secondary charter schools and 2 state schools in the south of Valencia		
Mean age [range]	13.7 [12-18]		
Risk of bias	Moderate		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of using social media platforms	Sent a sext	647
Other	Number of social media platforms used	Sent a sext	647
Other	Number of social media platforms used	Forwarded a sext	647

Table A12.83. Characteristics of included study – Nesi 2017

Study author and year	Nesi 2017		
Study design	Cohort		
Study period	2009-2013		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 6-8 middle school students' part of a larger study		
Mean age [range]	15.8 [not reported]		
Risk of bias	Moderate		
Number of datapoints	6		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Ever exposed to friends' SNS alcohol content	Initiation of drinking	658
Exposure to health-risk behaviour content	Ever exposed to friends' SNS alcohol content	Initiation of becoming drunk	658
Exposure to health-risk behaviour content	Ever exposed to friends' SNS alcohol content	Initiation of heavy episodic drinking	658
Time spent	Average time on Facebook per day	Initiation of drinking	658
Time spent	Average time on Facebook per day	Initiation of becoming drunk	658
Time spent	Average time on Facebook per day	Initiation of heavy episodic drinking	658

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.84. Characteristics of included study – Nesi 2019

Study author and year	Nesi 2019		
Study design **Study period** **Country** **Equity** **Participants** **Mean age [range]** **Risk of bias** **Number of datapoints** **Included in meta-analysis, subgroup or sensitivity analysis**	Cohort 2015-2016 United States of America High-income country with low socioeconomic circumstance(s) Grade 7-8 rural, lower-middle class school students' part of a larger study 16.0 [not reported] High 10 Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of daily social media use	No. of sexual partners in the past year	716
Frequency of use	Frequency of daily social media use	No. of sexual partners in the past year	716
Frequency of use	Frequency of daily social media use	No. of sexual partners in the past year	716
Frequency of use	Frequency of daily social media use	No. of sexual partners in the past year	716
Frequency of use	Posted selfies on Instagram over 1 month period *(objectively recorded)*	No. of sexual partners in the past year	233
Frequency of use	Posted selfies on Instagram over 1 month period *(objectively recorded)*	Substance use (alcohol use and past year marijuana and cigarette use)	233
Other	Online status-seeking strategy use	No. of sexual partners in the past year	716
Other	Online status-seeking strategy use	Substance use (alcohol and past year marijuana and cigarette use)	716

Legend: Abbreviation(s): No.=Number.

Table A12.85. Characteristics of included study – Ng Fat 2021

Study author and year	Ng Fat 2021		
Study design	Cohort		
Study period	2011-2016		
Country	UK		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Sample members of the UK Household Longitudinal Survey		
Mean age [range]	12.5 (10-15 year olds) 17.5 (16-19 year olds) [10-19]		
Risk of bias	Low		
Number of datapoints	8		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media on a normal weekday	Increase in drink frequency in the past 3 years (in those 10-15 years)	856
Time spent	Time spent on social media on a normal weekday	Increase in drink frequency in the past 3 years (in those 16-19 years)	511
Time spent	Time spent on social media on a normal weekday	Increase in binge drinking frequency in the past 3 years (in those 16-19 years)	1,057
Time spent	Time spent on social media on a normal weekday	Drank alcohol in the past month (in those 10-15 years)	4,093
Time spent	Time spent on social media on a normal weekday	Drank alcohol 1-3 times a month in the past month (in those 16-19 years)	2,689
Time spent	Time spent on social media on a normal weekday	Drank alcohol at least weekly in the past month (in those 16-19 years)	2,689
Time spent	Time spent on social media on a normal weekday	Binge drinking 1-2 times a month (in those 16-19 years)	2,687
Time spent	Time spent on social media on a normal weekday	Binge drinking ≥3 times a month (in those 16-19 years)	2,687

Table A12.86. Characteristics of included study – Ngqangashe 2021

Study author and year	Ngqangashe 2021		
Study design	Randomised control trial		
Study period	Not reported		
Country	Belgium		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Students in Flanders part of a larger research project on food media use		
Mean age [range]	13.9 [12-14]		
Risk of bias	Some concerns		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Watched YouTube Tasty video portraying preparation of sweet snacks *(objectively recorded)*	Food choice behaviour (choosing fruit over a sweet snack) *(objectively recorded)*	126

Table A12.87. Characteristics of included study – Ohannessian 2009

Study author and year	Ohannessian 2009		
Study design	Cross-sectional		
Study period	2006		
Country	United States of America		
Equity	High-income country		
Participants	Grade 9-10 high-school students		
Mean age [range]	15.0 [14-16]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent emailing and instant messaging on an average/typical day	Frequency of daily alcohol consumption in the past 6 months	328
Time spent	Time spent emailing and instant messaging on an average/typical day	Smoking onset	328

Table A12.88. Characteristics of included study – Pegg 2018

Study author and year	Pegg 2018		
Study design	Cross-sectional		
Study period	2014		
Country	Australia		
Equity	High-income country		
Participants	Year 12 students' part of the Youth Activity Participation Survey		
Mean age [range]	17.3 [not reported]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	SNS alcohol exposure in the past 6 months	Alcohol use in the past 6 months	793
Frequency of use	Frequency of SNS use (intensity)	Alcohol use in the past 6 months	793

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.89. Characteristics of included study – Pérez 2022

Study author and year	Pérez 2022		
Study design	Cohort		
Study period	2014-2016		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Adolescents part of the Population Assessment of Tobacco and Health Study		
Mean age [range]	Not reported [12-17]		
Risk of bias	Low		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to tobacco related content on social media in the past 12 months (including e-cigarettes)	Dual use of e-cigarettes and at least one combustible product in the past month	16,109,064

Table A12.90. Characteristics of included study – Prince 2021

Study author and year	Prince 2021		
Study design	Cross-sectional		
Study period	2015-2017		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 7-12 students living on or near reservations part of the Our Youth, Our Future Survey		
Mean age [range]	14.78 [not reported]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of Snapchat use	Past month opioid use	25

Table A12.91. Characteristics of included study – Qutteina 2022

Study author and year	Qutteina 2022		
Study design	Cross-sectional		
Study period	2019		
Country	Belgium		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Adolescents attending 18 secondary schools across Flanders		
Mean age [range]	15 [11-19]		
Risk of bias	Moderate		
Number of datapoints	5		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to non-core foods (energy-dense, low nutrient: sweetened drinks, sweets, salty/savoury snacks) on social media	Frequency of sweet intake in the past month	1,002
Exposure to health-risk behaviour content	Exposure to non-core foods (energy-dense, low nutrient: sweetened drinks, sweets, salty/savoury snacks) on social media	Consumption of sweets in the past month (g/day)	1,002
Exposure to health-risk behaviour content	Exposure to non-core foods (energy-dense, low nutrient: sweetened drinks, sweets, salty/savoury snacks) on social media	Frequency of soft drink intake in the past month	1,002
Exposure to health-risk behaviour content	Exposure to non-core foods (energy-dense, low nutrient: sweetened drinks, sweets, salty/savoury snacks) on social media	Consumption of soft drinks in the past month (ml/day)	1,002
Exposure to health-risk behaviour content	Exposure to non-core foods (energy-dense, low nutrient: sweetened drinks, sweets, salty/savoury snacks) on social media	Frequency of fried food intake in the past month	1,002

Table A12.92. Characteristics of included study – Riehm 2021

Study author and year	Riehm 2021		
Study design	Cross-sectional		
Study period	2015		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Students from 10 public high-schools in Los Angeles part of the Happiness & Health Study		
Mean age [range]	16.5 [not reported]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of posting own photos, images, videos, status updates, or blogs on social media	Ever use of alcohol	2,373

Table A12.93. Characteristics of included study – Roditis 2016

Study author and year	Roditis 2016		
Study design	Cross-sectional		
Study period	2014-2015		
Country	United States of America		
Equity	High-income country		
Participants	Grade 9 and 12 high-school students residing in California		
Mean age [range]	16.1 [not reported]		
Risk of bias	Moderate		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Other	Ever seen a message posted on social media about the risks/bad things of using marijuana	Ever use of marijuana	786
Exposure to health-risk behaviour content	Ever seen a message posted on social media about the benefits/good things of using marijuana	Ever use of marijuana	786

Table A12.94. Characteristics of included study – Romo 2017

Study author and year	Romo 2017		
Study design	Cross-sectional		
Study period	2014		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Adolescents recruited from 3 primary care paediatric clinics in Northern Manhattan		
Mean age [range]	16.0 [13-21]		
Risk of bias	High		
Number of datapoints	8		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of SNS use *(via validated tool)*	Inconsistent condom use overall and at last sex	333
Frequency of use	Frequency of social media app use *(via validated tool)*	Inconsistent condom use overall and at last sex	333
Frequency of use	Frequency of SNS use *(via validated tool)*	4 or more lifetime partners in sexually active participants	333
Frequency of use	Frequency of SNS use *(via validated tool)*	More than 1 partner in the past 3 months in sexually active participants	333
Frequency of use	Frequency of SNS use *(via validated tool)*	STI diagnosis ever in sexually active participants	333
Frequency of use	Frequency of SNS use (via validated tool)	History of no use of long-term acting reversible contraception in sexually active female participants	Not reported
Frequency of use	Frequency of SNS use *(via validated tool)*	History of no use of regular forms of hormonal contraception in sexually active female participants	Not reported
Frequency of use	Frequency of SNS use *(via validated tool)*	History of no use of emergency contraception in sexually active female participants	Not reported

Legend: Abbreviation(s): SNS=Social networking site(s) and STI=Sexually transmitted infection.

Table A12.95. Characteristics of included study – Rutter 2021

Study author and year	Rutter 2021		
Study design	Cross-sectional		
Study period	2019		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Adolescents in the United States of America		
Mean age [range]	14.6 [12-17]		
Risk of bias	Moderate		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social media use (checking and posting)	Physical activity	4,592

Table A12.96. Characteristics of included study – Sampasa-Kanyinga 2015

Study author and year	Sampasa-Kanyinga 2015		
Study design	Cross-sectional		
Study period	2013		
Country	Canada		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 11-12 high-school students' part of the Ontario Student Drug Use and Health Survey		
Mean age [range]	15.2 [not reported]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media websites either posting or browsing per day	Cannabis use in the past year	5,329
Time spent	Time spent on social media websites either posting or browsing per day	Tobacco use in the past year	5,329

Table A12.97. Characteristics of included study – Sampasa-Kanyinga 2015

Study author and year	Sampasa-Kanyinga 2015		
Study design	Cross-sectional		
Study period	2013		
Country	Canada		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 7-12 high-school students' part of the Ontario Student Drug Use and Health Survey		
Mean age [range]	15.2 [11-19]		
Risk of bias	Low		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media websites either posting or browsing per day	Skipping breakfast in the past 5 days	9,858
Time spent	Time spent on social media websites either posting or browsing per day	Sugar-sweetened beverage consumption in the past 7 days	9,858
Time spent	Time spent on social media websites either posting or browsing per day	Energy drink consumption in the past 7 days	9,858

Table A12.98. Characteristics of included study – Sampasa-Kanyinga 2016

Study author and year	Sampasa-Kanyinga 2016		
Study design	Cross-sectional		
Study period	2013		
Country	Canada		
Equity	High-income country with mixed socioeconomic circumstances(s)		
Participants	Grade 7-12 high-school students' part of the Ontario Student Drug Use and Health Survey		
Mean age [range]	15.2 [11-20]		
Risk of bias	Low		
Number of datapoints	6		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media websites either posting or browsing per day	Occasional alcohol use in the past year	4,814
Time spent	Time spent on social media websites either posting or browsing per day	Regular alcohol use in the past year	4,814
Time spent	Time spent on social media websites either posting or browsing per day	Binge drinking in the past month	4,814

Table A12.99. Characteristics of included study – Sampasa-Kanyinga 2016

Study author and year	Sampasa-Kanyinga 2016		
Study design	Cross-sectional		
Study period	2013		
Country	Canada		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 7-12 public high-school students' part of the Ontario Student Drug Use and Health Survey		
Mean age [range]	15.3 [11-19]		
Risk of bias	Low		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media websites either posting or browsing per day	Not meeting physical activity recommendation in past week (≥60 minutes per day of moderate to vigorous physical activity on all 7 days)	9,388

Table A12.100. Characteristics of included study – Sampasa-Kanyinga 2018

Study author and year	Sampasa-Kanyinga 2018		
Study design	Cross-sectional		
Study period	2013		
Country	Canada		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 9-10 high-school students' part of the Ontario Student Drug Use and Health Survey		
Mean age [range]	16.1 [not reported]		
Risk of bias	Moderate		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media websites either posting or browsing per day	Ever use of e-cigarettes	2,841

Table A12.101. Characteristics of included study – Sandercock 2016

Study author and year	Sandercock 2016		
Study design	Cross-sectional		
Study period	2014		
Country	UK		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 6-11 junior and high-school students residing in the East of England		
Mean age [range]	13.5 [not reported]		
Risk of bias	Low		
Number of datapoints	5		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on social media on a normal day	Daily sedentary time	678
Time spent	Time spent on social media on a normal day	High sedentary time	678
Time spent	Time spent on social media on a normal day	Low cardio-respiratory fitness in female participants	308

Table A12.102. Characteristics of included study – Savolainen 2020

Study author and year	Savolainen 2020		
Study design	Cross-sectional		
Study period	2017-2019		
Country	United States of America, South Korea, Finland, and Spain		
Equity	High-income country		
Participants	Adolescents in 4 countries across 4 continents		
Mean age [range]	Not reported [15-17]		
Risk of bias	High		
Number of datapoints	20		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of Facebook use *(via validated tool)*	Hazardous alcohol use *(via AUDIT-C)*	USA: 329 KOR: 264 FIN: 154 ESP: 314
Frequency of use	Frequency of YouTube use *(via validated tool)*	Hazardous alcohol use *(via AUDIT-C)*	As above
Frequency of use	Frequency of Twitter use *(via validated tool)*	Hazardous alcohol use *(via AUDIT-C)*	As above
Frequency of use	Frequency of Instagram use *(via validated tool)*	Hazardous alcohol use *(via AUDIT-C)*	As above
Frequency of use	Frequency of instant messaging *(via validated tool)*	Hazardous alcohol use *(via AUDIT-C)*	As above

Legend: Abbreviation(s): AUDIT-C=Alcohol Use Disorders Identification Test; ESP=Spain; FIN=Finland; KOR=South Korea; and USA = United States of America.

Table A12.103. Characteristics of included study – Self-Brown 2018

Study author and year	Self-Brown 2018		
Study design	Cross-sectional		
Study period	2014		
Country	Uganda		
Equity	Low-middle income country with low socioeconomic circumstance(s)		
Participants	Adolescents living in slums part of the Kampala Youth Survey		
Mean age [range]	17.0 [12-18]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Presence of social media use *(via validated tool)*	Transactional sex in sexually active youth *(via validated tool)*	593

Table A12.104. Characteristics of included study – Shan 2022

Study author and year	Shan 2022		
Study design	Cohort		
Study period	2013-2018		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Adolescents part of the Population Assessment of Health and Tobacco Study		
Mean age [range]	Not reported [12-14]		
Risk of bias	Low		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Followed tobacco brands (e.g., Marlboro, Newport, American Spirit, Vuse) on Facebook/Twitter or other social media sites	Initiation of cigarettes	6,557
Exposure to health-risk behaviour content	Followed tobacco brands (e.g., Marlboro, Newport, American Spirit, Vuse) on Facebook/ Twitter or other social media sites	Initiation of e-cigarettes	6,632

Table A12.105. Characteristics of included study – Sharma 2021

Study author and year	Sharma 2021		
Study design	Cross-sectional		
Study period	Not reported		
Country	India		
Equity	Low-middle income country with mixed socioeconomic circumstance(s)		
Participants	Grade 9-12 students in Barwala village, Delhi		
Mean age [range]	Not reported		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to tobacco adverts on social media	Smokeless tobacco use	652

Table A12.106. Characteristics of included study – Shimoga 2019

Study author and year	Shimoga 2019		
Study design	Cross-sectional		
Study period	2014-2015		
Country	United States of America		
Equity	High-country with mixed socioeconomic circumstance(s)		
Participants	Grade 8,10 and 12 school students' part of the Monitoring the Future Survey		
Mean age [range]	Not reported		
Risk of bias	Low		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social media use	Frequency of vigorous physical activity	19,543

Table A12.107. Characteristics of included study – Smout 2021

Study author and year	Smout 2021		
Study design	Cohort		
Study period	2012-2015		
Country	Australia		
Equity	High-income country		
Participants	Middle school students' part of the CAP study		
Mean age [range]	13.4 [13-16]		
Risk of bias	Moderate		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Time spent on SM on a typical day	Days drinking per month	441
Exposure to health-risk behaviour content	Exposure to peer-generated content on SM depicting risky substance use	Days drinking per month	441

Table A12.108. Characteristics of included study – Soneji 2018

Study author and year	Soneji 2018		
Study design	Cohort		
Study period	2013-2015		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Sample members of the Population Assessment of Tobacco and Health Study		
Mean age [range]	Not reported [12-17]		
Risk of bias	Low		
Number of datapoints	4		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social networking account use	Initiation of binge drinking in the past month	8,542
Frequency of use	Frequency of social networking account use	Initiation of tobacco use in the past month	9,067
Frequency of use	Frequency of social networking account use	Increased frequency of tobacco product use	11,996
Frequency of use	Frequency of social networking account use	Progression from tobacco single-product to poly-product use (i.e., ≥ 2 products)	10,928

Table A12.109. Characteristics of included study – Stevens 2017

Study author and year	Stevens 2017		
Study design	Cross-sectional		
Study period	2013-2014		
Country	United States of America		
Equity	High-income country with low socioeconomic circumstance(s)		
Participants	Sample members of a larger mixed methods study		
Mean age [range]	18.2 [13-24]		
Risk of bias	Low		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Other	Exposure to contraception information on SNS in the past month	No condom use at last intercourse in sexually active participants	172
Other	Exposure to contraception information on SNS in the past month	No contraception use at last intercourse in sexually active participants	175

Legend: Abbreviation(s): SNS=Social networking site(s).

Table A12.110. Characteristics of included study – Suwanwong 2021

Study author and year	Suwanwong 2021		
Study design	Cross-sectional		
Study period	2017		
Country	Thailand		
Equity	Low-middle income country		
Participants	Adolescents part of the Cigarette Smoking and Alcohol Drinking Behaviour Survey		
Mean age [range]	Not reported [15-19]		
Risk of bias			
Number of datapoints	Thailand		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Other	Exposure to anti-smoking social media campaign	Smoking status (occasional smoker)	5,669
Other	Exposure to anti-smoking social media campaign	Smoking status (daily smoker)	5,851

Table A12.111. Characteristics of included study – Svensson 2020

Study author and year	Svensson 2020		
Study design	Repeat cross-sectional		
Study period	2016-2019		
Country	Sweden		
Equity	High-income country		
Participants	Students from 17 secondary schools in 8 small municipalities in the county of Skåne part of the Öckerö project		
Mean age [range]	Not reported [14-15]		
Risk of bias	Moderate		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of posting information on Facebook, Instagram, Snapchat, or other social media	Lifetime alcohol use	3,733
Frequency of use	Frequency of posting information on Facebook, Instagram, Snapchat, or other social media	Drunkenness in the past year	3,733
Frequency of use	Frequency of posting information on Facebook, Instagram, Snapchat, or other social media	Drunkenness in the past month	3,733

Table A12.112. Characteristics of included study – Tao 2022

Study author and year	Tao 2022		
Study design	Cross-sectional		
Study period	2020-2021		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Adolescents		
Mean age [range]	16.5 [15-18]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Average time on social media per week	Alcohol use disorder *(via AUDIT*)	407
Time spent	Average time on social media per week	Illicit drug use problems *(via validated tool)*	407

Legend: Abbreviation(s): AUDIT=Alcohol Use Disorders Identification Test.

Table A12.113. Characteristics of included study – Trangenstein 2019

Study author and year	Trangenstein 2019		
Study design	Cross-sectional		
Study period	2018		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Adolescents residing in United States of America (states with legalised retail cannabis)		
Mean age [range]	Not reported [15-19]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Liked/followed cannabis business pages on Facebook, Twitter and/or Instagram	Cannabis use in the past year	482
Exposure to health-risk behaviour content	Liked/followed cannabis business pages on Facebook, Twitter and/or Instagram	Cannabis use in the past 28 days	482

Table A12.114. Characteristics of included study – Tsitsika 2009

Study author and year	Tsitsika 2009		
Study design	Cross-sectional		
Study period	2007-2008		
Country	Greece		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 9-10 urban district school students in Athens		
Mean age [range]	14.9 [not reported]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Ever accessed the internet to visit chat rooms	Frequency of pornographic internet site use	344

Table A12.115. Characteristics of included study – Tsitsika 2011

Study author and year	Tsitsika 2011		
Study design	Cross-sectional		
Study period	2007-2008		
Country	Greens		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 9-10 school students in the urban district of Athens		
Mean age [range]	14.9 [not reported]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Presence of internet chat room use	Internet gambling practices (not via social media) at least once per week	484

Table A12.116. Characteristics of included study – Vandenbosch 2016

Study author and year	Vandenbosch 2016		
Study design	Cross-sectional		
Study period	2010		
Country	Belgium		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	School students' part of the MORES Panel Study		
Mean age [range]	15.4 [12-18]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of chat room use	Use of erotic contact websites in the past 6 months	1,163

Table A12.117. Characteristics of included study – Vannucci 2019

Study author and year	Vannucci 2019		
Study design	Cohort		
Study period	2016-2017		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Grade 7-8 middle school students' part of the PANDA Research Project		
Mean age [range]	12.7 [11-14]		
Risk of bias	Low		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social media use	Delinquent behaviours in the past 6 months *(via validated tool)*	563

Table A12.118. Characteristics of included study – Vazquez-Nava 2020

Study author and year	Vazquez-Nava 2020		
Study design	Cross-sectional		
Study period	Not reported		
Country	Mexico		
Equity	Low-middle income country with mixed socioeconomic circumstance(s)		
Participants	Urban school students in North-Eastern Mexico		
Mean age [range]	Not reported [13-19		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Presence of use of social networks WhatsApp/Facebook *(via validated tool)*	Tobacco smoking *(via validated tool)*	1,328

Table A12.119. Characteristics of included study – Vente 2020

Study author and year	Vente 2020		
Study design	Cross-sectional		
Study period	2016-2018		
Country	United States of America		
Equity	High-income country		
Participants	Adolescents seen at a paediatric clinic at an urban medical centre		
Mean age [range]	16.8 [12-21]		
Risk of bias	High		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Use of ≥4 social media applications per day	Sexting	179
Time spent	Time spent on social media per day	Sexting	179

Table A12.120. Characteristics of included study – Wana 2019

Study author and year	Wana 2019		
Study design	Cross-sectional		
Study period	2017		
Country	Ethiopia		
Equity	Low-middle income country		
Participants	Pre-college students residing in Adama Town		
Mean age [range]	Not reported		
Risk of bias	Moderate		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Presence of social media use	Risky sexual behaviour	346

Table A12.121. Characteristics of included study – Ward 2022

Study author and year	Ward 2022		
Study design	Cross-sectional		
Study period	2017-2018		
Country	United States of America		
Equity	High-income country		
Participants	Adolescents in the Seattle metro area part of a larger longitudinal experimental study		
Mean age [range]	18.4 [15-20]		
Risk of bias	Moderate		
Number of datapoints	3		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of Facebook use per day	Past month typical drinks per week	274
Frequency of use	Frequency of Instagram use per day	Past month typical drinks per week	274
Frequency of use	Frequency of Facebook use per day	Past month peak drinks per occasion	274

Table A12.122. Characteristics of included study – Whitehill 2020

Study author and year	Whitehill 2020		
Study design	Cross-sectional		
Study period	2018		
Country	United States of America		
Equity	High-income country with mixed socioeconomic circumstance(s)		
Participants	Adolescents (aged 15-19) residing in United States of America (states with legalised retail cannabis)		
Mean age [range]	Not reported [15-19]		
Risk of bias	High		
Number of datapoints	4		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of social media use	Lifetime cannabis use	469
Frequency of use	Presence of Facebook use	Lifetime cannabis use	469
Time spent	Time spent on social media per day	Lifetime cannabis use	469
Frequency of use	Presence of Instagram use	Lifetime cannabis use	469

Table A12.123. Characteristics of included study – Widman 2014

Study author and year	Widman 2014		
Study design	Cross-sectional		
Study period	2014		
Country	United States of America		
Equity	High-income country		
Participants	Grade 9-10 high-school students' part of a larger study		
Mean age [range]	17.4 [16-19]		
Risk of bias	High		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	Yes		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Used technology-based sexual communication to communicate with dating partners about using condoms	Inconsistent condom use in the past 6 months	176
Frequency of use	Used technology-based sexual communication to communicate with dating partners about risk of pregnancy	Inconsistent condom use in the past 6 months	176

Table A12.124. Characteristics of included study – Worku 2022

Study author and year	Worku 2022		
Study design	Cross-sectional		
Study period	2021		
Country	Ethiopia		
Equity	Low-middle income country with low socioeconomic circumstance(s)		
Participants	Female high-school students at selected high-schools of Yeka Sub-city, Addis Ababa		
Mean age [range]	Not reported [14-16]		
Risk of bias	Moderate		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Time spent	Stayed more than 2 hours/day on social media	Low dietary diversity *(via FANTA)*	284

Legend: Abbreviation(s): FANTA=Food and Nutrition Technical Assistance 2016 version of the woman's minimum dietary diversity measurement tool.

Table A12.125. Characteristics of included study – Wulff 2021

Study author and year	Wulff 2021		
Study design	Cross-sectional		
Study period	2015		
Country	Germany		
Equity	High-income country		
Participants	Adolescent obesity therapy participants		
Mean age [range]	Not reported [11-17]		
Risk of bias	Moderate		
Number of datapoints	1		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Frequency of use	Frequency of WhatsApp use	Physical inactivity (exercised 0-2 days per week)	228

Table A12.126. Characteristics of included study – Yao 2022

Study author and year	Yao 2022		
Study design	Cross-sectional		
Study period	Not reported		
Country	China		
Equity	High-income country		
Participants	Grade 4-10 elementary and middle school students		
Mean age [range]	13.35 [6-18]		
Risk of bias	Moderate		
Number of datapoints	2		
Included in meta-analysis, subgroup or sensitivity analysis	No		
Exposure(s)	**Exposure measure(s)**	**Outcome measure(s)**	**n**
Exposure to health-risk behaviour content	Exposure to content (including text and pictures) about drinking or smoking (e.g., saw drinking-related information)	Tobacco and alcohol use	1,491

Section A13 Characteristics of excluded studies

Table A13.1. List of studies excluded at full-text screening (n=571 studies) with reasons for exclusion

Author and year	Title	Publication source	Reason for exclusion
Abara 2014	Understanding internet sex-seeking behaviour and sexual risk among young men who have sex with men: Evidence from a cross-sectional study	Sexually Transmitted Infections	Incorrect population
Abdi 2015	Personal, social, and environmental risk factors of problematic gambling among high school adolescents in Addis Ababa, Ethiopia	Journal of Gambling Studies	Incorrect exposure
Abed-Ali 2018	Violence among high school female students in Baghdad city	Indian Journal of Public Health Research and Development	Incorrect exposure
Acar 2020	Eating attitudes and physical appearance comparison with others in daily life versus on social media in adolescents	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Adam 2011	When do online sexual fantasies become reality? The contribution of erotic chatting via the Internet to sexual risk-taking in gay and other men who have sex with men	Health Education Research	Incorrect exposure
Adams 2010	Correlates of physical activity in young American Indian children: Lessons learned from the Wisconsin Nutrition and Growth Study	Journal of Public Health Management and Practice	Incorrect exposure
Adams 2019	Predictors of overweight and obesity in American Indian families with young children	Journal of Nutrition Education and Behaviour	Incorrect exposure
Adebayo 2006	Gender, internet use, and sexual behaviour orientation among young Nigerians	Cyberpsychology and Behaviour	Incorrect exposure
Afolabi 2015	Media exposure and weight concern?	Child and Adolescent Health Issues	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
Agaku 2014	Trends in exposure to pro-tobacco advertisements over the Internet, in newspapers/magazines, and at retail stores among US middle and high school students, 2000-2012	Preventive Medicine	Incorrect exposure
Aggio 2012	Temporal relationships between screen-time and physical activity with cardiorespiratory fitness in English schoolchildren: A 2-year longitudinal study	Preventive Medicine	Incorrect exposure
Agurcia-Parker 2009	An investigation into the relationship between screen time, consumption of advertised foods, and physical activity among Texas 4th grade elementary school children	Dissertation Abstracts International: Section B: The Sciences and Engineering	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Ahern 2015	Risky behaviours and social networking sites	Journal of Psychosocial Nursing & Mental Health Services	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Aires 2010	A 3-year longitudinal analysis of changes in fitness, physical activity, fatness, and screen time	Acta Paediatrica, International Journal of Paediatrics	Incorrect exposure
Aires 2010	A 3-year longitudinal analysis of changes in body mass index	International Journal of Sports Medicine	Incorrect exposure
Al-Ajlouni 2018	Partner meeting venue typology and sexual risk behaviours among French men who have sex with men	International Journal of STD & AIDS	Incorrect exposure
Albert 2018	#consumingitall: Understanding the complex relationship between media consumption and eating behaviours	Dissertation Abstracts International: Section B: The Sciences and Engineering	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Albury 2018	Young people, digital media research and counter public sexual health	Sexualities	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
Alghadir 2020	Differences among Saudi and expatriate students: Body composition indices, sitting time associated with media use and physical activity pattern	International Journal of Environmental Research and Public Health	Incorrect exposure
Alhabash 2021	Trick or drink: Offline and social media hierarchical normative influences on Halloween celebration drinking	Health Communication	Incorrect population
Al-Hamdani 2021	Perceptions and experiences of vaping among youth and young adult e-cigarette users: Considering age, gender, and tobacco use	Journal of Adolescent Health	Incorrect population
Al-Hamdani 2022	Do perceptions and experiences of vaping among youth and young adults differ by device type?	Addiction Research & Theory	No relevant outcome(s)
Al-Hazzaa 2011	Physical activity, sedentary behaviours, and dietary habits among Saudi adolescents relative to age, gender, and region	The International Journal of Behavioural Nutrition and Physical Activity	Incorrect exposure
Al-Hazzaa 2019	Activity energy expenditure, screen time and dietary habits relative to gender among Saudi youth: Interactions of gender with obesity status and selected lifestyle behaviours	Asia Pacific Journal of Clinical Nutrition	Incorrect exposure
Alhusaini 2020	Cross-cultural variation in BMI, sedentary behaviour, and physical activity in international schoolgirls residing in Saudi Arabia	International Journal of Environmental Research and Public Health	Incorrect exposure
Allen 2017	Mobile phone and internet use mostly for sex-seeking and associations with sexually transmitted infections and sample characteristics among Black/African American and Hispanic/Latino men who have sex with men in 3 US cities	Sexually Transmitted Diseases	Incorrect population
Allen 2018	The dirt on clean eating: A cross sectional analysis of dietary intake, restrained eating, and opinions about clean eating among women	Nutrients	Incorrect population
Allender 2011	Associations between activity-related behaviours and standardized BMI among Australian adolescents	Journal of Science and Medicine in Sport	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Alosaimi 2016	Smartphone addiction among university students in Riyadh, Saudi Arabia	Saudi Medical Journal	Incorrect population
Altenburg 2012	Direction of the association between body fatness and self-reported screen time in Dutch adolescents	International Journal of Behavioural Nutrition and Physical Activity	Incorrect exposure
Altenburg 2017	Actual and perceived weight status and its association with slimming and energy-balance related behaviours in 10- to 12-year-old European children: The ENERGY-project	Pediatric Obesity	Incorrect exposure
Alvarez-Jimenez 2019	HORYZONS trial: Protocol for a randomised controlled trial of a moderated online social therapy to maintain treatment effects from first-episode psychosis services	BMJ Open	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Ammouri 2004	Correlates of exercise participation in adolescents	Correlates of Exercise Participation in Adolescents	Incorrect exposure
Amornsriwatanakul 2017	Are Thai children and youth sufficiently active? Prevalence and correlates of physical activity from a nationally representative cross-sectional study	International Journal of Behavioural Nutrition and Physical Activity	Incorrect exposure
Andrie 2019	Gambling involvement and problem gambling correlates among European adolescents: Results from the European Network for Addictive Behaviour study.	Social Psychiatry and Psychiatric Epidemiology	Incorrect exposure
Arie 2014	Doctors and teachers receive new guidance on the internet's effect on young people's sex lives and relationships	BMJ	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
Armstrong 2018	An exploration of how simulated gambling games may promote gambling with money	Journal of Gambling Studies	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Arriscado 2014	Factors associated with low adherence to a Mediterranean diet in healthy children in northern Spain	Appetite	Incorrect exposure
Arsad 2021	A systematic review of immersive social media activities and risk factors for sexual boundary violations among adolescents	IUM Medical Journal Malaysia	Incorrect study type: systematic review
Arseniev-Koehler 2014	Peer influence on undergraduates' intention to get drunk by communication formats	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Asad 2015	Screen-based behaviours of adolescents in Bangladesh	European Journal of Epidemiology	Incorrect exposure
Aschbrenner 2019	Randomised trial of a lifestyle intervention for young adults with serious mental illness in community mental health centres	Schizophrenia Bulletin	Incorrect study type: conference proceeding or abstract
Ashford 2017	Advertising exposure and use of e-cigarettes among female current and former tobacco users of childbearing age	Public Health Nursing	Incorrect population
Asut 2019	Relationships between screen time, internet addiction and other lifestyle behaviours with obesity among secondary school students in the Turkish Republic of Northern Cyprus	Turkish Journal of Paediatrics	Incorrect exposure
Athauda 2020	Factors influencing alcohol use among adolescents in South Asia: A systematic review	Journal of Studies on Alcohol and Drugs	Incorrect study type: systematic review
Atkin 2013	Determinants of change in children's sedentary time	Plos One	Incorrect exposure
Atkin 2021	Adolescent time use and mental health: A cross-sectional, compositional analysis in the Millennium Cohort Study	BMJ Open	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Atkinson 2010	Online behaviours of adolescents: Victims, perpetrators, and Web 2.0.	Journal of Sexual Aggression	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Attwood 2017	Using a mobile health application to reduce alcohol consumption: A mixed-methods evaluation of the drinkaware track & calculate units' application	BMC Public Health	Incorrect exposure
Atwood 2017	Adolescent problematic digital behaviours associated with mobile devices	North American Journal of Psychology	Incorrect exposure
Bae 2018	Selective exposure to misleading information in the new media environment by at-risk youth: A study of pro-smoking YouTube videos	Dissertation Abstracts International Section A: Humanities and Social Sciences	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Bai 2016	The associations of youth physical activity and screen time with fatness and fitness: The 2012 NHANES national youth fitness survey	Plos One	Incorrect exposure
Baird 2016	Social media and substance use	Journal Of Addictions Nursing	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Baird 2019	Teens and vaping: What you need to know	Journal of Addictions Nursing	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Bakhali 2016	Exploring the impact of information seeking behaviours of online health consumers in the Arab world	Studies in Health Technology & Informatics	Incorrect population
Balding 2015	Young People into 2015: The health-related behaviour questionnaire results for over 78,000 young people	Education & Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
Bareghamyan 2021	Sexual and reproductive health of adolescent girls	Akusherstvo i Ginekologiya (Russian Federation)	Unable to source full-text
Barman-Adhikari 2016	Social networking technology use and engagement in human immunodeficiency virus-related risk and protective behaviours among homeless youth	Journal of Health Communication	Incorrect population
Barnes 2015	Maternal correlates of objectively measured physical activity in girls	Maternal and Child Health Journal	Incorrect exposure
Barrere 2015	Oncogenic human papillomavirus infections in 18- to 24-year-old female online daters	Sexually Transmitted diseases	Incorrect exposure
Bass III 2016	Living life online: Talking to parents about social media	Contemporary Paediatrics	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Bauermeister 2014	Sexting among young men who have sex with men: Results from a national survey	Journal of Adolescent Health	Incorrect exposure
Baumgartner 2010	Assessing causality in the relationship between adolescents' risky sexual online behaviour and their perceptions of this behaviour	Journal of Youth and Adolescence	Duplicate sample
Baumgartner 2012	Unwanted online sexual solicitation and online sexual risk behaviour	Encyclopaedia of Cyber Behaviour, Vols. I - III	Incorrect population
Bell 2015	The debate over digital technology and young people	BMJ	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Benotsch 2013	Sexting, substance use, and sexual risk behaviour in young adults	Journal of Adolescent Health	Incorrect exposure
Berchtold 2018	Daily internet time: Towards an evidence-based recommendation?	European Journal of Public Health	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Bergman 2016	The association between alcohol use disorder and social network site engagement among treatment seeking emerging adults	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Bergman 2018	Instagram participation and substance use among emerging adults: The potential perils of peer belonging	Cyberpsychology, Behaviour and Social Networking	Incorrect population
Bergman 2020	Associations between substance use and Instagram participation to inform social network-based screening models: Multimodal cross-sectional study	Journal of Medical Internet Research	Incorrect population
Berner 2013	Lifestyle and depressive risk factors associated with problematic internet use in adolescents in an Arabian Gulf culture	Journal of Addiction Medicine	Incorrect population
Bernstein 2018	Child and adolescent psychiatry case studies: A broad range of ethical dilemmas	Journal of the American Academy of Child and Adolescent Psychiatry	Incorrect study type: conference proceeding or abstract
Beullens 2016	A conditional process analysis on the relationship between the use of social networking sites, attitudes, peer norms, and adolescents' intentions to consume alcohol	Media Psychology	No relevant outcome(s)
Beutel 2011	Regular and problematic leisure-time Internet use in the community: Results from a German population-based survey	Cyberpsychology, Behaviour and Social Networking	Incorrect population
Bevelander 2018	Youth's social network structures and peer influences: Study protocol MyMovez project - Phase I	BMC Public Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Bharucha 2018	Social network use and youth well-being: A study in India	Safer Communities	Incorrect study type: qualitative
Bhuyan 2019	How vaping became fire: Snap streaks, social influencers, and bubble gum	American Sociological Association	Incorrect study type: conference proceeding or abstract

Author and year	Title	Publication source	Reason for exclusion
Bickham 2020	Dating app use and sexual risk behaviours: Examining aspects of use and motivation	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Biddle 2014	Interventions designed to reduce sedentary behaviours in young people: A review of reviews	British Journal of Sports Medicine	Incorrect study type: systematic review
Bilgrami 2017	Health implications of new-age technologies: A systematic review	Minerva Pediatrica	Incorrect study type: systematic review
Black 2013	Actual versus perceived peer sexual risk behaviour in online youth social networks	Translational Behavioural Medicine	Incorrect exposure
Blanchard 2013	Adolescent perceptions of digital play: A study in third-person effects	Dissertation Abstracts International Section A: Humanities and Social Sciences	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Blasco 2019	Pattern of internet use and parental monitoring of social networks as a predictor of sexting in adolescents: A gender perspective	Revista de Psicología y Educación	Potentially relevant non-English language
Blaszczynski 2016	Mental health and online, land-based, and mixed gamblers	Journal of Gambling Studies	Incorrect population
Blaya 2015	The young people and risk-taking on the Internet	Neuropsychiatrie de l'Enfance et de l'Adolescence	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Blazquez Barba 2018	Use of new technologies by adolescents in the search for health information	Atencion Primaria	Potentially relevant non-English language
Bleakley 2011	A model of adolescents' seeking of sexual content in their media choices	Journal of Sex Research	Incorrect exposure
Bobkowski 2012	'Hit me up and we can get down': US youths' risk behaviours and sexual self-disclosure in MySpace profiles	Journal of Children and Media	Incorrect population

Author and year	Title	Publication source	Reason for exclusion
Boggs 2017	The impact of exposure to alcohol advertisements on adolescents: A literature review	International Public Health Journal	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Bonnaire 2012	Internet gambling: What are the risks?	L'Encéphale	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Borajy 2019	Relationship of electronic device usage with obesity and speech delay in children	Family Medicine & Primary Care Review	Incorrect exposure
Borden 2019	Vaping marketers take aim at youth through social media	Chest Physician	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Bousono Serrano 2017	Substance use or abuse, internet use, psychopathology, and suicidal ideation in adolescents	Adicciones	Incorrect exposure
Boyland 2016	Advertising as a cue to consume: A systematic review and meta-analysis of the effects of acute exposure to unhealthy food and non-alcoholic beverage advertising on intake in children and adults	The American Journal of Clinical Nutrition	Incorrect study type: systematic review
Boyle 2018	The social mindfeed project: Using objective assessment methods to better understand the nature of social-media based peer alcohol influence	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Bozzola 2019	Adolescence, smartphone and tablets: A review of the literature	Italian Journal of Pediatrics	Incorrect study type: conference proceeding or abstract
Brailovskaia 2020	Relationship between depression symptoms, physical activity, and addictive social media use	CyberPsychology, Behavior & Social Networking	Incorrect exposure
Branley 2018	Risky behaviour via social media: The role of reasoned and social reactive pathways.	Computers in Human Behaviour	Incorrect population

Author and year	Title	Publication source	Reason for exclusion
Braun-Courville 2009	Exposure to sexually explicit web sites and adolescent sexual attitudes and behaviours	Journal of Adolescent Health	Incorrect exposure
Broaddus 2015	Social media use and high-risk sexual behaviour among black men who have sex with men: A three-city study	AIDS and Behaviour	Incorrect population
Brown 2011	Older and newer media: Patterns of use and effects on adolescents' health and wellbeing	Journal of Research on Adolescence	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Brown 2012	Too much, much too young	Therapy Today	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Brunborg 2017	Social media use and episodic heavy drinking among adolescents	Psychological Reports	Duplicate sample
Brunelle 2012	Internet gambling, substance use, and delinquent behaviour: An adolescent deviant behaviour involvement pattern	Psychology of Addictive Behaviours	Incorrect exposure
Buchanan 2018	The effects of digital marketing of unhealthy commodities on young people: A systematic review	Nutrients	Incorrect study type: systematic review
Buhi 2011	Evaluating the internet as an std risk environment for teens: Findings from the communication, health, and teens (ch@t) study	Sexually Transmitted Infections	Incorrect study type: conference proceeding or abstract
Buhi 2013	Evaluating the internet as a sexually transmitted disease risk environment for teens: Findings from the communication, health, and teens study	Sexually Transmitted Diseases	Incorrect exposure
Buhi 2013	Teens, the internet, and STD Risk: Findings and lessons learned from the communication, health, and teens (CH@T) study	Sexually Transmitted Infections	Incorrect study type: conference proceeding or abstract
Bunnell 2015	Intentions to smoke cigarettes among never-smoking US middle and high school electronic cigarette users: National Youth Tobacco Survey, 2011-2013	Nicotine and Tobacco Research	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Burgos 2013	The relationship between risky behaviours and perceived victimization in individuals who participate in social networking websites	Dissertation Abstracts International: Section B: The Sciences and Engineering	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Burke 2019	The paradoxical outcomes of observing others' exercise behaviour on social network sites: Friends' exercise posts, exercise attitudes, and weight concern	Health Communication	Incorrect population
Burns 2021	Social media preference and condom use behaviours: An analysis of digital spaces with young African American males	Health Education & Behaviour	Incorrect study type: qualitative
Butdabut 2021	Factors predicting sexual risk behaviours of adolescents in North-Eastern Thailand	Studies in Health Technology and Informatics	Incorrect exposure
Cabrera-Nguyen 2016	Young adults' exposure to alcohol- and marijuana-related content on twitter	Journal Of Studies On Alcohol And Drugs	Incorrect population
Caravaca Sanchez 2016	Prevalence and patterns of traditional bullying victimization and cyber-teasing among college population in Spain	BMC Public Health	Incorrect exposure
Card 2017	Exploring the role of sex-seeking apps and websites in the social and sexual lives of gay, bisexual, and other men who have sex with men: A cross-sectional study	Sexual Health	Incorrect exposure
Carrotte 2015	Predictors of "Liking" three types of health and fitness-related content on social media: A cross-sectional study	Journal of Medical Internet Research	Incorrect population
Carrotte 2016	Who 'likes' alcohol? Young Australians' engagement with alcohol marketing via social media and related alcohol consumption patterns	Australian And New Zealand Journal of Public Health	Incorrect population
Castren 2022	Risk factors for excessive social media use differ from those of gambling and gaming in Finnish youth	International Journal of Environmental Research and Public Health	Incorrect exposure
Castro-Calvo 2018	Building bridges between substance and behavioural addictions: Alcohol consumption and their predictive power over internet and cybersex use and abuse in adolescents	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract

Author and year	Title	Publication source	Reason for exclusion
Cavazos-Rehg 2021	Exploring how social media exposure and interactions are associated with ENDS and tobacco use in adolescents from the PATH Study	Nicotine and Tobacco Research	Duplicate sample
Cemelli 2016	Video games impact lifestyle behaviors in adults	Topics in Clinical Nutrition	Incorrect population
Cen Chen-Sankey 2019	E-cigarette marketing exposure and subsequent experimentation among youth and young adults	Pediatrics	Incorrect exposure
Chan 2017	The role of gay identity confusion and outness in sex-seeking on mobile dating apps among men who have sex with men: A conditional process analysis	Journal of Homosexuality	Incorrect exposure
Chiao 2014	Adolescent Internet use and its relationship to cigarette smoking and alcohol use: A prospective cohort study	Addictive Behaviours	Incorrect exposure
Children & Young People Now 2008	Youth work support needed in new world of social networking	Children & Young People Now	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Cho 2019	Mechanisms of social media effects on attitudes toward e-cigarette use: Motivations, mediators, and moderators in a national survey of adolescents	Journal of Medical Internet Research	No relevant outcome(s)
Chortatos 2020	Comparing three screen-based sedentary behaviours' effect upon adolescents' participation in physical activity: The ESSENS study	Plos One	Incorrect exposure
Clayton 2013	Loneliness, anxiousness, and substance use as predictors of Facebook use	Computers in Human Behaviour	Incorrect population
Coates 2018	Does social media food marketing influence children's food intake and preferences?	Obesity Facts	Incorrect study type: conference proceeding or abstract
Cook 2013	Online network influences on emerging adults' alcohol and drug use	Journal Of Youth And Adolescence	Incorrect population
Cookingham 2015	The impact of social media on the sexual and social wellness of adolescents	Journal of Paediatric and Adolescent Gynaecology	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
Coreas 2021	Smoking susceptibility and tobacco media engagement among youth never smokers	Paediatrics	Duplicate sample
Cox 2021	Profiles of parenting in the digital age: Associations with adolescent alcohol and marijuana use	Journal of Studies on Alcohol and Drugs	Incorrect exposure
Cruz 2016	Use of social networking applications (apps) and meeting sites in patients with acute human immunodeficiency virus infection in a specialized clinic in Mexico City	Journal of the International AIDS Society	Incorrect study type: conference proceeding or abstract
Cruz 2019	Tobacco marketing and subsequent use of cigarettes, e-cigarettes, and hookah in adolescents	Nicotine and Tobacco Research	Incorrect exposure
Cubitt 2014	Social networking and risk-taking behaviour: The Lynx effect	Journal Of the International Society for Burn Injuries	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Cui 2018	Patterns of online and offline connectedness among gay, bisexual, and other men who have sex with men	AIDS & Behaviour	Incorrect exposure
Cureau 2018	Associations of multiple unhealthy lifestyle behaviours with overweight/obesity and abdominal obesity among Brazilian adolescents: A country-wide survey	Nutrition, Metabolism and Cardiovascular Diseases	Incorrect exposure
Curlee 2021	The role of social media use in adolescent alcohol use accounting for peer alcohol use	Dissertation Abstracts International: Section B: The Sciences and Engineering	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Curtis 2018	Meta-analysis of the association of alcohol-related social media use with alcohol consumption and alcohol-related problems in adolescents and young adults	Alcoholism: Clinical and Experimental Research	Incorrect study type: systematic review
da Costa 2020	Association between lifestyle behaviours and health-related quality of life in a sample of Brazilian adolescents	International Journal of Environmental Research and Public Health	No relevant outcome(s)

Author and year	Title	Publication source	Reason for exclusion
da Costa 2022	Movement behaviours and their association with depressive symptoms in Brazilian adolescents: A cross-sectional study	Journal of Sport and Health Science	Duplicate sample
Dai 2017	Geographic variations in electronic cigarette advertisements on Twitter in the United States	International Journal of Public Health	Incorrect population
Dalisay 2022	Exposure to tobacco and betel nut content on social media, risk perceptions, and susceptibility to peer influence among early adolescents in Guam	Addictive Behaviours Reports	No relevant outcome(s)
D'Angelo 2019	Facebook-induced friend shift and identity shift: A longitudinal study of Facebook posting and collegiate drinking	Cyberpsychology, Behaviour and Social networking	Incorrect population
Das 2016	Interventions for adolescent substance abuse: An overview of systematic reviews	Journal of Adolescent Health	Incorrect study type: systematic review
Davis 2021	Temporal, sex-specific, social media-based alcohol influences during the transition to college	Substance Use & Misuse	Incorrect population
Dawson 2019	Exploring technology-mediated social interactions among adolescents with attention deficit hyperactivity disorder	Dissertation Abstracts International: Section B: The Sciences and Engineering	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
de Bruijn 2016	European longitudinal study on the relationship between adolescents' alcohol marketing exposure and alcohol use	Addiction	Incorrect exposure
Deforche 2015	Changes in weight, physical activity, sedentary behaviour, and dietary intake during the transition to higher education: A prospective study	International Journal of Behavioural Nutrition and Physical Activity	Incorrect exposure
Depue 2015	Encoded exposure to tobacco use in social media predicts subsequent smoking behaviour	American Journal of Health Promotion	Incorrect population
De-Sola 2019	Cell phone use habits among the Spanish population: Contribution of applications to problematic use	Frontiers in Psychiatry	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Diaz 2022	Online tobacco advertising and current chew, dip, snuff, and snus use among youth and young adults, 2018-2019	International Journal of Environmental Research and Public Health	Incorrect population
Divecha 2012	Tweeting about testing: Do low-income, parenting adolescents and young adults use new media technologies to communicate about sexual health?	Perspectives on Sexual and Reproductive Health	Incorrect exposure
Doggett 2019	Examining the association between exposure to various screen time sedentary behaviours and cannabis use among youth in the COMPASS study	Society of Social Medicine - Population Health	Incorrect exposure
Dolcini 2014	A new window into adolescents' worlds: The impact of online social interaction on risk behaviour	Journal of Adolescent Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Domingues-Montanari 2017	Clinical and psychological effects of excessive screen time on children	Journal of Paediatrics and Child Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Doornwaard 2015	Adolescents' use of sexually explicit Internet material and their sexual attitudes and behaviour: Parallel development and directional effects	Developmental Psychology	Incorrect exposure
Dowdell 2011	Online social networking patterns among adolescents, young adults, and sexual offenders	The American Journal of Nursing	No relevant outcome(s)
Dowdell 2011	Risky internet behaviours of middle-school students: Communication with online strangers and offline contact	Computers Informatics Nursing	No relevant outcome(s)
Dowdell 2022	Problematic behaviours and predicting online risk behaviours in high school students	The Journal of School Nursing	Incorrect exposure
Dowell 2009	Clustering of internet risk behaviours in a middle school student population	Journal of School Health	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Drescher 2011	Caffeine and screen time in adolescence: Associations with short sleep and obesity	Journal of Clinical Sleep Medicine	Incorrect exposure
Dubuc 2020	Lifestyle habits predict academic performance in high school students: The adolescent student academic performance longitudinal study (ASAP)	International Journal of Environmental Research and Public Health	No relevant outcome(s)
Dumas 2019	Am I cool now? Examining the relations between need for popularity, alcohol-related social media posts and heavy drinking among emerging adults	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Dumas 2021	Everyone loves my beer pong pics! examining feedback on social network sites and its role in shaping young adult binge drinking behaviour	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Dumas 2021	Likelihood of posting alcohol-related content scale	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Dunaev 2016	Seeking safe sex information: Social media use, gossip, and sexual health behaviour among minority youth	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Dunlop 2016	Exposure to internet-based tobacco advertising and branding: Results from population surveys of Australian youth 2010-2013	Journal of Medical Internet Research	Incorrect exposure
Duplaga 2020	The use of fitness influencers' websites by young adult women: A cross-sectional study	International Journal of Environmental Research and Public Health	Incorrect population
Durbin 2018	Social media and adolescents: What are the health risks?	Clinical Advisor	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Edler 2022	The role of personality traits and social support in relations of health-related behaviours and depressive symptoms	BMC Psychiatry	Incorrect population

Author and year	Title	Publication source	Reason for exclusion
Effertz 2018	The effect of online gambling on gambling problems and resulting economic health costs in Germany	European Journal of Health Economics	Incorrect population
Elavsky 2017	Who are mobile app users from healthy lifestyle websites? Analysis of patterns of app use and user characteristics	Translational Behavioural Medicine	Incorrect exposure
Eleuteri 2017	Identity, relationships, sexuality, and risky behaviours of adolescents in the context of social media	Journal of Physical Education, Recreation & Dance	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Emery 2014	Wanna know about vaping? Patterns of message exposure, seeking and sharing information about e-cigarettes across media platforms	Tobacco Control	Incorrect population
Emory 2019	Lesbian, gay, bisexual, and transgender (LGBT) view it differently than non-LGBT: Exposure to tobacco-related couponing, e-cigarette advertisements, and anti-tobacco messages on social and traditional media	Journal of the Society for Research on Nicotine and Tobacco	Incorrect population
Englander 2017	Social media sex: Exploitation or everlasting love?	Journal of the American Academy of Child and Adolescent Psychiatry	Incorrect study type: conference proceeding or abstract
Epstein 2011	Adolescent computer use and alcohol use: What are the role of quantity and content of computer use?	Addictive Behaviours	Incorrect exposure
Epstein-Ngo 2013	Alcohol use, dating aggression, and mindfulness in high risk youth: Preliminary analyses	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Epstein-Ngo 2014	Alcohol, drugs, and other factors associated with digital dating violence among high risk urban youth	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Erevik 2017	Sharing of alcohol-related content on social networking sites: Frequency, content, and correlates	Journal of Studies on Alcohol and Drugs	Incorrect population
Escobar-Chaves 2005	Impact of the media on adolescent sexual attitudes and behaviours	Paediatrics	Incorrect study type: systematic review

Author and year	Title	Publication source	Reason for exclusion
Eugene 2015	It's more than just a "sext"- a brief discussion on sexting activity among teens	Journal of Adolescent Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Evans 2019	Outcomes of the Adelante community social marketing campaign for Latino youth	Health Education Research	Incorrect exposure
Faulkner 2017	'Unintended' audiences of alcohol advertising: Exposure and drinking behaviours among Australian adolescents	Journal of Substance Use	Incorrect exposure
Fielding-Singh 2021	Tobacco product promotions remain ubiquitous and are associated with use and susceptibility to use among adolescents	Nicotine and Tobacco Research	Incorrect exposure
Fife 2019	STI testing and documentation via a phone application (APP): Experience with the safe app	Sexually Transmitted Infections	Incorrect study type: conference proceeding or abstract
Floros 2015	Adolescent online gambling in Cyprus: Associated school performance and psychopathology	Journal of Gambling Studies	Incorrect exposure
Folkvord 2016	Food advertising and eating behaviour in children	Current Opinion in Behavioural Sciences	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Ford-Jones 2003	Impact of media use on children and youth	Paediatrics and Child Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Forsyth 2013	The effect of the internet on teen and young adult tobacco use: A literature review	Journal of Paediatric Health Care	Incorrect study type: systematic review
Frankis 2017	Regular STI testing amongst men who have sex with men and use social media is suboptimal - A cross-sectional study	International journal of STD & AIDS	Incorrect exposure
Friedman 2011	GYT (Get Yourself Tested) Campaign: Getting young people talking and tested and sparking a social movement	Sexually Transmitted Infections	Incorrect study type: conference proceeding or abstract

Author and year	Title	Publication source	Reason for exclusion
Friedman 2013	Do you GYT? Evaluation of the first two years of the united states' national get yourself tested campaign	Sexually Transmitted Infections	Incorrect study type: conference proceeding or abstract
Fung 2018	Public health implications of image-based social media: A systematic review of Instagram, Pinterest, Tumblr, and Flickr	The Permanente Journal	Incorrect study type: systematic review
Gabrielli 2019	A new recall of alcohol marketing scale for youth: Measurement properties and associations with youth drinking status	Journal of Studies on Alcohol and Drugs	Duplicate sample
Gainsbury 2014	Are psychology university student gamblers representative of non-university students and general gamblers? a comparative analysis	Journal of Gambling Studies	Incorrect exposure
Gansner 2017	"The internet made me do it": Social media and potential for violence in adolescents	Psychiatric Times	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Gebremeskel 2014	Social media use and adolescent risk-taking behaviour	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Geisner 2012	Differences between athletes and non-athletes in risk and health behaviours in graduating high school seniors	Journal of Child & Adolescent Substance Abuse	Incorrect exposure
Gentzke 2022	Tobacco product use and associated factors among middle and high school students - National Youth Tobacco Survey, United States, 2021	Centers for Disease Control and Prevention Surveillance Summaries	Incorrect exposure
Geusens 2016	The association between social networking sites and alcohol abuse among Belgian adolescents: The role of attitudes and social norms	Journal of Media Psychology	Duplicate sample
Gilliam 2014	Digital media and sexually transmitted infections	Current Opinion in Obstetrics & Gynaecology	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
Godinho 2014	Characteristics associated with media use in early adolescence	Cadernos de Saude Publica	Incorrect exposure
Gold 2011	A systematic examination of the use of online social networking sites for sexual health promotion	BMC Public Health	Incorrect study type: systematic review
Golpe 2017	The relationship between consumption of alcohol and other drugs and problematic Internet use among adolescents	Adicciones	Incorrect exposure
Gomez 2020	Minors and online gambling: Prevalence and related variables	Journal of Gambling Studies	Exact duplicate
Gommans 2015	Frequent electronic media communication with friends is associated with higher adolescent substance use	International Journal of Public Health	Incorrect exposure
Gonzalez 2015	Use and risks of information and communication technologies in the adolescents from 13 to 18 years	Acta Pediatrica Espanola	Potentially relevant non-English language
Govindappa 2014	Internet use and risk-taking behaviours among adolescents	Indian Journal of Paediatrics	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Grant 2014	Social norms and social networking sites: The role of Facebook in predicting alcohol use among first-year undergraduate students	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Greene 2020	Social media use among adolescents being evaluated for sexual abuse	Journal of Paediatric and Adolescent Gynaecology	Incorrect study type: conference proceeding or abstract
Griffiths 2010	Adolescent gambling on the internet: A review	International Journal of Adolescent Medicine and Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
Griffiths 2013	Adolescent gambling via social networking sites: A brief overview	Education & Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Groom 2021	The influence of friends on teen vaping: A mixed-methods approach	International Journal of Environmental Research and Public Health	No relevant outcome(s)
Guerrero 2019	Screen time and problem behaviours in children: Exploring the mediating role of sleep duration	International Journal of Behavioural Nutrition & Physical Activity	Incorrect population
Gulec 2020	Social media usage and health promoting lifestyle in profile related socio-demographic factors in Turkey	Health Promotion Perspectives	Incorrect population
Gumus 2021	The relationship between adolescents' social media addiction and eating behaviours	Clinical Nutrition	Incorrect study type: conference proceeding or abstract
Gupta 2016	A systematic review of the impact of exposure to internet-based alcohol-related content on young people's alcohol use behaviours	Alcohol and Alcoholism	Incorrect study type: systematic review
Gupta 2018	The association between exposure to social media alcohol marketing and youth alcohol use behaviours in India and Australia	BMC Public Health	Incorrect population
Gutierrez 2013	Internet and cell phone usage associated with risky situations of child sexual exploitation	Salud Mental	No relevant outcome(s)
Gutierrez 2015	The impact of e-cigarette advertisements on e-cigarette initiation among middle and high school students	Drug and Alcohol Dependence	Incorrect study type: conference proceeding or abstract
Guy 2012	Internet pornography and adolescent health: Early findings on effects of online pornography on adolescents show associations with risky behaviour	Medical Journal of Australia	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
Hadjipanayis 2019	Social media and children: What is the paediatrician's role?	European Journal of Paediatrics	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Hakim 2018	Correlates of attempting to quit smoking among adults in Bangladesh	Addictive Behaviours Reports	Incorrect population
Hamm 2014	A systematic review of the use and effectiveness of social media in child health	BMC Paediatrics	Incorrect study type: systematic review
Han 2021	Identifying emerging predictors for adolescent electronic nicotine delivery systems use: A machine learning analysis of the Population Assessment of Tobacco and Health Study	Preventive Medicine	Duplicate sample
Hands 2011	The associations between physical activity, screen time and weight from 6 to 14 yrs: The Raine Study	Journal of Science and Medicine in Sport	Incorrect exposure
Hansen 2018	Electronic cigarette marketing and smoking behaviour in adolescence: A cross-sectional study	European Respiratory Society Open Research	Incorrect exposure
Hardon 2014	Ethnographies of youth drug use in Asia	International Journal of Drug Policy	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Hassan 2010	Using technology to improve adolescent healthcare	Current Opinion in Paediatrics	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Hendriks 2021	Causal effects of alcohol-related Facebook posts on drinking behaviour: Longitudinal experimental study	Journal of Medical Internet Research	Incorrect population
Henry 2009	Food and beverage brands that market to children and adolescents on the Internet: A content analysis of branded web sites	Journal of Nutrition Education & Behaviour	Incorrect exposure
Henzel 2021	Hooked on virtual social life. Problematic social media use and associations with mental distress and addictive disorders	Plos One	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Herbert 2017	Exposure and engagement with tobacco and e-cigarette related social media	Journal of Adolescent Health	Incorrect exposure
Hieftje 2013	Electronic media-based health interventions promoting behaviour change in youth: A systematic review	JAMA Paediatrics	Incorrect study type: systematic review
Hill 2019	Prevalence and correlates of lifetime and recent human immunodeficiency virus testing among men who have sex with men (MSM) who use mobile geo-social networking applications in Greater Tokyo	Plos One	Incorrect exposure
Hingle 2013	up34 stealth health: Youth innovation, mobile technology, online social networking, and informal learning to promote physical activity	Journal of Nutrition Education & Behaviour	Incorrect study type: conference proceeding or abstract
Ho 2001	Computer usage and its relationship with adolescent lifestyle in Hong Kong	Journal of Adolescent Health	Incorrect exposure
Hoare 2020	Association of child and adolescent mental health with adolescent health behaviours in the UK Millennium Cohort	JAMA Network Open	Incorrect exposure
Hoffmann 2019	High sedentary time in children is not only due to screen media use: A cross-sectional study	BMC Paediatrics	Incorrect exposure
Hollingdale 2014	The effect of online violent video games on levels of aggression	Plos One	Incorrect population
Holloway 2014	Acceptability of smartphone application-based human immunodeficiency virus prevention among young men who have sex with men	AIDS and Behaviour	Incorrect population
Holt 2012	HIV testing, gay community involvement and internet use: Social and behavioural correlates of human immunodeficiency virus testing among Australian men who have sex with men	AIDS and Behaviour	Incorrect population
Hospers 2002	Chatters on the Internet: A special target group for human immunodeficiency virus prevention	AIDS Care	Incorrect population
Hospers 2005	A new meeting place: Chatting on the internet, e-dating and sexual risk behaviour among Dutch men who have sex with men	AIDS	Incorrect exposure
Howe 2016	Gotta catch'em all! Pokemon GO and physical activity among young adults: Difference in differences study	BMJ	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Huang 2012	The effects of online and offline friendship networks and media use on alcohol and smoking behaviours	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Huang 2014	The interplay of friendship networks and social networking sites: Longitudinal analysis of selection and influence effects on adolescent smoking and alcohol use	American Journal of Public Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Huang 2017	Trends and correlates of hookah use among high school students in North Carolina	North Carolina Medical Journal	Incorrect exposure
Hur 2013	Growing up in the web of social networking: Adolescent development and social media	Adolescent Psychiatry	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Hutton 2019	mhealth interventions to reduce alcohol use in young people: A systematic review of the literature	Comprehensive Child and Adolescent Nursing	Incorrect study type: systematic review
Hwang 2009	Being young and feeling blue in Taiwan: Examining adolescent depressive mood and online and offline activities	New Media & Society	No relevant outcome(s)
Ilakkuvan 2019	Patterns of social media use and their relationship to health risks among young adults	The Journal of Adolescent Health	Incorrect population
Ioannidis 2018	Problematic internet use as an age-related multifaceted problem: Evidence from a two-site survey	Addictive Behaviours	Incorrect population
Ishaque 2012	Frequency of and factors leading to obesity and overweight in school children	Journal of Ayub Medical College, Abbottabad	Incorrect exposure
Janikian 2015	Adolescent gambling in seven European countries: Prevalence and related emotional and behavioural problems	Journal of Behavioural Addictions	Incorrect study type: conference proceeding or abstract
Jardine 2020	The Dark Web and cannabis use in the United States: Evidence from a big data research design	International Journal of Drug Policy	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Jaronko 2019	Leisure computer usage and perceived body weight, diet, and physical activity	Dissertation Abstracts International: Section B: The Sciences and Engineering	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Jenkins 2019	Youth appeal in recreational marijuana promotions across three social media platforms	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Johnson 2014	Social media use and physical activity: Searching for opportunities to connect adolescents and older adults for health promotion	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Jones 2014	The impact of health education transmitted via social media or text messaging on adolescent and young adult risky sexual behavior: A systematic review of the literature	Sexually Transmitted Diseases	Incorrect study type: systematic review
Jones 2016	Association between young Australian's drinking behaviours and their interactions with alcohol brands on Facebook: Results of an online survey	Alcohol and Alcoholism	Incorrect population
Jones Jayanetti 2018	Pizza, burgers, and booze: Online marketing and promotion of food and drink to university students	Australian and New Zealand Journal of Public Health	Incorrect population
Jonsson 2015	Online sexual behaviours among Swedish youth: Associations to background factors, behaviours, and abuse	European Child and Adolescent Psychiatry	Incorrect exposure
Kairouz 2012	Are online gamblers more at risk than offline gamblers?	Cyberpsychology, Behaviour and Social Networking	Incorrect population
Kandola 2021	Prospective relationships of adolescents' screen-based sedentary behaviour with depressive symptoms: The Millennium Cohort Study	Psychological Medicine	No relevant outcome(s)
Kandola 2022	Impact on adolescent mental health of replacing screen-use with exercise: A prospective cohort study	Journal of Affective Disorders	No relevant outcome(s)
Kaplan 2012	Social networking and teen drug use: Tremendous potential to help and potential to harm?	Psychiatric Times	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
Kazemi 2017	Systematic review of surveillance by social media platforms for illicit drug use	Journal of Public Health	Incorrect study type: systematic review
Keihner 2009	Psychosocial, socioeconomic, behavioural, and environmental risk factors for BMI and overweight among 9- to 11-year-old children	Californian Journal of Health Promotion	Incorrect exposure
Kemp 2020	'Social screens' and 'the mainstream': Longitudinal competitors of non-organized physical activity in the transition from childhood to adolescence	The International Journal of Behavioural Nutrition and Physical Activity	Incorrect exposure
Kennewell 2022	The relationships between school children's wellbeing, socio-economic disadvantage, and after-school activities: A cross-sectional study	BMC Paediatrics	Incorrect exposure
Kerekes 2021	Changes in adolescents' psychosocial functioning and well-being as a consequence of long-term COVID-19 restrictions	International Journal of Environmental Research and Public Health	No relevant outcome(s)
Kerr 2018	Associations between problem alcohol use and active and passive social media posts	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Ketchoo 2013	Smoking behaviour and associated factors of illicit cigarette consumption in a border province of southern Thailand	Tobacco Control	Incorrect exposure
Khajeheian 2018	Effect of social media on child obesity: Application of structural equation modelling with the Taguchi method	International Journal of Environmental Research and Public Health	No relevant outcome(s)
Khundadze 2017	Impact of internet gambling on mental and psychological health of children of various ages	Georgian Medical News	Incorrect exposure
Kim 2015	International note: Teen users' problematic online behaviour: Using panel data from South Korea	Journal of Adolescence	Incorrect exposure
Kim 2017	A path model of school violence perpetration: Introducing online game addiction as a new risk factor	Journal of Interpersonal Violence	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Kim 2021	Parental mental health and children's behaviours and media usage during COVID-19-related school closures	Journal of Korean Medical Science	Incorrect exposure
King 2007	Surf and turf wars online--growing implications of Internet gang violence	Journal of Adolescent Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Klainman 2015	Comparison of smoking habits between Jewish and Arabic youth in Israel	European Journal of Preventive Cardiology	Incorrect study type: conference proceeding or abstract
Kleppang 2021	Lifestyle habits and depressive symptoms in Norwegian adolescents: A national cross-sectional study	BMC Public Health	No relevant outcome(s)
Ko 2008	The association between Internet addiction and problematic alcohol use in adolescents: The problem behaviour model	Cyberpsychology & Behaviour	Incorrect exposure
Kocturk 2018	A modern danger for adolescents: From online flirtation to sexual abuse	Journal of Psychiatry & Neurological Sciences	Incorrect exposure
Korogoda 2016	Developmental neuroscience explaining why adolescents engage in risky behaviours	Journal of Psychosocial Nursing & Mental Health Services	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Kranzler 2019	Youth social media use and health outcomes: #diggingdeeper	Journal of Adolescent Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Krauss 2017	Marijuana advertising exposure among current marijuana users in the US	Drug And Alcohol Dependence	Incorrect exposure
Kristiansen 2022	Adolescent gambling advertising awareness: A national survey	International Journal of Social Welfare	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Kurten 2021	Mothers matter: Using regression tree algorithms to predict adolescents' sharing of drunk references on social media	International Journal of Environmental Research and Public Health	No relevant outcome(s)
Kuss 2017	Social networking sites and addiction: Ten lessons learned	International Journal of Environmental Research and Public Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Kwon 2020	Factors associated with adolescents' internet use duration by suicidal ideation	International Journal of Environmental Research and Public Health	Incorrect exposure
LaBrie 2021	An examination of the prospective associations between objectively assessed exposure to alcohol-related Instagram content, alcohol-specific cognitions, and first-year college drinking	Addictive Behaviours	Incorrect population
LaBrie 2021	Prospective relationships between objectively assessed social media use, drinking norms, and alcohol consumption among first-year students	Journal of Studies on Alcohol and Drugs	Incorrect population
Lampert 2007	Use of electronic media in adolescence: Results of the German health interview and examination survey for children and adolescents	Bundesgesund-heitsblatt Gesundheitsforschung Gesundheitsschutz	Incorrect exposure
Leatherdale 2010	Factors associated with communication-based sedentary behaviours among youth: Are talking on the phone, texting, and instant messaging new sedentary behaviours to be concerned about?	Journal of Adolescent Health	Incorrect exposure
Lee 2002	Internet and displacement effect: Children's media use and activities in Singapore	Journal of Computer-Mediated Communication	Incorrect exposure
Lee 2013	Substance abuse precedes internet addiction	Addictive Behaviours	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Lee 2015	Impact of the Internet use in the adolescence on the smoking and drinking in the early adult period: With the panel data	Journal of Behavioural Addictions	Incorrect study type: conference proceeding or abstract
Lee 2015	The association between online health information-seeking behaviours and health behaviours among Hispanics in New York city: A community-based cross-sectional study	Journal of Medical Internet Research	Incorrect population
Lee 2017	Longitudinal study shows that addictive Internet use during adolescence was associated with heavy drinking and smoking cigarettes in early adulthood	Acta Paediatric	Incorrect exposure
Lee 2019	Social networking addiction and depressive symptoms among adolescents in Korea	Journal of Behavioural Addictions	Incorrect study type: conference proceeding or abstract
Lee 2020	Youth and young adult use of pod-based electronic cigarettes from 2015 to 2019: a systematic review	JAMA Paediatrics	Incorrect study type: systematic review
Lees 2020	Screen media activity does not displace other recreational activities among 9–10-year-old youth: A cross-sectional ABCD study R	BMC Public Health	Incorrect population
Lehmkuhl 2013	The new media and their influence on children and adolescents	Child and Adolescent Psychiatry and Psychotherapy	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Lerman 2015	Using the internet to meet people and adolescent sexual risk	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Leung 2018	Exposure to electronic cigarette advertising and intention to use electronic cigarettes in Hong Kong adolescents	Tobacco Induced Diseases	Incorrect study type: conference proceeding or abstract
Leventhal 2018	New tobacco products with fewer advertising restrictions and consequences for the current generation of youths	JAMA Paediatrics	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Lewycka 2018	Downwards trends in adolescent risk-taking behaviours in New Zealand: Exploring driving forces for change	Journal of Paediatrics and Child Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
Li 2017	Condom use peer norms and self-efficacy as mediators between community engagement and condom use among Chinese men who have sex with men	BMC Public Health	Incorrect exposure
Lipsky 2016	Behavioural and sociodemographic correlates of overall diet quality over 4 years in a national cohort of US emerging adults	Federation of American Societies for Experimental Biology Journal	Incorrect study type: conference proceeding or abstract
Litt 2011	Adolescent alcohol use: The roles of social norms and social networking sites	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Litt 2018	#drunktwitter: Examining the relations between alcohol-related Twitter content and alcohol willingness and use among underage young adults	Drug And Alcohol Dependence	Incorrect population
Litt 2019	A longitudinal randomized experimental study examining the impact of social networking site abstainer and drinker content on normative perceptions	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Liu 2017	A pilot study of Pokémon go and players' physical activity	Games for Health Journal	Incorrect exposure
Liu 2021	The feasibility of using Instagram data to predict exercise identity and physical activity levels: Cross-sectional observational study	Journal of Medical Internet Research	Incorrect population
Livingstone 2008	Taking risky opportunities in youthful content creation: Teenagers' use of social networking sites for intimacy, privacy, and self-expression	New Media & Society	Incorrect study type: qualitative
Livingstone 2015	What difference does 'the digital' make to children's experiences of risk?	International Journal of Public Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Lizandra 2019	Screen time and moderate-to-vigorous physical activity changes and displacement in adolescence: A prospective cohort study	European Journal of Sport Science	Incorrect exposure
Long 2018	Online and health risk behaviours in high school students: An examination of bullying	Paediatric Nursing	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Lorenzo-Blanco 2021	E-cigarette use susceptibility among youth in Mexico: The roles of remote acculturation, parenting behaviours, and internet use frequency	Addictive Behaviours	Incorrect exposure
Lorimer 2016	Young men who have sex with men's use of social and sexual media and sex-risk associations: Cross-sectional, online survey across four countries	Sexually Transmitted Infections	Incorrect population
Lou 2012	Media's contribution to sexual knowledge, attitudes, and behaviours for adolescents and young adults in three Asian Cities	Journal of Adolescent Health	Incorrect exposure
Loukas 2019	Electronic nicotine delivery systems marketing and initiation among youth and young adults	Paediatrics	Incorrect exposure
Love 2019	How social media influences high school students to commit criminal offenses in South-eastern United States	Dissertation Abstracts International Section A: Humanities and Social Sciences	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Lu 2018	Cross-sectional and temporal associations between cyber dating abuse victimization and mental health and substance use outcomes	Journal Of Adolescence	Incorrect exposure
Lukhele 2016	Multiple sexual partnerships and their correlates among Facebook users in Swaziland: An online cross-sectional study	African Journal of AIDS Research	Incorrect population
Luo 2018	Risk of human immunodeficiency virus infection and its factors among men who have sex with men: A geosocial networking application-based survey in Beijing of China, 2017	Chinese Journal of Preventive Medicine	Incorrect population
Luo 2020	Comparison of human immunodeficiency virus infection risk between 15 to 24 year-old student men who have sex with men and non-student men who have sex with men: A cross-sectional study	Chinese Journal of Preventive Medicine	Unable to source full-text
Lwin 2017	Media exposure and parental mediation on fast-food consumption among children in metropolitan and suburban Indonesia	Asia Pacific Journal of Clinical Nutrition	Incorrect population
Lyons 2017	Masculinities, alcohol consumption and social networking	Youth Drinking Cultures in a Digital World	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
Lyvers 2020	Alexithymia, impulsivity, disordered social media use, mood, and alcohol use in relation to Facebook self-disclosure	Computers in Human Behaviour	Incorrect population
Maas 2019	Online sexual experiences predict subsequent sexual health and victimization outcomes among female adolescents: A latent class analysis	Journal of Youth and Adolescence	Incorrect exposure
Macapagal 2018	Hookup app use, sexual behaviour, and sexual health among adolescent men who have sex with men in the United States	Journal Of Adolescent Health	Incorrect exposure
Macapagal 2019	Geosocial networking application use, characteristics of app-met sexual partners, and sexual behaviour among sexual and gender minority adolescents assigned male at birth	Journal of Sex Research	Incorrect exposure
MacMillan 2021	Exploring factors associated with alcohol and/or substance use during the COVID-19 pandemic	International Journal of Mental Health and Addiction	Incorrect population
Mahase 2019	Social media can harm when use displaces sleep or exercise or involves bullying, finds study	BMJ	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Malheiros 2021	Association between physical activity, screen time activities, diet patterns and daytime sleepiness in a sample of Brazilian adolescents	Sleep Medicine	No relevant outcome(s)
Marker 2019	Exploring the myth of the chubby gamer: A meta-analysis on sedentary video gaming and body mass	Social Science and Medicine	Incorrect study type: systematic review
Marks 2015	Friendship network characteristics are associated with physical activity and sedentary behaviour in early adolescence	Plos One	Incorrect exposure
Marotta 2018	Impact and risks of new information technologies in adolescents: Results of a survey conducted on 1534 subjects	Giornale di Neuropsichiatria dell'Età Evolutiva	Potentially relevant non-English language
Marques 2018	Facebook: Risks and opportunities in Brazilian and Portuguese youths with different levels of psychosocial adjustment	The Spanish Journal of Psychology	No relevant outcome(s)

Author and year	Title	Publication source	Reason for exclusion
Masitah 2019	Social media and adolescent macro nutrition intake	Annals of Nutrition and Metabolism	Incorrect study type: conference proceeding or abstract
Mata 2011	Obesity in children and adolescents: Risks, causes, and therapy from a psychological perspective	Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Mayhew 2017	Youth and sexually explicit internet material: Separating truth from fiction	Journal of the American Academy of Child and Adolescent Psychiatry	Incorrect study type: conference proceeding or abstract
McBride 2011	Risks and benefits of social media for children and adolescents	Journal of Paediatric Nursing	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
McCarthy 2022	The influence of unhealthy food and beverage marketing through social media and advergaming on diet-related outcomes in children-a systematic review	Obesity Reviews	Incorrect study type: systematic review
McClure 2013	TV and internet alcohol marketing and underage alcohol use	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
McClure 2013	Alcohol marketing receptivity, marketing-specific cognitions, and underage binge drinking	Alcoholism: Clinical and Experimental Research	Incorrect exposure
McClure 2016	Internet alcohol marketing and underage alcohol use	Paediatrics	Incorrect exposure
McCreanor 2013	Youth drinking cultures, social networking, and alcohol marketing: Implications for public health	Critical Public Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
McFarlane 2002	Young adults on the Internet: Risk behaviours for sexually transmitted diseases and human immunodeficiency virus	Journal of Adolescent Health	Incorrect exposure
Meeus 2018	Managing positive and negative media effects among adolescents: Parental mediation matters but not always	Journal of Family Communication	Incorrect exposure
Melkevik 2010	Is spending time in screen-based sedentary behaviours associated with less physical activity: A cross national investigation	International Journal of Behavioural Nutrition and Physical Activity	Incorrect exposure
Merkel 2018	Social media use and physical activity: To share or not to share?	Journal of Physical Education, Recreation & Dance	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Miller 2021	Online peers and offline highs: An examination of online peer groups, social media homophily, and substance use	Journal of Psychoactive Drugs	Incorrect population
Mishu 2021	Predictors of cigarette smoking, smokeless tobacco consumption, and use of both forms in adolescents in South Asia: A secondary analysis of the Global Youth Tobacco Surveys	Nicotine and Tobacco Research	Incorrect exposure
Mitchell 2007	Youth internet users at risk for the most serious online sexual solicitations	American Journal of Preventive Medicine	No relevant outcome(s)
Mitchell 2014	Rural Environments and Community Health (REACH): A randomised controlled trial protocol for an online walking intervention in rural adults	BMC Public Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Mitchell 2019	Physical inactivity in childhood from preschool to adolescence	ACSM's Health & Fitness Journal	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Moitra 2021	Screen time is associated with eating habits, sleep patterns, and adiposity measures in adolescents	Obesity Facts	Incorrect study type: conference proceeding or abstract

Author and year	Title	Publication source	Reason for exclusion
Moreno 2012	Social networking sites and adolescent health	Paediatric Clinics of North America	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Moreno 2014	Influence of social media on alcohol use in adolescents and young adults	Alcohol Research: Current Reviews	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Moreno 2016	#Wasted: The intersection of substance use behaviours and social media in adolescents and young adults	Current Opinion in Psychology	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Moreno 2019	Testing young adults' reactions to Facebook cues and their associations with alcohol use	Substance Use & Misuse	Incorrect exposure
Morioka 2016	Association between smoking and problematic internet use among Japanese adolescents: Large-scale nationwide epidemiological study	Cyberpsychology, Behaviour and Social Networking	Incorrect exposure
Morioka 2017	The association between alcohol use and problematic internet use: A large-scale nationwide cross-sectional study of adolescents in Japan	Journal of Epidemiology	Incorrect exposure
Mu 2015	Internet use and adolescent binge drinking: Findings from the monitoring the future study	Addictive Behaviours Reports	Incorrect exposure
Mucci 2016	Prevalence of internet addiction: A pilot study in a group of Italian students	European Neuropsycho-pharmacology	Incorrect study type: conference proceeding or abstract
Mukadi 2018	Sexual behaviour of the school-going youth in the city of Likasi, democratic Republic of Congo	Pan African Medical Journal	Incorrect exposure
Munoz-Miralles 2016	The problematic use of Information and Communication Technologies (ICT) in adolescents by the cross sectional JOITIC study	BMC Paediatrics	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Murray 2015	A survey of the practices and perceptions of students in one catholic high school on the use of the internet regarding safety, cyberbullying, and sexting	Dissertation Abstracts International Section A: Humanities and Social Sciences	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Namkoong 2017	Communication, reasoning, and planned behaviours: Unveiling the effect of interactive communication in an anti-smoking social media campaign	Health communication	Incorrect exposure
Nawi 2021	Risk and protective factors of drug abuse among adolescents: A systematic review	BMC Public Health	Incorrect study type: systematic review
Negriff 2018	Structural characteristics of the online social networks of maltreated youth and offline sexual risk behaviour	Child Abuse and Neglect	Incorrect comparator group
Negriff 2019	The influence of online-only friends on the substance use of young adults with a history of childhood maltreatment	Substance Use & Misuse	Incorrect exposure
Nelson 2019	Sexually explicit media use among 14-17-year-old sexual minority males in the U.S	Archives of Sexual Behaviour	Incorrect exposure
Ng Fat 2021	Associations between social media usage and alcohol use among youths and young adults: Findings from Understanding Society	Addiction	Exact duplicate
No Authors listed 2003	Adolescents advertising and tobacco smoking	Medicine Today	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
No Authors listed 2010	The "excess" generation	Rivista Italiana di Medicina dell'Adolescenza	Unable to source full-text
No authors listed 2015	Social media to combat youth drinking	Australian Nursing & Midwifery Journal	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Author and year	Title	Publication source	Reason for exclusion
No authors listed 2016	Social media as a new venue for aggression and bullying	Adolescent Medicine: State of the Art Reviews	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
No authors listed 2018	The role of internet addiction on fatigue, sleep disturbances and poor life-style habits among adolescents	European Psychiatry	Incorrect study type: conference proceeding or abstract
Noel 2020	Exposure to digital alcohol marketing and alcohol use: A systematic review	Journal of Studies on Alcohol and Drugs	Incorrect study type: systematic review
Noll 2013	Association of maltreatment with high-risk internet behaviours and offline encounters	Paediatrics	No relevant outcome(s)
Norris Turner 2011	Social media and chlamydia testing by university students: A pilot study	Sexually Transmitted Infections	Incorrect study type: conference proceeding or abstract
Nunez-Smith 2010	Media exposure and tobacco, illicit drugs, and alcohol use among children and adolescents: A systematic review	Substance Abuse	Incorrect study type: systematic review
O'Brien 2021	Relationship between gender, physical activity, screen time, body mass index and wellbeing in Irish children from social disadvantage	Child Care in Practice	Incorrect exposure
O'Cathail 2011	Association of cigarette smoking with drug use and risk taking behaviour in Irish teenagers	Addictive Behaviours	Incorrect exposure
Ogunleye 2012	Prevalence of high screen time in English youth: Association with deprivation and physical activity	Journal of Public Health	Incorrect exposure
Ojanen 2014	Investigating online harassment and offline violence among young people in Thailand: Methodological approaches, lessons learned	Culture, Health & Sexuality	Incorrect study type: qualitative
O'Keeffe 2011	Clinical report - The impact of social media on children, adolescents, and families	Pediatrics	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
O'Keeffe 2011	The impact of social media on children, adolescents, and families	Paediatrics	Exact duplicate

Author and year	Title	Publication source	Reason for exclusion
Oksanen 2021	Social media and access to drugs online: A nationwide study in the United States and Spain among adolescents and young adults	The European Journal of Psychology Applied to Legal Context	Incorrect population
Olafsdottir 2014	Young children's screen activities, sweet drink consumption and anthropometry: Results from a prospective European study	European Journal of Clinical Nutrition	Incorrect exposure
Olaleye 2017	Social-media use and sexual behaviour among in-school adolescents in Ibadan, Nigeria	Sexually Transmitted Infections	Incorrect study type: conference proceeding or abstract
O'Sullivan 2012	Texts from last night: Screen time, porn use, sexting, and chat as predictors of sexual intercourse experience among Canadian adolescents	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Ouellette 2019	YouTube and risky behaviours in adolescents: The "choking game"	The American Journal of Emergency Medicine	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Pahn 2019	Impact of short message service (SMS) and social media on sexual intercourse of high school students in Cambodia	Journal of Korean Academy of Community Health Nursing	No relevant outcome(s)
Palamar 2020	Posting, texting, and related social risk behaviour while high	Substance Abuse	Incorrect exposure
Palasinski 2013	Can computer-mediated communication increase adolescents' sexually risky behaviours?	The American Psychologist	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Palkar 2019	Digitizing interventions: An internet-based approach to reach out to the "hidden network of men who have sex with men" in Mumbai, India	Journal of the International AIDS Society	Incorrect study type: conference proceeding or abstract
Park 2011	The relation between screen time and health behaviours in Korean children	Obesity	Incorrect study type: conference proceeding or abstract

Author and year	Title	Publication source	Reason for exclusion
Park 2013	A systematic review of social networking sites: Innovative platforms for health research targeting adolescents and young adults	Journal of Nursing Scholarship	Incorrect study type: systematic review
Parker 2021	The use of digital platforms for adults' and adolescents' physical activity during the COVID-19 pandemic (our life at home): Survey study	Journal of Medical Internet Research	Incorrect exposure
Parkes 2013	Are sexual media exposure, parental restrictions on media use and co-viewing TV and DVDs with parents and friends associated with teenagers' early sexual behaviour?	Journal of Adolescence	Incorrect exposure
Patel 2013	Social media use and human immunodeficiency virus risk behaviours in young men who have sex with men of colour in New York city: Implications for outreach and prevention	Journal of General Internal Medicine	Incorrect study type: conference proceeding or abstract
Patel 2016	Social media use and human immunodeficiency virus related risk behaviours in young black and Latino gay and bi men and transgender individuals in New York city: Implications for online interventions	Journal of Urban Health	Incorrect population
Patrick 2015	Demographic and behavioural correlates of six sexting behaviours among Australian secondary school students	Sexual Health	Incorrect exposure
Patton 2014	Social media as a vector for youth violence: A review of the literature	Computers in Human Behaviour	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Paulos 2010	DID video kill the radio star? - Assessing gambling and multimedia use in Luxembourg's high school students	European Psychiatry	Incorrect study type: conference proceeding or abstract
Pauwels 2016	Differential online exposure to extremist content and political violence: Testing the relative strength of social learning and competing perspectives	Terrorism and Political Violence	Incorrect population
Pedersen 2004	Mobile phones, web chat, and sex among Norwegian adolescents	Tidsskr Nor Laegeforen	Potentially relevant non-English language
Pedersen 2004	Mobile phones, web chat, and sex: A study of Norwegian adolescents based on a representative sample	Tidsskrift for den Norske Laegeforening	Exact duplicate

Author and year	Title	Publication source	Reason for exclusion
Peek 2014	The selfie in the digital age: From social media to sexting	Psychiatric Times	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Peiper 2020	Differential patterns of e-cigarette and tobacco marketing exposures among youth: Associations with substance use and tobacco prevention strategies	International Journal of Drug Policy	Incorrect exposure
Peter 2011	The influence of sexually explicit internet material on sexual risk behaviour: A comparison of adolescents and adults	Journal of Health Communication	Incorrect exposure
Piguet 2015	What keeps female problematic Internet users busy online?	European Journal of Paediatrics	Incorrect exposure
Pocs 2019	Tobacco reduction on Facebook among 14-35-year-olds	Orv Hetil	Incorrect population
Pokhrel 2021	Exposure to e-cigarette content on social media and e-cigarette use: An ecological momentary assessment study	Addictive Behaviours Reports	Incorrect population
Post 2021	SARS-CoV-2 wave two surveillance in East Asia and the Pacific: Longitudinal trend analysis	Journal of Medical Internet Research	Incorrect exposure
Potenza 2011	Correlates of at-risk/problem internet gambling in adolescents	Journal of the American Academy of Child & Adolescent Psychiatry	Incorrect exposure
Prot 2014	Long-term relations among prosocial-media use, empathy, and prosocial behaviour	Psychological Science	Incorrect exposure
Przybylski 2018	Internet filtering and adolescent exposure to online sexual material	Cyberpsychology, Behaviour and Social Networking	Incorrect exposure
Pujazon-Zazik 2010	Adolescents' self-presentation on a teen dating website: A risk content analysis	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract

Author and year	Title	Publication source	Reason for exclusion
Pujazon-Zazik 2010	To tweet, or not to tweet: Gender differences and potential positive and negative health outcomes of adolescents' social internet use	American Journal of Men's Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Queiroz 2019	Sexually transmitted infections and factors associated with condom use in dating app users in Brazil	Acta Paulista de Enfermagem	Incorrect population
Ra 2018	Association of digital media use with subsequent symptoms of attention-deficit/hyperactivity disorder among adolescents	Journal of the American Medical Association	No relevant outcome(s)
Radanielina Hita 2018	Parental mediation in the digital era: Increasing children's critical thinking may help decrease positive attitudes toward alcohol	Journal of Health Communication	Incorrect population
Ragelienė 2021	The role of peers, siblings and social media for children's healthy eating socialization: A mixed methods study	Food Quality and Preference	No relevant outcome(s)
Raggatt 2019	Correlates of reduced alcohol consumption among a sample of young Australians	Alcohol and Alcoholism	Incorrect population
Rankine 2016	The association between online risk behaviours and real life sexual behaviours among African American female adolescents	Dissertation Abstracts International: Section B: The Sciences and Engineering	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Reid 2014	Social media use among adolescents: Benefits and risks	Adolescent Psychiatry	Exact duplicate
Reid 2014	Social media use among adolescents: Benefits and risks	Adolescent Psychiatry	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Rial 2018	Minors and problematic internet use: Evidence for better prevention	Computers in Human Behaviour	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Ribisl 2003	The potential of the internet as a medium to encourage and discourage youth tobacco use	Tobacco Control	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Rice 2010	Internet use, social networking, and human immunodeficiency virus /AIDS risk for homeless adolescents	Journal of Adolescent Health	Incorrect population
Rice 2016	Social media and digital technology use among Indigenous young people in Australia: A literature review	International Journal for Equity in Health	Incorrect study type: systematic review
Richards 2015	Impact of social media on the health of children and young people	Journal of Paediatrics and Child Health	Incorrect study type: systematic review
Richter 2020	The good, the bad and the ugly: The relationship between social media use, subjective health and risk behaviour among children and adolescents	Gesundheitswesen (Bundesverband der Arzte des Offentlichen Gesundheitsdienstes (Germany))	Potentially relevant non-English language
Richter 2021	The good, the bad and the ugly: The relationship between social media use, subjective health and risk behaviour among children and adolescents	Gesundheitswesen	Exact duplicate
Ricketts 2015	The effect of Internet related problems on the sexting behaviours of juveniles	American Journal of Criminal Justice	Incorrect exposure
Rideout 2002	Generation Rx.com What are young people really doing online?	Marketing Health Services	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Rodenhizer 2019	The impacts of sexual media exposure on adolescent and emerging adults' dating and sexual violence attitudes and behaviours: A critical review of the literature	Trauma, Violence & Abuse	Incorrect study type: systematic review
Rodgers 2020	A biopsychosocial model of social media use and body image concerns, disordered eating, and muscle-building behaviours among adolescent girls and boys	Journal of Youth and Adolescence	No relevant outcome(s)

Author and year	Title	Publication source	Reason for exclusion
Rodopman Arman 2015	Defining social reciprocity deficits in internet addiction: Evaluation of problematic internet user (PIU) adolescents in an university outpatient clinic	European Child and Adolescent Psychiatry	Incorrect study type: conference proceeding or abstract
Romer 2017	Digital media and risks for adolescent substance abuse and problematic gambling	Paediatrics	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Romo 2016	Associations between frequent social media and sexting with sexual risk behaviours in Uganda adolescents	Sexually Transmitted Diseases	Incorrect study type: conference proceeding or abstract
Romo 2016	Understanding adolescent social media use: Association with sexual risk and parental monitoring factors that can influence protection	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Rosen 2014	Media and technology use predicts ill-being among children, preteens, and teenagers independent of the negative health impacts of exercise and eating habits	Computers in Human Behaviour	Incorrect exposure
Rosengren 2020	Online sex partner seeking and human immunodeficiency virus testing frequency among young black sexual minority men	Journal of Human Immunodeficiency Virus/AIDS & Social Services	Incorrect population
Rosser 2013	The effects of gay sexually explicit media on the human immunodeficiency virus risk behaviour of men who have sex with men	AIDS and Behaviour	Incorrect exposure
Rounsefell 2020	Social media, body image and food choices in healthy young adults: A mixed methods systematic review	Nutrition & Dietetics	Incorrect study type: systematic review
Rucker 2015	Problematic Internet use is associated with substance use in young adolescents	Acta Paediatrica	Incorrect exposure
Russell 2022	Social networking site use and alcohol use behaviors among adolescents: A latent profile analysis	Addictive Behaviors	Incorrect population
Ryu 2022	Smartphone usage patterns and dietary risk factors in adolescents	The Journal of nutrition	Duplicate sample

Author and year	Title	Publication source	Reason for exclusion
Sabramani 2021	Bullying and Its associated individual, peer, family and school factors: Evidence from Malaysian national secondary school students	International Journal of Environmental Research and Public Health	No relevant outcome(s)
Sampasa-Kanyinga 2020	Sex differences in the relationship between social media use, short sleep duration, and body mass index among adolescents	Sleep Health	No relevant outcome(s)
Sande 2021	Alcohol-related risks for slovene secondary school students on graduation trips: Ten years later	Archives of Psychiatry Research	Incorrect exposure
Sano 2020	Relationship between prolonged media usage and lifestyle habits among junior and senior high school students	Japanese Journal of Public Health	Incorrect exposure
Santistevan 2017	Awareness of e-cigarettes and correlation of use among high school students	Dissertation Abstracts International Section A: Humanities and Social Sciences	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Sarchiapone 2013	The use of internet in prevention	European Psychiatry	Incorrect study type: conference proceeding or abstract
Saunders 2016	A snapshot of the sexual experiences of bisexual black adolescent males over 1 year	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Savoia 2021	Adolescents' exposure to online risks: Gender disparities and vulnerabilities related to online behaviours	International Journal of Environmental Research and Public Health	No relevant outcome(s)
Savolainen 2020	Online relationships and social media interaction in youth problem gambling: A four-country study	International Journal of Environmental Research and Public	Incorrect exposure
Savolainen 2021	The role of online group norms and social identity in youth problem gambling	Computers in Human Behaviour	Incorrect population

Author and year	Title	Publication source	Reason for exclusion
Schafer 2022	Stigma, social support, and substance use in diverse men who have sex with men and transgender women living with human immunodeficiency virus in the US Southeast	Southern Medical Journal	Incorrect population
Scott 2016	The social influence of friends' alcohol-related content posted on social media	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Seidenberg 2017	A national study of social media, television, radio, and internet usage of adults by sexual orientation and smoking status: Implications for campaign design	International Journal of Environmental Research and Public Health	Incorrect population
Sela-Shayovitz 2012	Gangs and the web: Gang members online behavior	Journal of Contemporary Criminal Justice	Incorrect study type: qualitative
Self-Brown 2021	Individual and parental risk factors for sexual exploitation among high-risk youth in Uganda	Journal of Interpersonal Violence	Exact duplicate
Sevcikova 2013	Predictors of online and offline sexual activities and behaviours among adolescents	Cyberpsychology, Behaviour and Social Networking	Incorrect exposure
Ševčíková 2016	Girls' and boys' experience with teen sexting in early and late adolescence	Journal of Adolescence	Incorrect exposure
Sevic 2020	The relationship between the use of social networking sites and sexually explicit material, the internalization of appearance ideals and body self-surveillance: Results from a longitudinal study of male adolescents	Journal of Youth and Adolescence	No relevant outcome(s)
Shamu 2020	Knowledge, attitudes, and practices of young adults towards human immunodeficiency virus prevention: An analysis of baseline data from a community-based human immunodeficiency virus prevention intervention study in two high human immunodeficiency virus burden districts, South Africa	BMC Public Health	Incorrect population
Shapiro 2017	Correlates of tinder use and risky sexual behaviours in young adults	Cyberpsychology, Behaviour and Social Networking	Incorrect population

Author and year	Title	Publication source	Reason for exclusion
She 2022	Profiles of stress and coping associated with mental, behavioural, and internet use problems among adolescents during the COVID-19 pandemic: A stratified random sampling and cluster analysis	Frontiers in Public Health	Incorrect exposure
Shi 2011	Weekend television viewing and video gaming are associated with less adolescent smoking	Journal of Substance Use	Incorrect exposure
Shuai 2021	Influences of digital media use on children and adolescents with attention deficit hyperactivity disorder during COVID-19 pandemic	Globalization and Health	No relevant outcome(s)
Shukla 2019	Sugar-sweetened beverages and screen time: Partners in crime for adolescent obesity	Journal of Paediatrics	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Silva 2016	Type and quantity of physical activity and screen based activities of students from the 7th to the 12th grades: Characterization and association	Revista Portuguesa de Saude Publica	Incorrect exposure
Silva 2018	Prevalence of overweight and obesity and associated factors in school children and adolescents in a medium-sized Brazilian city	Clinics (Sao Paulo, Brazil)	Incorrect exposure
Simon 2018	Socioeconomic status and adolescent e-cigarette use: The mediating role of e-cigarette advertisement exposure	Preventive Medicine	Incorrect exposure
Sina 2022	Social media and children's and adolescents' diets - a systematic review of the underlying social and physiological mechanisms	Advances in Nutrition	Incorrect study type: systematic review
Smith 2016	Is sexual content in new media linked to sexual risk behaviour in young people? A systematic review and meta-analysis	Sexual Health	Incorrect study type: systematic review
Sobowale 2017	Understanding the role of reward processing and depression in compulsive internet use among V adolescents	Journal of the American Academy of Child and Adolescent Psychiatry	Incorrect study type: conference proceeding or abstract
Soneji 2018	Engagement with online tobacco marketing and associations with tobacco product use among US youth: Findings from Wave 1 of the Population Assessment of Tobacco and Health Study	Journal of Adolescent Health	Duplicate sample

Author and year	Title	Publication source	Reason for exclusion
Soneji 2019	Online tobacco marketing among US adolescent sexual, gender, racial, and ethnic minorities	Addictive Behaviours	No relevant outcome(s)
Spilkova 2017	Predictors of excessive use of social media and excessive online gaming in Czech teenagers	Journal of Behavioural Addictions	Incorrect exposure
Stevens 2022	On sex, drugs, and alcohol: A mixed-method analysis of youth posts on social media in the united states	Journal of Children and Media	Incorrect exposure
Stiglic 2019	Effects of screentime on the health and well-being of children and adolescents: A systematic review of reviews	BMJ open	Incorrect study type: systematic review
Stoddard 2012	Permissive norms and young adults' alcohol and marijuana use: The role of online communities	Journal of Studies on Alcohol and Drugs	Incorrect population
Strizek 2020	Perceived problems with adolescent online gaming: National differences and correlations with substance use	Journal of Behavioural Addictions	Incorrect exposure
Stulhofer 2005	Internet and sexual compulsivity	Socijalna Psihijatrija	Potentially relevant non-English language
Sun 2005	Internet accessibility and usage among urban adolescents in Southern California: Implications for web-based health research	Cyberpsychology and Behaviour	Incorrect exposure
Suris 2014	Problematic internet use and substance use in adolescence	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Suwarni 2019	Determinants of the pornography exposure effects on junior and senior high school adolescence in Sanggau District, West Kalimantan	Indian Journal of Public Health Research and Development	Incorrect exposure
Tadena 2020	The influence of social media affinity on eating attitudes and body dissatisfaction in Philippine adolescents	Child Health Nursing Research	No relevant outcome(s)
Tahir 2020	Does watching violent electronic and social media content lead to increased levels of aggression? A survey among adolescents in an urban slum of metropolitan Karachi	International Journal of Adolescent Medicine and Health	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Teunissen 2016	Friends' drinking norms and male adolescents' alcohol consumption: The moderating role of performance-based peer influence susceptibility	Journal Of Adolescence	Incorrect exposure
Thammasarn 2020	Effects of food fit for fun program with social media used on health literacy and obesity prevention behaviours among senior-primary school students, in Nakhon Ratchasima Province Thailand	Indian Journal of Public Health Research and Development	Incorrect exposure
Thompson 2005	Addicted media: Substances on screen	Child and Adolescent Psychiatric Clinics of North America	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Thonglua 2015	The association between internet use and sexual attitudes and behaviours of the secondary school students in Bangkok	Journal of Sexual Medicine	No relevant outcome(s)
Thrasher 2016	Prevalence and correlates of e-cigarette perceptions and trial among early adolescents in Mexico	Journal of Adolescent Health	Incorrect exposure
Tomic 2018	Associations between Croatian adolescents' use of sexually explicit material and sexual behavior: Does parental monitoring play a role?	Archives of Sexual Behavior	Incorrect exposure
Törrönen 2020	How do social media-related attachments and assemblages encourage or reduce drinking among young people?	Journal of Youth Studies	Incorrect study type: qualitative
Trangenstein 2021	Cannabis marketing and problematic cannabis use among adolescents	Journal of Studies on Alcohol and Drugs	Duplicate sample
Trangenstein 2022	Typology of adolescents exposed to non-medical cannabis marketing and associations with consumption Patterns	Prevention Science	Duplicate sample
Tucker 2013	Cross-lagged associations between substance use-related media exposure and alcohol use during middle school	Alcoholism: Clinical and Experimental Research	Incorrect study type: conference proceeding or abstract
Tucker 2013	Cross-lagged associations between substance use-related media exposure and alcohol use during middle school	Journal of Adolescent Health	Incorrect exposure
Twenge 2022	Specification curve analysis shows that social media use is linked to poor mental health, especially among girls	Acta Psychologica	No relevant outcome(s)

Author and year	Title	Publication source	Reason for exclusion
Uhls 2017	Benefits and costs of social media in adolescence	Pediatrics	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Unger 2018	Talking about tobacco on Twitter is associated with tobacco product use	Preventive Medicine	Incorrect population
van der Sanden 2021	Predictors of using social media to purchase drugs in New Zealand: Findings from a large-scale online survey	International Journal of Drug Policy	Incorrect population
Van Hulst 2020	Determinants of new onset cardiometabolic risk among normal weight children	International Journal of Obesity	Incorrect exposure
van Oosten 2015	Exploring associations between exposure to sexy online self-presentations and adolescents' sexual attitudes and behaviour	Journal of Youth and Adolescence	No relevant outcome(s)
van Oosten 2017	Sexy online self-presentation on social network sites and the willingness to engage in sexting: A comparison of gender and age	Journal of Adolescence	No relevant outcome(s)
van Oosten 2018	The importance of adolescents' sexually outgoing self-concept: Differential roles of self- and other-generated sexy self-presentations in social media	Cyberpsychology, behaviour and social networking	No relevant outcome(s)
Van Ouytsel 2016	Cyber dating abuse: Research on young people's motives and the associations of the behaviour in Flanders, Belgium	Journal of the American Academy of Child and Adolescent Psychiatry	Incorrect study type: conference proceeding or abstract
Van Ouytsel 2019	An exploratory study of sexting behaviours among heterosexual and sexual minority early adolescents	Journal of Adolescent Health	Incorrect exposure
Vandenbosch 2018	Explaining the relationship between sexually explicit internet material and casual sex: A two-step mediation model	Archives of Sexual Behavior	Incorrect exposure
Vander Wyst 2019	A social media intervention to improve nutrition knowledge and behaviours of low income, pregnant adolescents, and adult women	Plos One	Incorrect exposure
Vannucci 2020	Social media use and risky behaviours in adolescents: A meta-analysis	Journal of Adolescence	Incorrect study type: systematic review

Author and year	Title	Publication source	Reason for exclusion
Vaterlaus 2015	#Gettinghealthy: The perceived influence of social media on young adult health behaviours	Computers in Human Behaviour	Incorrect study type: qualitative
Vente 2017	Social media as a vehicle for expression of self-harm and risk-taking behaviour in adolescents	Journal of the American Academy of Child and Adolescent Psychiatry	Incorrect study type: conference proceeding or abstract
Vente 2018	Evaluating high-risk behaviours in adolescents on social media	Journal of Adolescent Health	Incorrect study type: conference proceeding or abstract
Villani 2001	Impact of media on children and adolescents: A 10-year review of the research	Journal of the American Academy of Child and Adolescent Psychiatry	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Viner 2019	Roles of cyberbullying, sleep, and physical activity in mediating the effects of social media use on mental health and wellbeing among young people in England: A secondary analysis of longitudinal data	The Lancet Child and Adolescent Health	No relevant outcome(s)
Viner 2020	Correction to Lancet Child Adolescent Health 2019: Roles of cyberbullying, sleep, and physical activity in mediating the effects of social media use on mental health and wellbeing among young people in England: A secondary analysis of longitudinal data	The Lancet Child and Adolescent Health	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Vogel 2020	Effects of social media on adolescents' willingness and intention to use e-cigarettes: An experimental investigation	Journal of the Society for Research on Nicotine and Tobacco	No relevant outcome(s)
Wahyuni 2020	Determinants of adolescent’s high-risk sexual behaviour in SMK 8 and MegaRezky Health Vocational School Makassar	Enfermería Clínica	Unable to source full-text
Wahyurin 2019	Physical activity, screen time, and nutritional status in adolescents in Banyumas	Annals of Tropical Medicine and Public Health	Incorrect exposure
Walther 2014	Nutrition, lifestyle factors, and mental health in adolescents and young adults living in Austria	International Journal of Adolescent Medicine And Health	Incorrect exposure

Author and year	Title	Publication source	Reason for exclusion
Wang 2012	Adolescent bullying involvement and psychosocial aspects of family and school life: A cross-sectional study from Guangdong province in China	Plos One	Incorrect exposure
Watchirs Smith 2013	Do new media affect adolescent sexual attitudes and behaviours? A systematic review	Sexually Transmitted Infections	Incorrect study type: conference proceeding or abstract
Welsh 2013	The sugar-sweetened beverage wars: Public health and the role of the beverage industry	Current Opinion in Endocrinology, Diabetes, and Obesity	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)
Werneck 2018	Social, behavioural, and biological correlates of cardiorespiratory fitness according to sex, nutritional status, and maturity status among adolescents. A cross-sectional study	Sao Paulo Medical Journal	Incorrect exposure
Westgate 2014	"I will take a shot for every 'like' I get on this status": Posting alcohol-related Facebook content is linked to drinking outcomes	Journal of Studies on Alcohol and Drugs	Incorrect population
White 2015	Adolescents' and young adults' online risk taking: The role of gist and verbatim representations	Risk Analysis	Incorrect exposure
Whitehill 2015	Emerging adults' use of alcohol and social networking sites during a large street festival: A real-time interview study	Substance Abuse Treatment, Prevention, and Policy	Incorrect population
Whitehill 2020	Exposure to cannabis marketing in social and traditional media and past-year use among adolescents in states with legal retail cannabis	Journal of Adolescent Health	Exact duplicate
Whiteley 2011	African American adolescents and new media: Associations with human immunodeficiency virus/STI risk behaviour and psychosocial variables	Ethnicity and Disease	Incorrect exposure
Wickel 2013	Variables associated with active and inactive behaviour during the after-school period	Paediatric Exercise Science	Incorrect exposure
Willoughby 2022	Social media, marijuana, and sex: An exploratory study of adolescents' intentions to use and college students' use of marijuana	Journal of Sex Research	Incorrect population
Winetrobe 2014	Associations of unprotected anal intercourse with Grindr-met partners among Grindr-using young men who have sex with men in Los Angeles	AIDS Care	Incorrect population

Author and year	Title	Publication source	Reason for exclusion
Winther 2014	Leisure time computer use and adolescent bone health: Findings from the tromso study-fit futures	Osteoporosis International	Incorrect study type: conference proceeding or abstract
Winther 2015	Leisure time computer use and adolescent bone health-findings from the Tromso Study, Fit Futures: A cross-sectional study	BMJ Open	Incorrect exposure
Xu 2018	The effect of using geosocial networking apps on the human immunodeficiency virus incidence rate among men who have sex with men: Eighteen-month prospective cohort study in Shenyang, China	Journal of Medical Internet Research	Incorrect exposure
Yau 2014	Relationships between problematic Internet use and problem-gambling severity: Findings from a high-school survey	Addictive Behaviours	Incorrect exposure
Ybarra 2006	Internet use among Ugandan adolescents: Implications for human immunodeficiency virus intervention	PLoS Medicine	No relevant outcome(s)
Ybarra 2008	Linkages between internet and other media violence with seriously violent behaviour by youth	Paediatrics	Incorrect exposure
Ybarra 2014	Sexual media exposure, sexual behaviour, and sexual violence victimization in adolescence	Clinical Paediatrics	Incorrect exposure
Ybarra 2015	Can clans protect adolescent players of massively multiplayer online games from violent behaviours?	International Journal of Public Health	Incorrect comparator group
Ybarra 2016	A national study of lesbian, gay, bisexual (LGB), and non-LGB youth sexual behaviour online and in-person	Archives of Sexual Behaviour	No relevant outcome(s)
Yonker 2015	"Friending" teens: Systematic review of social media in adolescent and young adult health care	Journal of Medical Internet Research	Incorrect study type: systematic review
Yoo 2014	Associations between overuse of the internet and mental health in adolescents	Nursing & Health Sciences	Incorrect exposure
Young 2011	Online social networking technologies, human immunodeficiency virus knowledge, and sexual risk and testing behaviours among homeless youth	AIDS and Behaviour	Incorrect population
Young 2013	Social networking and diffusion of risks and interventions among youth	Sexually Transmitted Infections	Incorrect study type: conference proceeding or abstract

Author and year	Title	Publication source	Reason for exclusion
Young 2018	HIV prevention and sex behaviours as organizing mechanisms in a Facebook group affiliation network among young black men who have sex with men	AIDS & Behaviour	Incorrect comparator group
Yu 2017	Predictors and the distal outcome of general Internet use: The identification of children's developmental trajectories	The British Journal of Developmental Psychology	Incorrect exposure
Yusriani 2020	Education through WhatsApp media in changing of smoking behaviour among senior high school students	National Public Health Journal	Incorrect exposure
Zhan 2019	Electronic cigarette usage patterns: A case study combining survey and social media data	Journal of the American Medical Informatics Association	Incorrect population
Zheng 2021	How does online e-cigarette advertisement promote youth's e-cigarettes use? The mediating roles of social norm and risk perceptions	Health Communication	Exact duplicate
Zheng 2021	How Does Online e-cigarette Advertisement Promote Youth's e-cigarettes Use? The Mediating Roles of Social Norm and Risk Perceptions	Health communication	Duplicate sample
Zheng 2021	Social media and E-cigarette use among US youth: Longitudinal evidence on the role of online advertisement exposure and risk perception	Addictive Behaviours	Duplicate sample
Zhou 2014	Internet use and its impact on engagement in leisure activities in China	Plos One	Incorrect exposure
Zhu 2017	Pro-smoking information scanning using social media predicts young adults' smoking behaviour	Computers in Human Behaviour	Incorrect population
Zonfrillo 2014	NekNominate: A deadly, social media-based drinking dare	Clinical Pediatrics	Incorrect study type: commentary/editorial/non-systematic review/theses/book chapter(s)

Legend: Abbreviations(s): AIDS= Acquired immunodeficiency syndrome; BMI= Body mass index; SARS-COV-2=Coronavirus disease; STD=Sexually transmitted disease; and STI=Sexually transmitted infection.

Section A14 Risk of bias (RoB) domain and overall grade for included datapoints and studies

Table A14.1. Risk of bias (RoB) domain and overall grades for included cross-sectional and cohort datapoints (n=334), and overall study risk of bias (Rob) grade (n=122), assessed using adapted Newcastle Ottawa Scale (NOS)

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Anastario 2020	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Anastario 2020	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Baker 2016	NOS: cross-sectional studies	High	High	High	Moderate	High	High
Baker 2016	NOS: cross-sectional studies	High	High	High	Moderate	High	
Baker 2016	NOS: cross-sectional studies	High	High	High	Moderate	High	
Baldwin 2018	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Baldwin 2018	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Baldwin 2018	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Baldwin 2018	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Baldwin 2018	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Baldwin 2018	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Baldwin 2018	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Ball 2020	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	Low
Ball 2020	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Baru 2020	NOS: cross-sectional studies	High	Moderate	Moderate	Moderate	High	High
Baumgartner 2012	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Bayraktar 2007	NOS: cross-sectional studies	High	High	High	Moderate	High	High
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	High
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Beebe 2004	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Boers 2020	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	Low
Booker 2015	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	High
Boniel-Nissim 2022	NOS: cross-sectional studies	Moderate	Low	Low	Low	Low	Low
Boniel-Nissim 2022	NOS: cross-sectional studies	Moderate	Low	Low	Low	Low	
Boniel-Nissim 2022	NOS: cross-sectional studies	Moderate	Low	Low	Low	Low	
Boniel-Nissim 2022	NOS: cross-sectional studies	Moderate	Low	Low	Low	Low	
Brunborg 2019	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	Low
Brunborg 2019	NOS: cohort studies	Low	Moderate	Low	Low	Low	
Brunborg 2019	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	
Brunborg 2019	NOS: cross-sectional studies	Low	Moderate	High	Low	High	
Brunborg 2022	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Camenga 2018	NOS: cohort studies	Moderate	Moderate	Moderate	High	High	High
Canale 2016	NOS: cross-sectional studies	Moderate	High	Low	Low	High	Low
Canale 2016	NOS: cross-sectional studies	Moderate	High	Low	Low	High	
Canale 2016	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	
Casaló 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Casaló 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Casaló 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Casaló 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Cavazos-Rehg 2014	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	High
Chang 2016	NOS: cohort studies	Low	Moderate	High	High	High	High
Chang 2016	NOS: cohort studies	Low	Moderate	High	High	High	
Chapin 2018	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	High
Chapin 2018	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Chau 2022	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Chau 2022	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Chau 2022	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Chau 2022	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Chau 2022	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Chen 2019	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	High
Chen 2019	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	
Coyne 2013	NOS: cross-sectional studies	High	Moderate	High	Low	High	High
Coyne 2018	NOS: cohort studies	Low	Moderate	High	Moderate	High	High
Coyne 2018	NOS: cohort studies	Low	Moderate	High	Moderate	High	
Critchlow 2019	NOS: cross-sectional studies	Low	Moderate	Low	Low	Low	
Critchlow 2019	NOS: cross-sectional studies	Low	Moderate	Low	Low	Low	Low
Critchlow 2019	NOS: cross-sectional studies	Low	Moderate	Low	Low	Low	
da Costa 2021	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	
da Costa 2021	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	Low
da Costa 2021	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Dai 2022	NOS: cross-sectional studies	Low	Low	Moderate	Low	Low	Low
Dai 2022	NOS: cross-sectional studies	Low	Low	Moderate	Low	Low	
Davis 2019	NOS: cohort studies	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Dawson 2019	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	High
Dawson 2019	NOS: cross-sectional studies	High	Low	High	Moderate	High	
Dawson 2019	NOS: cross-sectional studies	High	Low	High	Moderate	High	
de Bruijn 2016	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
de Bruijn 2016	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
De Looze 2019	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
De Looze 2019	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
De Looze 2019	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Doornwaard 2014	NOS: cross-sectional studies	High	Low	High	Low	High	High
Doornwaard 2015	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	Moderate
Doornwaard 2015	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Doornwaard 2015	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Doornwaard 2015	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Elton-Marshall 2016	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	High
Elton-Marshall 2016	NOS: cross-sectional studies	Moderate	Moderate	High	Low	High	
Erreygers 2017	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	High
Floros 2013	NOS: cross-sectional studies	Moderate	High	Moderate	Moderate	High	High
Floros 2013	NOS: cross-sectional studies	Moderate	High	High	Low	High	
Froyland 2020	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	Low
Froyland 2020	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Froyland 2020	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Froyland 2020	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	
Froyland 2020	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	
Froyland 2020	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	
Froyland 2020	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	
Froyland 2020	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	
Gascoyne 2021	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Gascoyne 2021	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Gazendam 2020	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Gazendam 2020	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Geber 2021	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Geusens 2017	NOS: cohort studies	Moderate	Moderate	Moderate	High	High	High
Geusens 2017	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	
Geusens 2017	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Low	Moderate	Moderate
Geusens 2017	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Low	Moderate	
Geusens 2019	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Geusens 2019	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Gomez 2019	NOS: cross-sectional studies	Moderate	High	High	High	High	High
Gordon 2011	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	High
Gordon 2011	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	
Gregg 2018	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Low	Moderate	Moderate
Gunnlaugsson 2020	NOS: cross-sectional studies	Moderate	Low	Moderate	Low	Low	
Gunnlaugsson 2020	NOS: cross-sectional studies	Moderate	Low	Moderate	Low	Low	Low
Gunnlaugsson 2020	NOS: cross-sectional studies	Moderate	Low	Moderate	Low	Low	
Hamilton 2020	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	High

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Hayer 2018	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Hayer 2018	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	
Holtz 2011	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Low	Moderate	Moderate
Hryhorczuk 2019	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Hryhorczuk 2019	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Hryhorczuk 2019	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Hryhorczuk 2019	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Hryhorczuk 2019	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Hryhorczuk 2019	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Hrywna 2020	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Hrywna 2020	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Huang 2012	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Huang 2014	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	Low
Huang 2014	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	
Huang 2014	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	
Huang 2014	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	
Jeong 2022	NOS: cross-sectional studies	Moderate	Moderate	High	Low	High	High
Jiang 2018	NOS: cross-sectional studies	High	Low	Low	Low	High	High
Kaufman 2014	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	Low
Kaufman 2014	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Low	Moderate	
Kaufman 2014	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	
Kaufman 2014	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Low	Moderate	
Kaufman 2014	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Kaufman 2014	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Kaufman 2014	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Kaufman 2014	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Kaur 2020	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Low	
Kaur 2020	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Low	
Kaur 2020	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Low	Low
Kaur 2020	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Low	
Kaur 2020	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Low	
Kaur 2020	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Low	
Kelleghan 2020	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	
Kelleghan 2020	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	
Kelleghan 2020	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	
Kelleghan 2020	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Kelleghan 2020	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	
Kelleghan 2020	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	
King 2014	NOS: cross-sectional studies	High	Moderate	High	Low	High	High
Ko 2009	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Ko 2009	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Ko 2009	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Kontostoli 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	
Kontostoli 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	
Kontostoli 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Kontostoli 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	Low
Kontostoli 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	
Kontostoli 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Koutamanis 2015	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	High
Kwon 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Kwon 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Kwon 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Kwon 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Landry 2013	NOS: cross-sectional studies	High	Moderate	Moderate	Moderate	High	High
Landry 2013	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	
Larm 2017	NOS: cross-sectional studies	Moderate	Moderate	High	Low	High	High
Larm 2017	NOS: cross-sectional studies	Moderate	Moderate	High	Low	High	
Larm 2019	NOS: cross-sectional studies	High	Moderate	Moderate	Low	High	High
Larm 2019	NOS: cross-sectional studies	High	Moderate	Moderate	Low	High	
Lee 2015	NOS: cross-sectional studies	High	Moderate	Moderate	Moderate	High	High
Lee 2019	NOS: cohort studies	Low	Moderate	Moderate	High	High	High
Lee 2019	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	
Lee 2021	NOS: cross-sectional studies	High	Low	Moderate	Low	High	High
Lee 2021	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Lee 2021	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Lee 2021	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Lin 2012	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	High
Lin 2012	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	
Lipsky 2017	NOS: cohort studies	Low	Moderate	Low	Low	Low	Low
Lipsky 2017	NOS: cohort studies	Low	Moderate	Low	Low	Low	
Lipsky 2017	NOS: cohort studies	Low	Moderate	Low	Low	Low	
Longobardi 2021	NOS: cross-sectional studies	Moderate	High	High	Low	High	High

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
McClure 2020	NOS: cross-sectional studies	High	Moderate	Low	Moderate	High	High
Merrill 2019	NOS: cross-sectional studies	High	Moderate	Moderate	Moderate	High	High
Michael 2016	NOS: cross-sectional studies	Moderate	High	High	High	High	High
Moitra 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Moitra 2022	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	
Mojica 2014	NOS: cross-sectional studies	High	Moderate	Moderate	Moderate	High	High
Mojica 2014	NOS: cross-sectional studies	High	Moderate	Moderate	Moderate	High	
Mojica 2014	NOS: cross-sectional studies	High	Moderate	Moderate	Moderate	High	
Molla-Esparza 2021	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Molla-Esparza 2021	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Molla-Esparza 2021	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Nesi 2017	NOS: cohort studies	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Nesi 2017	NOS: cohort studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Nesi 2017	NOS: cohort studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Nesi 2017	NOS: cohort studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Nesi 2017	NOS: cohort studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Nesi 2017	NOS: cohort studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Nesi 2019	NOS: cohort studies	Low	Moderate	High	Moderate	High	High
Nesi 2019	NOS: cohort studies	Low	Moderate	High	Moderate	High	
Nesi 2019	NOS: cohort studies	Low	Moderate	High	Moderate	High	
Nesi 2019	NOS: cohort studies	Low	Low	High	Moderate	High	
Nesi 2019	NOS: cohort studies	Low	Low	High	Moderate	High	
Nesi 2019	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Nesi 2019	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Nesi 2019	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Nesi 2019	NOS: cross-sectional studies	Moderate	Low	High	Moderate	High	
Nesi 2019	NOS: cross-sectional studies	Moderate	Low	High	Moderate	High	
Ng Fat 2021	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	
Ng Fat 2021	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	
Ng Fat 2021	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	
Ng Fat 2021	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Ng Fat 2021	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Ng Fat 2021	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Ng Fat 2021	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Ng Fat 2021	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Ohannessian 2009	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	
Ohannessian 2009	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	
Pegg 2018	NOS: cross-sectional studies	High	Moderate	Moderate	Moderate	High	
Pegg 2018	NOS: cross-sectional studies	High	Moderate	Moderate	Moderate	High	
Pérez 2022	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	Low
Prince 2021	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	High
Qutteina 2022	NOS: cross-sectional studies	Low	Moderate	Moderate	Low	Moderate	
Qutteina 2022	NOS: cross-sectional studies	Low	Moderate	Moderate	Low	Moderate	
Qutteina 2022	NOS: cross-sectional studies	Low	Moderate	Moderate	Low	Moderate	
Qutteina 2022	NOS: cross-sectional studies	Low	Moderate	Moderate	Low	Moderate	
Qutteina 2022	NOS: cross-sectional studies	Low	Moderate	Moderate	Low	Moderate	
Riehm 2021	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	High
Roditis 2016	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Roditis 2016	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Romo 2017	NOS: cross-sectional studies	High	Low	Moderate	Low	High	High
Romo 2017	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Romo 2017	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Romo 2017	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Romo 2017	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Romo 2017	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Romo 2017	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Romo 2017	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Rutter 2021	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Sampasa-Kanyinga 2015	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Sampasa-Kanyinga 2015	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Sampasa-Kanyinga 2015	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Sampasa-Kanyinga 2015	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	High
Sampasa-Kanyinga 2015	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Sampasa-Kanyinga 2016	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	Low
Sampasa-Kanyinga 2016	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Sampasa-Kanyinga 2016	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Sampasa-Kanyinga 2016	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Sampasa-Kanyinga 2016	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Sampasa-Kanyinga 2016	NOS: cross-sectional studies	Low	Moderate	Low	Moderate	Low	
Sampasa-Kanyinga 2016	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Sampasa-Kanyinga 2016	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Sampasa-Kanyinga 2018	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Sandercock 2016	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Sandercock 2016	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Sandercock 2016	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Sandercock 2016	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Sandercock 2016	NOS: cross-sectional studies	Moderate	Moderate	Low	Low	Low	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	High
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Savolainen 2020	NOS: cross-sectional studies	High	Low	Moderate	Low	High	
Self-Brown 2018	NOS: cross-sectional studies	Low	Low	High	Low	High	High
Self-Brown 2018	NOS: cross-sectional studies	Low	Low	High	Low	High	
Shan 2022	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	Low
Shan 2022	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	
Sharma 2021	NOS: cross-sectional studies	Low	Moderate	High	High	High	High
Shimoga 2019	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Smout 2021	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Smout 2021	NOS: cohort studies	Low	Moderate	Moderate	Moderate	Moderate	
Soneji 2018	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	Low
Soneji 2018	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	
Soneji 2018	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	
Soneji 2018	NOS: cohort studies	Low	Moderate	Low	Moderate	Low	
Stevens 2017	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	Low
Stevens 2017	NOS: cross-sectional studies	Moderate	Moderate	Low	Moderate	Low	
Suwanwong 2021	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	High
Suwanwong 2021	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	
Svensson 2020	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Svensson 2020	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Svensson 2020	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	
Tao 2022	NOS: cross-sectional studies	Low	Moderate	High	Low	High	High
Tao 2022	NOS: cross-sectional studies	Low	Moderate	High	Low	High	
Trangenstein 2019	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	High
Trangenstein 2019	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	

Author and year	RoB assessment tool	Selection	Exposure	Comparability	Outcome	Overall datapoint RoB	Overall study RoB
Tsitsika 2009	NOS: cross-sectional studies	Moderate	High	High	Moderate	High	High
Tsitsika 2011	NOS: cross-sectional studies	Low	Moderate	High	Moderate	High	High
Vandenbosch 2016	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	High
Vannucci 2019	NOS: cohort studies	Low	Moderate	Low	Low	Low	
Vannucci 2019	NOS: cross-sectional studies	Low	Moderate	High	Low	High	Low
Vannucci 2019	NOS: cross-sectional studies	Low	Moderate	High	Low	High	
Vannucci 2019	NOS: cross-sectional studies	Low	Moderate	High	Low	High	
Vazquez-Nava 2020	NOS: cross-sectional studies	Moderate	Low	High	Low	High	High
Vente 2020	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	High
Vente 2020	NOS: cross-sectional studies	Moderate	Moderate	High	Moderate	High	
Wana 2019	NOS: cross-sectional studies	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Ward 2022	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Ward 2022	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Ward 2022	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	
Whitehill 2020	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	
Whitehill 2020	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	High
Whitehill 2020	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	
Whitehill 2020	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	
Widman 2014	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	High
Widman 2014	NOS: cross-sectional studies	High	Moderate	High	Moderate	High	
Worku 2022	NOS: cross-sectional studies	Low	Moderate	Moderate	Low	Moderate	Moderate
Wulff 2021	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Low	Moderate	Moderate
Yao 2022	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Yao 2022	NOS: cross-sectional studies	Moderate	Moderate	Moderate	Moderate	Moderate	

Legend: Abbreviation(s): NOS=Adapted Newcastle Ottawa Scale and RoB=Risk of bias.

Table A14.2. Risk of bias domain and overall grades for included randomised control trial datapoints (n=4), and overall study risk of bias grade (n=4), assessed using Cochrane Risk of Bias-2 tool

Author and year	RoB assessment tool	Randomisation	Adherence	Missingness	Measurement	Reporting	Overall datapoint RoB	Overall study RoB
Coates 2019	RoB-2	Low	Some concerns	Low	Low	Some concerns	Some concerns	Some concerns
De Jans 2021	RoB-2	Low	Low	Low	Low	Low	Low	Low
Folkvord 2020	RoB-2	Low	Low	Low	Low	Low	Low	Low
Ngqangashe 2021	RoB-2	Some concerns	Low	Low	Low	Low	Some concerns	Some concerns

Legend: Abbreviation(s): RoB=Risk of bias and RoB-2=Cochrane Risk of Bias-2 tool.

Section A15 Social media measures reported in included studies

Tables A15.1 - A15.4 presented in this section outline the social media exposure measures (n=253) used to assess social media use across included studies. Within included studies, many social media exposure measures were reported and were incorporated in our exploration of how social media use is measured in relation to adolescent health-risk behaviours; therefore, the number of datapoints reported differs from those included in the review synthesis. The information in Tables A15.1 - A15.4 reflects the information reported in included studies. The final three columns, titled *'Platform'*, *'Category (active/passive use)'*, and *'Content'*, used information from included studies to categorise the social media platform, category and content type under study. The categorisation was conducted using the *Process of social media categorisation* presented in Appendix A, Section A4.

Please also note Tables A15.1 - A15.4 record the exposure measures (e.g., continuous, binary) in their original form as reported in included studies. In some instances, the exposure measures may have been transformed/specific pairwise comparisons selected for inclusion in meta-analyses/SWiM as per the decision rules outlined in Appendix A, Section A7.

Table A15.1. Social media measures assessing *time spent* reported in included studies

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Brunborg 2019	Change in hrs of SM use per day (Δ=T2–T1)	Self-report 2-item measure 1. Frequency of SM use in the past 6/12 months. Participant asked to report on active SM use: reading, writing, watching pictures, making comments, or appointments on SM etc, and not merely the time logged on. Responses: every day to not at all. Responses recoded into the average number of days per month spent on SM. 2. How many hrs/day usually spent on SM. Responses: <1 hr to >15 hrs/day in hourly increments. Product of frequency (average days/month) and quantity (average hrs/day) divided by 30 to reflect the average number of hrs spent on SM per day.	Cont.	T1: past 12 months T2: past 6 months	Examples: Facebook, Snapchat, WhatsApp, Twitter, Instagram, and Kik	Mixed platforms	SNS (active use)	NA
Brunborg 2019	Average number of hrs spent on SM per day	Self-report 2-item measure 1. Frequency of SM use in the past 6/12 months. Respondents asked to report on active SM use: reading, writing, watching pictures, making comments, or appointments on SM etc, and not merely the time logged on. Responses: every day to not at all. Responses recoded into the average number of days per month spent on SM.	Cont.	Past 12 months	Examples: Facebook, Snapchat, WhatsApp, Twitter, Instagram, and Kik	Mixed platforms	SNS (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		2. How many hrs per day usually spent on SM. Responses: <1 hr to >15 hrs/day in hourly increments. Product of frequency (average days/month) and quantity (average hrs/day) divided by 30 to reflect the average number of hrs spent on SM per day.						
Brunborg 2022	Average number of hrs spent on SM per day	Self-report 2-item measure 1. Frequency of active use of SM (e.g., Facebook, Snapchat, and Instagram) in the past 30 days. Responses: not at all to 5-days a week. 2. How many hrs per day spent actively using SM. Responses: less than 1 hr to 10 hr or more. Product of frequency (days per month) and quantity (average hrs/day) divided by 30 to reflect average number of hrs spent on SM per day.	Cont.	Past month	Examples: Facebook, Snapchat, and Instagram	Mixed platforms	General SM (active use)	NA
Boers 2020	Time spent on SM per day	Self-report 1-item measure 1. How much time spent on Facebook, Twitter or other SNS per day. Responses: 0–30 min, 30 min–1 hr 30 min, 1 hr 30 min–2 hrs 30 min, and ≥3 hrs 30 min/day.	Cont.	Current	Specified: Facebook, Twitter, and other SNS	Mixed platforms	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Booker 2015	Time spent chatting on social websites on a normal school day	Self-report 1-item measure 1. How many hrs spent chatting or interacting with friends through a social web site like Bebo, Facebook, and Myspace on a normal school day. Responses: (1) none to (5) ≥7 hrs/day. 3-category variable constructed: <1 hr, 1 to 3 hrs, and ≥4 hrs/day.	Cont.	Current	Examples: Bebo, Facebook, and Myspace	Mixed platforms	SNS (active use)	NA
Casaló 2022	Time spent on SNS per day	Self-report 1-item measure 1. Time spent on SNS for fun (and not to do homework/work) per day. Responses: no time devoted, 30 mins or less, around an hr, 2-3 hrs, 4 or more hrs/day.	Cont.	Current	NR	NR	SNS (unclear)	NA
Chau 2022	Time spent on discussion forums and chatting online during a weekday	Self-report 1-item measure 1. How many hours spent with discussion forums and chatting online during a weekday. Responses: (1) <2 hrs (2) 2-4 hrs (3) 5 or more hrs/day.	Cat.	Current	NR	NR	Blogs & forums (active use)	NA
Chau 2022	Time spent on discussion forums and chatting online during a weekend day	Self-report 1-item measure 1. How many hours spent with discussion forums and chatting online during a weekend day. Responses: (1) <2 hrs (2) 2-4 hrs (3) 5 or more hrs/day.	Cat.	Current	NR	NR	Blogs & forums (active use)	NA
Chen 2019	Time spent on SM on a regular	Self-report 8-item measure 8 questions about time spent on Facebook, Instagram, and Snapchat on a	Cont.	Current	Specified: Facebook,	Mixed platforms	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
	weekday and weekend day	regular weekday (Monday–Friday) and a weekend day (Saturday and Sunday). Responses: (0) from 0 hrs to (10) the platform is opened throughout the day continuously. Weighted score of average daily time for each SM platform computed: (time weekday × 5 + time weekend day × 2)/7. SM use computed by the average score of the 3 platforms.			Instagram, and Snapchat			
Coyne 2013	Time spent on SNS on a typical day	Self-report 1-item measure 1. How much time spent on SNS in a typical day. Responses: 9-point scale from (1) none to (9) >8 hrs/day.	Cont.	Current	NR	NR	SNS (unclear)	NA
Coyne 2018	Time spent on SNS on a typical day	Self-report 1-item measure Assessed at 6 timepoints over 6 years. 1. How much time spent on SNS, like Facebook, on a typical day. Responses: (1) none to (9) >8 hrs/day. 3-category variable constructed: peak users (low SM use that increases quickly after a few years and then returns to baseline), moderate users (steady SM use over time), and increasers (low SM use that increases gradually and ends high at the end of the study).	Cat.	Current	Examples: Facebook and Instagram	Mixed platforms	SNS (unclear)	NA
da Costa 2021	Time spent on SM on a typical	Self-report 2-item measure	Cont.	Current	NR	NR	General SM (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
	weekday and weekend day	1. Time spent engaged on SM on a typical weekday. 2. Time spent engaged on SM on a typical weekend day. Daily time on SM estimated by weighting answers ([volume on weekdays x 5 + volume on weekend x 2]/7) hrs/day. 4-category variable constructed: <2 hrs, ≥2 hrs, <4 hrs, and ≥4 hrs/day						
Doornwaard 2015	Time spent on SNS (most frequently used platform) per day	Self-report 1-item measure 1. How much time actively spent each day on most used SNS. Responses: not an SNS member, <15 mins, 15–30 mins, 30–60 mins, 1–2 hrs, 3–4 hrs, and >4 hrs/day.	Ordinal	Current	NR	NR	SNS (active use)	NA
Froyland 2020	Time spent on SM per day	Self-report 1-item measure 1. How much time spent daily on SM (e.g., Facebook, Instagram, etc). Responses: non, <30 min, 30 min-1 hr, 1-2 hrs, 2-3 hrs, >3 hrs.	Cont.	Current	Examples: Facebook and Instagram	Mixed platforms	General SM (unclear)	NA
Gazendam 2020	Time spent on SM per day	Self-report 1-item measure 1. How many hrs a day, in free time, spent using electronic devices such as computers, tablets (like iPad) or smartphone for other purposes (e.g., tweeting, Facebook, chatting). Responses: none at all, about 30 mins, about 1 hr, about 2 hrs, about ≥3 hrs/day.	Binary	Current	Examples: Facebook, chatting, and Twitter	Mixed platforms	General SM (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		Variable dichotomised: <3hrs and ≥3 hrs/day.						
Hamilton 2020	Time spent on SNS per day	Daily diary self-report 1. How much time spent on SNS (e.g., TikTok, Snapchat, Instagram) per day. Responses: none, <30 min, 0.5–1 hr, 1-2 hrs, 2-4 hrs, 4-6 hrs, and >6 hrs/day.	Cont.	Current	Examples: TikTok, Snapchat, and Instagram	Mixed platforms	SNS (unclear)	NA
Kaur 2020	Time spent on SNS per day	Self-report 1-item measure 1. How many hrs on an average day spent on social networking web sites like Facebook, Twitter, Instagram, etc. Responses: none, <1 hr, 1−2 hrs, 3−4 hrs, 5−6 hrs, 7−8 hrs, and ≥9 hrs/day. 4-category variable constructed: 0 hrs, <1 hr, 1-2 hrs and ≥3 hrs/day.	Binary	Current	Examples: Facebook, Twitter, and Instagram	Mixed platforms	SNS (unclear)	NA
Kontostoli 2020	Time spent browsing and updating SNS on a weekday	Time-use diary Participants recorded their behaviour in 10-min timeslots from 4 to 4 am the next day. For each 10-min timeslot, participants indicated their main activity, selecting from a pre-specified list of 44 activities, nested within 12 categories for both weekday and weekend day. Participants were categorised according to whether they did (user) or did not (non-user) report time browsing and updating social networking sites.	Binary	Current	Examples: Facebook, Twitter, and Snapchat	Mixed platforms	SNS (active and passive use)	NA

Author and year	**Definition**	**Ascertainment** ***(validated/objectively recorded measures marked with *)***	**Measure type**	**Time period**	**Platform**	***Platform***	***Category (active/ passive use)***	***Content***
Kontostoli 2020	Time spent browsing and updating SNS on a weekend day	<u>Time-use diary</u> Participants recorded their behaviour in 10-min timeslots from 4 to 4 am the next day. For each 10-min timeslot, participants indicated their main activity, selecting from a pre-specified list of 44 activities, nested within 12 categories for both weekday and weekend day. Participants were categorised according to whether they did (user) or did not (non-user) report time browsing and updating social networking sites.	Binary	Current	Examples: Facebook, Twitter, and Snapchat	Mixed platforms	SNS (active and passive use)	NA
Larm 2017	Online social networking chatting	<u>Self-report 2-item measure</u> 1. How often chats on online SNS such as Myspace, Facebook, and others. Responses: (1) never to (7) 6-7 days/week. 2. Average amount of time each day chatting on online SNS. Responses: (1) do not chat to (5) >5 hrs/day. Summarised score from 0 to 10 derived from 2 items.	Cont.	Current	Examples: Myspace and Facebook	Mixed platforms	SNS (active use)	NA
Larm 2019	Time spent on SM/chatting per day	<u>Self-report 1-item measure</u> 1. How many hrs per day usually spent chatting on the internet/SM sites. Responses: not using computers, <1 hr/day, 1–2 hrs/day, 2–5 hrs/day, and >5 hrs/day.	Binary	Current	NR	NR	General SM (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		Variable dichotomised: ≥2 hrs/day and <2 hrs/day.						
Lee 2015	Time spent on SNS per day	Self- report 7-item measure 1. SNS usage time. Responses: <30 min, 30 min-1 hr, 1-2 hrs, 2-3 hrs, and >3 hrs/day.	Binary	Current	NR	NR	SNS (unclear)	NA
Lee 2021	Daytime use of social networks	Objective measure* Smartphone assessed usage of social networks. Time spent on each session computed as the difference between the closing and opening time. Usage sessions of <1 second were discarded. Daytime usage defined as the time from waking up to 1 hr before sleep, where sleeping time was identified using accelerometer data.	Cont.	Past week	Examples: Facebook, Twitter, Instagram, and Weibo	Mixed platforms	SNS (unclear)	NA
Lee 2021	Bedtime use of social networks	Objective measure* Smartphone assessed usage of social networks. Time spent on each session computed as the difference between the closing and opening time. Usage sessions of <1 second were discarded. Bedtime usage defined as 1 hr before sleep, where sleeping time was identified using accelerometer data.	Cont.	Past week	Examples: Facebook, Twitter, Instagram, and Weibo	Mixed platforms	SNS (unclear)	NA
Lee 2021	Use of social networks at wakeful moment during sleep	Objective measure* Smartphone assessed usage of social networks. Time spent on each session computed as the difference between the	Cont.	Past week	Examples: Facebook, Twitter,	Mixed platforms	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		closing and opening time. Usage sessions of <1 second were discarded.			Instagram, and Weibo			
Lipsky 2017	Time spent on social networking per day	Self-report 2-item measure 1. Time spent using a computer or cell phone for chatting online, internet, emailing, texting, tweeting, or similar social networking (other than for a job or school work) during weekdays. 2. Time spent using a computer or cell phone for chatting online, internet, emailing, texting, tweeting, or similar social networking (other than for a job or school work) during the weekend. Responses: 0.5 hrs, ~1, ~2, ~3, ~4, ~5, ~6, and ~≥7 hrs/day - converted to the number of hrs per day (ranging from 0 to 7).	Cont.	Current	NR	NR	SNS (active use)	NA
Longobardi 2021	Time spent on SM per day	Self-report measure No information provided.	Cont.	Current	NR	NR	General SM (unclear)	NA
Merrill 2019	Time spent on SM per day	Self-report 1-item measure 1. How many hrs plays video or computer games or uses a computer for something that is not schoolwork (incl. Xbox, PlayStation, an iPod, an iPad or other tablet, a smartphone, YouTube, Facebook or other social networking tools, and the Internet) on an average school day. Due to the interactive nature of the	Cont.	Current	Examples: Xbox, PlayStation, iPod, iPad or other tablet, smartphone, YouTube, Facebook, or other social networking	Mixed platforms	General SM (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		items included as "computer use," this was relabelled "social media use" by study investigators. Responses: 0 hrs per average school day, <1 hr, 1 hrs, 2 hrs, 3 hrs, 4 hrs, and ≥5 hrs/day.			tools, and the internet			
Michael 2016	Average time spent on SM per day	Self-report 1-item measure 1. How much time spent on SM per day. Responses: 0-1 hrs, 2-3 hrs, 4-5 hrs, 6-7 hrs, ≥8 hrs/day. 3-category variable constructed: low, moderate, and high.	Cat.	Current	Examples reported by participants Facebook, 2 go, Twitter, WhatsApp, and YouTube	Mixed platforms	SNS (unclear)	NA
Moitra 2022	Time spent using SNS on a typical weekend and weekday	Self-report 1-item measure 1. How much time spent on SNS on a typical weekend and weekday. Responses: mins/day	Cont.	Past week	NR	NR	SNS (unclear)	NA
Mojica 2014	Average time spent on SNS per week	Self-report 2-item measure 1. Number of days SNS used in the past week. 2-Number of hrs per day of SNS use. Items combined to create mean hrs per week.	Cont.	Current	NR	NR	SNS (unclear)	NA
Nesi 2017	Average time on Facebook per day	Self-report 1-item measure 1. Average time spent on Facebook per day. Responses: 7-point scale (1) <10 min to (7) ≥ 4 hrs/day.	Cont.	Current	Specified: Facebook	Facebook	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Ng Fat 2021	Time spent on SM on a normal weekday	Self-report 1-item measure 1. How many hrs spent chatting or interacting with friends through social websites on a normal weekday. Responses: no-profile (those not on SM sites), non-daily user, <1 hr, 1–3 hrs, ≥4 hrs/day.	Ordinal	Current	Examples: Facebook, Myspace, and Bebo	Mixed platforms	SNS (active use)	NA
Ohannessian 2009	Time spent emailing and instant messaging on an average/typical day	Self-report 1-item measure 1. How much time spent emailing/instant messaging on an average/typical day. Responses: (1) none to (6) ≥4 hrs/day. Variable dichotomised: high levels of email or instant messaging use (≥1 hr/day)/low levels of email or instant messaging use.	Binary	Current	NR	NR	SNS (active use)	NA
Sampasa-Kanyinga 2015	Time spent on SM websites either posting or browsing per day	Self-report 1-item measure 1. How many hrs a day spent on SM websites such as Facebook, Twitter, Instagram, Myspace, either posting or browsing. Responses: do not use, visit these websites but not daily, <1 hr, about 1 hr, 2 hrs, 3–4 hrs, and ≥5 hrs/day.	Ordinal	Current	Examples: Facebook, Twitter, Instagram, and Myspace	Mixed platforms	SNS (active and passive use)	NA
Sampasa-Kanyinga 2015	Time spent on SM websites either posting or browsing per day	Self-report 1-item measure 1. How many hrs a day spent on SM websites such as Facebook, Twitter, Instagram, Myspace, either posting or browsing. Responses: do not use, visit these	Ordinal	Current	Examples: Facebook, Twitter, Instagram, and Myspace	Mixed platforms	SNS (active and passive use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		websites but not daily, <1 hr, about 1 hr, 2 hrs, 3–4 hrs, and ≥5 hrs/day.						
Sampasa-Kanyinga 2016	Time spent on SM websites either posting or browsing per day	Self-report 1-item measure 1. How many hrs a day spent on SM websites such as Facebook, Twitter, Instagram, Myspace, either posting or browsing. Responses: daily use (<1 hr, about 1 hr, 2 hrs, 3-4 hrs, 5- 6 hrs, and ≥7 hrs/day). 3-category variable constructed: infrequent or no use of SNS (use SM, but not daily; use the Internet, but never visit SNS; and do not use the Internet), regular use (daily use ≤2 hrs), and heavy use (3-4 hrs, 5- 6 hrs, and ≥7 hrs/day).	Ordinal	Current	Examples: Facebook, Twitter, Instagram, and Myspace	Mixed platforms	SNS (active and passive use)	NA
Tao 2022	Average time on SM per week	Self-report 2-item measure 1. In the past month, on average, approximately how many days in each week was time spent on SM (e.g., Instagram, Snapchat, Facebook, Tumble, Reddit). Responses: 0 to 7 days/week. 2. In the past month, on average approximately how many hours in each day was time spent on SM (e.g., Instagram, Snapchat, Facebook, Twitter, Tumblr, Reddit). Average hours of SM use per week calculated by multiplying the number of	Cont.	Past month	Examples: Instagram, Snapchat, Facebook, Twitter, Tumblr, and Reddit	Mixed platforms	General SM (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		hrs of SM use a day (0-24) with days of SM use per week (0-7).						
Vente 2020	Time spent on SM per day	Self-report 1-item measure 1. Total time spent on SM per day. Variable dichotomised: >5 hrs of SM use per day/5 or less hrs of SM use.	Binary	Current	NR	NR	General SM (unclear)	NA
Worku 2022	Stayed more than 2 hrs/day on SM	Self-report 1-item measure 1. Long stay on SM. Variable dichotomised: >2 and ≤2 hrs/day on SM.	Binary	Current	NR	NR	General SM (unclear)	NA
Sampasa-Kanyinga 2016	Time spent on SM websites either posting or browsing per day	Self-report 1-item measure 1. How many hrs a day spent on SM websites such as Facebook, Twitter, Instagram, Myspace, either posting or browsing. Responses: do not use, visit these websites but not daily, <1 hr, about 1 hr, 2 hrs, 3–4 hrs, and ≥5 hrs/day.	Ordinal	Current	Examples: Facebook, Twitter, Instagram, and Myspace	Mixed platforms	SNS (active and passive use)	NA
Sampasa-Kanyinga 2018	Time spent on SM websites either posting or browsing per day	Self-report 1-item measure 1. How many hrs a day spent on SM websites such as Facebook, Twitter, Instagram, Myspace, either posting or browsing. Responses: <1 hr, about 1 hr, 2 hrs, 3-4 hrs, 5- 6 hrs, ≥7 hrs/day, visit these web sites but not daily, use the Internet but never visit these web sites, and do not use the Internet. 5-category variable constructed:	Ordinal	Current	Examples: Facebook, Twitter, Instagram, and Myspace	Mixed platforms	SNS (active and passive use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		Infrequent or no use of SNS (visit these web sites but not daily, use the internet but never visit these web sites, and do not use the internet), <1 hr, 1 hr, 2/hrs, and ≥3 hrs/day.						
Sandercock 2016	Time spent on SM on a normal day	Self-report 2-item measure 1. Use of SM. Responses: yes/no. 2. If yes, asked how long spent using SM on a normal day. Responses: <30 min, 30-60 min, 60-90 min, 90 min- 2 hrs, and >2 hrs/day.	Cont.	Current	NR	NR	General SM (unclear)	NA
Smout 2021	Time spent on SM on a typical day	Self-report measure 1. How many minutes spent on Facebook, Myspace, and other social networking sites on a typical day. Responses greater than 12h per day truncated to 12h.	Cont.	Current	Specified: Facebook, Myspace, and other social networking sites	Mixed platforms	SNS (unclear)	NA
Whitehill 2020	Time spent on SM per day	Self-report measure Responses: <30 min, 30-60 min, 1-2 hrs, 2-4 hrs, and ≥ 4 hrs/day. No further information provided.	Ordinal	Current	NR	NR	General SM (unclear)	NA

Legend: Abbreviation(s): Cont=Continuous; Cat=Categorical; H/Hrs=Hours; Incl=Including; Min/s=Minute/s; NA=Not applicable; NR=Not reported; SM=Social media; SNS=Social networking site(s); and T=Timepoint.

Table A15.2. Social media measures assessing *frequency of use* reported in included studies

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Anastario 2020	Frequency of use of Twitter to talk/learn about sex or any topic related to sex	Self-report 1-item measure 1. How often do you use Twitter to talk or learn about sex or any topic related to sex? Responses: daily, a few days a week, every few weeks, less often, never use.	Cont.	Current	Specified: Twitter	Twitter	Micro-blogging (active and passive use)	NA
Anastario 2020	Frequency of use of Snapchat to talk/learn about sex or any topic related to sex	Self-report 1-item measure 1. How often do you use Snapchat to talk or learn about sex or any topic related to sex? Responses: daily, a few days a week, every few weeks, less often, never use.	Cont.	Current	Specified: Snapchat	Snapchat	SNS (active and passive use)	NA
Anastario 2020	Frequency of use of Facebook to talk/learn about sex or any topic related to sex	Self-report 1-item measure 1. How often do you use Facebook to talk or learn about sex or any topic related to sex? Responses: daily, a few days a week, every few weeks, less often, never use.	Cont.	Current	Specified: Facebook	Facebook	SNS (active and passive use)	NA
Baker 2016	Frequency of SNS use	Self-report 1- item measure 1. How often used Myspace.com, Facebook.com, chat rooms or other online social networking websites. Variable dichotomised: frequent SNS users (using such sites a few times per week, each week or everyday)/ infrequent SNS users (using SNS never, a few times per year or a few times per month).	Binary	Current	Specified: Myspace, Facebook, chat rooms, and other SNS	Mixed platforms	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Baldwin 2018	Frequency of watching videos on YouTube	Self-report 1-item measure 1. How often watch videos on YouTube. Reponses: never or rarely, less than once a week, a few times a week, once a day, a few times a day, and many times every day. Variable dichotomised: at least daily users/less than daily users.	Binary	Current	Specified: YouTube	YouTube	Media-sharing (passive use)	NA
Baldwin 2018	Frequency of logging in, or checking Facebook account	Self-report 1-item measure 1. How often login to, or check, Facebook account. Response options: never or rarely, less than once a week, a few times a week, once a day, a few times a day, and many times every day. Variable dichotomised: at least daily users/less than daily users.	Binary	Current	Specified: Facebook	Facebook	SNS (passive use)	NA
Baru 2020	Frequency of SM use	Self-report 1-item measure 1. Frequency of SM use (Facebook, WhatsApp, IMO, Instagram etc). Response: many times a day, several times a week, once a while.	Ordinal	Current	Specified: Facebook, WhatsApp, instant messenger, and Instagram	Mixed platforms	SNS (unclear)	NA
Baumgartner 2012	Frequency of online communication	Self-report 1-item measure 1. How often use instant messaging, internet chats, and SNS. Responses: (0) never to (10) every day.	Cont.	Current	Specified: Instant messaging, internet chats, and SNS	Mixed platforms	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Ball 2020	Frequency of using SM (status updates, uploading photos or videos)	Self-report measure 1. Internet activities used during the past 7 days. Response options included SM activity (status updates and uploading photos or videos).	Binary	Past week	Examples: Facebook, Twitter, Instagram, Snapchat, and YouTube	NR	General SM (active use)	NA
Ball 2020	Frequency of online gambling	Self-report measure 1. Internet activities used during the past 7 days. Response options included online gambling activity.	Binary	Past week	NR	NR	Online gambling (active use)	NA
Boniel-Nissim 2022	Frequency of online contact with others via SM	Self-report validated questionnaire* Social Media Use Intensity Scale and Social Media Disorder Scale used to categorise participants into non-active users (online contact with others not at all or at most weekly and non-problematic user) and active users (online contact with others daily but not all the time and non-problematic user).	Binary	Current	NR	NR	General SM (active and passive use)	NA
Beebe 2004	Presence of internet chat room use	Self-report 2-item measure 1. Use the internet at home. 2. If yes, asked what internet is used for at home. Those who checked the option “chat rooms” compared with those who did not.	Binary	Current	NR	NR	SNS (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Canale 2016	Frequency of using internet for leisure activities	Self-report 1-item measure 1. Internet used for leisure activities (e.g., online chatting, playing online games). Responses: yes/no.	Binary	Current	NR	NR	General SM (active use)	NA
Canale 2016	Frequency of online gambling in past year	Self-report 1-item measure 1. How many occasions (if any) participated in online gambling activities. Responses: 7 options from 0 times to ≥40 times. Variable dichotomised: online gambler (anyone who had participated in online gambling at least once in the past 12 months)/non-online gamblers.	Binary	Past year	NR	NR	Online gambling (active use)	NA
Chang 2016	Frequency of chat room use during past week	Self-report 1-item measure 1. How many days during the past week used chat rooms. Responses: 0 to 7 days.	Cont.	Past week	NR	NR	SNS (active use)	NA
Chang 2016	Frequency of online game use during past week	Self-report 1-item measure 1. How many days during the past week played online games. Responses: 0 to 7 days.	Cont.	Past week	NR	NR	Online gaming (active use)	NA
Critchlow 2019	SM apps used at least weekly	Self-report measure 1. Which, if any, of the following apps used at least once a week: (1) Facebook; (2) Instagram; (3) Pinterest; (4) Snapchat; (5) Spotify; (6) Tumblr; (7) Twitter; (8) WhatsApp; (9) YouTube; and	Ordinal	Past week	Specified: Facebook, Instagram, Pinterest, Snapchat, Spotify,	Mixed platforms	General SM (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		(10) Other, with free-text box to write in. Responses: yes/no/none of the above. Cumulative score computed for SM apps used at least weekly (0–10), and 3-category variable constructed: high (6 or more apps), medium (4 or 5), and low use (3 or fewer).			Tumblr, Twitter, WhatsApp, YouTube, and other			
Dawson 2019	Frequency of Facebook use	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Responses: (1) less than once a week to (6) almost constantly.	Cont.	Current	Specified: Facebook	Facebook	SNS (unclear)	NA
Dawson 2019	Presence of SNS use	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Responses: (0) not reported, and (1) reported.	Binary	Current	Examples: Instagram, Snapchat, Facebook, Twitter, Skype, Kik, Tumblr, Pinterest, Curious Cat, Discord, and Amino	Mixed platforms	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Dawson 2019	Presence of messaging app use	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Responses: (0) not reported, and (1) reported.	Binary	Current	Example: WhatsApp	WhatsApp	SNS (unclear)	NA
Dawson 2019	Presence of discussion board use	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Responses: (0) not reported, and (1) reported.	Binary	Current	Example: Reddit	Reddit	Social News Sites (unclear)	NA
Dawson 2019	Presence of anonymous sharing app use	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Responses: (0) not reported, and (1) reported.	Binary	Current	Example: Whisper	Whisper	SNS (unclear)	NA
Dawson 2019	Presence of Twitter use	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey	Binary	Current	Specified: Twitter	Twitter	Micro-blogging (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		(Lenhart *et al.*, 2015). Responses: (0) not reported, and (1) reported.						
Dawson 2019	Presence of Instagram use	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Responses: (0) not reported, and (1) reported.	Binary	Current	Specified: Instagram	Instagram	Media-sharing (unclear)	NA
Dawson 2019	Presence of Snapchat use	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Responses: (0) not reported, and (1) reported.	Binary	Current	Specified: Snapchat	Snapchat	SNS (unclear)	NA
Dawson 2019	Presence of Facebook use	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Responses: (0) not reported, and (1) reported.	Binary	Current	Specified: Facebook	Facebook	SNS (unclear)	NA
Dawson 2019	Facebook activity: keeping	Self-report measure	Binary	Current	Specified: Facebook	Facebook	SNS (passive use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
	up with friends (passive)	Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Facebook activity coded based on posting activity: (0) no to minimal activity, 0-25th percentile, and (3) heavy user, 75th+ percentile. Responses: (0) not reported, and (1) reported.						
Dawson 2019	Facebook activity: posting on own timeline (active)	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Facebook activity coded based on posting activity: (0) no to minimal activity, 0-25th percentile, and (3) heavy user, 75th+ percentile. Responses: (0) not reported, and (1) reported.	Binary	Current	Specified: Facebook	Facebook	SNS (active use)	NA
Dawson 2019	Facebook activity: commenting on friend's posts (active)	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Facebook activity coded based on posting	Binary	Current	Specified: Facebook	Facebook	SNS (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		activity: (0) no to minimal activity, 0-25th percentile, and (3) heavy user, 75th+ percentile. Responses: (0) not reported, and (1) reported.						
Dawson 2019	Facebook activity: looking at videos or news stories (passive)	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Facebook activity coded based on posting activity: (0) no to minimal activity, 0-25th percentile, and (3) heavy user, 75th+ percentile. Responses: (0) not reported, and (1) reported.	Binary	Current	Specified: Facebook	Facebook	SNS (passive use)	NA
Dawson 2019	Facebook interactions with friends they see daily	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Responses: (0) not reported, and (1) reported.	Binary	Current	Specified: Facebook	Facebook	SNS (active use)	NA
Dawson 2019	Facebook interactions with friends they see occasion-ally	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey	Binary	Current	Specified: Facebook	Facebook	SNS (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		(Lenhart *et al.*, 2015). Responses: (0) not reported, and (1) reported.						
Dawson 2019	Facebook interactions with online friends	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Responses: (0) not reported, and(1) reported.	Binary	Current	Specified: Facebook	Facebook	SNS (active use)	NA
Dawson 2019	Facebook interactions with family members	Self-report measure Assessed via The Online Behaviour Demographic Questionnaire adapted from the Pew Research Centre's Internet, Science, and Tech self-report survey (Lenhart *et al.*, 2015). Responses: (0) not reported, and (1) reported.	Binary	Current	Specified: Facebook	Facebook	SNS (active use)	NA
Dawson 2019	Number of participant posts on Facebook posted by participant	Observationally coded measure* Coded using Mikami and Szwedo (2013) Facebook Coding Manual. Facebook profile coded over 2-month period to obtain total number of participant posted posts.	Cont.	Current	Specified: Facebook	Facebook	SNS (active use)	NA
Dawson 2019	Percentage of participant posts that were shared	Observationally coded measure* Coded using Mikami and Szwedo (2013) Facebook Coding Manual. Facebook profile coded over 2-month	Cont.	Current	Specified: Facebook	Facebook	SNS (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
	external material on Facebook	period to obtain proportion of total participant posts that were "shared" external material (i.e., memes or web links copied and reposted from another location; types: emotional, animal related, intended humour, sports, motivational, news/politics, and music).						
Dawson 2019	Percentage of participant posts sharing accomplishments on Facebook	Observationally coded measure* Coded using Mikami and Szwedo (2013) Facebook Coding Manual. Facebook profile coded over 2-month period to obtain proportion of total participant posts sharing accomplishments (i.e., something that typically infers pride in some skillset or effort).	Cont.	Current	Specified: Facebook	Facebook	SNS (active use)	NA
Dawson 2019	Percentage of participant posts illustrating connection on Facebook	Observationally coded measure* Coded using Mikami and Szwedo (2013) Facebook Coding Manual. Facebook profile coded over 2-month period to obtain proportion of total participant posts illustrating connection with friends (e.g., meetings withing the year, specific plans for future meetings, or shared information (such as inside jokes).	Cont.	Current	Specified: Facebook	Facebook	SNS (active use)	NA
Dawson 2019	Percentage of participant posts	Observationally coded measure* Coded using Mikami and Szwedo (2013) Facebook Coding Manual.	Cont.	Current	Specified: Facebook	Facebook	SNS (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
	sharing support on Facebook	Facebook profile coded over 2-month period to obtain proportion of total participant posts containing emotional support (i.e., posts offering encouragement, validation, compliments, or empathy).						
De Looze 2019	Frequency of electronic media communication with friends	Self-report 3-item measure Asked how often: 1. Contacted friends using texting/SMS. 2. Actively contacted friends using instant messaging (e.g., Facebook chat). 3. Contacted friends using other SM, such as Facebook (posting on wall, not chat), Myspace, Twitter, apps (e.g., Instagram), games (e.g., Xbox), YouTube. Responses: hardly ever or never, less than weekly, weekly, and daily. Variable dichotomised: (0) less than daily/(1) daily.	Binary	Current	Examples: Blackberry Messaging, Facebook chat, Facebook, Myspace, Twitter, Instagram, Xbox, and YouTube	Mixed platforms	SNS (active use)	NA
Elton-Marshall 2016	Frequency of playing free simulated gambling games on Facebook	Self-report 1-item measure 1. Participation in any online gambling games on Facebook for fun (no money). Responses: not in the past 3 months, about once per month, 2–3 times per month, about once per week, 2–6 times per week, and daily. Variable dichotomised: at least monthly but less than weekly (about once per month or 2–3 times per month)/at least weekly (about once per week, 2–6 times	Binary	Past 3 months	Specified: Facebook	Facebook	Online gambling (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		per week, or daily). Overall prevalence based on any participation (indicated about once per month or more frequent).						
Elton-Marshall 2016	Frequency of online gambling participation	Self-report measure Online gamblers: respondents who indicated that they had gambled money or something of value in the past for any of 3 online gambling activities: internet poker, sports pools online, and slot machines online. Land-based gamblers: respondents who had gambled money or something of value in the past 3 months but had not participated in any of the online gambling activities. No further information reported.	Binary	Past 3 months	NR	NR	Online gambling (active use)	NA
Erreygers 2017	Frequency of online gaming	Self-report 2-item measure 1. How often used online gaming (playing with others). 2. How often used online gaming (playing alone or against the computer). Responses: never, just a few times, 1-4 times per month, almost every day, multiple times per day, I don't know and not applicable. Confirmatory factor analyses used to generate online gaming factor.	Cont.	Past 6 months	NR	NR	Online gaming (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Floros 2013	Frequency of using SNS	Self-report measure Internet activities measured on Likert scale for frequency. No further information reported.	Cont.	Past year	NR	NR	SNS (unclear)	NA
Floros 2013	Frequency of online discussions in real-time (IRC, MSN etc)	Self-report measure Internet activities measured on Likert scale for frequency. No further information reported.	Cont.	Past year	NR	NR	SNS (active use)	NA
Floros 2013	Frequency of online discussions with posts on boards, forums	Self-report measure Internet activities measured on Likert scale for frequency. No further information reported.	Cont.	Past year	NR	NR	Blogs & forums (active use)	NA
Gregg 2018	Frequency of electronic communication	Self-report 3-item measure 1. How long used SM on a normal school day. Responses: from (0) never, to (7) >4 hrs/day. 2. How long used SM on a normal non-school day. Responses: from (0) never, to (7) >4 hrs/day. 3. How many text messages sent on an average day. Responses: from (0) I do not text to (6) >300. Responses added to produce overall estimate of SM use. Higher scores indicated more frequent use of SM.	Cont.	Current	NR	NR	General SM (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Gunnlaugsson 2020	Frequency of SM use	Self-report 1-item validated measure* 1. Experience of communicating in the last 12 months on SM with friends, family, and people the respondent would like to know. Responses: everyday, 2-3 times a week, every week, less than monthly, and never.	Binary	Past year	NR	NR	General SM (active use)	NA
Hayer 2018	Frequency of participation in any simulated gambling on social networks	Self-report 1-item measure 1. Frequency of participation in any simulated gambling on social networks. Responses (5 options): from not at all to more than 8 times a month. Variable dichotomised: participation/no participation.	Binary	Past year	NR	NR	Online gambling (active use)	NA
Hayer 2018	Frequency of participation in any simulated gambling via apps	Self-report 1-item measure 1. Frequency of participation in any simulated gambling via apps. Responses (5 options): from not at all to more than 8 times a month. Variable dichotomised: participation/no participation.	Binary	Past year	NR	NR	Online gambling (active use)	NA
Hayer 2018	Frequency of participation in simulated gambling from home on social networks	Self-report 1-item measure 1. Frequency of participation in simulated gambling from home on social networks. Responses (5 options): from not at all to more than 8 times a month.	Binary	Past year	NR	NR	Online gambling (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		Variable dichotomised: participation/no participation.						
Hayer 2018	Frequency of participation in simulated gambling from home via apps	<u>Self-report 1-item measure</u> 1. Frequency of participation in simulated gambling from home via apps. Responses (5 options): from not at all to more than 8 times a month. Variable dichotomised: participation/no participation.	Binary	Past year	NR	NR	Online gambling (active use)	NA
Hayer 2018	Frequency of participation in simulated gambling when out and about on social networks	<u>Self-report 1-item measure</u> 1. Frequency of participation in simulated gambling when out and about on social networks. Responses (5 options): from not at all to more than 8 times a month. Variable dichotomised: participation/no participation.	Binary	Past year	NR	NR	Online gambling (active use)	NA
Hayer 2018	Frequency of participation in simulated gambling when out and about via apps	<u>Self-report 1-item measure</u> 1. Frequency of participation in simulated gambling when out and about via apps. Responses (5 options): from not at all to more than 8 times a month. Variable dichotomised: participation/no participation.	Binary	Past year	NR	NR	Online gambling (active use)	NA
Holtz 2011	Frequency of online gaming	<u>Self-report 3-item measure</u> Frequency of playing: 1. First person shooters online.	Cont.	Current	NR	NR	Online gaming (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		2. Online role-playing games. 3. Other games. Responses: 1 (never) to 5 (very often). Latent factor generated.						
Holtz 2011	Frequency of communicational internet use (e.g., chat rooms, social platforms like Myspace)	Self-report 3-item measure Frequency of use of: 1. Email. 2. Chat rooms. 3. Social platforms like Myspace. Responses: (1) never to (5) very often. Latent factor created.	Cont.	Current	Example: Myspace	Myspace	SNS (active and passive use)	NA
Hryhorczuk 2019	Frequency of SM use	Self-report measure 1. How free time spent. Adolescents who responded they use SM frequently or sometimes compared to those who said that they never use SM.	Binary	Current	NR	NR	General SM (unclear)	NA
Huang 2012	Frequency of social internet activity (online gaming, chatting with real friends, chatting with online friends)	Self-report measure 1. How often conducted the following computer and internet-based activities: online games, chatting with friends in real daily life and chatted with friends met online. The average of the items played online games, chatting with friends in real daily life, and chatted with friends met online taken and loaded to create factor 'Social internet activity' and appropriate scale.	Cont.	Past week	NR	NR	SNS (active use)	NA
Huang 2014	Frequency of Facebook use	Self-report 1-item measure	Ordinal	Past month	Specified: Facebook	Facebook	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		1. How frequently SNS Facebook visited. Responses: never, rarely (about once a month or less), occasionally (about once a week or less), frequently (about once every 2-3 days), and very frequently (about once a day or more).						
Huang 2014	Frequency of Myspace use	Self-report 1-item measure 1. How frequently SNS Myspace visited. Responses: never, rarely (about once a month or less), occasionally (about once a week or less), frequently (about once every 2-3 days), and very frequently (about once a day or more).	Ordinal	Past month	Specified: Myspace	Myspace	SNS (unclear)	NA
Jeong 2022	Frequency of SM use	Self-report 1-item measure 1. SM usage frequency. Response: not at all, sometimes, and often. Variable dichotomised: SM users (sometimes, often)/non-SM user (not at all).	Binary	Current	NR	NR	General SM (unclear)	NA
Jiang 2018	Frequency of online gaming	Exposure ascertained via clinical records* 5 items assessed- online gaming history, frequency of online gaming, degree of involvement, number of gaming buddies, and amount of time of online gaming on average. Responses: 5-point Likert scale.	Cont.	Current	NR	NR	Online gaming (active use)	NA
Kaufman 2014	Frequency of SM use	Self-report 1-item measure	Binary	Current	Examples: Facebook,	Mixed platforms	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		1. How often used Facebook, Mxit, or other social networks. Responses: every day, every 2–3 days, once a week, once every 2–3 weeks, never and almost never. Variable dichotomised: SM used every day/ did not use SM every day.			Mxit, and other social networks			
Kelleghan 2020	Frequency of SM posting (posting photos, video or statuses and sharing others content)	Self-report 1-item measure 1. How often posted own photographs, images, videos, status updates, or blogs over past week. Responses: 0 times, 1-2 times per week, 1-2 times per day, and many times per day. Variable dichotomised: high frequency use (multiple times per day)/less frequent use (0 times, 1-2 times per week, 1-2 times per day)	Binary	Current	NR	NR	General SM (active use)	NA
King 2014	Ever use of simulated gambling via SNS applications	Self-report 1-item measure 1. Ever tried simulated gambling via SNS applications (Facebook). Responses: yes/no.	Binary	Ever	Specified: Facebook	Facebook	Online gambling (active use)	NA
Ko 2009	Ever online chatting	Self-report 1-item measure 1. Ever participated in online chatting. No further information provided.	Binary	Ever	NR	NR	SNS (active use)	NA
Ko 2009	Ever online gaming	Self-report 1-item measure 1. Ever participated in online gaming. No further information provided.	Binary	Ever	NR	NR	Online gaming (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Ko 2009	Ever online gambling	Self-report 1-item measure 1. Ever participated in online gambling. No further information provided.	Binary	Ever	NR	NR	Online gambling (active use)	NA
Koutamanis 2015	Frequency of online social exploration on SNS	Self-report 4-item measure How often following things done on SNS: 1. Invited someone to become friends. 2. Commented on a message or picture of someone they don't know that well. 3. Sent a message to someone they don't know that well. 4. Asked someone whether they want to do something fun with them. Responses: never, almost never, sometimes, often, and very often. Average of 4 items used to create composite scale.	Cont.	Current	NR	NR	SNS (active use)	NA
Kwon 2022	Frequency of SNS use	Self-report measure 1. Frequency of smartphone use at weekday and weekend day, and specific content accessed (e.g., SNS).	Cont.	Past month	Examples: Blogs, Instagram, Twitter, and Facebook	Mixed platforms	SNS (unclear)	NA
Landry 2013	Frequency of logging into SM sites	Self-report measure If internet used, how often, and if had accounts on any of the following SM sites: Facebook, Myspace, Twitter, Yahoo, YouTube, My Yearbook, Tumblr, Google buzz, Flickr, Ustream, and Other. A count variable created for the number of SM accounts. If participant had an	Binary	Current	Specified: Facebook, Myspace, Twitter, Yahoo, YouTube, My Yearbook, Tumblr,	Mixed platforms	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		account, they were asked about their frequency of internet use and logging in to SM sites. Responses: several times a day, about once a day, 3 to 5 days week, 1 to 2 days a week, every few weeks, and less often. Frequency of logging in to SM sites dichotomised: daily log-in/less frequent log-in.			Google buzz, Flickr, Ustream, and other			
Lee 2019	Frequency of visiting social networking account	Self-report 1-item measure 1. How often visited Facebook, Google Plus, Myspace, Twitter, or other social networking account. Responses: no account/use, monthly or less, weekly, and daily.	Ordinal	Current	Examples: Facebook, Google plus, Myspace, and Twitter	Mixed platforms	SNS (unclear)	NA
Lee 2021	Frequency of Facebook use	Self-report 1-item measure 1. How often Facebook visited. Responses: never, every few months, every few weeks, 1-2 days per week, 3-5 days per week, once per day, and several times per day. 3-category variable constructed: never/non-daily (every few months, every few weeks, 1-2 days per week, and 3-5 days per week)/daily (once per day, and several times per day)	Ordinal	Current	Specified: Facebook	Facebook	SNS (unclear)	NA
Lee 2021	Frequency of Instagram use	Self-report 1-item measure 1. How often Instagram visited. Responses: never, every few months, every few weeks, 1-2 days per week, 3-5	Ordinal	Current	Specified: Instagram	Instagram	Media-sharing (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		days per week, once per day, and several times per day. 3-category variable constructed: never/non-daily (every few months, every few weeks, 1-2 days per week, and 3-5 days per week)/daily (once per day, and several times per day)						
Lee 2021	Frequency of Twitter use	Self-report 1-item measure 1. How often Twitter visited. Responses: never, every few months, every few weeks, 1-2 days per week, 3-5 days per week, once per day, and several times per day. 3-category variable constructed: never/non-daily (every few months, every few weeks, 1-2 days per week, and 3-5 days per week)/daily (once per day, and several times per day)	Ordinal	Current	Specified: Twitter	Twitter	Micro-blogging (unclear)	NA
Lee 2021	Frequency of Snapchat use	Self-report 1-item measure 1. How often Snapchat visited. Responses: never, every few months, every few weeks, 1-2 days per week, 3-5 days per week, once per day, and several times per day. 3-category variable constructed: never/non-daily (every few months, every few weeks, 1-2 days per week, and 3-5 days per week)/daily (once per day, and several times per day).	Ordinal	Current	Specified: Snapchat	Snapchat	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
McClure 2020	Frequency of SM use	Self-report 1-item measure 1. How often SM used. Responses: never, rarely, once in a while, about once a day, and many times a day. Mean score calculated.	Cont.	Current	NR	NR	General SM (unclear)	NA
Molla-Esparza 2021	Frequency of using SM platforms	Self-report 1-item measure 1. How often SM used. Responses: daily, several days a week, several days a month, almost never, never. Variable dichotomised: low usage frequency (never, almost never, and several days a month)/high usage frequency (several days a week and daily)	Binary	Current	NR	NR	General SM (unclear)	NA
Nesi 2019	Posted photos with peers on Instagram	Observationally coded measure* 1. Photos posted with peers, where both participant and same-age peers depicted. Sum of the number of photos with peers posted during the 3-month coding period taken.	Cont.	During coding period	Specified: Instagram	Instagram	Media-sharing (active use)	NA
Nesi 2019	Frequency of daily SM use	Self-report 1-item measure 1. Average daily frequency of SM use defined as any website/app that involves social interaction, i.e., Facebook, Instagram, Tumblr, Snapchat. Responses: (0) I don't use this to (6) ≥5 hrs/day.	Cont.	Current	Examples: texting, Facebook, Instagram, and Snapchat	Mixed platforms	SNS (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Nesi 2019	Posted selfies on Instagram	Observationally coded measure* 1. Selfies, or photos of the participant alone. Sum of the number of selfies posted during the 3-month coding period taken.	Cont.	During coding period	Specified: Instagram	Instagram	Media-sharing (active use)	NA
Pegg 2018	Frequency of SNS use (intensity)	Self-report 1-item measure 1. How many hrs per week spent on SNS. Responses: 0 hrs/week to ≥30 hrs/week.	Cont.	Current	NR	NR	SNS (unclear)	NA
Prince 2021	Frequency of Snapchat use	Self-report 1-item measure 1. How often Snapchat used. Responses: never, rarely, sometimes, and often. Variable dichotomised: sometimes/often.	Binary	Current	Specified: Snapchat	Snapchat	SNS (unclear)	NA
Riehm 2021	Frequency of checking SM sites	Self-report 1-item measure 1. How often checked SM sites. Responses: none, 1 to 2 times per week, 1 to 2 times per day, and many times per day. Variable dichotomised: high frequency engagement (many times per day)/lower frequency engagement	Binary	Current	Examples: Facebook, Twitter, and Instagram	NR	General SM (passive use)	NA
Riehm 2021	Frequency of posting own photos, images, videos, status updates, or blogs on SM	Self-report 1-item measure 1. How often posted own photos, images, videos, status updates, or blogs on SM. Responses: none, 1 to 2 times per week, 1 to 2 times per day, and many times per day. Variable dichotomised: high frequency	Binary	Current	NR	NR	General SM (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		engagement (many times per day)/lower frequency engagement.						
Riehm 2021	Frequency of liking or commenting on other people's statuses, wall posts, pictures, etc on SM	Self-report 1-item measure 1. How often liked or commented on other people's statuses, wall posts, pictures, etc on SM. Responses: none, 1 to 2 times per week, 1 to 2 times per day, and many times per day. Variable dichotomised: high frequency engagement (many times per day)/lower frequency engagement	Binary	Current	NR	NR	General SM (active use)	NA
Riehm 2021	Frequency of sharing other people's photos, images, videos, status updates, blogs, articles, news, or websites on SM	Self-report 1-item measure 1. How often shared other people's photos, images, videos, status updates, blogs, articles, news, or websites on SM. Responses: none, 1 to 2 times per week, 1 to 2 times per day, and many times per day. Variable dichotomised: high frequency engagement (many times per day) and lower frequency engagement	Binary	Current	NR	NR	General SM (active use)	NA
Romo 2017	Frequency of SM app use	Self-report 1-item measure via validated questionnaire* 1. How often visited/used apps per day or week. Variable dichotomised: frequent use of visiting online SM apps (>10 times per	Binary	Current	NR	NR	General SM (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		day) and infrequent use (≤10 times per day).						
Romo 2017	Frequency of SNS use	Self-report 1-item measure via validated questionnaire* 1. How often SNS visited/used per day or week. Variable dichotomised: frequent use of visiting online SNS (>10 times per day) and infrequent use (≤ 10 times per day).	Binary	Current	NR	NR	SNS (unclear)	NA
Rutter 2021	Frequency of SM use (checking and posting)	Self-report measure Panel of surveys assessing SM use and SM rules. No further information reported.	Cont.	Current	NR	NR	General SM (unclear)	NA
Savolainen 2020	Frequency of Facebook use	Self-report 1-item measure via validated questionnaire* 1. How often Facebook used. Responses: I do not use, seldom, daily, and several times a day. Variable dichotomised: daily user and non-daily user.	Binary	Current	Specified: Facebook	Facebook	SNS (unclear)	NA
Savolainen 2020	Frequency of YouTube use	Self-report 1-item measure via validated questionnaire* 1. How often YouTube used. Responses: I do not use, seldom, daily, and several times a day. Variable dichotomised: daily user and non-daily user.	Binary	Current	Specified: YouTube	YouTube	Media-sharing (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Savolainen 2020	Frequency of Twitter use	Self-report 1-item measure via validated questionnaire* 1. How often Twitter used. Responses: I do not use, seldom, daily, and several times a day. Variable dichotomised: daily user and non-daily user.	Binary	Current	Specified: Twitter	Twitter	Micro-blogging (unclear)	NA
Savolainen 2020	Frequency of Instagram use	Self-report 1-item measure via validated questionnaire* 1. How often Instagram used. Responses: I do not use, seldom, daily, and several times a day. Variable dichotomised: daily user and non-daily user.	Binary	Current	Specified: Instagram	Instagram	Media-sharing (unclear)	NA
Savolainen 2020	Frequency of instant messaging	Self-report 1-item measure via validated questionnaire 1. How often instant messaging used (e.g., WhatsApp/Snapchat). Responses: I do not use, seldom, daily, and several times a day. Variable dichotomised: daily user and non-daily user.	Binary	Current	Specified: Instant messaging. Examples: WhatsApp, and Snapchat	Instant messaging	SNS (active use)	NA
Self-Brown 2018	Presence of SM use	Self-report 1-item measure via validated questionnaire* 1. Used any type of SM (e.g., Twitter, Facebook). Responses: yes/no.	Binary	Current	Examples: Twitter and Facebook	Mixed platforms	General SM (unclear)	NA
Shimoga 2019	Frequency of SM use	Self-report 1-item measure	Ordinal	Current	Examples: Twitter,	Mixed platforms	SNS	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		1. How often social networking websites like Facebook, Twitter, Instagram, etc visited. Responses: never, a few times a year, one to two times a month, once a week, and every day.			Facebook, and Instagram		(unclear)	
Soneji 2018	Frequency of social networking account use	Self-report 1-item measure 1. How often Facebook, Google Plus, Myspace, Twitter, or other social networking account visited. Responses: several times a day, daily, weekly, monthly, and less.	Ordinal	Current	Examples: Facebook, Google plus, Myspace, Twitter, and other	Mixed platforms	SNS (unclear)	NA
Svensson 2020	Frequency of posting information on Facebook, Instagram, Snapchat, or other SM	Self-report 1-item measure 1. How often use a computer, mobile phone, or tablet to post information about yourself on Facebook, Instagram, Snapchat, or other SM. Responses: never, once a month, about once a week, several times a day, every day.	Cont.	Current	Examples: Facebook, Instagram, Snapchat, or other SM	Mixed platforms	General SM (active use)	NA
Svensson 2020	Frequency of staying in contact with and staying informed about friends via Facebook, Instagram or similar	Self-report 1-item measure 1. How often use a computer, mobile phone, or tablet to stay in contact with and stay informed about friends via Facebook, Instagram or similar. Responses: never, once a month, about once a week, several times a day, every day.	Cont.	Current	Examples: Facebook, Instagram, or similar	Mixed platforms	General SM (active and passive use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Tsitsika 2009	Ever accessing the internet to visit chat rooms	Self-report measure Primary objects of interest via internet. No further info provided	Binary	Current	NR	NR	SNS (active use)	NA
Tsitsika 2011	Presence of internet chat room use	Self-report measure Use of internet chat rooms. No further information provided.	Binary	Current	NR	NR	SNS (active use)	NA
Vandenbosch 2016	Frequency of chat room use	Self-report 1-item measure 1. How often usually visited chat rooms. Responses: (1) never to (8) all day long. 3-category variable constructed: non-users, infrequent (less than once a month, and frequent (monthly to daily).	Ordinal	Current	NR	NR	SNS (active use)	NA
Vannucci 2019	Frequency of SM use	Self-report measure via Technology Use Questionnaire 1. How often used a range of SM platforms on a typical day (discussion boards, FB, Google +, Instagram, Pin Boards, Snapchat, Tumblr, Twitter). Responses: (0) never to (8) almost constantly. Total number of platforms used calculated by coding each platform as either (0) never used and (1) used at least once or more, and then summing usage scores. 2. How much time, overall, they spent using SM platforms on a typical day (in hrs). Latent profile analyses used to identify	Cat.	Current	Examples: Discussion boards, FB, Google +, Instagram, Pin Boards, Snapchat, Tumblr, and Twitter	Mixed platforms	General SM (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		latent subgroups of SM: high SM use (frequent daily overall use across platforms), high Instagram/Snapchat use (hourly use of Instagram + Snapchat use only, with low use of all other SM platforms), and low SM use (less than once daily use of all SM platforms).						
Vannucci 2019	Frequency of Google+ use	Self-report 1-item measure 1. How often used Google + on a typical day. Responses: never, less than once a week, once a week, several times a week, once a day, several times a day, once an hr, several times an hr, and almost constantly.	Cont.	Current	Specified: Google +	Google+	SNS (unclear)	NA
Vannucci 2019	Frequency of use of pin boards	Self-report 1-item measure 1. How often used pin boards on a typical day. Responses: never, less than once a week, once a week, several times a week, once a day, several times a day, once an hr, several times an hr, and almost constantly.	Cont.	Current	Specified: Pin board	Discussion & Pin Boards	Blogs & Forums (unclear)	NA
Vannucci 2019	Frequency of Facebook use	Self-report 1-item measure 1. How often used Facebook on a typical day. Responses: never, less than once a week, once a week, several times a week, once a day, several times a day, once an hr,	Cont.	Current	Specified: Facebook	Facebook	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		several times an hr, and almost constantly.						
Vannucci 2019	Frequency. of Instagram use	Self-report 1-item measure 1. How often used Instagram on a typical day. Responses: never, less than once a week, once a week, several times a week, once a day, several times a day, once an hr, several times an hr, and almost constantly.	Cont.	Current	Specified: Instagram	Instagram	SNS (unclear)	NA
Vannucci 2019	Frequency of Snapchat use	Self-report 1-item measure 1. How often used Snapchat on a typical day. Responses: never, less than once a week, once a week, several times a week, once a day, several times a day, once an hr, several times an hr, and almost constantly.	Cont.	Current	Specified: Snapchat	Snapchat	SNS (unclear)	NA
Vannucci 2019	Frequency of Twitter use	Self-report 1-item measure 1. How often used Twitter on a typical day. Responses: never, less than once a week, once a week, several times a week, once a day, several times a day, once an hr, several times an hr, and almost constantly.	Cont.	Current	Specified: Twitter	Twitter	Micro-blogging (unclear)	NA
Vannucci 2019	Frequency of Tumblr use	Self-report 1-item measure 1. How often used Tumblr on a typical day.	Cont.	Current	Specified: Tumblr	Tumblr	Micro-blogging (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		Responses: never, less than once a week, once a week, several times a week, once a day, several times a day, once an hr, several times an hr, and almost constantly.						
Vannucci 2019	Frequency of use of discussion boards	Self-report 1-item measure 1. How often used discussion boards on a typical day. Responses: never, less than once a week, once a week, several times a week, once a day, several times a day, once an hr, several times an hr, and almost constantly.	Cont.	Current	Specified: Discussion boards	Discussion & Pin Boards	Blogs & forums (unclear)	NA
Vazquez-Nava 2020	Presence of use of social networks (WhatsApp or Facebook)	Self-report measure via validated questionnaire* 1. Use of online messaging platforms such as WhatsApp or Facebook to communicate with their friends and other people.	Binary	Current	Specified: WhatsApp and Facebook	Mixed platforms	SNS (active use)	NA
Vente 2020	Any SM per day	Self-report measure Total time spent on SM per day, and number and type of SM application used.	Binary	Current	NR	NR	General SM (unclear)	NA
Vente 2020	Use of ≥4 SM applications per day	Self-report measure Total time spent on SM per day, and number and type of SM application used.	Binary	Current	NR	NR	General SM (unclear)	NA
Wana 2019	Presence of SM use	Self-report measure	Binary	Current	Examples: Facebook, Viber, WhatsApp,	Mixed platforms	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		If SM user, what platforms used, frequency of SM use, and the purpose of using SM.			YouTube, and Instagram			
Ward 2022	Frequency of Facebook use per day	Self-report 1-item measure 1. How many times per day Facebook checked. Responses: 0 to 7+ times.	Cont.	Current	Specified: Facebook	Facebook	SNS (unclear)	NA
Ward 2022	Frequency of Snapchat use per day	Self-report 1-item measure 1. How many times per day Snapchat checked. Responses: 0 to 7+ times.	Cont.	Current	Specified: Snapchat	Snapchat	SNS (unclear)	NA
Ward 2022	Frequency of Instagram use per day	Self-report 1-item measure 1. How many times per day Instagram checked. Responses: 0 to 7+ times.	Cont.	Current	Specified: Instagram	Instagram	Media-sharing (unclear)	NA
Whitehill 2020	Frequency of SM use	Self-report 1-item measure Responses: never, monthly, a few times a month, weekly, a few times a week, once a day, and more than once a day. No further information provided.	Ordinal	Current	NR	NR	General SM (unclear)	NA
Whitehill 2020	Presence of Facebook use	No information reported.	Binary	Current	Specified: Facebook	Facebook	SNS (unclear)	NA
Whitehill 2020	Presence of Twitter use	No information reported.	Binary	Current	Specified: Twitter	Twitter	Micro-blogging (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Whitehill 2020	Presence of Instagram use	No information reported.	Binary	Current	Specified: Instagram	Instagram	Media-sharing (unclear)	NA
Widman 2014	Used technology-based sexual communication to communicate with dating partners about using condoms	Self-report 1-item measure 1. Ever used private technology (i.e., "electronically interacting with someone in a way that is not visible to the public, such as Snapchat, or private Facebook messaging") to communicate with dating partners about using condoms. Dating partners defined as a boy/girlfriend or someone with whom participants had a romantic or sexual relationship.	Binary	Ever	Examples: texting, Snapchat, and Facebook	Mixed platforms	SNS (active use)	NA
Widman 2014	Used technology-based sexual communication to communicate with dating partners about using other forms of birth control	Self-report 1-item measure 1. Ever used private technology (i.e., "electronically interacting with someone in a way that is not visible to the public, such as Snapchat, or private Facebook messaging") to communicate with dating partners about using other forms of birth control. Dating partners defined as a boy/girlfriend or someone with whom participants had a romantic or sexual relationship.	Binary	Ever	Examples: texting, Snapchat, and Facebook	Mixed platforms	SNS (active use)	NA
Widman 2014	Used technology-based sexual communication to	Self-report 1-item measure 1. Ever used private technology (i.e., "electronically interacting with someone	Binary	Ever	Examples: texting,	Mixed platforms	SNS (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
	communicate with dating partners about HIV/AIDS	in a way that is not visible to the public, such as Snapchat, or private Facebook messaging") to communicate with dating partners about HIV/AIDS. Dating partners defined as a boy/girlfriend or someone with whom participants had a romantic or sexual relationship.			Snapchat, and Facebook			
Widman 2014	Used technology-based sexual communication to communicate with dating partners about STIs	Self-report 1-item measure 1. Ever used private technology (i.e., "electronically interacting with someone in a way that is not visible to the public, such as Snapchat, or private Facebook messaging") to communicate with dating partners about STIs. Dating partners defined as a boy/girlfriend or someone with whom participants had a romantic or sexual relationship.	Binary	Ever	Examples: texting, Snapchat, and Facebook	Mixed platforms	SNS (active use)	NA
Widman 2014	Used technology-based sexual communication to communicate with dating partners about risk of pregnancy	Self-report 1-item measure 1. Ever used private technology (i.e., "electronically interacting with someone in a way that is not visible to the public, such as Snapchat, or private Facebook messaging") to communicate with dating partners about risk of pregnancy. Dating partners defined as a boy/girlfriend or someone with whom participants had a romantic or sexual relationship.	Binary	Ever	Examples: texting, Snapchat, and Facebook	Mixed platforms	SNS (active use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Widman 2014	Used technology-based sexual communication to communicate with dating partners about sexual limits	Self-report 1-item measure 1. Ever used private technology (i.e., "electronically interacting with someone in a way that is not visible to the public, such as Snapchat, or private Facebook messaging") to communicate with dating partners about sexual limits. Dating partners defined as a boy/girlfriend or someone with whom participants had a romantic or sexual relationship.	Binary	Ever	Examples: texting, Snapchat, and Facebook	Mixed platforms	SNS (active use)	NA
Wulff 2021	Frequency of WhatsApp use	Self-report 1-item measure 1. Frequency of social network use (e.g., Twitter, Facebook) and used functions (e.g., texting, view pictures, posting content). Responses: never, at least once a month, at least once a week, daily, more than 1 hr/day.	Binary	Current	Specified: WhatsApp	WhatsApp	SNS (active and passive use)	NA
Wulff 2021	Frequency of YouTube use	Self-report 1-item measure 1. Frequency of social network use (e.g., Twitter, Facebook) and used functions (e.g., texting, view pictures, posting content). Responses: never, at least once a month, at least once a week, daily, more than 1 hr/day.	Binary	Current	Specified: YouTube	YouTube	Media-sharing (active and passive use)	NA
Wulff 2021	Frequency of Instagram use	Self-report 1-item measure	Binary	Current	Specified: Instagram	Instagram	Media-sharing	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		1. Frequency of social network use (e.g., Twitter, Facebook) and used functions (e.g., texting, view pictures, posting content). Responses: never, at least once a month, at least once a week, daily, more than 1 hr/day.					(active and passive use)	
Wulff 2021	Frequency of Facebook use	Self-report 1-item measure 1. Frequency of social network use (e.g., Twitter, Facebook) and used functions (e.g., texting, view pictures, posting content). Responses: never, at least once a month, at least once a week, daily, more than 1 hr/day.	Binary	Current	Specified: Facebook	Facebook	SNS (active and passive use)	NA
Wulff 2021	Frequency of Google+ use	Self-report 1-item measure 1. Frequency of social network use (e.g., Twitter, Facebook) and used functions (e.g., texting, view pictures, posting content). Responses: never, at least once a month, at least once a week, daily, more than 1 hr/day.	Binary	Current	Specified: Google +	Google+	SNS (active and passive use)	NA
Wulff 2021	Frequency of Twitter use	Self-report 1-item measure 1. Frequency of social network use (e.g., Twitter, Facebook) and used functions (e.g., texting, view pictures, posting content). Responses: never, at least once a month,	Binary	Current	Specified: Twitter	Twitter	Micro-blogging (active and passive use)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		at least once a week, daily, more than 1 hr/day.						

Legend: Abbreviation(s): AIDS=Acquired immunodeficiency syndrome; Cont=Continuous; Cat=Categorical; HIV=Human immunodeficiency virus; NA=Not applicable; NR=Not reported; SM=Social media; SNS=Social networking site(s); and STI=Sexually transmitted infection.

Table A15.3. Social media measures assessing *exposure to health-risk behaviour content* reported in included studies

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Baldwin 2018	Watched food/beverage brand YouTube videos	Self-report 1-item measure 1. Ever watched any commercials/ads for food or drink products on YouTube. Responses: yes/no.	Binary	Ever	Specified: YouTube	YouTube	Media-sharing (passive use)	Marketer-gen
Baldwin 2018	Seen favourite food advertised on SM	Self-report 1-item measure 1. Had seen favourite food brands advertised on SM. Responses: yes/no.	Binary	NR	NR	NR	General SM (passive use)	Marketer-gen
Baldwin 2018	Liked a food/beverage brand on Facebook	Self-report 1-item measure 1. Ever liked any food/beverage companies or brands on Facebook (e.g., they liked or shared any of these pages' content). Responses: yes/no.	Binary	Ever	Specified: Facebook	Facebook	SNS (active use)	Marketer-gen
Baldwin 2018	Entered a food/beverage brand competition on Facebook	Self-report 1-item measure 1. Ever entered a food/beverage brand competition/contest on Facebook. Responses: yes/no.	Binary	Ever	Specified: Facebook	Facebook	SNS (active use)	Marketer-gen
Bayraktar 2007	Online gaming: murdering games	Self-report measure Completed a set of questionnaires related to internet experience, internet sites used (chatting sites, music sites, popstar sites, played games online etc), and reasons for internet usage etc. No further information provided.	Cont.	Current	NR	NR	Online gaming (active use)	Marketer-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Bayraktar 2007	Online gaming: fighting games	Self-report measure: Completed a set of questionnaires related to internet experience, internet sites used (chatting sites, music sites, popstar sites, played games online etc), and reasons for internet usage etc. No further information provided.	Cont.	Current	NR	NR	Online gaming (active use)	Marketer-gen
Bayraktar 2007	Online gaming: bombing games	Self-report measure: Completed a set of questionnaires related to internet experience, internet sites used (chatting sites, music sites, popstar sites, played games online etc), and reasons for internet usage etc. No further information provided.	Cont.	Current	NR	NR	Online gaming (active use)	Marketer-gen
Camenga 2018	Exposure to e-cigarette advertisements on Facebook	Self-report 1-item measure 1. Recently seen advertisements on Facebook. Responses: yes/no.	Binary	Current	Specified: Facebook	Facebook	SNS (passive use)	Marketer-gen
Camenga 2018	Exposure to e-cigarette advertisements on Twitter	Self-report 1-item measure 1. Recently seen advertisements on Twitter. Responses: yes/no.	Binary	Current	Specified: Twitter	Twitter	Micro-blogging (passive use)	Marketer-gen
Camenga 2018	Exposure to e-cigarette advertisements on YouTube	Self-report 1-item measure 1. Recently seen advertisements on YouTube. Responses: yes/no.	Binary	Current	Specified: YouTube	YouTube	Media-sharing (passive use)	Marketer-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Camenga 2018	Exposure to e-cigarette advertisements on Pinterest/ Google +	Self-report 1-item measure 1. Recently seen advertisements on Pinterest/Google +. Responses: yes/no.	Binary	Current	Specified: Google + and Pinterest	Mixed platforms	Media-sharing (passive use)	Marketer-gen
Cavazos-Rehg 2014	Exposure to tobacco ads/ promotions via Facebook or Myspace	Self-report 2-item measure If during the past 30 days had: 1. Received coupons from a tobacco company through… 2. Received ads from a tobacco company through…. Participants could select one or more responses from the following choices: the mail, E-mail, the Internet, Facebook, Myspace, a text message. Responses for Facebook and Myspace combined to represent variable.	Binary	Past month	Specified: Facebook and Myspace	Facebook & Myspace	SNS (unclear)	Marketer-gen
Chen 2019	Exposure to risky selfie descriptive norms	Self-report 1-item measure 1. How many of friends posted risky selfies. Responses: (1) nobody to (5) everybody.	Cont.	Current	NR	NR	General SM (passive use)	User-gen
Coates 2019	Exposure to unhealthy mock Instagram influencer marketing	Exposed to mock Instagram profiles for 2 SM influencers (male and female)* Profiles consisted of the Instagram banner and 6 images (3 test and 3 filler unbranded non-food items) of influencer holding a product (unhealthy e.g., choc cookies; healthy e.g., banana; branded non-food e.g., sneakers). Images	Cat.	Current	Specified: Instagram	Instagram	SNS (passive use)	Marketer-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		obtained and edited from influencer YouTube channels. Participant randomly exposed to 1 of 3 mock Instagram profiles of an influencer holding a product: unhealthy snacks, healthy snacks, or branded non-food items. Counterbalancing of participants to condition, and influencer order (man first or woman first), was conducted by using randomizer.org.						
Critchlow 2019	Participation with alcohol marketing on SM	Self-report 5-item measure If participant had: 1. Liked an alcohol brand on SM, such as Twitter, Facebook or Instagram. 2. Shared something related to an alcohol drinks brand, such as a status, Tweet, or picture. 3. Followed an alcohol brand on social media. 4. Entered a competition run by an alcoholic drink brand online or on social media. 5. Searched for alcoholic drinks adverts on websites, such as YouTube. Responses: yes/no/none of the above. A cumulative score was computed (0–5). 3-category variable constructed: no participation with any marketing, participation with 1 form of marketing,	Ordinal	Past month	Examples: Twitter, Facebook, Instagram, and SM	Mixed platforms	General SM (active use)	Marketer-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		or participation with ≥2 forms of marketing.						
Critchlow 2019	Participation with user-created alcohol promotion on SM	Self-report 1-item measure 1. Updated status or uploaded pictures of themselves or friends drinking an alcoholic drink. Responses: yes/no.	Binary	Past month	NR	NR	General SM (active use)	User-gen
Dai 2022	Exposure to e-cigarette advertisements on SM	Self-report 1-item validated measure* 1. Seen e-cigarette advertisements on SM in the past 30 days. Responses: never, sometimes (once or twice), and often (more than 3 times). Variable dichotomised: yes (sometimes/often)/no (never).	Binary	Past month	NR	NR	General SM (passive use)	Marketer-gen
Davis 2019	Substance-related media exposure via SM	Self-report 2-item measure 1,2. How often saw or heard pictures or comments on a SNS (e.g., Facebook) showing someone or talking about someone who is drunk. Responses: (0) not at all to (6) every day. Average of 2 items taken for analysis.	Cont.	Past 3 months	Example: Facebook	Facebook	SNS (passive use)	User + Marketer-generated
Dawson 2019	Percentage of participant posts sharing inappropriate content on Facebook	Observationally coded measure* Coded using Mikami and Szwedo (2013) Facebook Coding Manual. Facebook profile coded over 2-month period to obtain proportion of total participant posts shared containing inappropriate content (i.e., profanity,	Cont.	Current	Specified: Facebook	Facebook	SNS (active use)	User-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		substance use, sexual behaviour, violence, or other illegal behaviour).						
Dawson 2019	Percentage of participant posts containing relational aggression on Facebook	Observationally coded measure* Coded using Mikami and Szwedo (2013) Facebook Coding Manual. Facebook profile coded over 2-month period to obtain proportion of total participant posts containing relational aggression (i.e., comments meant to criticise, ostracise, or embarrass a person or group of people).	Cont.	Current	Specified: Facebook	Facebook	SNS (active use)	User-gen
Dawson 2019	Percentage of participant friend posts containing relational aggression on Facebook	Observationally coded measure* Coded using Mikami and Szwedo (2013) Facebook Coding Manual. Facebook profile coded over 2-month period to obtain proportion of friend posts on participant timeline containing content on relational aggression (i.e., comments meant to criticize, ostracise, or embarrass a person or group of people).	Cont.	Current	Specified: Facebook	Facebook	SNS (passive use)	User-gen
Dawson 2019	Percentage of participant friend posts containing inappropriate content	Observationally coded measure* Coded using Mikami and Szwedo (2013) Facebook Coding Manual. Facebook profile coded over 2-month period to obtain proportion of friend posts on participant timeline containing inappropriate content (i.e., profanity,	Cont.	Current	Specified: Facebook	Facebook	SNS (passive use)	User-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		substance use, sexual behaviour, violence, or other illegal behaviour).						
de Bruijn 2016	Ever used alcohol branded SM page	Self-report 1-item measure 1. Ever used a profile page on sites such as Hyves, Facebook, MSN, or Myspace containing an alcohol brand or logo. Responses: never, rarely/sometimes, and often/very often.	Binary	Ever	Examples: Hyves, Facebook, MSN, and Myspace	Mixed platforms	SNS (passive use)	Marketer-gen
De Jans 2021	Exposure to snack with low nutritional value (mini donut) on Instagram	Exposed to 1 of 2 individual Instagram posts* 1. Post portraying snack high in nutritional value (i.e., strawberries). 2. Post portraying snack low in nutritional value (i.e., donuts).	Binary	Current	Specified: Instagram	Instagram	Media-sharing (passive use)	Marketer-gen
Doornwaard 2014	Exposure to displays of sexual references on Facebook	Observationally coded measure* Using codebook based on procedures used in previous content analyses of SNS (Moreno *et al.*, 2011). Reviewers analysed visible elements on participant Facebook timeline via content analysis: status updates, images, comments and downloaded icons to investigate sexual references on Facebook related to safe sex, risky sex, sexual behaviour, sexualised personal descriptions, revealing personal images, sexual paraphernalia, and romance. Sexual references defined as any textual or visual depiction of sexual activity or	Binary	During coding period	Specified: Facebook	Facebook	SNS (active and passive use)	User-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		sexually suggestive behaviour. References did not need to be created by the owner (participant), they included posts, comments, tags by friends on the participant's profile. Sexual reference displayers compared with non-sexual reference displayers.						
Folkvord 2020	Exposure to popular influencer Instagram post showing energy-dense foods	Exposed to 1 of 2 popular SM influencers on Instagram* 1. Post showing vegetables (control condition). 2. Post showing energy-dense snacks (experimental condition). 3. Post showing non-food products.	Binary	Current	Specified: Instagram	Instagram	Media-sharing (passive use)	Marketer-gen
Gascoyne 2021	Seen an advertisement for a food or drink product on SM (e. g. Facebook, Instagram)	Self-report 1-item measure 1. How often in last month saw a food or drink product on SM (e. g. Facebook, Instagram). Responses: not in the last month, 1–3 times a month, 1–3 times a week and daily or almost daily.	Ordinal	Past month	Examples: Facebook and Instagram	Mixed platforms	General SM (passive use)	Marketer-gen
Gascoyne 2021	Liked/ shared posts related to a food or drink product or brand (e.g., soft drink, fast food)	Self-report 1-item measure 1. How often in last month 'liked' or 'shared' posts related to a food or drink product or brand (e.g., soft drink, fast food). Responses: not in the last month, 1–3	Ordinal	Past month	Examples: Facebook and Instagram	Mixed platforms	General SM (active use)	Marketer-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		times a month, 1–3 times a week and daily or almost daily.						
Gerber 2021	Exposure to alcohol related content on Instagram and Snapchat	Self-report 2-item measure 1. How often see content in which alcohol is present on Instagram. 2. How often see content in which alcohol is present on Snapchat. Responses: (1) never to (5) very often. Mean of both items calculated, representing exposure to alcohol-related content on SM.	Cont.	Current	Specified: Instagram and Snapchat	Mixed platforms	Media-sharing (passive use)	User + Marketer-generated
Gerber 2021	Shared alcohol related content on Instagram and Snapchat	Self-report 2-item measure 1. How often post or send content on Instagram depicting alcohol. 2. How often post or send content on Snapchat depicting alcohol. Responses: (1) never to (5) very often. Mean of both items calculated, representing exposure to alcohol-related content on SM.	Cont.	Current	Specified: Instagram and Snapchat	Mixed platforms	Media-sharing (active use)	User + Marketer-generated
Geusens 2017	Frequency of sharing alcohol references on SNS	Self-report 8-item measure How often privately shared the following things on any social medium and how often publicly shared the following things on any social medium: 1. Photos or video clips referring to alcohol use. 2. Textual updates referring to alcohol use.	Cont.	Ever	NR	NR	SNS (active use)	User-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		3. Photos or video clips in which they or their friends were drunk. 4. Textual updates while they were drunk. 'Private sharing' was defined as 'references shared with a limited amount of people, e.g., through communication via direct messaging, private groups, or group chats'. Responses: (0) never to (6) several times a day.						
Geusens 2017	Perceived number of friends sharing alcohol references online	Self-report 4-item measure How many of their friends shared: 1. Photos or video clips referring to alcohol use. 2. Textual updates referring to alcohol use. 3. Photos or video clips in which they are drunk. 4. Textual updates while they are drunk. Responses: (0) none to (4) all of them.	Cont.	Current	NR	NR	SNS (passive use)	User-gen
Geusens 2019	Frequency of exposure to peer alcohol references on SNS	Self-report 3-item measure How often saw videos or images: 1. On YouTube or similar sites. 2. On other SNS, such as Facebook or Twitter, about youth drinking alcohol. 3. Youth being drunk. Responses: (0) never to (8) all day long. Factor analysis used to load all 3 items loaded onto one scale.	Cont.	Current	Examples: YouTube, Facebook, Twitter, and other SNS	Mixed platforms	SNS (passive use)	User-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Geusens 2019	Frequency of sharing of alcohol references on SNS	Self-report 1-item measure How often shared videos/images: 1. On YouTube or similar sites. 2. On other SNS, such as Facebook or Twitter, about youth drinking alcohol. 3. Youth being drunk. Responses: (0) never to (8) all day long. Upper scale points collapsed after calculating the composite score with 0 (never), 1 (a few times per year), 2 (once per month), and 3 (more than once per month).	Cont.	Current	Examples: YouTube, Facebook, Twitter, and other SNS	Mixed platforms	SNS (active use)	User-gen
Gordon 2011	Awareness of alcohol marketing on SNS	Self-report 1-item measure 1. Had seen any alcohol marketing on SNS. Responses: yes/no/don't know.	Binary	Current	NR	NR	SNS (passive use)	Marketer-gen
Gordon 2011	Used SNS containing alcohol brands or logos	Self-report 1-item measure 1. Has used SNS containing alcohol brands or logos. Responses: yes/no/don't know.	Binary	Current	NR	NR	SNS (passive use)	Marketer-gen
Hrywna 2020	Liked or followed a tobacco brand on SM	Self-report 1-item measure 1. Had visited, followed, liked, or become a fan of a tobacco brand on sites like Instagram, Twitter, Facebook, or YouTube.	Binary	Past year	Examples: Instagram, Twitter, Facebook, and YouTube	Mixed platforms	SNS (active and passive use)	Marketer-gen
Huang 2014	Number of friends who posted risky pictures partying or drinking	Self-report measure Egocentric (personal) networks created for each participant, participant asked to name 7 best friends regardless of where	Cont.	Ever	NR	NR	SNS (passive use)	User-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		they live or go to school and provide basic information about each of them (alters). Friends' online behaviours were assessed by asking whether alters ever "posted pictures of themselves partying or drinking alcohol online" Indicator friends' online risk behaviour created using total number of alters for these items.						
Lin 2012	Used SNS containing alcohol brands or logos	Self-report 1-item measure 1. Used SNS containing alcohol brands or logos. Responses: yes/no/don't know.	Binary	Current	NR	NR	SNS (passive use)	Marketer-gen
Lin 2012	Awareness of alcohol marketing on SNS	Self-report measure If they could think of any makes or brands of alcohol that they had seen or heard advertised recently. Followed by a set of questions assessing awareness across 15 types of marketing channels (including SNS). Response: yes/no/don't know.	Binary	Current	NR	NR	SNS (passive use)	Marketer-gen
Nesi 2017	Ever exposed to friends' SNS alcohol content	Self-report 2-item measure Whether a friend had ever: 1. Posted a picture of themselves with alcohol. 2. Posted a status, picture, or link about drinking alcohol.	Binary	Ever	NR	NR	SNS (passive use)	User-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		Items combined, with endorsement of either item coded as (1) and endorsement of neither as (0).						
Nesi 2017	Exposure to SNS alcohol content posted by self	Self-report 5-item measure If had: 1. Posted status, picture, or link about alcohol. 2. Posted picture of self with alcohol 3. Tagged friends in photos with alcohol. 4. Posted picture of self, passed out or vomiting as result of alcohol. 5. Posted picture of friend passed out or vomiting as a result of alcohol.	Binary	Ever	NR	NR	SNS (active use)	User-gen
Ngqangashe 2021	Watched YouTube Tasty video portraying preparation of sweet snacks	Exposed to 1 of 2 short-form 'Tasty' culinary videos on YouTube* 1. Video portraying sweet snacks (The Best Fudgy Brownies Ever, Chocolate Peanut Brownies (Buckeye Brownies), and 6 Ways to Make Better Boxed Brownies. 2. Video portraying fruits and vegetables (4 make-ahead vegetable-packed smoothies, 4 healthier desserts, and fruit salad four ways).	Binary	Current	Specified: YouTube	YouTube	Media-sharing (passive use)	Marketer-gen
Pegg 2018	SNS alcohol exposure	Self-report 1-item measure 1. How often in the previous 6 months friends posted pictures, updates, or wall posts that showed or talked about them drinking alcohol. Responses: (1) none to (8) ≥31 times.	Cont.	Past 6 months	NR	NR	SNS (active and passive use)	User-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Pérez 2022	Exposure to tobacco related content on SM in the past 12 months (including e-cigarettes)	Self-report 1-item measure 1. In past 12 months, posted content about tobacco products (including e-cigarettes) on any SM sites. Responses: yes/no.	Binary	Past year	NR	NR	General SM (active use)	User + Marketer-generated
Pérez 2022	Posted tobacco related content on SM in the past 12 months (including e-cigarettes)	Self-report 1-item measure 1. In past 12 months, seen content posted about tobacco products (including e-cigarettes) on SM sites. Responses: yes/no.	Binary	Past year	NR	NR	General SM (passive use)	User + Marketer-generated
Qutteina 2022	Exposure to non-core foods (energy-dense, low nutrient: sweetened drinks, sweets, salty or savoury snacks) on SM	Self-report measure 1. How often saw food messages posted by friends, influencers, and celebrities as well as messages posted by brands. Responses: (1) not at all to (5) very often.	Ordinal	Current	NR	NR	General SM (passive use)	User + Marketer-generated
Qutteina 2022	Exposure to branded non-core foods (energy-dense, low nutrient: sweetened drinks, sweets, salty/savoury snacks) on SM	Self-report measure 1. How often saw food messages posted by friends, influencers, and celebrities as well as messages posted by brands. Responses: (1) not at all to (5) very often.	Ordinal	Current	NR	NR	General SM (passive use)	User + Marketer-generated

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Roditis 2016	Ever seen a message posted on SM about the benefits or good things of using marijuana	Self-report 1-item measure 1. Ever seen a message posted on SM about benefits or good things related to using marijuana. Responses: yes/no.	Binary	Ever	NR	NR	General SM (passive use)	User + Marketer-generated
Shan 2022	Followed tobacco brands on Facebook/Twitter or other SM sites	Self-report 1-item measure 1. In past 12 months, liked or followed any of the following brands (e.g., Marlboro, Newport, American Spirit, Vuse) on Facebook, Twitter, or other SM sites. Responses; yes/no	Binary	Past year	Examples: Facebook and Twitter	Mixed platforms	General SM (active use)	Marketer-gen
Sharma 2021	Exposure to tobacco adverts on SM	Self-report measure Modified Global Youth Tobacco Survey questionnaire. Responses: yes/no. No further information reported.	Binary	Current	NR	NR	General SM (passive use)	Marketer-gen
Smout 2021	Exposure to peer-generated content on SM depicting risky substance use	Self-report 1-item measure 1. See pictures of kids drunk, passed out or using drugs on these sites? Responses: yes/no	Binary	Current	Specified: Facebook, Myspace, and other SNS	Mixed platforms	SNS (passive use)	User-gen
Trangenstein 2019	Liked/follow cannabis business pages on Facebook, Twitter and/or Instagram	Self-report measure 1. Engagement: if like/follow any cannabis business pages on Facebook, Instagram and/or Twitter and if so, which ones. Engagement defined as liking, following, and/or commenting on	Binary	Current	Specified: Facebook, Twitter, and Instagram	Mixed platforms	SNS (active use)	Marketer-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
		a cannabis business page. Responses: yes/no.						
Trangenstein 2019	Liked/follow cannabis business pages on Facebook	Self-report 1-item measure 1. Engagement: if like/follow any cannabis business pages on Facebook. Engagement defined as liking, following, and/or commenting on a cannabis business page. Responses: yes/no.	Binary	Current	Specified: Facebook	Facebook	SNS (active use	Marketer-gen
Trangenstein 2019	Liked/follow cannabis business pages on Twitter	Self-report 1-item measure 1. Engagement: if like/follow any cannabis business pages on Twitter. Engagement defined as liking, following, and/or commenting on a cannabis business page. Responses: yes/no.	Binary	Current	Specified: Twitter	Twitter	Micro-blogging (active use)	Marketer-gen
Trangenstein 2019	Liked/follow cannabis business pages on Instagram	Self-report 1-item measure 1. Engagement: if like/follow any cannabis business pages on Instagram. Engagement defined as liking, following, and/or commenting on a cannabis business page. Responses: yes/no.	Binary	Current	Specified: Instagram	Instagram	Media-sharing (active use)	Marketer-gen
Yao 2022	Exposure to content (including text and pictures) about drinking or smoking (e.g.,	Self-report 1-item measure 1. How often exposed to content (including text and pictures) about drinking or smoking (e.g., saw drinking-related information) in three popular Chinese social media platforms—WeChat	Cont.	Current	Specified: WeChat Moment, Qzone, and Weibo	Mixed Platforms	General SM (passive use)	User + Marketer-generated

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
	saw drinking-related information)	Moment, Qzone, and Weibo. Responses: (1) never to (5) always) with higher scores indicating higher frequency of SM exposure to tobacco and alcohol content.						
Whitehill 2020	Cumulative frequency of exposure to cannabis promotions (Facebook, Twitter, and Instagram)	<u>Self-report 3-item measure</u> When using (1-Facebook, 2-Twitter, and 3-Instagram), how often saw ads or promotions for cannabis or related products. Responses: never, rarely, sometimes, most of the time, always, and do not use platform. Variable dichotomised for each platform: rarely, sometimes, most of the time, and always/never and I do not use (1-Facebook, 2-Twitter, 3-Instagram). Binary variables summed to give counts of exposure across Facebook, Twitter and Instagram giving cumulative exposure.	Cont.	Current	Specified: Facebook, Twitter, and Instagram	Mixed platforms	SNS (passive use)	Marketer-gen
Whitehill 2020	Frequency of exposure to cannabis promotions on Facebook	<u>Self-report 1-item measure</u> 1. When using Facebook, how often saw ads or promotions for cannabis or related products. Responses: never, rarely, sometimes, most of the time, always, and do not use platform. Variable dichotomised: rarely, sometimes, most of the time, and always/never and I do not use Facebook.	Binary	Current	Specified: Facebook	Facebook	SNS (passive use)	Marketer-gen

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Whitehill 2020	Frequency of exposure to cannabis promotions on Twitter	Self-report 1-item measure 1. When using Twitter, how often saw ads or promotions for cannabis or related products. Responses: never, rarely, sometimes, most of the time, always, and do not use platform. Variable dichotomised: rarely, sometimes, most of the time, and always/ never and I do not use Twitter.	Binary	Current	Specified: Twitter	Twitter	Micro-blogging (passive use)	Marketer-gen
Whitehill 2020	Frequency of exposure to cannabis promotions on Instagram	Self-report 1-item measure 1. When using Instagram, how often saw ads or promotions for cannabis or related products. Responses: never, rarely, sometimes, most of the time, always, and do not use platform. Variable dichotomised: rarely, sometimes, most of the time, and always/ never and I do not use Instagram.	Binary	Current	Specified: Instagram	Instagram	Media-sharing (passive use)	Marketer-gen

Legend: Abbreviation(s): Cont=Continuous; Cat=Categorical; Marketer-gen=Marketer-generated content; NA=Not applicable; NR=Not reported; SM=Social media; SNS=Social networking site(s); and User-gen=User-generated content.

Table A15.4. Social media measures assessing *other social media activities* reported in included studies

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Chapin 2018	Number of SM platforms used	Self-report measure Asked to circle which SM platforms used and to identify which were favourites. A space was provided for students write in other platforms they were using.	Cont.	Current	Examples: Texting, Facebook, Twitter, Instagram, Pinterest, and Snapchat	Mixed platforms	SNS (unclear)	NA
Gomez 2019	Signed up to more than 5 SNS	Self-report measure No further information reported.	Binary	NR	NR	NR	SNS (unclear)	NA
Kaufman 2014	Has a Facebook account	Self-report 1-item measure 1. Had a Facebook account. Responses: yes/no.	Binary	Current	Specified: Facebook	Facebook	SNS (unclear)	NA
Kaufman 2014	Has a Mxit account	Self-report 1-item measure 1. Had a Mxit account. Responses: yes/no.	Binary	Current	Specified: Mxit	Mxit	SNS (unclear)	NA
Landry 2013	Has a Facebook account	Self-report measure If internet used, how often, and if had accounts on any of the following SM sites: Facebook, Myspace, Twitter, Yahoo, YouTube, My yearbook, Tumblr, Google buzz, Flickr, Ustream, and other. Responses: yes/no.	Binary	Current	Specified: Facebook, Myspace, Twitter, Yahoo, YouTube, My Yearbook, Tumblr, Google buzz, Flickr, Ustream, and other	Facebook	SNS (unclear)	NA

Author and year	**Definition**	**Ascertainment** ***(validated/objectively recorded measures marked with *)***	**Measure type**	**Time period**	**Platform**	***Platform***	***Category (active/ passive use)***	***Content***
Landry 2013	Has a SM account	Self-report measure If internet used, how often, and if had accounts on any of the following SM sites: Facebook, Myspace, Twitter, Yahoo, YouTube, My yearbook, Tumblr, Google buzz, Flickr, Ustream, and other. Responses: yes/no.	Binary	Current	Specified: Facebook, Myspace, Twitter, Yahoo, YouTube, My Yearbook, Tumblr, Google buzz, Flickr, Ustream, and other	Mixed platforms	SNS (unclear)	NA
Molla-Esparza 2021	Number of SM platforms used	Self-report 1-item measure 1. Number of SM platforms used.	Cont.	Current	NR	NR	General SM (unclear)	NA
Nesi 2019	Online status-seeking strategy use	Self-report 2-item measure Rated use of strategies to manage their online presence and accumulate online status indicators: 1. "I purposefully post on social media during 'high traffic' times (i.e., times that I know most people will see it) so that my posts/photos get more likes and comments." 2. "If something I post does not get a lot of likes or comments, I might take it down." Responses: from (1) not at all true to (5) extremely true.	Cont.	Current	NR	NR	SNS (unclear)	NA

Author and year	Definition	Ascertainment *(validated/objectively recorded measures marked with *)*	Measure type	Time period	Platform	*Platform*	*Category (active/ passive use)*	*Content*
Roditis 2016	Ever seen a message posted on SM about the risks or bad things of using marijuana	Self-report 1-item measure 1. Ever seen a message posted on SM about the risks or bad things related to using marijuana. Responses: yes/no.	Binary	Ever	NR	NR	General SM (passive use)	NA
Stevens 2017	Exposure to contraception information on SNS	Self-report measure In past 30 days, where had heard about pregnancy prevention among young people. Options included SNS. Responses: yes/no.	Binary	Past month	NR	NR	SNS (unclear)	NA
Stevens 2017	Exposure to HIV/STD information on SNS	Self-report measure In past 30 days, where had heard about HIV or STDs. Options included SNS. Responses: yes/no	Binary	Past month	NR	NR	SNS (unclear)	NA
Suwanwong 2021	Exposure to anti-smoking SM campaign	Self-report 1-item measure 1. In past 30 days, seen any information about anti-smoking in SM. Responses: yes/no.	Binary	Past month	NR	NR	General SM (passive use)	NA

Legend: Cont=Continuous; Cat=Categorical; HIV=Human immunodeficiency virus; NA=Not applicable; NR=Not reported; STD=Sexually transmitted disease; SM=Social media; and SNS=Social networking site(s).

Section A16 Exposure and outcome combinations amenable to meta-analysis

Table A16.1. List of exposures for which sufficient data were available to undertake meta-analysis, subgroup analysis/meta-regression[a] or sensitivity analysis for the outcome *alcohol use*

Outcome	Exposure	Exposure measure type	Outcome measure type	Common metric	Meta-analysis	Pre-specified sensitivity analyses				Pre-specified subgroup analyses/ meta-regression[a]						
						Study design	Excl. age overlap	Adjustment	Risk of bias	Sex	Age	Income	SEC	SM platform	SM category	SM content
Alcohol use	Time spent	Cont.	Cont.	Std. Beta	✓	✓		✓								
		Cont.	Cont.	SMD	✓										✓	
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓	✓	✓	✓	✓		✓				✓	
	Frequency of use	Cont.	Cont.	Std. Beta	✓	✓		✓			✓				✓	
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	
	Exposure to health-risk behaviour content	Cont.	Cont.	Std. Beta	✓	✓	✓	✓	✓		✓		✓		✓	
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓	✓		✓	✓						✓	✓

Legend: [a] Where ≥10 studies were included in a meta-analysis, meta-regression was conducted. Abbreviation(s): Cont=Continuous; Excl=Excluding; OR=Odds ratio; SEC=Socioeconomic circumstance(s); SM=Social media; SMD=Standardised mean difference; and Std.=Standardised.

Table A16.2. List of exposures for which sufficient data were available to undertake meta-analysis, subgroup analysis/meta-regression[a] or sensitivity analysis for the outcome *sexual risk behaviour*

Outcome	Exposure	Exposure measure type	Outcome measure type	Common metric	Meta-analysis	Pre-specified sensitivity analyses				Pre-specified subgroup analyses/ meta-regression[a]						
						Study design	Excl. age overlap	Adjustment	Risk of bias	Sex	Age	Income	SEC	SM platform	SM category	SM content
Sexual risk behaviour	Time spent	Cont.	Cont.	Std. Beta	✓											
		Cont.	Cont.	SMD	✓											
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												
	Frequency of use	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD	✓	✓					✓					
		Cont.	Binary	OR	✓	✓			✓						✓	
		Binary	Binary/Cont.	OR	✓		✓	✓	✓	✓	✓	✓	✓		✓	
	Exposure to health-risk behaviour content	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												

Legend: [a] Where ≥10 studies were included in a meta-analysis, meta-regression was conducted. Abbreviation(s): Cont=Continuous; Excl=Excluding; OR=Odds ratio; SEC=Socioeconomic circumstance(s); SM=Social media; SMD=Standardised mean difference; and Std.=Standardised.

Table A16.3. List of exposures for which sufficient data were available to undertake meta-analysis, subgroup analysis/meta-regression[a] or sensitivity analysis for the outcome *anti-social behaviour*

Outcome	Exposure	Exposure measure type	Outcome measure type	Common metric	Meta-analysis	Pre-specified sensitivity analyses				Pre-specified subgroup analyses/ meta-regression[a]						
						Study design	Excl. age overlap	Adjustment	Risk of bias	Sex	Age	Income	SEC	SM platform	SM category	SM content
Anti-social behaviour	Time spent	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD	✓						✓				✓	
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												
	Frequency of use	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓	✓	✓	✓	✓			✓			✓	
	Exposure to health-risk behaviour content	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												

Legend: [a] Where ≥10 studies were included in a meta-analysis, meta-regression was conducted. Abbreviation(s): Cont=Continuous; Excl=Excluding; OR=Odds ratio; SEC=Socioeconomic circumstance(s); SM=Social media; SMD=Standardised mean difference; and Std.=Standardised.

Table A16.4. List of exposures for which sufficient data were available to undertake meta-analysis, subgroup analysis/meta-regression[a] or sensitivity analysis for the outcome *tobacco use*

Outcome	Exposure	Exposure measure type	Outcome measure type	Common metric	Meta-analysis	Pre-specified sensitivity analyses				Pre-specified subgroup analyses/ meta-regression[a]						
						Study design	Excl. age overlap	Adjustment	Risk of bias	Sex	Age	Income	SEC	SM platform	SM category	SM content
Tobacco use	Time spent	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												
	Frequency of use	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓	✓	✓	✓	✓		✓	✓			✓	
	Exposure to health-risk behaviour content	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓	✓		✓	✓			✓			✓	

Legend: [a] Where ≥10 studies were included in a meta-analysis, meta-regression was conducted. Abbreviation(s): Cont=Continuous; Excl=Excluding; OR=Odds ratio; SEC=Socioeconomic circumstance(s); SM=Social media; SMD=Standardised mean difference; and Std.=Standardised.

Table A16.5. List of exposures for which sufficient data were available to undertake meta-analysis, subgroup analysis/meta-regression[a] or sensitivity analysis for the outcome *drug use*

Outcome	Exposure	Exposure measure type	Outcome measure type	Common metric	Meta-analysis	Pre-specified sensitivity analyses				Pre-specified subgroup analyses/ meta-regression[a]						
						Study design	Excl. age overlap	Adjustment	Risk of bias	Sex	Age	Income	SEC	SM platform	SM category	SM content
Drug use	Time spent	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD	✓											
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓				✓							
	Frequency of use	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓	✓		✓	✓		✓			✓	✓	
	Exposure to health-risk behaviour content	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												

Legend: [a] Where ≥10 studies were included in a meta-analysis, meta-regression was conducted. Abbreviation(s): Cont=Continuous; Excl=Excluding; OR=Odds ratio; SEC=Socioeconomic circumstance(s); SM=Social media; SMD=Standardised mean difference; and Std.=Standardised.

Table A16.6. List of exposures for which sufficient data were available to undertake meta-analysis, subgroup analysis/meta-regression[a] or sensitivity analysis for the outcome *inadequate physical activity*

Outcome	Exposure	Exposure measure type	Outcome measure type	Common metric	Meta-analysis	Pre-specified sensitivity analyses				Pre-specified subgroup analyses/ meta-regression[a]						
						Study design	Excl. age overlap	Adjustment	Risk of bias	Sex	Age	Income	SEC	SM platform	SM category	SM content
Inadequate physical activity	Time spent	Cont.	Cont.	Std. Beta	✓			✓	✓		✓	✓			✓	
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												
	Frequency of use	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												
	Exposure to health-risk behaviour content	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												

Legend: [a] Where ≥10 studies were included in a meta-analysis, meta-regression was conducted. Abbreviation(s): Cont=Continuous; Excl=Excluding; OR=Odds ratio; SEC=Socioeconomic circumstance(s); SM=Social media; SMD=Standardised mean difference; and Std.=Standardised.

Table A16.7. List of exposures for which sufficient data were available to undertake meta-analysis, subgroup analysis/meta-regression[a] or sensitivity analysis for the outcome *unhealthy dietary behaviour*

Outcome	Exposure	Exposure measure type	Outcome measure type	Common metric	Meta-analysis	Pre-specified sensitivity analyses				Pre-specified subgroup analyses/ meta-regression[a]						
						Study design	Excl. age overlap	Adjustment	Risk of bias	Sex	Age	Income	SEC	SM platform	SM category	SM content
Unhealthy dietary behaviour	Time spent	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												
	Frequency of use	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												
	Exposure to health-risk behaviour content	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓	✓									✓	

Legend: [a] Where ≥10 studies were included in a meta-analysis, meta-regression was conducted. Abbreviation(s): Cont=Continuous; Excl=Excluding; OR=Odds ratio; SEC=Socioeconomic circumstance(s); SM=Social media; SMD=Standardised mean difference; and Std.=Standardised.

Table A16.8. List of exposures for which sufficient data were available to undertake meta-analysis, subgroup analysis/meta-regression[a] or sensitivity analysis for the outcome *gambling*

Outcome	Exposure	Exposure measure type	Outcome measure type	Common metric	Meta-analysis	Pre-specified sensitivity analyses				Pre-specified subgroup analyses/ meta-regression[a]						
						Study design	Excl. age overlap	Adjustment	Risk of bias	Sex	Age	Income	SEC	SM platform	SM category	SM content
Gambling	Time spent	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												
	Frequency of use	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓	✓		✓	✓		✓				✓	
	Exposure to health-risk behaviour content	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												

Legend: [a] Where ≥10 studies were included in a meta-analysis, meta-regression was conducted. Abbreviation(s): Cont=Continuous; Excl=Excluding; OR=Odds ratio; SEC=Socioeconomic circumstance(s); SM=Social media; SMD=Standardised mean difference; and Std.=Standardised.

Table A16.9. List of exposures for which sufficient data were available to undertake meta-analysis, subgroup analysis/meta-regression[a] or sensitivity analysis for the outcome *multiple risk behaviours*

Outcome	Exposure	Exposure measure type	Outcome measure type	Common metric	Meta-analysis	Pre-specified sensitivity analyses				Pre-specified subgroup analyses/ meta-regression[a]						
						Study design	Excl. age overlap	Adjustment	Risk of bias	Sex	Age	Income	SEC	SM platform	SM category	SM content
Multiple risk behaviours	Time spent	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												
	Frequency of use	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓											
	Exposure to health-risk behaviour content	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												

Legend: [a] Where ≥10 studies were included in a meta-analysis, meta-regression was conducted. Abbreviation(s): Cont=Continuous; Excl=Excluding; OR=Odds ratio; SEC=Socioeconomic circumstance(s); SM=Social media; SMD=Standardised mean difference; and Std.=Standardised.

Table A16.10. List of exposures for which sufficient data were available to undertake meta-analysis, subgroup analysis/meta-regression[a] or sensitivity analysis for the outcome *use of electronic nicotine delivery systems (ENDS)*

Outcome	Exposure	Exposure measure type	Outcome measure type	Common metric	Meta-analysis	Pre-specified sensitivity analyses				Pre-specified subgroup analyses/ meta-regression[a]						
						Study design	Excl. age overlap	Adjustment	Risk of bias	Sex	Age	Income	SEC	SM platform	SM category	SM content
Use of ENDS	Time spent	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												
	Frequency of use	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR												
	Exposure to health-risk behaviour content	Cont.	Cont.	Std. Beta												
		Cont.	Cont.	SMD												
		Cont.	Binary	OR												
		Binary	Binary/Cont.	OR	✓	✓		✓	✓					✓	✓	

Legend: [a] Where ≥10 studies were included in a meta-analysis, meta-regression was conducted. Abbreviation(s): Cont=Continuous; Excl=Excluding; OR=Odds ratio; SEC=Socioeconomic circumstance(s); SM=Social media; SMD=Standardised mean difference; and Std.=Standardised.

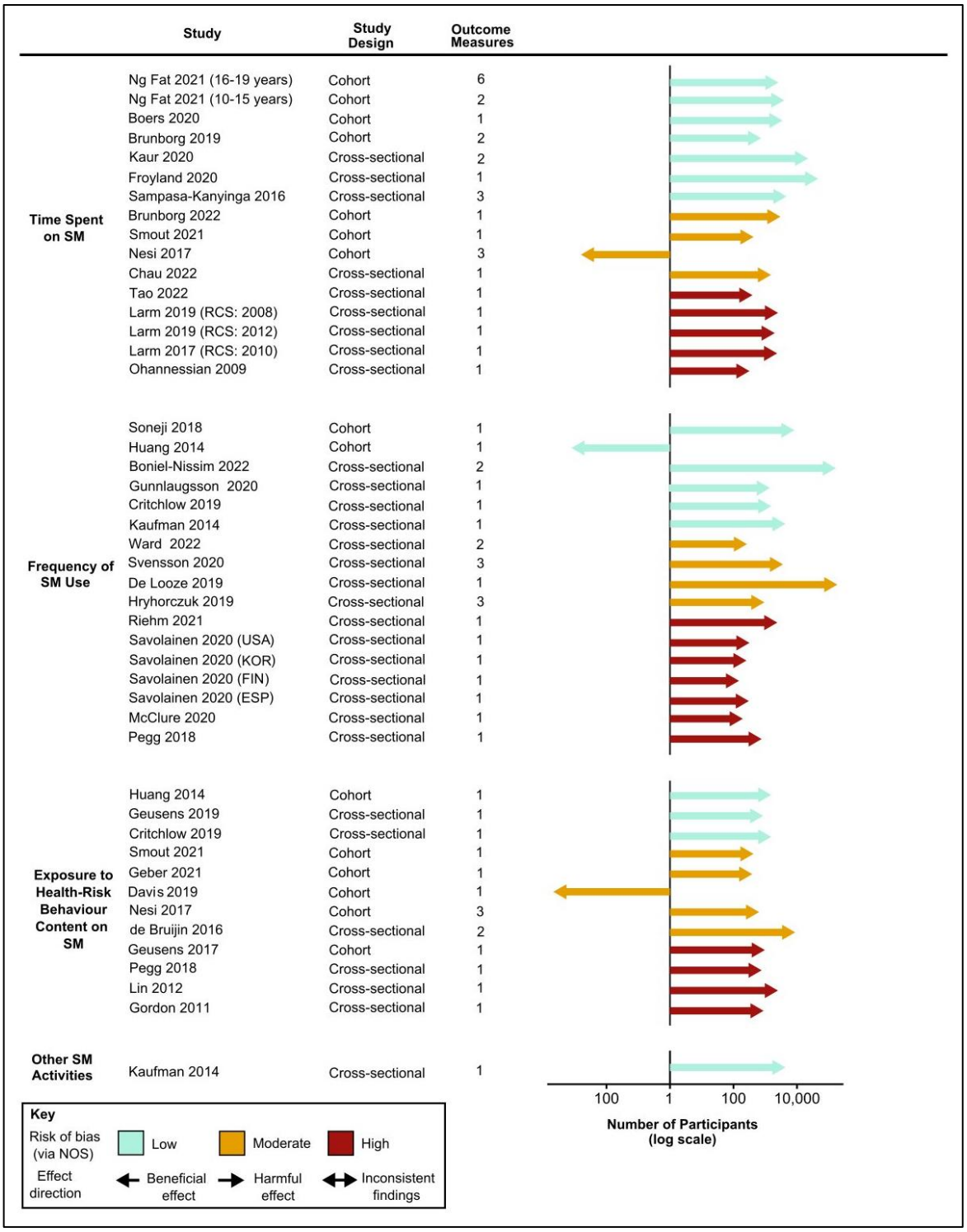
Section A17 Synthesis Without Meta-analysis (SWiM), meta-analyses, meta-regression, subgroup, and sensitivity analyses

Section A17.1 Alcohol use

Effect direction

Figure A17.1.1 demonstrates the effect direction in those studies investigating alcohol use by exposure. Six studies examined more than one exposure (Huang *et al.*, 2014; Kaufman *et al.*, 2014; Nesi *et al.*, 2017; Pegg *et al.*, 2018; Critchlow *et al.*, 2019; Smout *et al.*, 2021). For time spent on social media, 15/16 studies (93.8%) reported harmful associations (95% CI 71.7 to 98.9%; participant n=100,354; sign test p<0.001), 16/17 studies (94.1%) reported harmful associations for frequency of social media use (73.0 to 99.0%; participant n=391,445; sign test p<0.001), and 11/12 studies (91.7%) reported harmful associations for exposure to health-risk behaviour content on social media (64.6 to 98.5%; participant n=24,451; sign test p=0.006). Other social media activities was investigated by one study, which demonstrated a harmful association (20.7 to 100%; participant n=4,485; insufficient data to conduct sign test).

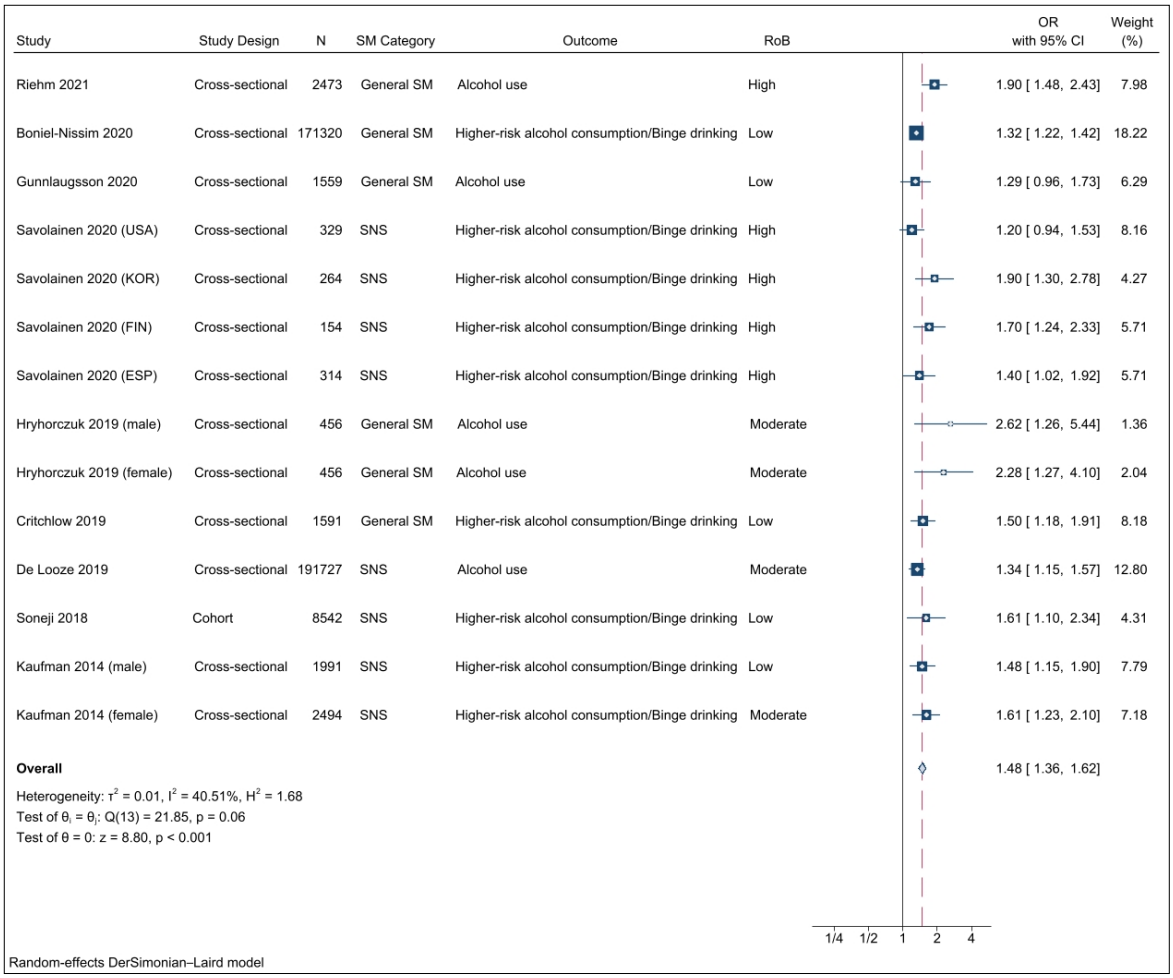
Figure A17.1.1. Effect direction plot for studies of the association between social media use and adolescent alcohol use by social media exposure. Arrow size indicates sample size; arrow colour indicates study risk of bias (also shown in Chapter 4).



Legend: Sample size: represented by the size of the arrow, measured on a log scale. Outcome measure: number of outcome measures synthesised within each study. Studies organised by risk of bias grade, study design, and year of publication. Repeat cross-sectional studies, multiple study populations from different countries, and age subsets originating from the same study reported as separate studies. Abbreviation(s): ESP=Spain; FIN=Finland; KOR=South Korea; NOS= Assessed via adapted Newcastle Ottawa Scale; RCS=Repeat cross-sectional study; SM=Social media; and USA=United States of America.

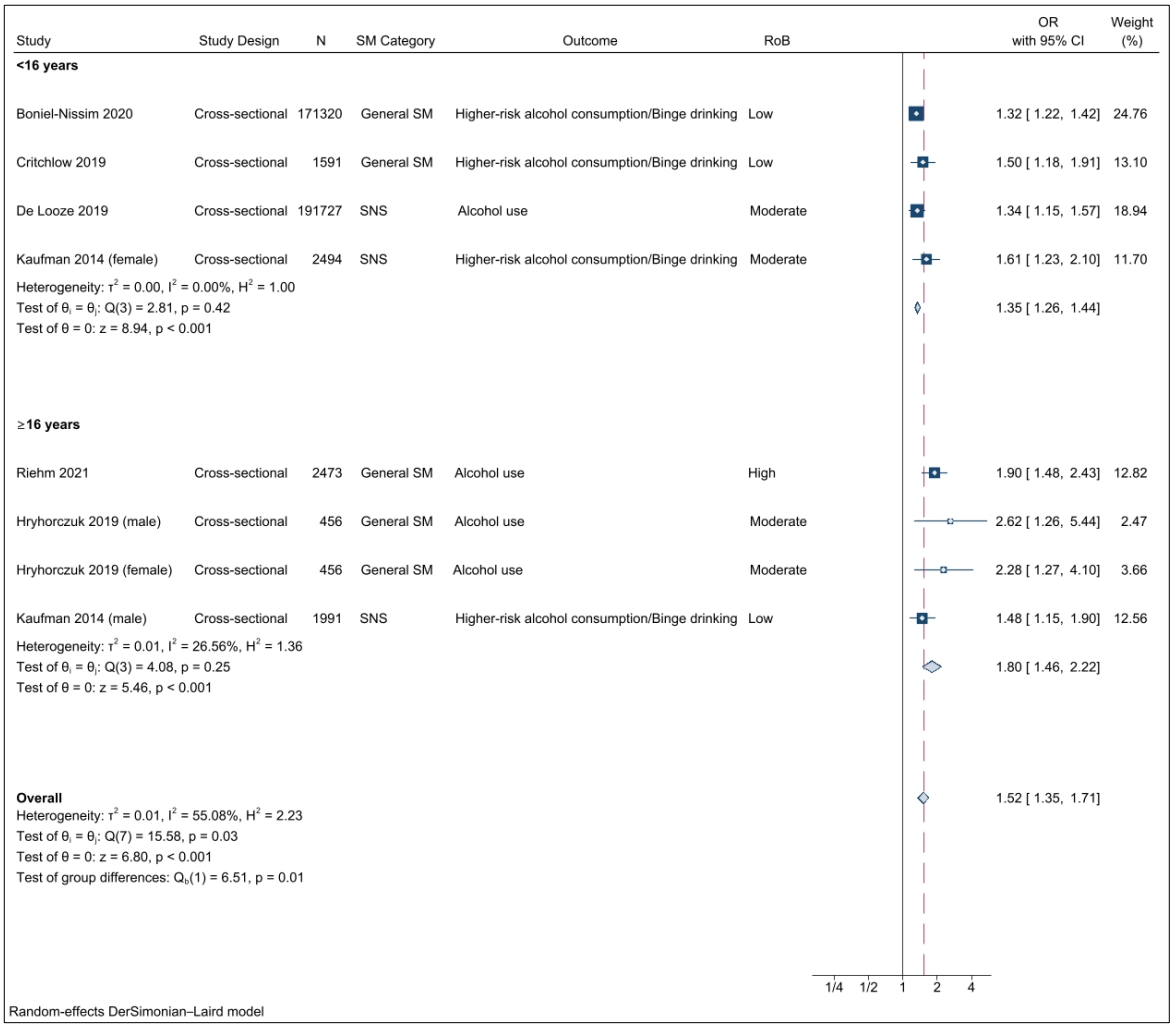
Forest plots for meta-analyses and subgroup analyses

Figure A17.1.2. Forest plot for association between frequency of social media use and alcohol use (also shown in Chapter 4)



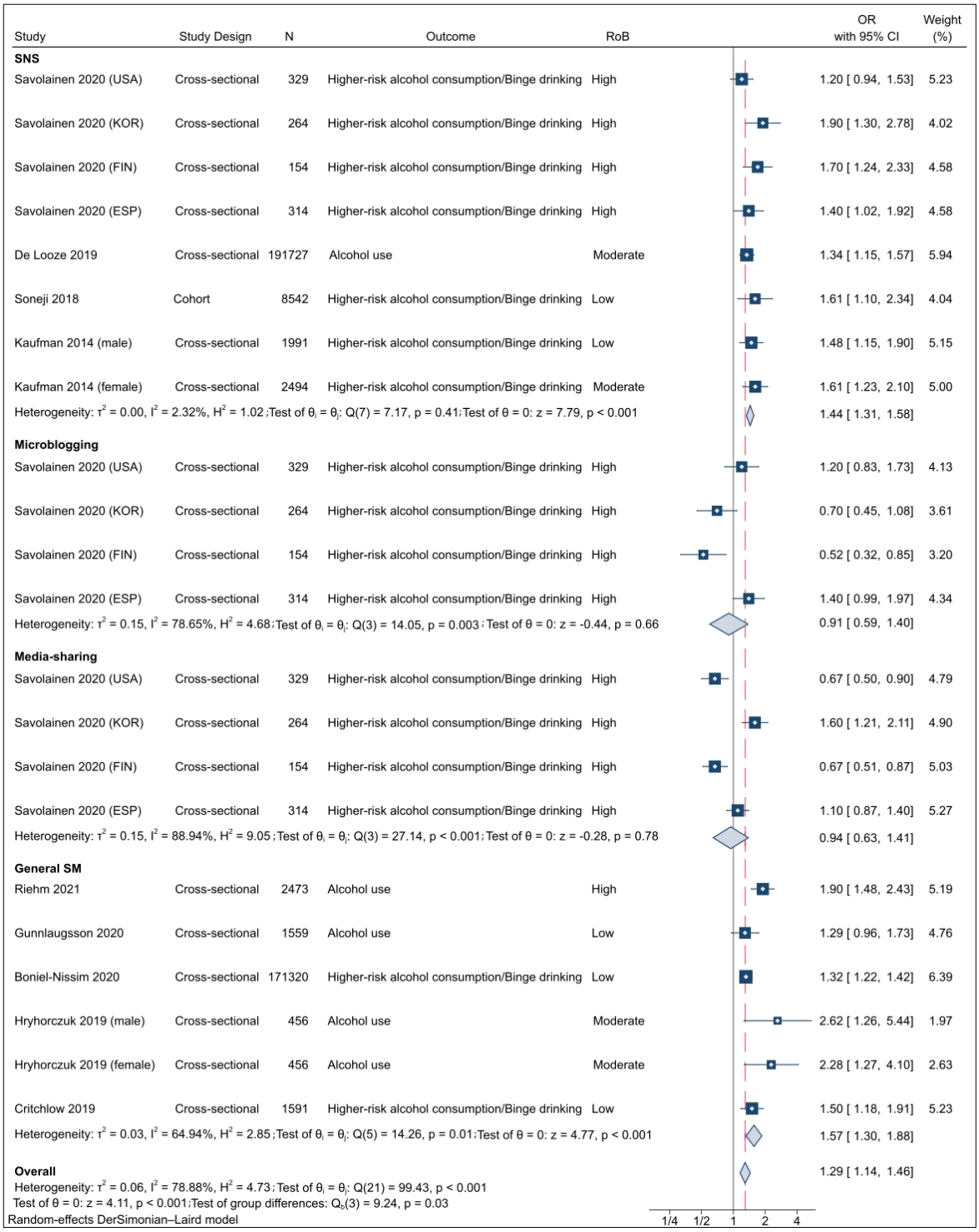
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=383,670. Abbreviation(s): CI=Confidence interval; ESP=Spain; FIN=Finland; KOR=South Korea; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and USA=United States of America.

Figure A17.1.3. Forest plot for association between frequency of social media use and alcohol use, stratified by average age of study participants



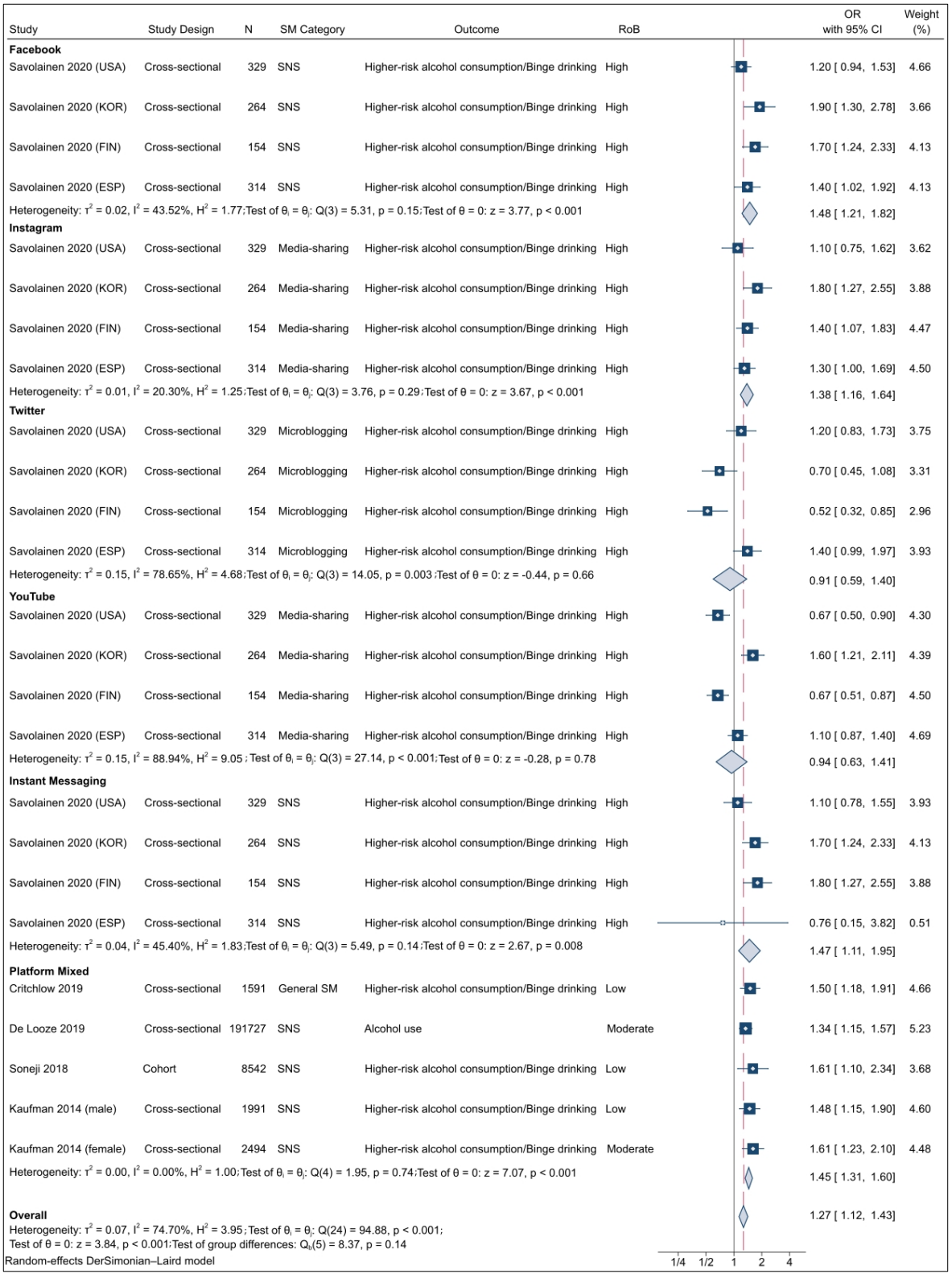
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=372,508. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.1.4. Forest plot for association between frequency of social media use and alcohol use, stratified by social media category



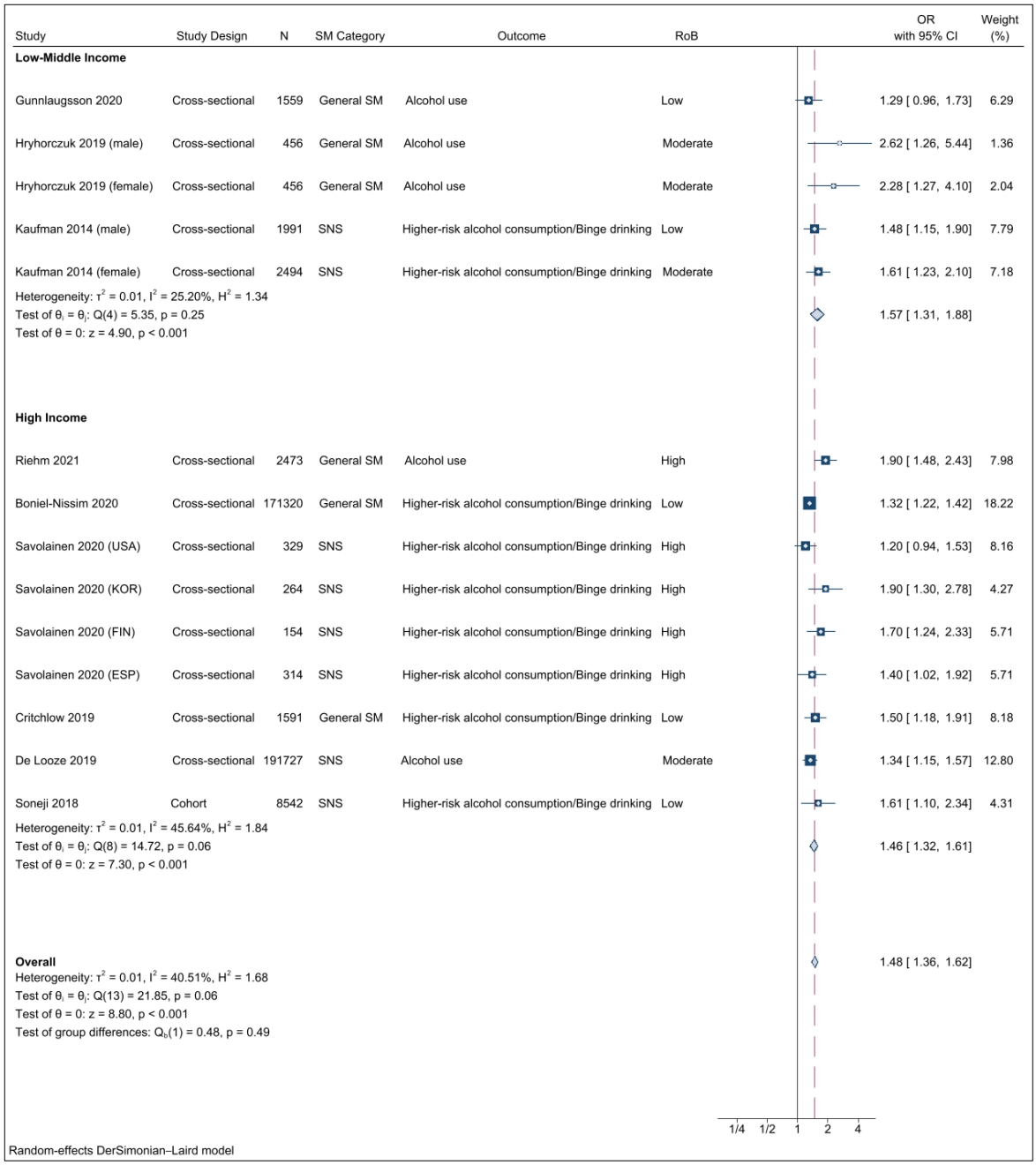
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=385,792. Abbreviation(s): CI=Confidence interval; ESP=Spain; FIN=Finland; KOR=South Korea; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and USA=United States of America.

Figure A17.1.5. Forest plot for association between frequency of social media use and alcohol use, stratified by social media platform



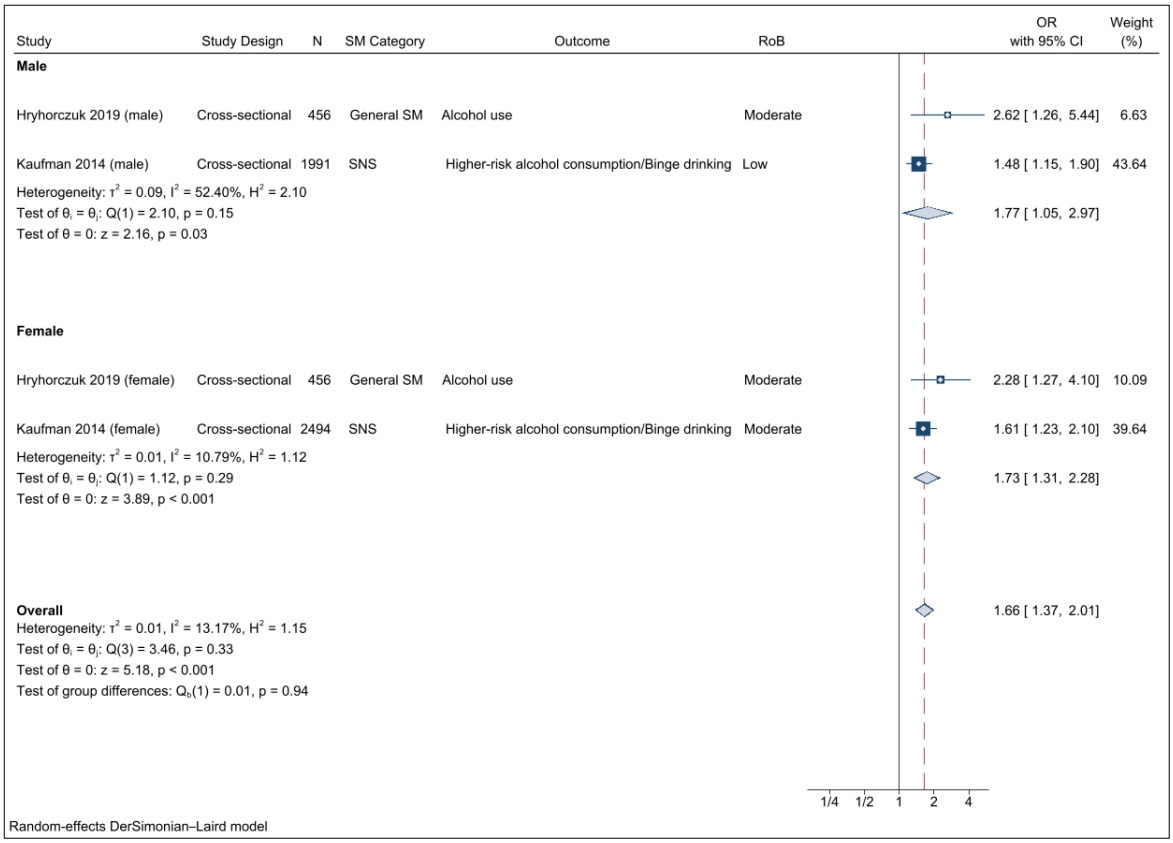
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=211,650. Abbreviation(s): CI=Confidence interval; ESP=Spain; FIN=Finland; KOR=South Korea; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and USA=United States of America.

Figure A17.1.6. Forest plot for association between frequency of social media use alcohol use, stratified by development status of study setting[a]



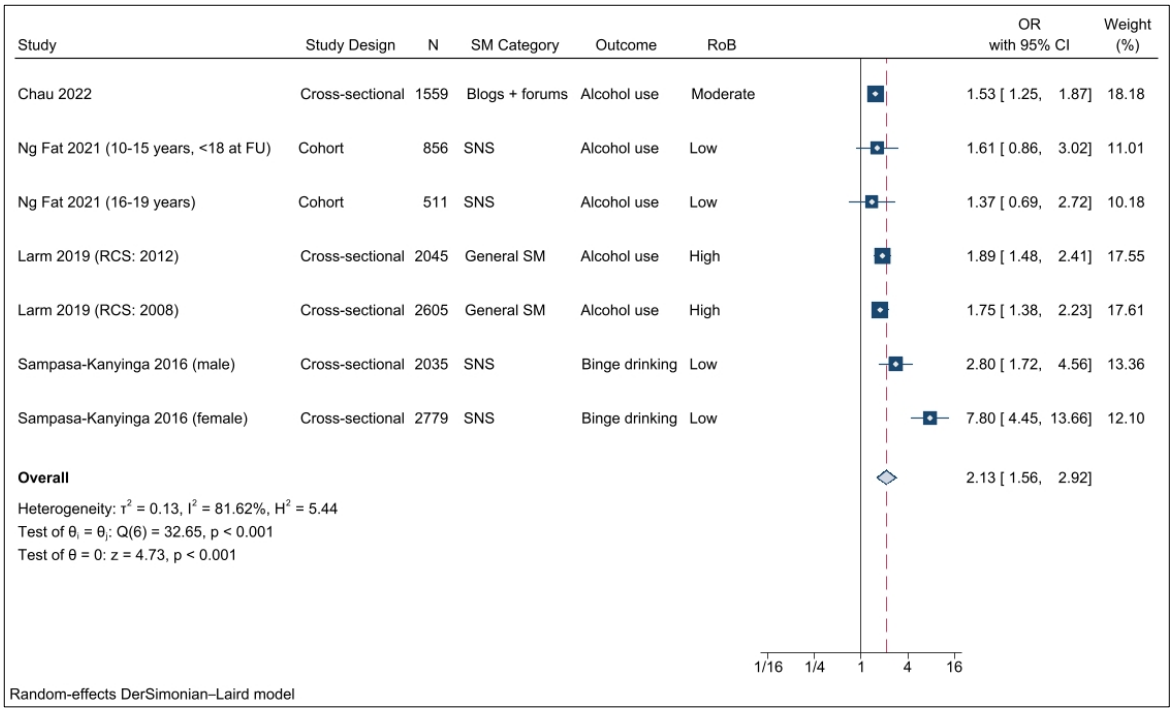
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. [a] Development status classified as per the World Bank Country Income Level Classification (World Bank, 2021). Total number of study participants=383,670. Abbreviation(s): CI=Confidence interval; ESP=Spain; FIN=Finland; KOR=South Korea; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and USA=United States of America.

Figure A17.1.7. Forest plot for association between frequency of social media use and alcohol use, stratified by sex



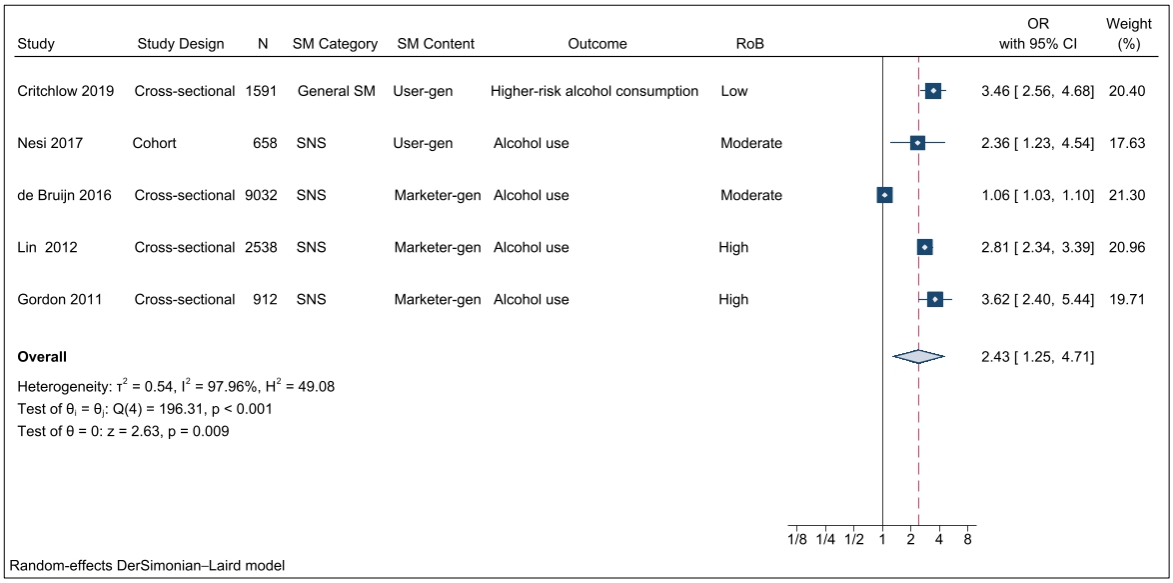
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=5,397. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.1.8. Forest plot for association between time spent on social media and alcohol use



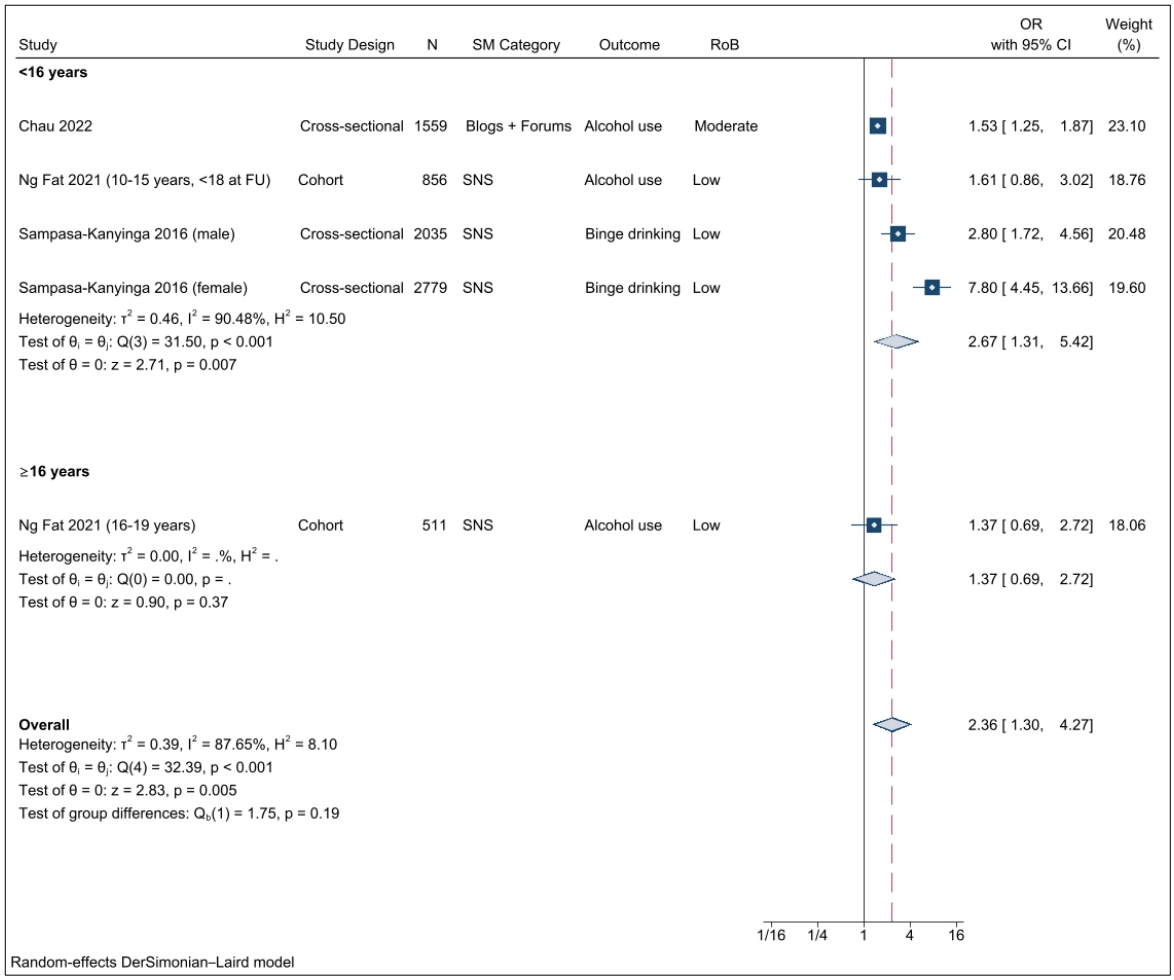
Legend: Figure presents forest plot for binary exposure (≥2 vs <2 hours/day social media use) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=12,390. Abbreviation(s): CI=Confidence interval; FU=Follow-up; N=Number of study participants; OR=Odds ratio; RCS=Repeat cross-sectional study; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.1.9. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use



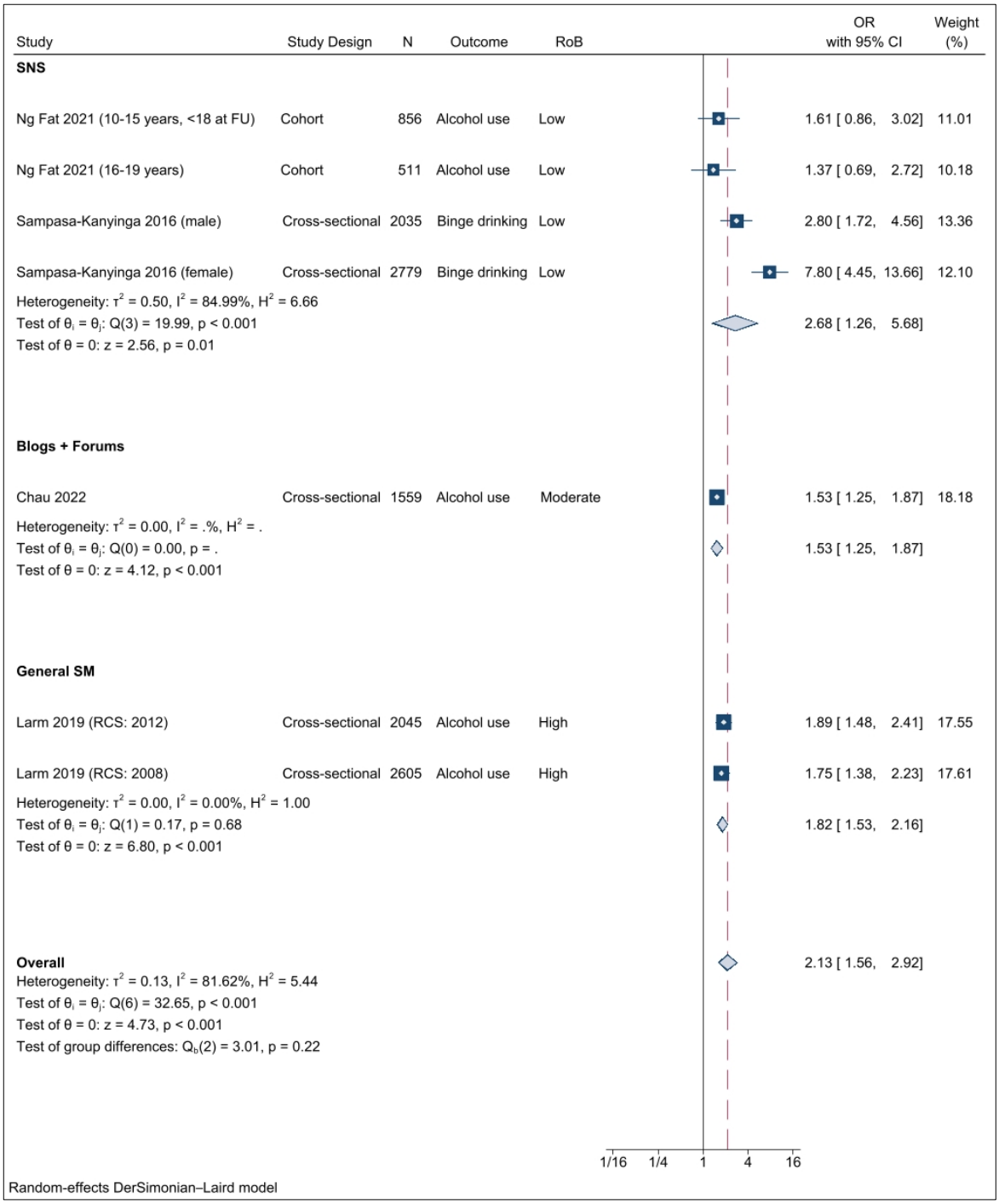
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=14,731. Abbreviation(s): CI=Confidence interval; Marketer-gen=Marketer-generated content; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and User-gen=User-generated content.

Figure A17.1.10. Forest plot for association between time spent on social media and alcohol use, by average age of study participants



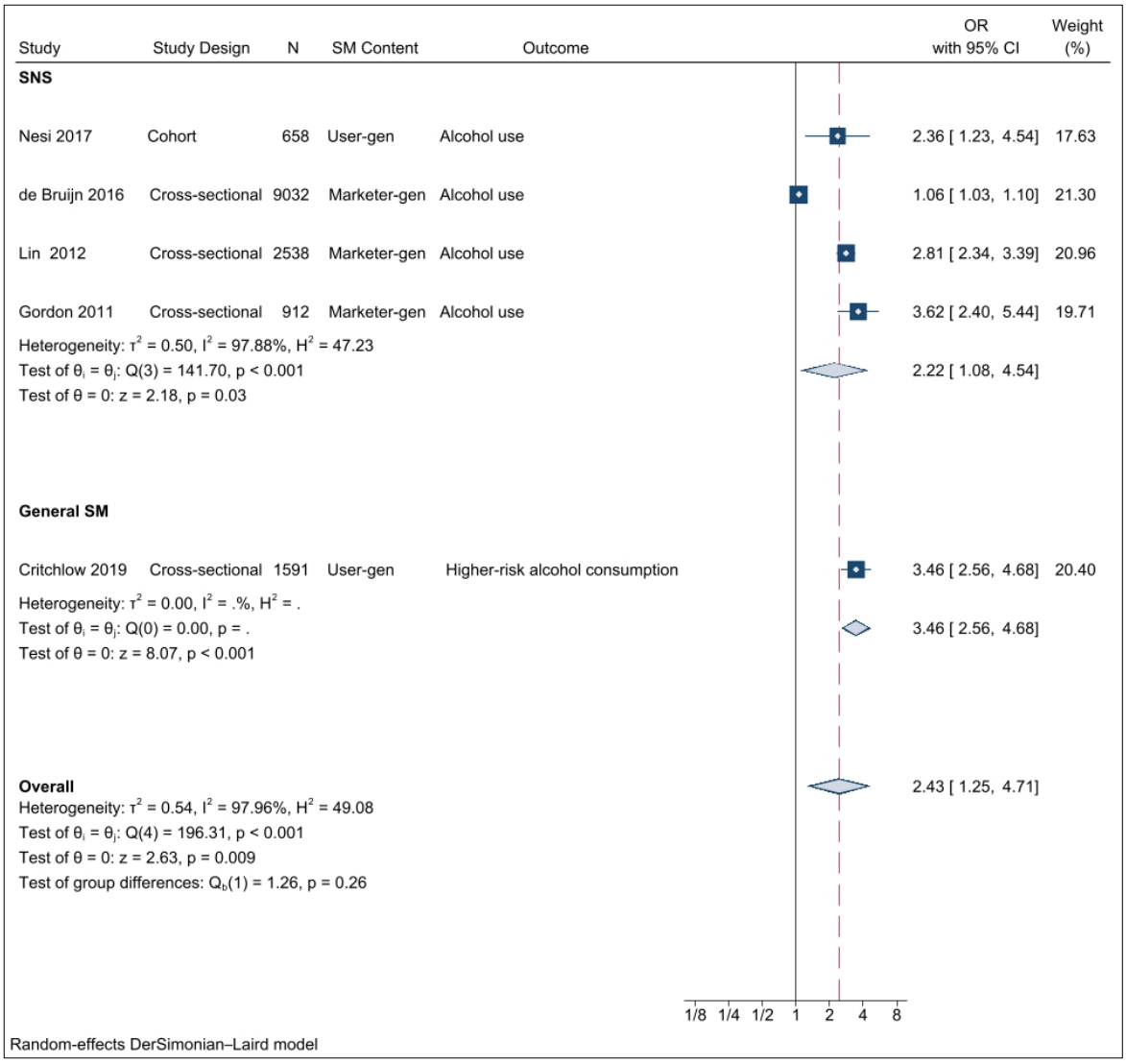
Legend: Figure presents forest plot for binary exposure (≥2 vs <2 hours/day social media use) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=7,740. Abbreviation(s): CI=Confidence interval; FU=Follow-up; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.1.11. Forest plot for association between time spent on social media and alcohol use, by social media category



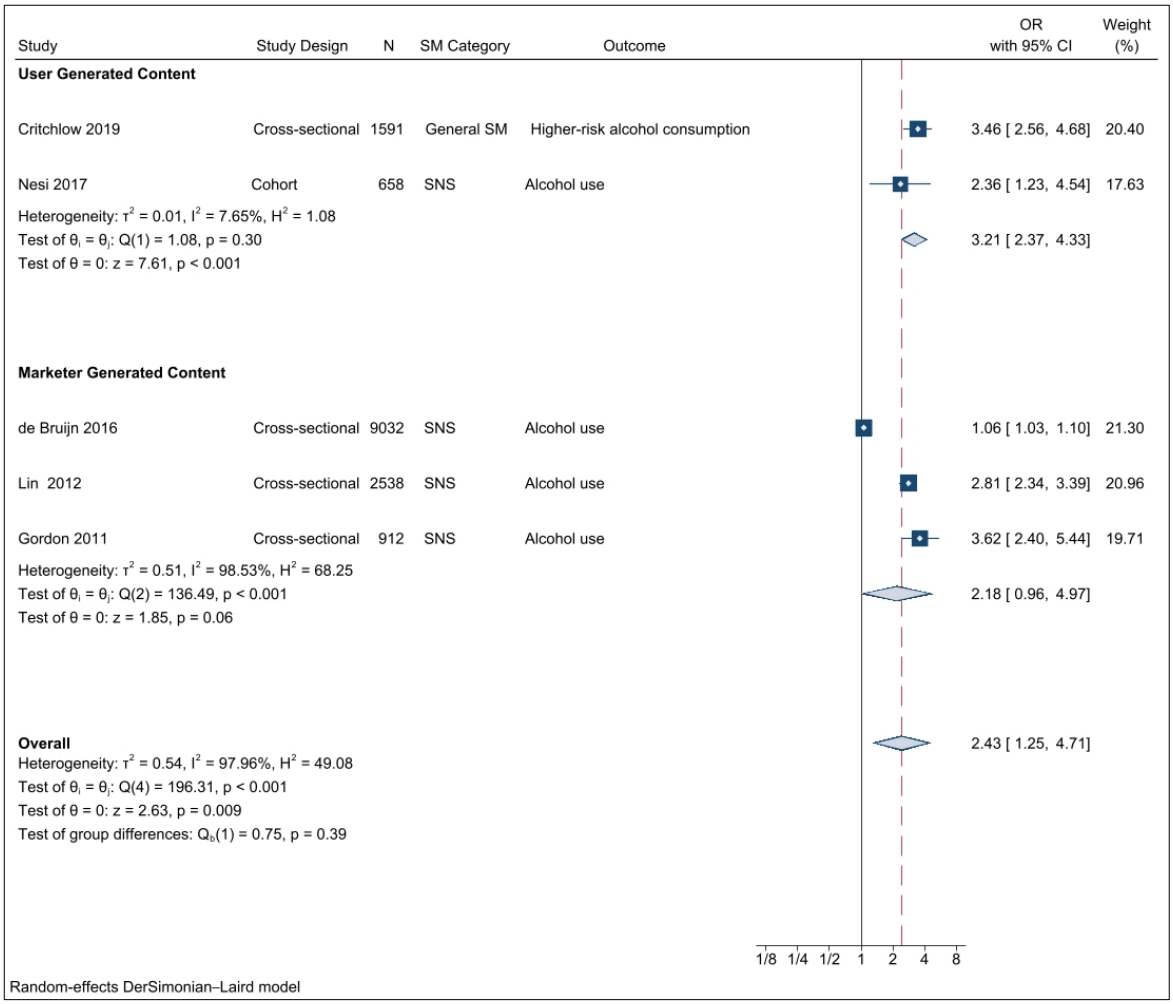
Legend: Figure presents forest plot for binary exposure (≥2 vs <2 hours/day social media use) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=12,390. Abbreviation(s): CI=Confidence interval; FU=Follow-up; N=Number of study participants; OR=Odds ratio; RCS=Repeat cross-sectional study; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.1.12. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use, by social media category



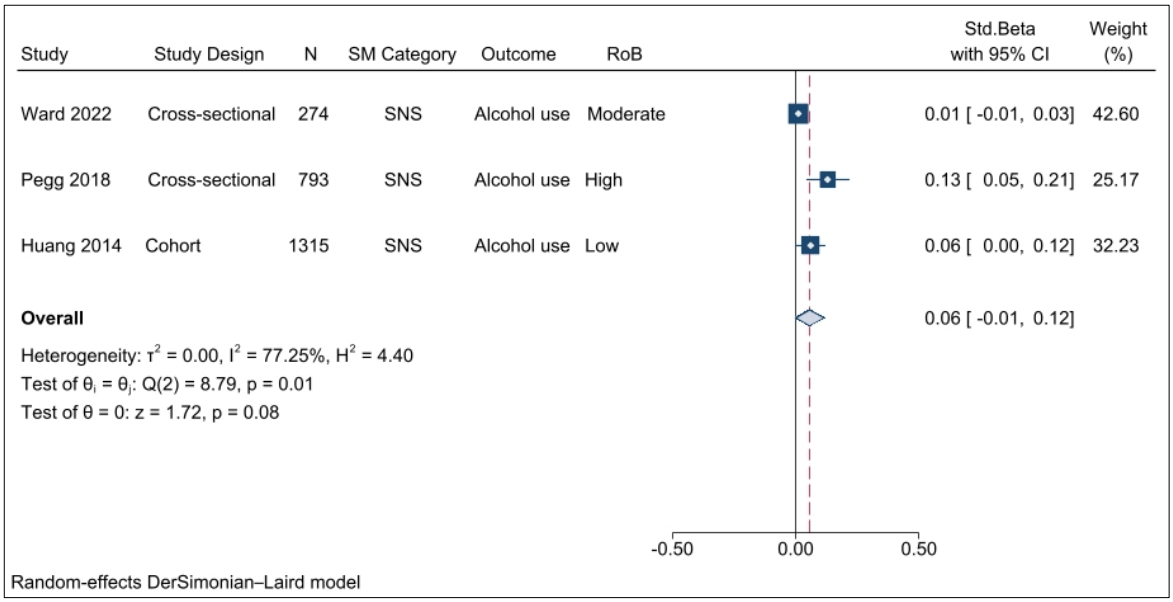
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=14,731. Abbreviation(s): CI=Confidence interval; Marketer-gen=Marketer-generated content; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and User-gen=User-generated content.

Figure A17.1.13. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use, by social media content



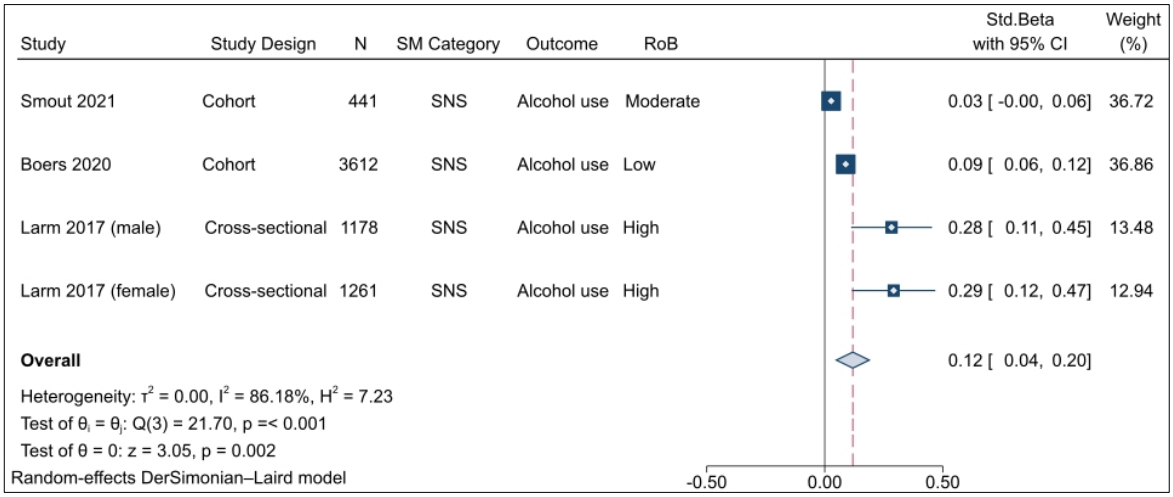
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=14,731. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.1.14. Forest plot for association between frequency of social media use and alcohol use



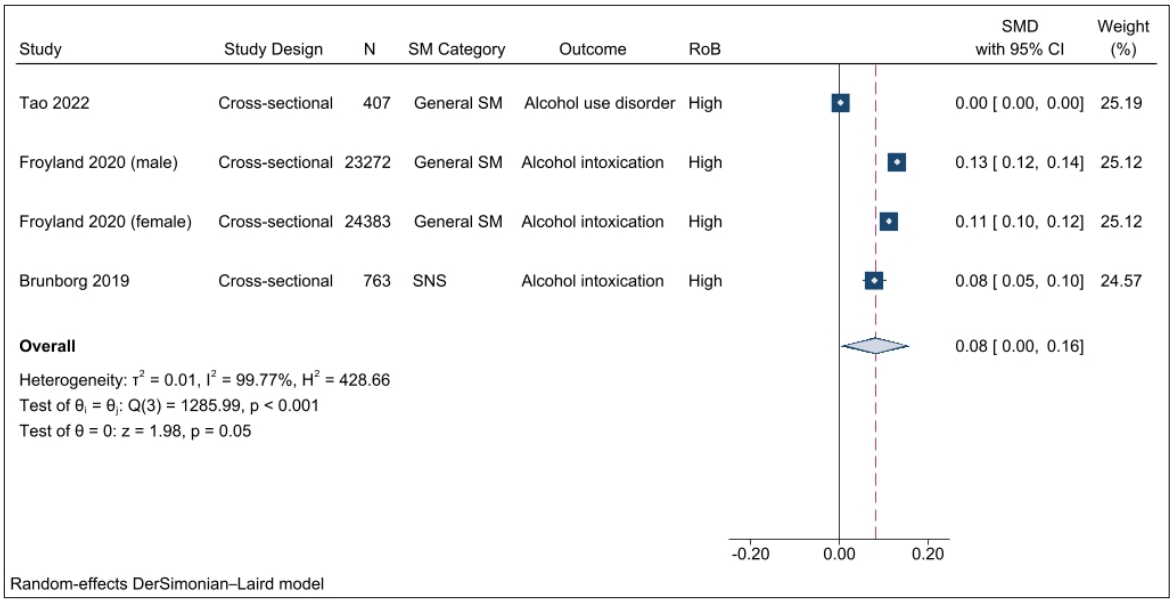
Legend: Figure presents forest plot for continuous exposure & continuous outcome meta-analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=2,382. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.1.15. Forest plot for association between time spent on social media and alcohol use



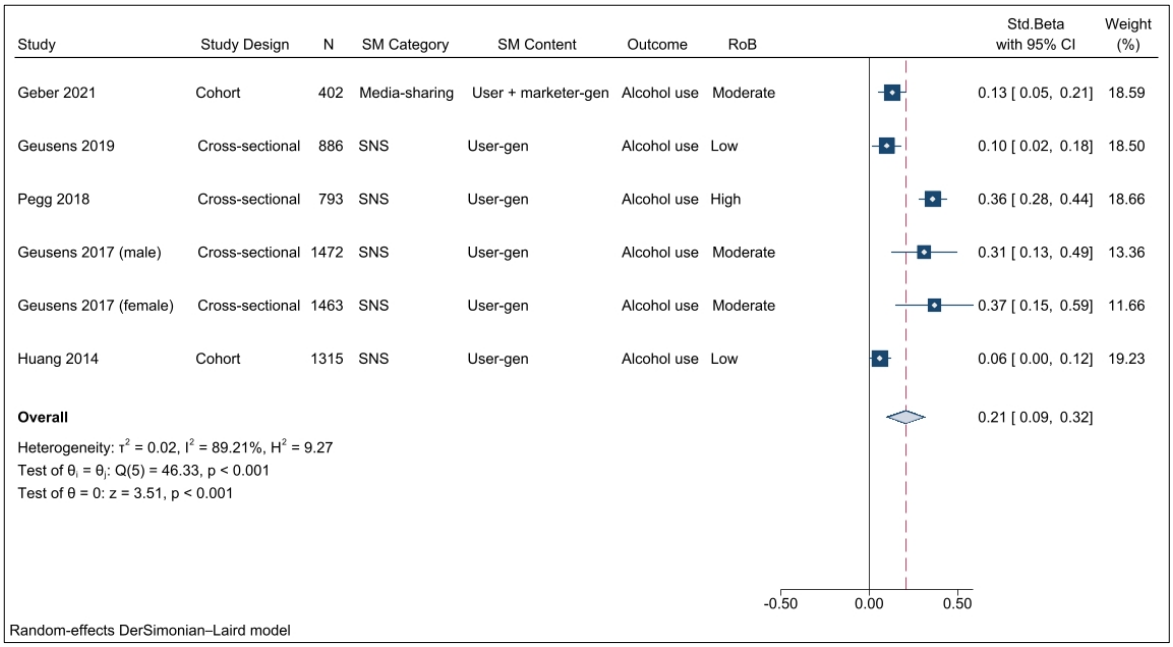
Legend: Figure presents forest plot for continuous exposure & continuous outcome meta-analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=6,492. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.1.16. Forest plot for association between time spent on social media and alcohol use



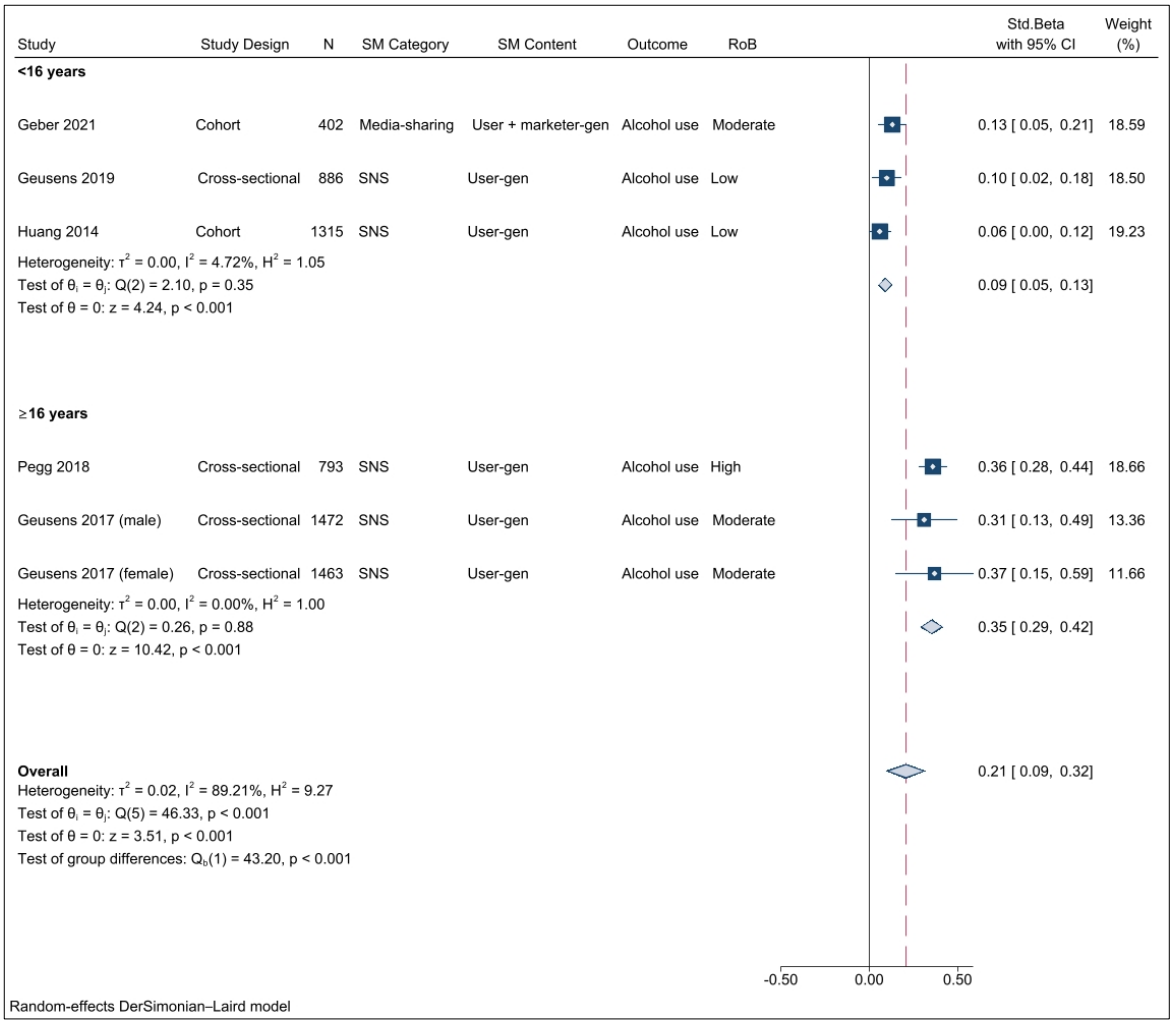
Legend: Figure presents forest plot for continuous exposure & continuous outcome meta-analysis, with standardised mean difference (SMD) used as common metric. Total number of study participants=48,825. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SMD=Standardised mean difference; and SNS=Social networking site(s).

Figure A17.1.17. Forest plot for associations between exposure to health-risk behaviour content on social media and alcohol use



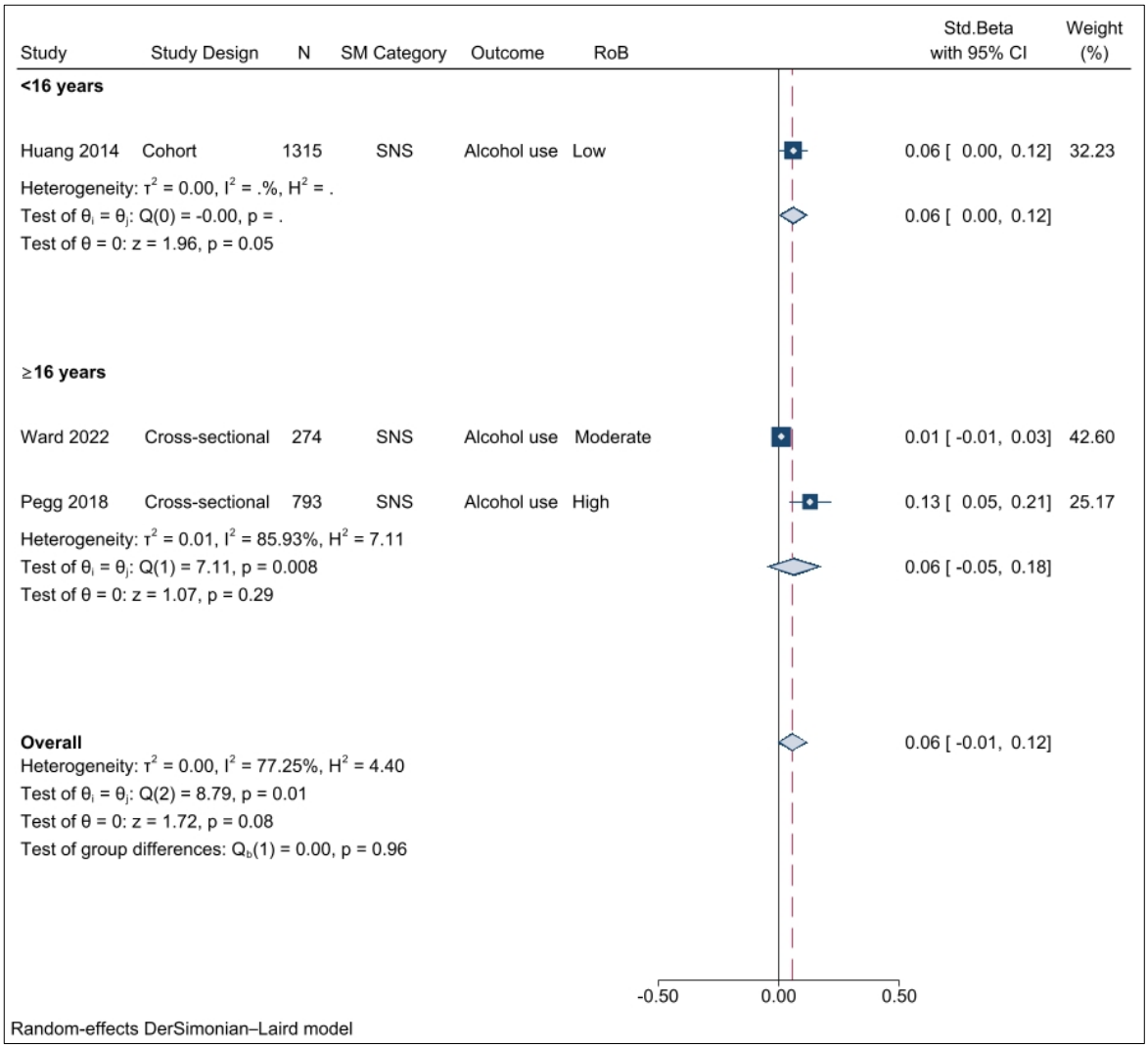
Legend: Figure presents forest plot for continuous exposure & continuous outcome meta-analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=6,331. Abbreviation(s): CI=Confidence interval; N=Number of study participants; Marketer-gen=Marketer-generated content; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); Std. Beta=Standardised beta; and User-gen=User-generated content.

Figure A17.1.18. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use, by average age of study participants



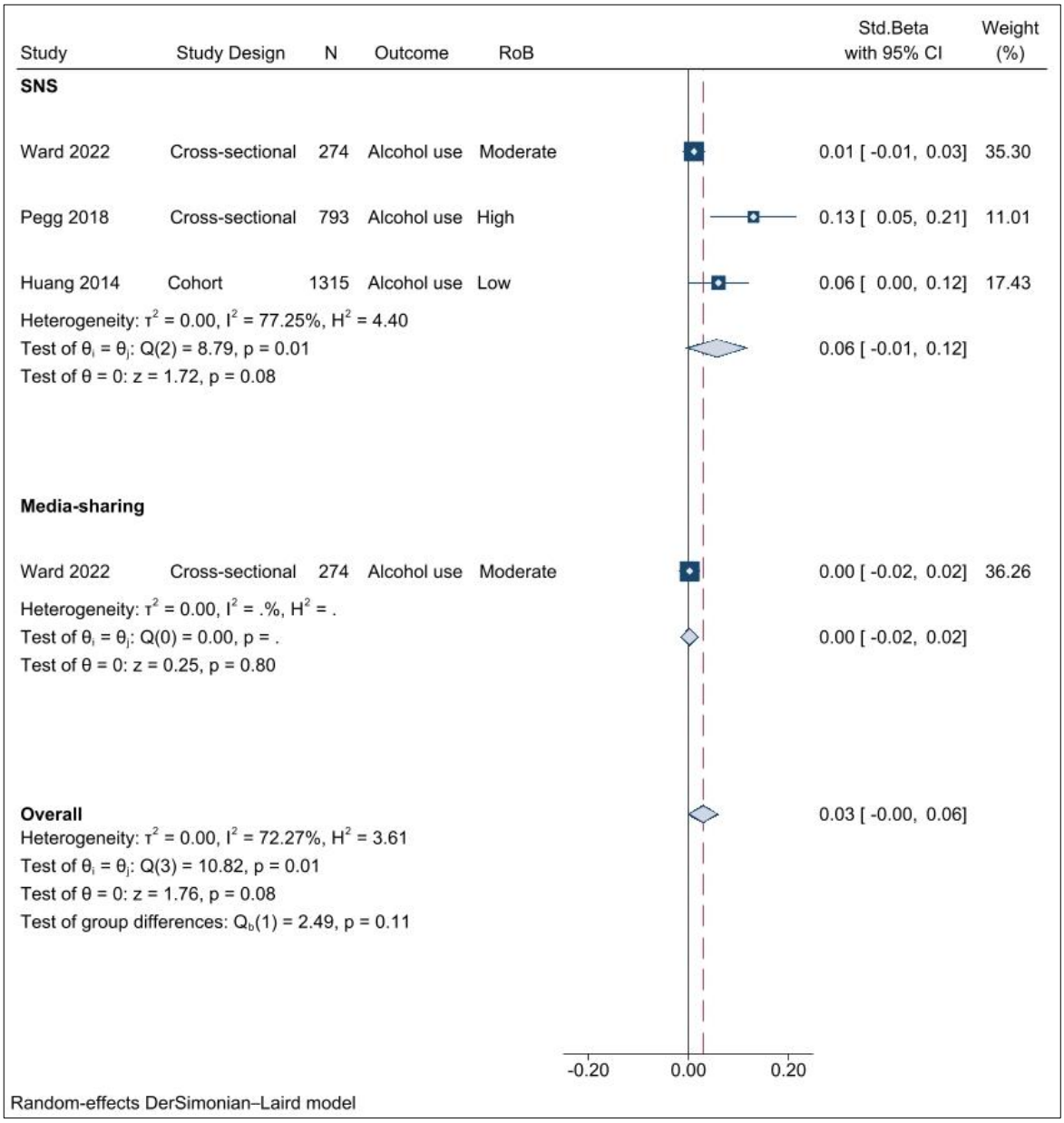
Legend: Figure presents forest plot for continuous exposure & continuous outcome subgroup analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=6,331. Abbreviation(s): CI=Confidence interval; N=Number of study participants; Marketer-gen=Marketer-generated content; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); Std. Beta=Standardised beta; and User-gen=User-generated content.

Figure A17.1.19. Forest plot for association between frequency of social media use and alcohol use, by average age of study participants



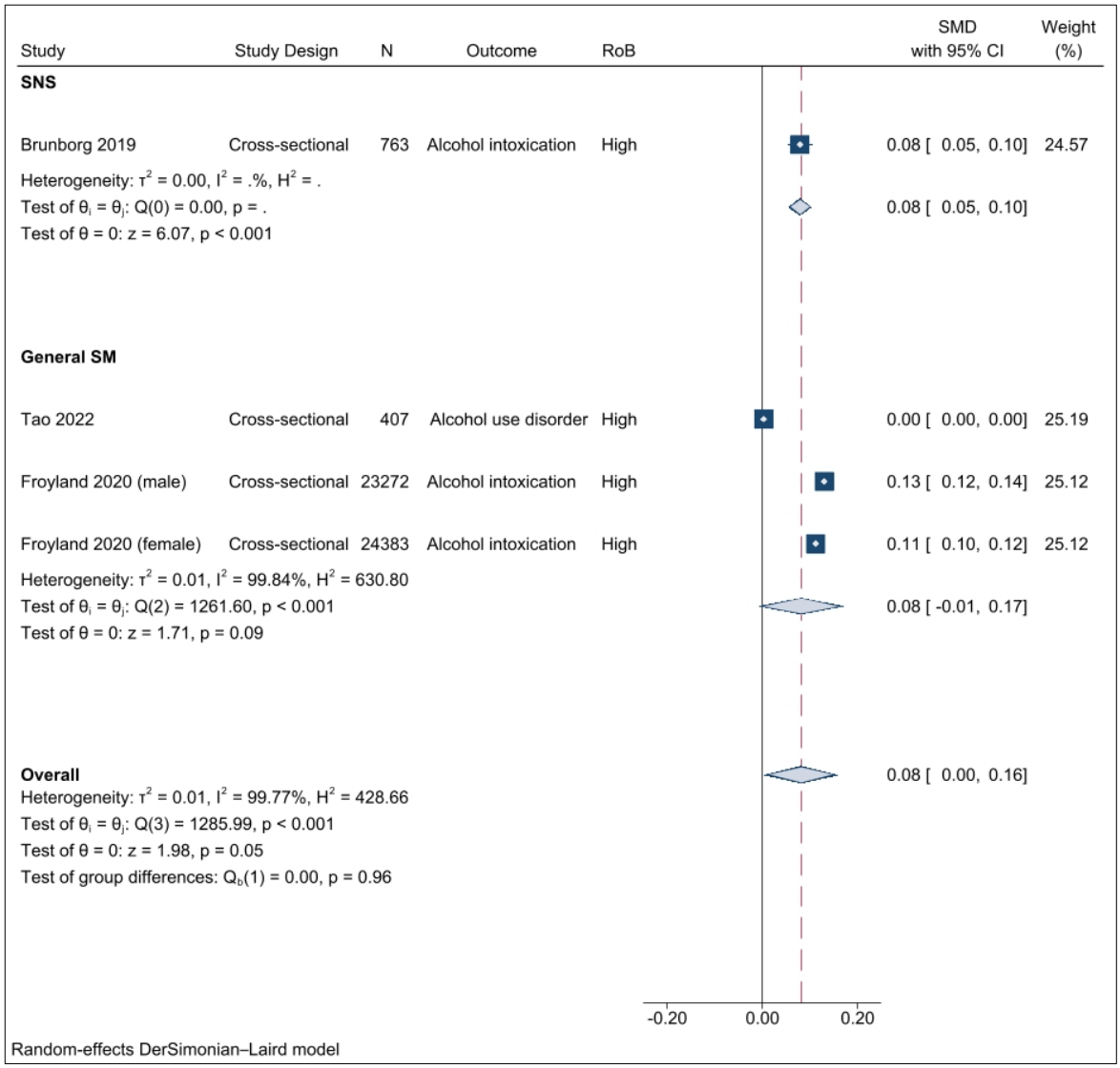
Legend: Figure presents forest plot for continuous exposure & continuous outcome subgroup analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=2,382. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.1.20. Forest plot for association between frequency of social media use and alcohol use, by social media category



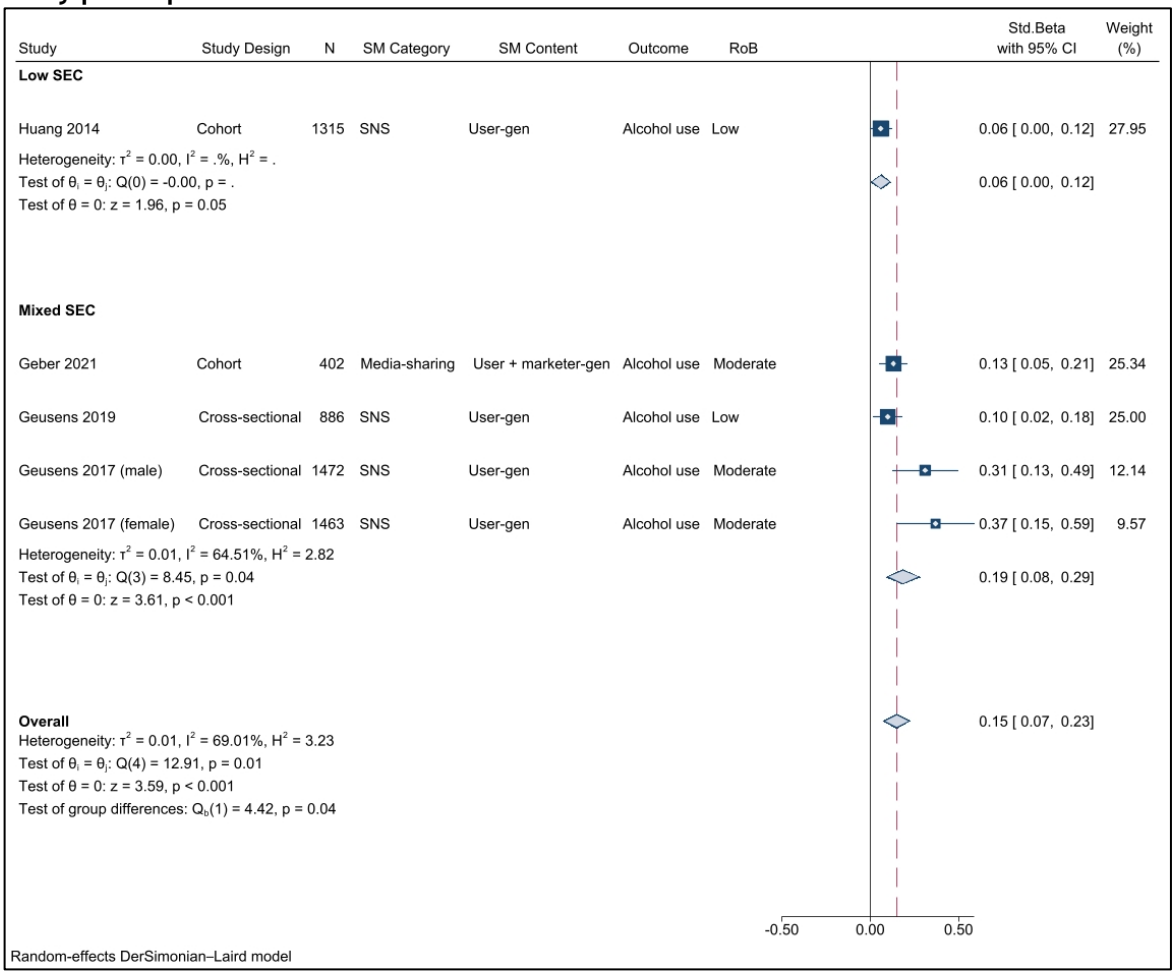
Legend: Figure presents forest plot for continuous exposure & continuous outcome subgroup analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=2,656. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.1.21. Forest plot for association between time spent on social media and alcohol use, by social media category



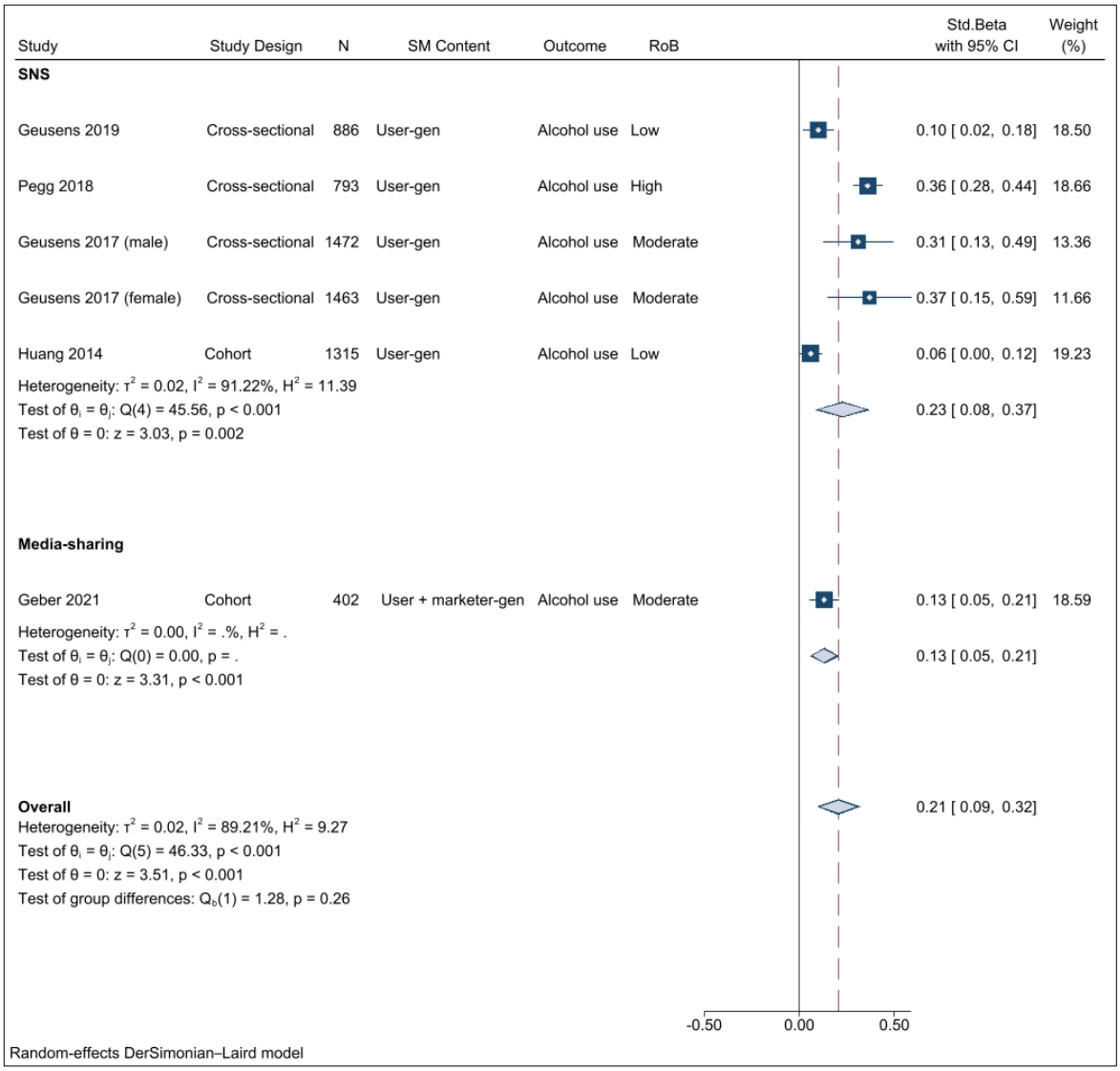
Legend: Figure presents forest plot for continuous exposure & continuous outcome subgroup analysis, with standardised mean difference (SMD) used as common metric. Total number of study participants=48,825. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SMD=Standardised mean difference; and SNS=Social networking site(s).

Figure A17.1.22. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use, by average socioeconomic circumstance(s) of study participants



Legend: Figure presents forest plot for continuous exposure & continuous outcome subgroup analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=5,538. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SEC=Socioeconomic circumstance(s); SM=Social media; SNS=Social networking site(s); Std. Beta=Standardised beta; and User-gen=User-generated content.

Figure A17.1.23. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use, by social media category



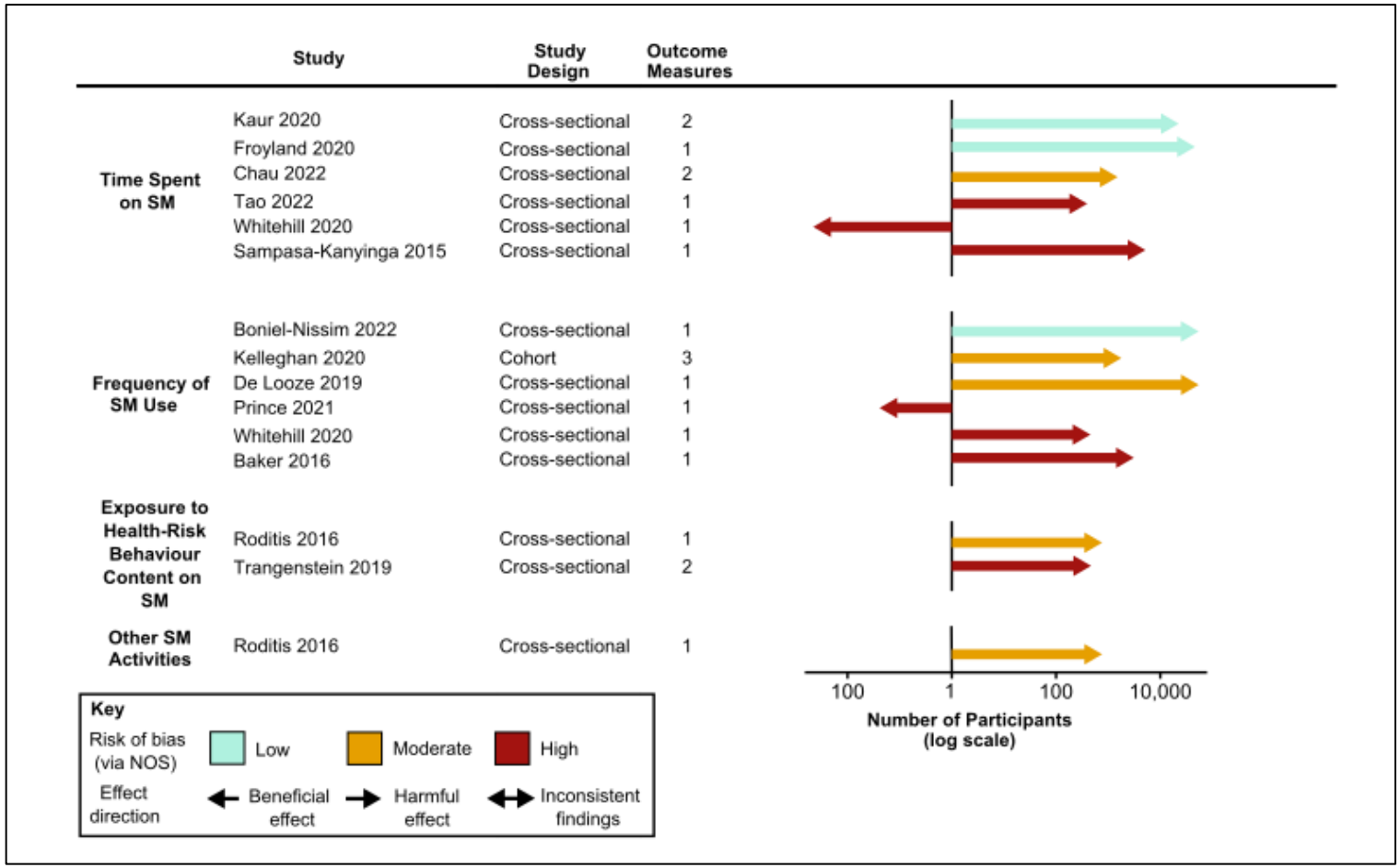
Legend: Figure presents forest plot for continuous exposure & continuous outcome subgroup analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=6,331. Abbreviation(s): CI=Confidence interval; N=Number of study participants; Marketer-gen=Marketer-generated content; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); Std. Beta=Standardised beta; and User-gen=User-generated content.

Section A17.2 Drug use

Effect direction

Figure A17.2.1 demonstrates the effect direction in those studies (n=13) investigating drug use by exposure. Two studies investigated more than one exposure (Roditis *et al.*, 2016; Whitehill *et al.*, 2020). For time spent on social media, 5/6 studies (83.3%) reported harmful associations (95% CI 43.6 to 97.0%; participant n=727,788; sign test p=0.22). For frequency of social media use, 5/6 studies (83.3%) demonstrated harmful associations (43.6 to 97.0%; participant n=117,645; sign test p=0.22), and for exposure to health-risk behaviour content on social media, all studies demonstrated harmful associations (34.2 to 100.0%; study n=2; participant n=1,268; insufficient data to conduct sign test). Other social media activities was investigated by one study, which demonstrated a harmful association (20.7 to 100.0%; participant n=786; insufficient data to conduct sign test).

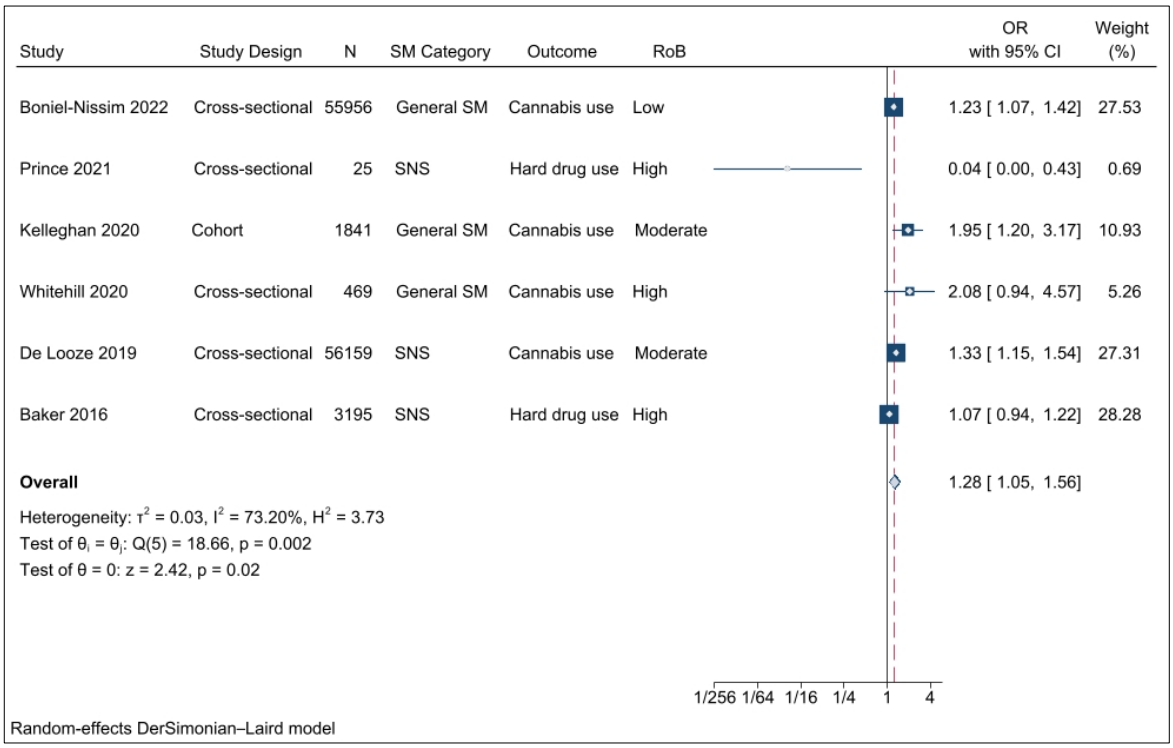
Figure A17.2.1. Effect direction plot for studies of the association between social media use and adolescent drug use by social media exposure. Arrow size indicates sample size; arrow colour indicates study risk of bias.



Legend: Sample size: represented by the size of the arrow, measured on a log scale. Outcome measure: number of outcome measures synthesised within each study. Studies organised by risk of bias grade, study design, and year of publication. Repeat cross-sectional studies, multiple study populations from different countries, and age subsets originating from the same study reported as separate studies. Abbreviation(s): NOS=Assessed via adapted Newcastle Ottawa Scale and SM=Social media.

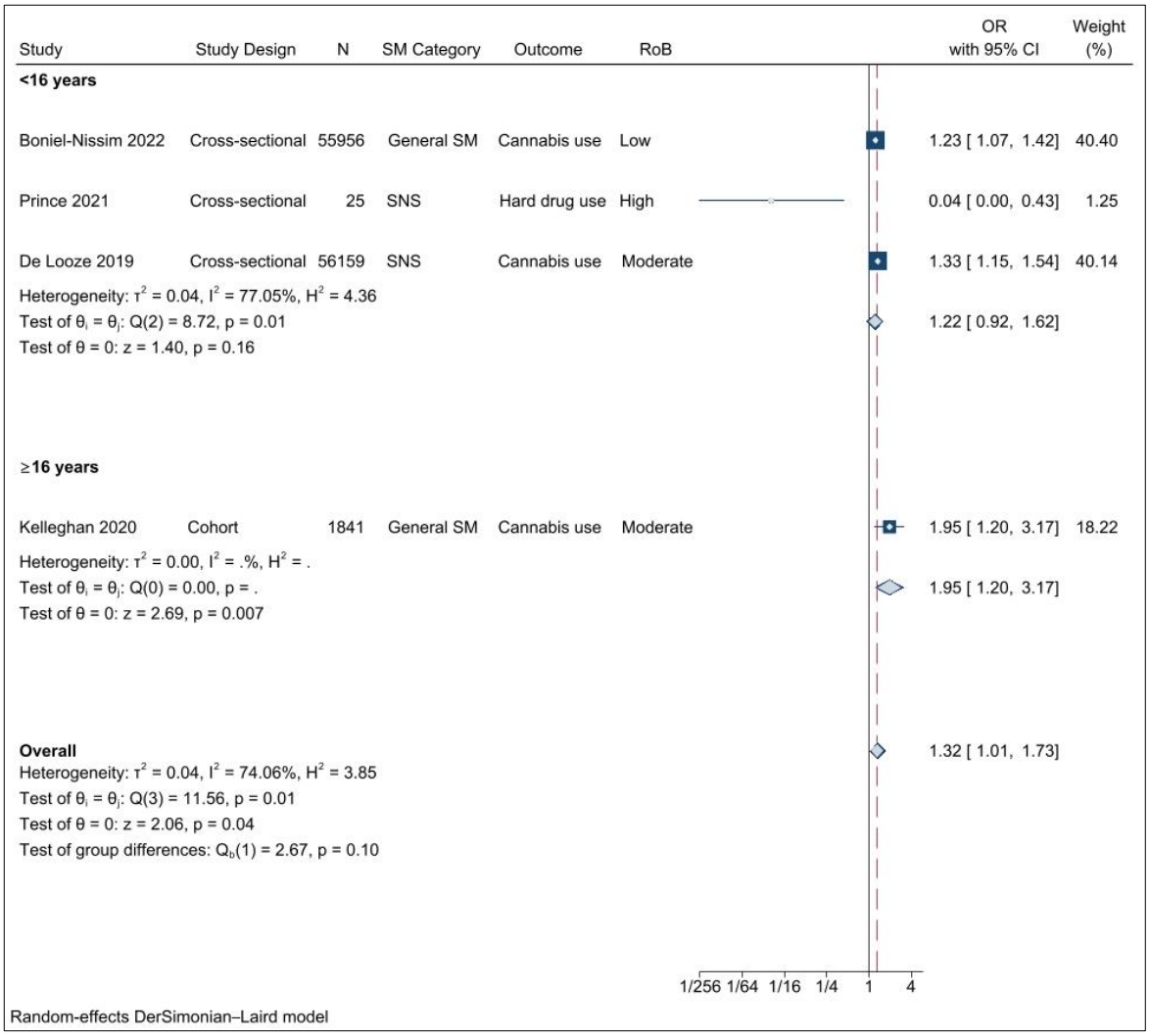
Forest plots for meta-analyses and subgroup analyses

Figure A17.2.2. Forest plot for association between frequency of social media use and drug use (also shown in Chapter 4)



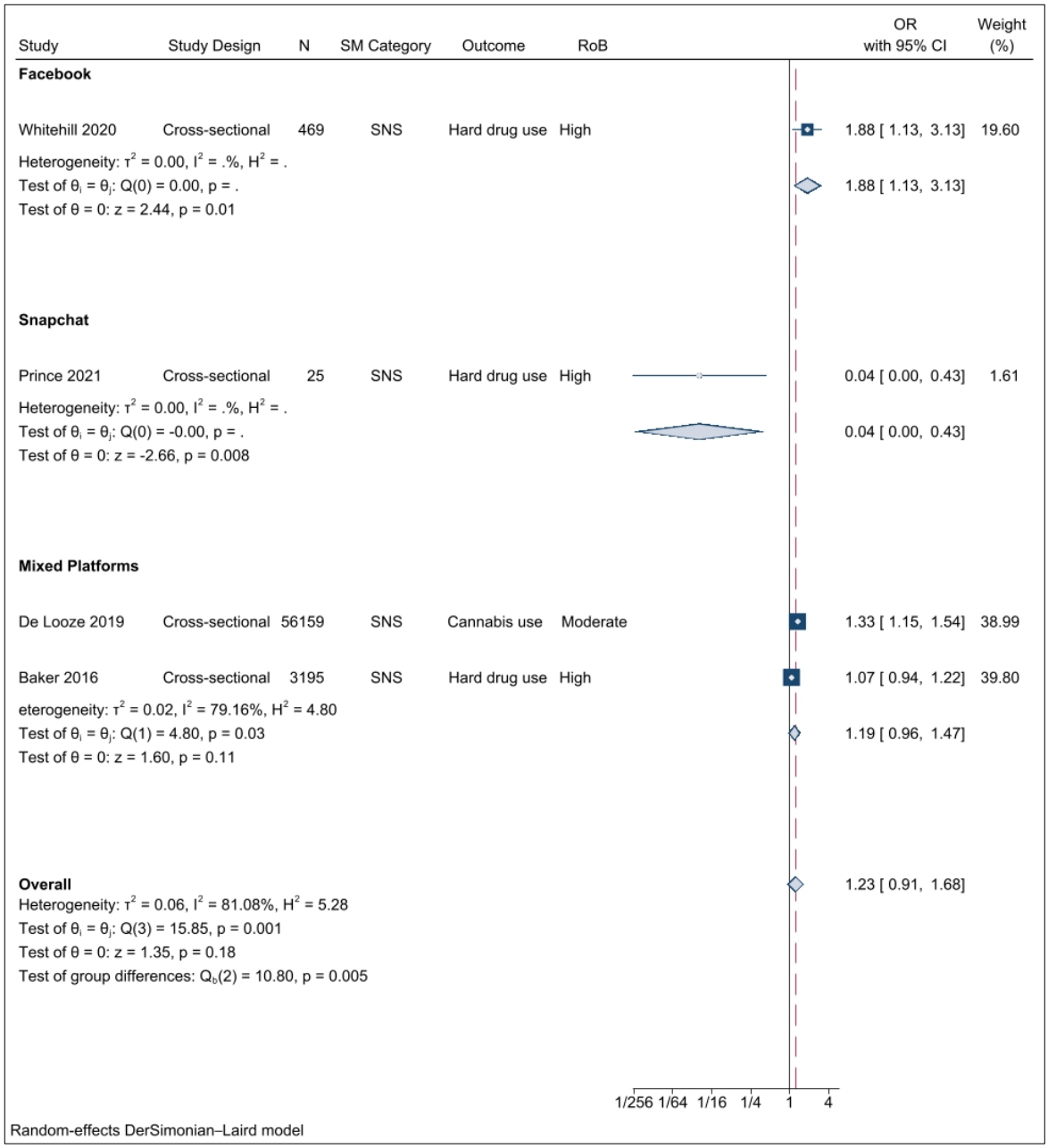
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=117,645. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.2.3. Forest plot for association between frequency of social media use and drug use, by average age of study participants



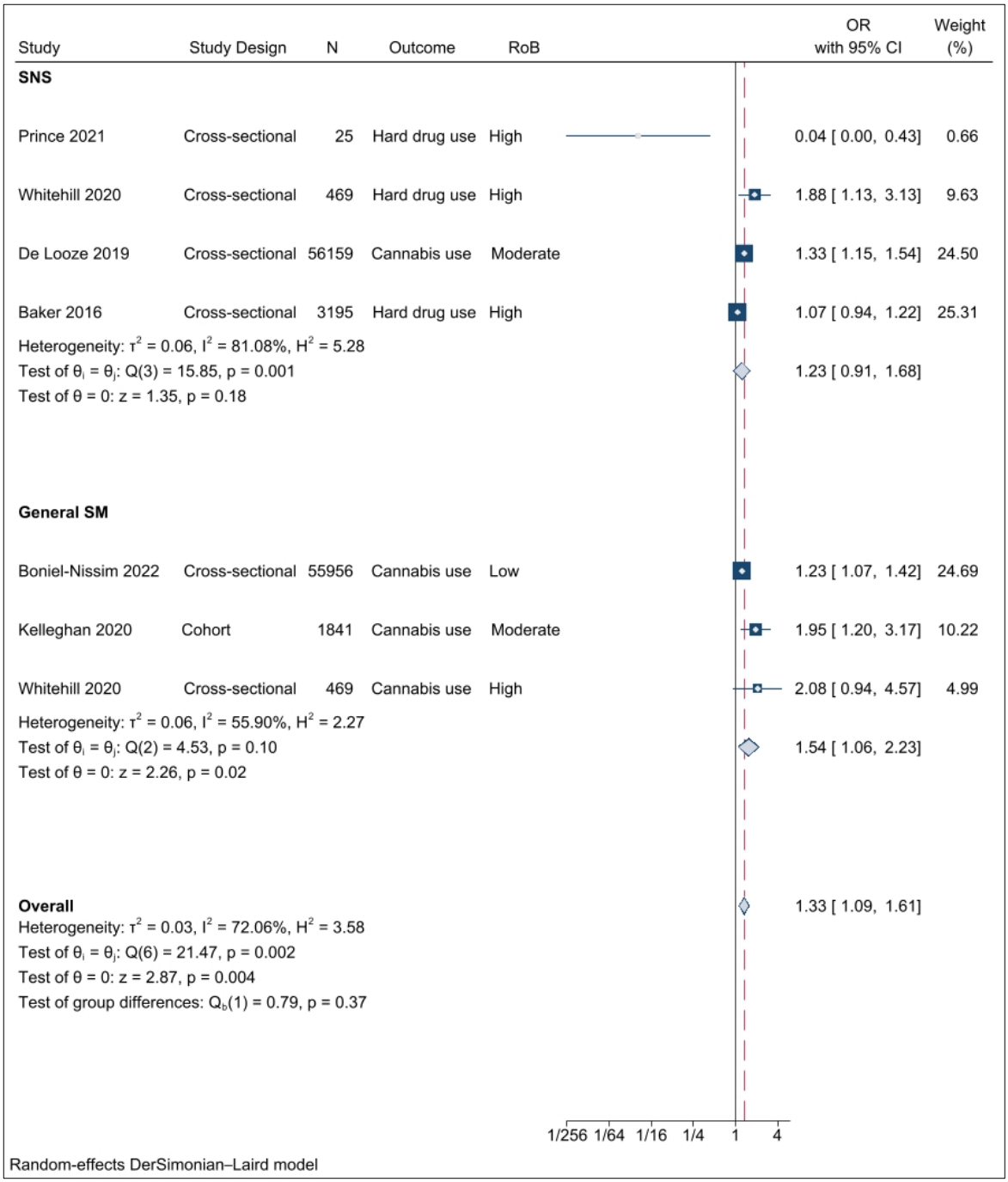
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=113,981. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.2.4. Forest plot for association between frequency of social media use and drug use, by social media platform



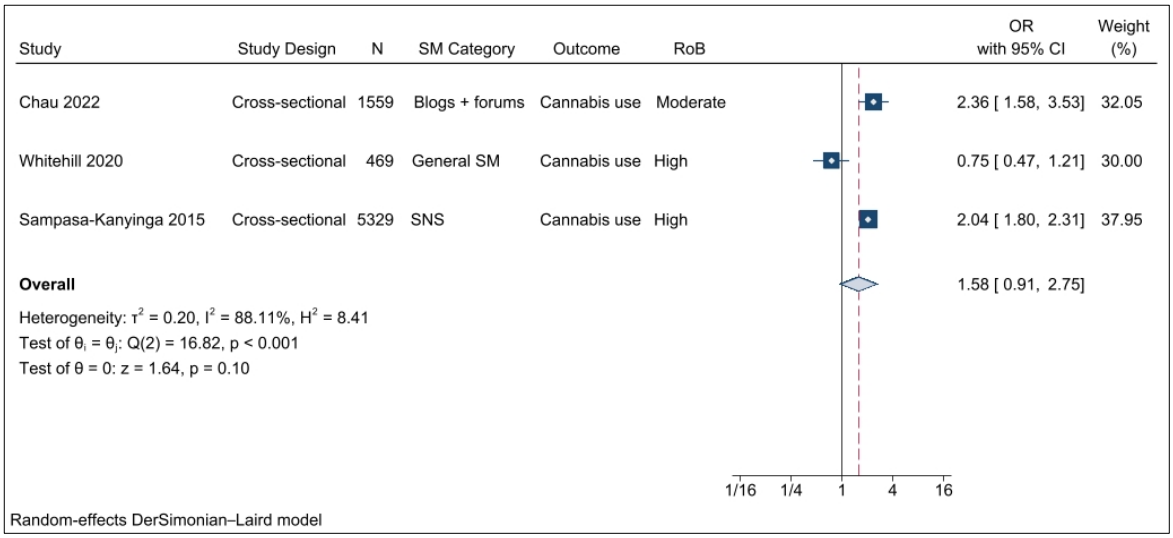
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=59,848. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.2.5. Forest plot for association between frequency of social media use and drug use, by social media category



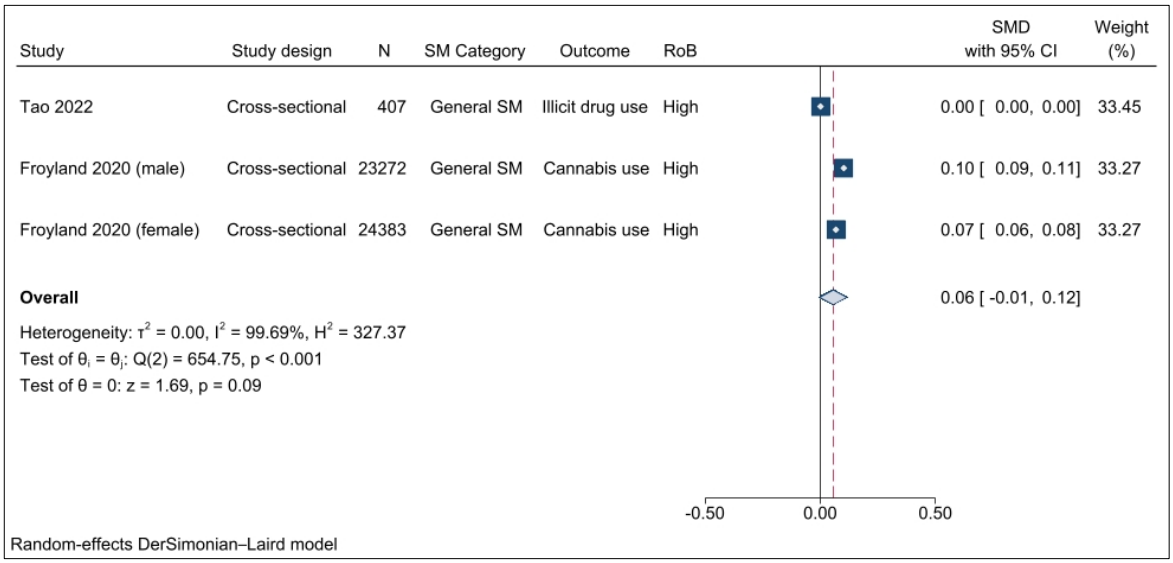
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=118,114. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.2.6. Forest plot for association between time spent on social media and drug use



Legend: Figure presents forest plot for binary exposure (≤1 vs >1 hour/day) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=7,357. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.2.7. Forest plot for association between time spent on social media and drug use



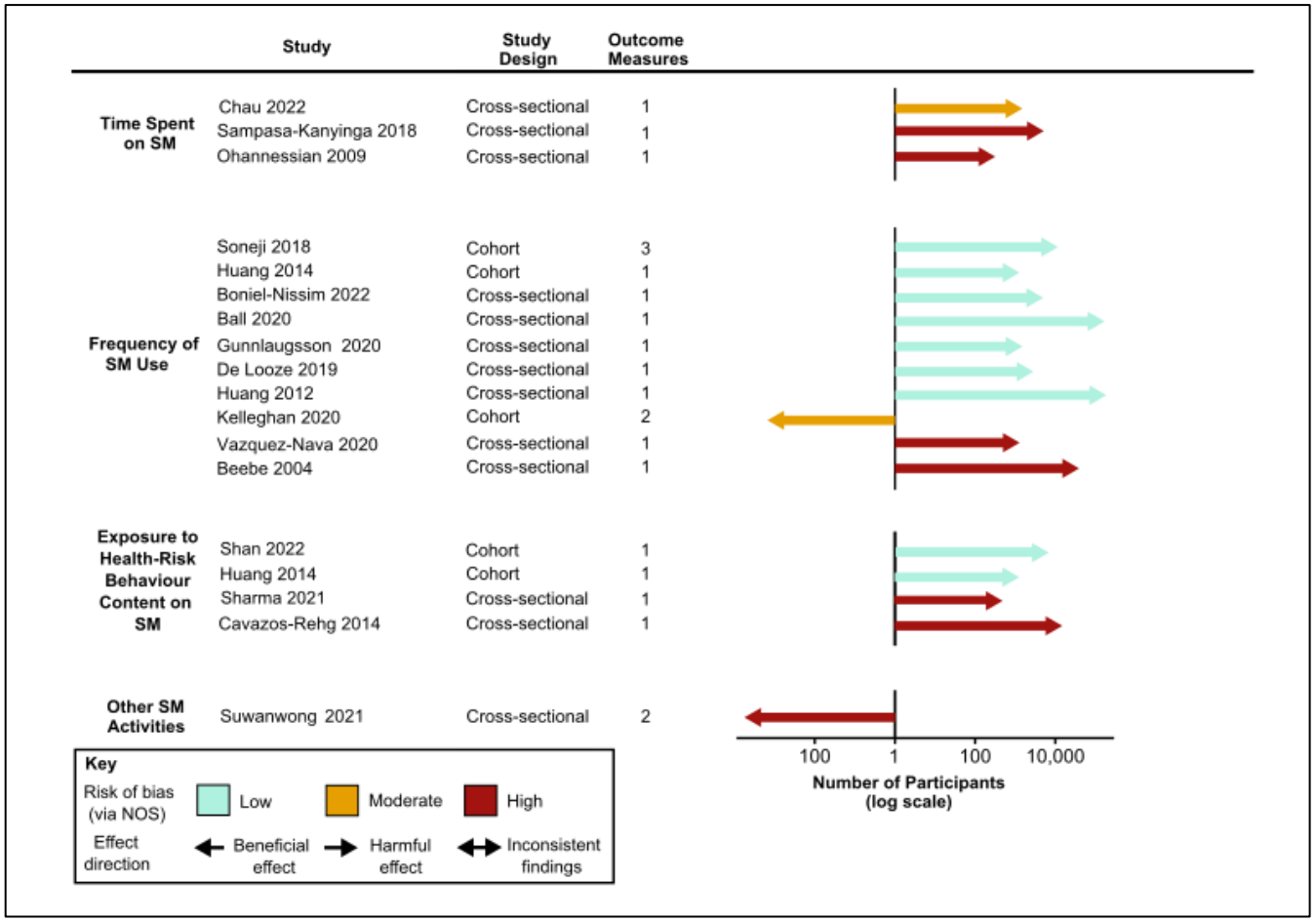
Legend: Figure presents forest plot for continuous exposure & continuous meta-analysis, with standardised mean difference (SMD) used as common metric. Total number of study participants=48,062. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SMD=Standardised mean difference.

Section A17.3 Tobacco use

Effect direction

Figure A17.3.1 illustrates the effect direction in those studies investigating tobacco use by exposure. One study investigated more than one exposure (Huang *et al.*, 2014). For time spent on social media, all studies demonstrated harmful associations of social media use (95% CI 43.9 to 100%; study n=3; participant n=7,216; sign test p=0.25), as did all studies investigating exposure to health-risk behaviour content (51.0 to 100%; study n=4; participant n=24,197; sign test p=0.13). For frequency of social media use, 9/10 studies (90.0%) demonstrated harmful associations (59.6 to 98.2%; participant n=431,501; sign test p=0.02). Other social media activities was investigated by one study, which demonstrated a harmful association (0.00 to 79.3%; participant n=5,851; insufficient data to conduct sign test).

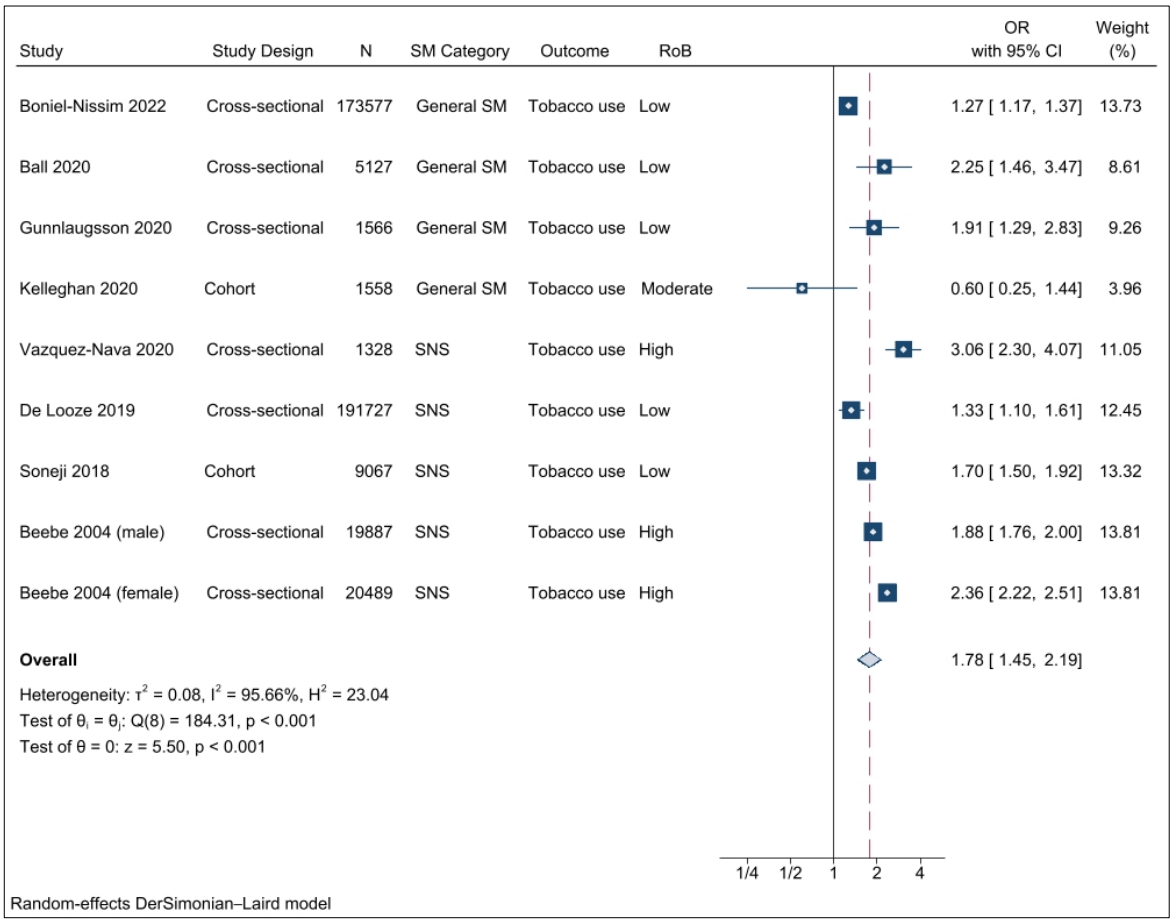
Figure A17.3.1. Effect direction plot for studies of the association between social media use and adolescent tobacco use, by social media exposure. Arrow size indicates sample size; arrow colour indicates study risk of bias.



Legend: Sample size: represented by the size of the arrow, measured on a log scale. Outcome measure: number of outcome measures synthesised within each study. Studies organised by risk of bias grade, study design, and year of publication. Repeat cross-sectional studies, multiple study populations from different countries, and age subsets originating from the same study reported as separate studies. Abbreviation(s): NOS=Assessed via adapted Newcastle Ottawa Scale and SM=Social media.

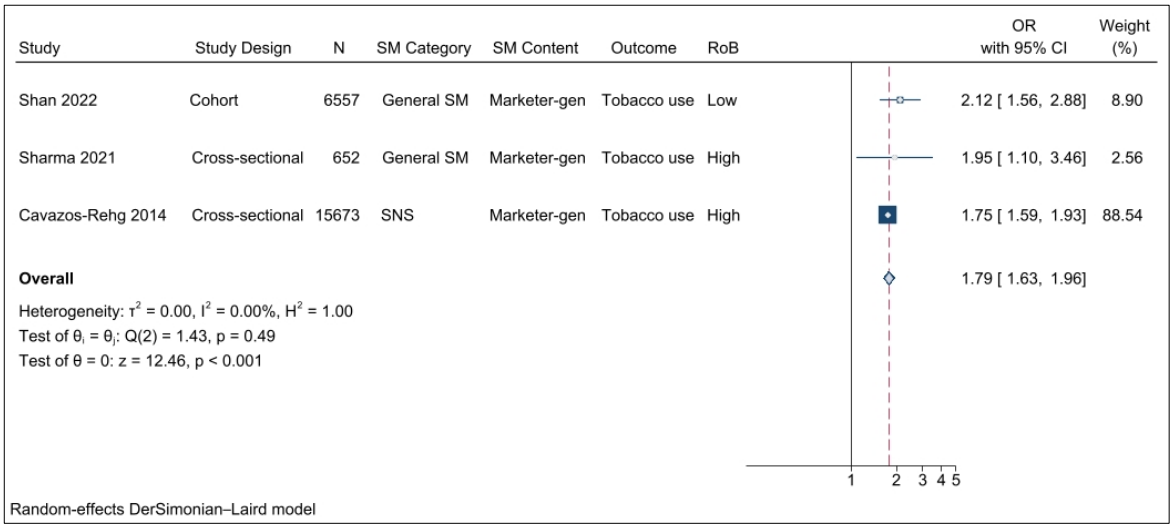
Forest plots for meta-analyses and subgroup analyses

Figure A17.3.2. Forest plot for association between frequency of social media use and tobacco use (also shown in Chapter 4)



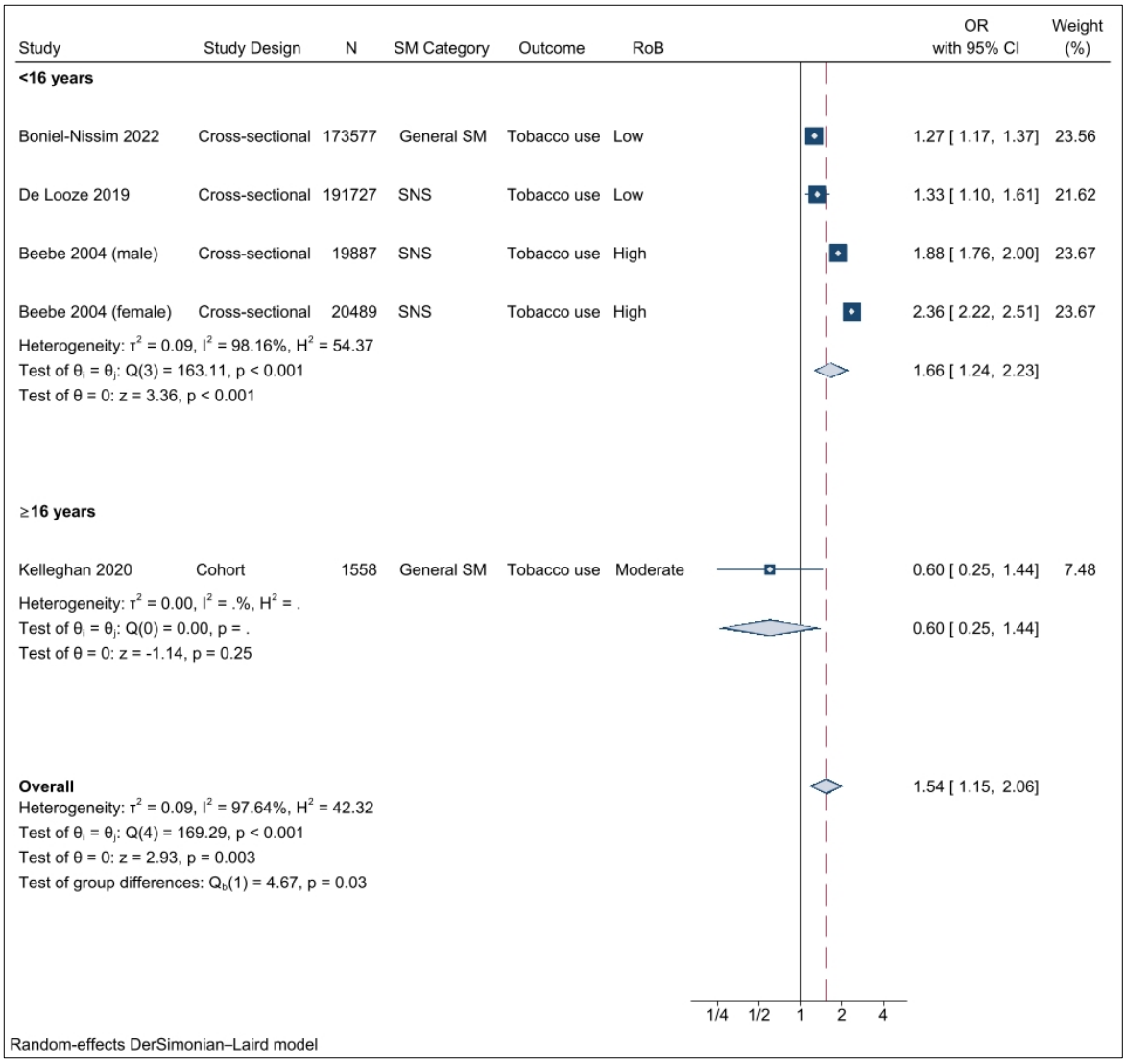
Legend: Figure presents forest plot for binary exposure (frequent vs infrequent) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=424,326. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.3.3. Forest plot for association between exposure to health-risk behaviour content on social media and tobacco use



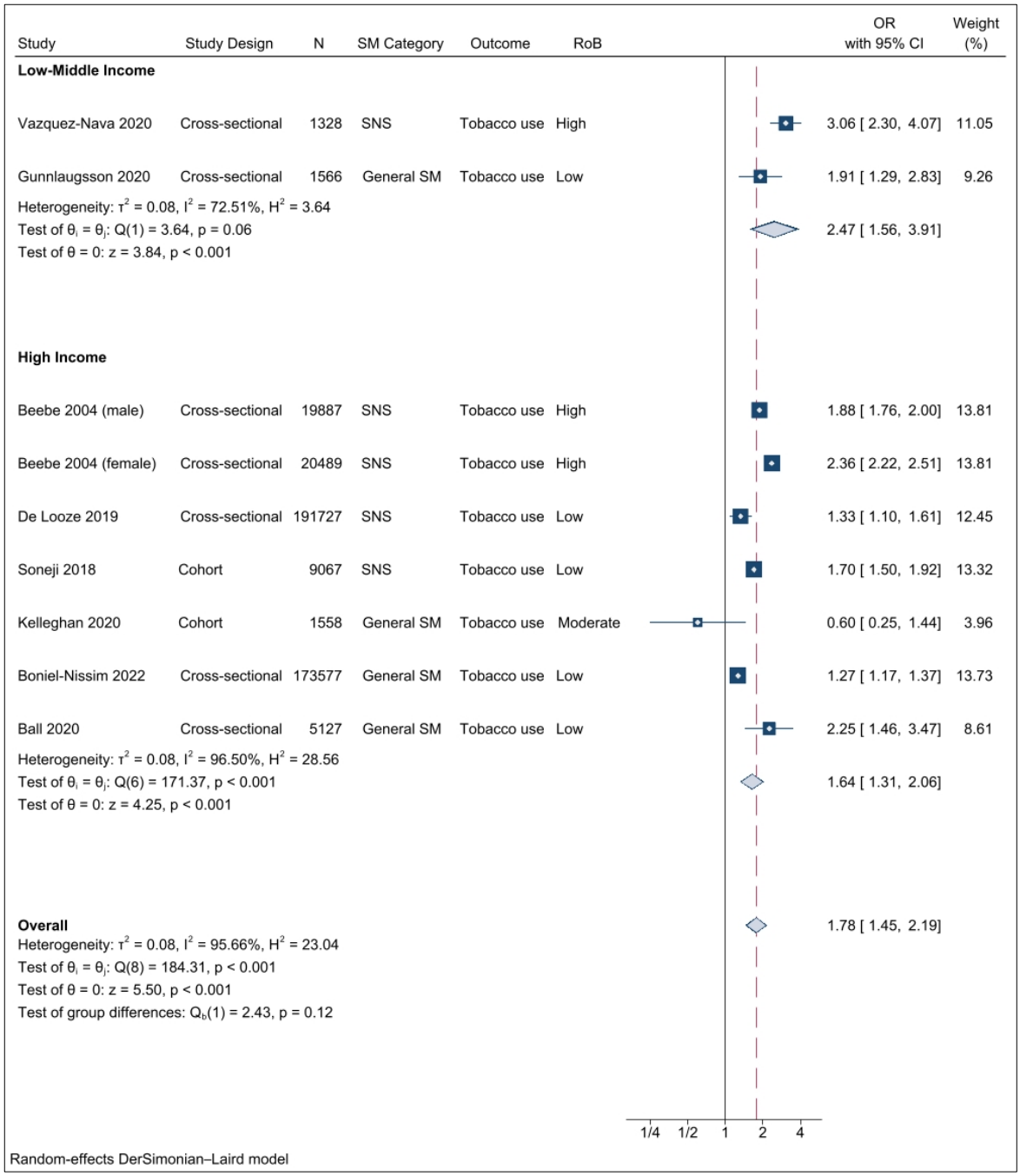
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=22,882. Abbreviation(s): CI=Confidence interval; Marketer-gen= Marketer-generated content; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.3.4. Forest plot for association between frequency of social media use and tobacco use, by average age of study participants



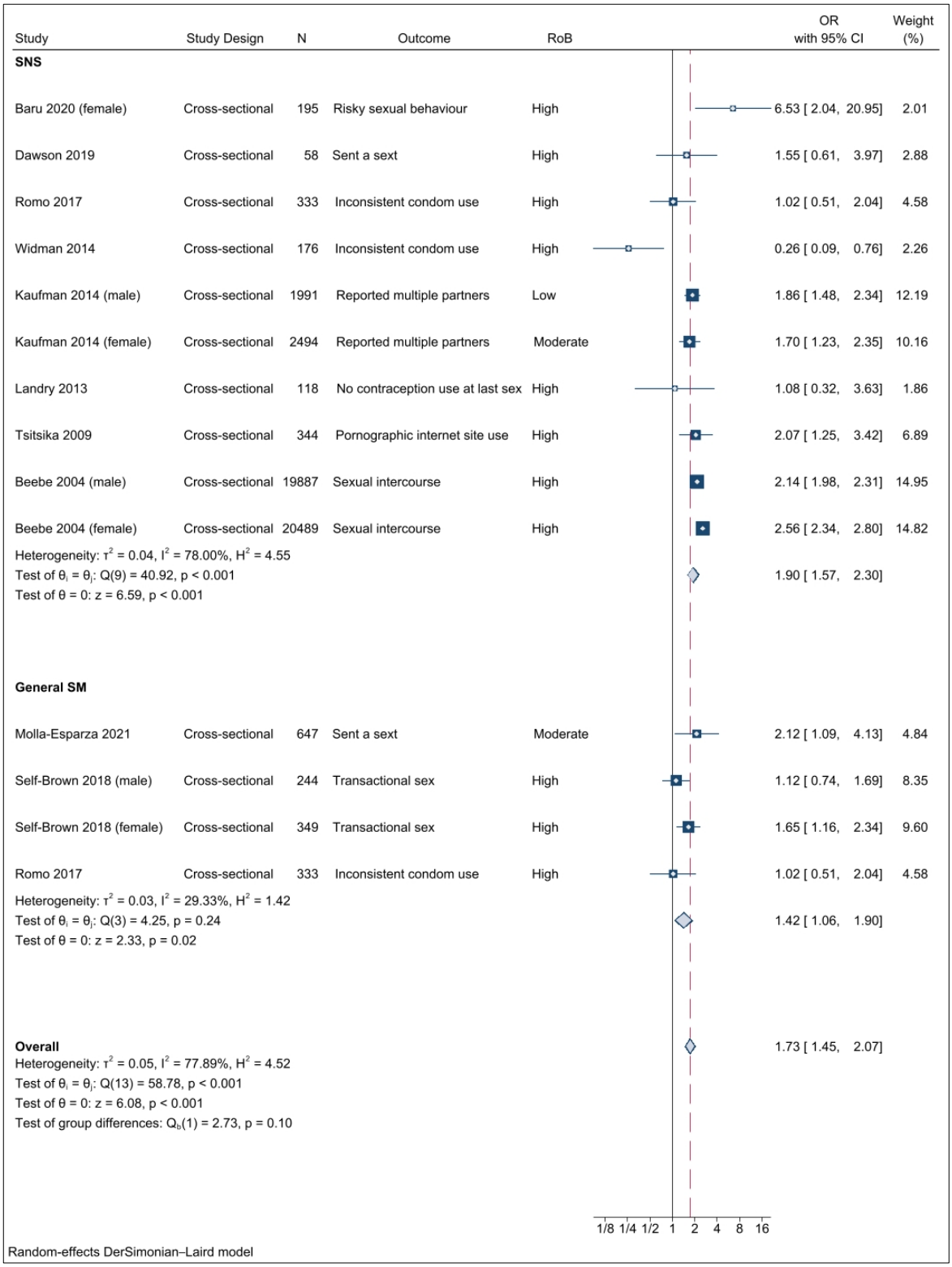
Legend: Figure presents forest plot for binary exposure (frequent vs infrequent) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=407,238. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.3.5. Forest plot for association between frequency of social media use and tobacco use, by development status of study setting[a]



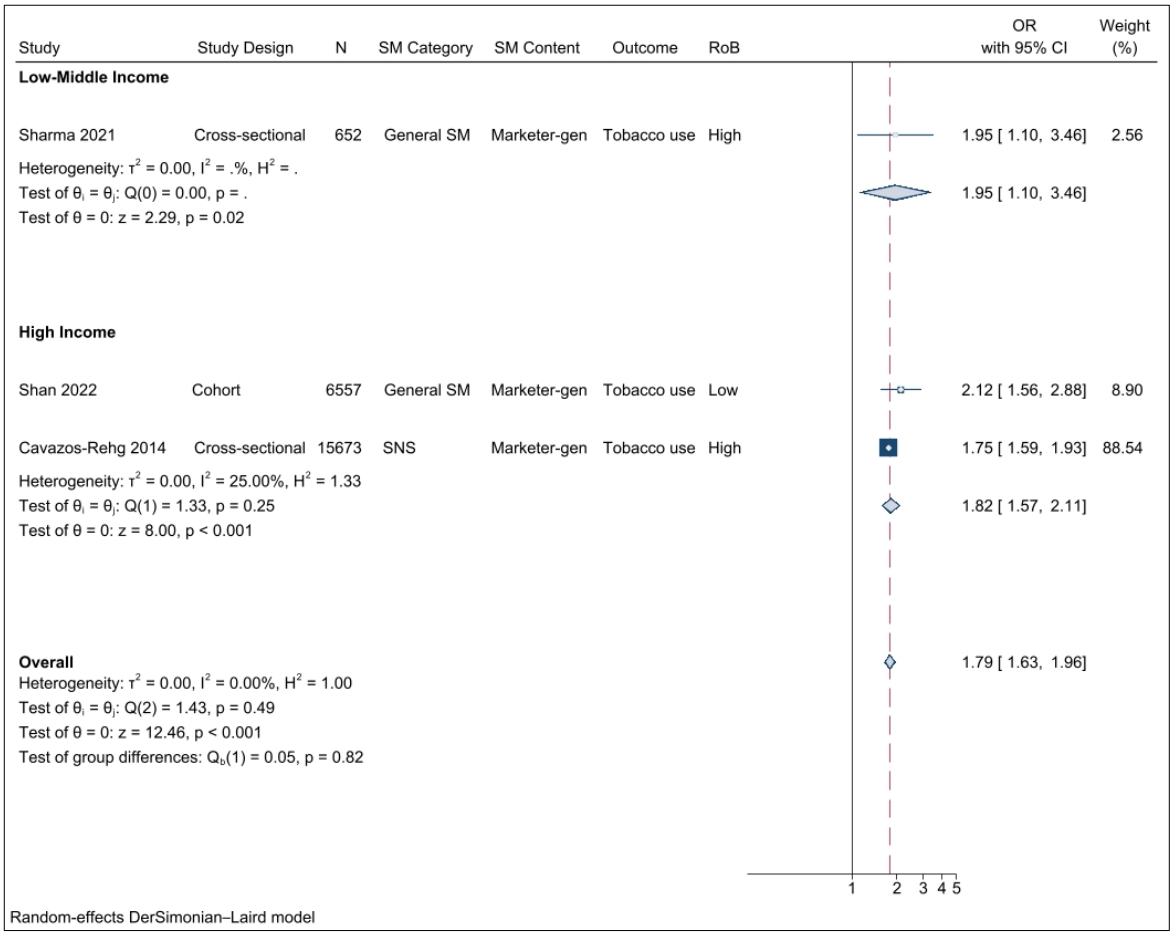
Legend: Figure presents forest plot for binary exposure (frequent vs infrequent) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric.
[a] Development status classified as per the World Bank Country Income Level Classification (World Bank, 2021). Total number of study participants=424,326. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.3.6. Forest plot for association between frequency of social media use and tobacco use, by social media category



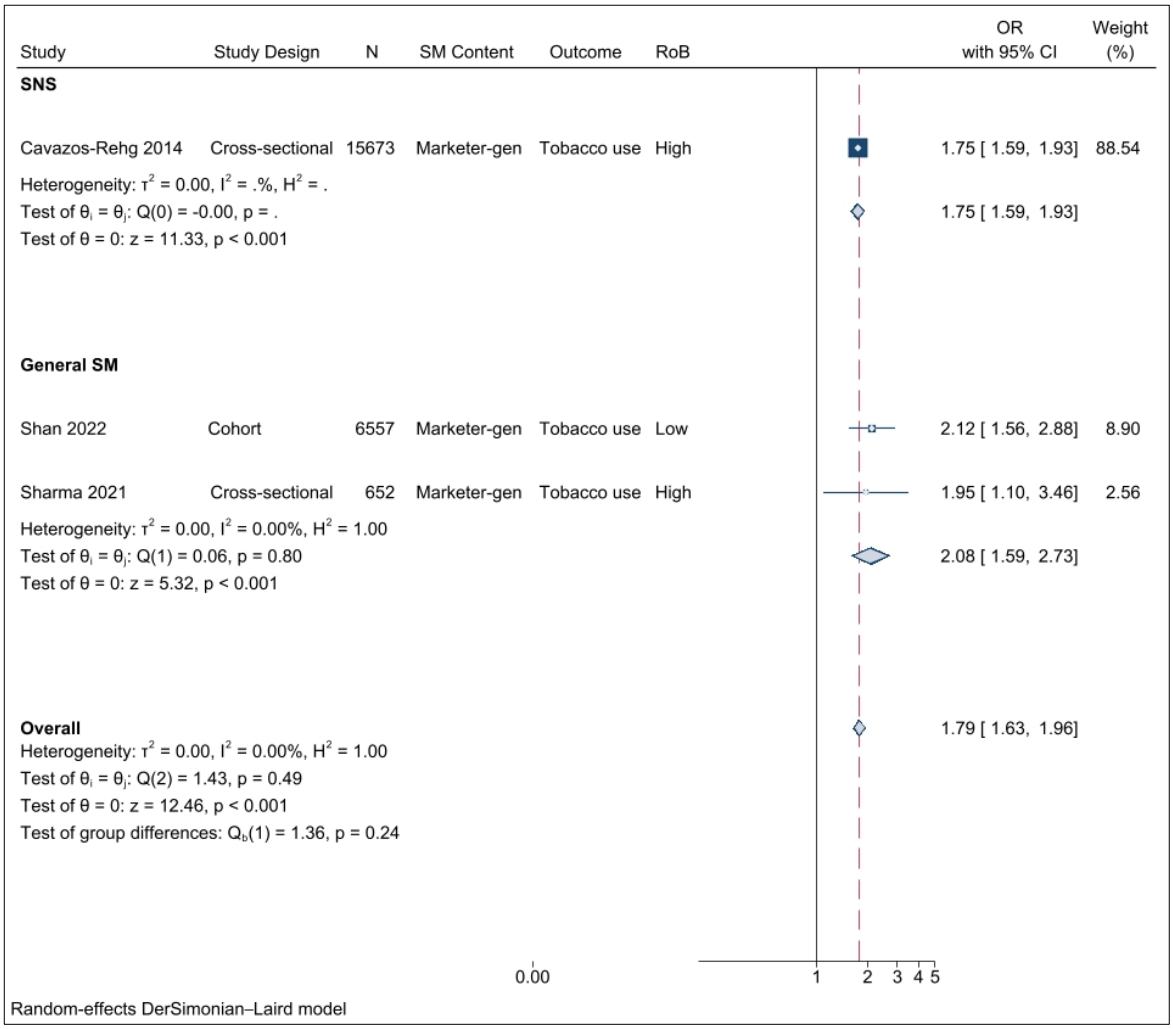
Legend: Figure presents forest plot for binary exposure (frequent vs infrequent) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=47,658. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.3.7. Forest plot for association between exposure to health-risk behaviour content on social media and tobacco use, by development status of study setting[a]



Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. [a] Development status classified as per the World Bank Country Income Level Classification (World Bank, 2021). Total number of study participants=22,882. Abbreviation(s): CI=Confidence interval; Marketer-gen=Marketer-generated content; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.3.8. Forest plot for association between exposure to health-risk behaviour content on social media and tobacco use, by social media category



Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=22,882. Abbreviation(s): CI=Confidence interval; Marketer-gen=Marketer-generated content; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Meta-regression

Table A17.3.1. Summary of meta-regression findings for tobacco use

Exposure	Outcome	Study level variable	Coefficient (95% CI)	*p-value*	Corresponding forest plot
Frequency of use (binary exposure)	Tobacco use	SM category (reference category-SNS)	General SM: -0.27 (-0.61 to 0.07)	0.12	Figure A17.3.6.

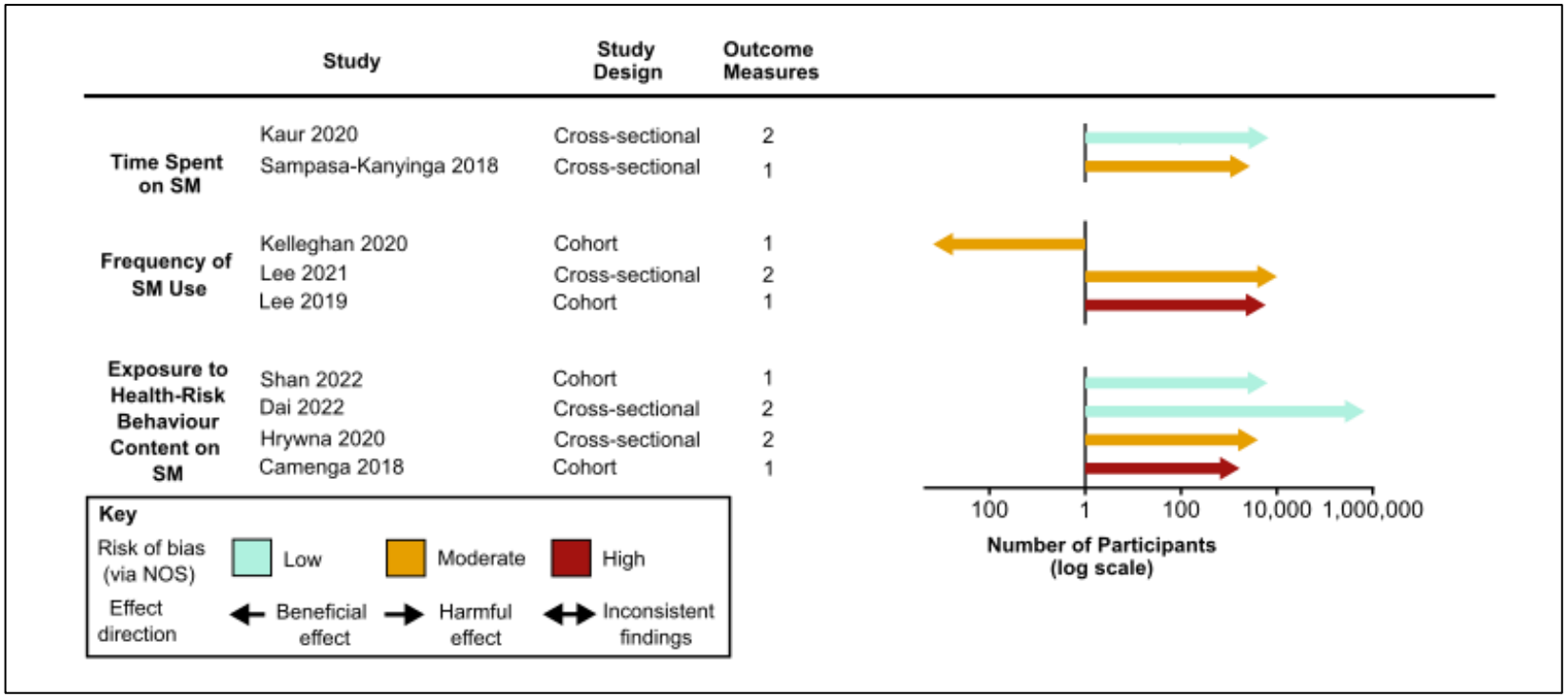
Legend: Results with p<0.05 in bold. Abbreviation(s): CI=Confidence interval; SM=Social media; and SNS=Social networking site(s).

Section A17.4 Use of electronic nicotine delivery systems (ENDS)

Effect direction

Figure A17.4.1 demonstrates the effect direction in those studies (n=9) investigating use of ENDS by exposure. For time spent on social media, all studies reported harmful associations (95% CI 34.2 to 100.0%; study n=2; participant n=9,821; insufficient data to conduct sign test), for frequency of social media use, 2/3 studies (66.7%) demonstrated harmful associations (20.8 to 93.9%; participant n=18,047; sign test p=1.00) and for exposure to health-risk behaviour content on social media all studies reported harmful effects (51.0 to 100.0%; study n=4; participant n=721,322; sign test p=1.00).

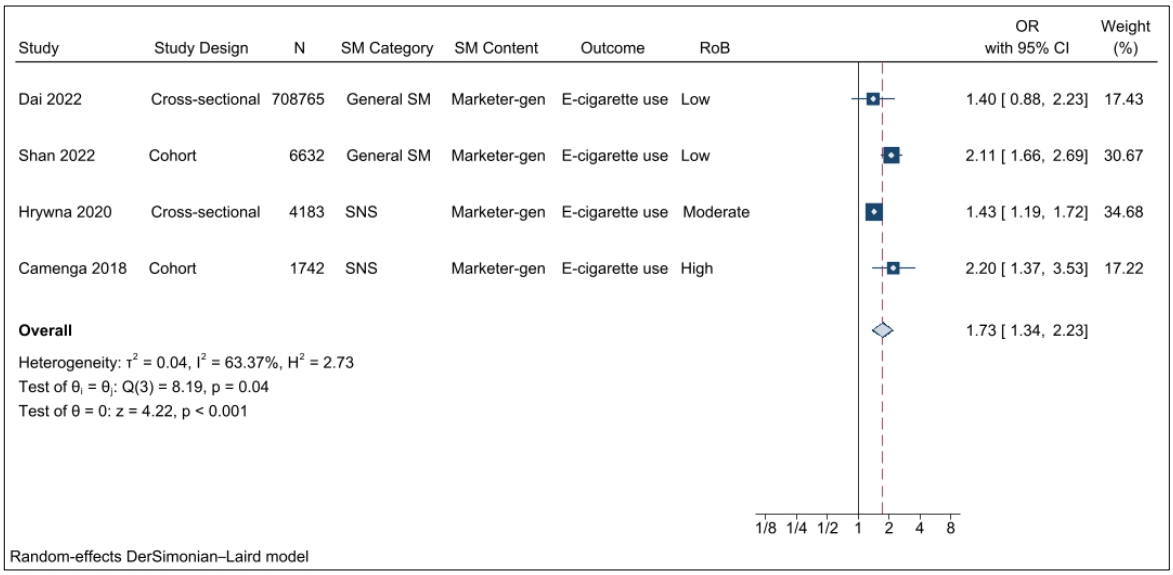
Figure A17.4.1. Effect direction plot for studies of the association between social media and adolescent use of electronic nicotine delivery systems by social media exposure. Arrow size indicates sample size; arrow colour indicates study risk of bias.



Legend: Sample size: represented by the size of the arrow, measured on a log scale. Outcome measure: number of outcome measures synthesised within each study. Studies organised by risk of bias grade, study design, and year of publication. Repeat cross-sectional studies, multiple study populations from different countries, and age subsets originating from the same study reported as separate studies. Abbreviation(s): NOS=Assessed via adapted Newcastle Ottawa Scale and SM=Social media.

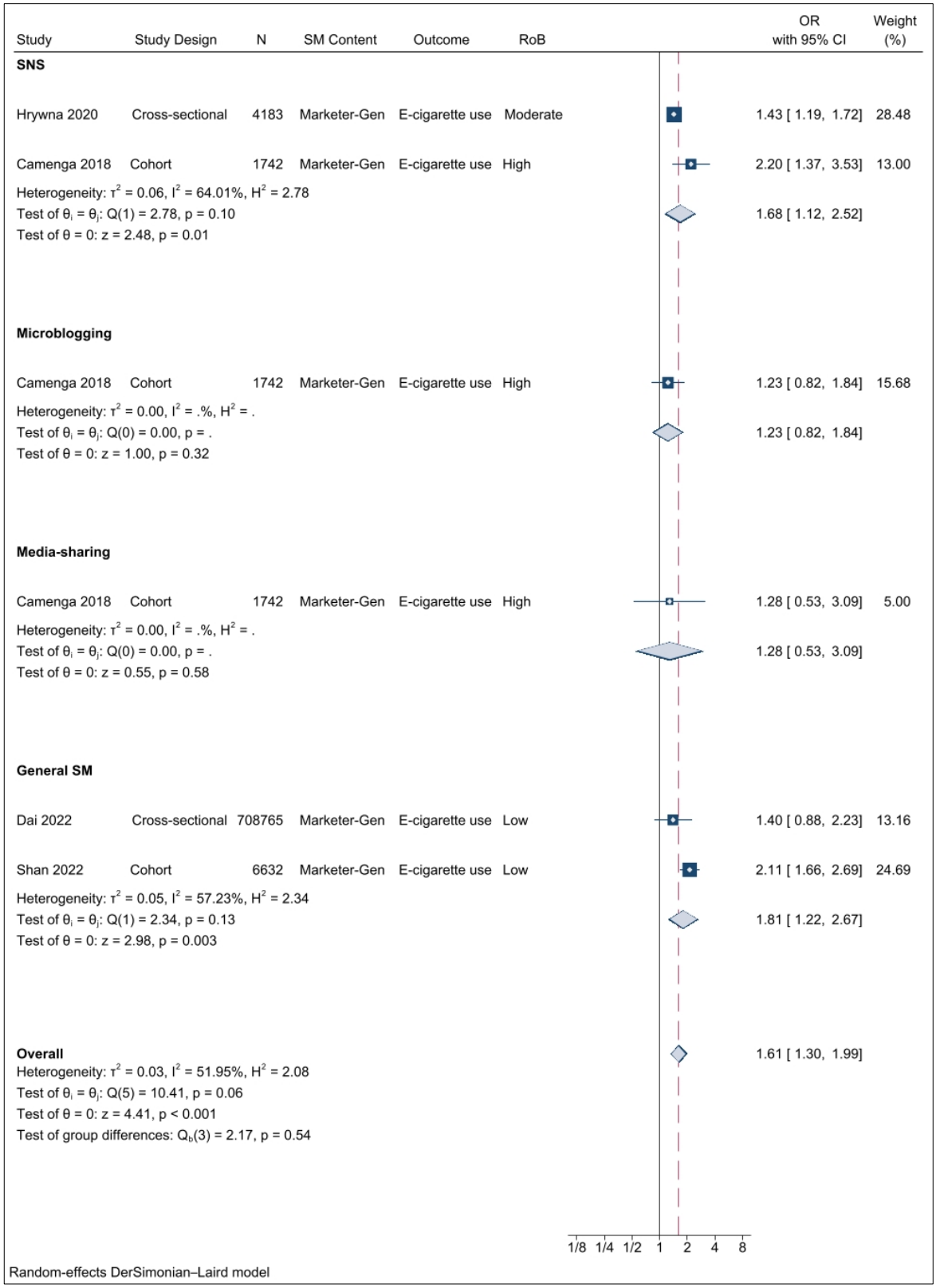
Forest plots for meta-analyses and subgroup analyses

Figure A17.4.2. Forest plot for association between exposure to health-risk behaviour content on social media and use of electronic nicotine delivery systems (ENDS)



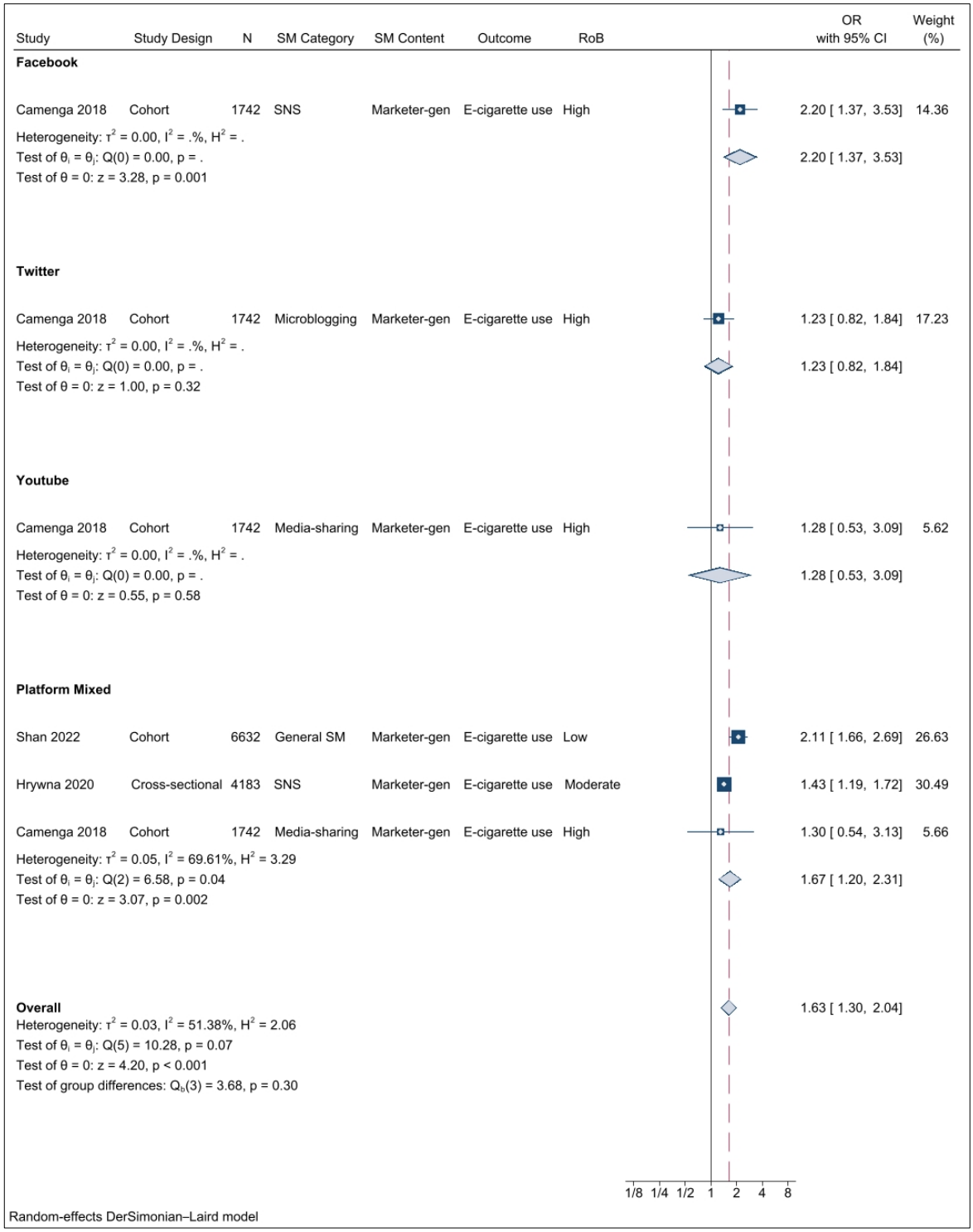
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=721,322. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.4.3. Forest plot for association between exposure to health-risk behaviour content on social media and use of electronic nicotine delivery systems (ENDS), by social media category



Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=724,716. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.4.4. Forest plot for association between exposure to health-risk behaviour content on social media and use of electronic nicotine delivery systems (ENDS), by social media platform



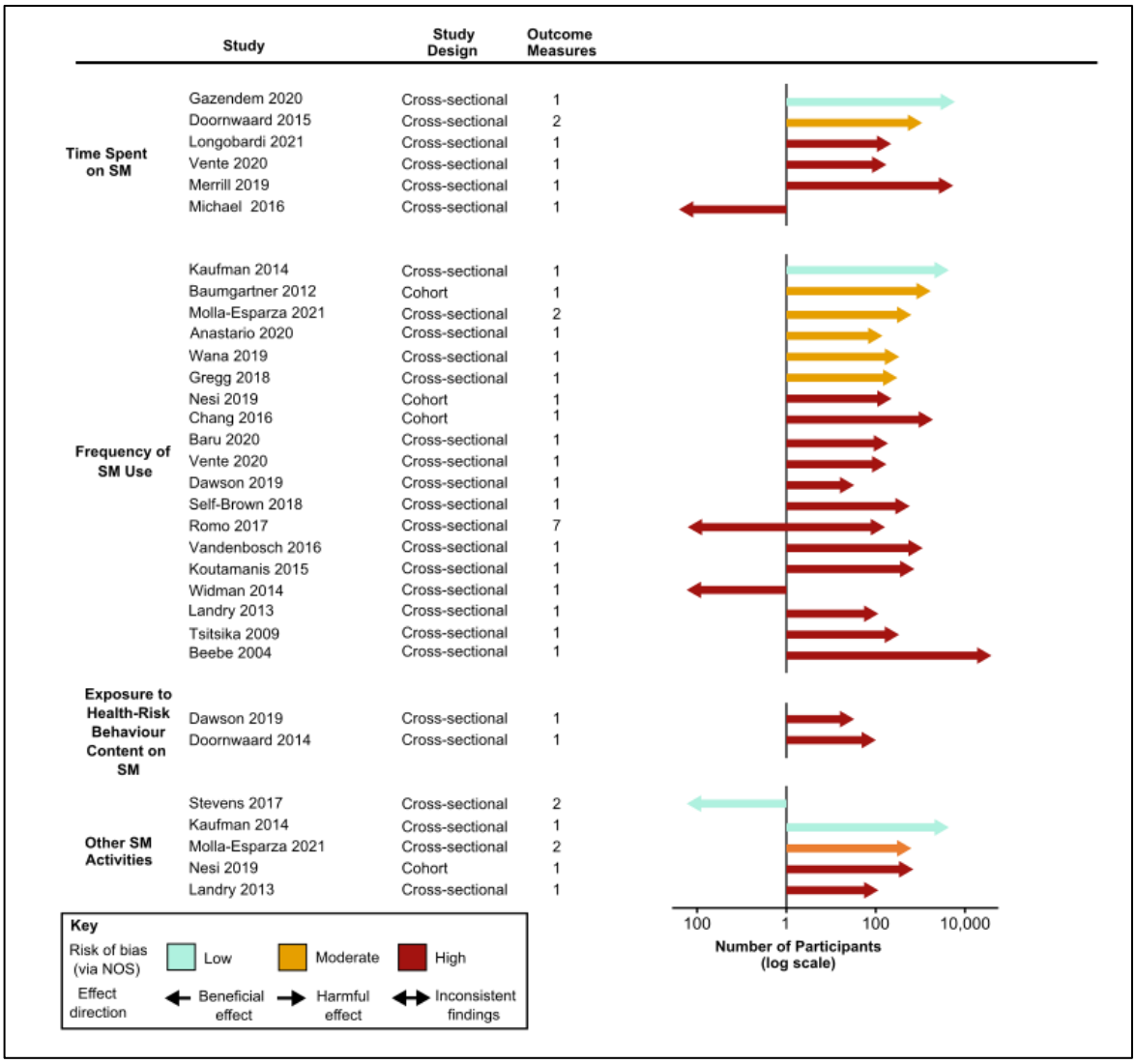
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=17,783. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Section A17.5 Sexual risk behaviour

Effect direction

Figure A17.5.1 demonstrates the effect direction in those studies investigating sexual risk behaviour by exposure. Six studies investigated more than one exposure type (Landry *et al.*, 2013; Kaufman *et al.*, 2014; Dawson *et al.*, 2019; Nesi and Prinstein, 2019; Vente *et al.*, 2020; Molla-Esparza *et al.*, 2021). After excluding one study with inconsistent findings (participant n=333; Romo *et al.*, 2017) for time spent on social media, 5/6 studies (83.3%) reported harmful associations (95% CI 43.6 to 97.0%; participant n=13,528; sign test p=0.22), 17/18 studies (94.5%) reported harmful associations for frequency of social media use (74.2 to 99.0%; participant n=53,850; sign test p<0.001), all studies reported harmful associations for exposure to health-risk behaviour content on social media (34.2 to 100.0%; study n=2; participant n=138; insufficient data to conduct sign test), and 4/5 studies (80.0%) reported harmful associations of engagement in other social media activities (37.6 to 96.4%; participant n=6,141; sign test p=0.38).

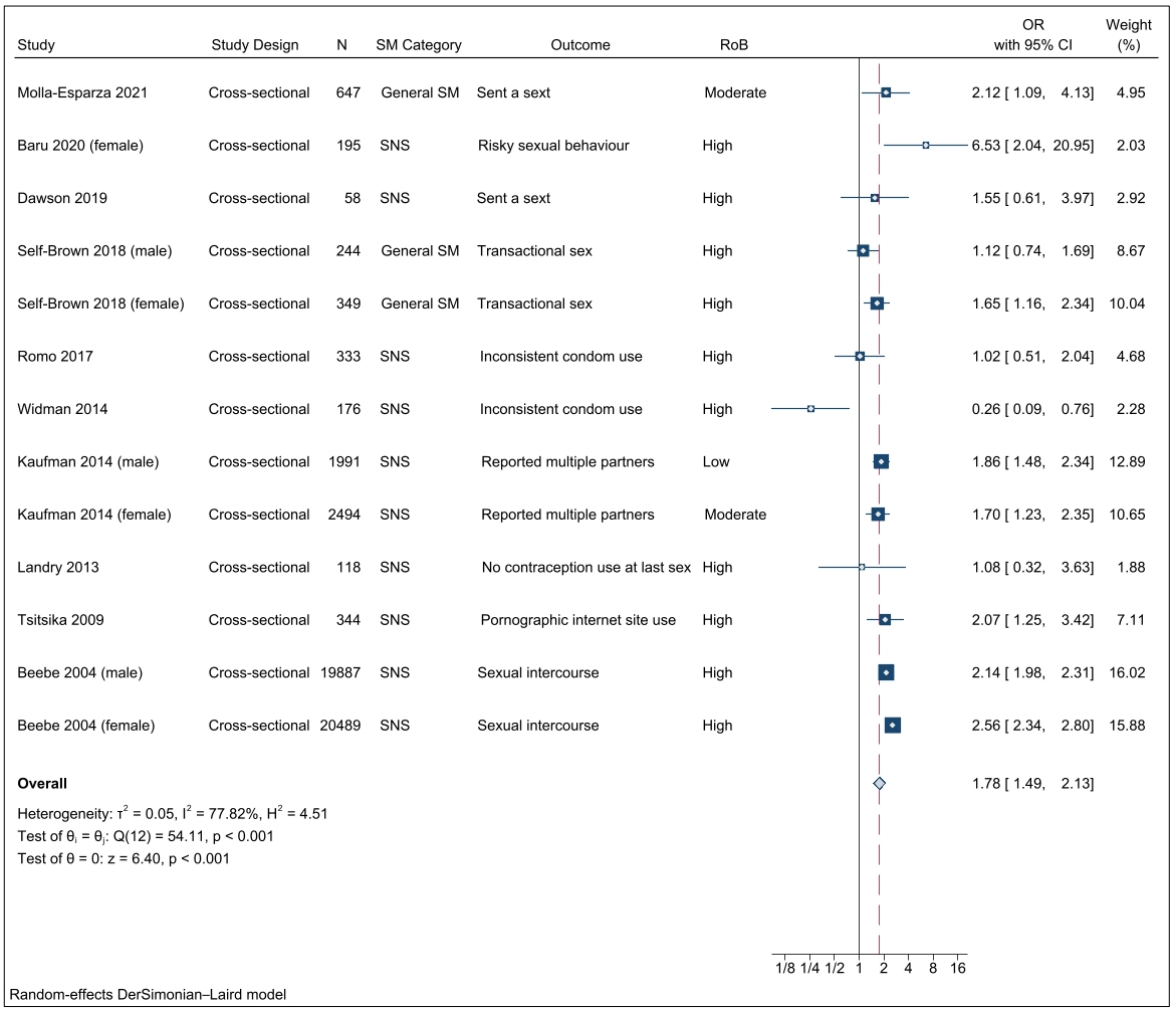
Figure A17.5.1. Effect direction plot for studies of the association between social media use and adolescent engagement in sexual risk behaviour by social media exposure. Arrow size indicates sample size; arrow colour indicates study risk of bias.



Legend: Sample size: represented by the size of the arrow, measured on a log scale. Outcome measure: number of outcome measures synthesised within each study. Studies organised by risk of bias grade, study design, and year of publication. Repeat cross-sectional studies, multiple study populations from different countries, and age subsets originating from the same study reported as separate studies. Abbreviation(s): NOS=Assessed via adapted Newcastle Ottawa Scale and SM=Social media.

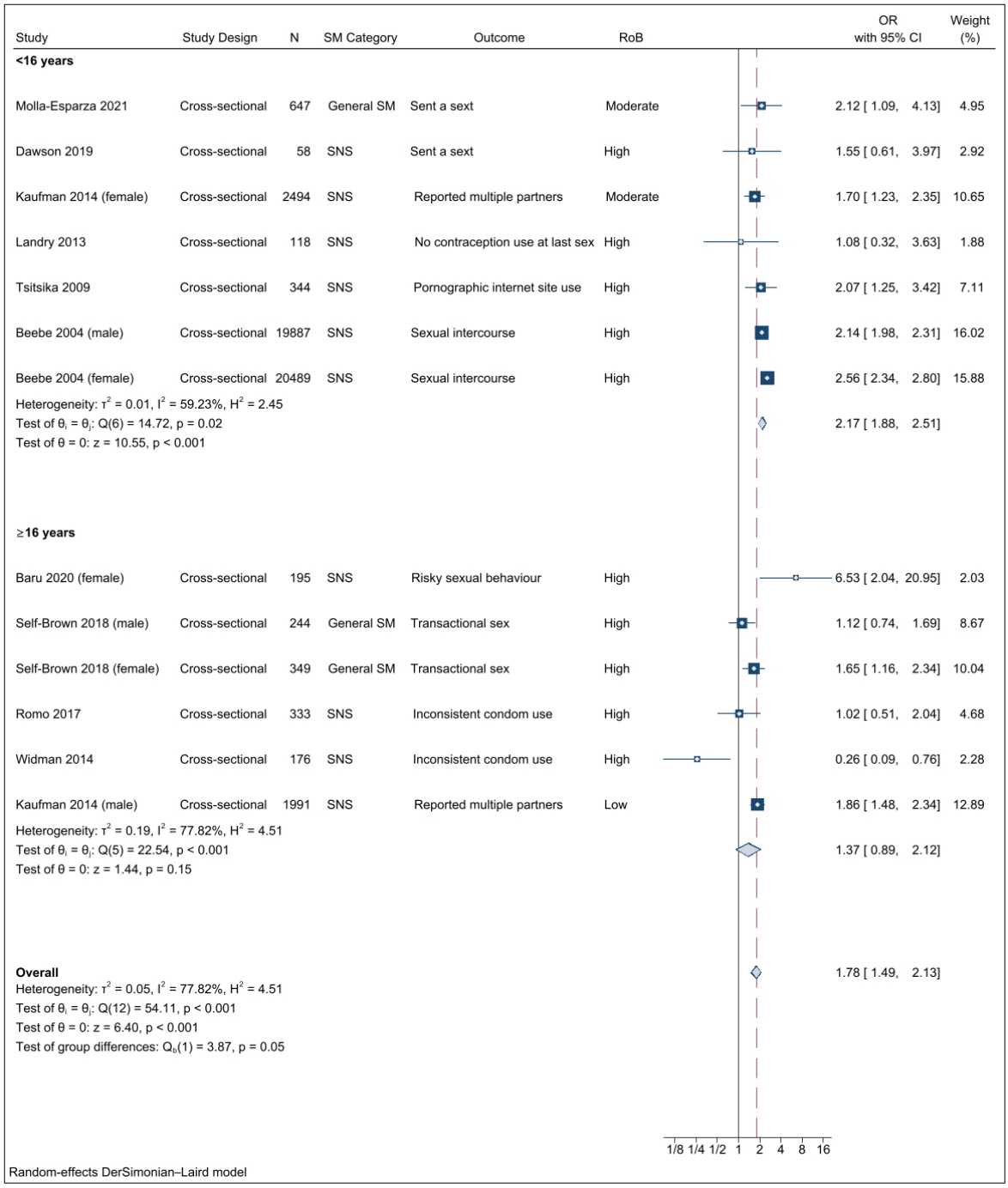
Forest plots for meta-analyses and subgroup analyses

Figure A17.5.2. Forest plot for association between frequency of social media use and sexual risk behaviour (also shown in Chapter 4)



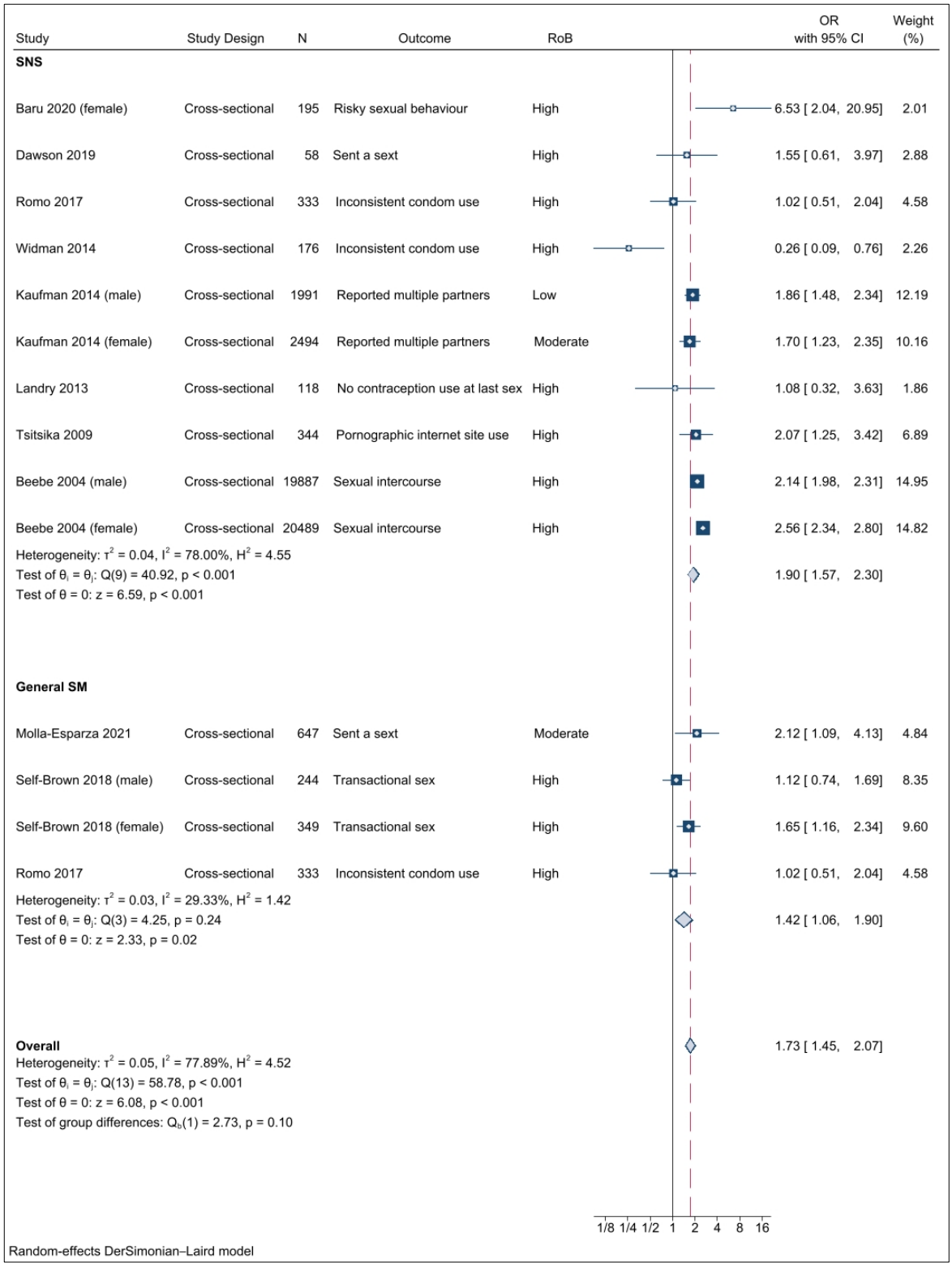
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=47,325. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.5.3. Forest plot for association between frequency of social media use and sexual risk behaviour, average age of study participants



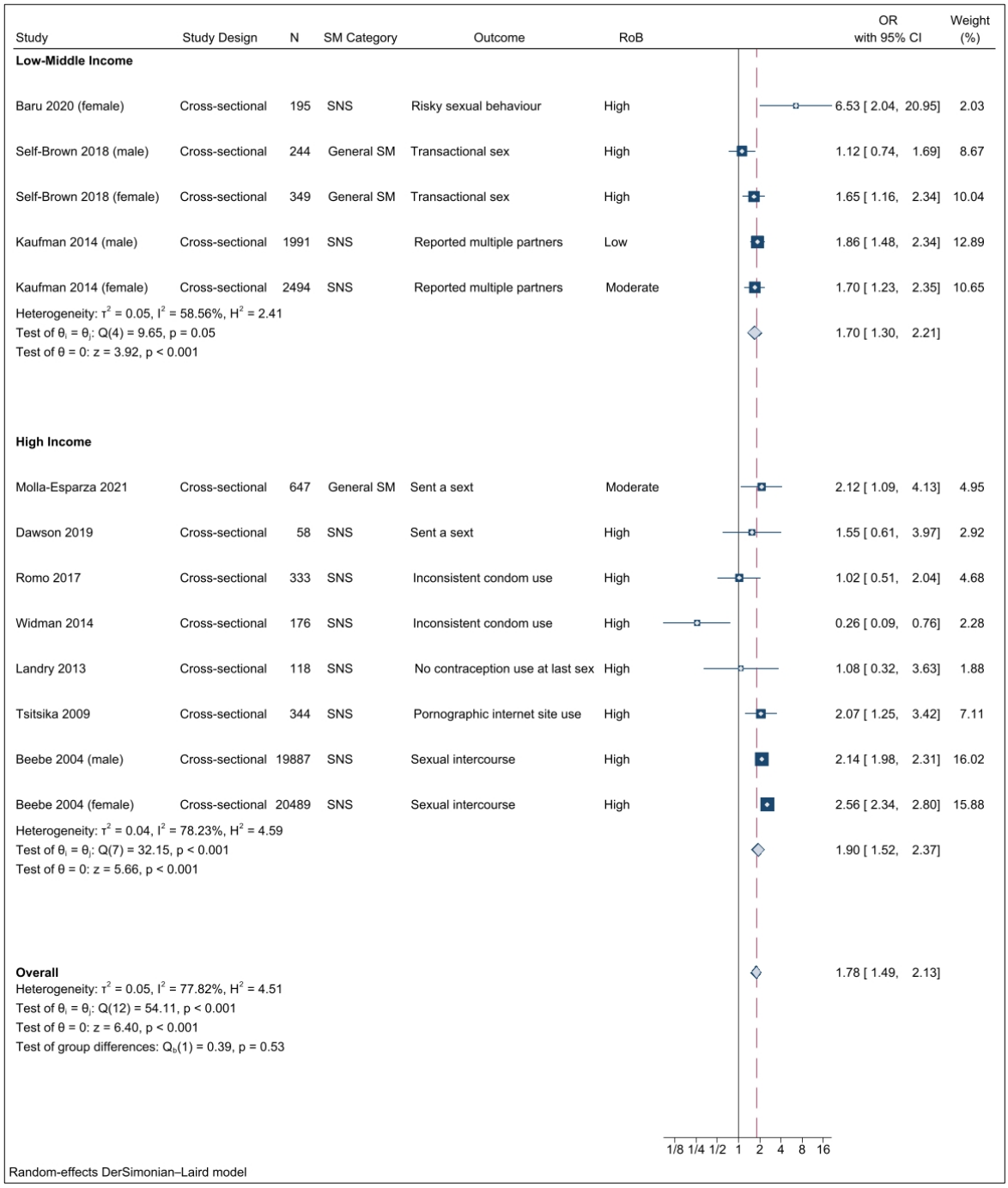
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=47,325. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.5.4. Forest plot for association between frequency of social media use and sexual risk behaviour, by social media category



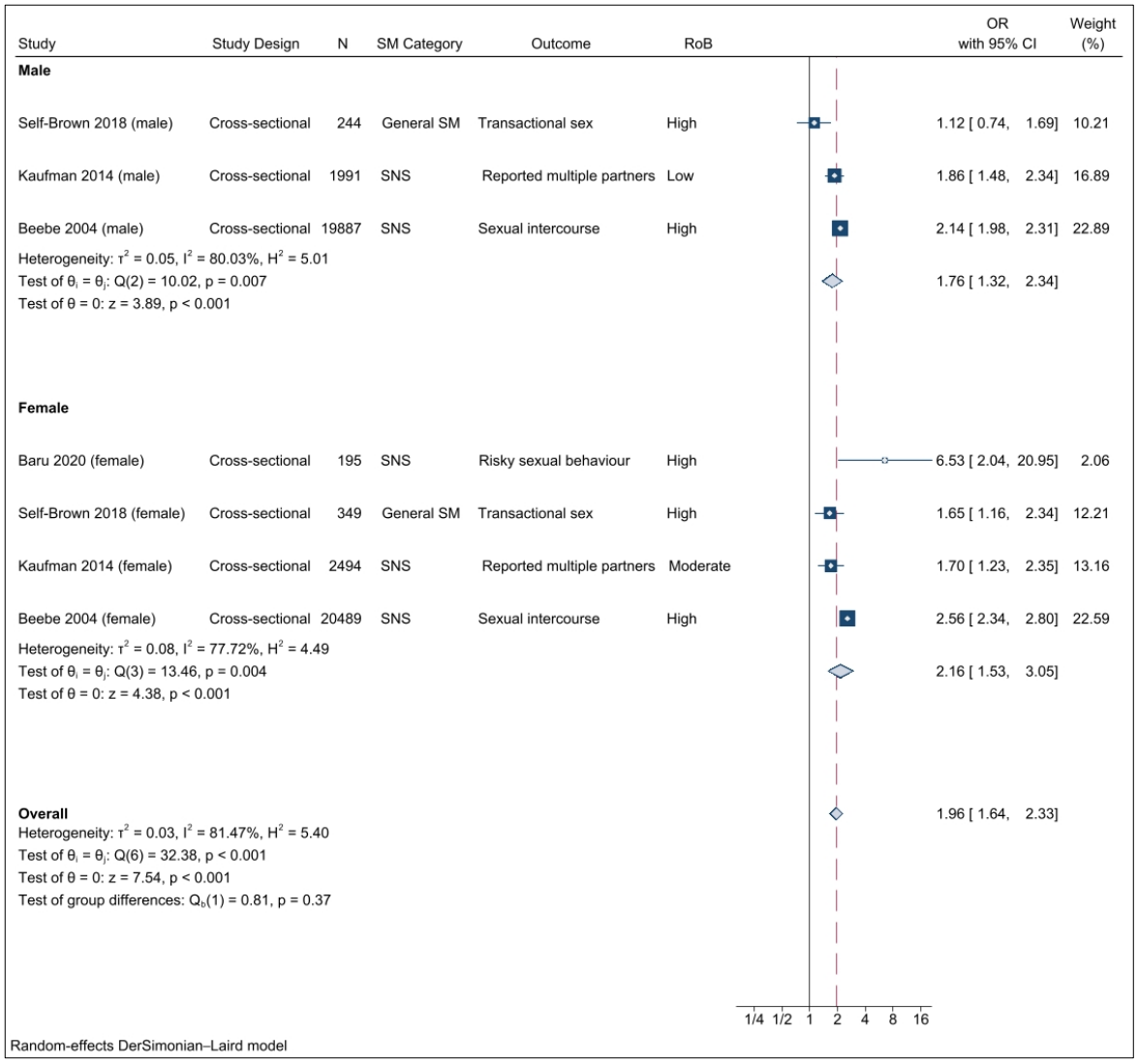
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=47,658. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.5.5. Forest plot for association between frequency of social media use and sexual risk behaviour, by development status of study setting[a]



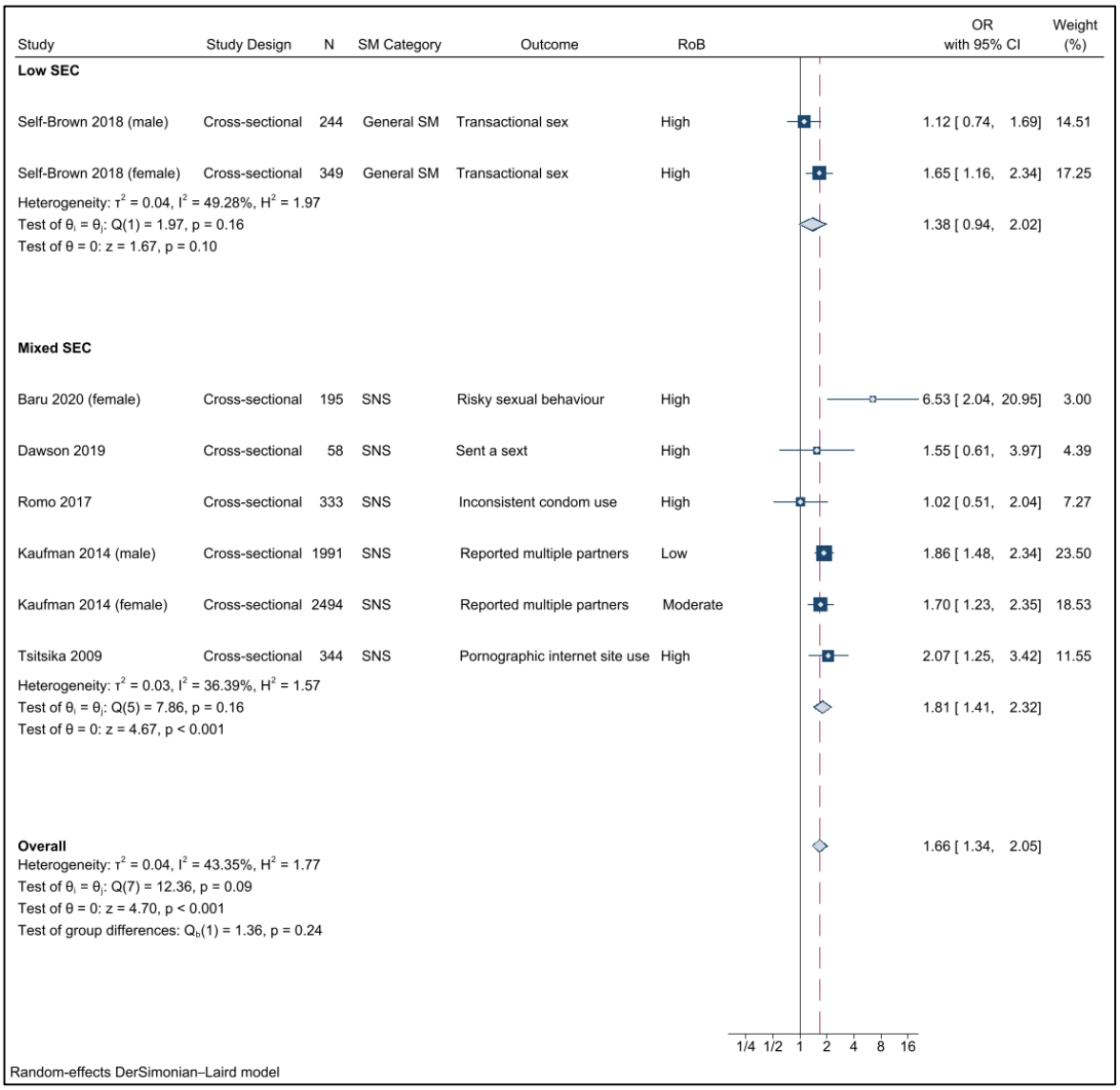
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. [a] Development status classified as per the World Bank Country Income Level Classification (World Bank, 2021). Total number of study participants=47,325. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.5.6. Forest plot for association between frequency of social media use and sexual risk behaviour, by sex



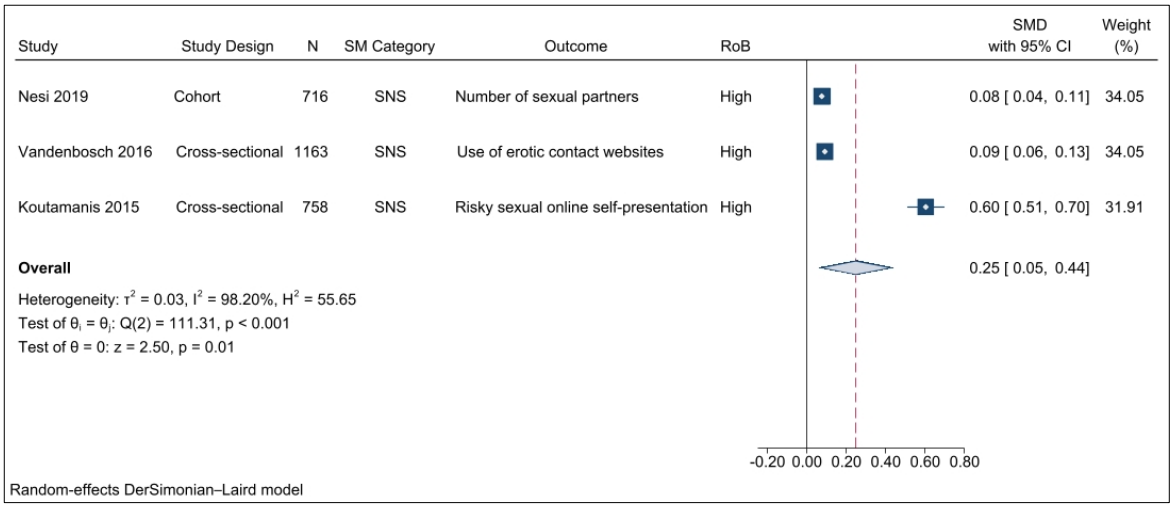
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=45,649. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.5.7. Forest plot for association between frequency of social media use sexual risk behaviour, by average socioeconomic circumstance(s) of study participants



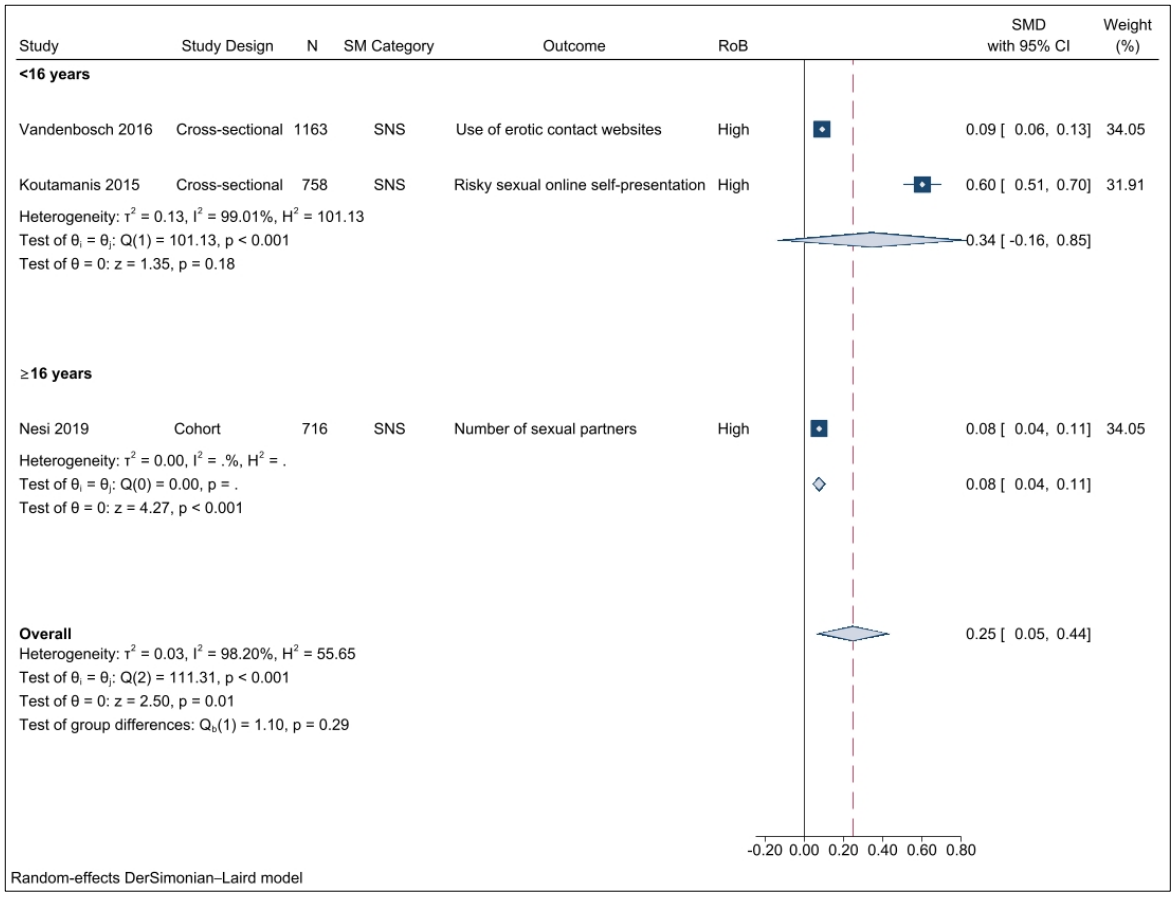
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=6,008. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SEC=Socioeconomic circumstance(s); SM=Social media; and SNS=Social networking site(s).

Figure A17.5.8. Forest plot for association between frequency of social media use and sexual risk behaviour



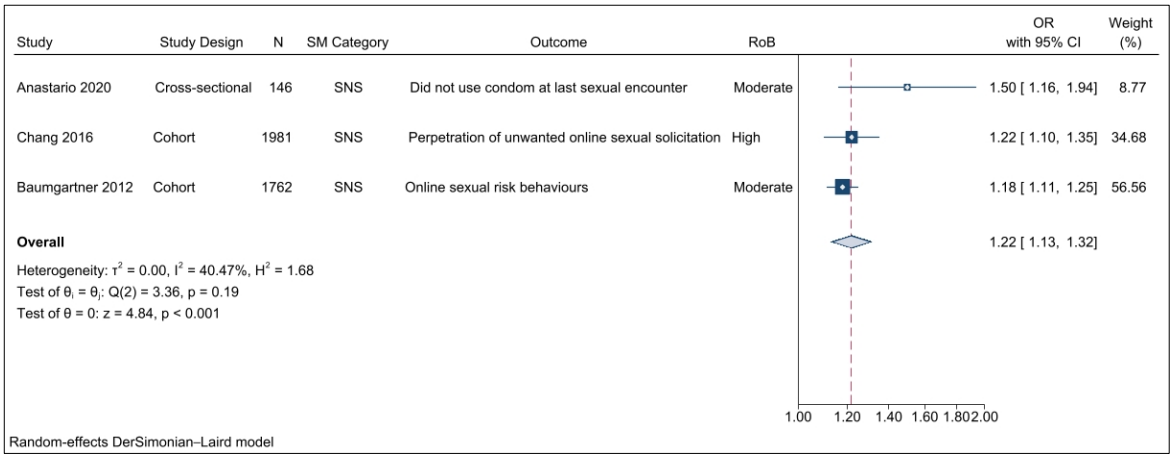
Legend: Figure presents forest plot for continuous exposure & continuous outcome meta-analysis, with standardised mean difference (SMD) used as common metric. Total number of study participants=2,637. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SMD=Standardised mean difference; and SNS= Social networking site(s).

Figure A17.5.9. Forest plot for association between frequency of social media use and sexual risk behaviour, by average age of study participants



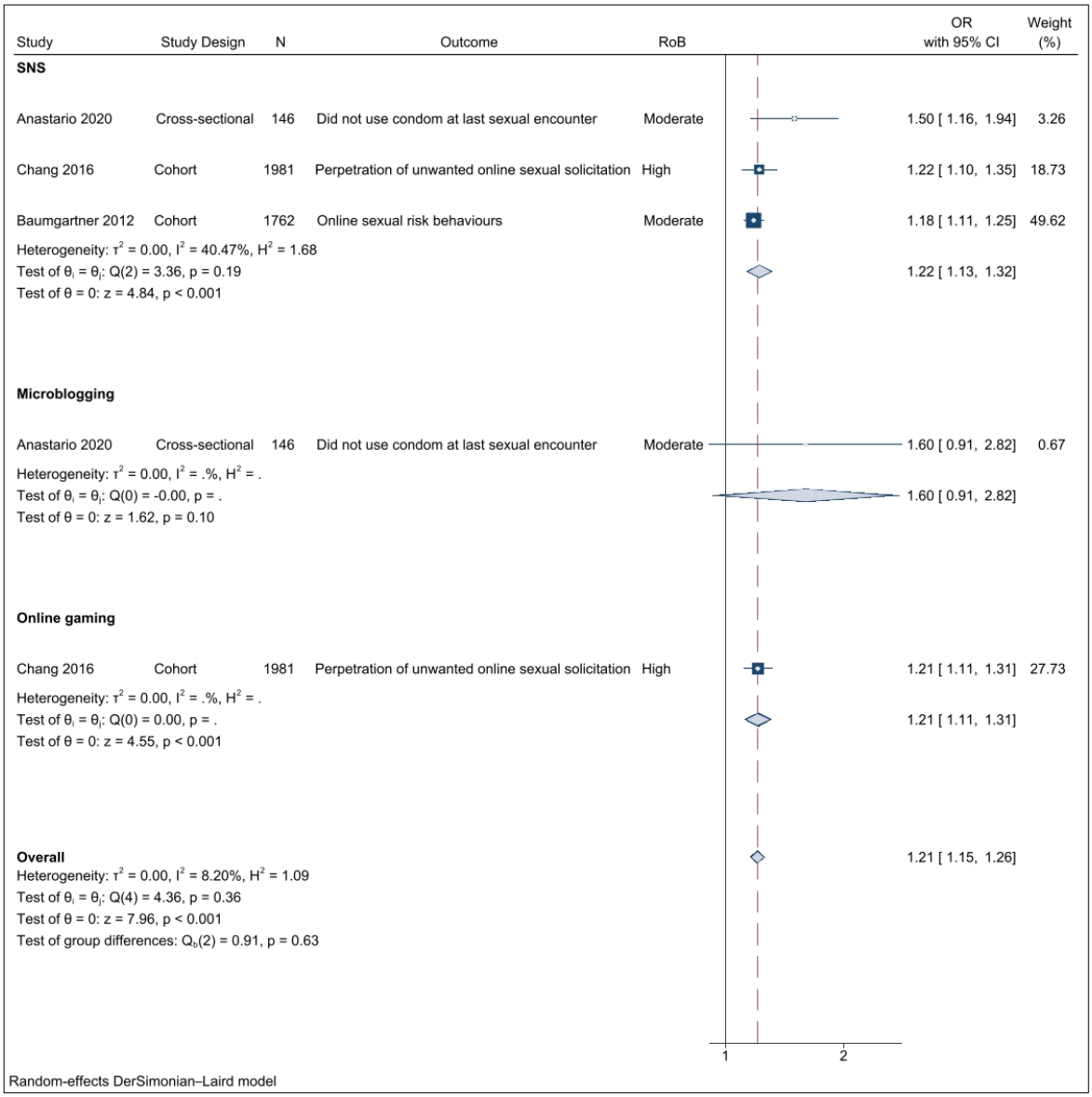
Legend: Figure presents forest plot for continuous exposure & continuous outcome subgroup analysis, with standardised mean difference (SMD) used as common metric. Total number of study participants=2,637. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SMD=Standardised mean difference; and SNS=Social networking site(s).

Figure A17.5.10. Forest plot for association between frequency of social media use and sexual risk behaviour



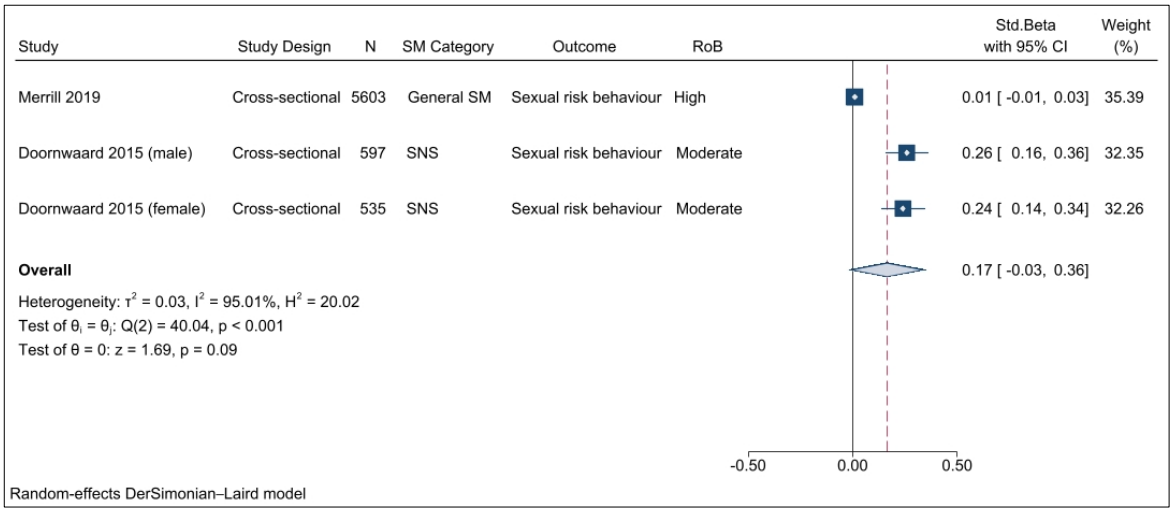
Legend: Figure presents forest plot for continuous exposure & binary outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=3,889. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.5.11. Forest plot for association between frequency of social media use and sexual risk behaviour, by social media category



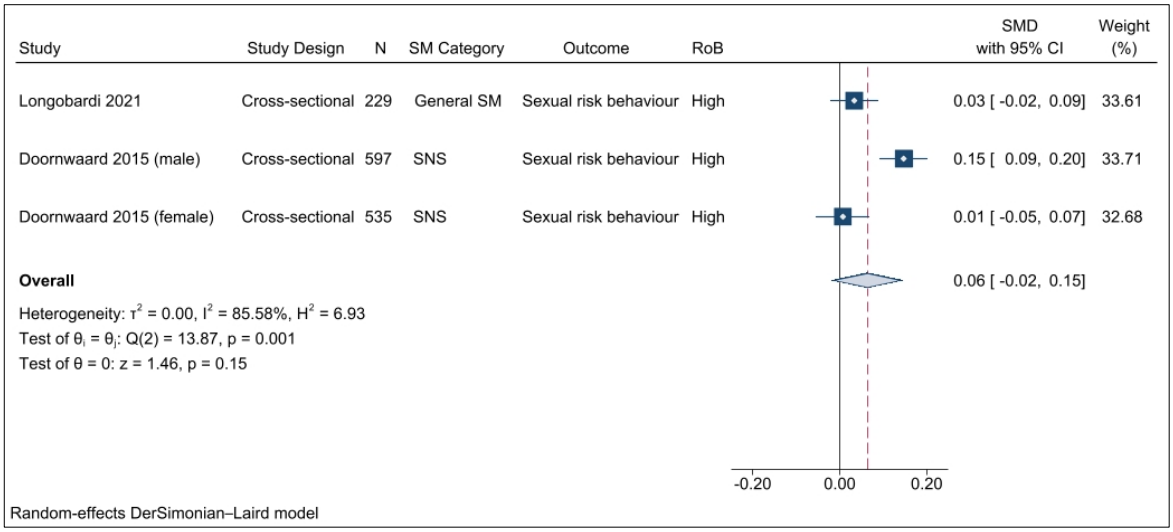
Legend: Figure presents forest plot for continuous exposure & binary outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=6,016. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; SM=Social media; and SNS=Social networking site(s).

Figure A17.5.12. Forest plot for association between time spent on social media and sexual risk behaviour



Legend: Figure presents forest plot for continuous exposure & continuous outcome meta-analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=6,735. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.5.13. Forest plot for association between time spent on social media and sexual risk behaviour



Legend: Figure presents forest plot for continuous exposure & continuous outcome meta-analysis, with standardised mean difference (SMD) used as common metric. Total number of study participants=1,361. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SMD=Standardised mean difference; and SNS=Social networking site(s).

Meta-regression

Table A17.5.1. Summary of meta-regression findings for sexual risk behaviour

Exposure	Outcome	Study level variable	Coefficient (95% CI)	*p-value*	Corresponding forest plot
Frequency of use (binary exposure)	Sexual risk behaviour	Average age of study participants (reference category-<16 years)	≥16 years: -0.36 (-0.68 to 0.04)	0.03	Figure A17.5.3.
		SM category (reference category-General SM)	SNS: 0.30 (-0.07 to 0.67)	0.12	Figure A17.5.4.
		Development status of study setting (reference category-Low-middle income)	High-income: 0.11 (-0.23 to 0.45)	0.52	Figure A17.5.5.

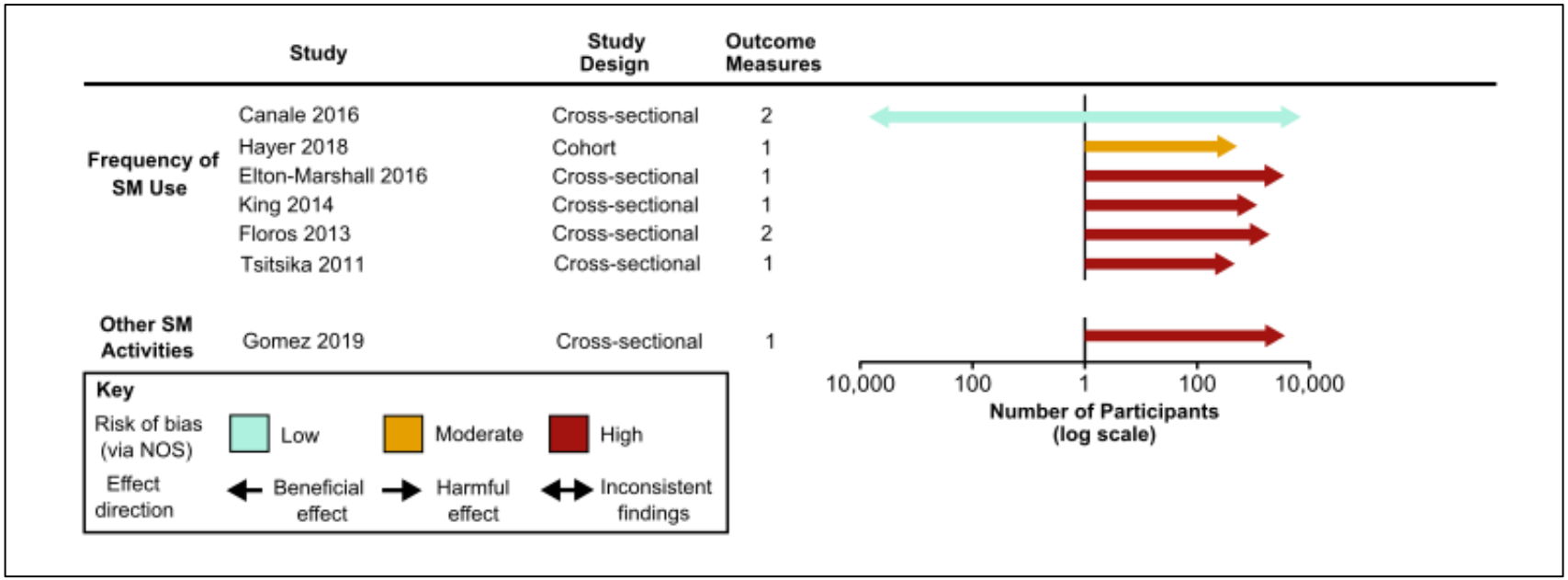
Legend: Results with p<0.05 in bold. Abbreviation(s): CI=Confidence interval; SM=Social media; and SNS=Social networking site(s).

Section A17.6 Gambling

Effect direction

Figure A17.6.1 shows the effect direction in those studies investigating gambling behaviour by exposure. After excluding one study demonstrating inconsistent effects (participant n=14,478; Canale *et al.*, 2016) for frequency of social media use, all studies reported harmful associations (95% CI 56.6 to 100.0%; study n=5; participant n=7,928; sign test p=0.06). Other social media activities was investigated by one study, which demonstrated a harmful association on gambling behaviours (20.7 to 100.0%; participant n=3,772; insufficient data to conduct sign test).

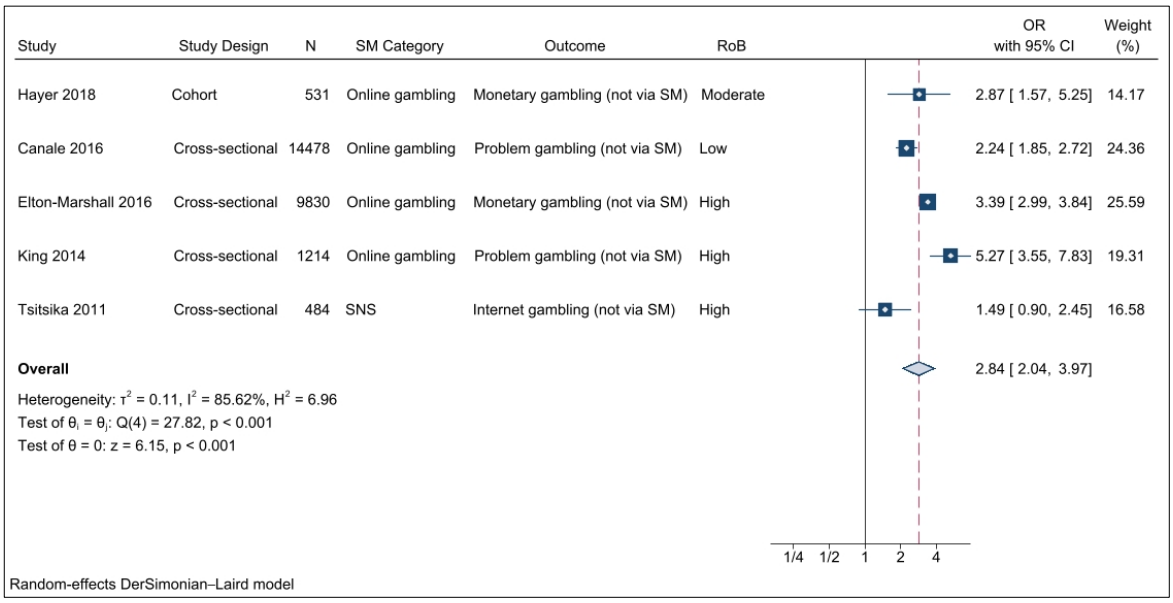
Figure A17.6.1. Effect direction plot for studies of the association between social media use and adolescent gambling by social media exposure. Arrow size indicates sample size; arrow colour indicates study risk of bias.



Legend: Sample size: represented by the size of the arrow, measured on a log scale. Outcome measure: number of outcome measures synthesised within each study. Studies organised by risk of bias grade, study design, and year of publication. Repeat cross-sectional studies, multiple study populations from different countries, and age subsets originating from the same study reported as separate studies. Abbreviation(s): NOS=Assessed via adapted Newcastle Ottawa Scale and SM=Social media.

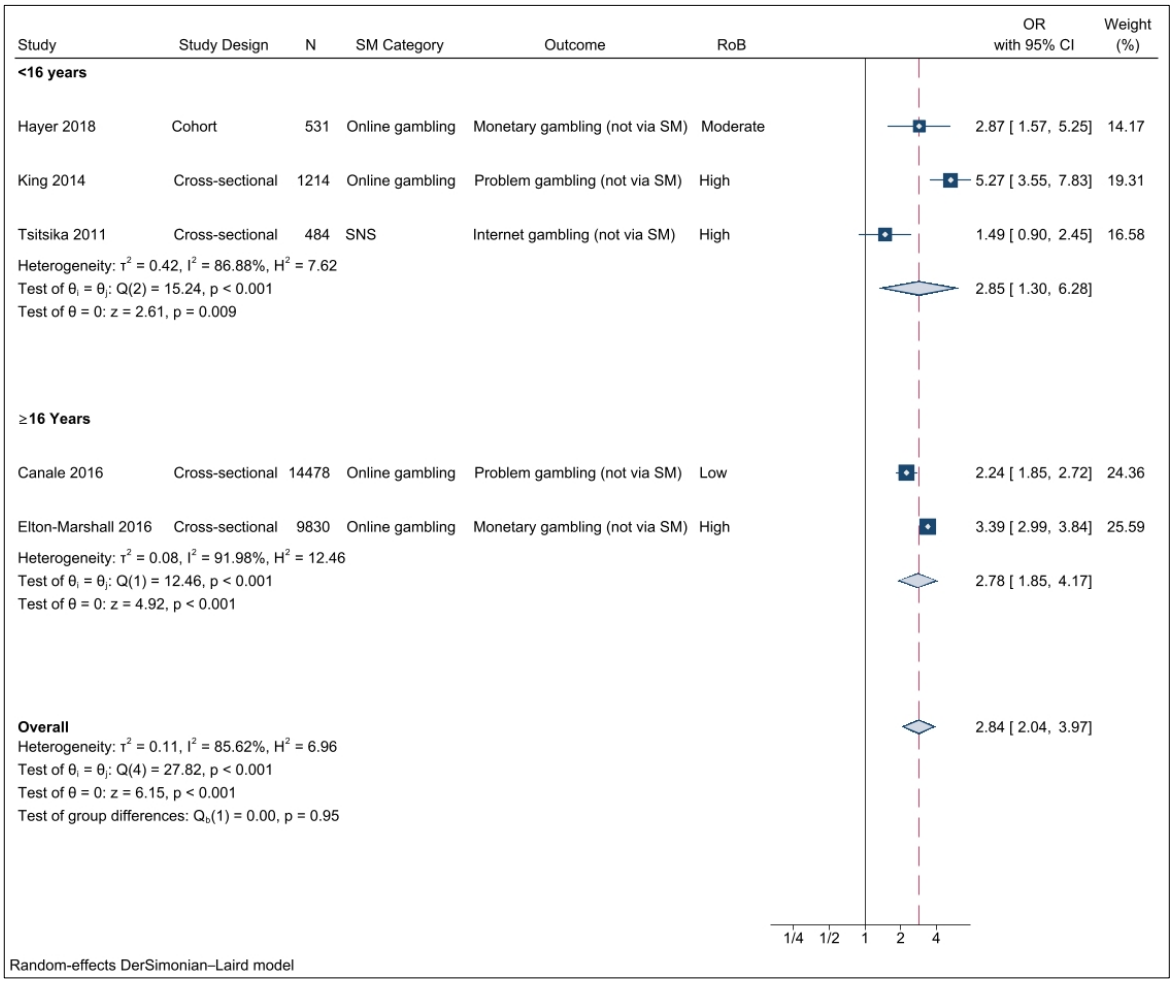
Forest plots for meta-analyses and subgroup analyses

Figure A17.6.2. Forest plot for association between frequency of social media use and gambling (not via social media) (also shown in Chapter 4)



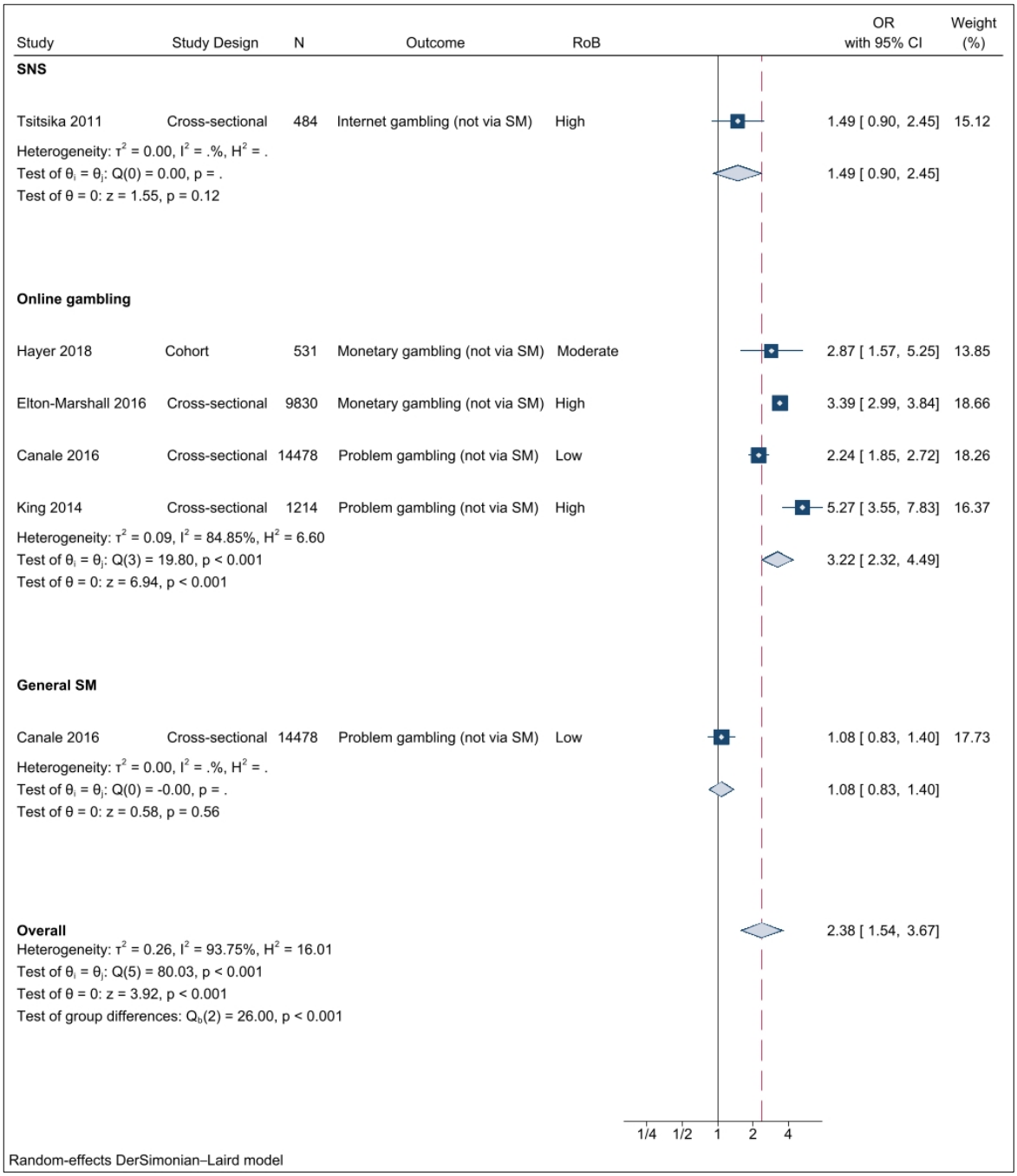
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=26,537. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.6.3. Forest plot for association between frequency of social media use and gambling (not via social media), by average age of study participants



Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=26,537. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.6.4. Forest plot for association between frequency of social media use and gambling (not via social media), by social media category



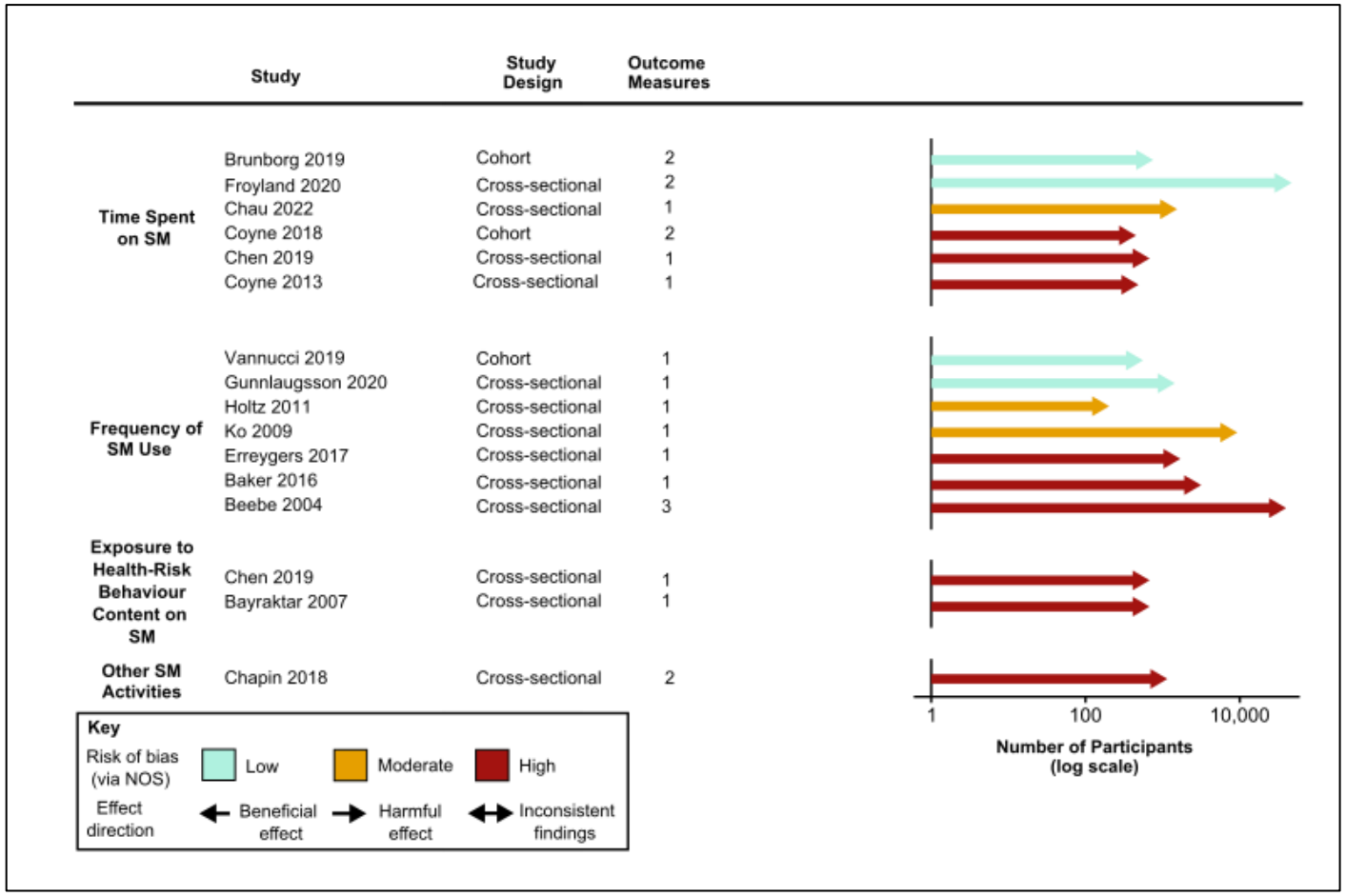
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=41,015. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Section A17.7 Anti-social behaviour

Effect direction

Figure A17.7.1 demonstrates the effect direction in those studies investigating anti-social risk behaviour by exposure. One study investigated more than one exposure type (Chen *et al.*, 2019). Across all investigated exposures, all studies demonstrated harmful associations of social media use (time spent on social media: 95% CI 61.0 to 100.0%, study n=6, participant n=51,611, sign test p=0.03; frequency of social media use: 64.6 to 100.0%, study n=7, participant n=56,918, sign test p=0.02; and exposure to health-risk behaviour content on social media: 34.2 to 100.0%, study n=2, participant n=1372, insufficient data to conduct sign test). Other social media activities was investigated by one study, which demonstrated a harmful effect (20.7 to 100.0%; participant n=1,167; insufficient data to conduct sign test.

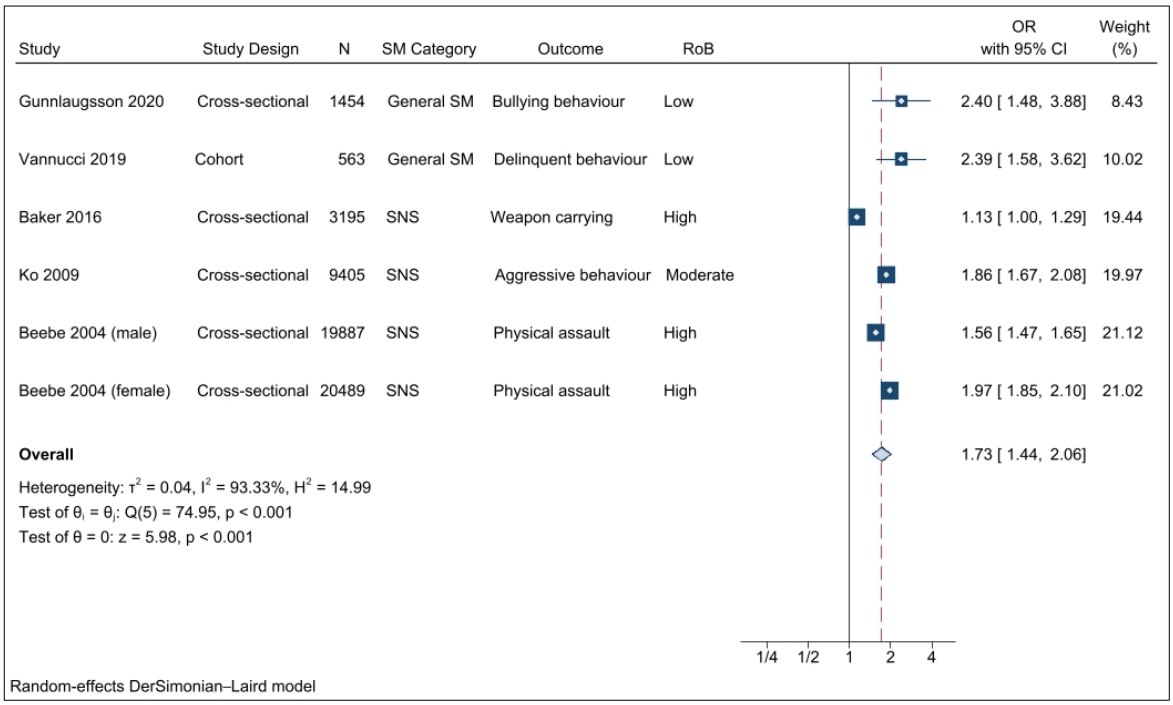
Figure A17.7.1. Effect direction plot for studies of the association between social media use and adolescent engagement in anti-social behaviour by social media exposure. Arrow size indicates sample size; arrow colour indicates study risk of bias.



Legend: Sample size: represented by the size of the arrow, measured on a log scale. Outcome measure: number of outcome measures synthesised within each study. Studies organised by risk of bias grade, study design, and year of publication. Repeat cross-sectional studies, multiple study populations from different countries, and age subsets originating from the same study reported as separate studies. Abbreviation(s): NOS=Assessed via adapted Newcastle Ottawa Scale and SM=Social media.

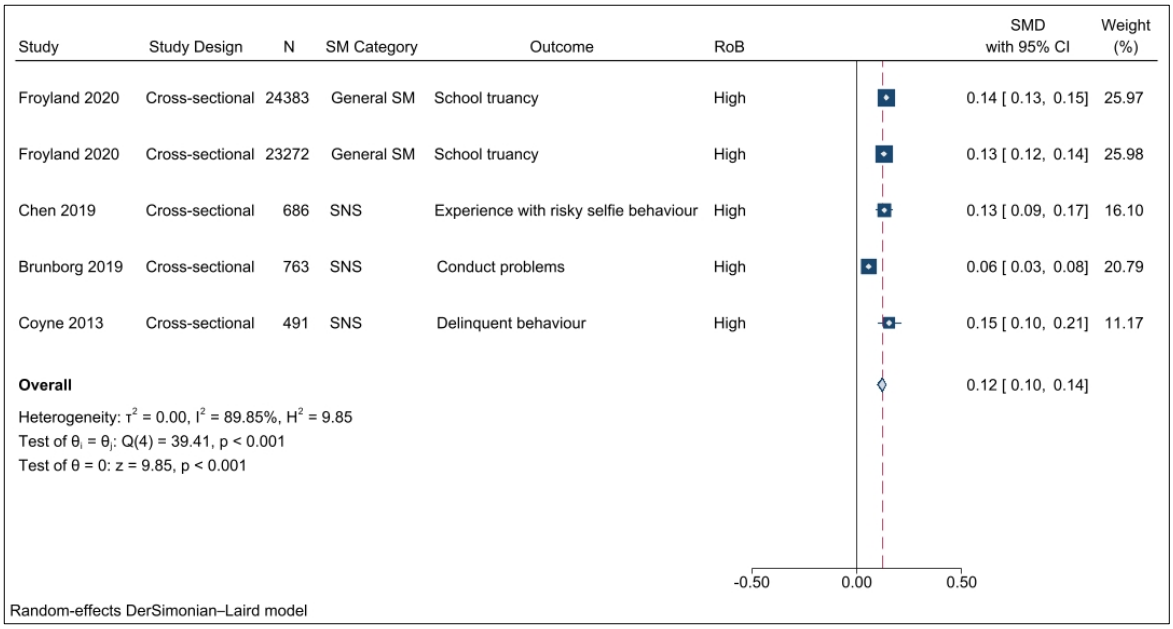
Forest plots for meta-analyses and subgroup analyses

Figure A17.7.2. Forest plot for association between frequency of social media use and anti-social behaviour (also shown in Chapter 4)



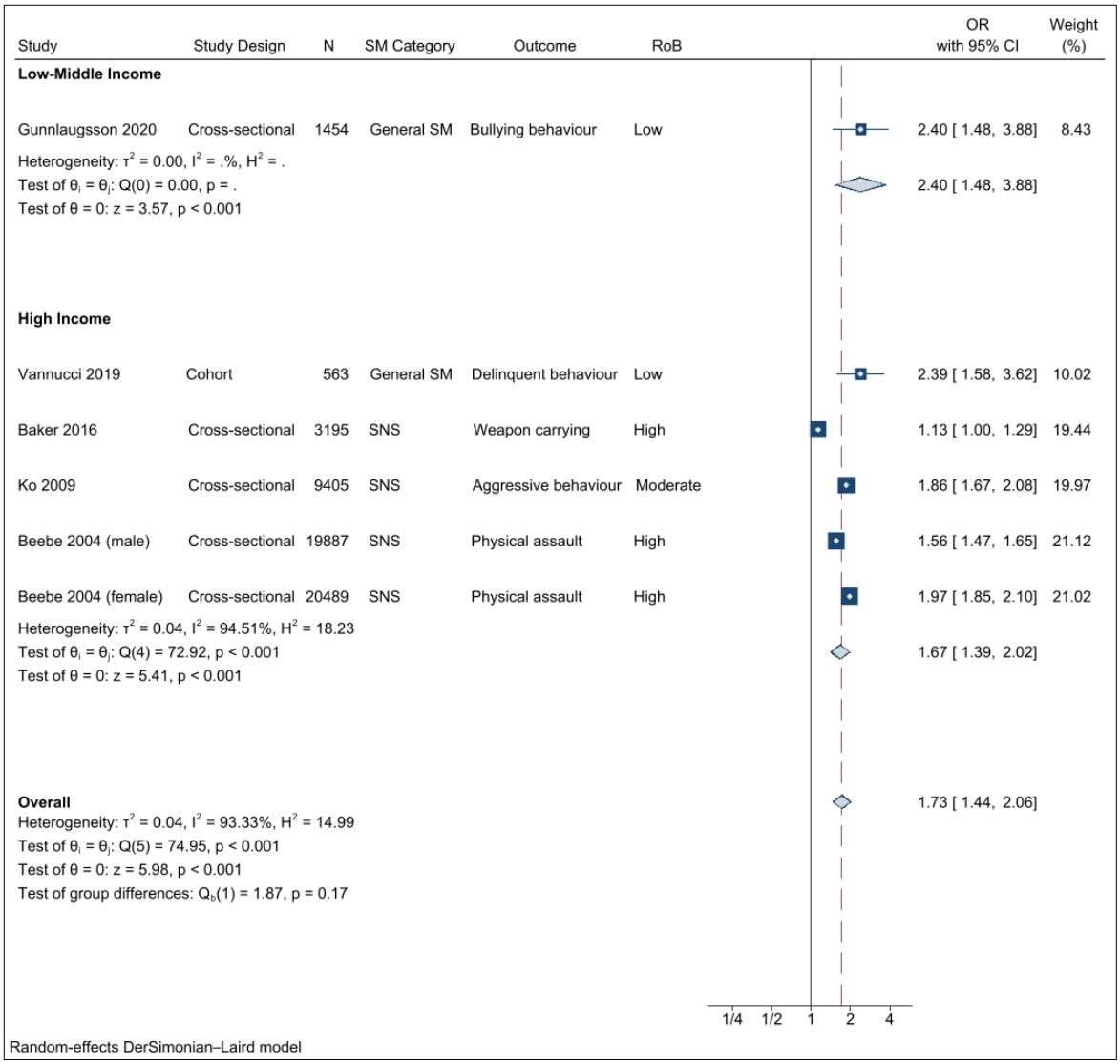
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome meta-analysis, with odds (OR) used as common metric. Total number of study participants=54,993. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.7.3. Forest plot for association between time spent on social media and anti-social behaviour



Legend: Figure presents forest plot for continuous exposure & continuous outcome meta-analysis, with standardised mean difference (SMD) used as common metric. Total number of study participants=49,595. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SMD=Standardised mean difference; and SNS=Social networking site(s).

Figure A17.7.4. Forest plot for association between frequency of social media use and anti-social behaviour, by development status of study setting[a]

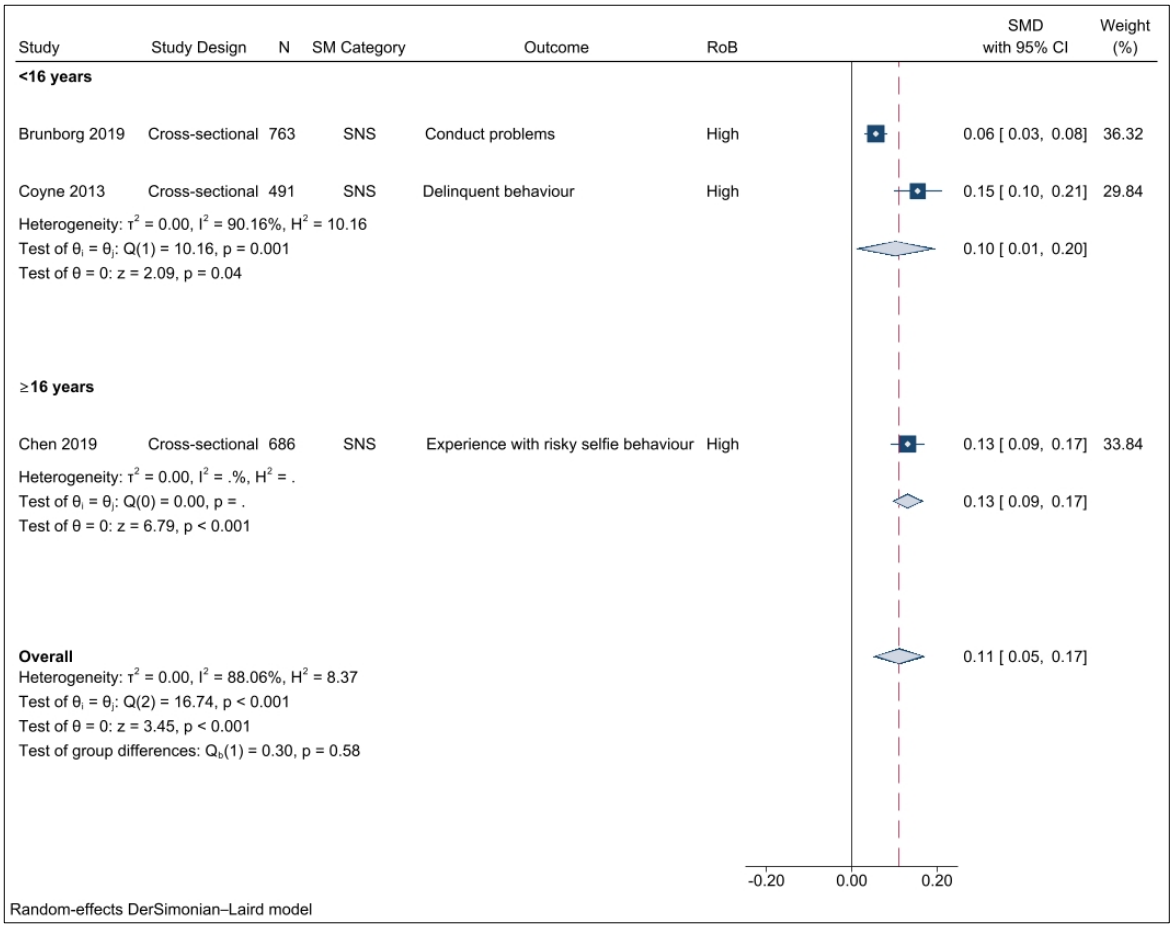


Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome subgroup analysis, with odds (OR) used as common metric.
[a] Development status classified as per the World Bank Country Income Level Classification (World Bank, 2021). Total number of study participants=54,993. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.7.5. Forest plot for association between frequency of social media use and anti-social behaviour, by social media category

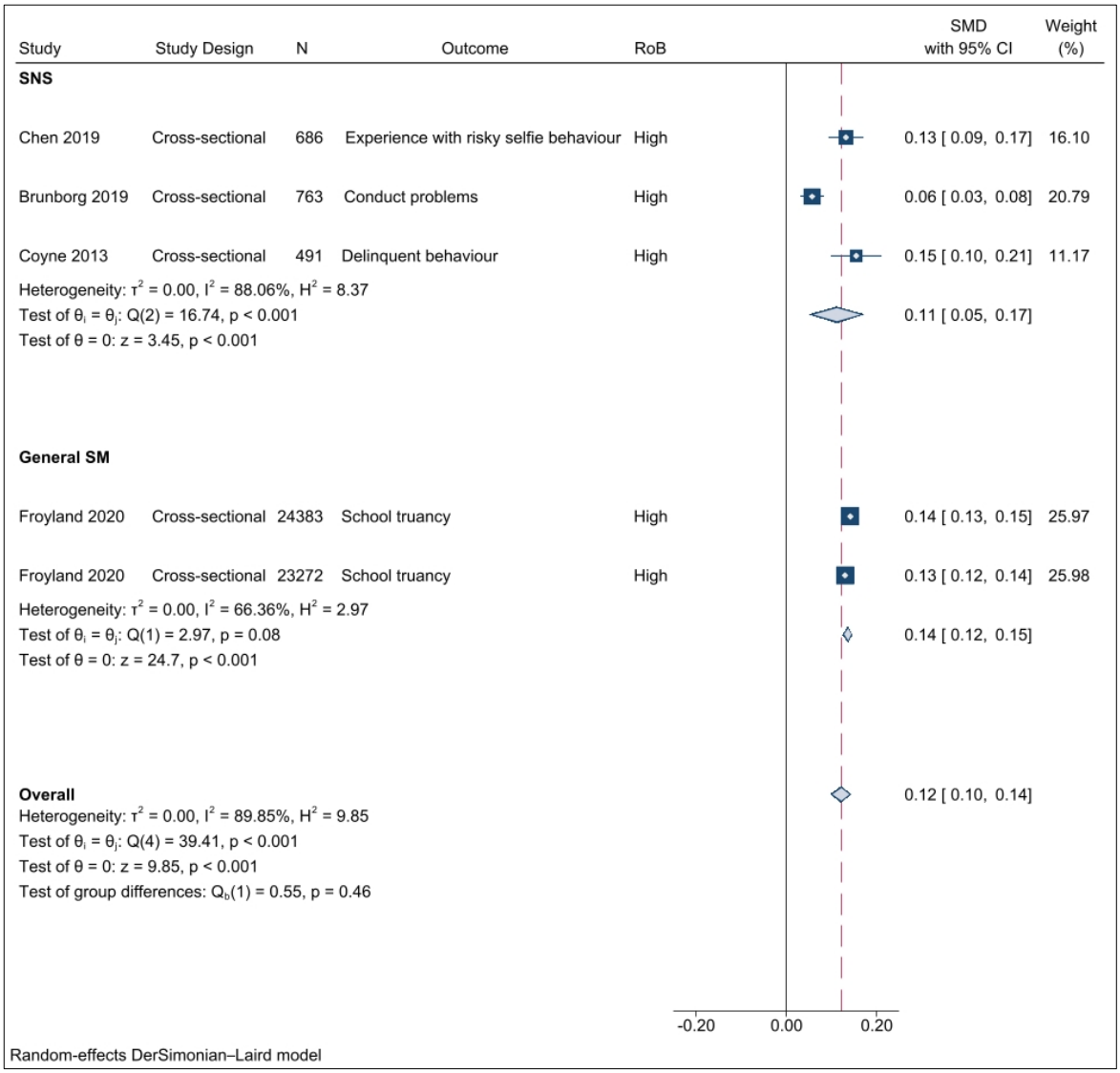
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome subgroup analysis, with odds (OR) used as common metric. Total number of study participants=73,803. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.7.6. Forest plot for association between time spent on social media and anti-social behaviour, by average age of study participants



Legend: Figure presents forest plot for continuous exposure & continuous outcome subgroup analysis, with standardised mean difference (SMD) used as common metric. Total number of study participants=1,940. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SMD=Standardised mean difference; and SNS=Social networking site(s).

Figure A17.7.7. Forest plot for association between time spent on social media and anti-social behaviour, by social media category



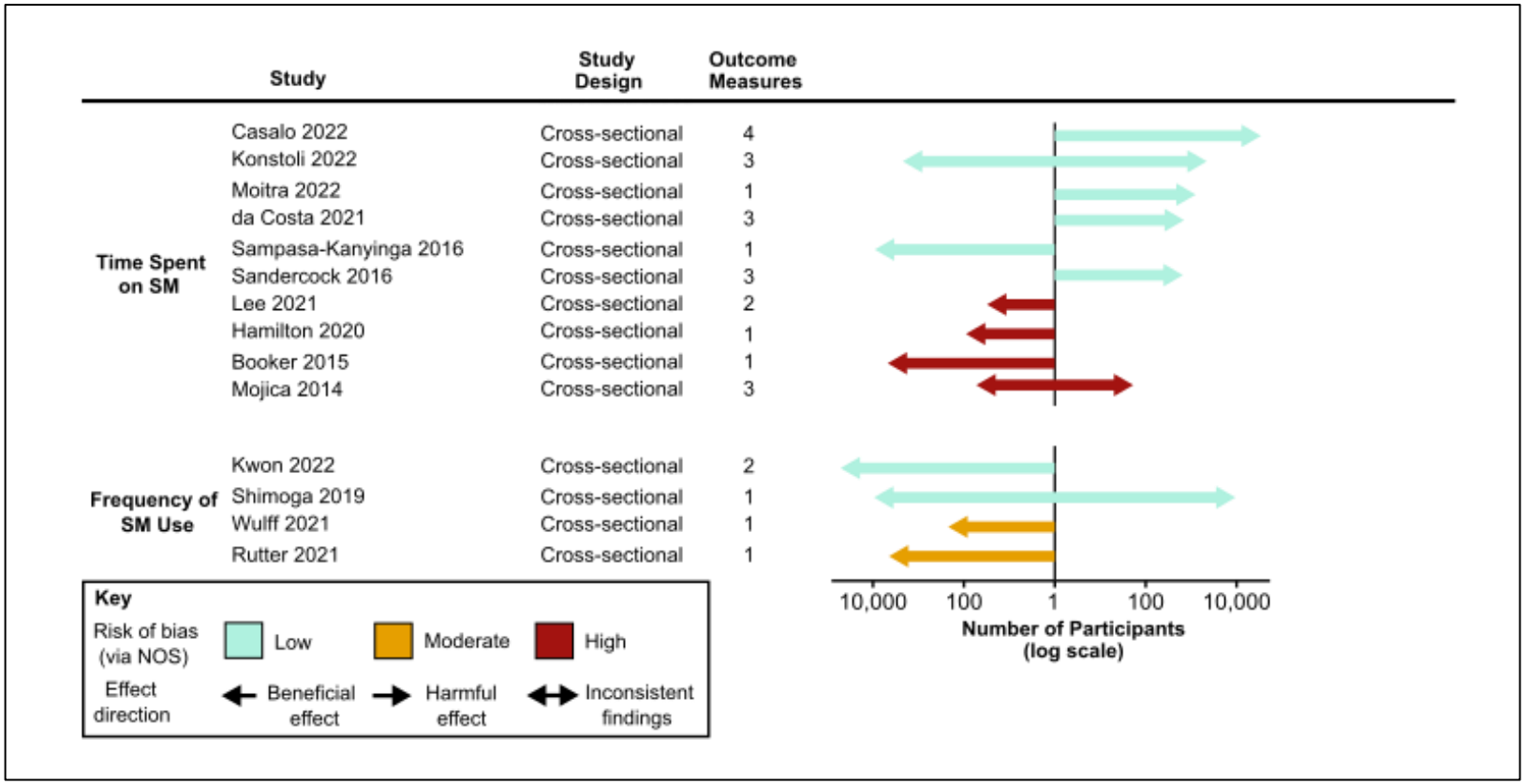
Legend: Figure presents forest plot for continuous exposure & continuous outcome meta-analysis, with standardised mean difference (SMD) used as common metric. Total number of study participants=49,595. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SMD=Standardised mean difference; and SNS=Social networking site(s).

Section A17.8 Inadequate physical activity

Effect direction

Figure A17.8.1 demonstrates the effect direction in those studies (n=14) investigating inadequate physical activity by exposure. After excluding those with inconsistent findings (n=3; Mojica *et al.*, 2014; Shimoga *et al.*, 2019; Kontostoli *et al.*, 2022), for time spent on social media, 4/8 of studies reported harmful associations (95% CI 21.5 to 78.5%; participant n=52,475; sign test p=1.00), whilst for frequency of social media use no study reported a harmful association (0.00 to 56.1%; study n=3; participant n=57,953; sign test p=0.25).

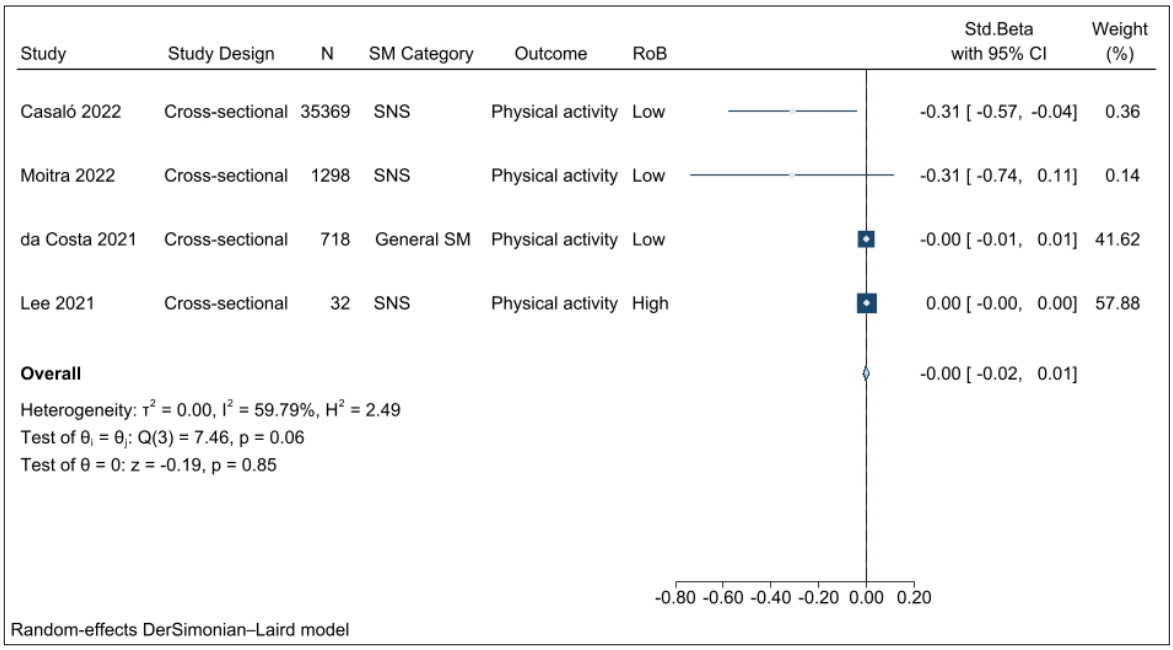
Figure A17.8.1. Effect direction plot for studies of the association between social media use and adolescent inadequate physical activity by social media exposure. Arrow size indicates sample size; arrow colour indicates study risk of bias.



Legend: Sample size: represented by the size of the arrow, measured on a log scale. Outcome measure: number of outcome measures synthesised within each study. Studies organised by risk of bias grade, study design, and year of publication. Repeat cross-sectional studies, multiple study populations from different countries, and age subsets originating from the same study reported as separate studies. Shimoga *et al.* (2019) assessed frequency of social media use and one outcome (physical activity) across three subgroups. Two of the three subgroups showed increased frequency of social media resulted in decreased physical activity, and one subgroup showed increased frequency of social media resulted in increased physical activity; thus, this study was classified as demonstrating inconsistent findings. Abbreviation(s): NOS=Assessed via adapted Newcastle Ottawa Scale and SM=Social media.

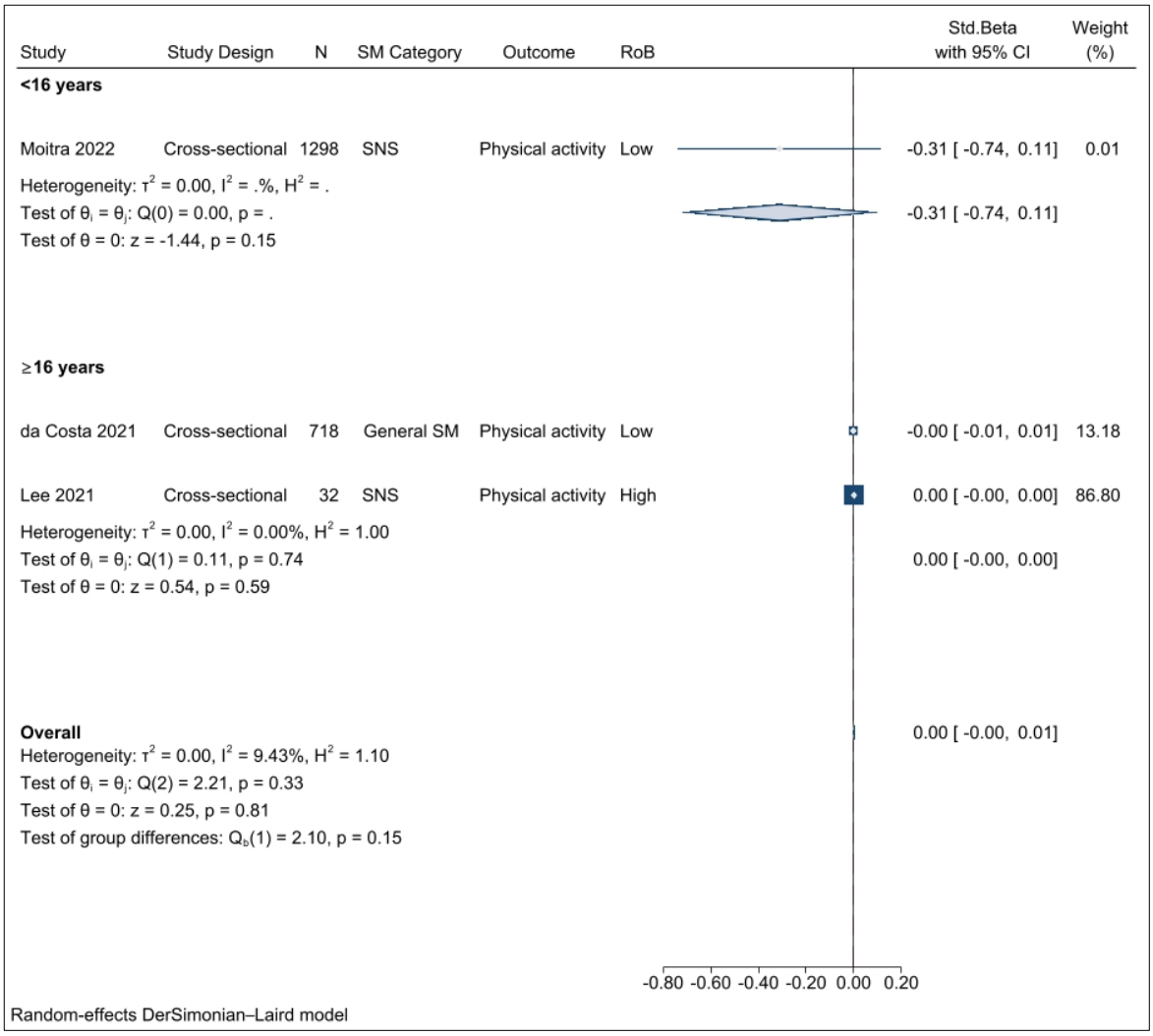
Forest plots for meta-analyses and subgroup analyses

Figure A17.8.2. Forest plot for association between time spent on social media and inadequate physical activity



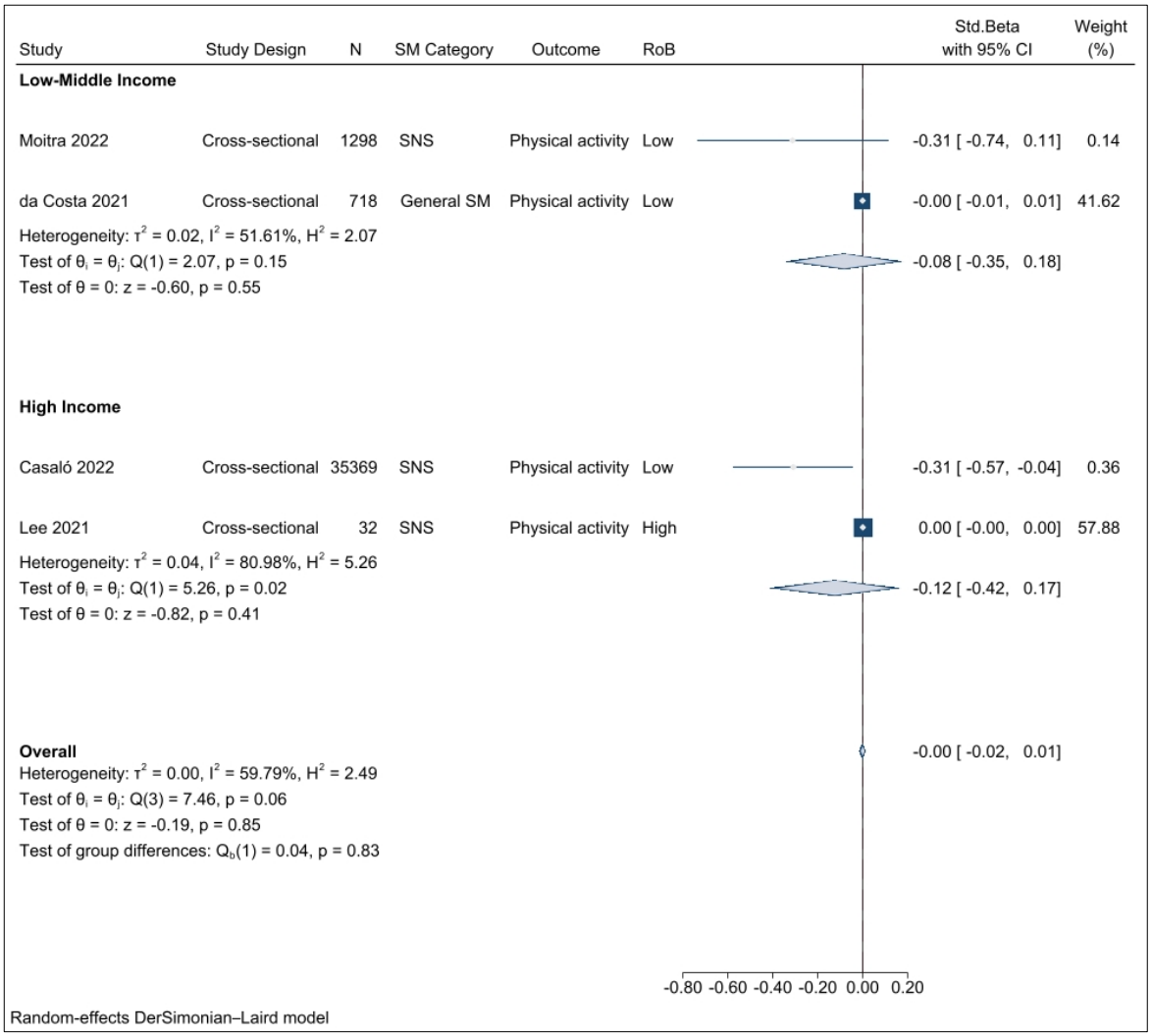
Legend: Figure presents forest plot for continuous exposure & continuous outcome meta-analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=37,417. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.8.3. Forest plot for association between time spent on social media and inadequate physical activity, by average age of study participants



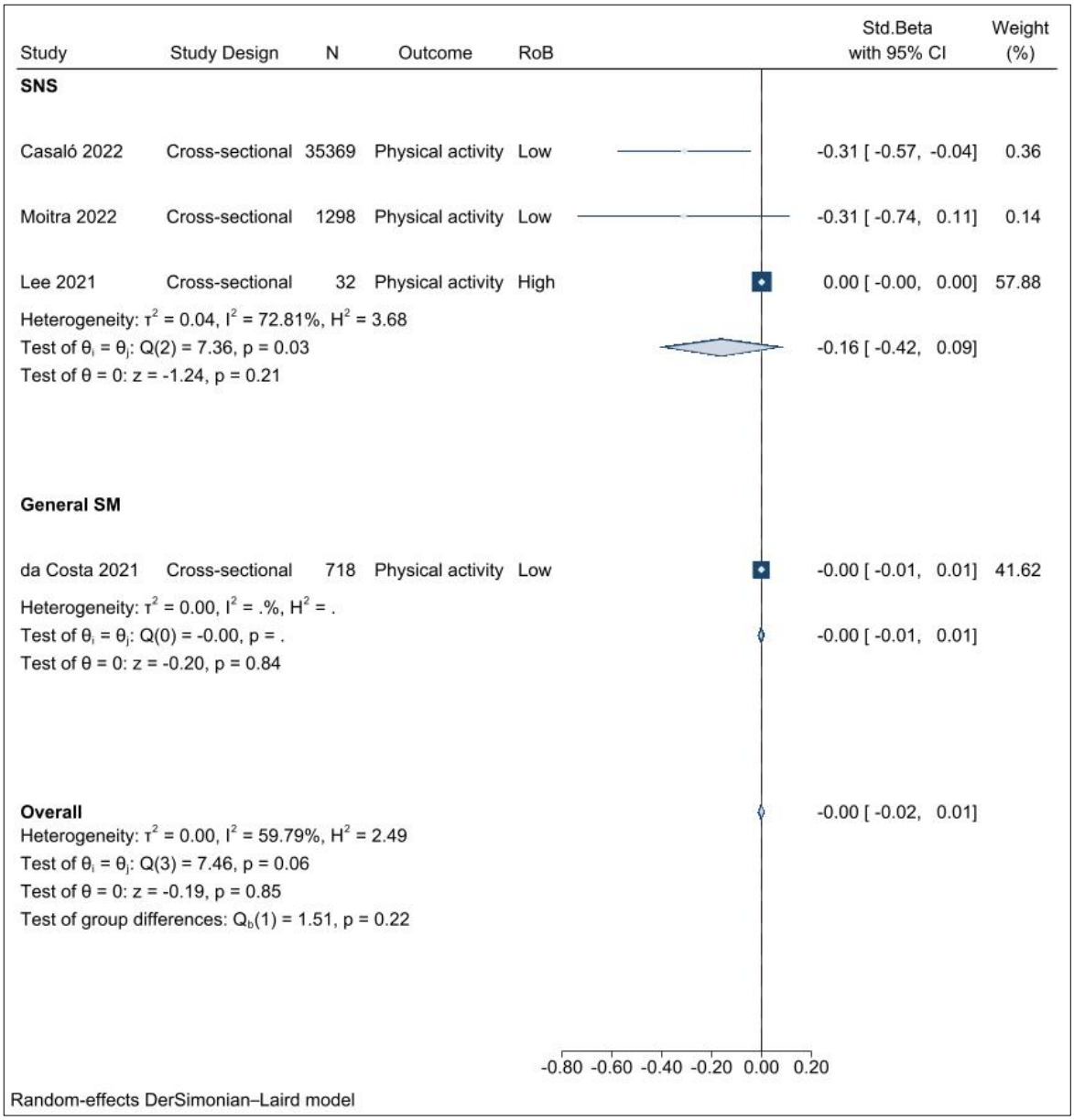
Legend: Figure presents forest plot for continuous exposure & continuous outcome subgroup analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=2,048. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.8.4. Forest plot for association between time spent on social media and inadequate physical activity, by development status of study setting[a]



Legend: Figure presents forest plot for continuous exposure & continuous outcome subgroup analysis, with standardised beta (Std. Beta) used as common metric. [a] Development status classified as per the World Bank Country Income Level Classification (World Bank, 2021). Total number of study participants=37,417. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.8.5. Forest plot for association between time spent on social media and inadequate physical activity, by social media category



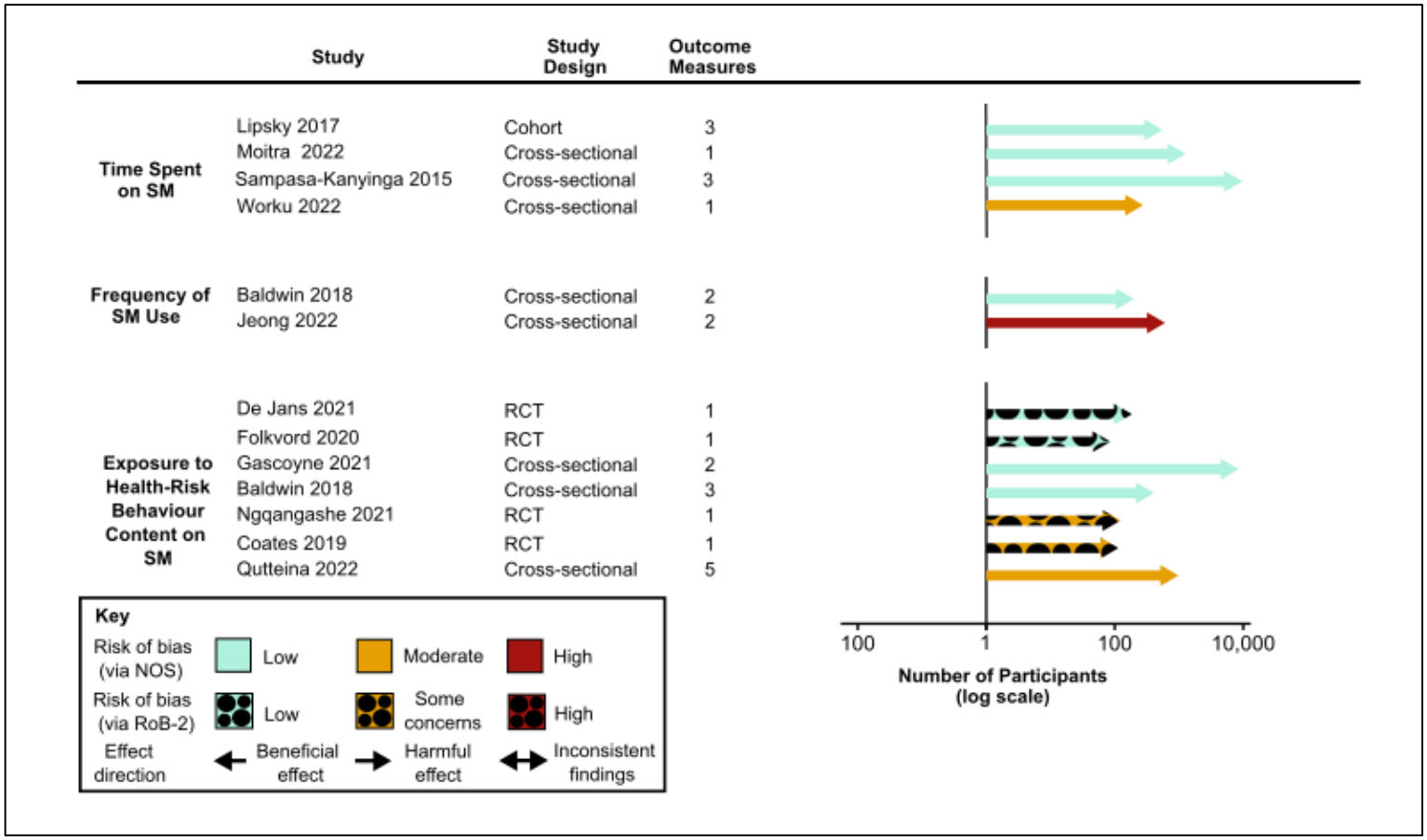
Legend: Figure presents forest plot for continuous exposure & continuous outcome subgroup analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=37,417. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Section A17.9 Unhealthy dietary behaviour

Effect direction

Figure A17.9.1 demonstrate the effect direction in those studies investigating unhealthy dietary behaviours by exposure. Two studies investigated more than one exposure (Baldwin *et al.*, 2018; Ragelienė and Grønhøj, 2021). For time spent on social media and frequency of social media use, all studies reported harmful associations (time spent on social media: 95% CI 51.0 to 100.0%, study n=4, participant n=12,006, sign test p=0.13; frequency of social media use: 34.2 to 100.0%, study n=2, participant n=826, insufficient data to conduct sign test). The relationship between exposure to health-risk behaviour content on social media and unhealthy dietary behaviours was investigated by four RCTs (two rated low RoB and two rated some concerns via the Cochrane RoB-2 Tool) and three cross-sectional studies (two rated low RoB and one moderate). Considering all seven studies together, all studies reported harmful associations of social media (64.6 to 100.0%; study n=7; participant n=10,648; sign test p=0.02). When differentiating by study design, all RCTs reported harmful effects (51.0 to 100.0%; study n=4; participant n=521; sign test p=0.13) and all cross-sectional studies reported harmful associations (43.9 to 100.0%; study n=3; participant n=10,127; sign test p=0.25).

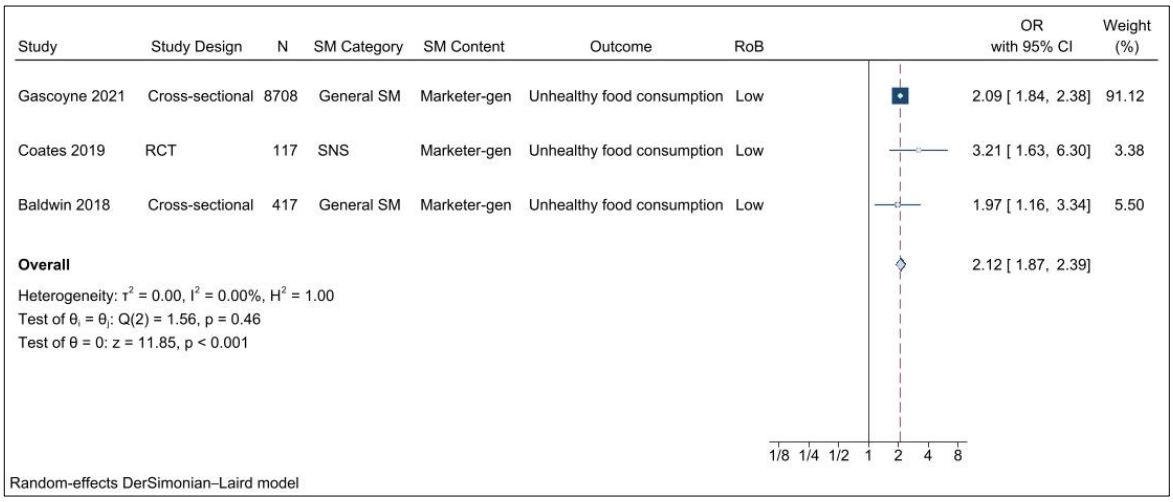
Figure A17.9.1. Effect direction plot for studies of the association between social media use and adolescent unhealthy dietary behaviour by social media exposure. Arrow size indicates sample size; arrow colour indicates study risk of bias.



Legend: Sample size: represented by the size of the arrow, measured on a log scale. Outcome measure: number of outcome measures synthesised within each study. Studies organised by risk of bias grade, study design, and year of publication. Repeat cross-sectional studies, multiple study populations from different countries, and age subsets originating from the same study reported as separate studies. Abbreviation(s): NOS=Assessed via adapted Newcastle Ottawa Scale; RCT=Randomised control trial; RoB-2=Assessed via Cochrane Risk of Bias-2 Tool; and SM=Social media.

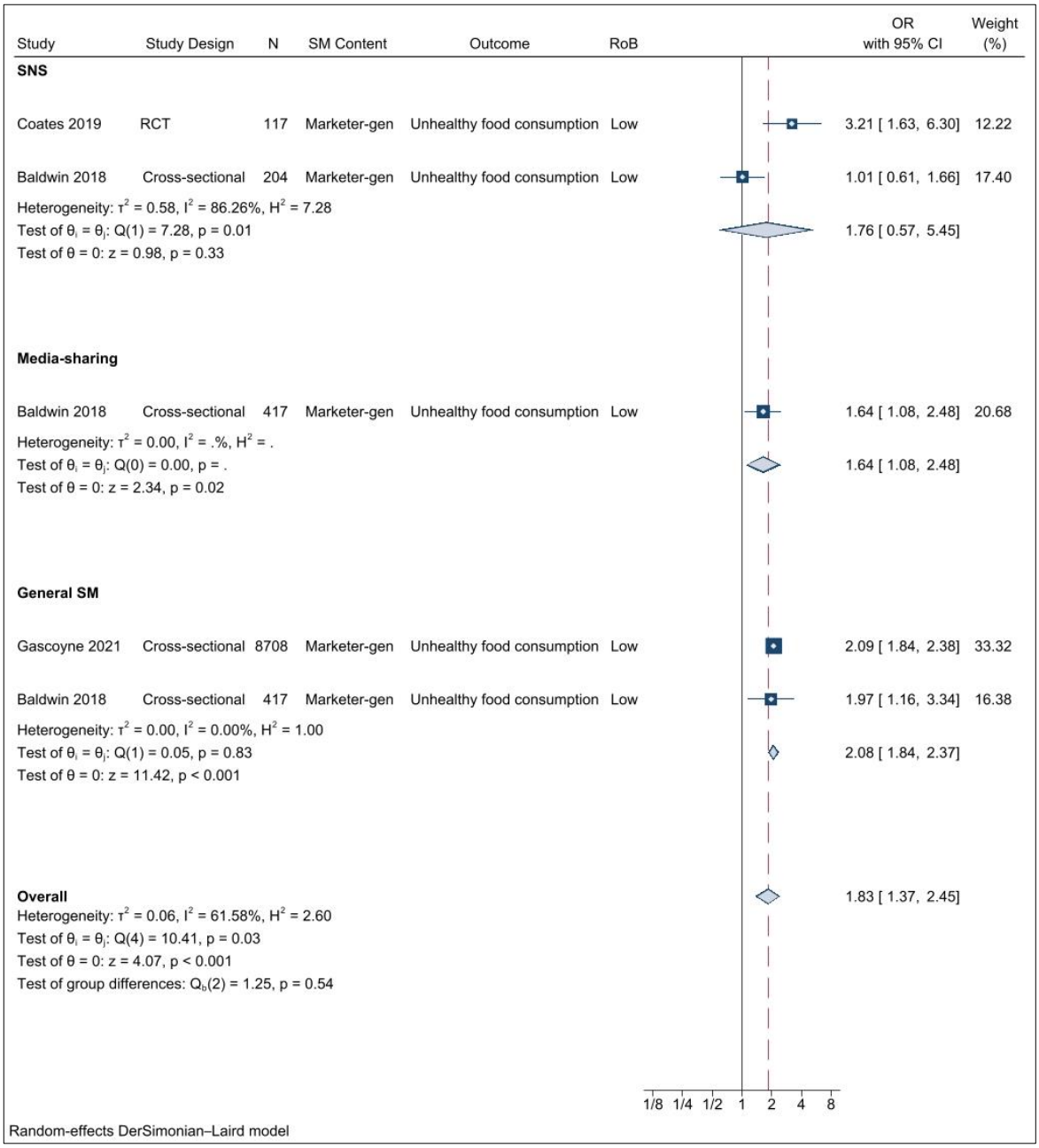
Forest plots for meta-analyses and subgroup analyses

Figure A17.9.2. Forest plot for association between exposure to health-risk behaviour content on social media and unhealthy dietary behaviour



Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=9,242. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.9.3. Forest plot for association between exposure to health-risk behaviour content on social media and unhealthy dietary behaviour, by social media category



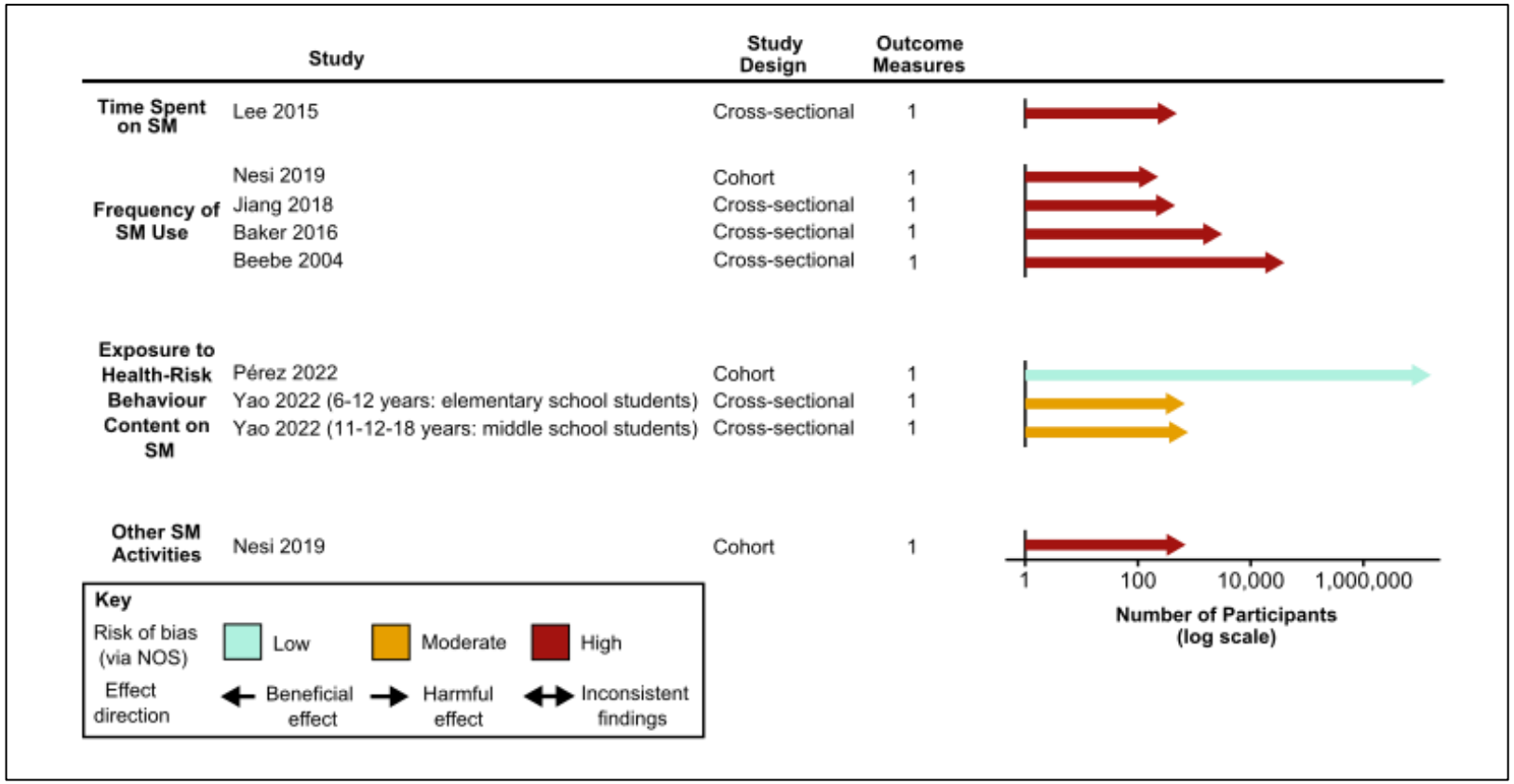
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome subgroup analysis, with odds ratio (OR) used as common metric. Total number of study participants=9,863. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Section A17.10 Multiple risk behaviours

Effect direction

Figure A17.10.1 demonstrates the effect direction in those studies (n=9) investigating multiple risk behaviours by exposure. One study investigated more than one exposure type (Nesi and Prinstein, 2019). For time spent on social media, the one study investigated reported a harmful association (95% CI 20.7 to 100.0%; participant n=500; insufficient data to conduct sign test); for frequency of social media use, all studies demonstrated harmful associations (51.0 to 100.0%; study n=4; participant n=44,271; sign test p=0.13). Similarly, for exposure to health-risk behaviour content on social media, all studies demonstrated harmful associations (43.9 to 100.0%; study n=3; participant n=16,110,555; sign test p=0.25). For other social media activities, the one study investigated reported a harmful association (20.7 to 100.0%; participant n=716; insufficient data to conduct sign test).

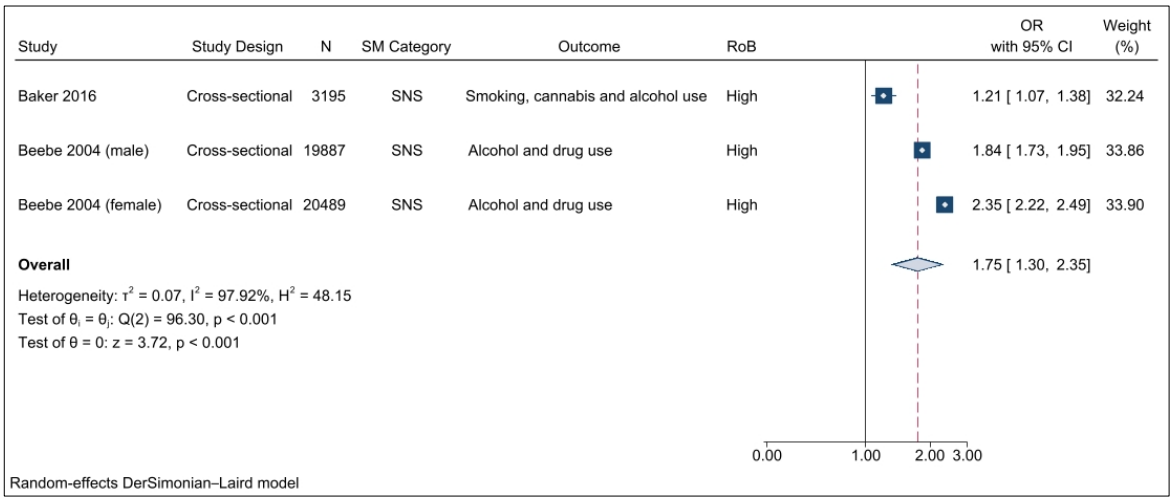
Figure A17.10.1. Effect direction plot for studies of the association between social media use and adolescent engagement in multiple risk behaviours by social media exposure. Arrow size indicates sample size; arrow colour indicates study risk of bias.



Legend: Sample size: represented by the size of the arrow, measured on a log scale. Outcome measure: number of outcome measures synthesised within each study. Studies organised by risk of bias grade, study design, and year of publication. Repeat cross-sectional studies, multiple study populations from different countries, and age subsets originating from the same study reported as separate studies. Abbreviation(s): NOS=Assessed via adapted Newcastle Ottawa Scale and SM=Social media.

Forest plots for meta-analyses and subgroup analyses

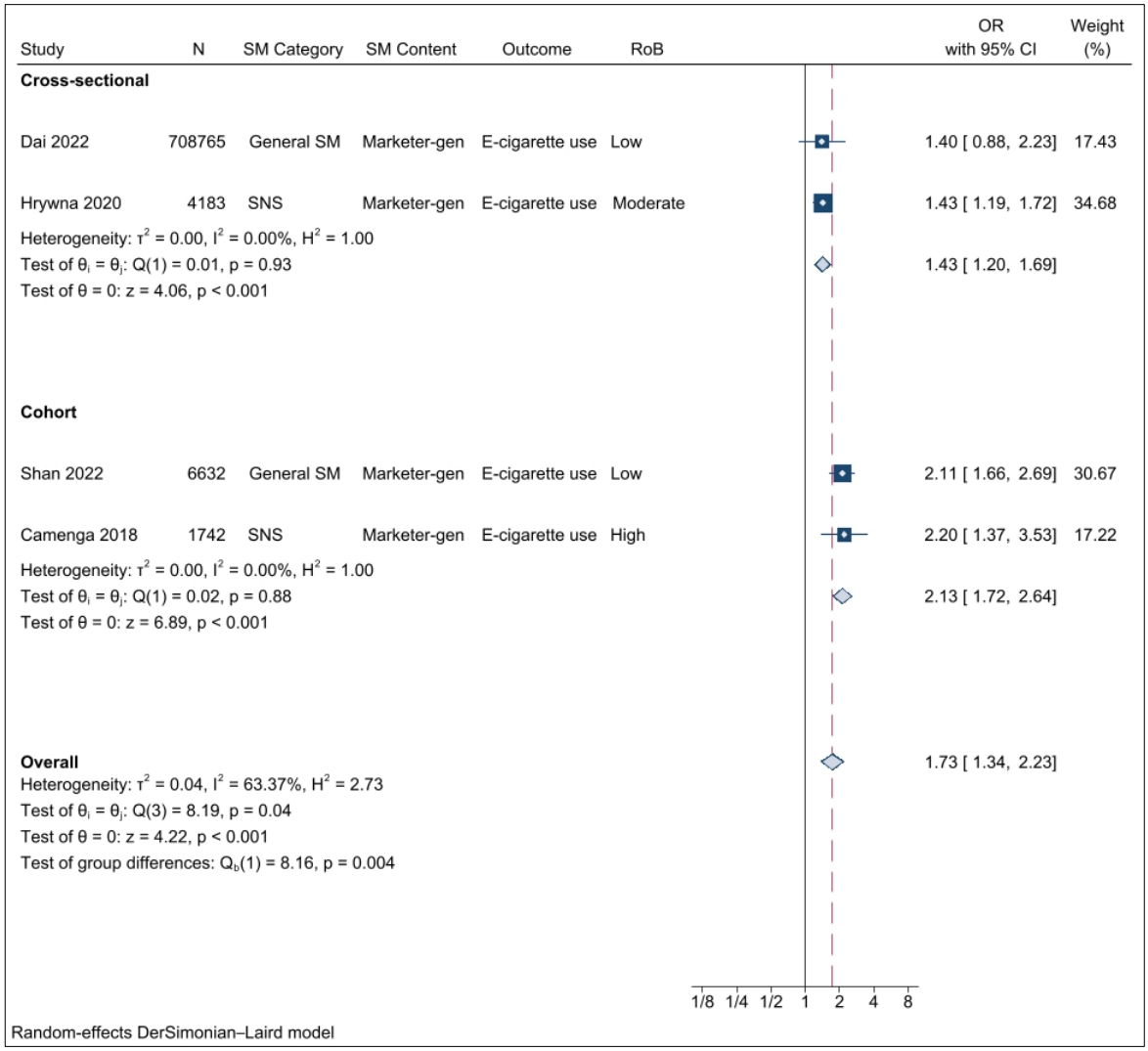
Figure A17.10.2. Forest plot for association between frequency of social media use and multiple risk behaviours (also shown in Chapter 4)



Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=43,571. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

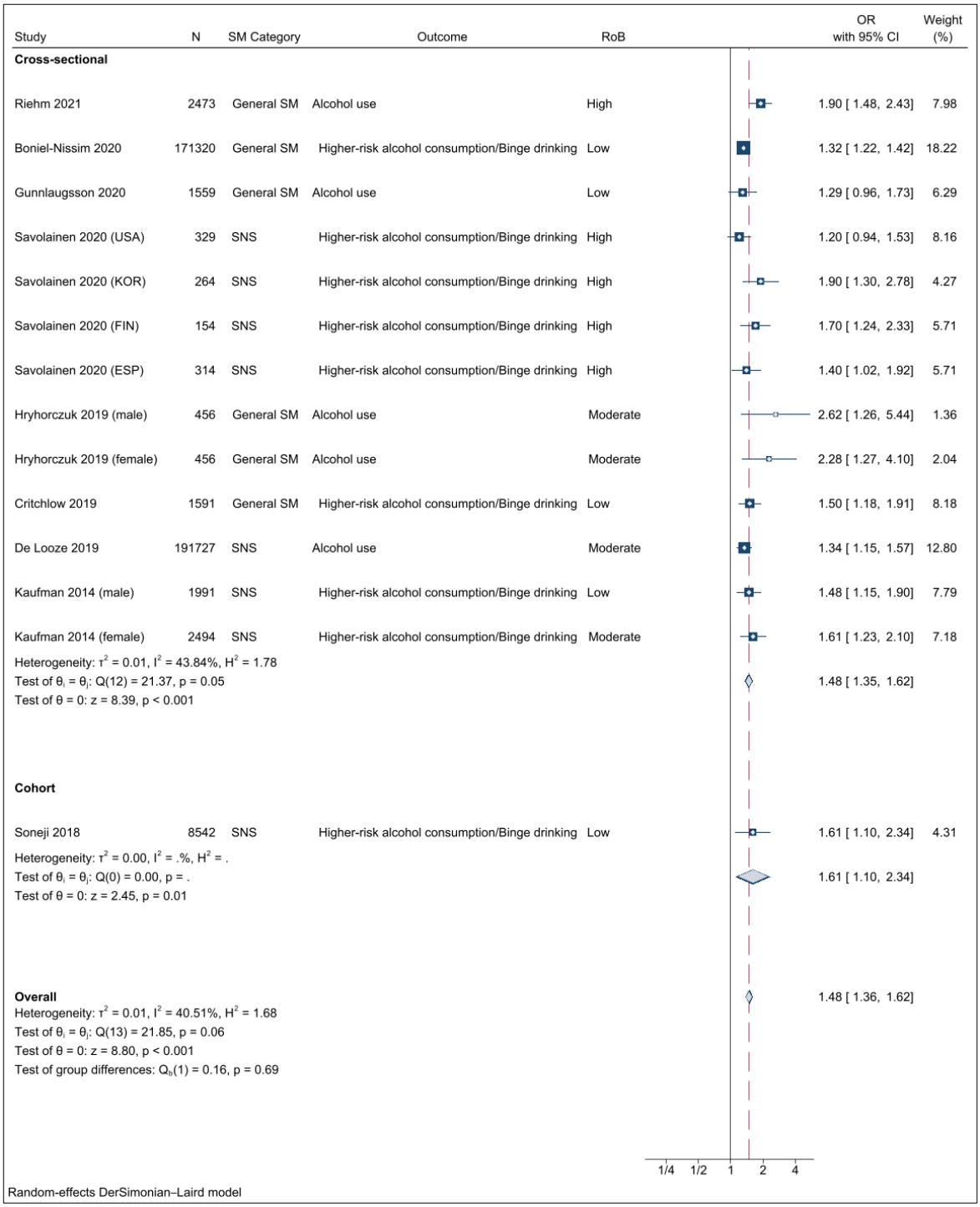
Section A17.11 Sensitivity analyses

Figure A17.11.1. Forest plot for association between exposure to health-risk behaviour content on social media and use of electronic nicotine delivery systems, by study design



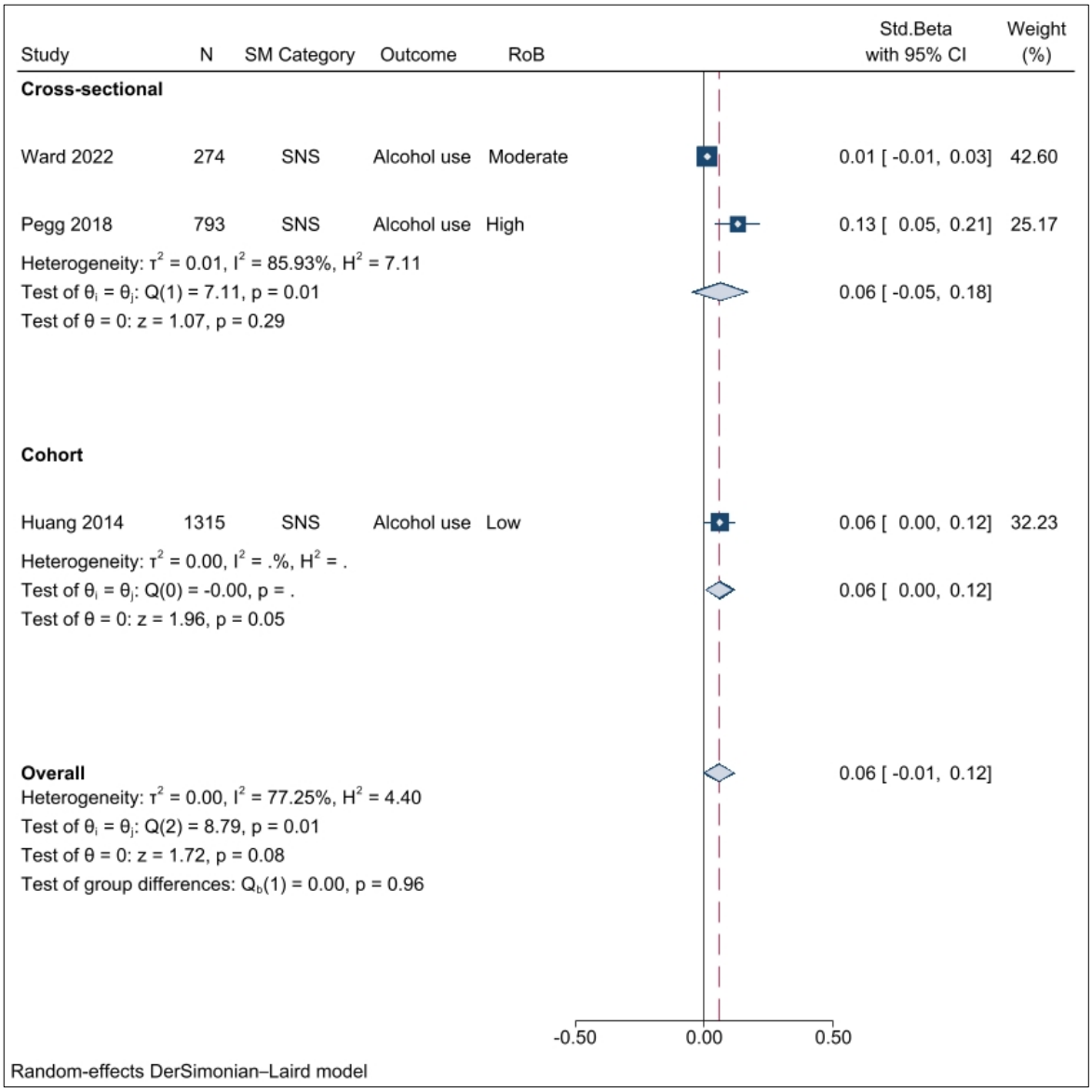
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=721,322. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.2. Forest plot for association between frequency of social media use and alcohol use, by study design



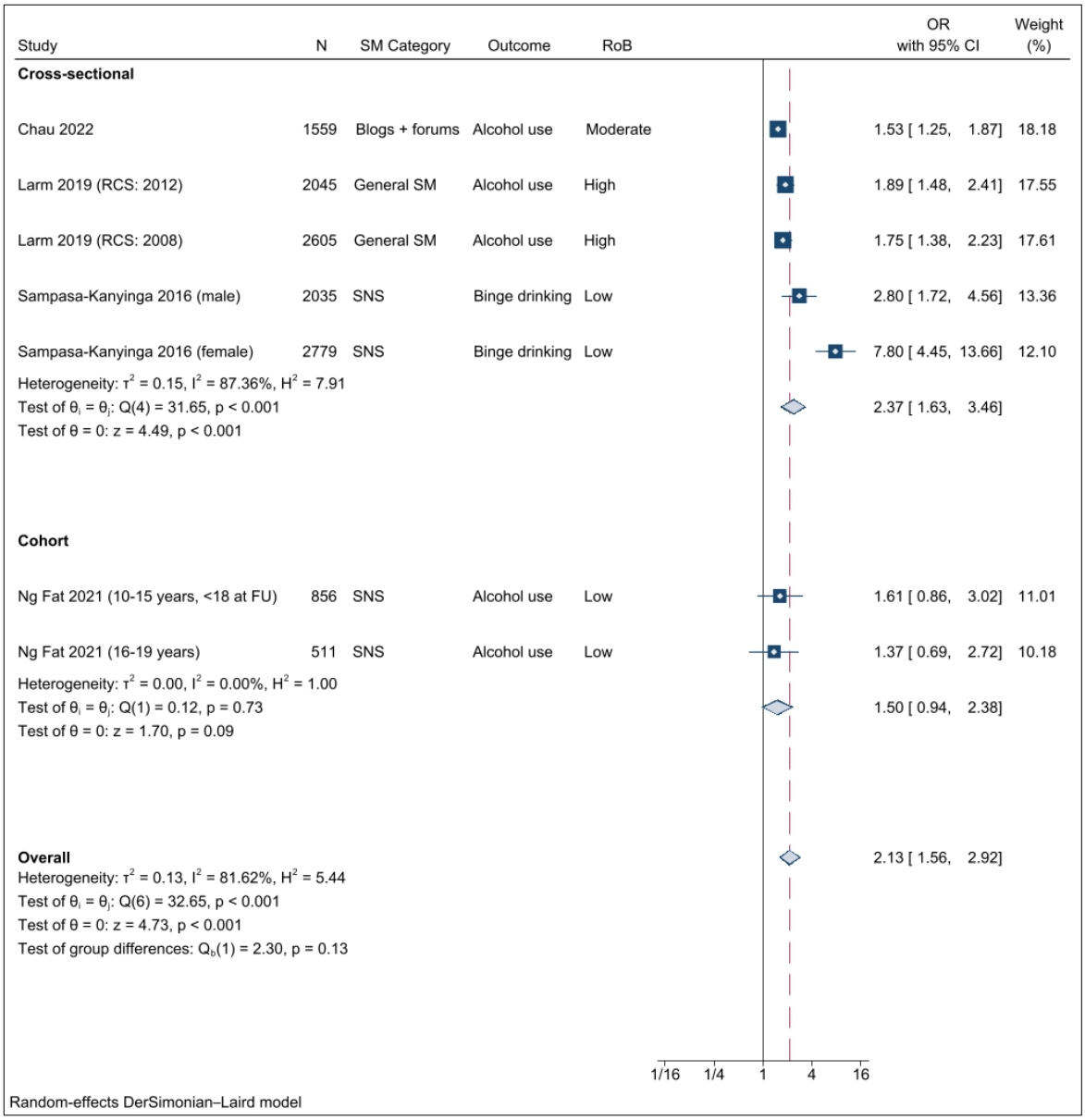
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=383,670. Abbreviation(s): CI=Confidence interval; ESP= Spain; FIN=Finland; KOR=South Korea; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and USA=United States of America.

Figure A17.11.3. Forest plot for association between frequency of social media use and alcohol use, by study design



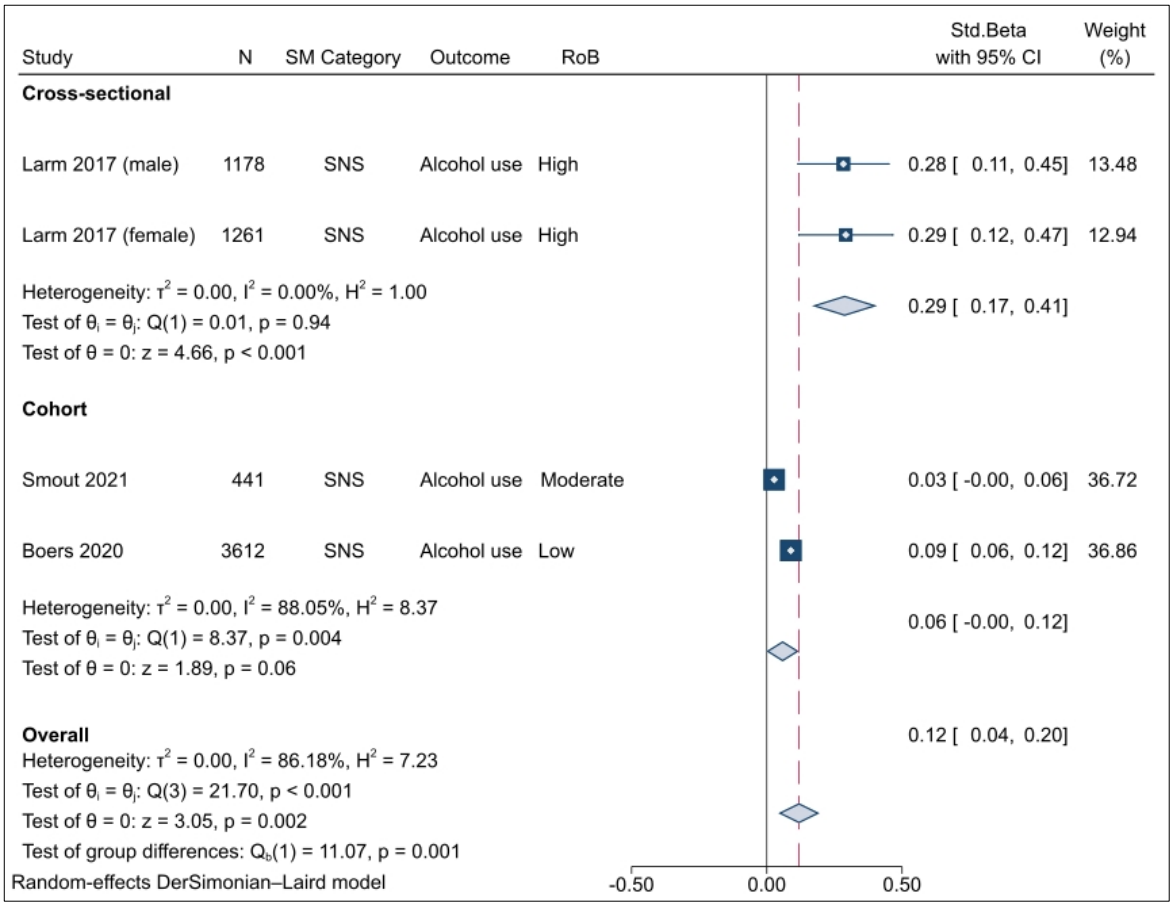
Legend: Figure presents forest plot for continuous exposure & continuous outcome sensitivity analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=2,382. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.11.4. Forest plot for association between time spent on social media and alcohol use, by study design



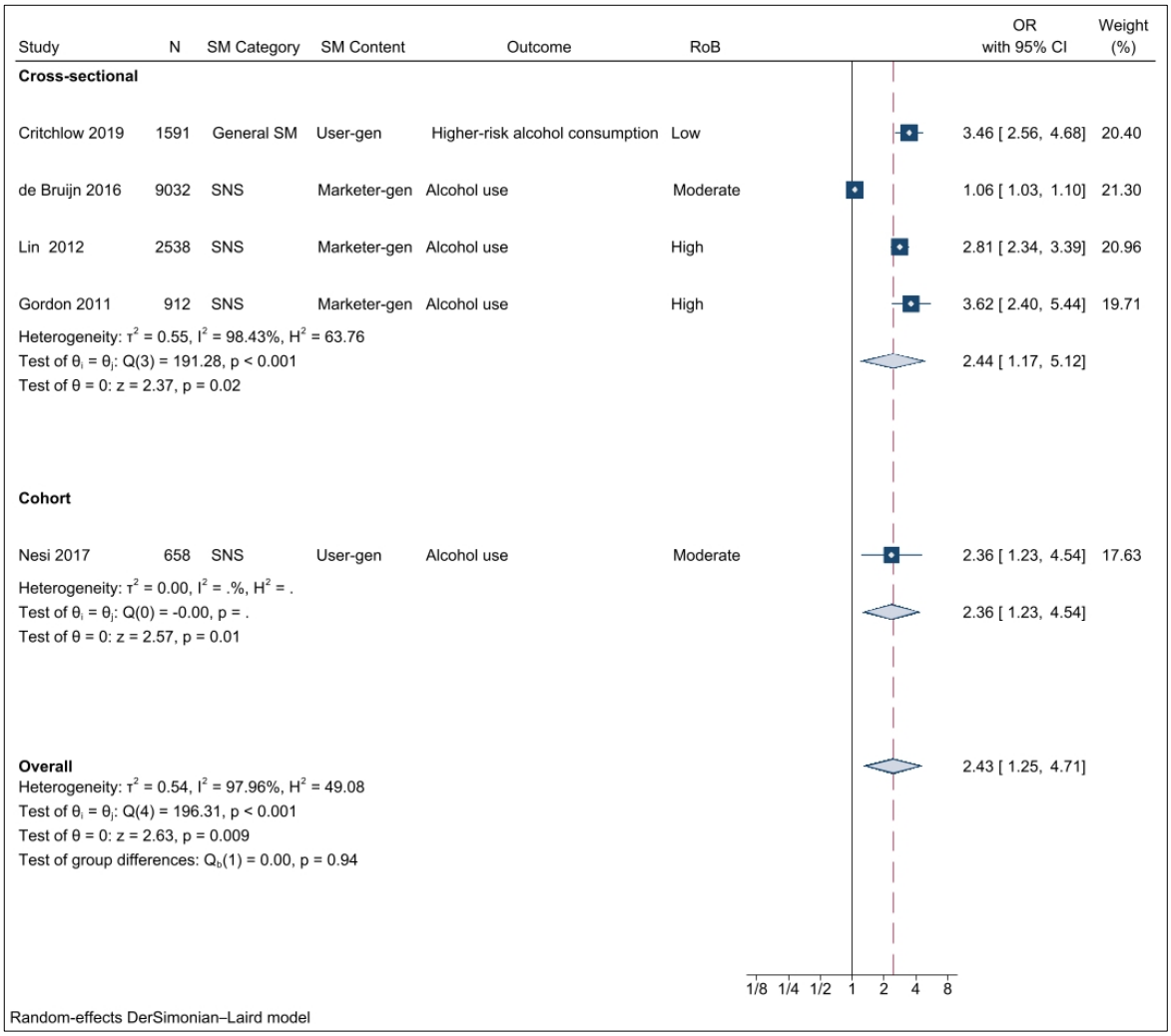
Legend: Figure presents forest plot for binary exposure (≥2 vs <2 hours/day social media use) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=12,390. Abbreviation(s): CI=Confidence interval; FU=Follow-up; N=Number of study participants; OR=Odds ratio; RCS=Repeat cross-sectional study; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.5. Forest plot for association between time spent on social media and alcohol use, by study design



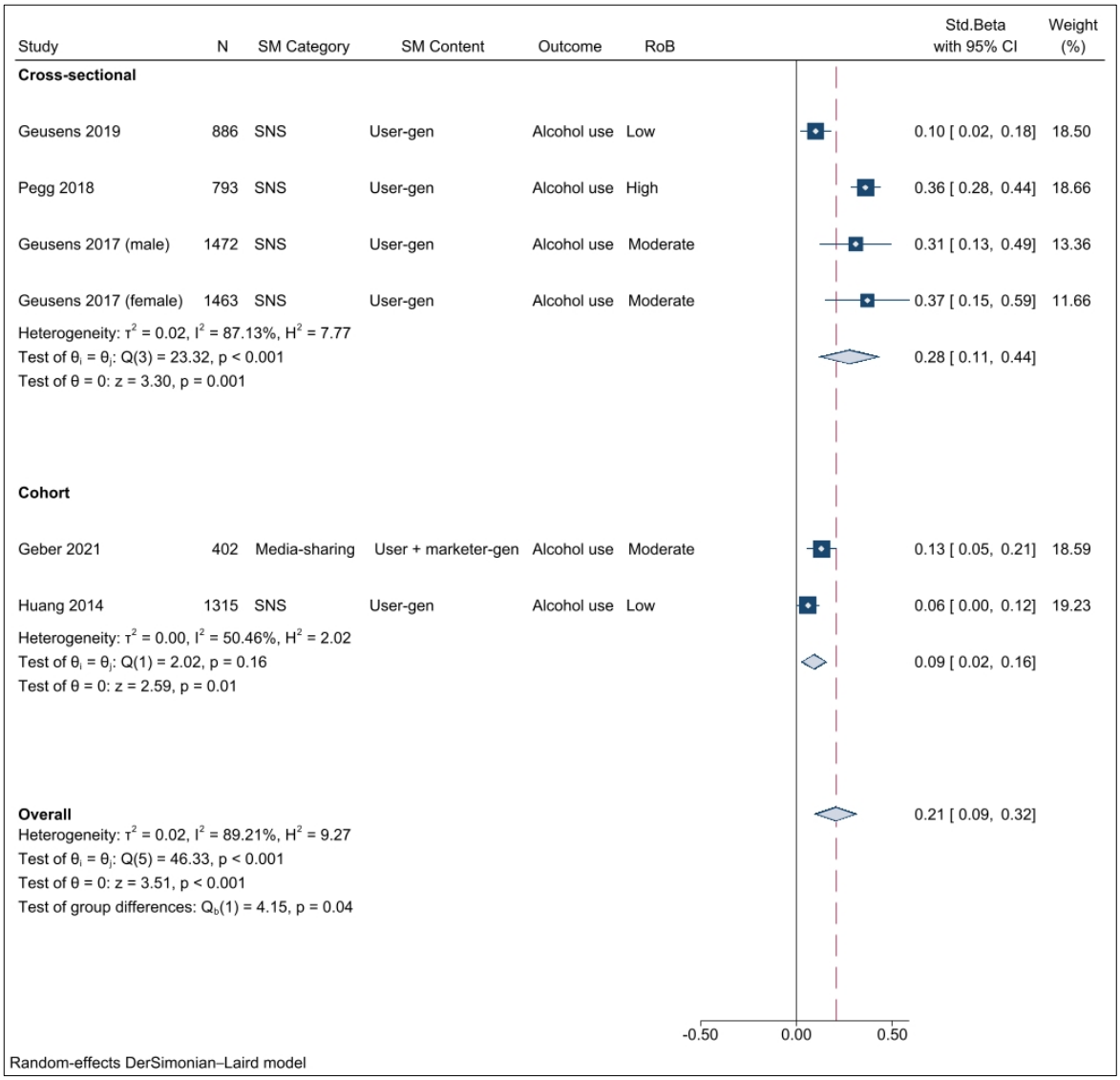
Legend: Figure presents forest plot for continuous exposure & continuous outcome sensitivity analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=6,492. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.11.6. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use, by study design



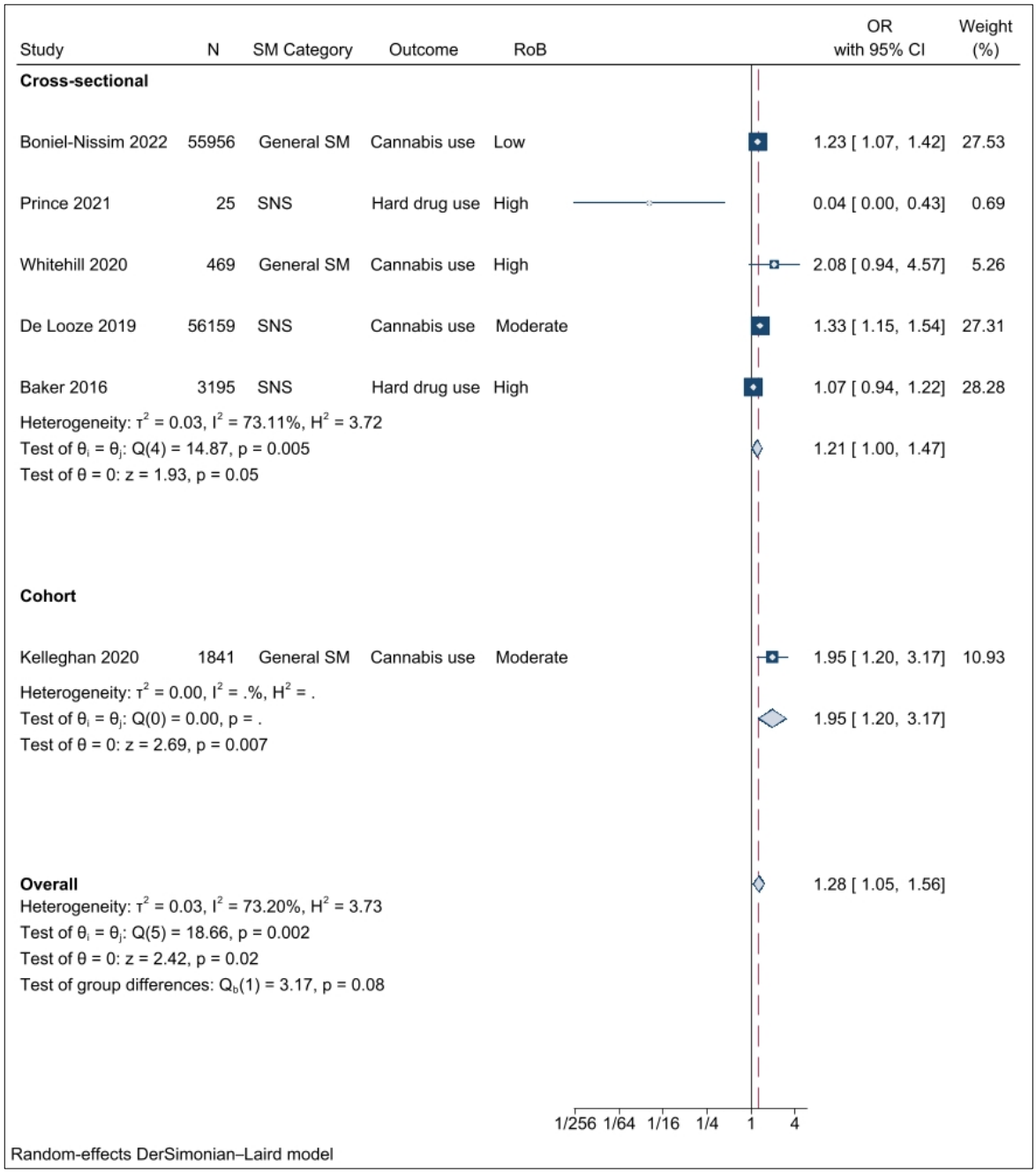
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=14,731. Abbreviation(s): CI=Confidence interval; Marketer-gen=Marketer-generated content; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and User-gen=User-generated content.

Figure A17.11.7. Forest plot for associations between exposure to health-risk behaviour content on social media and alcohol use, by study design



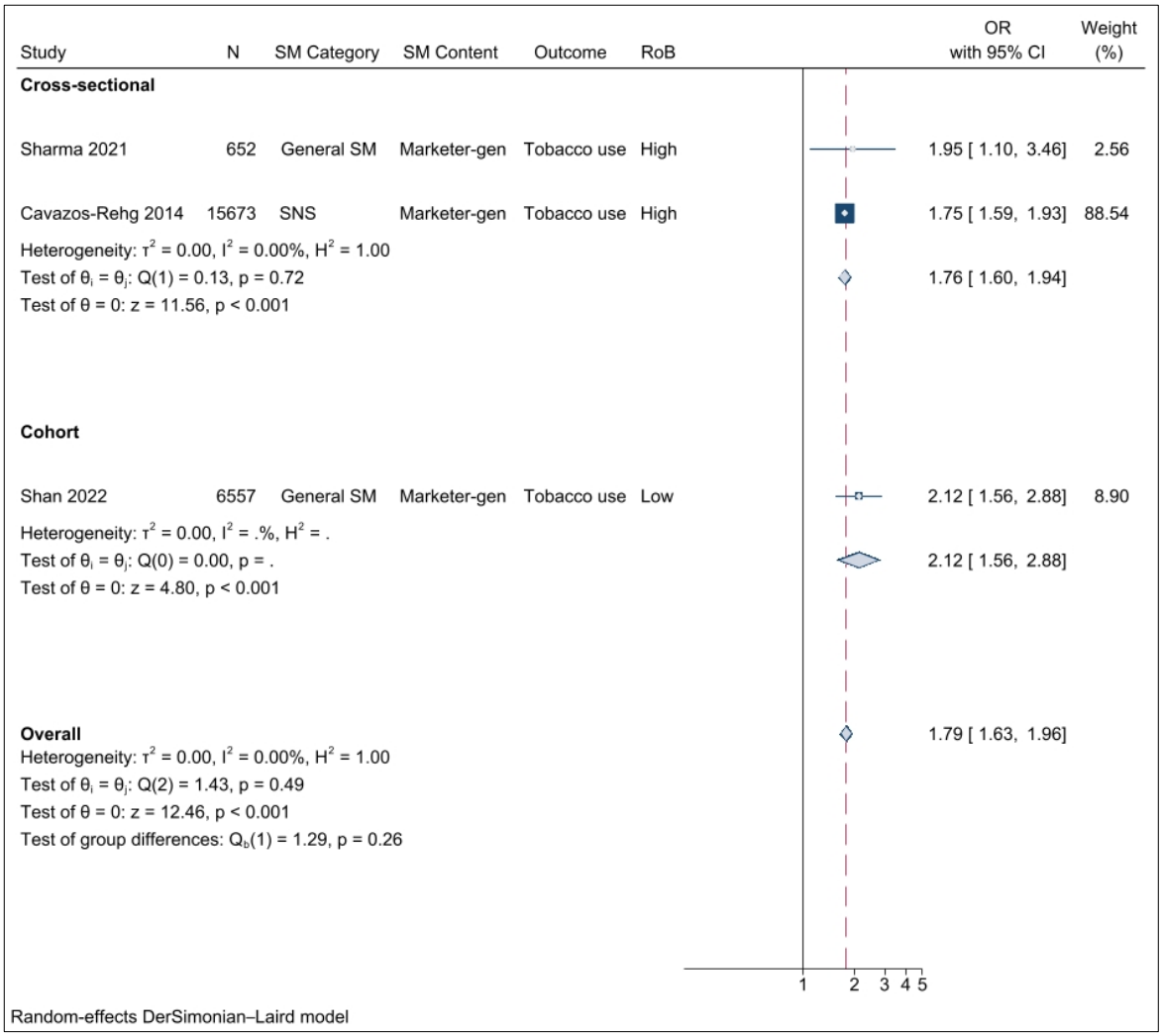
Legend: Figure presents forest plot for continuous exposure & continuous outcome sensitivity analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=6,331. Abbreviation(s): CI=Confidence interval; N=Number of study participants; Marketer-gen=Marketer-generated content; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); Std. Beta= Standardised beta; and User-gen=User-generated content.

Figure A17.11.8. Forest plot for association between frequency of social media use and drug use, by study design



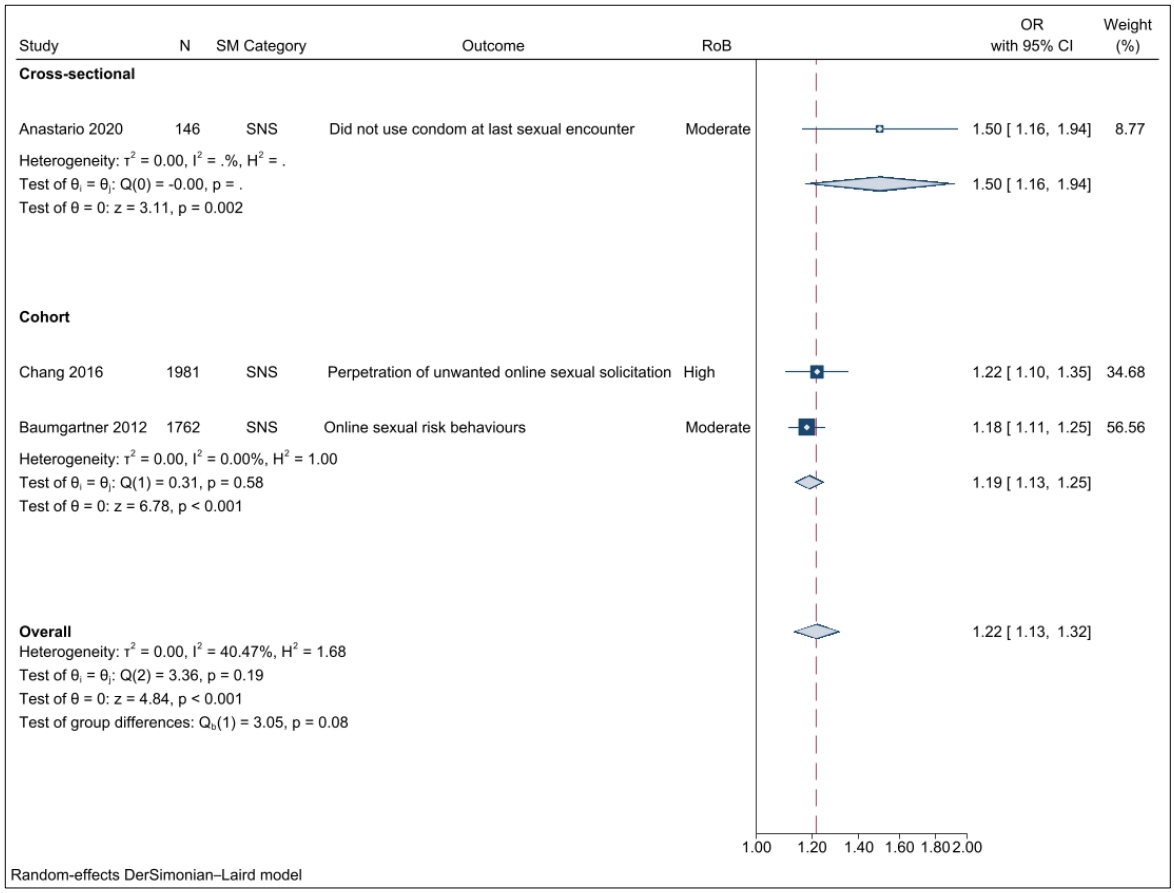
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=117,645. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.9. Forest plot for association between exposure to health-risk behaviour content on social media and tobacco use, by study design



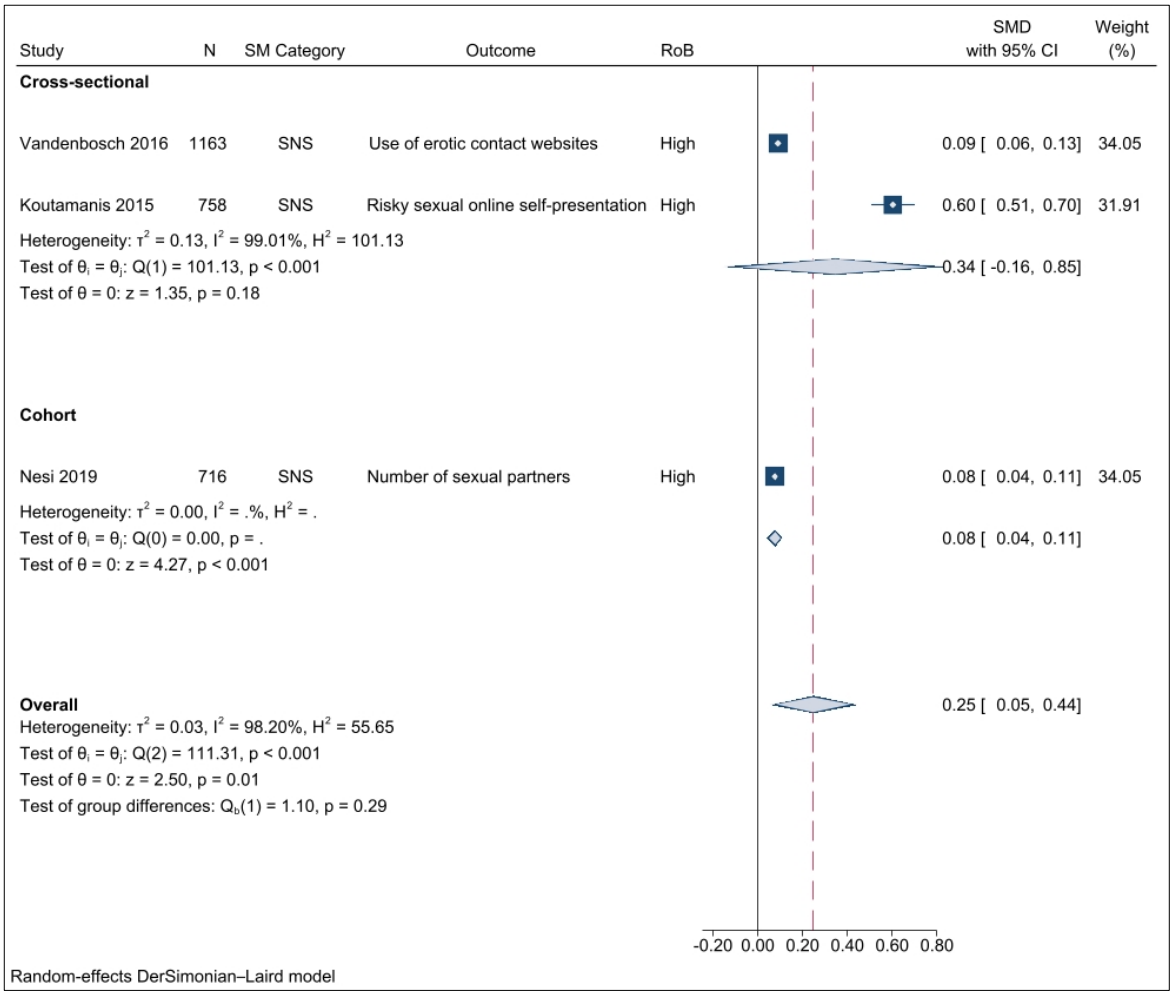
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=22,882. Abbreviation(s): CI=Confidence interval; Marketer-gen=Marketer-generated content; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.10. Forest plot for association between frequency of social media use and sexual risk behaviour, by study design



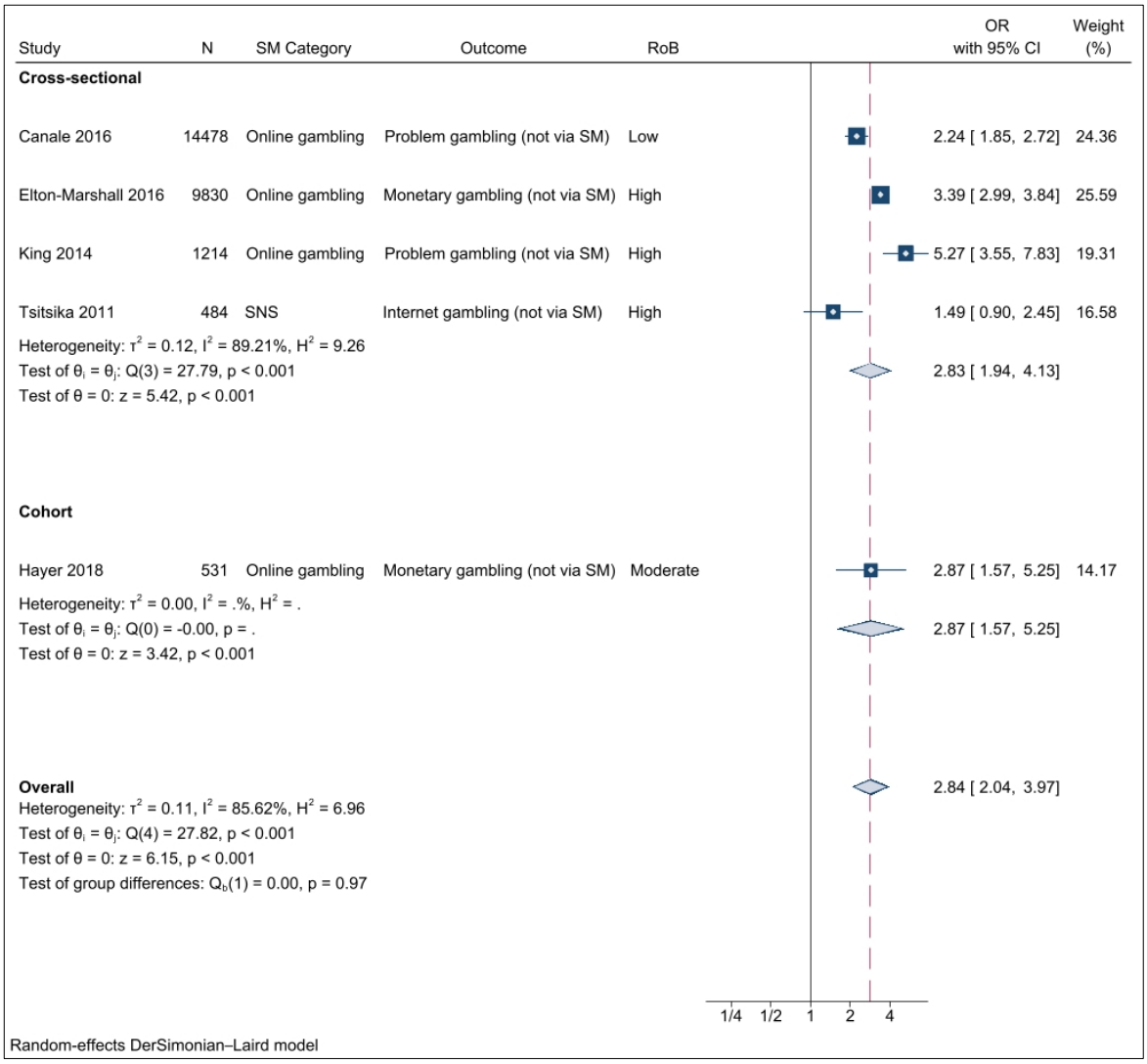
Legend: Figure presents forest plot for continuous exposure & binary outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=3,889. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.11. Forest plot for association between frequency of social media use and sexual risk behaviour, by study design



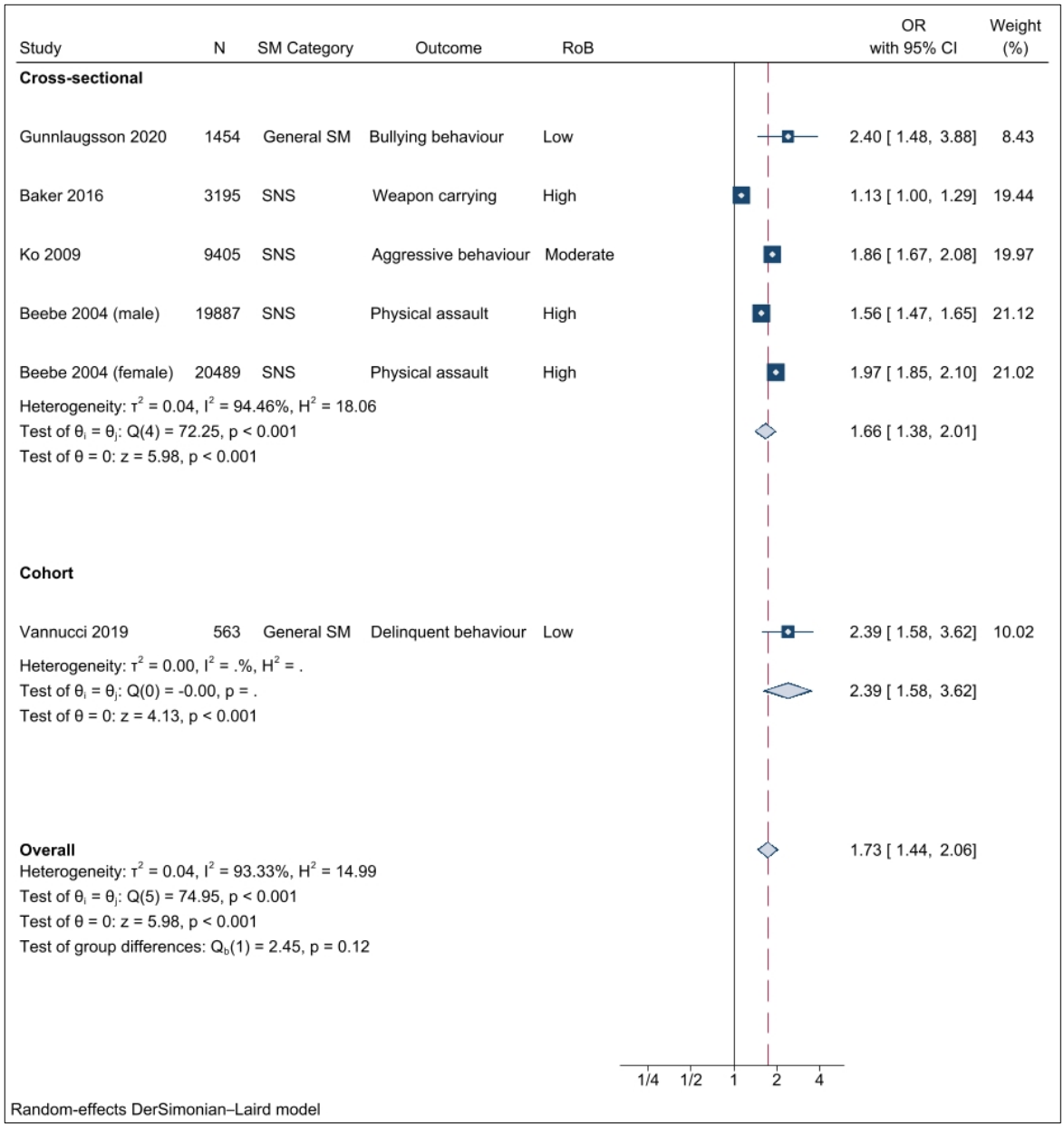
Legend: Figure presents forest plot for continuous exposure & continuous outcome sensitivity analysis, with standardised mean difference (SMD) used as common metric. Total number of study participants=2,637. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SMD=Standardised mean difference; and SNS=Social networking site(s).

Figure A17.11.12. Forest plot for association between frequency of social media use and gambling, by study design



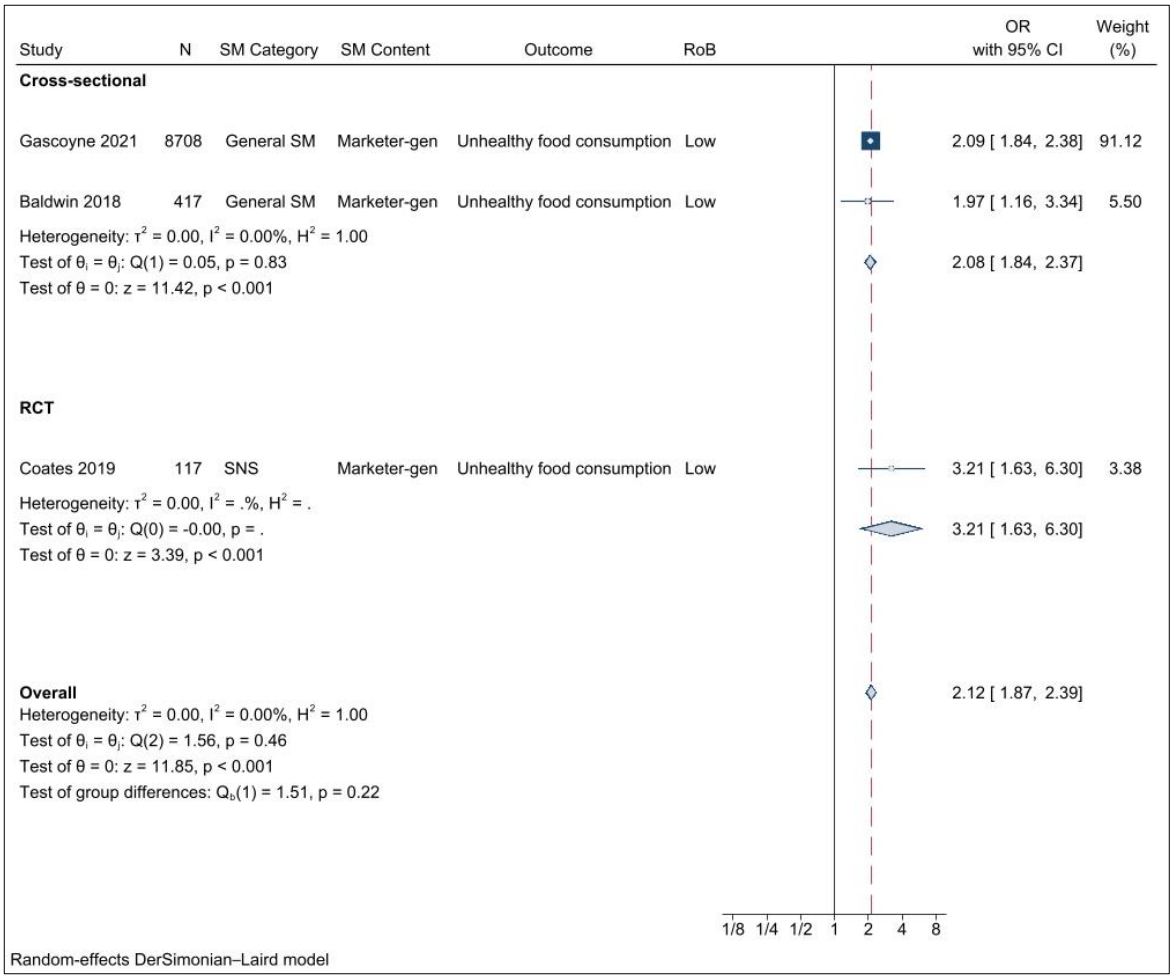
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=26,537. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.13. Forest plot for association between frequency of social media use and anti-social behaviour, by study design



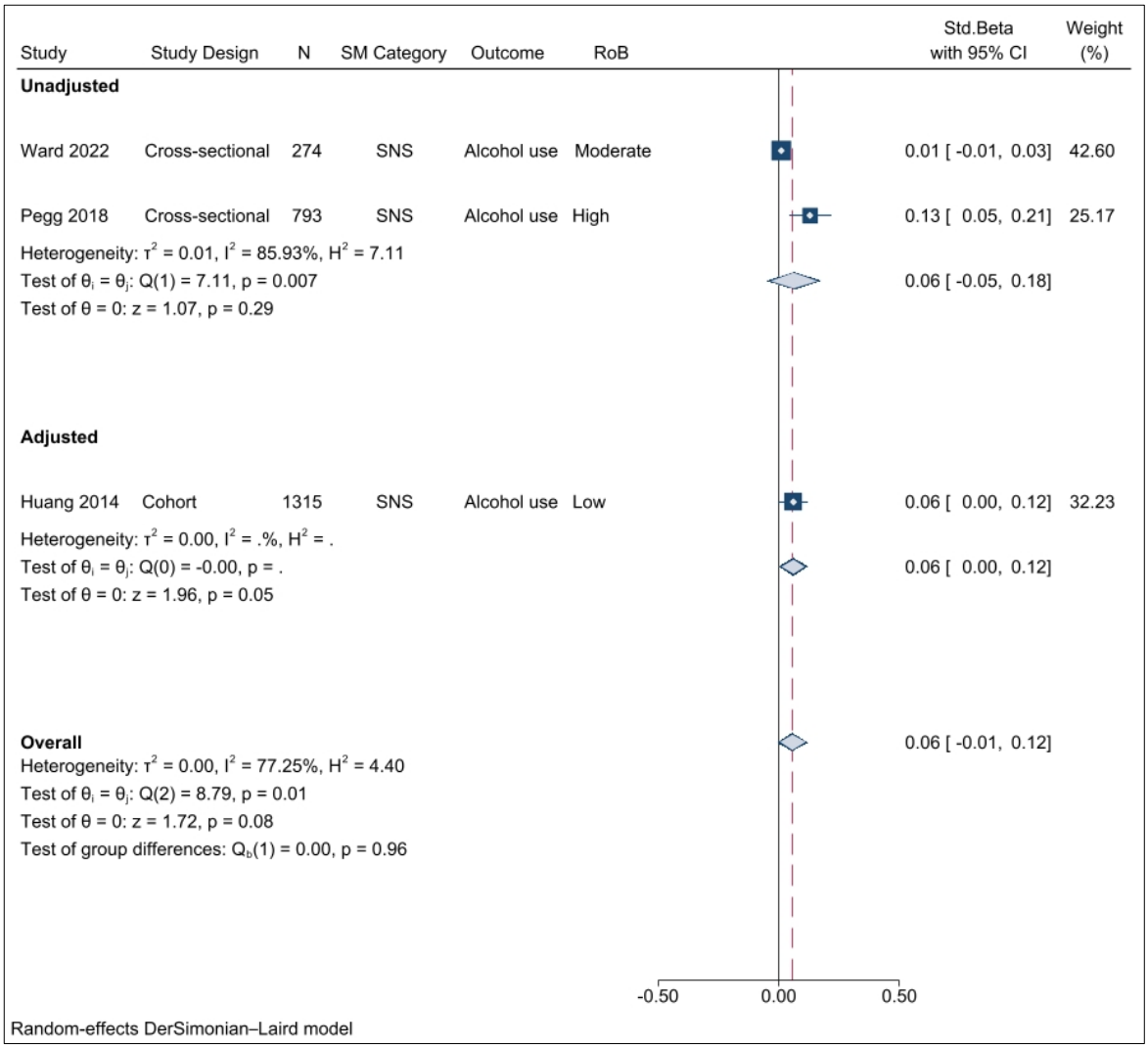
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome sensitivity analysis, with odds (OR) used as common metric. Total number of study participants=54,993. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.14. Forest plot for association between exposure to health-risk behaviour content on social media and unhealthy dietary behaviour, by study design



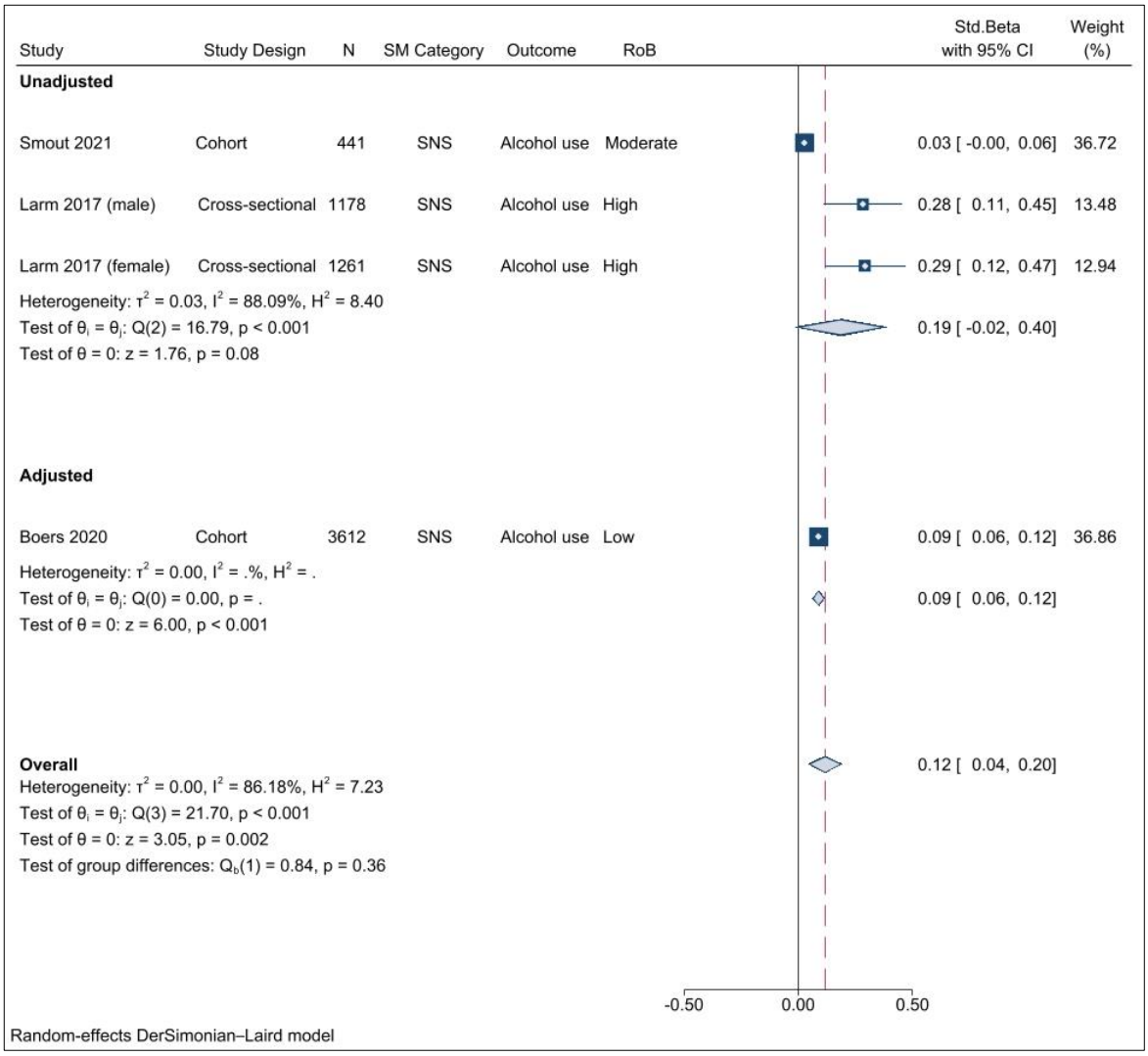
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=9,242. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.15. Forest plot for association between frequency of social media use and alcohol use, by adjustment for critical confounding domains[a]



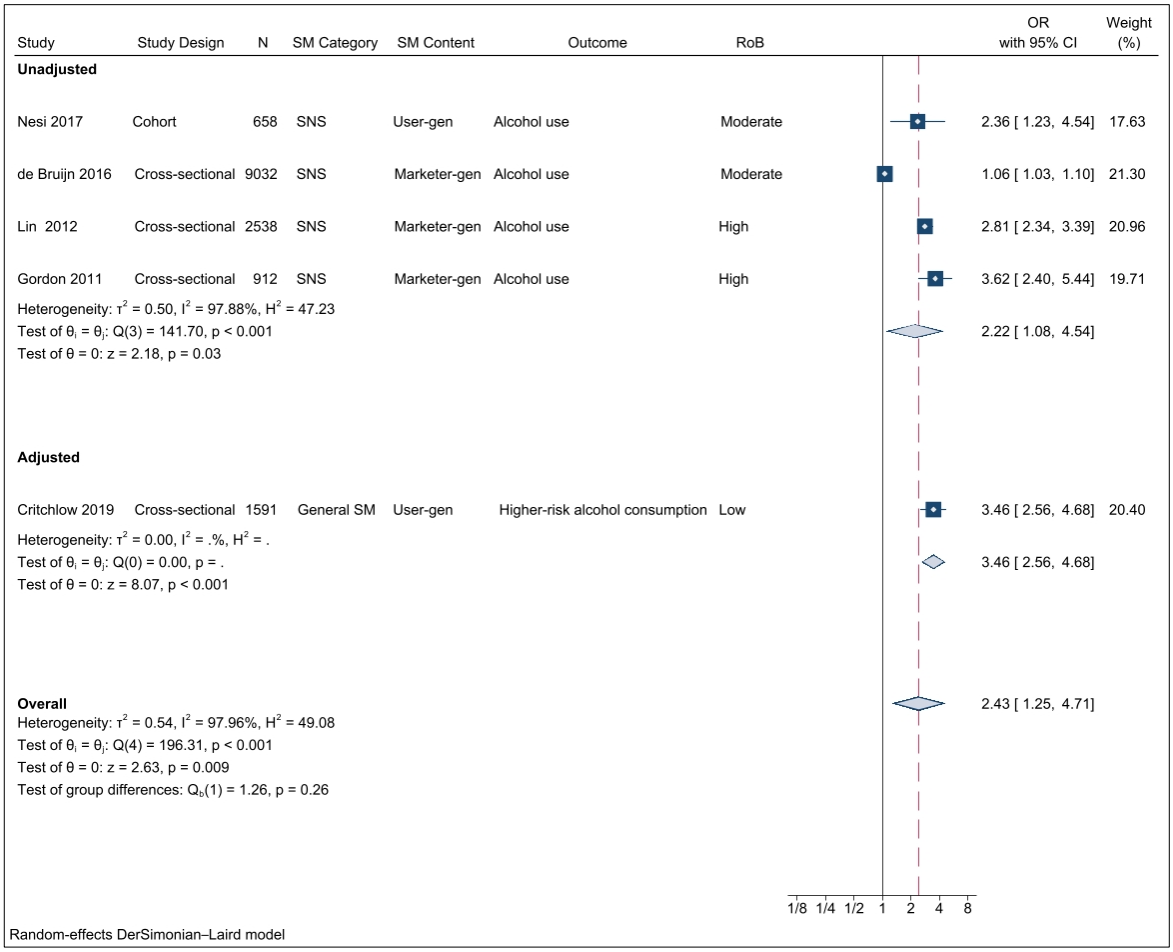
Legend: Figure presents forest plot for continuous exposure & continuous outcome sensitivity analysis, with standardised beta (Std. Beta) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=2,382. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.11.16. Forest plot for association between time spent on social media and alcohol use, by adjustment for critical confounding domains[a]



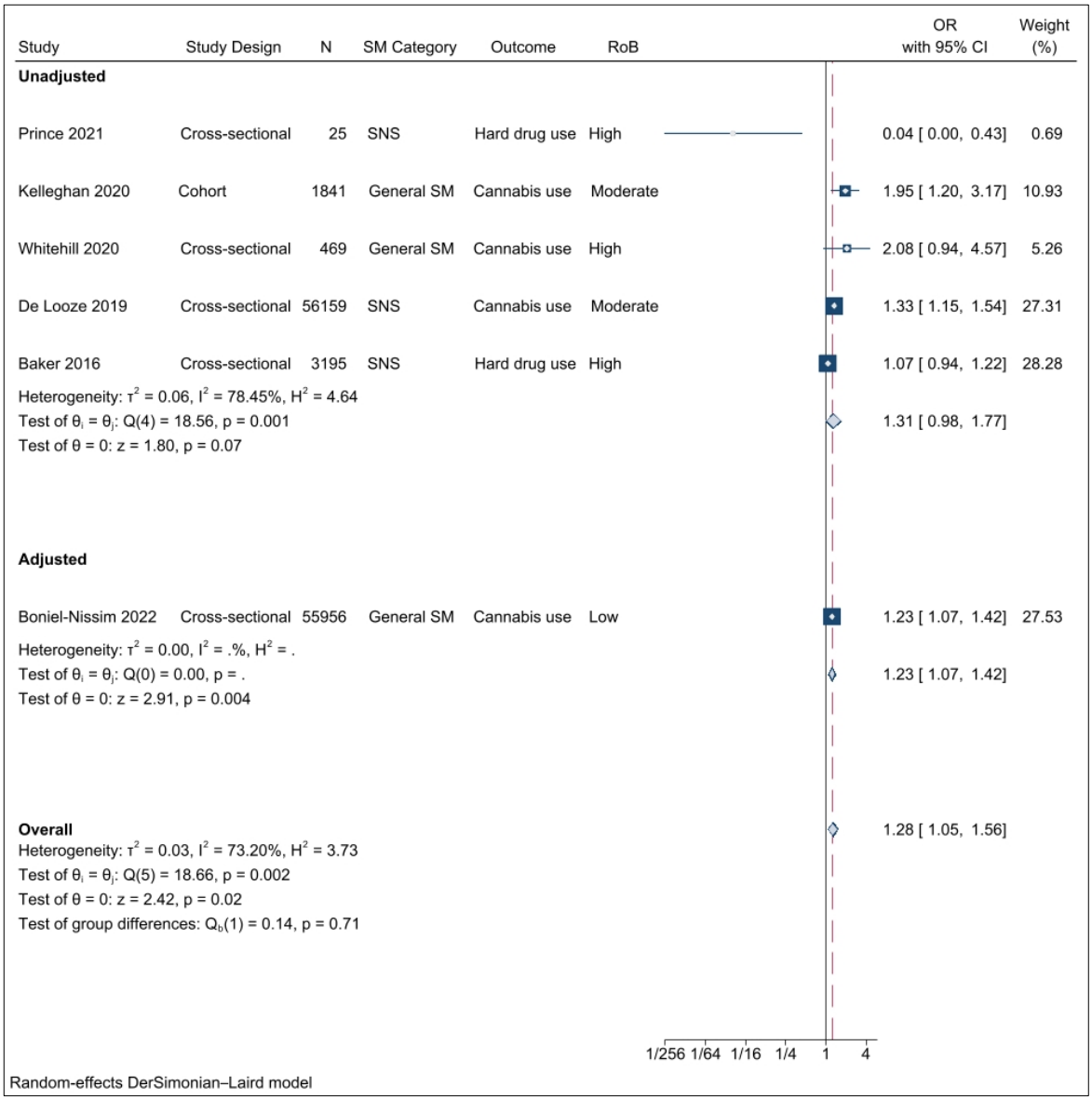
Legend: Figure presents forest plot for continuous exposure & continuous outcome sensitivity analysis, with standardised beta (Std. Beta) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=6,492. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.11.17. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use, by adjustment for critical confounding domains[a]



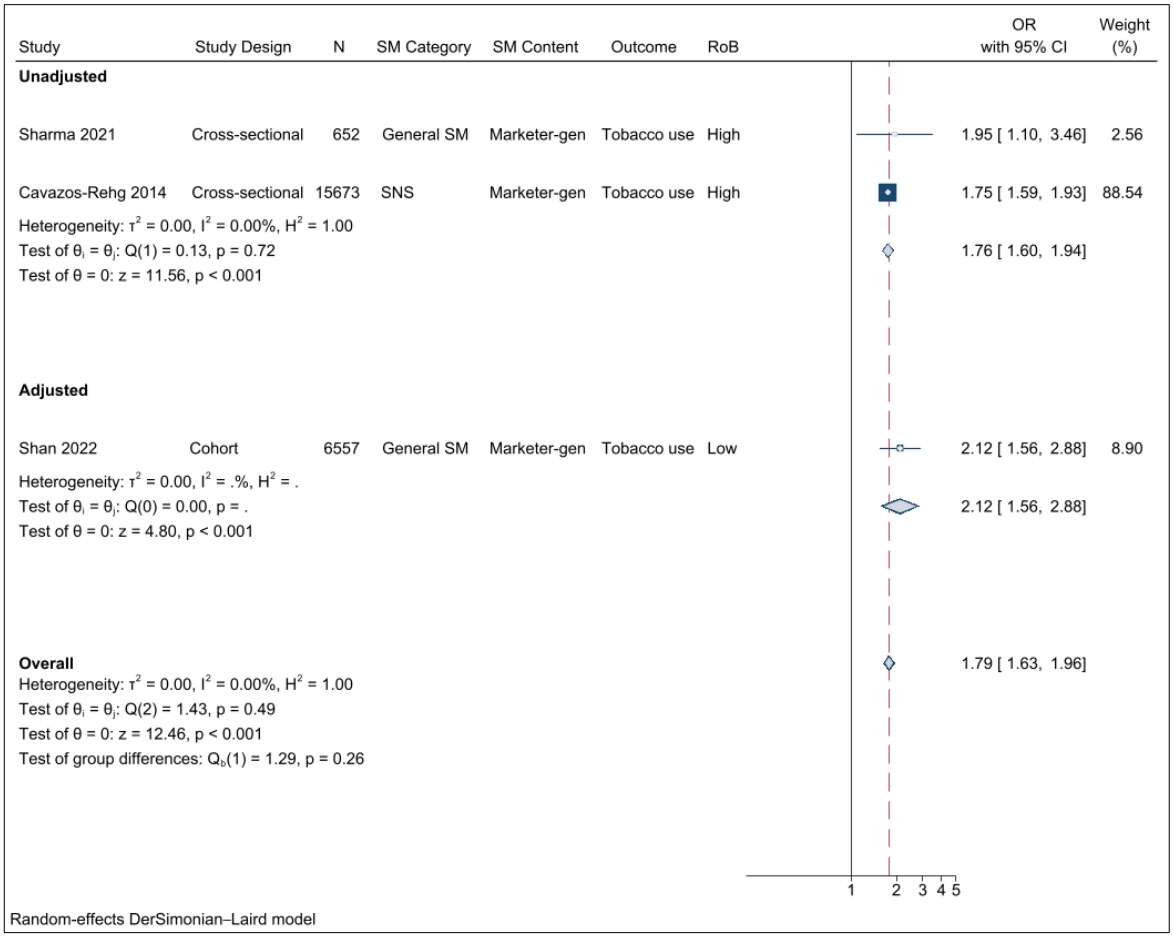
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=14,731. Abbreviation(s): CI=Confidence interval; Marketer-gen=Marketer-generated content; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and User-gen=User-generated content.

Figure A17.11.18. Forest plot for association between frequency of social media use and drug use, by adjustment for critical confounding domains[a]



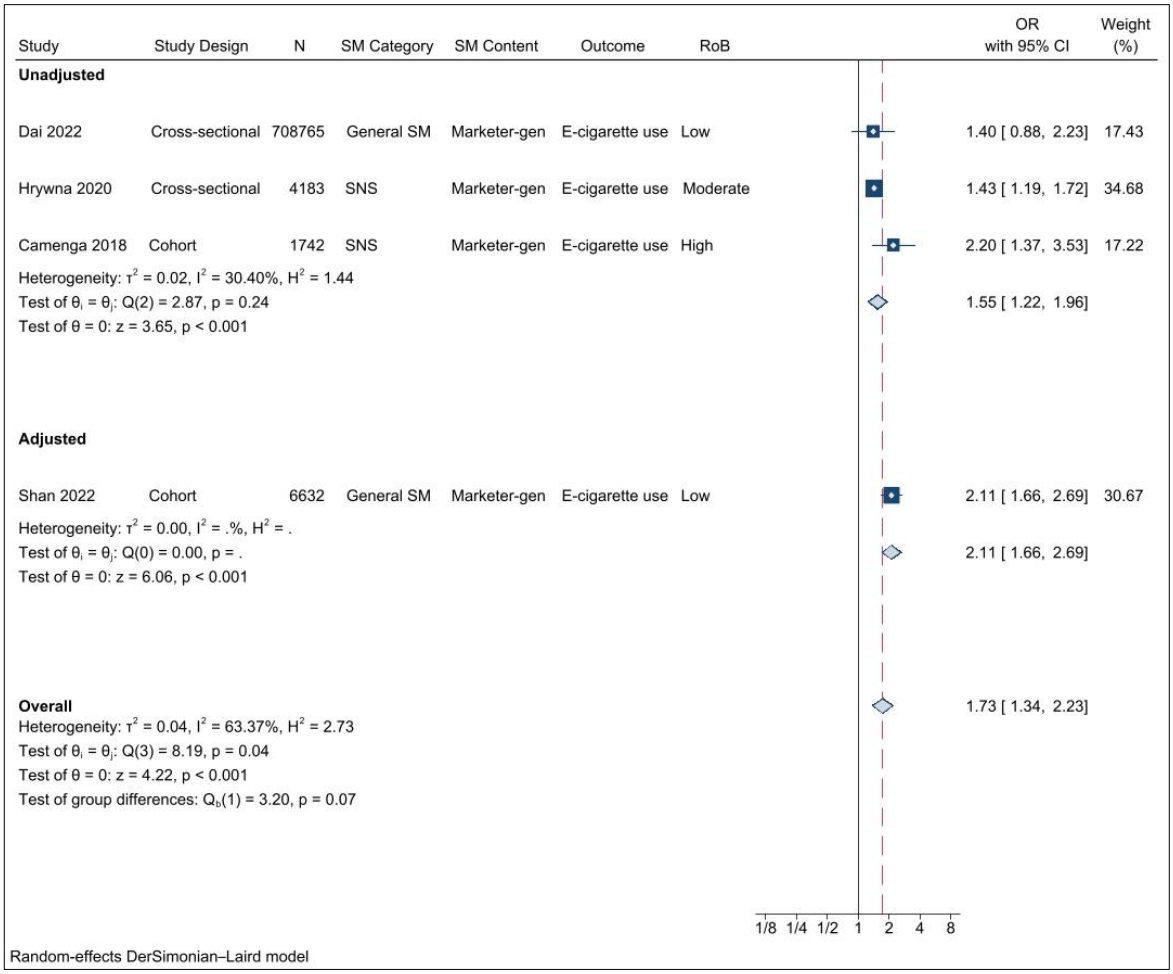
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=117,645. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.19. Forest plot for association between exposure to health-risk behaviour content on social media and tobacco use, by adjustment for critical confounding domains[a]



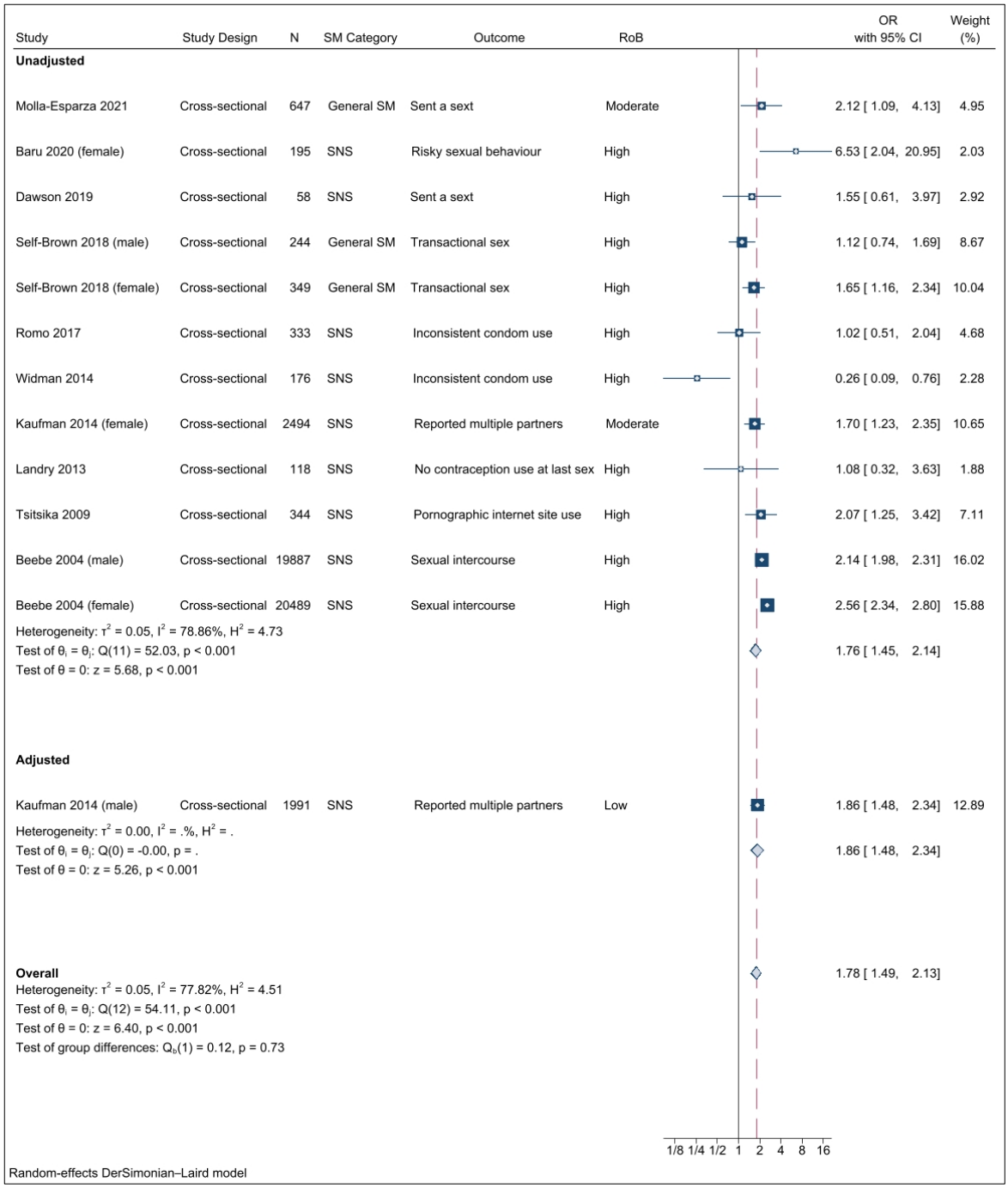
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=22,882. Abbreviation(s): CI=Confidence interval; Marketer-gen=Marketer-generated content; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.20. Forest plot for association between exposure to health-risk behaviour content on social media and use of electronic nicotine delivery systems, by adjustment for critical confounding domains[a]



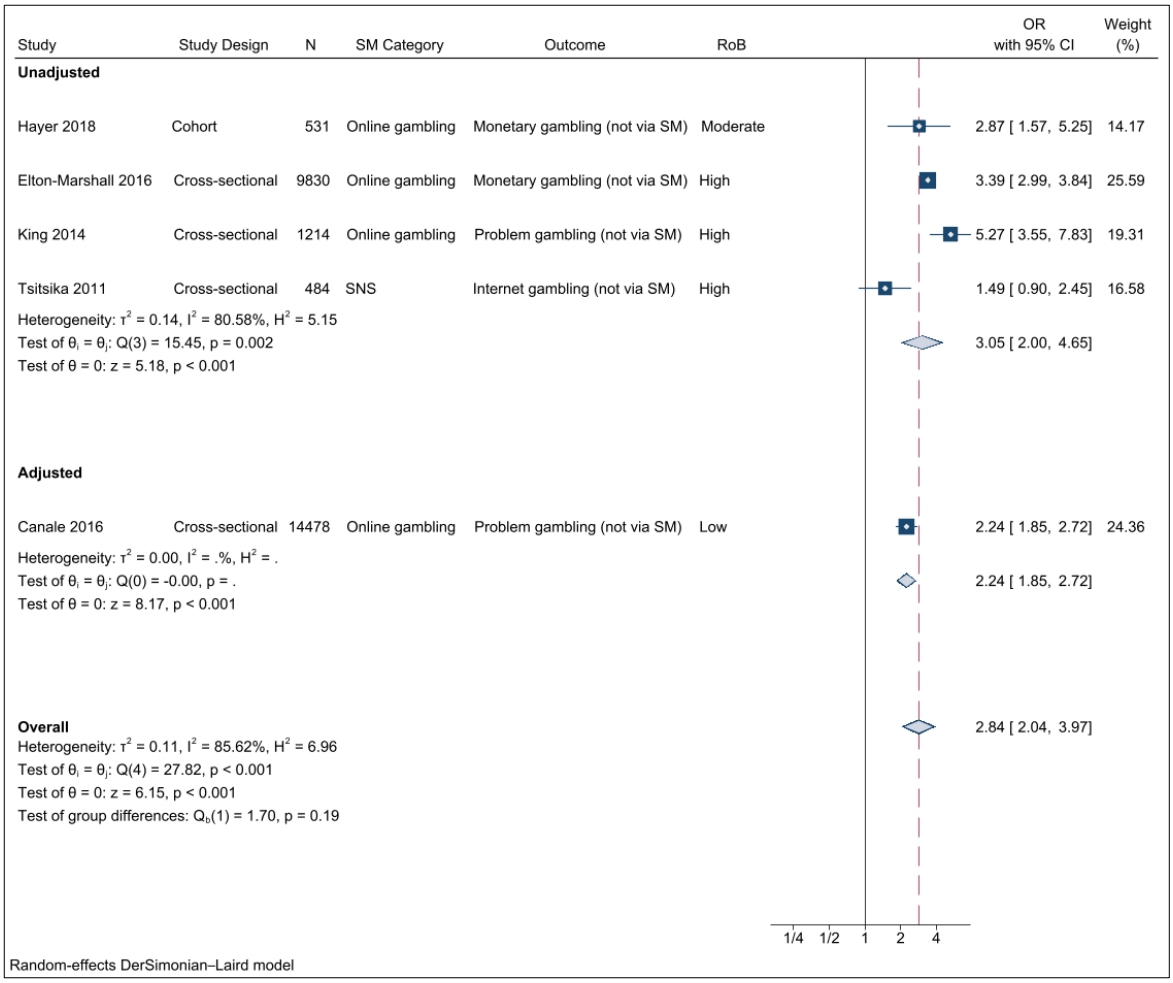
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=721,322. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.21. Forest plot for association between frequency of social media use and sexual risk behaviour, by adjustment for critical confounding domains[a]



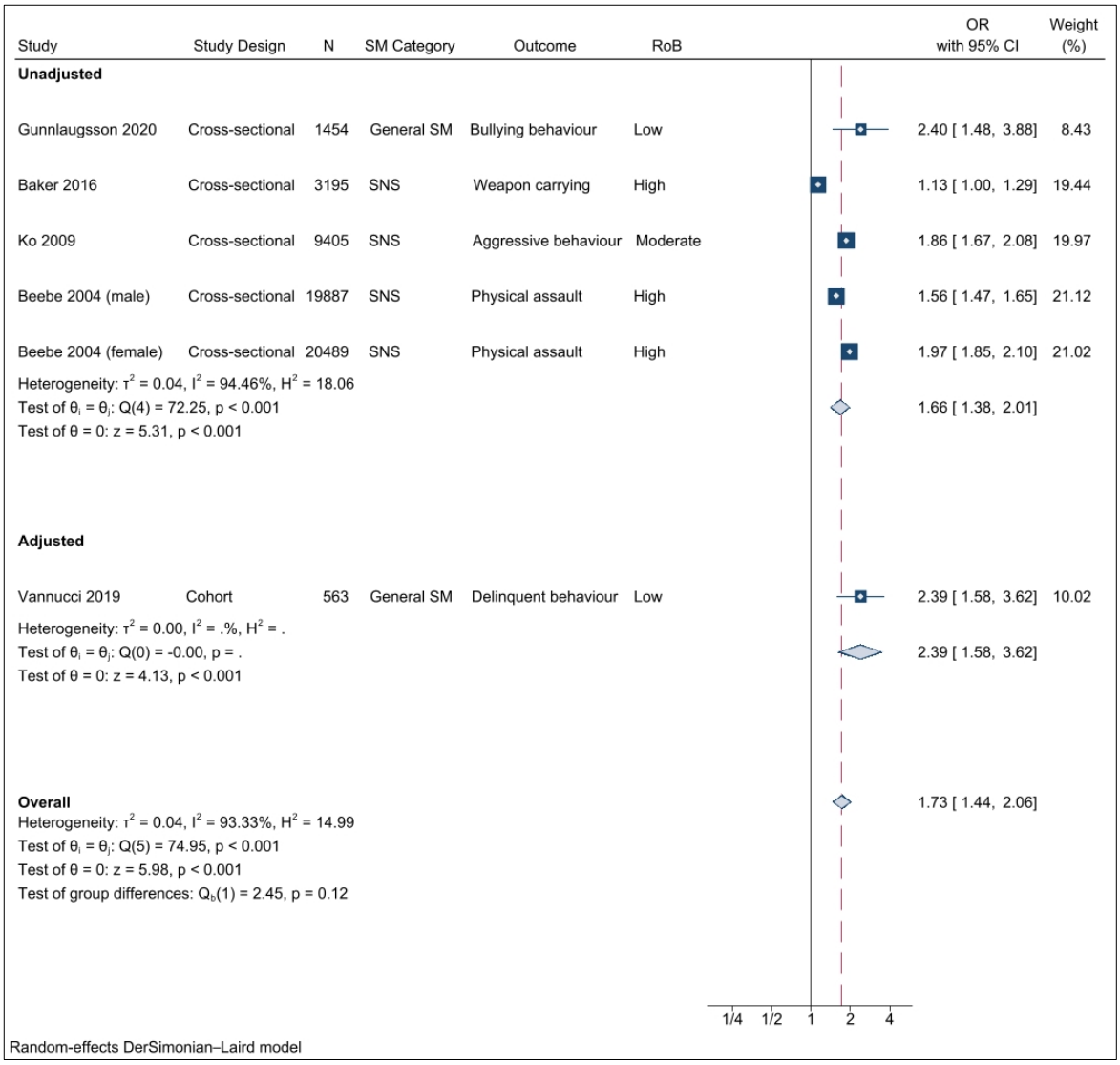
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=47,325. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.22. Forest plot for association between frequency of social media use and gambling, by adjustment for critical confounding domains[a]



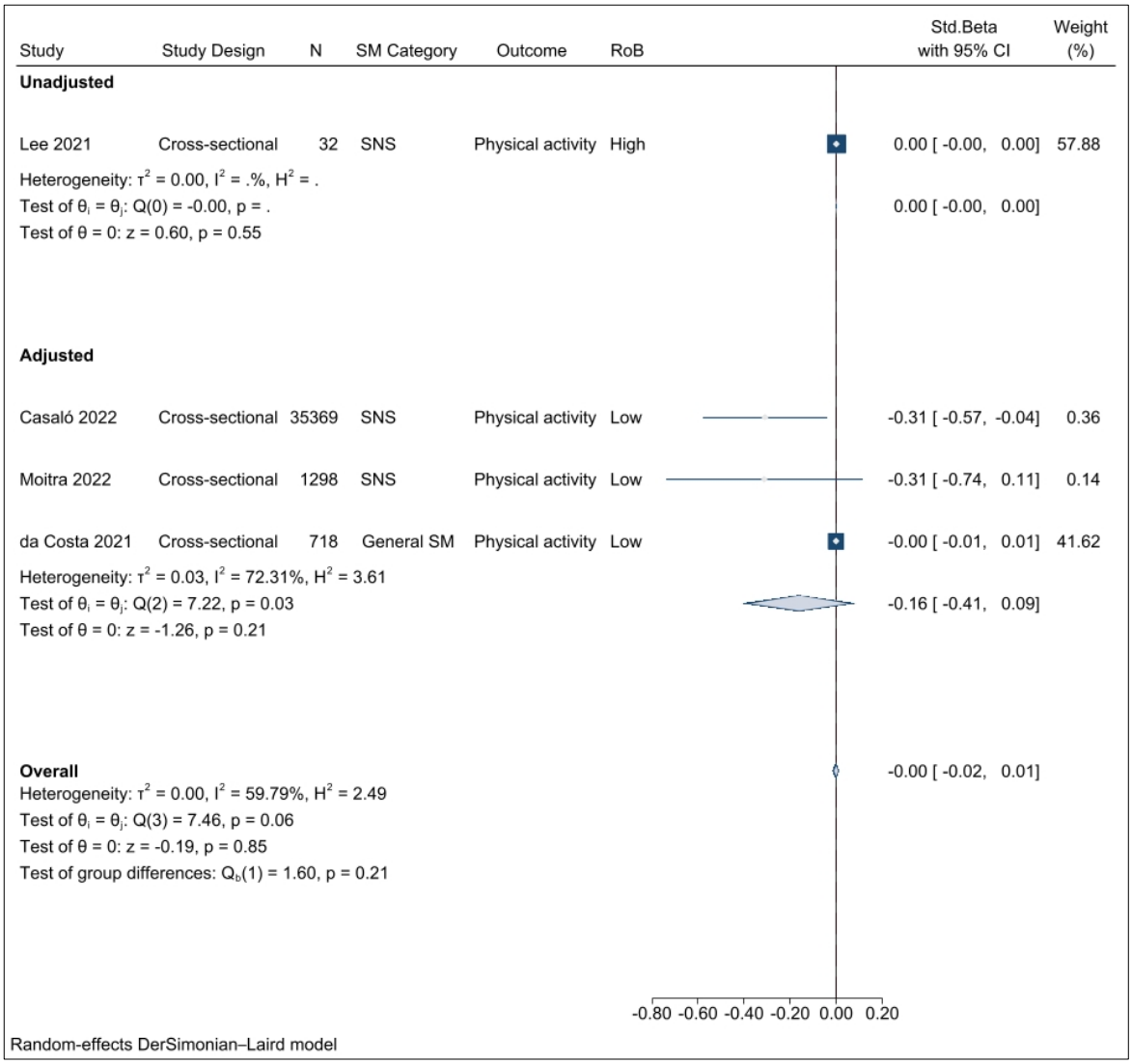
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=26,537. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.23. Forest plot for association between frequency of social media use and anti-social behaviour, by adjustment for critical confounding domains[a]



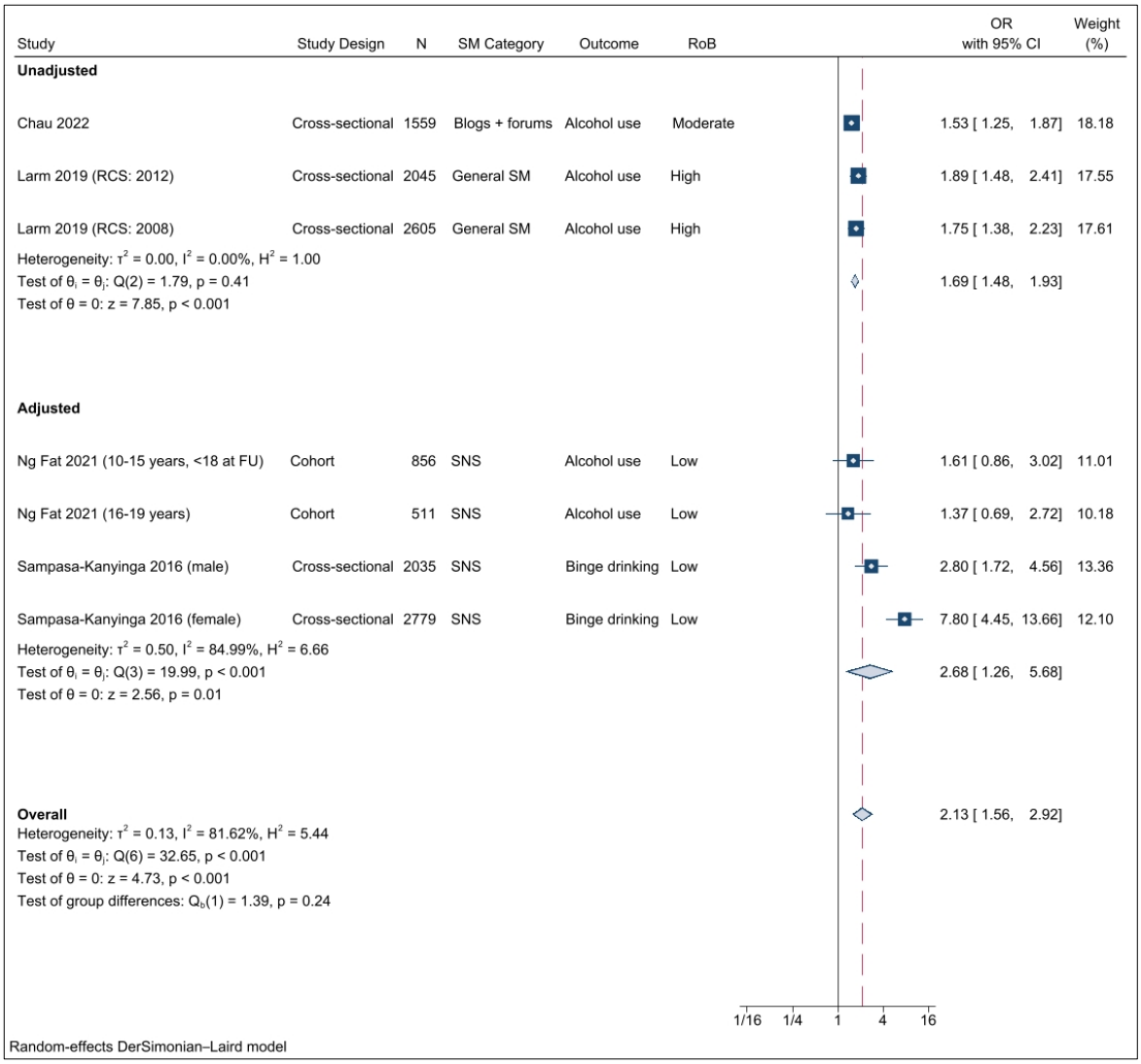
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome sensitivity analysis, with odds (OR) used as common metric.
[a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=54,993. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.24. Forest plot for association between time spent on social media and inadequate physical activity, by adjustment for critical confounding domains[a]



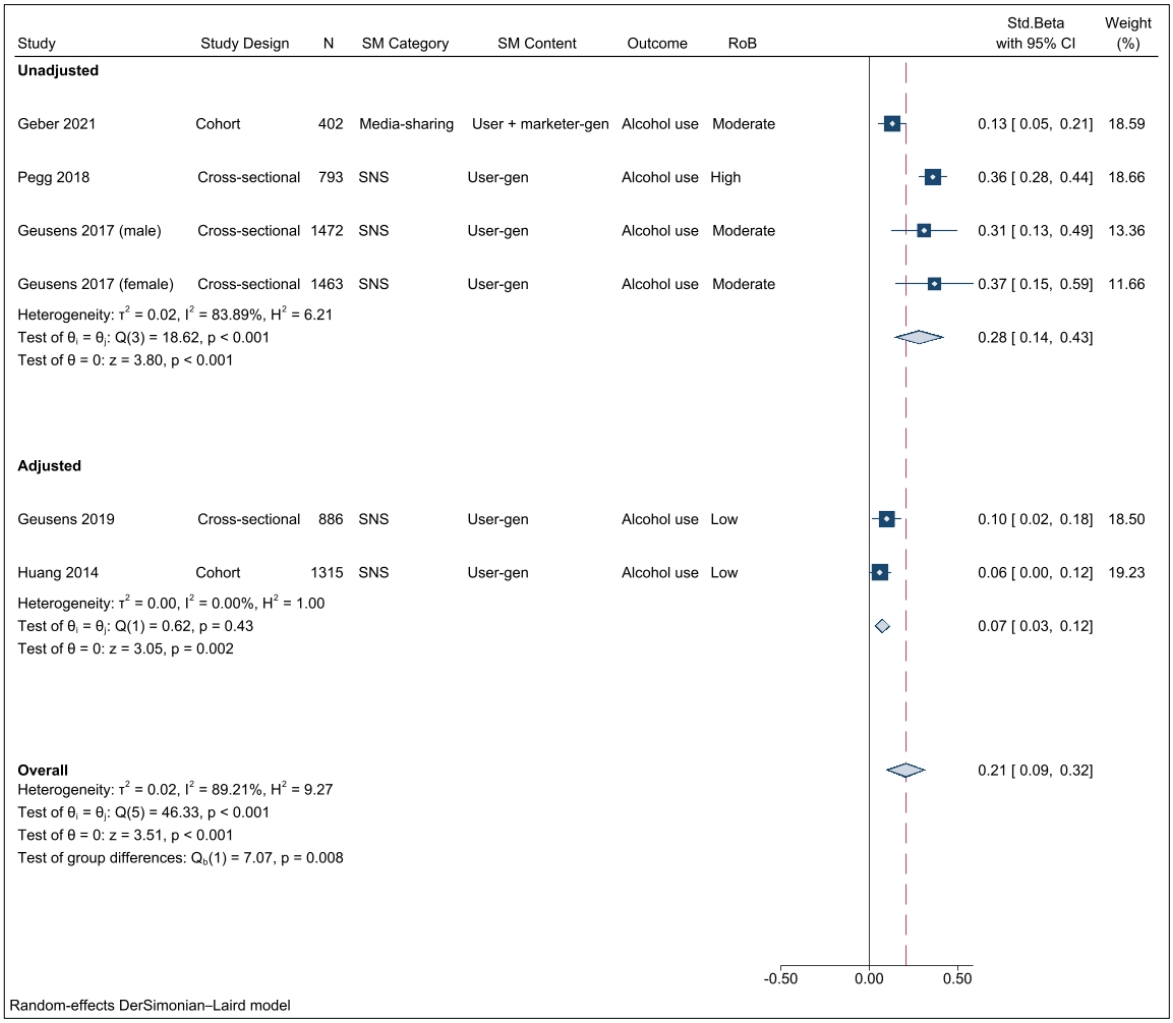
Legend: Figure presents forest plot for continuous exposure & continuous outcome sensitivity analysis, with standardised beta (Std. Beta) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=37,417. Abbreviation(s): CI=Confidence interval; N=Number of study participants; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.11.25. Forest plot for association between time spent on social media and alcohol use, by adjustment for critical confounding domains[a]



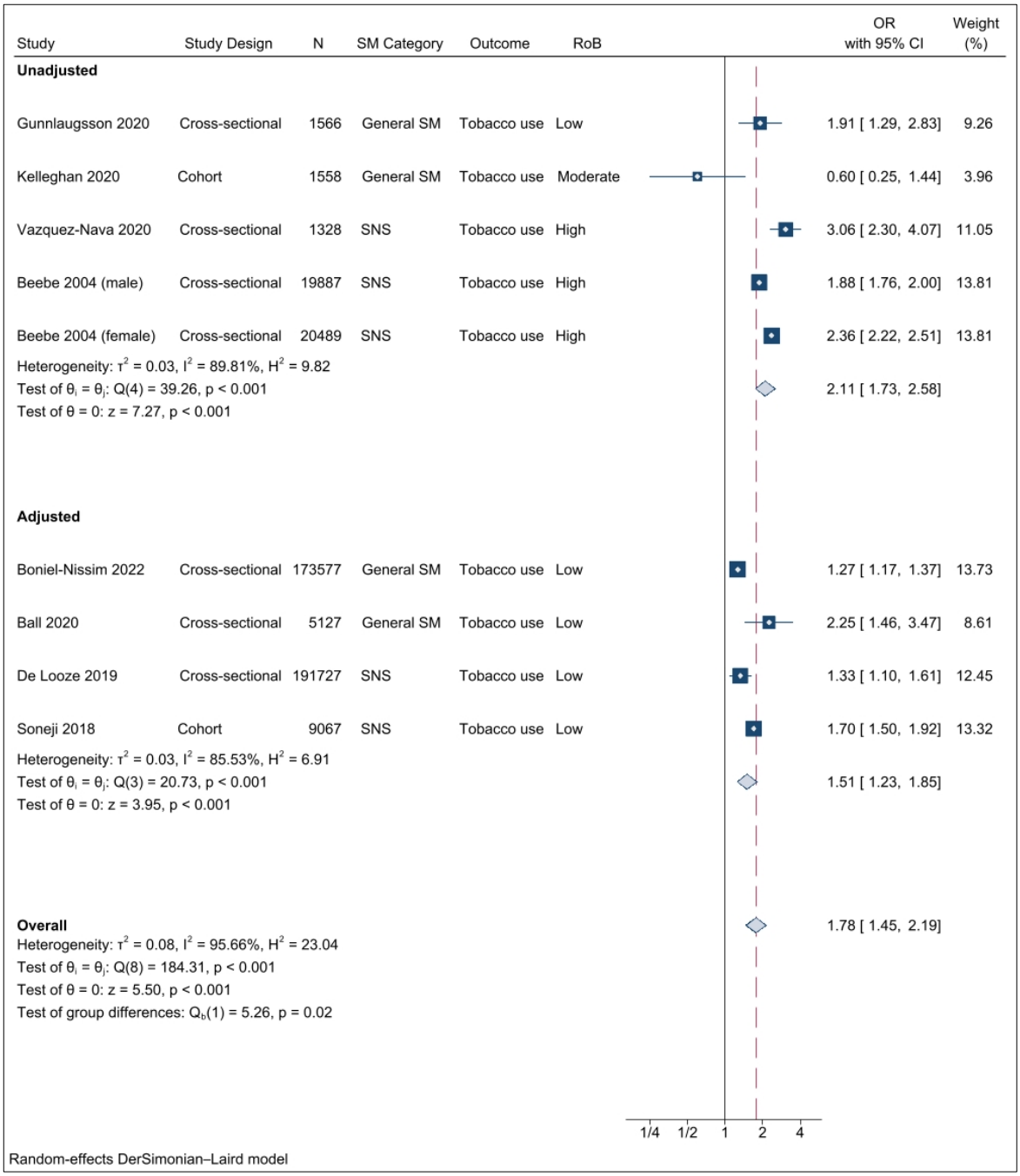
Legend: Figure presents forest plot for binary exposure (≥2 vs <2 hours/day social media use) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=12,390. Abbreviation(s): CI=Confidence interval; FU=Follow-up; N=Number of study participants; OR=Odds ratio; RCS=Repeat cross-sectional study; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.26. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use, by adjustment for critical confounding domains[a]



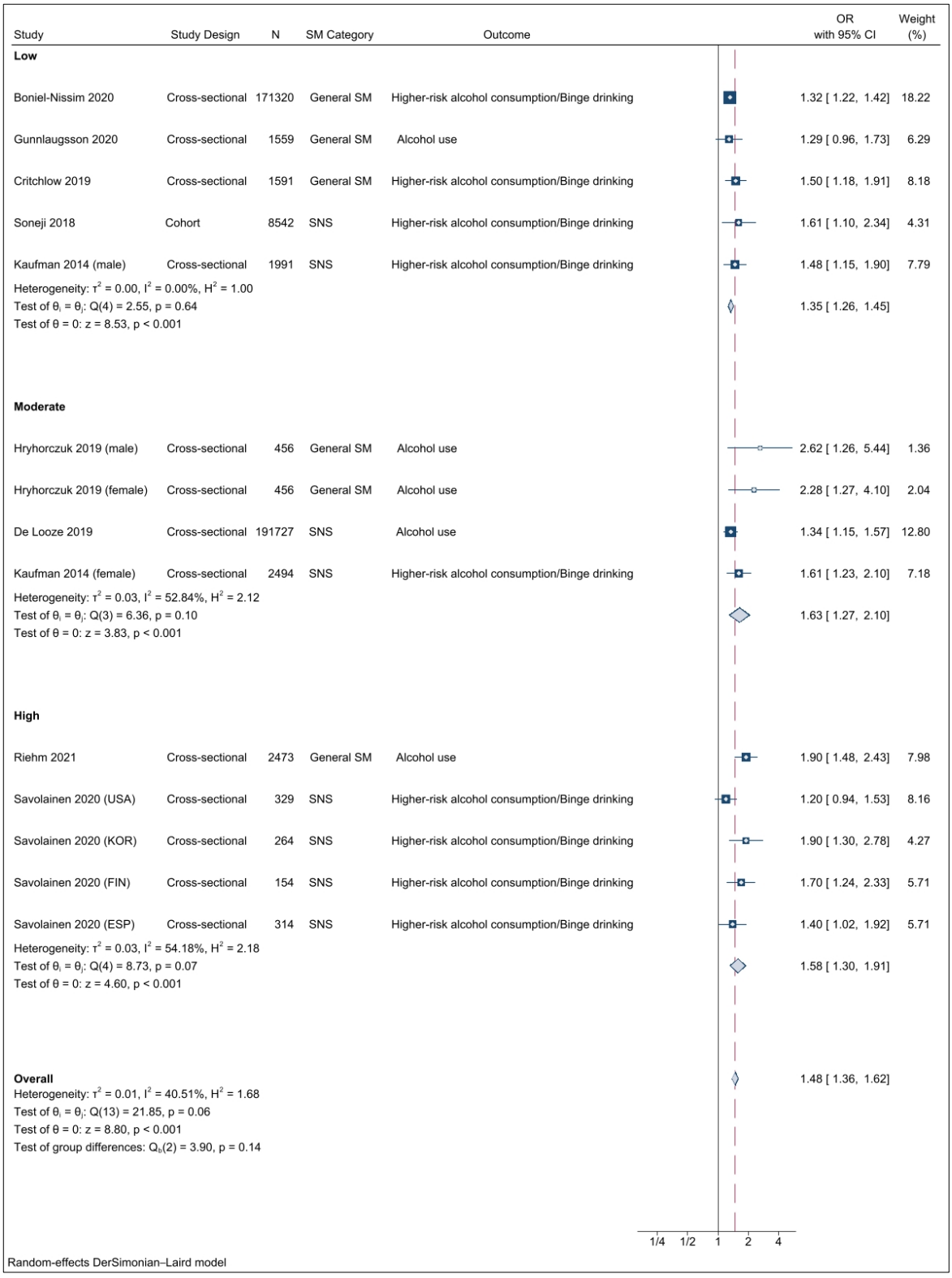
Legend: Figure presents forest plot for continuous exposure & continuous outcome sensitivity analysis, with standardised beta (Std. Beta) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=6,331. Abbreviation(s): CI=Confidence interval; N=Number of study participants; Marketer-gen=Marketer-generated content; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); Std. Beta=Standardised beta; and User-gen=User-generated content.

Figure A17.11.27. Forest plot for association between frequency of social media use and tobacco use, by adjustment for critical confounding domains[a]



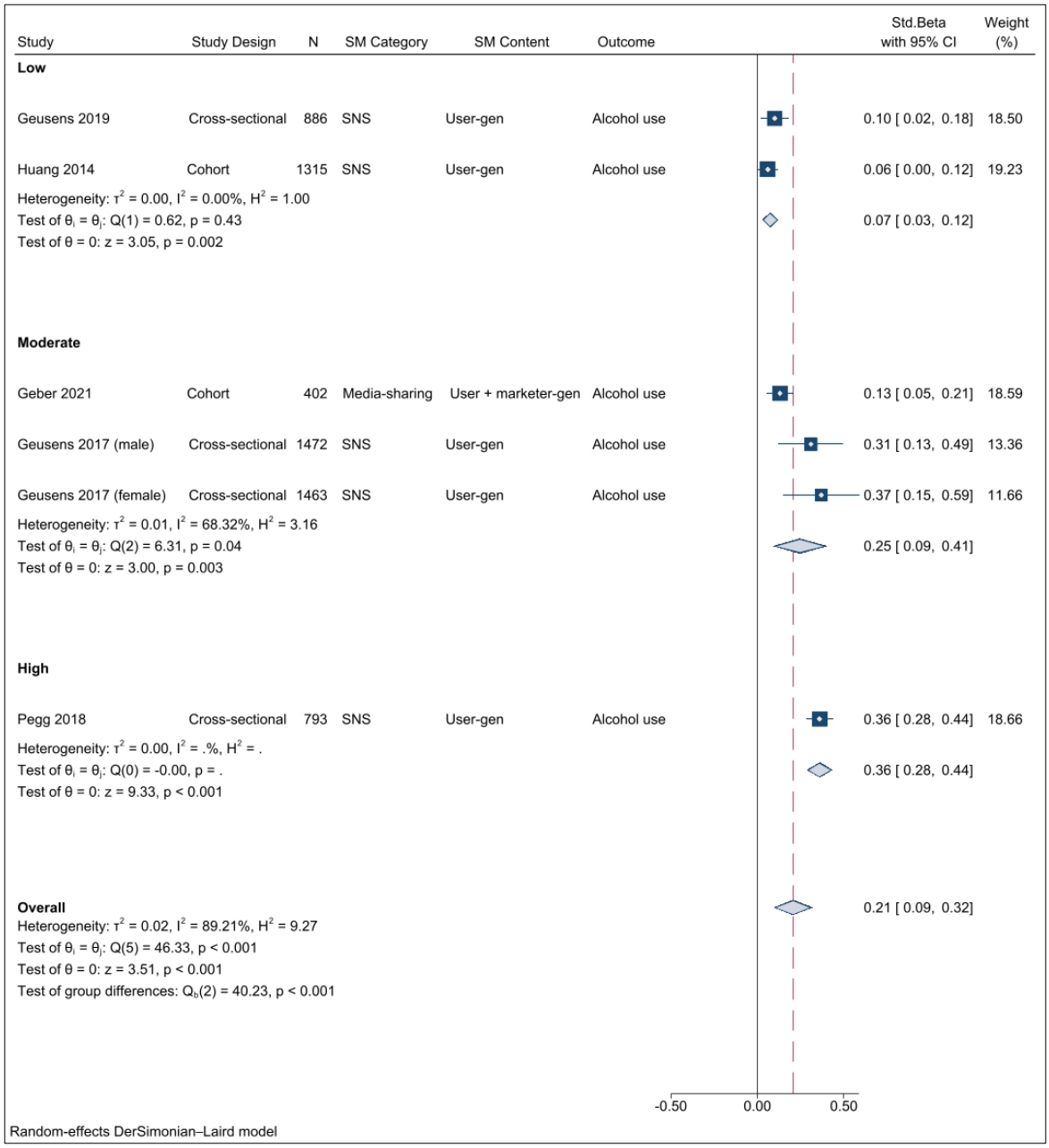
Legend: Figure presents forest plot for binary exposure (frequent vs infrequent) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. [a] Critical confounding domains: age, sex, and socioeconomic circumstance(s). Total number of study participants=424,326. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.28. Forest plot for association between frequency of social media use and alcohol use, by risk of bias grade



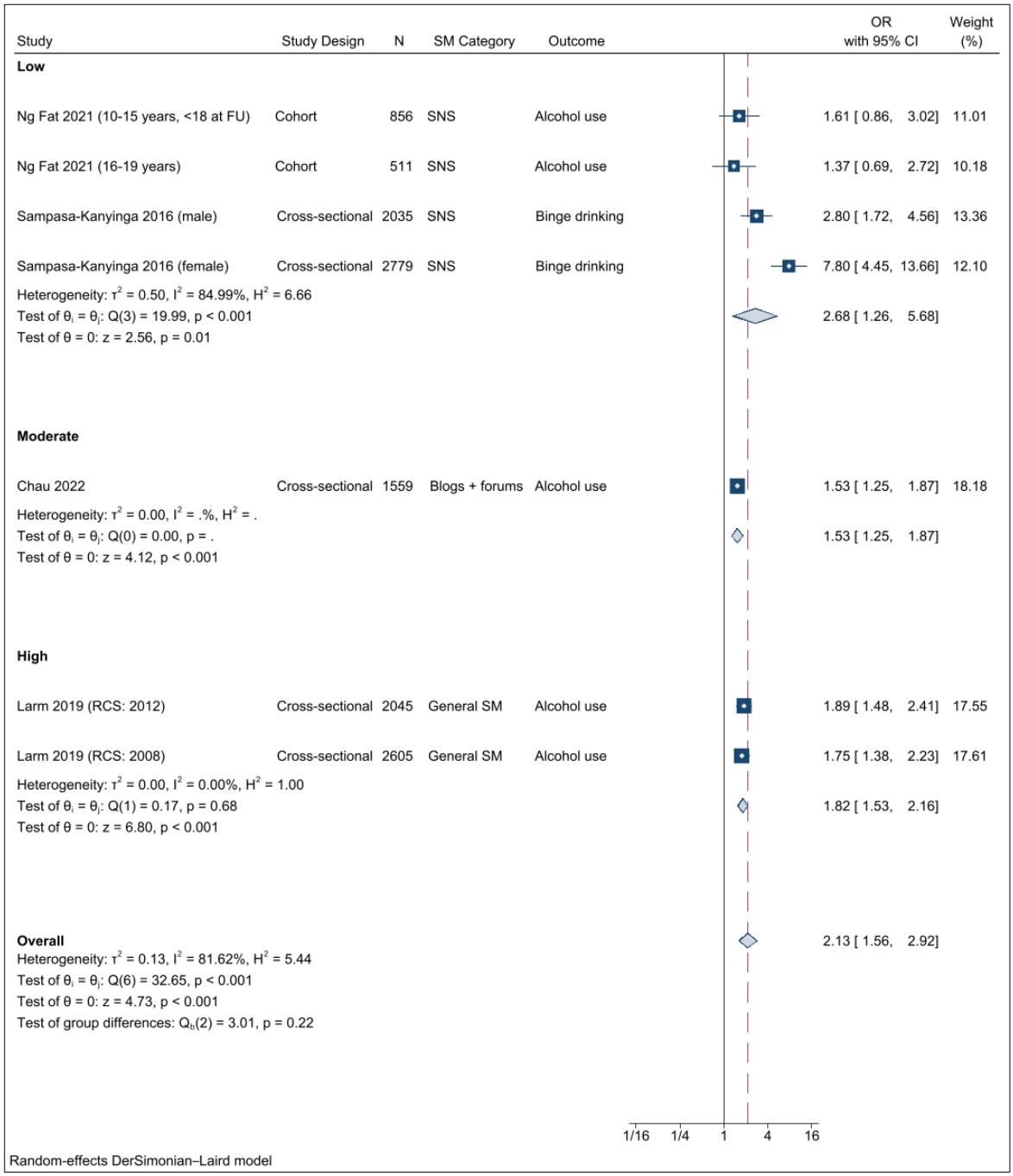
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=383,670. Abbreviation(s): CI=Confidence interval; ESP=Spain; FIN=Finland; KOR=South Korea; N=Number of study participants; OR=Odds ratio; SM=Social media; SNS=Social networking site(s); and USA=United States of America.

Figure A17.11.29. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use, by risk of bias grade



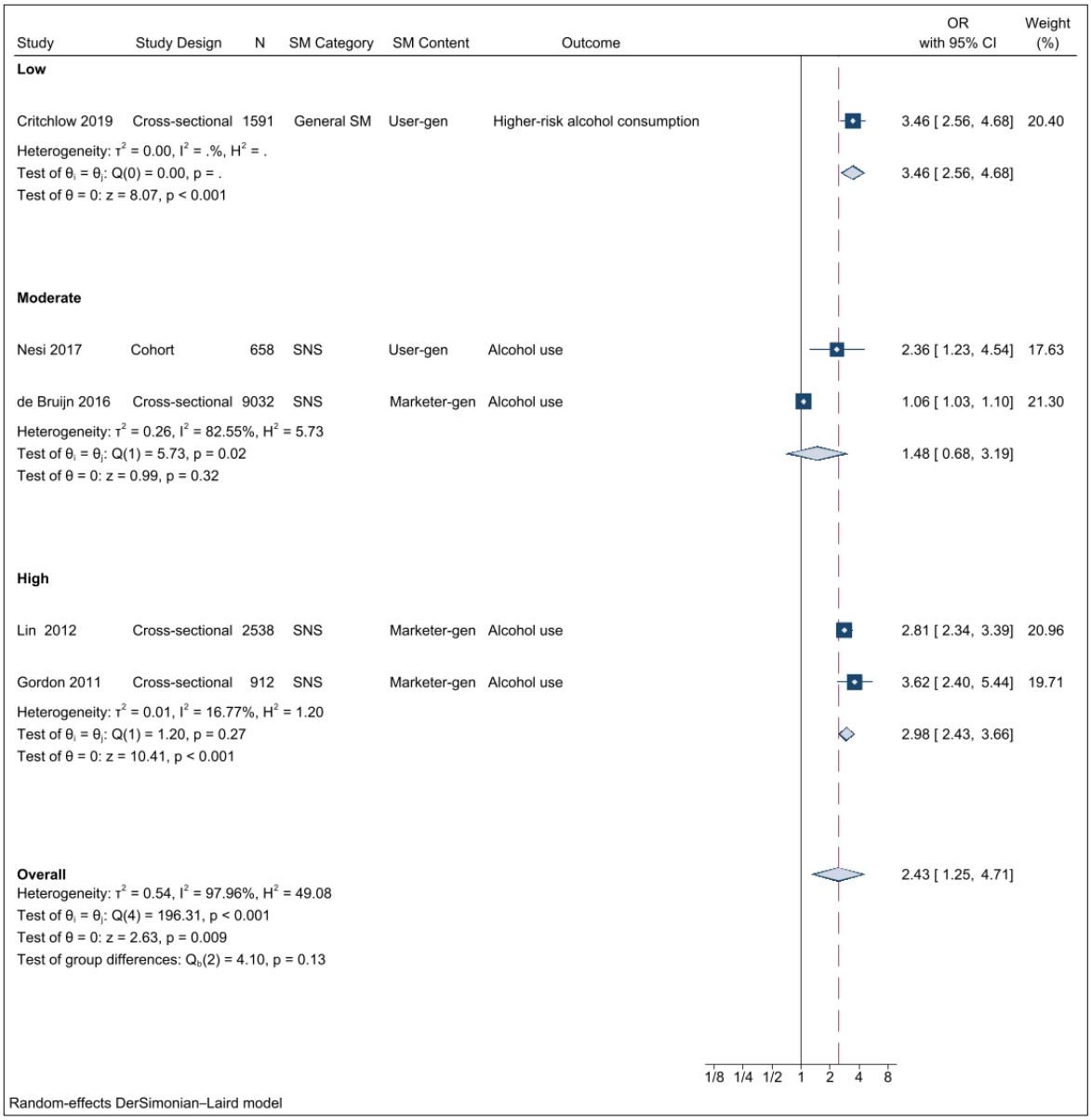
Legend: Figure presents forest plot for continuous exposure & continuous outcome sensitivity analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=6,331. Abbreviation(s): CI=Confidence interval; N=Number of study participants; Marketer-gen=Marketer-generated content; SM=Social media; SNS=Social networking site(s); Std. Beta=Standardised beta; and User-gen=User-generated content.

Figure A17.11.30. Forest plot for association between time spent on social media and alcohol use, by risk of bias grade



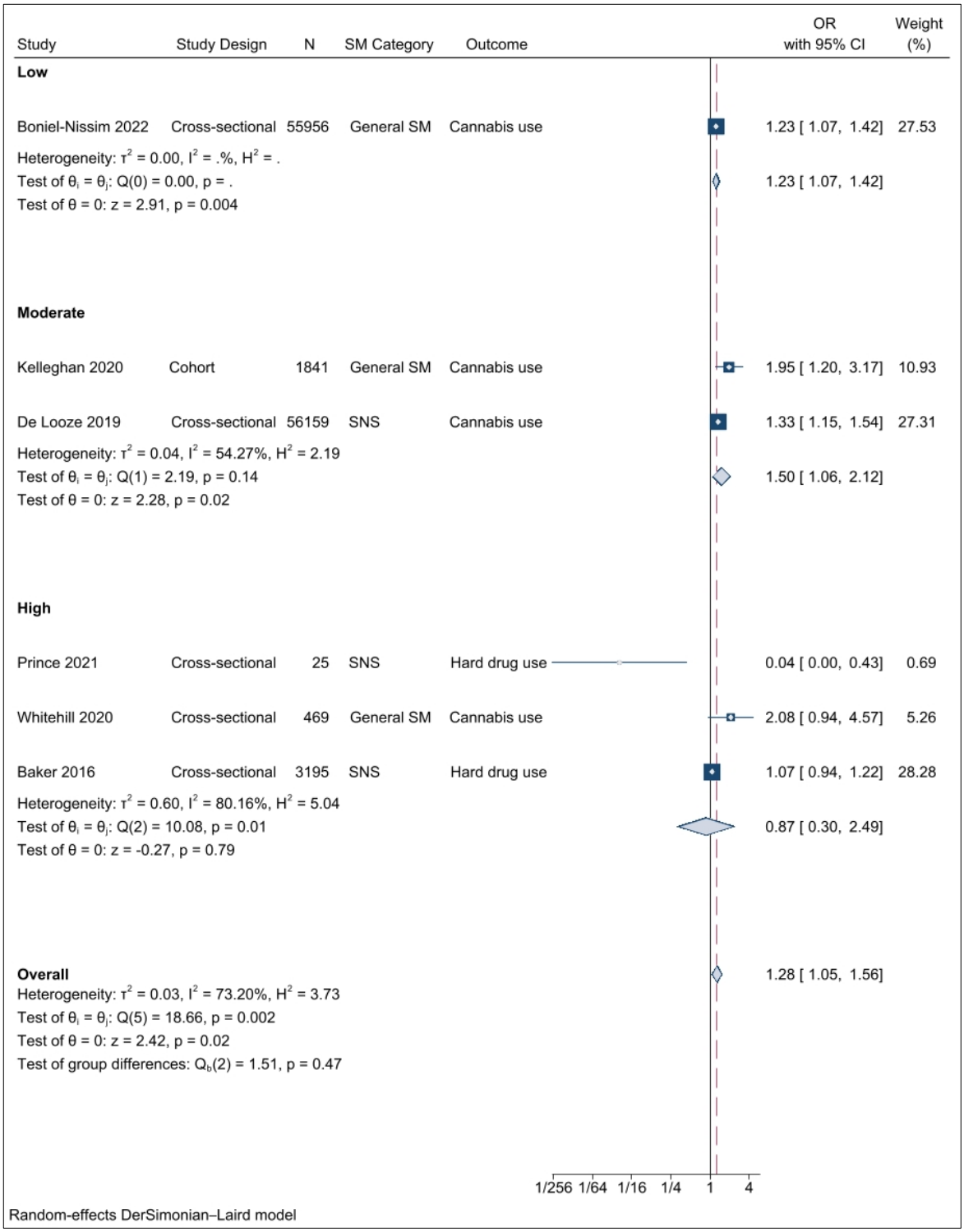
Legend: Figure presents forest plot for binary exposure (≥2 vs <2 hours/day social media use) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=12,390. Abbreviation(s): CI=Confidence interval; FU=Follow-up; N=Number of study participants; OR=Odds ratio; RCS=Repeat cross-sectional study; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.31. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use, by risk of bias grade



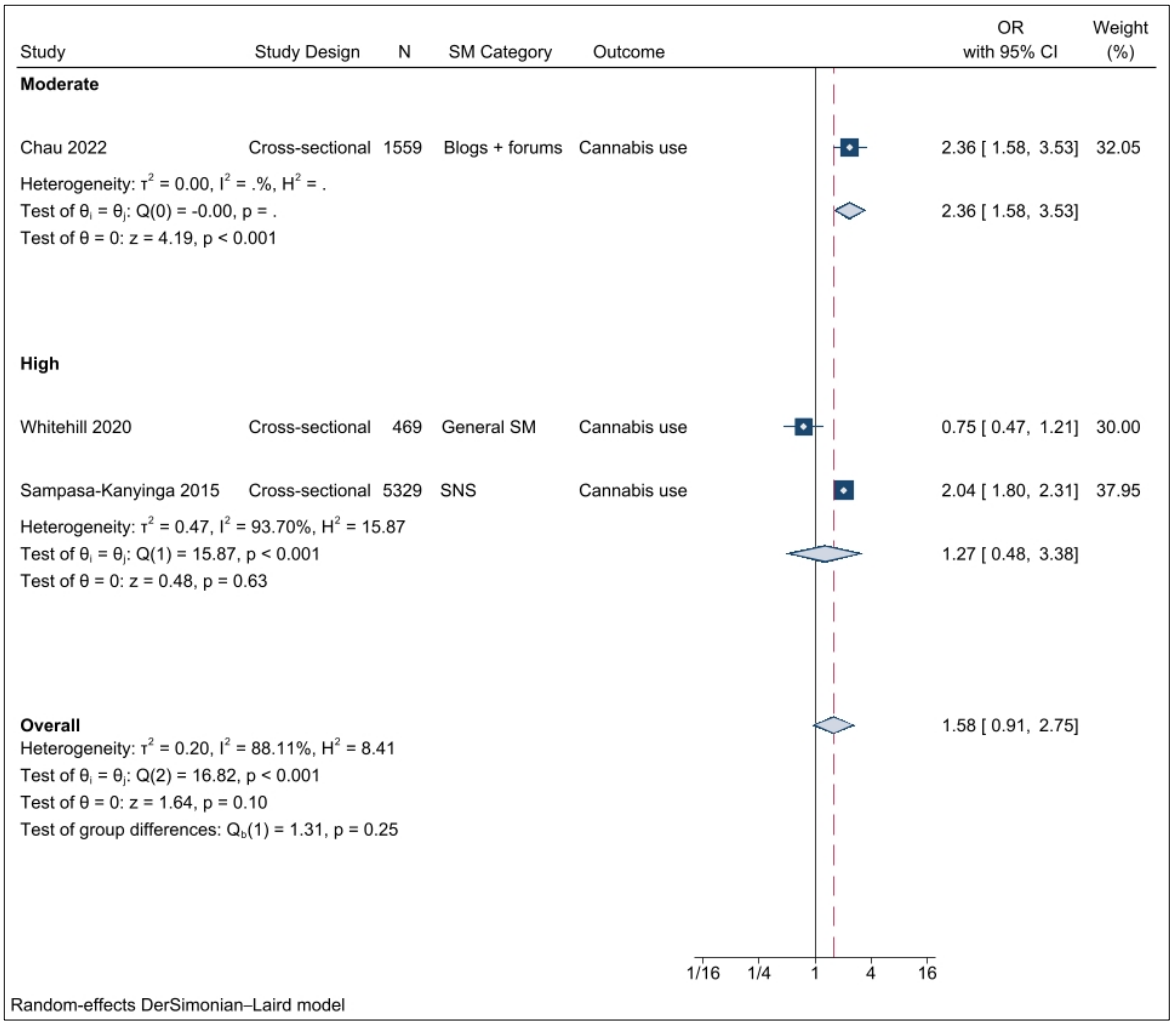
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=14,731. Abbreviation(s): CI=Confidence interval; Marketer-gen=Marketer-generated content; N=Number of study participants; OR=Odds ratio; SM=Social media; SNS=Social networking site(s); and User-gen=User-generated content.

Figure A17.11.32. Forest plot for association between frequency of social media use and drug use, by risk of bias grade



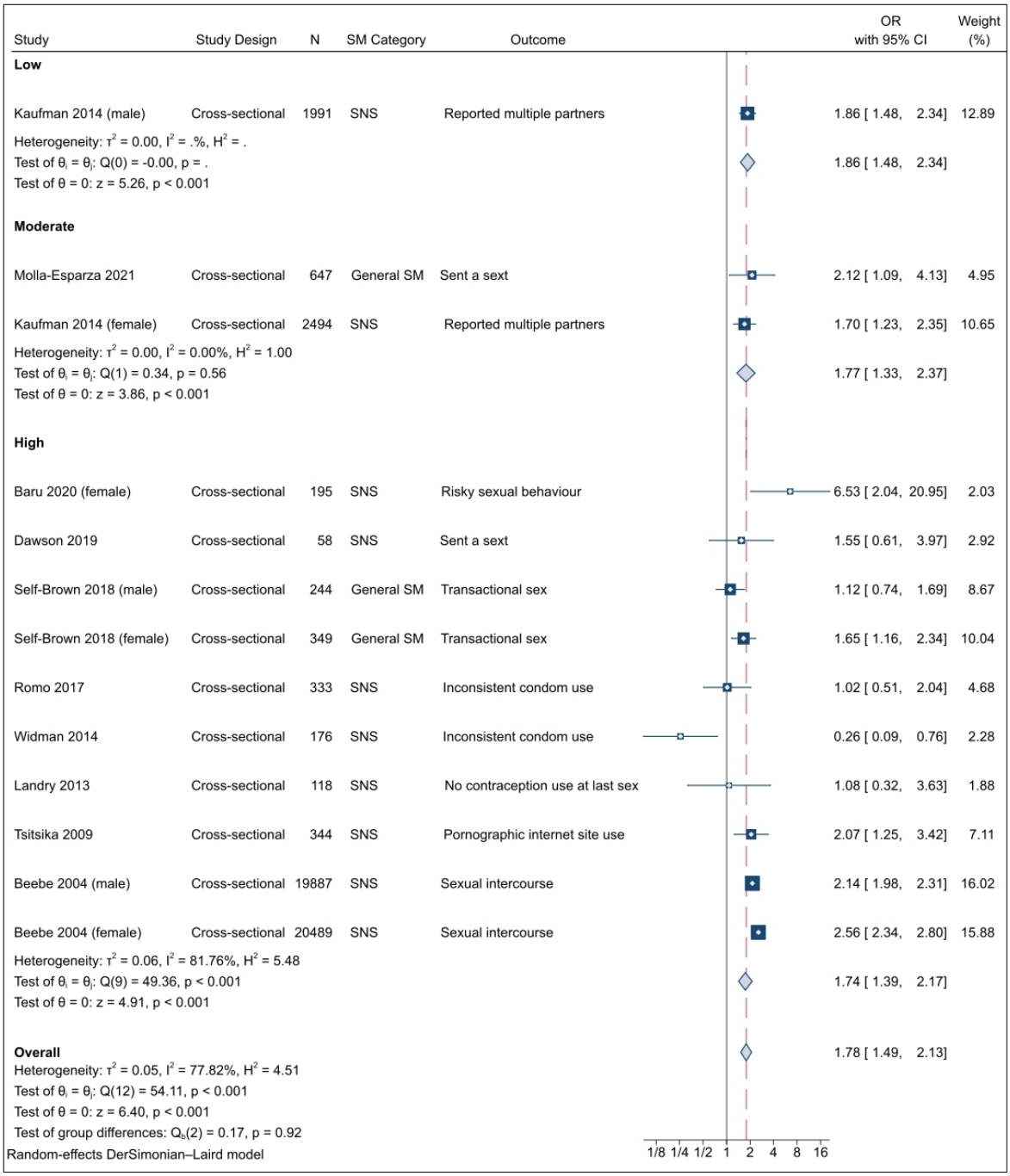
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=117,645. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.33. Forest plot for association between time spent on social media and drug use, by risk of bias grade



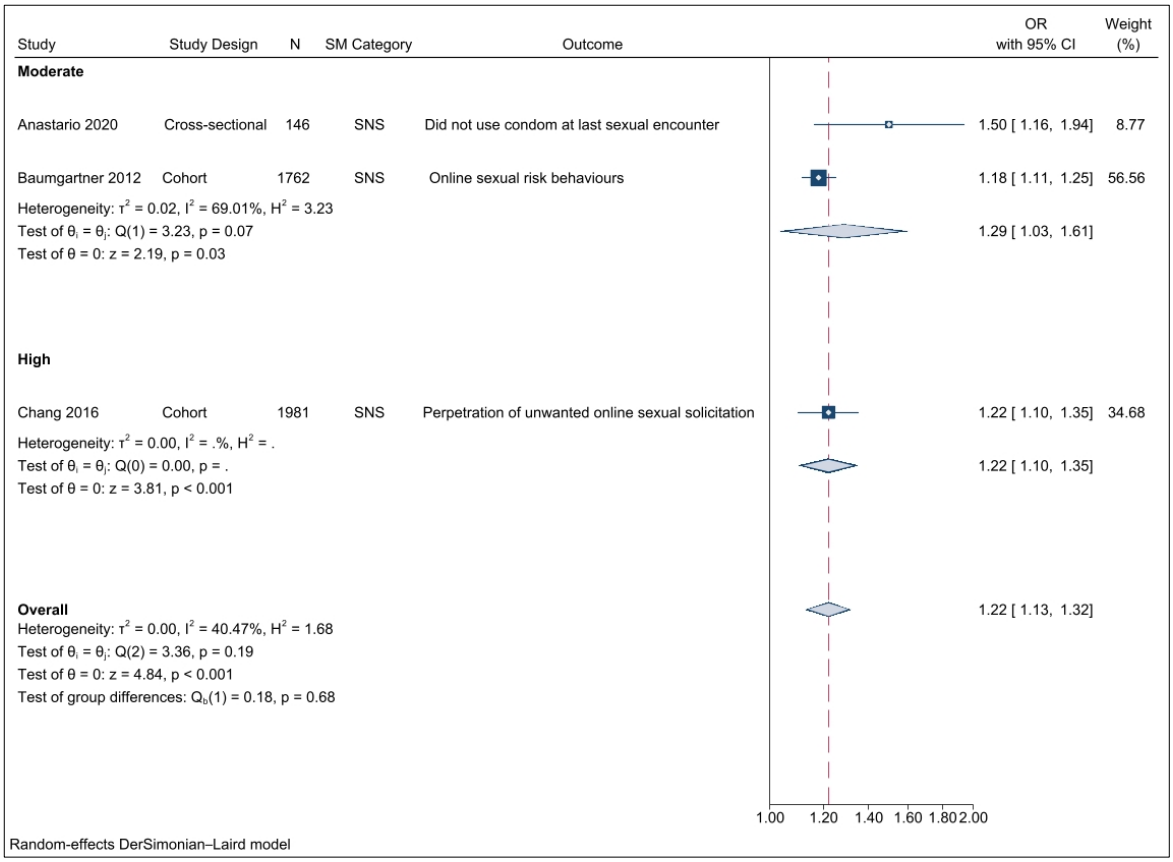
Legend: Figure presents forest plot for binary exposure (≤1 vs >1 hour/day) & binary/continuous outcome meta-analysis, with odds ratio (OR) used as common metric. Total number of study participants=7,357. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.34. Forest plot for association between frequency of social media use and sexual risk behaviour, by risk of bias grade



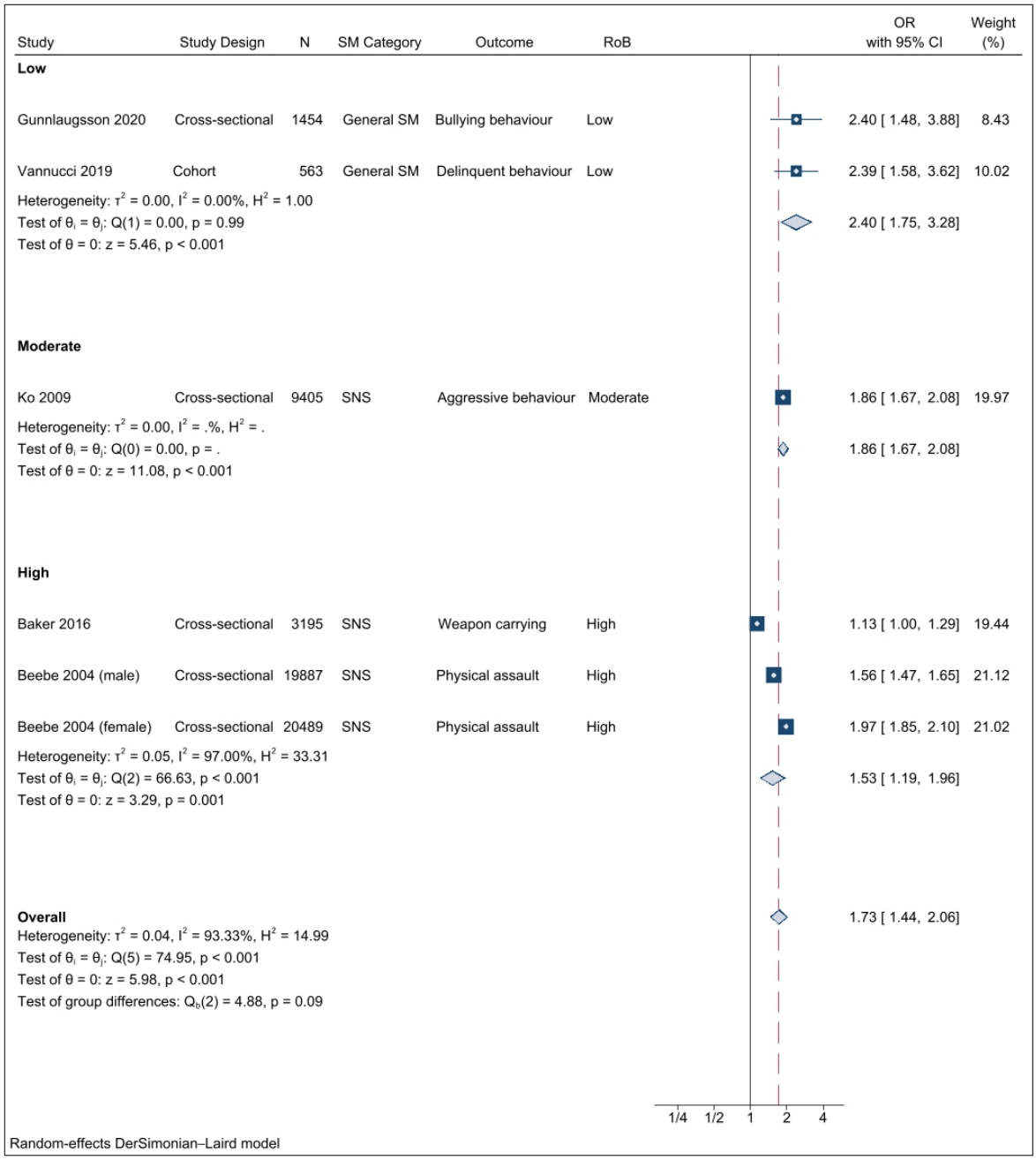
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=47,325. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.35. Forest plot for association between frequency of social media use and sexual risk behaviour, by risk of bias grade



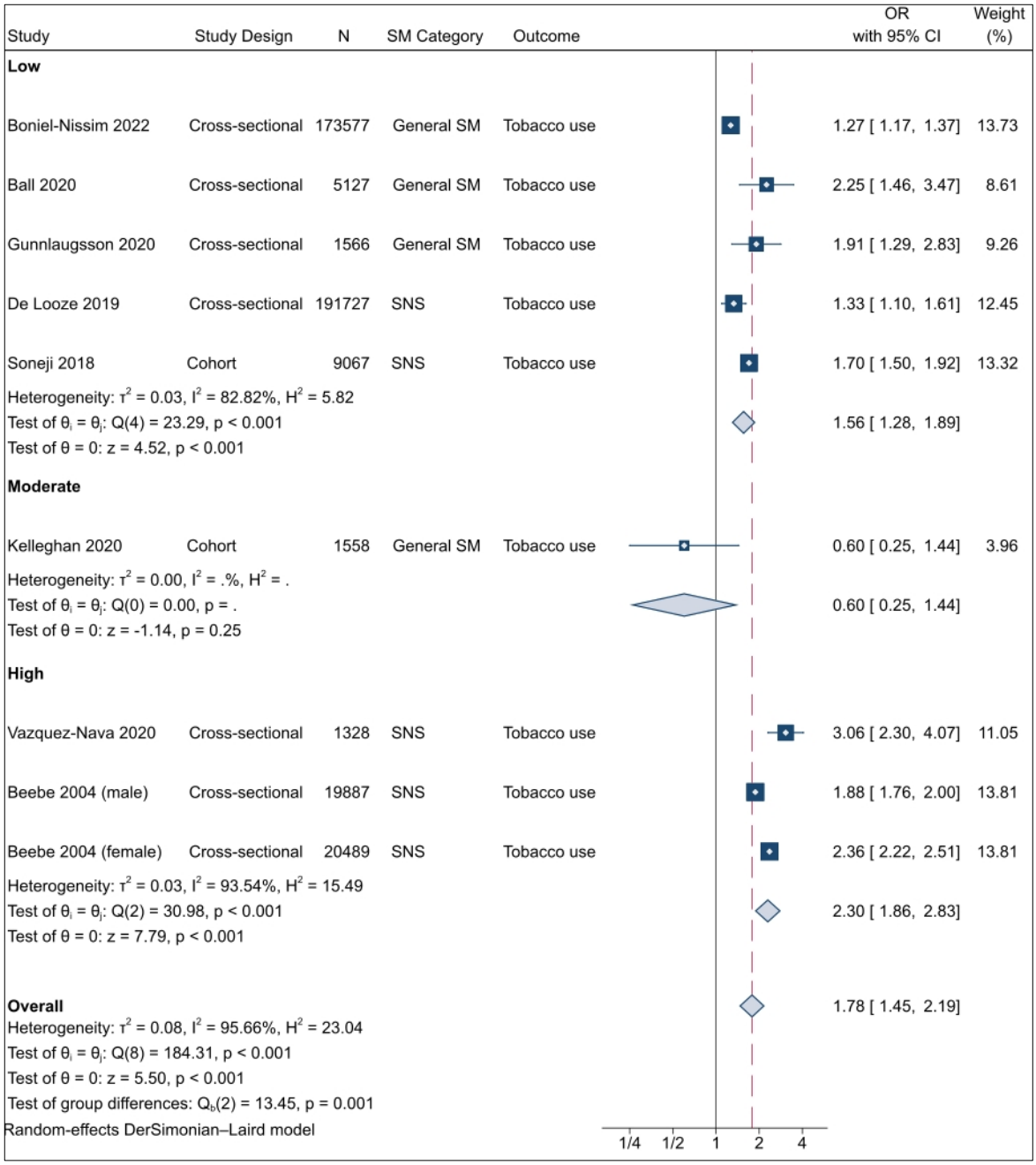
Legend: Figure presents forest plot for continuous exposure & binary outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=3,889. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.36. Forest plot for association between frequency of social media use and anti-social behaviour, by risk of bias grade



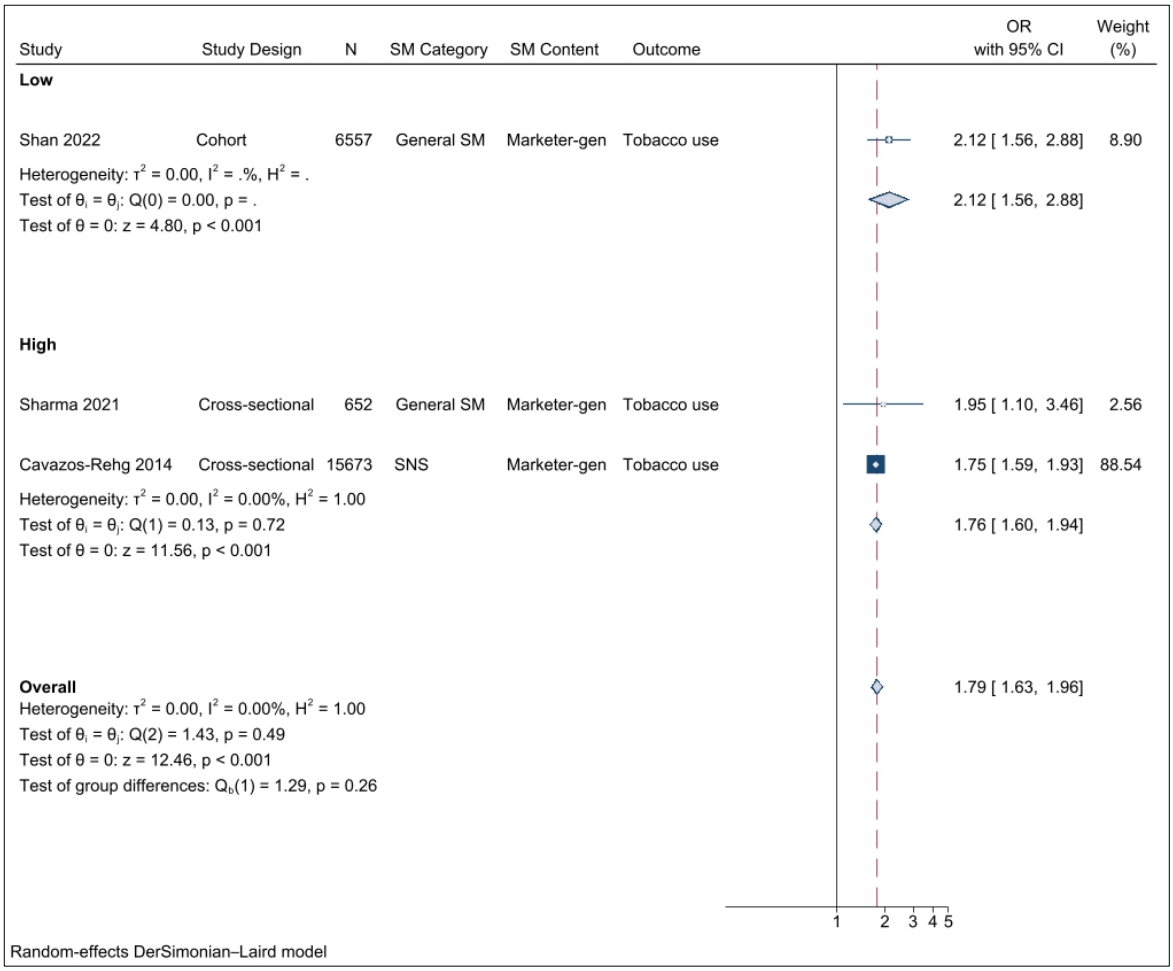
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome sensitivity analysis, with odds (OR) used as common metric. Total number of study participants=54,993. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.37. Forest plot for association between frequency of social media use and tobacco use, by risk of bias grade



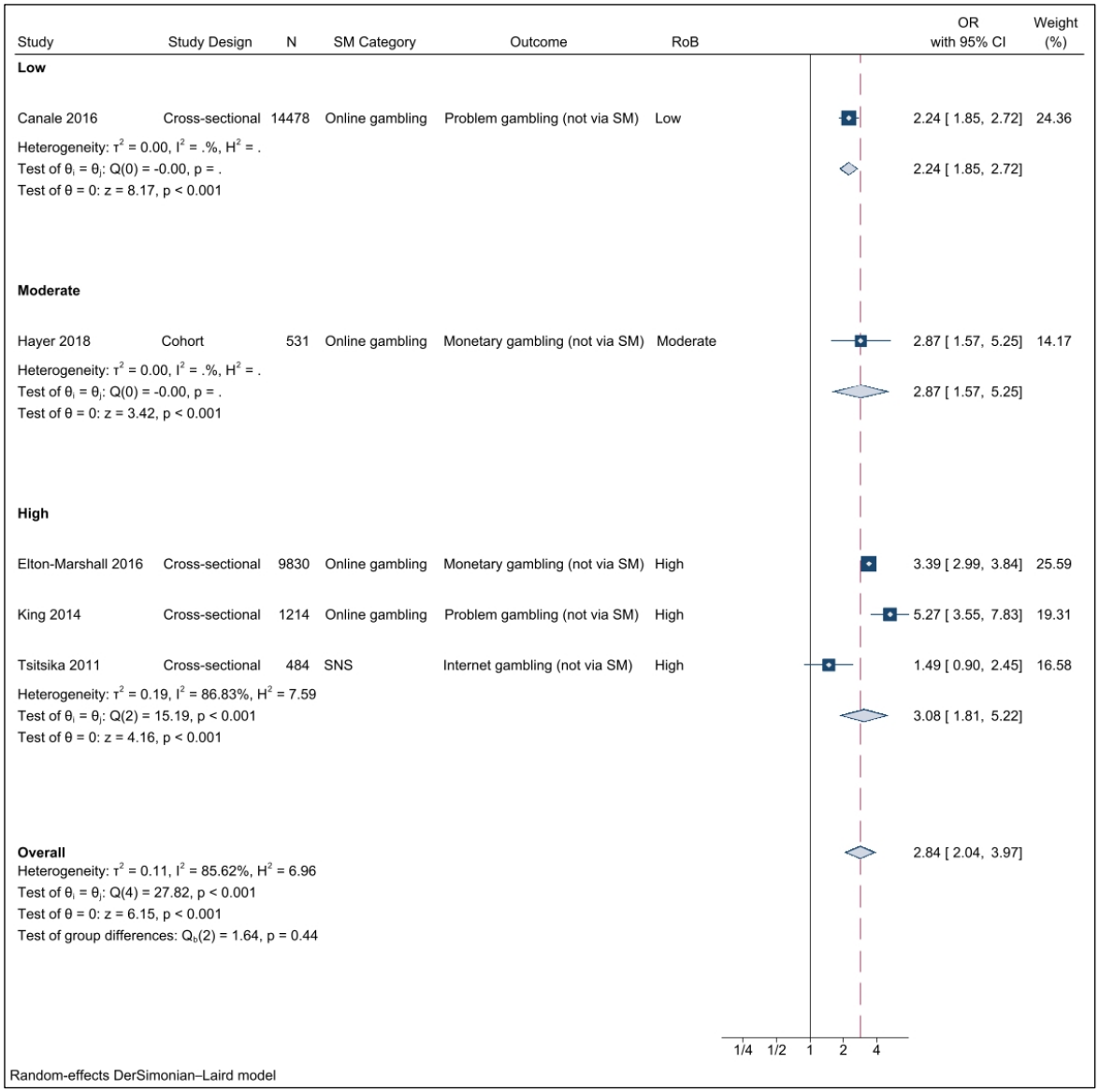
Legend: Figure presents forest plot for binary exposure (frequent vs infrequent) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=424,326. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.38. Forest plot for association between exposure to health-risk behaviour content on social media and tobacco use, by risk of bias



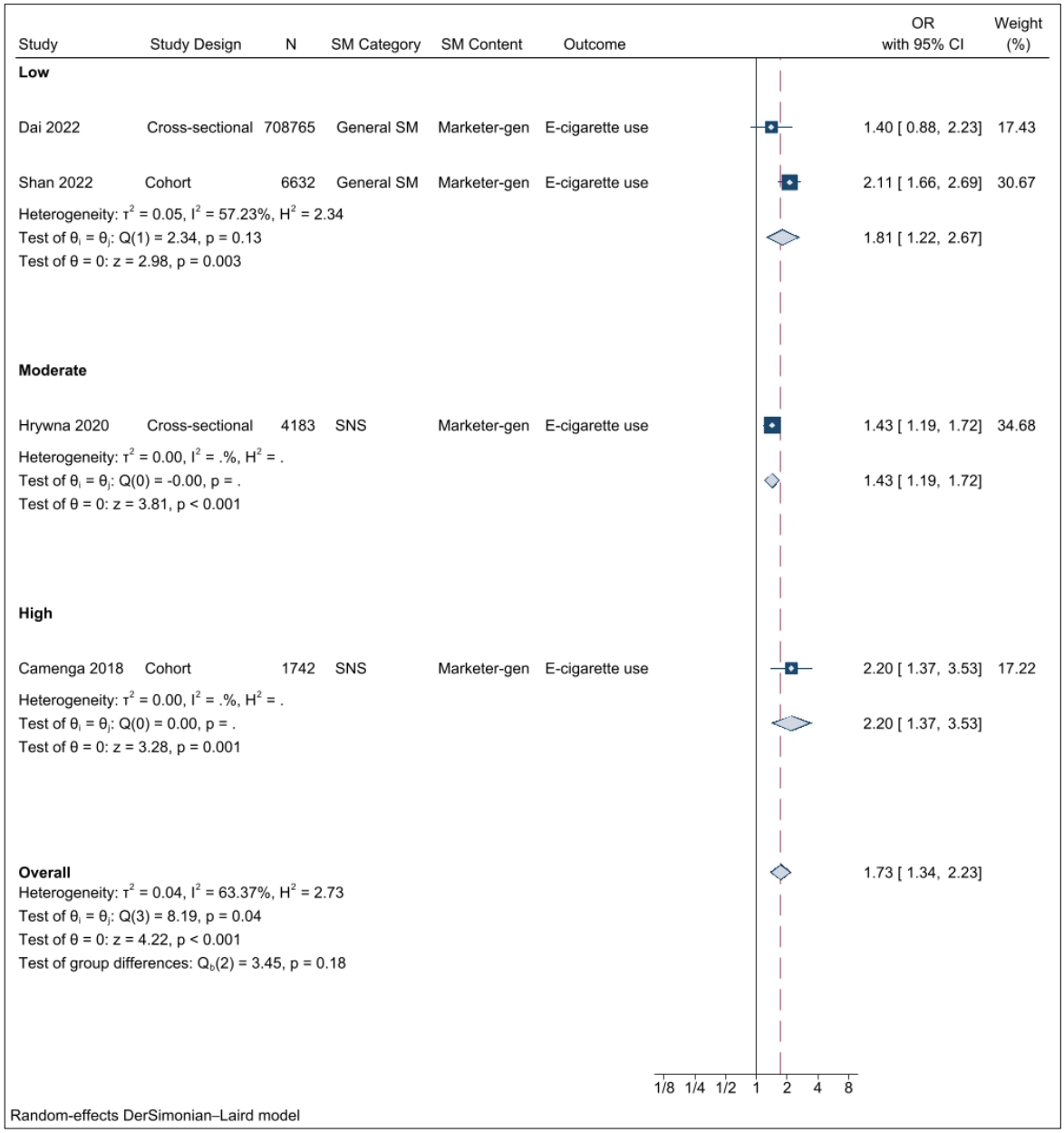
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=22,882. Abbreviation(s): CI=Confidence interval; Marketer-gen=Marketer-generated content; N=Number of study participants; OR=Odds ratio; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.39. Forest plot for association between frequency of social media use and gambling, by risk of bias grade



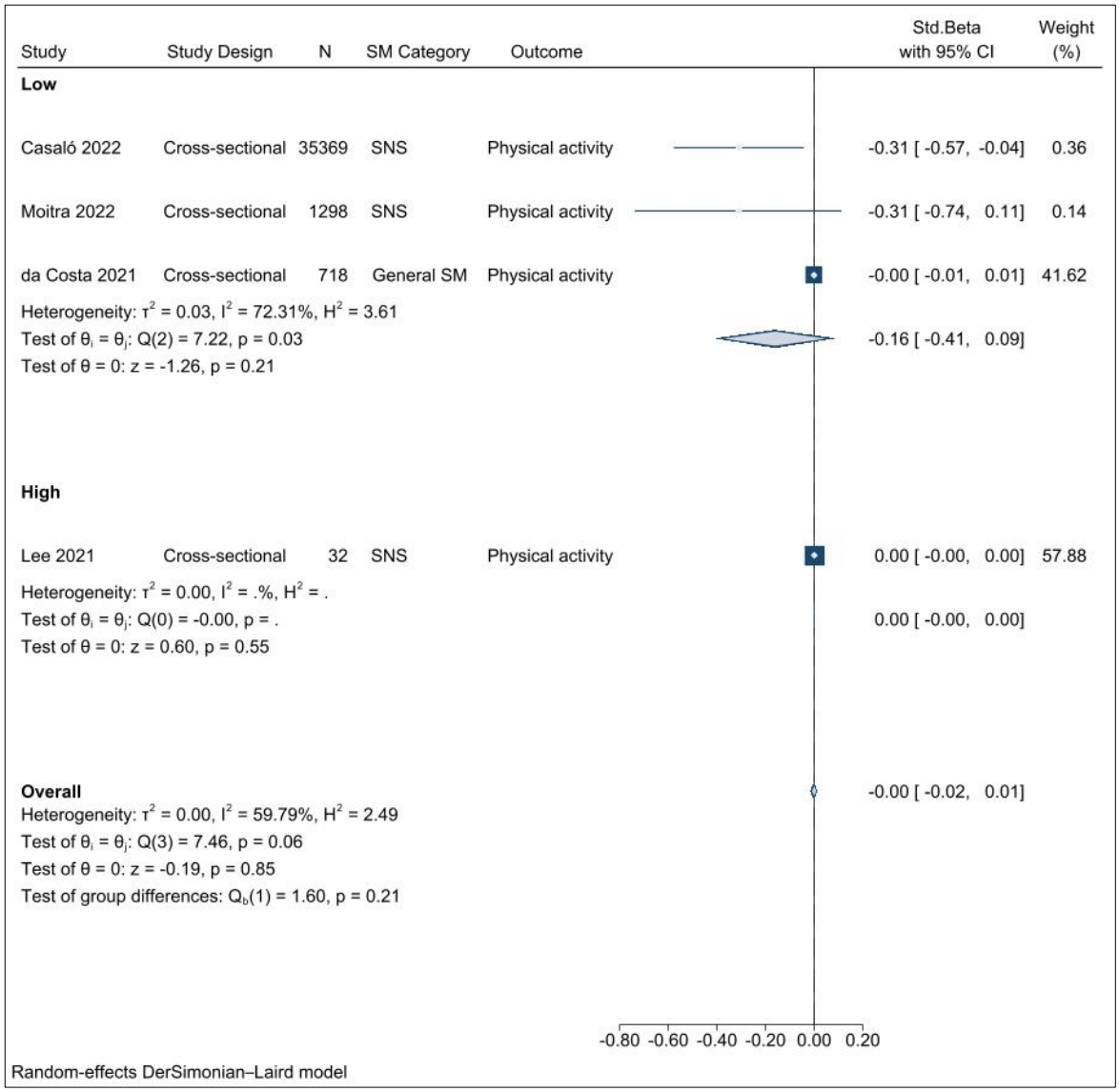
Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=26,537. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.40. Forest plot for association between exposure to health-risk behaviour content on social media and use of electronic nicotine delivery systems, by risk of bias grade



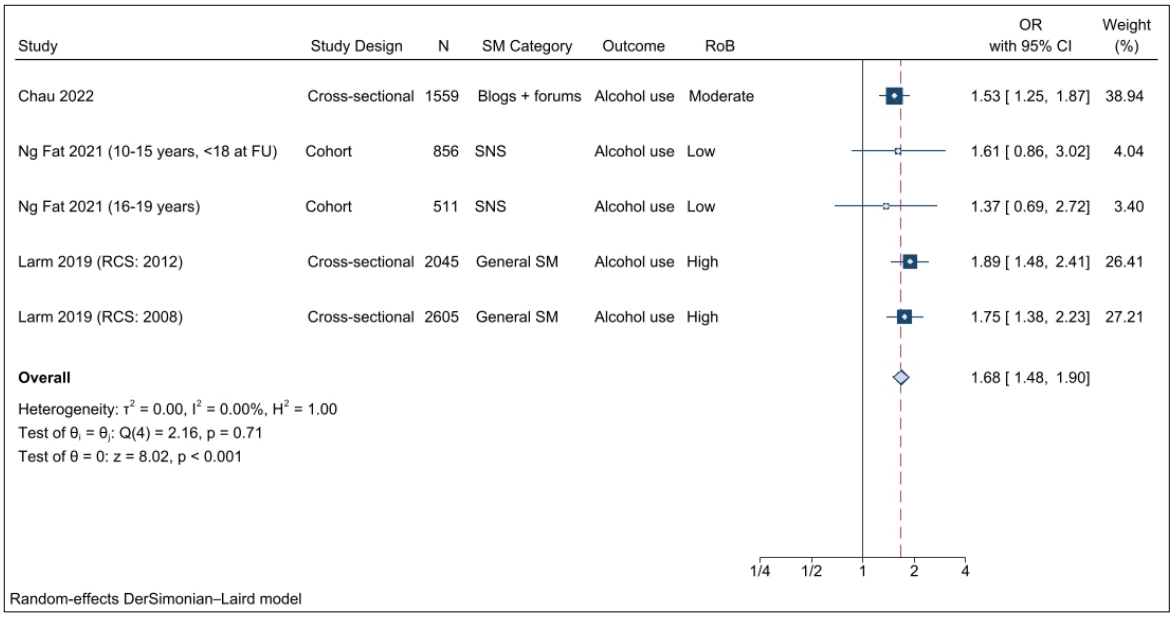
Legend: Figure presents forest plot for binary exposure (exposed vs not exposed) & binary/continuous outcome sensitivity analysis with odds ratio (OR) used as common metric. Total number of study participants=721,322. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.41. Forest plot for association between time spent on social media and inadequate physical activity, by risk of bias grade



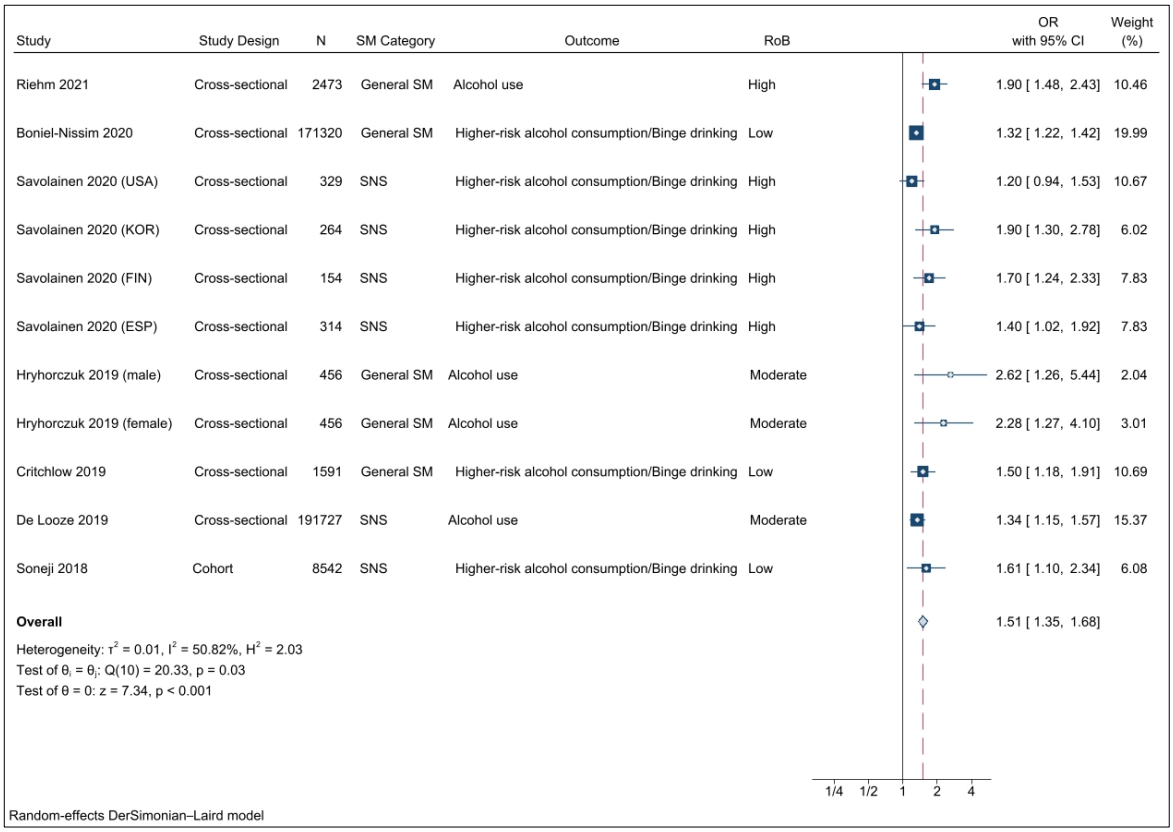
Legend: Figure presents forest plot for continuous exposure & continuous outcome sensitivity analysis, with standardised beta (Std .Beta) used as common metric. Total number of study participants=37,417. Abbreviation(s): CI=Confidence interval; N=Number of study participants; SM=Social media; SNS=Social networking site(s); and Std. Beta=Standardised beta.

Figure A17.11.42. Forest plot for association between time spent on social media and alcohol use, excluding datapoints which overlap 10-19 years



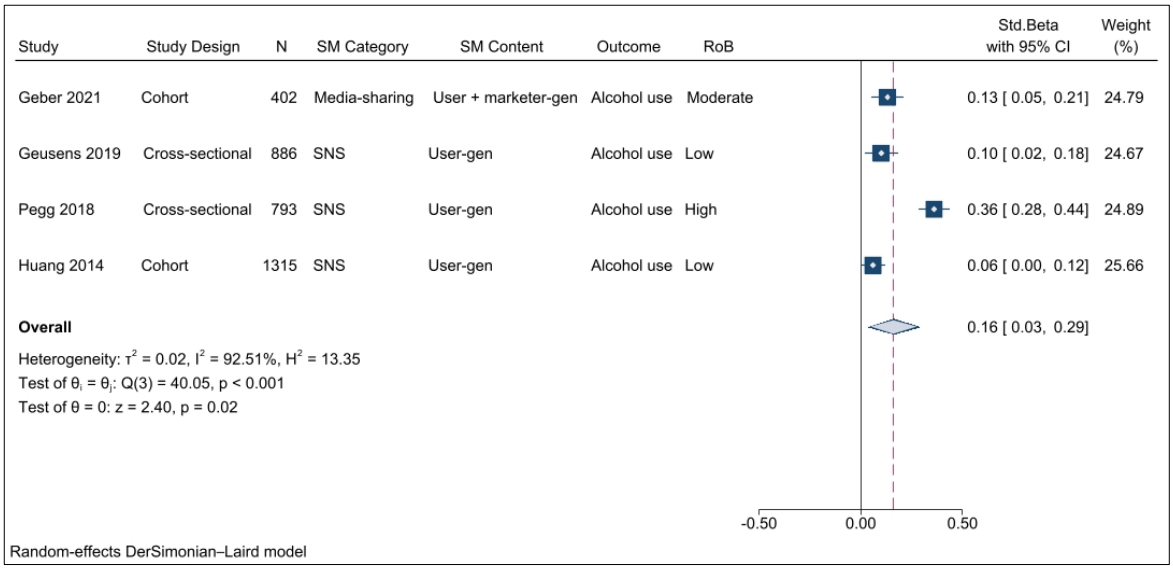
Legend: Figure presents forest plot for binary exposure (≥2 vs <2 hours/day social media use) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=7,576. Abbreviation(s): CI=Confidence interval; FU=Follow-up; N=Number of study participants; OR=Odds ratio; RCS=Repeat cross-sectional study; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.43. Forest plot for association between frequency of social media use and alcohol use, excluding datapoints which overlap 10-19 years



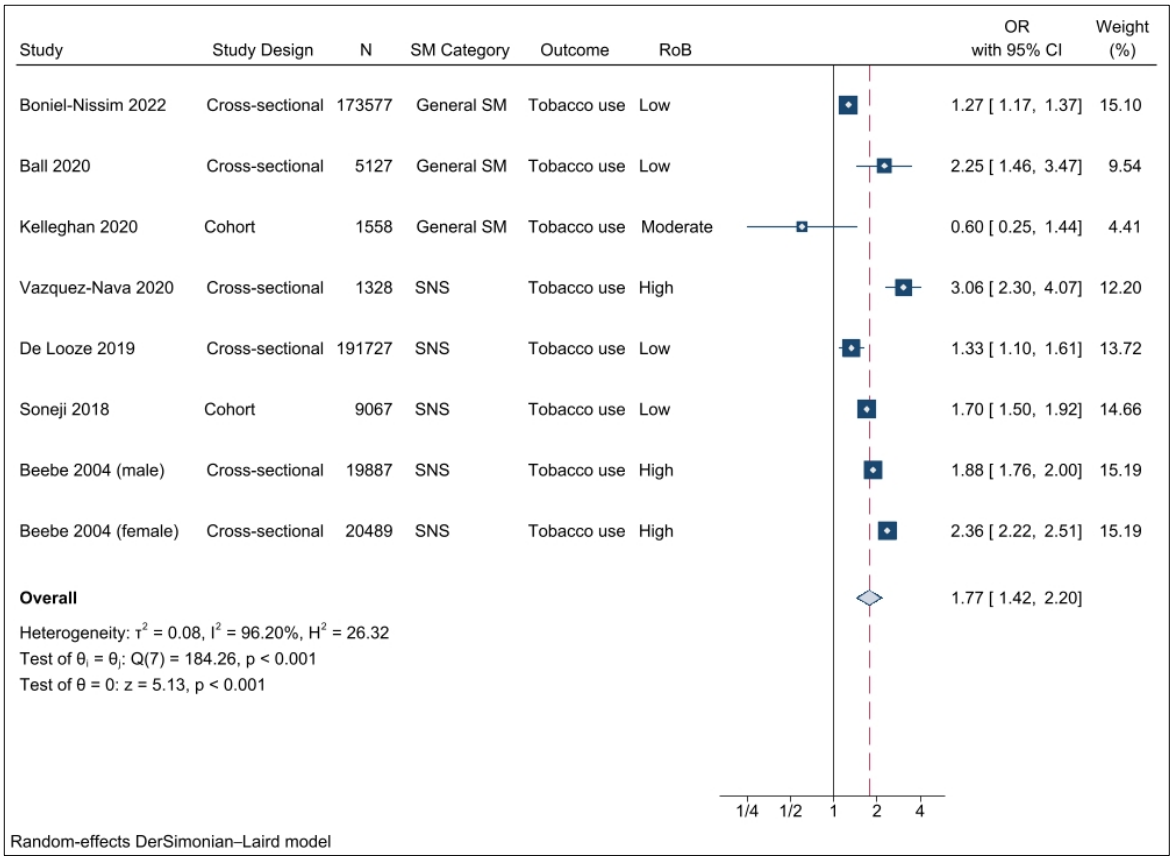
Legend: Figure presents forest plot for binary exposure (frequent/daily vs infrequent/non-daily) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=377,626. Abbreviation(s): CI=Confidence interval; ESP=Spain; FIN=Finland; KOR=South Korea; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); and USA=United States of America.

Figure A17.11.44. Forest plot for association between exposure to health-risk behaviour content on social media and alcohol use, excluding datapoints which overlap 10-19 years



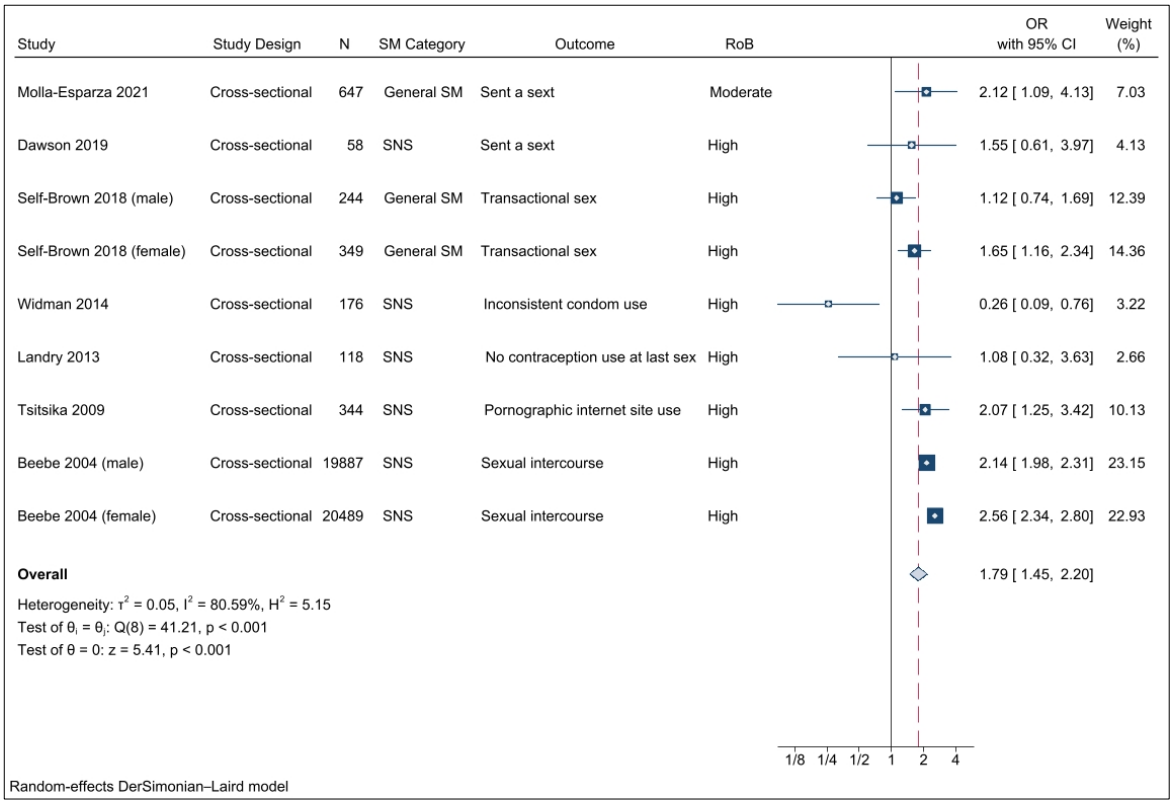
Legend: Figure presents forest plot for continuous exposure & continuous outcome sensitivity analysis, with standardised beta (Std. Beta) used as common metric. Total number of study participants=3,396. Abbreviation(s): CI=Confidence interval; N=Number of study participants; Marketer-gen=Marketer-generated content; RoB=Risk of bias; SM=Social media; SNS=Social networking site(s); Std. Beta=Standardised beta; and User-gen=User-generated content.

Figure A17.11.45. Forest plot for association between frequency of social media use and tobacco use, excluding datapoints which overlap 10-19 years



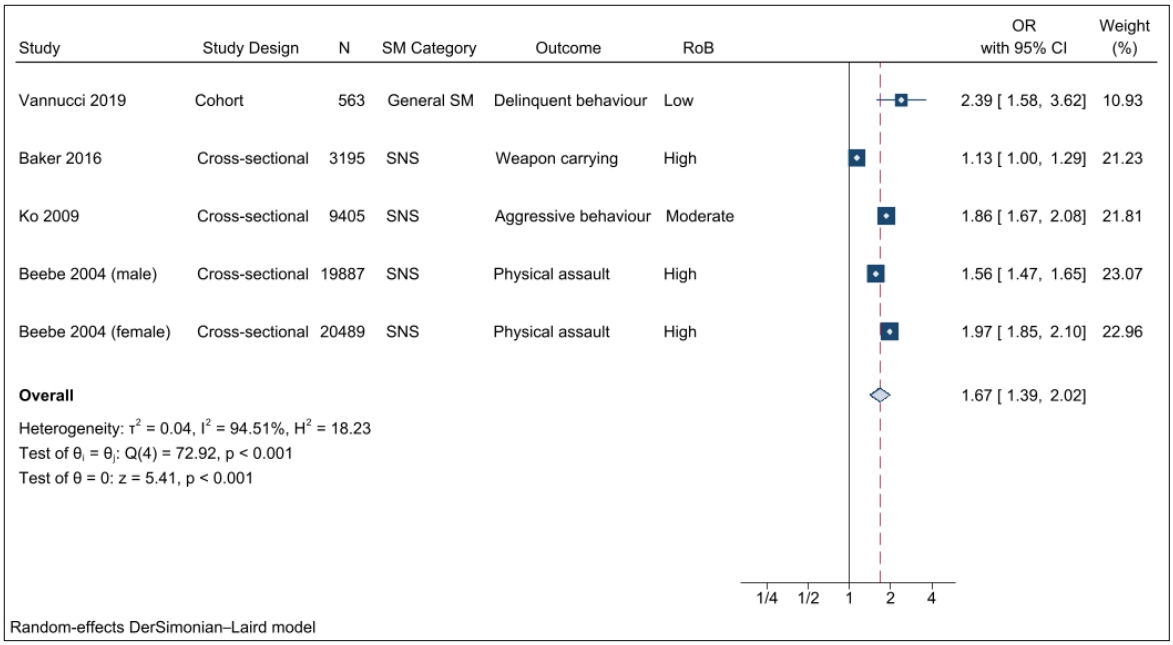
Legend: Figure presents forest plot for binary exposure (frequent vs infrequent) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=422,760. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Figure A17.11.46. Forest plot for association between frequency of social media use and sexual risk behaviour, excluding datapoints which overlap 10-19 years



Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome sensitivity analysis, with odds ratio (OR) used as common metric. Total number of study participants=42,312. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

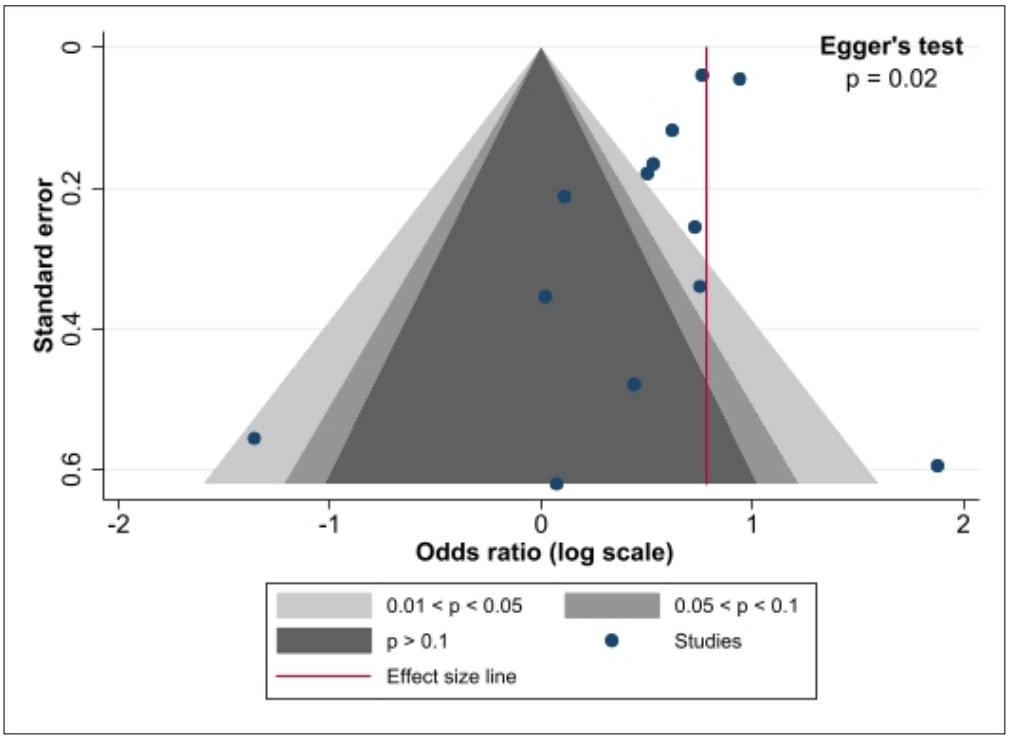
Figure A17.11.47. Forest plot for association between frequency of social media use and anti-social behaviour, excluding datapoints which overlap 10-19 years



Legend: Figure presents forest plot for binary exposure (frequent/at all vs infrequent/not at all) & binary/continuous outcome sensitivity analysis, with odds (OR) used as common metric. Total number of study participants=53,539. Abbreviation(s): CI=Confidence interval; N=Number of study participants; OR=Odds ratio; RoB=Risk of bias; SM=Social media; and SNS=Social networking site(s).

Section A18 Assessment of publication bias/small study effects

Figure A18.1. Contour enhanced funnel plot for meta-analysis of studies investigating the effect of frequency of social media use (frequent vs infrequent) on sexual risk behaviour, and Egger's test result



Section A19 Summary of findings and certainty of evidence

Table A19.1. Summary of findings and certainty of evidence for seven priority outcomes (as per GRADE) with reasons for upgrading/downgrading of the evidence (condensed table shown in Chapter 4)

Population/setting: Adolescents aged 10-19 years in high and low-middle income settings
Intervention: Frequent social media use
Comparison: Infrequent social media use

Outcome	Anticipated absolute effects[a] (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with infrequent social media use	Risk with frequent social media use				
Alcohol use	48.9% of participants in the control group used alcohol	58.6% of exposed group participants used alcohol (56.6 to 60.8%)	OR 1.48 (1.36 to 1.62)	383,670 (9 observational studies)	⨁⨁⊖⊖ Low [a,b,c,d,e]	Frequent social media use increases adolescent alcohol use. Absolute effect calculated from **Riehm *et al*. (2021).**
Drug use	17.0% of participants in the control group used drugs	20.8% of exposed group participants used drugs (17.7 to 24.2%)	OR 1.28 (1.05 to 1.56)	117,645 (6 observational studies)	⨁⊖⊖⊖ Very low [f,g,h]	Downgraded for RoB. Frequent social media use may increase adolescent drug use. Absolute effect calculated from **Whitehill *et al*. (2020).**
Tobacco use	12.1% of participants in the control group used tobacco	19.6% of exposed group participants used tobacco (16.6 to 23.1%)	OR 1.78 (1.45 to 2.19)	424,326 (8 observational studies)	⨁⊖⊖⊖ Very low [i,j,k]	Downgraded for RoB and inconsistency. Frequent social media use may increase adolescent tobacco use. Absolute effect calculated from **Vazquez-Nava *et al*. (2020).**

Population/setting: Adolescents aged 10-19 years in high and low-middle income settings **Intervention: Frequent social media use** **Comparison: Infrequent social media use**						
Outcome	**Anticipated absolute effects[a] (95% CI)**		**Relative effect (95% CI)**	**Number of participants (studies)**	**Certainty of the evidence (GRADE)**	**Comments**
	Risk with infrequent social media use	**Risk with frequent social media use**				
Electronic nicotine delivery system use	66.7% of studies demonstrated a harmful effect of social media use on participant use of electronic nicotine delivery systems (95% CI 20.8 to 93.9%)			18,047 (3 observational studies)	⨁⨁⨀⨀ Very low [l,m]	Downgraded for RoB and imprecision. Frequent social media use may increase adolescent use of electronic nicotine delivery systems.
Sexual risk behaviour	37.0% of participants in the control group engaged in sexual risk behaviours	51.1% of exposed group participants engaged in sexual risk behaviours (46.6 to 55.5%)	OR 1.78 (1.49 to 2.13)	47,325 (10 observational studies)	⨁⨀⨀⨀ Very low [n,o,p,q,r]	Downgraded for RoB and publication bias. Frequent social media use may increase adolescent sexual risk behaviour. Absolute effect calculated from **Self-Brown *et al*. (2018).**
Gambling	21.4% of participants in the control group engaged in gambling	43.6% of exposed group participants engaged in gambling (35.7 to 52.0%)	OR 2.84 (2.04 to 3.97)	26,537 (5 observational studies)	⨁⨀⨀⨀ Very low [s,t,u]	Downgraded for RoB. Frequent social media use may increase adolescent gambling. Absolute effect calculated from **King *et al*. (2014).**
Multiple risk behaviours	41.3% of participants in the control group engaged in multiple risk behaviours	55.2% of exposed group participants engaged in multiple risk behaviours (47.8 to 62.3%)	OR 1.75 (1.30 to 2.35)	43,571 (2 observational studies)	⨁⨀⨀⨀ Very low [v,x,y]	Downgraded for RoB and inconsistency. Frequent social media use may increase adolescent engagement in multiple risk behaviours. Absolute effect calculated from **Beebe *et al*. (2004).**

GRADE Working Group grades of evidence
High certainty ⨁⨁⨁⨁**:** We are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty ⨁⨁⨁⨀**:** We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty ⨁⨁⨀⨀**:** Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect.
Very low certainty ⨁⨀⨀⨀**:** We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect.

Explanations for upgrading/downgrading the evidence

[a] Not downgraded for RoB, as most studies were low RoB, assessed exposure and outcome via validated tools, and no difference in effect size in high RoB studies was observed on stratification.

[b] Not downgraded for inconsistency as heterogeneity was moderate (I^2=40.5%), and all 95% confidence intervals overlapped.

[c] Not downgraded for indirectness, as only 1/9 studies assessed text messaging as well as social media use.

[d] Not downgraded for imprecision as the 95% confidence interval did not cross the null effect, was narrow and did not include appreciable harm or benefit.

[e] Unable to assess publication bias via a funnel plot due to insufficient data; however, as a systematic search was conducted, the chance of publication bias is reduced.

[f] Downgraded for RoB as half of the studies were rated high RoB, only one study assessed exposure and outcome via validated tools, and all but one study failed to adjust for critical confounding domains.

[g] Not downgraded for indirectness, as the majority of included studies specifically assessed social media use.

[h] Not downgraded for imprecision as the 95% confidence interval did not cross the null effect, was narrow and did not include appreciable harm or benefit.

[i] Downgraded for RoB, as although majority of included studies were low/moderate RoB, the contributing high RoB studies reported notably larger effect sizes.

[j] Downgraded for serious inconsistency as heterogeneity of the included studies was considerable (I^2=95.7%).

[k] Not downgraded for imprecision as the 95% confidence interval did not cross the null effect, was narrow and did not include appreciable harm or benefit.

[l] Downgraded for RoB as all studies were moderate/high RoB, failed to adjust for critical confounding domains, and assessed exposure and outcome via non-validated tools.

[m] Downgraded for serious imprecision as the wide 95% confidence interval suggests lack of confidence in the estimate.

[n] Downgraded for RoB, as the majority of studies were high RoB, failed to adjust for critical confounding domains, and assessed exposure and outcome via non-validated tools.

[o] Not downgraded for serious inconsistency as heterogeneity was reduced when stratification was performed by socioeconomic circumstance(s), age, social media category and development status of study setting.

[p] Not downgraded for indirectness as only 1/10 studies assessed text messaging as well as social media use.

[q] Not downgraded for imprecision as the 95% confidence interval did not cross null effect, was narrow and did not include appreciable harm or benefit.

[r] Downgraded for suspected publication bias, given the impression from the asymmetric contour-enhanced funnel plot.

[s] Downgraded for RoB as the majority of studies were high RoB, failed to adjust for critical confounding domains, and assessed exposure via non-validated tools.

[t] Not downgraded for indirectness as no concerns were raised regarding population, intervention, comparator, direct comparisons, or outcome.

[u] Not downgraded for imprecision as the 95% confidence interval did not cross the null effect and did not include appreciable harm or benefit.

[v] Downgraded for RoB as all studies were high RoB, failed to adjust for critical confounding domains, and assessed exposure and outcome via non-validated tools.

[w] Downgraded for serious inconsistency as heterogeneity of included studies was considerable (I^2=97.9%), and confidence intervals show no or minimal overlap.

[x] Not downgraded for imprecision as the 95% confidence interval did not cross null effect, was narrow and did not include appreciable harm or benefit.

Legend: [a] The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI). Abbreviation(s): CI=Confidence interval; OR=Odds ratio and RoB=Risk of bias.

Table A19.2. Post-hoc assessment - summary of findings and certainty of evidence for unhealthy dietary behaviour (as per GRADE) with reasons for upgrading/downgrading of the evidence (condensed table shown in Chapter 4)

Population/setting: Adolescents aged 10-19 years in high and low-middle income settings
Intervention: Exposed to health-risk behaviour content
Comparison: Not exposed to health-risk behaviour content

Outcome	Effect direction	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
Unhealthy dietary behaviour (effect direction)	All studies demonstrated a harmful effect of social media use on participant unhealthy dietary behaviour (51.0 to 100.0%)	521 (4 randomised control trials)	⨁⨁⨁⨀ Moderate [a,b]	Downgraded for indirectness. Exposure to health-risk behaviour content on social media increases adolescent engagement in unhealthy dietary behaviours.

GRADE Working Group grades of evidence
High certainty ⨁⨁⨁⨁: We are very confident that the true effect lies close to that of the estimate of the effect
Moderate certainty ⨁⨁⨁⨀: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low certainty ⨁⨁⨀⨀: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
Very low certainty ⨁⨀⨀⨀: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

Explanations for upgrading/downgrading the evidence

[a] Not downgraded for RoB as all studies were randomised control trials, with two rated low RoB and two some concerns.

[b] Downgraded for serious indirectness of comparator, as two studies used a comparator group pertaining to healthy food exposure, and the remaining two used a comparator group pertaining to exposure to non-food items.

Legend: Abbreviation(s): RoB=Risk of bias.

Section A20 PRISMA checklists

Table A20.1. Completed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 checklist for systematic reviews and meta-analysis

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Chapter 4 Abstract
ABSTRACT			
Abstract	2	See PRISMA abstract checklist	Chapter 4 Abstract Appendix A, Table A20.2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Chapter 4 Introduction
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Chapter 4 Introduction
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Chapter 4 Study inclusion and exclusion criteria Appendix A, Section A4
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Chapter 4 Search methods for identification of studies Chapter 4 PRISMA study flow chart Appendix A, Section A2
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Chapter 4 Search methods for identification of studies

Section and Topic	Item #	Checklist item	Location where item is reported
			Appendix A, Section A2
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Chapter 4 Study inclusion and exclusion criteria Chapter 4 Selection of studies Chapter 4 Data extraction and RoB assessment
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Chapter 4 Selection of studies Chapter 4 Data extraction and RoB assessment Appendix A, Section A8
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, timepoints, analyses), and if not, the methods used to decide which results to collect.	Chapter 4 Study inclusion and exclusion criteria Appendix A, Section A6 Appendix A, Section A7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Chapter 4 Study inclusion and exclusion criteria Appendix A, Section A8
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Chapter 4 Data extraction and RoB assessment Appendix A, Section A9
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Chapter 4 Data synthesis Appendix A, Section A10
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Chapter 4 Data synthesis Appendix A, Section A7
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Chapter 4 Data synthesis Appendix A, Section A7

Section and Topic	Item #	Checklist item	Location where item is reported
			Appendix A, Section A10
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Chapter 4 Data synthesis Appendix A, Section A7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Chapter 4 Data synthesis
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Chapter 4 Data synthesis
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Chapter 4 Data synthesis
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Chapter 4 Data synthesis
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Chapter 4 Certainty of the evidence
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Chapter 4 Results Chapter 4 PRISMA study flow diagram
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Appendix A, Section A13
Study characteristics	17	Cite each included study and present its characteristics.	Chapter 4 Results Appendix A, Section A11 Appendix A, Section A12
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Chapter 4 Results Appendix A, Section A14 Appendix A, Section A19
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Chapter 4 Results Appendix A, Section A17

Section and Topic	Item #	Checklist item	Location where item is reported
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Chapter 4 Results Appendix A, Section A14 Appendix A, Section A15 Appendix A, Section A19
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Chapter 4 Results Appendix A, Section A17
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Chapter 4 Results Appendix A, Section A17 Appendix A, Section A18
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Chapter 4 Results Appendix A, Section A17
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Chapter 4 Results Appendix A, Section A14 Appendix A, Section A19
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Chapter 4 Certainty of the evidence Appendix A, Section A19
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Chapter 4 Discussion
	23b	Discuss any limitations of the evidence included in the review.	Chapter 4 Discussion
	23c	Discuss any limitations of the review processes used.	Chapter 4 Discussion
	23d	Discuss implications of the results for practice, policy, and future research.	Chapter 4 Discussion
OTHER INFORMATION			

Section and Topic	Item #	Checklist item	Location where item is reported
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Chapter 4 Methods Appendix A, Section A21
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Chapter 4 Methods Appendix A, Section A21
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Chapter 4 Methods Appendix A, Section A1
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Chapter 4 Funding
Competing interests	26	Declare any competing interests of review authors.	Chapter 4 Competing interests
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Chapter 4 Data sharing

Legend: Abbreviation(s): PRISMA=Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Table A20.2 Completed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 structured abstract checklist

Section and Topic	Item #	Checklist item	Reported (Yes/No)
TITLE			
Title	1	Identify the report as a systematic review.	Yes
BACKGROUND			
Objectives	2	Provide an explicit statement of the main objective(s) or question(s) the review addresses.	Yes
METHODS			
Eligibility criteria	3	Specify the inclusion and exclusion criteria for the review.	Yes
Information sources	4	Specify the information sources (e.g. databases, registers) used to identify studies and the date when each was last searched.	Yes
Risk of bias	5	Specify the methods used to assess risk of bias in the included studies.	Yes
Synthesis of results	6	Specify the methods used to present and synthesise results.	Yes
RESULTS			
Included studies	7	Give the total number of included studies and participants and summarise relevant characteristics of studies.	Yes
Synthesis of results	8	Present results for main outcomes, preferably indicating the number of included studies and participants for each. If meta-analysis was done, report the summary estimate and confidence/credible interval. If comparing groups, indicate the direction of the effect (i.e. which group is favoured).	Yes
DISCUSSION			
Limitations of evidence	9	Provide a brief summary of the limitations of the evidence included in the review (e.g. study risk of bias, inconsistency and imprecision).	Yes
Interpretation	10	Provide a general interpretation of the results and important implications.	Yes
OTHER			
Funding	11	Specify the primary source of funding for the review.	Yes
Registration	12	Provide the register name and registration number.	Yes

Legend: Abbreviation(s): PRISMA=Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Section A21 Registered/published protocols

The University of Glasgow published protocol:

https://www.gla.ac.uk/media/Media_718614_smxx.pdf

PROSPERO registered and updated protocol (ID: CRD42020179766):

www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020179766

Appendix B Supplementary material accompanying Chapter 5

Section B1 Advisory group

An advisory group of experts and policymakers in the field of social media and adolescent health-risk behaviours was established to provide guidance during development of the statistical analysis plan and the study stages. Recruited via expert stakeholders, members included patient/public representatives and stakeholders from policy, non-governmental, and academic sectors (Table B1.1). Advisory group members were provided with detailed background information on the study. During development of the statistical analysis plan, group members were asked to provide feedback on several factors, including the relevance of the study objectives, potential confounding factors of the relationship between time spent on social media and cigarette/e-cigarette use, potential effect modifiers worthy of investigation, and ongoing or published studies. Following study completion, group members supported interpretation and transferability of study findings to the wider policy context. Feedback was received during in-person meetings, via Zoom or email.

Table B1.1. Advisory group members

Name	Organisation	Period of involvement
Kirsty Blenkins	UK Health Security Agency, Office for Health Improvement and Disparities, London, UK	2020 to present
Lee Carlton	Public Health Scotland, Glasgow, UK	2020 to January 2023
Neil Coles	We Are With You, Kent, UK	2020 to February 2021
Nicholas Hickmott	We Are With You, Kent, UK	2020 to present
Professor John Holmes	Alcohol Policy, University of Sheffield, UK	2020 to present
Rachel Macpherson	Scottish Government, Edinburgh, UK	2020 to present
Dr Ross Whitehead	Public Health Scotland, Edinburgh, UK	2020 to July 2021
Dr Richard Purves	University of Stirling, Stirling, UK	2020 to present

Section B2 Deviations from the published statistical analysis plan

We planned to create a continuous variable representing the average time spent on social media across a weekday and weekend day (assessed via time-use diary), adopting a fractional polynomial approach. Following creation of the fractional polynomial, hypothesis tests comparing the fractional polynomial models with the linear model showed no significant differences. When categorised, a dose-response relationship was observed, suggesting some benefit of adopting a categorical variable, thus this variable was treated as categorical in all analyses.

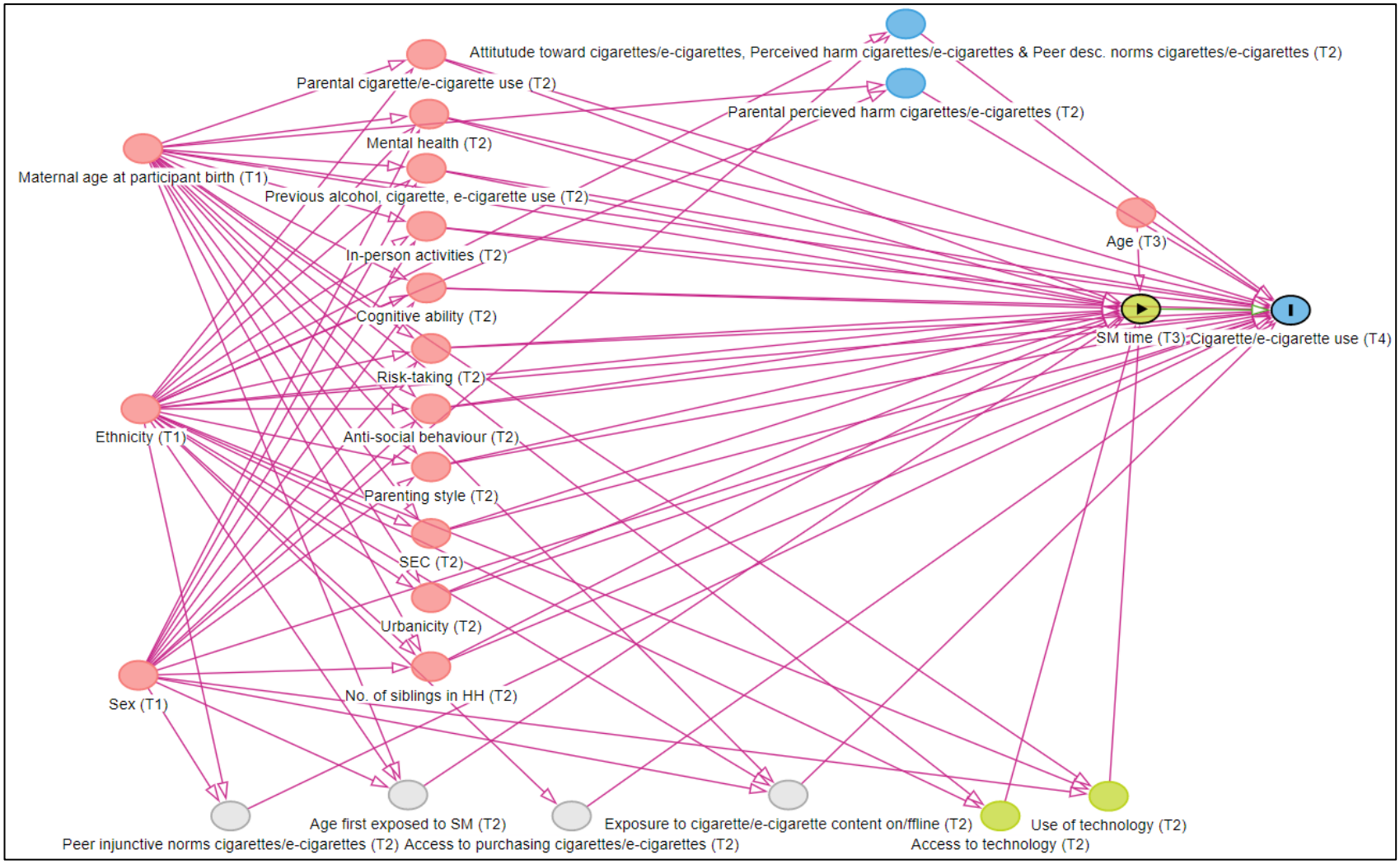
We planned to treat confounders, number of siblings of participant in the household, age, and maternal age at participant birth as continuous variables; however, due to the absence of a linear relationship with outcomes investigated, in some models, these variables were treated as categorical.

For the investigation of effect measure modification and interaction, we anticipated using '1 to <30 minutes and high parental education' as the reference category. However, following assessment, the stratum with the lowest risk of outcomes cigarette and e-cigarette use was 'no social media use and high parental education'; therefore, this was used as the reference category.

We anticipated creating a binary variable to represent highest parental education in the household where National Vocational Qualification (NVQ) level 1, other academic qualifications (incl. Overseas), and none would be classified as low parental education and NVQ levels 2,3,4 and 5, high parental education. Due to low frequencies, the following categorisation was used: low parental education (NVQ level 2, NVQ level 1, other academic qualifications (incl. Overseas), and none) and high parental education (NVQ levels 3,4 and 5).

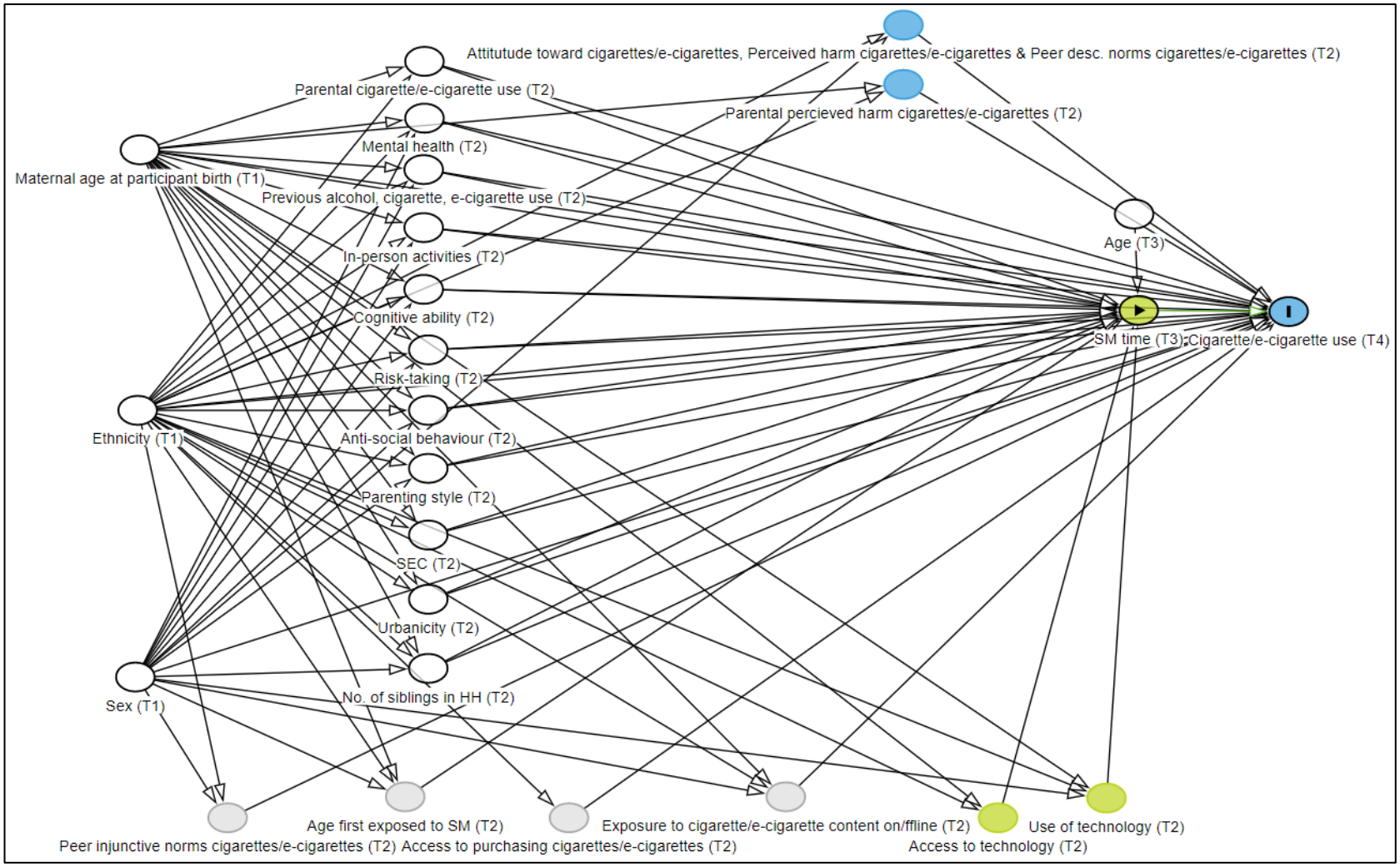
Section B3 DAGgity directed acyclic graphs

Figure B3.1. Saturated directed acyclic graph (DAG) illustrating the hypothesised relationship between social media use at 14 years and cigarette and e-cigarette use at 17 years to inform adjustment



Legend: Observed confounders-red node. Unobserved confounders-grey node. Exposure-green node (➢). Ancestor of exposure-green node. Outcome-blue node (I). Ancestor of outcome-blue node. Green bold arrow indicates focal relationship under investigation. Abbreviation(s): Desc.=Descriptive; HH=Household; No.=Number; SEC=Socioeconomic circumstance(s); SM=Social media; and T=Timepoint.

Figure B3.2. Saturated directed acyclic graph (DAG) illustrating the hypothesised relationship between social media use at 14 years and cigarette and e-cigarette use at 17 years- and the minimal sufficient adjustment set



Legend: Observed confounders-white node. Unobserved confounders-grey node. Exposure-green node (➢). Ancestor of exposure-green node. Outcome-blue node (I). Ancestor of outcome-blue node. Green bold arrow indicates focal relationship under investigation. Abbreviation(s): Desc.=Descriptive; HH= Household; No.=Number; SEC=Socioeconomic circumstance(s); SM=Social media; and T=Timepoint.

Section B4 Variables used in analysis

Table B4.1. Variables used in analysis

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
Time spent on social media on a normal weekday	MCS 6 (14 years)	Self-completion time-use diary Time spent browsing and updating social networking sites (e.g., Twitter, Facebook, BBM, Snapchat) on a normal weekday	Activity code Browsing and updating social networking sites (e.g., Twitter, Facebook, BBM, Snapchat) on a normal weekday	5-category variable On an assigned weekday, each participant recorded what they did from 04:00 to 04:00 the following day in 10-minute time slots (144 activity slots within 24 hours). The primary activity for each time slot was selected from a list of 44 predefined activity codes nested within 12 categories. The number of 10-minute activity slots recording social networking site activity on a weekday was summed to give total time (minutes) browsing and updating social networking sites on a normal weekday. The resulting continuous variable was collapsed into no social media use, 1-<30 mins, 30 mins-<60 mins, 1 hr-<2 hrs, and ≥2 hrs social media use. Adopting a similar approach to Atkin *et al.* (2021), diaries with ≥5 10-minute activity slots with no activity indicated were excluded from the analysis as these were deemed to be unreliable accounts of a complete day's activity.
Average time spent on social media across a normal weekday and weekend day	MCS 6 (14 years)	Self-completion time-use diary 1. Time spent browsing and updating social networking sites (e.g., Twitter, Facebook, BBM, Snapchat) on a normal weekday 2. Time spent browsing and updating social networking sites (e.g.,	Activity code Browsing and updating social networking sites (e.g., Twitter, Facebook, BBM, Snapchat) on a normal weekday and weekend day	5-category variable On an assigned weekday and weekend day, each participant recorded what they did from 04:00 to 04:00 the following day in 10-minute time slots (144 activity slots within 24 hours). The primary activity for each time slot was selected from a list of 44 predefined activity codes nested within 12 categories. The number of 10-minute activity slots recording social networking site activity on a weekday and weekend day was summed to give total time (minutes) browsing and updating social networking; this was then divided by two to give the average time spent across a weekday and weekend day. The resulting continuous variable was collapsed into no social media use, 1-<30

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
		Twitter, Facebook, BBM, Snapchat) on a normal weekend day		mins, 30 mins-<60 mins, 1 hr-<2 hrs, and ≥2 hrs social media use. Participants with missing data on 1 or both days were classified as missing. Adopting a similar approach to Atkin *et al.* (2021), diaries with ≥5 10-minute activity slots with no activity indicated were excluded from the analysis as these were deemed to be unreliable accounts of a complete day's activity.
Time spent on social media on a normal weekday during term time	MCS 6 (14 years)	Self-completion online questionnaire Time spent on social media on a normal weekday during term time	No social media use/1-<30 mins/30-<60 mins/1 hr-<2 hrs/2 hrs-<3 hrs/3 hrs-<5 hrs/5 hrs-<7 hrs/≥7 hrs social media use/Don't know/Don't wish to answer/Not applicable	5-category variable Don't know, don't wish to answer and not applicable responses were coded as missing. Categories 2 hrs-<3 hrs, 3 hrs-<5 hrs, 5 hrs-<7 and ≥7 hrs were collapsed to give ≥2 hrs social media use, with no changes made to the remaining categories. 4-category variable Don't know, don't wish to answer, and not applicable responses were coded as missing. Categories 1-<30 mins and 30-<60 mins were collapsed to give 1 min-<1 hr social media use, and categories 2 hrs-<3 hrs, 3 hrs-<5 hrs, 5 hrs-<7 hrs and ≥7 hrs were collapsed to give ≥2 hrs social media use, with no changes made to the remaining categories.
Cigarette use	MCS 7 (17 years)	Self-completion online questionnaire Please read the following statements carefully and decide which one best describes you. Do not include electronic cigarettes (e-cigarettes)	I have never smoked cigarettes/I have only ever tried smoking cigarettes once/I used to smoke sometimes but I never smoke a cigarette now/I sometimes smoke cigarettes now, but I don't smoke as many as 1 a week/I usually smoke between 1 and 6 cigarettes a week/I usually smoke more than 6 cigarettes a week/Don't	Binary variable Don't know, don't wish to answer, and no answer responses were coded as missing. Variable was dichotomised into never smoked or tried cigarettes once (I have never smoked cigarettes OR I have only ever tried smoking cigarettes once) and current or former cigarette use (I used to smoke sometimes but I never smoke a cigarette now OR I sometimes smoke cigarettes now, but I don't smoke as many as 1 a week OR I usually smoke between 1 and 6 cigarettes a week OR I usually smoke more than 6 cigarettes a week). 3-category variable

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
			want to answer/Don't know/No answer	Don't know, don't wish to answer, and no answer responses were coded as missing. Categories were collapsed to give never smoked or tried cigarettes once (I have never smoked cigarettes OR I have only ever tried smoking cigarettes once), former cigarette use (I used to smoke sometimes but I never smoke a cigarette now), and current cigarette use (I sometimes smoke cigarettes now, but I don't smoke as many as 1 a week OR I usually smoke between 1 and 6 cigarettes a week OR I usually smoke more than 6 cigarettes a week).
E-cigarette use	MCS 7 (17 years)	Self-completion online questionnaire Please read the following statements carefully and decide which one best describes you	I have never tried an e-cigarette or vaping device/ I have only ever tried an e-cigarette or vaping device once/I used to use an e-cigarette or vaping device sometimes, but I never use an e-cigarette or vaping device now/I sometimes use an e-cigarette or vaping device now, but I don't use an e-cigarette or vaping device as often as 1 a week/I usually use an e-cigarette or vaping device between 1 and 6 times a week/I usually use an e-cigarette or vaping device more than 6 times a week/Don't want to answer/Don't know/No answer	Binary variable Don't know, don't wish to answer and no answer responses were coded as missing. Variable was dichotomised into never used an e-cigarette or tried once (I have never tried an e-cigarette or vaping device OR I have only ever tried an e-cigarette or vaping device once) and current or former e-cigarette use (I used to use an e-cigarette or vaping device sometimes, but I never use an e-cigarette or vaping device now OR I sometimes use an e-cigarette or vaping device now, but I don't use an e-cigarette or vaping device as often as 1 a week OR I usually use an e-cigarette or vaping device between 1 and 6 times a week OR I usually use an e-cigarette or vaping device more than 6 times a week). 3-category variable Don't know, don't wish to answer, and no answer responses were coded as missing. Categories were collapsed to give never used an e-cigarette or tried once (I have never tried an e-cigarette or vaping device OR I have only ever tried an e-cigarette or vaping device once), former e-cigarette use (I used to use an e-cigarette or vaping device sometimes, but I never use an e-cigarette or vaping device now) and current e-cigarette use (I sometimes use an e-cigarette or vaping device now, but I don't use an e-cigarette or vaping device as

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
				often as 1 a week OR I usually use an e-cigarette or vaping device between 1 and 6 times a week OR I usually use an e-cigarette or vaping device more than 6 times a week).
Dual use of cigarettes and e-cigarettes	MCS 7 (17 years)	See above	See above	3-category composite variable Don't know, don't wish to answer, and no answer responses were coded as missing. Cigarette and e-cigarette use variables were collapsed into never used cigarette or e-cigarette or tried once (I have never tried an e-cigarette or vaping device OR I have only ever tried an e-cigarette or vaping device once) AND (I have never smoked cigarettes OR I have only ever tried smoking cigarettes once), current or former cigarette or e-cigarette use (I used to smoke sometimes but I never smoke a cigarette now OR I sometimes smoke cigarettes now but I don't smoke as many as 1 a week OR I usually smoke between 1 and 6 cigarettes a week OR I usually smoke more than 6 cigarettes a week OR I used to use an e-cigarette or vaping device sometimes, but I never use an e-cigarette or vaping device now OR I sometimes use an e-cigarette or vaping device now, but I don't use an e-cigarette or vaping device as often as 1 a week OR I usually use an e-cigarette or vaping device between 1 and 6 times a week ORI usually use an e-cigarette or vaping device more than 6 times a week) and dual use (I sometimes use an e-cigarette or vaping device now but I don't use an e-cigarette or vaping device as often as 1 a week OR I usually use an e-cigarette or vaping device between 1 and 6 times a week OR I usually use an e-cigarette or vaping device more than 6 times a week) & (I sometimes smoke cigarettes now but I don't smoke as many as 1 a week OR I usually smoke between 1 and 6 cigarettes a week OR I usually smoke more than 6 cigarettes a week) (Cronbach alpha=0.84).
Maternal age at	MCS 1 (9 months)/	Parental interview 1. Respondent age at	Variable 1: 11 to 19/20 to 29/30 to 39/40	4-category variable (used in complete case analyses) Variable 1, not applicable and not known responses, were coded as

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
participant birth	MCS 2 (3 years)	birth of participant (categorical) 2. Respondent age at birth of participant (continuous) 3. Respondent ID and interview status	plus years/Not applicable/Not known	missing, variable 3 was used to identify mother of participant and a categorical variable was then created representing maternal age at birth of participant. Continuous variable (used in imputed analyses) Variable 1, not applicable and not known responses, were coded as missing, variable 3 was used to identify mother of participant and a continuous variable was then created representing maternal age at birth of participant.
Sex	MCS 1 (9 months)/ MCS 2 (3 years)	Parental interview Participant sex	Male/Female	No alterations made to the existing variable.
Age	MCS 6 (14 years)	Parental interview Participant age at last birthday	13/14/15 years	No alterations made to the existing variable.
Ethnic group	MCS 1 (9 months)/ MCS 2 (3 years)/ MCS 3 (5 years)	Parental interview Participant ethnic group (6 category Census class)	White/Mixed/Indian/ Pakistani & Bangladeshi/Black or Black British/Other ethnic group (incl. Chinese, Other)/Refusal/Don't know/Not applicable	6-category variable (used in complete case questionnaire analysis) Refusal, don't know, and not applicable responses were coded as missing. No further alterations were made to the existing variable. Binary variable (used in remaining analyses) Refusal, don't know, and not applicable responses were coded as missing. Categories were collapsed to give White and Other (Mixed, Indian, Pakistani & Bangladeshi, Black or Black British, or Other ethnic group).
SDQ total difficulties	MCS 5 (11 years)	Parental interview Participant mental health problems (SDQ total difficulties)	Continuous score	Continuous variable Calculated the total difficulties score made up of 20 items from the conduct disorders, hyperactivity/inattention, emotional and peer problem subscales of the SDQ. For each subscale variable (e.g., conduct disorders), if >2 items were completed by the parent, the

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
				scale average was imputed. Participants classified as missing are those who had some subscales completed where ≤2 items were completed or who had no SDQ information.
Previous cigarette use (also used as a proxy for previous e-cigarette use)	MCS 5 (11 years)	Self-completion online questionnaire Participant ever regularly smoked tobacco products	Yes/No/Refused/Don't know/Not applicable	Binary variable Refused, don't know, and not applicable responses were coded as missing. No further alterations were made to the existing variable.
Previous alcohol use	MCS 5 (11 years)	Self-completion online questionnaire Participant ever had an alcoholic drink	Yes/No/No answer/Not applicable	Binary variable No answer and not applicable responses were coded as missing. No further alterations were made to the existing variable.
Average days/week of in-person activity	MCS 5 (11 years)	Parental interview 1. Days per week participant attends a club or class to do sport or any other physical activity like swimming, gymnastics, football, or dancing 2. Days per week participant attends non club/class physical activities with friends/siblings (not	Variable 1 and 2: ≥5 days a week/4 days a week/ 3 days a week/2 days a week/1 day a week/Less often than once a week/Not at all/Don't know/Refused/Not applicable	Continuous composite variable Don't know, refused, and not applicable responses were coded as missing. Variables 1 and 2 were recoded to represent number of days of activities per week. For each variable, categories not at all and less often than once a week were combined, as engagement less than once a week would imply no engagement in a week (=0 days), 1 day a week (=1 day), 2 days a week (=2 days), 3 days a week (=3 days), 4 days a week (=4 days). As per Twenge *et al*. (2019), and following observation of variable distributions, ≥5 days a week was coded as 6 days (the average of 5, 6, and 7 days). The sum of both frequency variables was calculated to create a composite variable representing weekly frequency of in-person activities, with no requirement to standardise as both variables were on the same scale. Cronbach alpha=0.31 (as we were not measuring the same activity explicitly and

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
		including walking to school)		instead generalising to any in-person activity, a high alpha statistic was not expected). Participants were classified as missing if they had missing data on 1/both variables used to create the composite variable.
Cognitive ability	MCS 5 (11 years)	Participant assessment BAS II Verbal Similarities-verbal reasoning and verbal knowledge	Standardised score (adjusted for age and ability)	No alterations made to the existing variable.
Risk-taking	MCS 5 (11 years)	Participant assessment CGT-risk-taking	Continuous score	No alterations made to the existing variable.
Anti-social behaviour	MCS 5 (11 years)	Self-completion online questionnaire 1. Participant ever taken something from a shop without paying for it 2. Participant ever written things or sprayed paint on a building 3. Participant ever been noisy or rude in a public place 4. Participant ever purposely damaged anything in a public place	Variables 1-4: Yes/No/No answer/Not applicable	Binary composite variable No answer and not applicable responses were coded as missing. Variables 1-4 were combined to create a composite variable with categories engagement in any anti-social behaviour and engagement in no anti-social behaviours (Cronbach alpha=0.95). Participants with missing data in ≥1 variables used to create the composite variable were coded as missing.

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
Number of siblings of participant in the household	MCS 5 (11 years)	Parental interview Participant siblings in the household	Continuous	4-category variable (used in time-use diary imputed analysis) Continuous variable categorised into 0,1,2-3, and 4-10 siblings. 5-category variable (used in remaining analyses) Following observation of variable distribution, variable was categorised into 0,1,2-3,4-5 and 6-10 siblings.
Parental cigarette use (also used as a proxy for parental e-cigarette use)	MCS 5 (11 years)	Parental interview Parent current use of tobacco products	Yes/No/Not applicable	Binary composite variable Not applicable responses were coded as missing. Using both main parental respondent and partner variable information (where relevant), a binary variable was created representing smoking habits across both parents in the household with categories 1+ smoker parents and non-smoker parents. For lone parents, their smoking status was captured. For 2 parent HHs if 1 parent was missing smoking status, the present parent's smoking status was captured. If both parents were missing smoking status, the variable was classified as missing. If a lone parent was missing smoking status, the variable was classified as missing.
Parenting style	MCS 5 (11 years)	Parental interview 1. Whether parent has rules for how early or late participant may watch TV & films, use a computer, access the internet, or play electronic games 2. Whether parent has rules about the kinds of programmes or films	Yes/No/Don't know/Refused/Not applicable	Binary composite variable Don't know, refused, and not applicable responses were coded as missing. Variables 1 and 2 were collapsed to generate a binary composite variable with categories parent has rules for how early or late participant can watch TV & films, use a computer, access the internet, or play electronic games or rules about the kinds of programmes or films, electronic games, internet sites they can watch, or access and parent does not have rules for either (Cronbach alpha=0.61).

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
		participant can watch, electronic games they may play, or internet sites they can access		
Urbanicity	MCS 5 (11 years)	Parental interview 1. ONS Rural Urban Classification (2005) England & Wales 2. Scottish Executive Urban Rural Classification 2005/6 (2005) Scotland 3. ONS Rural Urban Classification (2005) Northern Ireland	Variable 1: Urban > 10k–sparse/Urban > 10k-less sparse/Town and fringe–sparse/Village, hamlet, and isolated dwellings–sparse/Town and fringe-less sparse/Village, hamlet, and isolated dwellings-less sparse Variables 2-3: Urban/Rural	Binary composite variable Collapsed variable 1 into urban and rural and combined variables 1, 2, and 3 to create a binary variable with categories urban and rural.
Household income	MCS 5 (11 years)	Parental interview Household income (OECD Income Equivalised Quintiles-UK Whole)	Bottom/Second/Third/ Fourth/Top quintile	5-category variable No alterations made to the existing variable.
Family structure	MCS 5 (11 years)	Parental interview Family structure	Both natural parents/ Natural mother and step-parent/ Natural mother and other parent or carer/Natural mother and adoptive parent/Natural father and step-parent/Natural father and other parent or carer/Adoptive parents (x2)/Foster parents (x2)/	3-category variable Categories collapsed into natural parents, reconstituted and lone parent.

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
			Grandparents (x2)/ Grandmother and other parent or carer/Other parents (x2)/Natural mother only/Natural father only/Adoptive mother only/Adoptive father only/Step-mother only/Other parent or carer only (foster/sibling/ relative)/Step-father only/ Grandfather only/Adoptive mother and step-parent	
Highest parental occupation in the household	MCS 5 (11 years)	Parental interview 1. NS-SEC 5 category 2. Whether respondent is in work or not	Variable 1: Managerial and professional/Intermediate/Small employers and self-employed/Lower supervisory and technical/Semi routine and routine/Not applicable Variable 2: Respondent is in work or on leave/Respondent is not in work nor on leave/Not applicable	6-category composite variable Variable 1 and 2 not applicable responses were coded as missing. Variable 1 and variable 2 were combined to give NS-SEC 5 category variable with an additional category representing unemployed respondents for both the main parental respondent and partner respondent (where applicable). The highest occupation of both parents in the household (where relevant) was then used for analysis. For lone parents, their occupation was captured. For 2 parent HHs if 1 parent was missing occupation, the present parent's occupation was captured. If both parents were missing occupation, the variable was classified as missing. If a lone parent was missing occupation, the variable was classified as missing.
Highest parental education in the household	MCS 5 (11 years)	Parental interview NVQ equivalent of highest academic level across sweeps	NVQ level 5: higher degree/NVQ level 4: first degree, diplomas in higher education/NVQ level 3: A/AS/S levels/NVQ level 2: O level/GCSE grades A-C/ NVQ	7-category variable (used in complete case analyses) Not applicable responses were coded as missing. The highest academic education level of both parents (where relevant) was used for analysis. For lone parents, their academic qualification was captured. For 2 parent HHs, if 1 parent was missing academic

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
			level 1: GCSE grades D-G/Other academic qualifications (incl. Overseas)/None of these/Not applicable	qualifications, the present parent's academic qualification was captured. If both parents were missing academic qualification, the variable was classified as missing. If a lone parent was missing academic qualification, the variable was classified as missing Binary variable (used in imputed analyses) The above 7-category variable was dichotomised into high parental education (NVQ level 5, level 4, and level 3) and low parental education (NVQ level 2, level 1, Other academic qualifications (incl. Overseas), and None of these).
Area-level deprivation	MCS 5 (11 years)	Parental interview 1. IMD 2004 Overall Decile England 2. WIMD 2005 Overall Decile Wales 3. SIMD 2004 Overall Decile Scotland 4. IMD 2004 Overall Decile Northern Ireland 5. Country at interview	Variables 1-4: Most deprived/ 10-<20%/20-<30%/30-<40%/40-<50%/50-<60%/60-<70%/70-<80%/80-<90%/ Least deprived Variable 5: England/Wales/Scotland/ Northern Ireland	10-category composite variable Variables 1-4 were combined, and variable 5 was used to create indicator variables representing country.
Baseline cigarette use	MCS 6 (14 years)	Self-completion online questionnaire How often participant smokes cigarettes	I have never smoked cigarettes/I have only ever tried smoking cigarettes once/I used to smoke sometimes but I never smoke a cigarette now/I sometimes smoke cigarettes now, but I don't smoke as many as 1 a week/I usually smoke between 1 and 6 cigarettes a	5-category variable Do not know, I do not wish to answer, and no answer responses were coded as missing. Categories I usually smoke between 1 and 6 cigarettes a week and I usually smoke more than 6 cigarettes a week were combined to give I usually smoke 1 or more cigarettes a week. No alterations were made to the remaining categories.

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
			week/I usually smoke more than 6 cigarettes a week/Do not know/I do not wish to answer/No answer	
Baseline e-cigarette use	MCS 6 (14 years)	Self-completion online questionnaire How often participant smokes e-cigarettes	I've never used or tried electronic cigarettes (e-cigarettes)/I have used e-cigarettes but don't at all now/I now smoke e-cigarettes occasionally but not every day/I smoke e-cigarettes every day/Don't want to answer/Don't know/Not applicable	4-category variable Don't want to answer, don't know and not applicable responses were coded as missing. No further alterations were made to the existing variable.
Previous social media use	MCS 5 (11 years)	Self-completion online questionnaire How often participant visits a social networking website on the internet?	Most days/At least once a week/At least once a month/Less often than once a month/Never/No answer/Not applicable	5-category variable (used in questionnaire imputed analyses) No answer and not applicable responses were coded as missing. No further alterations were made to the existing variable. 4-category variable (used in time-use diary imputed analyses) No answer and not applicable responses were coded as missing. Categories at least once a month or less often than once a month were combined to give at least once a month or less than once a month. No alterations were made to the remaining categories.

Legend: Main parental respondent refers to the main parent of the participant completing the interview, and partner refers to the partner of the main respondent. Where variable structures differ between analyses (e.g., between complete case and imputed, or between questionnaire and time-use diary), this was due to issues regarding imputation model convergence; thus, variable structures were amended as required ensuring appropriate/meaningful categorisation. Abbreviation(s): BAS=British Ability Scales; BBM=Blackberry Messenger; CGT=Cambridge Gambling Task; Hr/s=Hour/s; IMD=Indices of Multiple Deprivation (England Index of Multiple Deprivation (IMD), Northern Ireland Multiple Deprivation Measure (IMD), Wales Index of Multiple Deprivation (WIMD) and Scottish Index of Multiple Deprivation (SIMD)); MCS=Millennium Cohort Study; Min/s=Minutes/s; NS-SEC=The National Statistics Socio-economic Classification; NVQ=National Vocational Qualification; SDQ=Strengths and Difficulties Questionnaire; OECD=Organisation for Economic Co-operation and Development; ONS=Office for National Statistics; and TV=Television.

Section B5 Weights used in analysis

The MCS provides sample design weights to correct for cases having unequal probabilities of selection (resulting from the stratified cluster design) and non-response weights (Mostafa and Ploubidis, 2017). The sample weights to be used depend on whether the analysis is confined to data relating to a single country (MCS sweep 7: GOVWT1) or whether the analysis covers all countries of the UK (MCS sweep 7: GOVWT2) (Centre for Longitudinal Studies, 2019).

Questionnaire analyses

Within the primary analysis models which include area-level deprivation as a confounder (and associated UK country-level indicator variables), the single country sample design weight was used. Whilst in effect modification and interaction analysis models, where area-level deprivation (and associated UK country-level indicator variables) were not included in the analysis models, the whole UK sample design weight was used.

Time-use diary analyses

For the time-use diary analysis models, as the MCS does not provide a weight to make the time-use diary sample representative of the entire sample, we created time-use diary specific weights, which additionally helped to account for participants excluded due to having ≥5 'no activity' slots recorded (thus deemed as having unreliable diary entries) and participants who did not complete the time-use diary at all.

To create the weights, a logistic regression approach to weighting was used (Johnson, 2008). We identified the characteristics which may have influenced a participant's ability to complete the time-use diary on both the weekday and weekend day as well as complete it reliably. This was achieved by entering all identified characteristics as independent variables into a logistic regression model with the binary dependent variable 1=completed the diary on both days (and reliably thus did not have ≥5 slots recorded as 'no activity') and 0=did not complete the diary on both days reliably or did not complete at all. Following this, we removed characteristics not identified as significant predictors of our

dependent binary variable in a sequential manner until left with a model with only significant predictors (listed below):

- Sex
- Mental health (assessed via Strengths and Difficulties Questionnaire)
- Cognitive ability (assessed via British Ability Scale II Verbal Similarities)
- Risk-taking (assessed via Cambridge Gambling Task)
- Anti-social behaviour
- Parental smoking
- Household income (assessed via Organisation for Economic Co-operation and Development Income Equivalised Quintiles)
- England country indicator variable

In line with the predictors used by the MCS when creating non-response weights, ethnicity, age, highest parental education in the household and family structure were additionally added to the model (Mostafa and Ploubidis, 2017; Fitzsimons *et al.*, 2020).

In the final model, the predicted probabilities were obtained, and the inverse of the predicted probabilities calculated to obtain the time-use diary weight. The time-use diary weight was then multiplied by both the single country analysis weight (time-use diary weight*GOVWT1) and whole UK analysis weight (time-use diary weight*GOVWT2) to obtain the final weights to be used in the respective analyses (see above).

Section B6 Variables included within imputation models

When estimating the effect of time spent on social media (assessed via time-use diary and questionnaire) on risk of cigarette, e-cigarette and dual use, due to the inclusion of area-level deprivation (and UK country indicator variables) as a confounder, the MCS single country analysis weight was included in the respective imputation model. Whilst for effect modification and interaction analyses where area-level deprivation was not identified as a confounder, the MCS whole UK country analysis weight was used. To facilitate investigation of effect modification and interaction, in the respective samples, an interaction term between time spent on social media and highest parental education in the household was included in the imputation models. Thus, separate imputation models were run not only for each exposure but to accommodate for each analysis and the weight used.

To account for the non-normal distribution of continuous variables, standard regression was not used; instead, as recommended, Predictive mean matching was used (Social Science Computing Operative, 2013). Predictive mean matching was also used for nominal categorical variables where multinomial and ordered logit did not facilitate model convergence and for binary variables where logistic did not facilitate model convergence (Social Science Computing Operative, 2013).

Table B6.1 details the variables included within each of the imputation models.

Table B6.1. Variables included within the imputation models

Variable	Questionnaire imputed sample (n=8,987)		Questionnaire imputed sample (n=8,954)		Time-use diary imputed sample (n=2,520)		Time-use diary imputed sample (n=2,520)	
	Primary analysis		Effect modification and interaction analysis		Primary analysis		Effect modification and interaction analysis	
	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed
Time spent on social media on a normal weekday (time-use diary)	-	-	-	-	Complete	0 (0)	Complete	0 (0)
Average time spent on social media across a normal weekday and weekend day (time-use diary)	-	-	-	-	Complete	0 (0)	Complete	0 (0)
Time spent on social media on a normal weekday (questionnaire)	Ordered logit	105 (1.2)	Ordered logit	105 (1.2)	-	-	-	-
Cigarette use[a]	Multinomial logit	216 (2.4)	Multinomial logit	215 (2.4)	Multinomial logit	27 (1.1)	Multinomial logit	27 (1.1)
E-cigarette use[a]	Multinomial logit	220 (2.4)	Multinomial logit	219 (2.4)	Multinomial logit	31 (1.2)	Multinomial logit	31 (1.2)
Maternal age at participant birth	Predictive mean matching	15 (0.2)	Predictive mean matching	13 (0.1)	Predictive mean matching	5 (0.2)	Predictive mean matching	5 (0.2)
Mental health	Predictive mean matching	336 (3.7)	Predictive mean matching	322 (0.0)	Complete	0 (0)	Complete	0 (0)
Previous cigarette use (also used as a proxy for previous e-cigarette use)	Logistic	261 (2.9)	Logistic	256 (2.9)	Logistic	13 (0.5)	Predictive mean matching	13 (0.5)
Previous alcohol use	Logistic	346 (3.9)	Logistic	340 (3.8)	Logistic	33 (1.3)	Predictive mean matching	33 (1.3)
In-person activities	Predictive mean matching	48 (0.5)	Predictive mean matching	34 (0.4)	Predictive mean matching	4 (0.2)	Predictive mean matching	4 (0.2)

Variable	Questionnaire imputed sample (n=8,987)		Questionnaire imputed sample (n=8,954)		Time-use diary imputed sample (n=2,520)		Time-use diary imputed sample (n=2,520)	
	Primary analysis		Effect modification and interaction analysis		Primary analysis		Effect modification and interaction analysis	
	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed
Cognitive ability	Predictive mean matching	121 (1.3)	Predictive mean matching	120 (1.3)	Complete	0 (0)	Complete	0 (0)
Risk-taking	Predictive mean matching	420 (4.7)	Predictive mean matching	418 (4.7)	Complete	0 (0)	Complete	0 (0)
Anti-social behaviour	Logistic	314 (3.5)	Logistic	312 (3.5)	Complete	0 (0)	Complete	0 (0)
Parental cigarette use (also used as a proxy for parental e-cigarette use)	Logistic	28 (0.3)	Logistic	14 (0.2)	Complete	0 (0)	Complete	0 (0)
Parenting style	Logistic	46 (0.5)	Logistic	32 (0.4)	Logistic	3 (0.1)	Predictive mean matching	3 (0.1)
Urbanicity	Logistic	1,476 (16.4)	Logistic	1,470 (16.4)	Logistic	320 (12.7)	Logistic	320 (12.7)
Highest parental occupation in the household	Ordered logit	121 (1.3)	Ordered logit	107 (1.2)	Ordered logit	24 (1.0)	Ordered logit	24 (1.0)
Highest parental education in the household	Logistic	33 (0.4)	Complete: interaction by()	0 (0)[b]	Complete	0 (0)	Complete: interaction by()	0 (0)
Area-level deprivation	Ordered logit	5 (0.1)	Ordered logit	5 (0.1)	Ordered logit	1 (0.0)	Ordered logit	1 (0.0)
Baseline cigarette use	Predictive mean matching	256 (2.8)	Predictive mean matching	254 (2.8)	Predictive mean matching	21 (0.8)	Predictive mean matching	21 (0.8)
Baseline e-cigarette use	Predictive mean matching	247 (2.7)	Predictive mean matching	245 (2.7)	Predictive mean matching	20 (0.7)	Predictive mean matching	20 (0.7)
Previous social media use	Ordered logit	202 (2.2)	Ordered logit	201 (2.2)	Ordered logit	18 (0.7)	Ordered logit	18 (0.7)
Sex	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)

Variable	Questionnaire imputed sample (n=8,987)		Questionnaire imputed sample (n=8,954)		Time-use diary imputed sample (n=2,520)		Time-use diary imputed sample (n=2,520)	
	Primary analysis		Effect modification and interaction analysis		Primary analysis		Effect modification and interaction analysis	
	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed
Age	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
Ethnic group	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
Number of siblings in the household	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
Household income	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
Family structure	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
UK country indicator variable	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
GOVWT1 (MCS single country weight)	Complete	0 (0)	-	-	-	-	-	-
GOVWT2 (MCS whole UK country weight)	-	-	Complete	0 (0)	-	-	-	-
Time-use diary weight*GOVWT1 (MCS single country weight)	-	-	-	-	Complete	0 (0)	-	-
Time-use diary weight*GOVWT2 (MCS whole UK country weight)	-	-	-	-	-	-	Complete	0 (0)

Legend: [a] Three category variables imputed, and binary variables and composite variable representing dual use created post imputation. [b] To facilitate inclusion of interaction between time spent on social media and highest parental education in the imputation model for effect modification and interaction analyses, n=33 with missing data on highest parental education excluded prior to imputation. Abbreviation(s): Complete=Complete variable; MCS=Millennium Cohort Study; and n=Number of participants.

Section B7 Differential effect of social media on cigarette and e-cigarette use - effect measure modification and interaction analyses

Effect measure modification - association between social media use and cigarette and e-cigarette use, according to strata of parental education

We estimated risk differences (RDs) representing the absolute difference in cigarette/e-cigarette use by social media use within the low and high parental education groups. Measures of effect modification on the additive scale represent the size of the absolute difference in RDs for cigarette/e-cigarette use by social media use between the high and low parental education groups (baseline: high parental education). A measure greater (or less) than zero indicates the presence of a positive (or negative) additive interaction.

Interaction - risk of cigarette and e-cigarette use according to 'combinations' of social media use and parental education

We estimated RDs for cigarette/e-cigarette use according to the combination of social media use and parental education (baseline: high parental education and no social media use (stratum with the lowest risk of cigarette/e-cigarette use; Knol *et al.*, 2011)). The measure of interaction represents the size of the difference between the RD in participants with (e.g.) low parental education and 1-<30 minutes social media use, compared with the RD for participants with low parental education and no social media use, plus the RD for those with high parental education and 1-<30 minutes social media use.

Additional/sensitivity analyses

Interaction should be examined alongside effect modification when the effect modifier is a potential cause of the outcome, as is likely for parental education and participants' social media use (Knol and VanderWeele, 2012). A key assumption in analysis of effect modification is that the exposure (in this case, social media use) is not a cause of the effect modifier (parental education). We theorise that participant social media use does not influence parental education (Vanderweele, 2009).

In line with epidemiological recommendations, we report results on both additive and multiplicative scales (Knol and VanderWeele, 2012). To supplement our investigation of additive effect measure modification and interaction, we report the relative excess risk due to interaction (RERI) for imputed adjusted estimates using the methodology of Andersson *et al*. (2005). Where we hypothesise the combined effect of parental education and social media use would be greater than the simple additive effects of each factor separately. In this case, the RERI would be greater than zero. Models were repeated using complete case samples.

Section B8 Characteristics of complete case and imputed samples

Table B8.1. Characteristics of complete case and imputed questionnaire samples

	Questionnaire complete case sample (n=6,234)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Time spent on social media on a normal weekday (questionnaire)				
No social media use	456	7.5 (6.7 to 8.4)	734	8.4 (7.6 to 9.1)
1 - <30 mins social media use	798	13.0 (12.0 to 13.9)	1,147	12.8 (12.0 to 13.6)
30 mins - <1 hr social media use	939	15.2 (14.2 to 16.2)	1,330	14.9 (13.9 to 15.8)
1 - <2 hrs social media use	1,087	17.4 (16.3 to 18.6)	1,562	17.3 (16.4 to 18.3)
≥2 hrs social media use	2,954	46.9 (45.4 to 48.5)	4,214	46.6 (45.4 to 47.8)
Time spent on social media on a normal weekday (time-use diary)				
No social media use	-	-	-	-
1 - <30 mins social media use	-	-	-	-
30 mins - <1 hr social media use	-	-	-	-
1 - <2 hrs social media use	-	-	-	-
≥2 hrs social media use	-	-	-	-
Average time spent on social media across a normal weekday and weekend day (time-use diary)				
No social media use	-	-	-	-
1 - <30 mins social media use	-	-	-	-
30 mins - <1 hr social media use	-	-	-	-
1 - <2 hrs social media use	-	-	-	-
≥ 2 hrs social media use	-	-	-	-

	Questionnaire complete case sample (n=6,234)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Cigarette use				
Never used cigarettes or tried once	4,504	70.8 (69.3 to 72.2)	6,603	71.1 (69.7 to 72.5)
Former cigarette use	421	7.0 (6.3 to 7.7)	604	7.0 (6.4 to 7.6)
Current cigarette use	1,309	22.2 (21.0 to 23.6)	1,780	21.9 (20.7 to 23.1)
E-cigarette use				
Never used e-cigarettes or tried once	4,845	77.1 (75.7 to 78.4)	6,929	76.2 (74.9 to 77.5)
Former e-cigarette use	688	11.2 (10.3 to 12.1)	1,030	11.7 (10.8 to 12.7)
Current e-cigarette use	701	11.7 (10.8 to 12.7)	1,028	12.0 (11.1 to 13.0)
Current dual use of cigarettes and e-cigarettes				
Never used both cigarettes or e-cigarettes or tried once	4,137	65.0 (63.4 to 66.6)	6,000	64.8 (63.4 to 66.2)
Current or former cigarette or e-cigarette use	1,618	26.9 (25.44 to 28.3)	2,315	27.0 (25.7 to 28.2)
Current dual use	479	8.1 (7.4 to 8.9)	672	8.2 (7.5 to 9.0)
Confounding variables				
Maternal age at participant birth				
11 to 19 years	310	4.9 (4.3 to 5.7)	-	-
20 to 29 years	2,569	40.0 (37.9 to 42.2)	-	-
30 to 39 years	3,179	52.2 (50.0 to 54.4)	-	-
40+ years	176	2.8 (2.4 to 3.2)	-	-
Mean (SD)	-	-	29.3 (5.69)	29.4 (5.67)
Sex				
Male	3,013	48.9 (47.5 to 50.3)	4,383	49.6 (48.4 to 50.8)

	Questionnaire complete case sample (n=6,234)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Female	3,221	51.1 (49.7 to 52.5)	4,604	50.4 (49.2 to 51.6)
Age				
13 years	1,586	25.3 (24.0 to 26.7)	2,282	25.1 (23.9 to 26.2)
14 years	4,584	73.4 (72.0 to 74.7)	6,610	73.7 (72.5 to 74.8)
15 years	64	1.3 (0.9 to 1.8)	95	1.3 (0.9 to 1.6)
Ethnic group				
White	5,467	93.2 (91.7 to 94.5)	7,346	91.0 (89.3 to 92.6)
Mixed	160	2.2 (1.7 to 2.8)	1,641	9.0 (7.4 to 10.7)
Indian	141	1.1 (0.8 to 1.5)		
Pakistani & Bangladeshi	214	1.4 (1.0 to 2.1)		
Black/Black British	171	1.5 (1.0 to 2.1)		
Other ethnic group (including Chinese, Other)	81	0.7 (0.5 to 1.0)		
Mental health (SDQ total difficulties)				
Mean (SD)	7.05 (5.44)	7.06 (5.58)	7.42 (5.67)	7.46 (5.89)
Previous cigarette use (also used as a proxy for previous e-cigarette use)				
No	6,117	98.1 (97.7 to 98.5)	8,800	97.8 (97.4 to 98.3)
Yes	117	1.9 (1.5 to 2.3)	187	2.2 (1.7 to 2.6)
Previous alcohol use				
No	5,521	87.9 (86.9 to 88.8)	8,001	88.1 (87.2 to 89.0)
Yes	713	12.1 (11.2 to 13.1)	986	11.9 (11.0 to 12.8)
Average days/week of in-person activities				

	Questionnaire complete case sample (n=6,234)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Mean (SD)	3.04 (1.53)	3.12 (1.51)	2.93 (1.56)	3.04 (1.54)
Cognitive ability				
Mean (SD)	60.3 (9.39)	60.2 (9.39)	59.4 (10.0)	59.6 (9.87)
Risk-taking				
Mean (SD)	0.52 (0.17)	0.52 (0.17)	0.52 (0.17)	0.52 (0.17)
Anti-social behaviour				
No	4,997	80.1 (78.8 to 81.3)	7,158	79.7 (78.6 to 80.8)
Yes	1,237	19.9 (18.7 to 21.2)	1,829	20.3 (19.2 to 21.4)
Number of siblings of participant in the household				
0	670	11.2 (10.2 to 12.1)	984	11.7 (10.9 to 12.5)
1	2,914	47.8 (46.4 to 49.3)	4,018	46.9 (45.5 to 48.3)
2 - 3	2,401	37.1 (35.7 to 38.6)	3,490	37.0 (35.8 to 38.3)
4 - 5	220	3.5 (2.9 to 4.1)	435	3.9 (3.3 to 4.5)
6 - 10	29	0.4 (0.3 to 0.7)	60	0.5 (0.3 to 0.6)
Parental cigarette use (also used as a proxy for parental e-cigarette use)				
Non-smoker parents	4,495	73.0 (71.5 to 74.5)	6,416	72.1 (70.7 to 73.5)
1+ smoker parents	1,739	27.0 (25.5 to 28.5)	2,571	27.9 (26.5 to 29.3)
Parenting style				
Parent has rules	6,081	97.3 (96.6 to 97.9)	8,726	97.1 (96.6 to 97.6)
Parent does not have rules	153	2.7 (2.1 to 3.4)	261	2.9 (2.4 to 3.4)
Urbanicity				

	Questionnaire complete case sample (n=6,234)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Urban	4,579	69.3 (65.4 to 73.0)	6,818	71.0 (67.8 to 74.2)
Rural	1,655	30.7 (27.0 to 34.6)	2,169	29.0 (25.8 to 32.2)
Household income				
Top quintile	1,623	29.2 (26.9 to 31.5)	2,075	27.1 (25.0 to 29.1)
Fourth quintile	1,551	26.1 (24.7 to 27.7)	2,062	25.0 (23.6 to 26.4)
Third quintile	1,372	21.0 (19.8 to 22.3)	1,883	20.6 (19.4 to 21.8)
Second quintile	998	14.6 (13.5 to 15.9)	1,514	15.4 (14.4 to 16.5)
Bottom quintile	690	9.1 (8.0 to 10.3)	1,453	11.9 (10.5 to 13.3)
Family structure				
Natural parents	4,502	70.6 (68.8 to 72.3)	6,397	69.2 (67.6 to 70.8)
Reconstituted	561	9.6 (8.6 to 10.7)	810	10.0 (9.1 to 10.9)
Lone parent	1,171	19.8 (18.5 to 21.1)	1,780	20.9 (19.7 to 22.1)
Highest parental occupation in the household				
Managerial and professional	3,157	52.0 (49.8 to 54.2)	4,166	49.0 (46.9 to 51.1)
Intermediate	753	12.4 (11.4 to 13.4)	1,069	12.6 (11.7 to 13.5)
Small employers and self-employed	566	9.0 (8.2 to 9.9)	873	9.2 (8.4 to 10.0)
Lower supervisory and technical	243	3.7 (3.1 to 4.3)	370	3.9 (3.4 to 4.4)
Semi routine and routine	724	11.6 (10.5 to 12.8)	1,129	12.0 (10.9 to 13.0)
Unemployed	791	11.4 (10.3 to 12.5)	1,380	13.4 (12.2 to 14.5)
Highest parental education in the household				
NVQ level 5 - higher degree	1,031	16.7 (15.3 to 18.3)	5,168	59.1 (56.9 to 61.4)

	Questionnaire complete case sample (n=6,234)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
NVQ level 4 - first degree, diplomas in higher education	2,283	36.9 (35.2 to 38.6)		
NVQ level 3 - A/AS/S levels	546	9.0 (8.2 to 9.9)		
NVQ level 2 - O level/GCSE grades A-C	1,580	25.9 (24.1 to 27.8)		
NVQ level 1 - GCSE grades D-G	337	5.2 (4.5 to 6.0)	3,819	40.9 (38.6 to 43.1)
Other academic qualifications (incl. Overseas)	119	1.5 (1.1 to 1.9)		
None of the above	338	4.9 (4.2 to 5.7)		
Area-level deprivation				
Least deprived	841	15.9 (13.3 to 19.0)	1,037	14.2 (11.8 to 16.7)
80 - <90%	749	14.2 (12.5 to 16.1)	929	13.0 (11.3 to 14.6)
70 - <80%	623	11.2 (9.7 to 12.9)	795	10.2 (8.8 to 11.6)
60 - <70%	615	10.6 (9.4 to 12.0)	809	10.3 (9.0 to 11.6)
50 - <60%	636	11.0 (9.4 to 12.8)	866	10.8 (9.3 to 12.3)
40 - <50%	617	9.2 (7.9 to 10.6)	833	9.2 (8.0 to 10.4)
30 - <40%	580	8.1 (7.0 to 9.3)	822	8.3 (7.3 to 9.3)
20 - <30%	572	7.9 (6.8 to 9.2)	901	8.6 (7.4 to 9.7)
10 - <20%	613	7.4 (6.3 to 8.6)	999	8.4 (7.3 to 9.4)
Most deprived	388	4.5 (3.6 to 5.6)	996	7.0 (5.7 to 8.4)

Legend: [a] Weighted to account attrition and sample design at the MCS 7 (17 year survey). Values may not add up due to rounding. Abbreviation(s): -=Not measured; CI=Confidence interval; GCSE=General Certificate in Secondary Education; Hr/s=Hour/s; Incl=Including; Min/s=Minute/s; n=Number of participants; NVQ=National Vocational Qualifications; SD=Standard deviation; and SDQ=Strengths and Difficulties Questionnaire.

Table B8.2. Characteristics of complete case and imputed time-use diary samples

	Time-use diary complete case sample (n=2,109)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**
Time spent on social media on a normal weekday (questionnaire)				
No social media use	-	-	-	-
1 - <30 mins social media use	-	-	-	-
30 mins - <1 hr social media use	-	-	-	-
1 - <2 hrs social media use	-	-	-	-
≥2 hrs social media use	-	-	-	-
Time spent on social media on a normal weekday (time-use diary)				
No social media use	1,288	63.0 (60.6 to 65.3)	1,548	63.8 (61.7 to 65.9)
1 - <30 mins social media use	197	8.7 (7.5 to 10.0)	230	8.3 (7.2 to 9.5)
30 mins - <1 hr social media use	230	9.9 (8.6 to 11.4)	269	9.9 (8.6 to 11.1)
1 - <2 hrs social media use	228	10.3 (8.9 to 11.8)	277	10.2 (8.9 to 11.5)
≥2 hrs social media use	166	8.2 (6.7 to 9.9)	196	7.8 (6.5 to 9.1)
Average time spent on social media across a normal weekday and weekend day (time-use diary)				
No social media use	978	48.2 (45.8 to 50.6)	1,178	49.0 (46.8 to 51.2)
1 - <30 mins social media use	416	18.8 (16.9 to 20.9)	497	18.8 (17.1 to 20.6)
30 mins - <1 hr social media use	331	14.2 (12.7 to 15.9)	390	14.3 (12.7 to 15.8)
1 - <2 hrs social media use	231	11.2 (9.7 to 13.1)	276	10.7 (9.2 to 12.2)
≥2 hrs social media use	153	7.5 (6.2 to 9.1)	179	7.2 (5.9 to 8.5)
Cigarette use				
Never used cigarettes or tried once	1,634	74.7 (72.2 to 77.1)	1,960	74.6 (72.4 to 76.9)
Former cigarette use	114	6.2 (5.0 to 7.7)	139	7.0 (5.5 to 8.5)

	Time-use diary complete case sample (n=2,109)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**
Current cigarette use	361	19.0 (17.0 to 21.2)	421	18.3 (16.4 to 20.2)
E-cigarette use				
Never used e-cigarettes or tried once	1,742	79.6 (77.1 to 81.9)	2,063	79.0 (76.8 to 81.2)
Former e-cigarette use	181	9.7 (8.3 to 11.4)	219	10.0 (8.5 to 11.5)
Current e-cigarette use	186	10.7 (9.0 to 12.7)	238	11.0 (9.3 to 12.7)
Current dual use of cigarettes and e-cigarettes				
Never used both cigarettes or e-cigarettes or tried once	1,536	69.3 (66.5 to 72.0)	1,831	68.9 (66.4 to 71.4)
Current or former cigarette or e-cigarette use	447	23.4 (21.1 to 25.9)	535	23.9 (21.6 to 26.2)
Current dual use	126	7.3 (6.0 to 8.8)	153	7.2 (6.0 to 8.4)
Confounding variables				
Maternal age at participant birth				
11 to 19 years	69	4.2 (3.1 to 5.6)	-	-
20 to 29 years	821	40.7 (38.0 to 43.5)	-	-
30 to 39 years	1,158	52.4 (49.6 to 55.2)	-	-
40+ years	61	2.7 (2.1 to 3.4)	-	-
Mean (SD)	-	-	30.0 (5.29)	29.7 (5.46)
Sex				
Male	938	50.1 (47.5 to 52.7)	1,123	49.9 (47.5 to 52.3)
Female	1,171	49.9 (47.3 to 52.5)	1,396	50.1 (47.7 to 52.5)
Age				
13 years	552	25.7 (23.4 to 28.2)	658	26.2 (23.9 to 28.5)

	Time-use diary complete case sample (n=2,109)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**
14 years	1,541	73.6 (71.1 to 75.9)	1,843	73.0 (70.7 to 75.4)
15 years	16	0.7 (0.4 to 1.2)	19	0.8 (0.4 to 1.2)
Ethnic group				
White	1,915	93.3 (91.1 to 94.9)	2,228	92.1 (90.2 to 94.0)
Mixed				
Indian				
Pakistani & Bangladeshi	194	6.7 (5.1 to 8.9)	292	7.9 (6.0 to 9.8)
Black/Black British				
Other ethnic group (including Chinese, Other)				
Mental health (SDQ total difficulties)				
Mean (SD)	6.11 (4.86)	7.01 (5.62)	6.23 (4.93)	7.22 (5.81)
Previous cigarette use (also used as a proxy for previous e-cigarette use)				
No	2,087	98.4 (97.4 to 99.0)	2,495	98.4 (97.7 to 99.2)
Yes	22	1.6 (1.0 to 2.6)	26	1.6 (0.8 to 2.3)
Previous alcohol use				
No	1,901	89.2 (87.4 to 90.7)	2,282	89.4 (87.8 to 91.0)
Yes	208	10.8 (9.3 to 12.6)	238	10.6 (9.0 to 12.2)
Average days/week of in-person activities				
Mean (SD)	3.11 (1.52)	3.12 (1.50)	3.07 (1.53)	3.07 (1.53)
Cognitive ability				
Mean (SD)	61.5 (8.75)	60.4 (8.82)	61.3 (8.84)	60.1 (9.02)

	Time-use diary complete case sample (n=2,109)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**
Risk-taking				
Mean (SD)	0.50 (0.17)	0.52 (0.17)	0.50 (0.17)	0.52 (0.17)
Anti-social behaviour				
No	1,784	80.7 (78.3 to 82.8)	2,131	80.4 (78.1 to 82.6)
Yes	325	19.3 (17.2 to 21.7)	389	19.6 (17.4 to 21.9)
Number of siblings of participant in the household				
0	205	10.0 (8.6 to 11.5)	266	11.5 (9.9 to 13.1)
1	1,054	47.3 (44.8 to 49.7)	1,237	46.3 (44.0 to 48.5)
2 - 3	793	39.0 (36.6 to 41.5)	929	38.1 (35.8 to 40.5)
4 - 5	49	3.1 (2.1 to 4.1)	88	4.1 (2.9 to 5.3)
6 - 10	8	0.6 (0.3 to 1.6)		
Parental cigarette use (also used as a proxy for parental e-cigarette use)				
Non-smoker parents	1,655	73.3 (70.7 to 75.7)	1,949	72.1 (69.7 to 74.5)
1+ smoker parents	454	26.7 (24.3 to 29.3)	571	27.9 (25.5 to 30.3)
Parenting style				
Parent has rules	2,056	97.6 (96.7 to 98.3)	2,453	97.5 (96.8 to 98.2)
Parent does not have rules	53	2.4 (1.7 to 3.3)	67	2.5 (1.8 to 3.2)
Urbanicity				
Urban	1,496	69.2 (64.6 to 73.4)	1,825	70.7 (66.7 to 74.7)
Rural	613	30.8 (26.6 to 35.4)	695	29.3 (25.3 to 33.3)
Household income				

	Time-use diary complete case sample (n=2,109)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**
Top quintile	677	29.1 (26.6 to 31.7)	776	28.0 (25.6 to 30.4)
Fourth quintile	599	26.5 (24.1 to 29.0)	658	25.6 (23.4 to 27.8)
Third quintile	446	21.6 (19.8 to 23.6)	533	21.6 (19.7 to 23.5)
Second quintile	260	14.6 (12.6 to 16.9)	312	14.5 (12.6 to 16.4)
Bottom quintile	127	8.1 (6.4 to 10.2)	214	10.4 (8.4 to 12.3)
Family structure				
Natural parents	1,668	71.1 (68.3 to 73.7)	1,969	69.3 (66.8 to 71.9)
Reconstituted	148	8.9 (7.3 to 10.8)	178	9.1 (7.4 to 10.8)
Lone parent	293	20.0 (17.8 to 22.5)	373	21.6 (19.2 to 23.9)
Highest parental occupation in the household				
Managerial and professional	1,188	50.7 (47.4 to 54.0)	1,382	49.3 (46.3 to 52.4)
Intermediate	275	13.7 (12.0 to 15.6)	329	13.8 (12.1 to 15.5)
Small employers and self-employed	188	9.5 (8.0 to 11.2)	231	9.3 (7.8 to 10.8)
Lower supervisory and technical	62	3.5 (2.5 to 4.9)	79	3.5 (2.5 to 4.5)
Semi routine and routine	221	11.9 (10.1 to 13.9)	262	11.5 (9.8 to 13.3)
Unemployed	175	10.7 (9.0 to 12.8)	237	12.6 (10.6 to 14.5)
Highest parental education in the household				
NVQ level 5 - higher degree	400	15.6 (13.7 to 17.7)		
NVQ level 4 - first degree, diplomas in higher education	865	38.1 (35.4 to 40.8)	1,712	61.6 (58.5 to 64.7)
NVQ level 3 - A/AS/S levels	211	10.3 (8.8 to 11.9)		
NVQ level 2 - O level/GCSE grades A-C	460	25.6 (23.0 to 28.3)	808	38.4 (35.3 to 41.5)

	Time-use diary complete case sample (n=2,109)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/mean & SD[a]**
NVQ level 1 - GCSE grades D-G	85	4.9 (3.9 to 6.1)		
Other academic qualifications (incl. Overseas)	30	1.6 (1.1 to 2.4)		
None of the above	58	4.0 (2.8 to 5.5)		
Area-level deprivation				
Least deprived	332	16.3 (13.3 to 19.7)	353	14.5 (11.7 to 17.3)
80 - <90%	282	14.9 (12.6 to 17.5)	306	13.4 (11.2 to 15.5)
70 - <80%	231	11.2 (9.3 to 13.4)	270	10.9 (8.9 to 12.8)
60 - <70%	231	11.0 (9.3 to 13.0)	275	11.4 (9.7 to 13.2)
50 - <60%	205	10.4 (8.4 to 12.7)	247	10.3 (8.4 to 12.2)
40 - <50%	225	10.4 (8.4 to 12.8)	260	10.1 (8.2 to 12.1)
30 - <40%	193	8.5 (7.0 to 10.4)	227	8.9 (7.2 to 10.6)
20 - <30%	169	7.8 (6.3 to 9.5)	213	8.5 (6.9 to 10.1)
10 - <20%	154	6.1 (4.9 to 7.6)	201	6.7 (5.4 to 7.9)
Most deprived	87	3.4 (2.5 to 4.6)	167	5.3 (3.8 to 6.8)

Legend: [a] Weighted to account for time-use diary non-response at MCS 6 (14 year survey) and for attrition and sample design at the MCS 7 (17 year survey). Values may not add up due to rounding. Abbreviation(s): -=Not measured; CI=Confidence interval; GCSE=General Certificate in Secondary Education; Hr/s=Hour/s; Incl=Including; Min/s=Minute/s; n=Number of participants; NVQ=National Vocational Qualifications; SD=Standard deviation; and SDQ=Strengths and Difficulties Questionnaire.

Section B9 Effect of social media use on cigarette, e-cigarette and dual use

Table B9.1. Time spent on social media on a normal weekday on risk of (A) cigarette, (B) e-cigarette (odds ratios), and (C) dual use (relative risk ratios) within the questionnaire imputed sample (n=8,987) (also displayed in Chapter 5)

	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]
A. Current or former cigarette use (ref: never used a cigarette or tried once)			
No social media use	14.9 (94)	0.83 (0.56 to 1.22)	0.82 (0.57 to 1.18)
1 - <30 mins	17.4 (175)	1.00	1.00
30 mins - <1 hr	22.9 (275)	1.41 (1.05 to 1.89)	1.48 (1.11 to 1.97)
1 - <2 hrs	26.9 (395)	1.74 (1.35 to 2.26)	1.78 (1.38 to 2.29)
≥2 hrs	37.2 (1,445)	2.80 (2.23 to 3.52)	2.76 (2.19 to 3.48)
B. Current or former e-cigarette use (ref: never used e-cigarette or tried once)			
No social media use	13.9 (88)	1.01 (0.66 to 1.53)	0.94 (0.63 to 1.39)
1 - <30 mins	13.8 (157)	1.00	1.00
30 mins - <1 hr	20.9 (262)	1.65 (1.24 to 2.20)	1.79 (1.34 to 2.39)
1 - <2 hrs	22.4 (351)	1.80 (1.42 to 2.29)	2.06 (1.61 to 2.64)
≥2 hrs	29.8 (1,200)	2.65 (2.14 to 3.29)	3.24 (2.59 to 4.05)
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**
C. Current or former cigarette or e-cigarette use (ref: never used cigarette or e-cigarette or tried once)			
No social media use	15.0 (95)	0.82 (0.56 to 1.19)	0.78 (0.55 to 1.12)
1 - <30 mins	17.7 (186)	1.00	1.00
30 mins - <1 hr	23.8 (302)	1.49 (1.13 to 1.97)	1.58 (1.21 to 2.07)
1 - <2 hrs	24.8 (383)	1.63 (1.27 to 2.10)	1.74 (1.36 to 2.22)
≥2 hrs	33.5 (1,350)	2.63 (2.11 to 3.28)	2.79 (2.23 to 3.48)
C. Current dual use (ref: never used cigarette or e-cigarette or tried once)			
No social media use	4.2 (29)	0.93 (0.46 to 1.88)	0.88 (0.45 to 1.72)
1 - <30 mins	4.3 (46)	1.00	1.00
30 mins - <1 hr	6.0 (68)	1.52 (0.92 to 2.52)	1.69 (1.03 to 2.77)
1 - <2 hrs	8.7 (125)	2.35 (1.54 to 3.59)	2.72 (1.79 to 4.13)
≥2 hrs	10.5 (405)	3.39 (2.31 to 4.98)	4.11 (2.77 to 6.08)

Legend: Questionnaire imputed sample: n=8,987 (weighted sample: n=6,175). [a] Adjusted for sex, ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table B9.2. Time spent on social media on a normal weekday on risk of (A) cigarette, (B) e-cigarette (odds ratios), and (C) dual use (relative risk ratios) within the questionnaire imputed sample (n=8,987), stratified by sex

	Males (n=4,383)			Females (n=4,604)		
	Weighted prevalence % (observed n with outcome)	**OR (95% CI)**	**AOR (95% CI)[a]**	**Weighted prevalence % (observed n with outcome)**	**OR (95% CI)**	**AOR (95% CI)[a]**
A. Current or former cigarette use (ref: never used a cigarette or tried once)						
No social media use	15.7 (66)	0.85 (0.52 to 1.38)	0.86 (0.54 to 1.36)	13.2 (28)	0.77 (0.43 to 1.36)	0.81 (0.46 to 1.42)
1 - <30 mins	17.9 (119)	1.00	1.00	16.5 (56)	1.00	1.00
30 mins - <1 hr	25.2 (184)	1.55 (1.06 to 2.25)	1.56 (1.10 to 2.23)	19.3 (91)	1.21 (0.77 to 1.89)	1.39 (0.89 to 2.17)
1 - <2 hrs	28.2 (219)	1.80 (1.29 to 2.53)	1.75 (1.27 to 2.40)	25.5 (176)	1.73 (1.15 to 2.58)	1.84 (1.24 to 2.72)
≥2 hrs	39.0 (545)	2.93 (2.16 3.99)	2.76 (2.04 to 3.75)	36.1 (900)	2.86 (1.96 to 4.16)	2.84 (1.97 to 4.09)
B. Current or former e-cigarette use (ref: never used e-cigarette or tried once)						
No social media use	16.4 (69)	0.99 (0.61 to 1.60)	0.95 (0.61 to 1.49)	7.8 (19)	0.92 (0.42 to 1.99)	0.96 (0.45 to 2.08)
1 - <30 mins	16.5 (125)	1.00	1.00	8.4 (32)	1.00	1.00
30 mins - <1 hr	25.8 (200)	1.76 (1.25 to 2.48)	1.76 (1.26 to 2.47)	13.0 (61)	1.62 (0.99 to 2.64)	1.89 (1.14 to 3.16)
1 - <2 hrs	29.2 (245)	2.09 (1.57 to 2.78)	2.07 (1.55 to 2.75)	14.9 (106)	1.90 (1.21 to 2.99)	2.02 (1.26 to 3.22)
≥2 hrs	41.0 (585)	3.52 (2.71 to 4.57)	3.23 (2.47 to 4.21)	23.3 (615)	3.31 (2.21 to 4.95)	3.25 (2.12 to 4.98)
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**	**Weighted prevalence % (observed n with outcome)**	**RRR (95% CI)**	**ARRR (95% CI)[a]**
C. Current or former cigarette or e-cigarette use (ref: never used cigarette or e-cigarette or tried once)						
No social media use	15.9 (64)	0.80 (0.49 to 1.30)	0.76 (0.48 to 1.20)	12.3 (31)	0.82 (0.46 to 1.49)	0.83 (0.46 to 1.48)
1 - <30 mins	19.1 (133)	1.00	1.00	15.2 (52)	1.00	1.00
30 mins - <1 hr	27.5 (211)	1.67 (1.18 to 2.37)	1.70 (1.22 to 2.36)	18.1 (90)	1.25 (0.79 to 1.99)	1.41 (0.90 to 2.24)

1 - <2 hrs	26.7 (229)	1.72 (1.25 to 2.37)	1.73 (1.27 to 2.36)	22.7 (154)	1.71 (1.11 to 2.61)	1.77 (1.18 to 2.67)
≥2 hrs	35.6 (529)	2.87 (2.16 to 3.81)	2.74 (2.09 to 3.58)	32.3 (830)	2.91 (1.95 to 4.34)	2.89 (1.97 to 4.25)
C. Current dual use (ref: never used cigarette or e-cigarette or tried once)						
No social media use	5.1 (24)	0.99 (0.44 to 2.22)	1.00 (0.47 to 2.13)	2.2 (4)	0.62 (0.18 to 2.16)	0.71 (0.20 to 2.55)
1 - <30 mins	4.8 (34)	1.00	1.00	3.3 (11)	1.00	1.00
30 mins - <1 hr	6.9 (50)	1.66 (0.91 to 3.03)	1.73 (0.96 to 3.12)	4.4 (18)	1.38 (0.61 to 3.10)	1.67 (0.72 to 3.86)
1 - <2 hrs	11.4 (83)	2.89 (1.71 to 4.88)	2.87 (1.73 to 4.76)	5.8 (41)	1.97 (0.95 to 4.06)	2.22 (1.03 to 4.80)
≥2 hrs	14.8 (204)	4.71 (2.95 to 7.51)	4.41 (2.73 to 7.11)	8.1 (201)	3.32 (1.70 to 6.50)	3.42 (1.67 to 6.99)

Legend: Questionnaire imputed sample: n=8,987 (weighted sample: n=6,175). [a] Adjusted for ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding.
Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table B9.3. Average time spent on social media across a normal weekday and weekend day on risk of (A) cigarette, (B) e-cigarette (odds ratios), and (C) dual use (relative risk ratios) within the time-use diary imputed sample (n=2,520) (also displayed in Chapter 5)

	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]
A. Current or former cigarette use (ref: never used a cigarette or tried once)			
No social media use	23.5 (239)	1.28 (0.93 to 1.76)	1.15 (0.83 to 1.60)
1 - <30 mins	19.3 (94)	1.0	1.0
30 mins - <1 hr	27.8 (95)	1.60 (1.09 to 2.35)	1.78 (1.22 to 2.60)
1 - <2 hrs	31.8 (74)	1.95 (1.29 to 2.94)	1.87 (1.23 to 2.84)
≥2 hrs	39.1 (58)	2.67 (1.68 to 4.27)	2.63 (1.68 to 4.12)
B. Current or former e-cigarette use (ref: never used e-cigarette or tried once)			
No social media use	20.4 (204)	1.19 (0.80 to 1.79)	1.04 (0.71 to 1.51)
1 - <30 mins	17.7 (73)	1.0	1.0
30 mins - <1 hr	21.5 (72)	1.28 (0.80 to 2.03)	1.54 (1.00 to 2.38)
1 - <2 hrs	25.2 (62)	1.57 (0.98 to 2.50)	1.56 (1.01 to 2.40)
≥2 hrs	27.0 (46)	1.72 (1.00 to 2.98)	1.77 (1.07 to 2.93)
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**
C. Current or former cigarette or e-cigarette use (ref: never used cigarette or e-cigarette or tried once)			
No social media use	22.1 (232)	1.21 (0.83 to 1.74)	1.05 (0.75 to 1.46)
1 - <30 mins	19.3 (83)	1.0	1.0
30 mins - <1 hr	28.4 (101)	1.68 (1.09 to 2.60)	1.96 (1.31 to 2.93)
1 - <2 hrs	28.7 (71)	1.82 (1.11 to 2.99)	1.75 (1.10 to 2.78)
≥2 hrs	32.5 (49)	2.19 (1.28 to 3.77)	2.17 (1.34 to 3.52)
C. Current dual use (ref: never used cigarette or e-cigarette or tried once)			
No social media use	6.9 (67)	1.28 (0.78 to 2.10)	1.19 (0.68 to 2.09)
1 - <30 mins	5.7 (28)	1.0	1.0
30 mins - <1 hr	6.3 (19)	1.25 (0.63 to 2.47)	1.42 (0.71 to 2.86)
1 - <2 hrs	10.3 (22)	2.20 (1.21 to 3.99)	2.24 (1.14 to 4.41)
≥2 hrs	10.0 (17)	2.26 (1.17 to 4.36)	2.37 (1.18 to 4.76)

Legend: Time-use diary imputed sample: n=2,520 (weighted sample: n=5,005). [a] Adjusted for sex, ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table B9.4. Average time spent on social media across a normal weekday and weekend day on risk of (A) cigarette, (B) e-cigarette (odds ratios), and (C) dual use (relative risk ratios) within the time-use diary imputed sample (n=2,520), stratified by sex

	Males (n=1,123)			Females (n=1,397)		
	Weighted prevalence % (observed n with outcome)	**OR (95% CI)**	**AOR (95% CI)[a]**	**Weighted prevalence % (observed n with outcome)**	**OR (95% CI)**	**AOR (95% CI)[a]**
A. Current or former cigarette use (ref: never used a cigarette or tried once)						
No social media use	24.2 (146)	0.94 (0.61 to 1.45)	0.96 (0.61 to 1.51)	22.4 (93)	1.65 (1.07 to 2.54)	1.48 (0.93 to 2.36)
1 - <30 mins	25.3 (48)	1.00	1.00	14.9 (46)	1.00	1.00
30 mins - <1 hr	28.1 (36)	1.15 (0.66 to 2.01)	1.29 (0.70 to 2.37)	27.6 (60)	2.18 (1.30 to 3.65)	2.20 (1.33 to 3.65)
1 - <2 hrs	38.9 (27)	1.88 (0.96 to 3.72)	1.83 (0.93 to 3.59)	28.0 (47)	2.23 (1.33 to 3.73)	2.15 (1.24 to 3.71)
≥2 hrs	40.0 (9)	1.97 (0.67 to 5.73)	1.69 (0.63 to 4.51)	38.8 (49)	3.64 (2.15 to 6.14)	3.62 (2.13 to 6.18)
B. Current or former e-cigarette use (ref: never used e-cigarette or tried once)						
No social media use	22.8 (142)	0.81 (0.47 to 1.40)	0.86 (0.53 to 1.40)	16.0 (62)	1.55 (0.91 to 2.64)	1.51 (0.88 to 2.60)
1 - <30 mins	26.6 (43)	1.00	1.00	10.9 (30)	1.00	1.00
30 mins - <1 hr	29.2 (36)	1.14 (0.56 to 2.30)	1.31 (0.66 to 2.59)	17.5 (36)	1.73 (0.96 to 3.09)	1.78 (0.99 to 3.22)
1 - <2 hrs	38.9 (29)	1.76 (0.84 to 3.68)	1.72 (0.85 to 3.51)	17.8 (33)	1.76 (0.94 to 3.30)	1.69 (0.89 to 3.20)
≥2 hrs	40.6 (11)	1.89 (0.63 to 5.64)	1.50 (0.58 to 3.88)	23.3 (35)	2.48 (1.35 to 4.56)	2.21 (1.21 to 4.05)
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**	**Weighted prevalence % (observed n with outcome)**	**RRR (95% CI)**	**ARRR (95% CI)[a]**
C. Current or former cigarette or e-cigarette use (ref: never used cigarette or e-cigarette or tried once)						
No social media use	23.9 (150)	0.85 (0.50 to 1.45)	0.89 (0.58 to 1.35)	18.8 (82)	1.50 (0.95 to 2.35)	1.36 (0.85 to 2.17)
1 - <30 mins	26.6 (40)	1.00	1.00	13.8 (42)	1.00	1.00
30 mins - <1 hr	33.9 (42)	1.44(0.71 to 2.91)	1.68 (0.86 to 3.26)	25.5 (59)	2.18 (1.31 to 3.64)	2.23 (1.32 to 3.76)

	Males (n=1,123)			Females (n=1,397)		
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**	**Weighted prevalence % (observed n with outcome)**	**RRR (95% CI)**	**ARRR (95% CI)[a]**
1 - <2 hrs	35.8 (27)	1.84 (0.77 to 4.37)	1.67 (0.80 to 3.50)	24.9 (44)	2.17 (1.24 to 3.77)	2.11 (1.17 to 3.82)
≥2 hrs	41.4 (10)	2.03 (0.66 to 6.23)	1.67 (0.66 to 4.22)	30.1 (39)	3.00 (1.68 to 5.35)	2.85 (1.65 to 4.93)
C. Current dual use (ref: never used cigarette or e-cigarette or tried once)						
No social media use	6.8 (41)	0.89 (0.47 to 1.70)	0.97 (0.42 to 2.25)	7.3 (26)	1.75 (0.82 to 3.73)	1.64 (0.70 to 3.83)
1 - <30 mins	7.3 (16)	1.00	1.00	4.6 (12)	1.00	1.00
30 mins - <1 hr	7.7 (9)	1.19 (0.46 to 3.08)	1.27 (0.41 to 3.97)	5.5 (9)	1.42 (0.52 to 3.88)	1.38 (0.53 to 3.60)
1 - <2 hrs	15.8 (11)	2.95 (1.15 to 7.55)	3.60 (1.24 to 10.4)	7.3 (11)	1.92 (0.76 to 4.87)	1.71 (0.67 to 4.34)
≥2 hrs	8.0 (3)	1.44 (0.37 to 5.53)	1.16 (0.29 to 4.70)	10.5 (14)	3.15 (1.34 to 7.38)	2.92 (1.21 to 7.08)

Legend: Time-use diary imputed sample: n=2,520 (weighted sample: n=5,005). [a] Adjusted for ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table B9.5. Time spent on social media on a normal weekday on risk of (A) cigarette, (B) e-cigarette (odds ratios), and (C) dual use (relative risk ratios) within the questionnaire complete case sample (n=6,234)

	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]
A. Current or former cigarette use (ref: never used cigarette or tried once)			
No social media use	15.2 (62)	0.93 (0.63 to 1.36)	0.90 (0.62 to 1.32)
1 - <30 mins	16.2 (122)	1.00	1.00
30 mins - <1 hr	23.8 (214)	1.61 (1.22 to 2.12)	1.66 (1.25 to 2.21)
1 - <2 hrs	26.6 (286)	1.87 (1.45 to 2.42)	1.92 (1.47 to 2.50)
≥2 hrs	37.8 (1,046)	3.14 (2.52 to 3.91)	3.08 (2.42 to 3.91)
B. Current or former e-cigarette use (ref: never used e-cigarette or tried once)			
No social media use	12.2 (49)	0.94 (0.59 to 1.49)	0.84 (0.55 to 1.26)
1 - <30 mins	12.9 (101)	1.00	1.00
30 mins - <1 hr	20.5 (186)	1.74 (1.31 to 2.31)	1.91 (1.42 to 2.58)
1 - <2 hrs	21.0 (237)	1.78 (1.36 to 2.33)	2.04 (1.53 to 2.73)
≥2 hrs	28.8 (816)	2.72 (2.16 to 3.43)	3.35 (2.61 to 4.30)
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**
C. Current or former cigarette or e-cigarette use (ref: never used cigarette or e-cigarette or tried once)			
No social media use	14.7 (57)	0.90 (0.58 to 1.38)	0.84 (0.57 to 1.25)
1 - <30 mins	16.1 (124)	1.00	1.00
30 mins - <1 hr	23.8 (217)	1.69 (1.29 to 2.22)	1.78 (1.35 to 2.33)
1 - <2 hrs	24.5 (271)	1.80 (1.40 to 2.31)	1.88 (1.46 to 2.43)
≥2 hrs	33.6 (949)	2.98 (2.39 to 3.72)	3.12 (2.48 to 3.93)
C. Current dual use (ref: never used cigarette or e-cigarette or tried once)			
No social media use	3.9 (18)	0.91 (0.47 to 1.77)	0.84 (0.41 to 1.69)
1 - <30 mins	4.2 (31)	1.00	1.00
30 mins - <1 hr	6.3 (55)	1.73 (1.07 to 2.78)	1.92 (1.16 to 3.17)
1 - <2 hrs	8.2 (86)	2.32 (1.53 to 3.51)	2.71 (1.75 to 4.21)
≥2 hrs	10.5 (298)	3.58 (2.44 to 5.25)	4.27 (2.81 to 6.50)

Legend: Questionnaire complete case sample: n=6,234 (weighted sample: n=4,484). [a] Adjusted for sex, ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio, Ref=Reference category; and RRR=Relative risk ratio.

Table B9.6. Average time spent on social media across a normal weekday and weekend day on risk of (A) cigarette, (B) e-cigarette (odds ratios), and (C) dual use (relative risk ratios) within the time-use diary complete case sample (n=2,109)

	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]
A. Current or former cigarette use (ref: never used cigarette or tried once)			
No social media use	23.3 (202)	1.27 (0.92 to 1.77)	1.18 (0.84 to 1.65)
1 - <30 mins	19.2 (78)	1.00	1.00
30 mins - <1 hr	24.0 (74)	1.33 (0.89 to 1.97)	1.47 (0.99 to 2.18)
1 - <2 hrs	34.1 (66)	2.17 (1.40 to 3.38)	2.02 (1.28 to 3.18)
≥2 hrs	42.6 (55)	3.12 (1.92 to 5.06)	3.08 (1.95 to 4.85)
B. Current or former e-cigarette use (ref: never used e-cigarette or tried once)			
No social media use	19.7 (164)	1.26 (0.80 to 2.00)	1.19 (0.79 to 1.79)
1 - <30 mins	16.3 (56)	1.00	1.00
30 mins - <1 hr	20.8 (57)	1.35 (0.79 to 2.29)	1.66 (1.02 to 2.70)
1 - <2 hrs	25.6 (51)	1.77 (1.05 to 2.98)	1.78 (1.12 to 2.82)
≥2 hrs	27.0 (39)	1.91 (1.02 to 3.55)	1.86 (1.06 to 3.26)
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**
C. Current or former cigarette or e-cigarette use (ref: never used cigarette or e-cigarette or tried once)			
No social media use	21.5 (196)	1.23 (0.82 to 1.86)	1.11 (0.78 to 1.59)
1 - <30 mins	18.5 (65)	1.00	1.00
30 mins - <1 hr	26.8 (85)	1.62 (1.01 to 2.58)	1.86 (1.22 to 2.82)
1 - <2 hrs	29.4 (59)	2.04 (1.18 to 3.50)	1.88 (1.16 to 3.06)
≥2 hrs	32.9 (42)	2.40 (1.30 to 4.40)	2.30 (1.35 to 3.91)
C. Current dual use (ref: never used cigarette or e-cigarette or tried once)			
No social media use	7.0 (53)	1.28 (0.74 to 2.20)	1.21 (0.65 to 2.28)
1 - <30 mins	5.8 (24)	1.00	1.00
30 mins - <1 hr	5.0 (12)	0.96 (0.42 to 2.19)	1.09 (0.46 to 2.59)
1 - <2 hrs	11.3 (21)	2.47 (1.31 to 4.64)	2.50 (1.17 to 5.31)
≥2 hrs	10.7 (16)	2.47 (1.25 to 4.86)	2.58 (1.19 to 5.58)

Legend: Time-use diary complete case sample: n=2,109 (weighted sample: n=4,199). [a] Adjusted for sex, ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table B9.7. Time spent on social media on a normal weekday on risk of (A) former cigarette use, (B) current cigarette use, (C) former e-cigarette use, and (D) current e-cigarette use (odds ratios) within the questionnaire imputed sample (n=8,987)

	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]
A. Former cigarette use (ref: never used cigarette or tried once)			
No social media use	3.3 (26)	0.59 (0.33 to 1.04)	0.58 (0.32 to 1.03)
1 min - <1 hr	5.2 (119)	1.00	1.00
1 - <2 hrs	4.8 (83)	1.00 (0.71 to 1.40)	0.96 (0.68 to 1.35)
≥2 hrs	9.6 (376)	2.31 (1.78 to 3.01)	2.08 (1.59 to 2.72)
B. Current cigarette use (ref: never used cigarette or tried once)			
No social media use	11.6 (68)	0.72 (0.47 to 1.09)	0.69 (0.46 to 1.02)
1 min - <1 hr	15.2 (330)	1.00	1.00
1 - <2 hrs	22.1 (312)	1.59 (1.30 to 1.95)	1.59 (1.30 to 1.95)
≥2 hrs	27.6 (1,070)	2.31 (1.95 to 2.74)	2.25 (1.88 to 2.70)
C. Former e-cigarette use (ref: never used e-cigarette or tried once)			
No social media use	6.5 (39)	0.69 (0.40 to 1.17)	0.62 (0.37 to 1.04)
1 min - <1 hr	9.0 (218)	1.00	1.00
1 - <2 hrs	11.0 (175)	1.30 (1.00 to 1.70)	1.39 (1.05 to 1.83)
≥2 hrs	14.6 (599)	1.92 (1.53 to 2.40)	2.14 (1.69 to 2.72)
D. Current e-cigarette use (ref: never used e-cigarette or tried once)			
No social media use	7.4 (49)	0.82 (0.49 to 1.36)	0.73 (0.46 to 1.15)
1 min - <1 hr	8.6 (200)	1.00	1.00
1 - <2 hrs	11.4 (177)	1.40 (1.10 to 1.79)	1.56 (1.23 to 1.99)
≥2 hrs	15.1 (602)	2.06 (1.68 to 2.52)	2.50 (2.03 to 3.07)

Legend: Questionnaire imputed sample: n=8,987 (weighted sample: n=6,175). [a] Adjusted for sex, ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; and Ref=Reference category.

Table B9.8. Comparison of estimates for time spent on social media on a normal weekday on risk of (A) cigarette, (B) e-cigarette (odds ratios), and (C) dual use (relative risk ratios) within the questionnaire (n=8,987) and time-use diary imputed samples (n=2,520)

	Questionnaire imputed sample			Time-use diary imputed sample		
	Weighted prevalence % (observed n with outcome)	**OR (95% CI)**	**AOR (95% CI)[a]**	**Weighted prevalence % (observed n with outcome)**	**OR (95% CI)**	**AOR (95% CI)[a]**
A. Current or former cigarette use (ref: never used cigarette or tried once)						
No social media use	14.9 (94)	0.83 (0.56 to 1.22)	0.82 (0.57 to 1.18)	24.0 (324)	1.34 (0.86 to 2.08)	1.29 (0.81 to 2.07)
1 - <30 mins	17.4 (175)	1.00	1.00	19.1 (41)	1.00	1.00
30 mins - <1 hr	22.9 (275)	1.41 (1.05 to 1.89)	1.48 (1.11 to 1.97)	23.9 (56)	1.33 (0.78 to 2.26)	1.25 (0.75, 2.10)
1 - <2 hrs	26.9 (395)	1.74 (1.35 to 2.26)	1.78 (1.38 to 2.29)	33.1 (82)	2.09 (1.28 to 3.43)	2.21 (1.32 to 3.70)
≥2 hrs	37.2 (1,445)	2.80 (2.23 to 3.52)	2.76 (2.19 to 3.48)	34.9 (58)	2.67 (1.33 to 3.87)	2.30 (1.31 to 3.95)
B. Current or former e-cigarette use (ref: never used e-cigarette or tried once)						
No social media use	13.9 (88)	1.01 (0.66 to 1.53)	0.94 (0.63 to 1.39)	21.3 (284)	1.47 (0.87 to 2.49)	1.24 (0.73 to 2.13)
1 - <30 mins	13.8 (157)	1.00	1.00	15.5 (29)	1.00	1.00
30 mins - <1 hr	20.9 (262)	1.65 (1.24 to 2.20)	1.79 (1.34 to 2.39)	15.8 (37)	1.02 (0.54 to 1.94)	0.91 (0.49 to 1.69)
1 - <2 hrs	22.4 (351)	1.80 (1.42 to 2.29)	2.06 (1.61 to 2.64)	25.1 (60)	1.82 (0.99 to 3.34)	1.80 (1.00 to 3.27)
≥2 hrs	29.8 (1,200)	2.65 (2.14 to 3.29)	3.24 (2.59 to 4.05)	26.0 (47)	1.91 (1.05 to 3.47)	1.78 (1.01 to 3.17)
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**	**Weighted prevalence % (observed n with outcome)**	**RRR (95% CI)**	**ARRR (95% CI)[a]**
C. Current or former cigarette or e-cigarette use (ref: never used cigarette or e-cigarette or tried once)						
No social media use	15.0 (95)	0.82 (0.56 to 1.19)	0.78 (0.55 to 1.12)	23.2 (313)	1.39 (0.89 to 2.17)	1.20 (0.74 to 1.94)
1 - <30 mins	17.7 (186)	1.00	1.00	18.3 (37)	1.00	1.00
30 mins - <1 hr	23.8 (302)	1.49 (1.13 to 1.97)	1.58 (1.21 to 2.07)	21.3 (50)	1.20 (0.68 to 2.12)	1.10 (0.64 to 1.89)

	Questionnaire imputed sample			Time-use diary imputed sample		
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**	**Weighted prevalence % (observed n with outcome)**	**RRR (95% CI)**	**ARRR (95% CI)[a]**
1 - <2 hrs	24.8 (383)	1.63 (1.27 to 2.10)	1.74 (1.36 to 2.22)	29.8 (79)	2.04 (1.19 to 3.50)	2.03 (1.18 to 3.51)
≥2 hrs	33.5 (1,350)	2.63 (2.11 to 3.28)	2.79 (2.23 to 3.48)	31.6 (56)	2.21 (1.27 to 3.84)	2.02 (1.14 to 3.56)
C. Current dual use (ref: never used cigarette or e-cigarette or tried once)						
No social media use	4.2 (29)	0.93 (0.46 to 1.88)	0.88 (0.45 to 1.72)	7.3 (95)	1.52 (0.78 to 2.95)	1.46 (0.68 to 3.11)
1 - <30 mins	4.3 (46)	1.00	1.00	5.3 (11)	1.00	1.00
30 mins - <1 hr	6.0 (68)	1.52 (0.92 to 2.52)	1.69 (1.03 to 2.77)	4.8 (12)	0.93 (0.39 to 2.26)	0.91 (0.34 to 2.41)
1 - <2 hrs	8.7 (125)	2.35 (1.54 to 3.59)	2.72 (1.79 to 4.13)	9.3 (19)	2.22 (0.99 to 5.00)	2.38 (1.00 to 5.66)
≥2 hrs	10.5 (405)	3.39 (2.31 to 4.98)	4.11 (2.77 to 6.08)	9.0 (15)	2.18 (0.94 to 5.04)	2.27 (0.95 to 5.43)

Legend: Questionnaire imputed sample n=8,987 (weighted sample: n=6,175). Time-use diary imputed sample: n=2,520 (weighted sample: n=5,005). [a] Adjusted for sex, ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table B9.9. Time spent on social media on a normal weekday on risk of (A) cigarette, (B) e-cigarette (odds ratios), and (C) dual use (relative risk ratios) within the questionnaire imputed sample (n=8,987) with additional adjustment for baseline outcome measures and previous social media use

	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]	AOR (95% CI)[b]	AOR (95% CI)[c]
A. Current or former cigarette use (ref: never used cigarette or tried once)					
No social media use	14.9 (94)	0.83 (0.56 to 1.22)	0.82 (0.57 to 1.18)	0.79 (0.54 to 1.15)	0.86 (0.60 to 1.23)
1 - <30 mins	17.4 (175)	1.00	1.00	1.00	1.00
30 mins - <1 hr	22.9 (275)	1.41 (1.05 to 1.89)	1.48 (1.11 to 1.97)	1.42 (1.06 to 1.90)	1.46 (1.10 to 1.94)
1 - <2 hrs	26.9 (395)	1.74 (1.35 to 2.26)	1.78 (1.38 to 2.29)	1.71 (1.32 to 2.22)	1.75 (1.35 to 2.25)
≥2 hrs	37.2 (1,445)	2.80 (2.23 to 3.52)	2.76 (2.19 to 3.48)	2.24 (1.77 to 2.84)	2.66 (2.11 to 3.34)
B. Current or former e-cigarette use (ref: never used e-cigarette or tried once)					
No social media use	13.9 (88)	1.01 (0.66 to 1.53)	0.94 (0.63 to 1.39)	0.95 (0.64 to 1.40)	0.99 (0.67 to 1.47)
1 - <30 mins	13.8 (157)	1.00	1.00	1.00	1.00
30 mins - <1 hr	20.9 (262)	1.65 (1.24 to 2.20)	1.79 (1.34 to 2.39)	1.61 (1.22 to 2.13)	1.76 (1.32 to 2.34)
1 - <2 hrs	22.4 (351)	1.80 (1.42 to 2.29)	2.06 (1.61 to 2.64)	1.86 (1.46 to 2.38)	2.02 (1.57 to 2.58)
≥2 hrs	29.8 (1,200)	2.65 (2.14 to 3.29)	3.24 (2.59 to 4.05)	2.54 (2.03 to 3.18)	3.10 (2.49 to 3.88)
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**	**ARRR (95% CI)[b]**	**ARRR (95% CI)[c]**
C. Current or former cigarette or e-cigarette use (ref: never used cigarette or e-cigarette or tried once)					
No social media use	15.0 (95)	0.82 (0.56 to 1.19)	0.78 (0.55 to 1.12)	0.78 (0.54 to 1.12)	0.81 (0.56 to 1.15)
1 - <30 mins	17.7 (186)	1.00	1.00	1.00	1.00
30 mins - <1 hr	23.8 (302)	1.49 (1.13 to 1.97)	1.58 (1.21 to 2.07)	1.47 (1.11 to 1.94)	1.56 (1.19 to 2.05)
1 - <2 hrs	24.8 (383)	1.63 (1.27 to 2.10)	1.74 (1.36 to 2.22)	1.63 (1.27 to 2.10)	1.71 (1.34 to 2.19)

	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]	ARRR (95% CI)[b]	ARRR (95% CI)[c]
≥2 hrs	33.5 (1,350)	2.63 (2.11 to 3.28)	2.79 (2.23 to 3.48)	2.16 (1.72 to 2.71)	2.70 (2.17 to 3.37)
C. Current dual use (ref: never used cigarette or e-cigarette or tried once)					
No social media use	4.2 (29)	0.93 (0.46 to 1.88)	0.88 (0.45 to 1.72)	0.88 (0.44 to 1.77)	0.97 (0.50 to 1.90)
1 - <30 mins	4.3 (46)	1.00	1.00	1.00	1.00
30 mins - <1 hr	6.0 (68)	1.52 (0.92 to 2.52)	1.69 (1.03 to 2.77)	1.47 (0.91 to 2.40)	1.63 (0.99 to 2.67)
1 - <2 hrs	8.7 (125)	2.35 (1.54 to 3.59)	2.72 (1.79 to 4.13)	2.45 (1.61 to 3.74)	2.59 (1.70 to 3.96)
≥2 hrs	10.5 (405)	3.39 (2.31 to 4.98)	4.11 (2.77 to 6.08)	2.92 (1.97 to 4.33)	3.80 (2.56 to 5.65)

Legend: Questionnaire imputed sample n=8,987 (weighted sample: n=6,175). [a] Adjusted for sex, ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). [b] Additional adjustment for baseline cigarette use (age 14 years) in model A; additional adjustment for baseline e-cigarette use (age 14 years) in model B, and additional adjustment for both baseline cigarette and e-cigarette use (age 14 years) in model C. [c] Additional adjustment for previous social media use (age 11 years) in all models. Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table B9.10. Average time spent on social media across a normal weekday and weekend day on risk of (A) cigarette, (B) e-cigarette (odds ratios), and (C) dual use (relative risk ratios) within the time-use diary imputed sample (n=2,520) with additional adjustment for baseline outcome measures and previous social media use

	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]	AOR (95% CI)[b]	AOR (95% CI)[c]
A. Current or former cigarette use (ref: never used cigarette or tried once)					
No social media use	23.5 (239)	1.28 (0.93 to 1.76)	1.15 (0.83 to 1.60)	1.12 (0.78 to 1.60)	1.18 (0.85 to 1.63)
1 - <30 mins	19.3 (94)	1.00	1.00	1.00	1.00
30 mins - <1 hr	27.8 (95)	1.60 (1.09 to 2.35)	1.78 (1.22 to 2.60)	1.81 (1.22 to 2.67)	1.74 (1.20 to 2.52)
1 - <2 hrs	31.8 (74)	1.95 (1.29 to 2.94)	1.87 (1.23 to 2.84)	1.52 (0.97 to 2.37)	1.88 (1.25 to 2.85)
≥2 hrs	39.1 (58)	2.67 (1.68 to 4.27)	2.63 (1.68 to 4.12)	2.31 (1.45 to 3.70)	2.44 (1.56 to 3.82)
B. Current or former e-cigarette use (ref: never used e-cigarette or tried once)					
No social media use	20.4 (204)	1.19 (0.80 to 1.79)	1.04 (0.71 to 1.51)	0.96 (0.65 to 1.44)	1.08 (0.75 to 1.56)
1 - <30 mins	17.7 (73)	1.00	1.00	1.00	1.00
30 mins - <1 hr	21.5 (72)	1.28 (0.80 to 2.03)	1.54 (1.00 to 2.38)	1.58 (1.02 to 2.46)	1.53 (0.99 to 2.37)
1 - <2 hrs	25.2 (62)	1.57 (0.98 to 2.50)	1.56 (1.01 to 2.40)	1.29 (0.81 to 2.05)	1.59 (1.04 to 2.43)
≥2 hrs	27.0 (46)	1.72 (1.00 to 2.98)	1.77 (1.07 to 2.93)	1.58 (0.95 to 2.62)	1.67 (1.01 to 2.77)
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**	**ARRR (95% CI)[b]**	**ARRR (95% CI)[c]**
C. Current or former cigarette or e-cigarette use (ref: never used cigarette or e-cigarette or tried once)					
No social media use	22.1 (232)	1.21 (0.83 to 1.74)	1.05 (0.75 to 1.46)	1.01 (0.70 to 1.44)	1.06 (0.77 to 1.49)
1 - <30 mins	19.3 (83)	1.00	1.00	1.00	1.00
30 mins - <1 hr	28.4 (101)	1.68 (1.09 to 2.60)	1.96 (1.31 to 2.93)	2.00 (1.33 to 3.02)	1.92 (1.30 to 2.84)
1 - <2 hrs	28.7 (71)	1.82 (1.11 to 2.99)	1.75 (1.10 to 2.78)	1.43 (0.89 to 2.29)	1.76 (1.11 to 2.78)
≥2 hrs	32.5 (49)	2.19 (1.28 to 3.77)	2.17 (1.34 to 3.52)	1.79 (1.09 to 2.95)	2.00 (1.24 to 3.25)

	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]	ARRR (95% CI)[b]	ARRR (95% CI)[c]
C. Current dual use (ref: never used cigarette or e-cigarette or tried once)					
No social media use	6.9 (67)	1.28 (0.78 to 2.10)	1.19 (0.68 to 2.09)	1.07 (0.59 to 1.95)	1.24 (0.70 to 2.18)
1 - <30 mins	5.7 (28)	1.00	1.00	1.00	1.00
30 mins - <1 hr	6.3 (19)	1.25 (0.63 to 2.47)	1.42 (0.71 to 2.86)	1.53 (0.76 to 3.10)	1.42 (0.70 to 2.87)
1 - <2 hrs	10.3 (22)	2.20 (1.21 to 3.99)	2.24 (1.14 to 4.41)	1.80 (0.89 to 3.63)	2.31 (1.20 to 4.47)
≥2 hrs	10.0 (17)	2.26 (1.17 to 4.36)	2.37 (1.18 to 4.76)	2.23 (1.08 to 4.64)	2.29 (1.13 to 4.63)

Legend: Time-use diary imputed sample: n=2,520 (weighted sample: n=5,005). [a] Adjusted for sex, ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). [b] Additional adjustment for baseline cigarette use (age 14 years) in model A; additional adjustment for baseline e-cigarette use (age 14 years) in model B, and additional adjustment for both baseline cigarette and e-cigarette use (age 14 years) in model C. [c] Additional adjustment for previous social media use (age 11 years) in all models. Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table B9.11. Time spent on social media on a normal weekday on risk of (A) cigarette, (B) e-cigarette (odds ratios), and (C) dual use (relative risk ratios) within the questionnaire imputed sample (n=8,987) replacing '1-<30 minutes' reference category with 'no social media use'

	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]
A. Current or former cigarette use (ref: never used cigarette or tried once)			
No social media use	14.9 (94)	1.00	1.00
1 - <30 mins	17.4 (175)	1.21 (0.82 to 1.77)	1.22 (0.85 to 1.75)
30 mins - <1 hr	22.9 (275)	1.70 (1.15 to 2.52)	1.81 (1.23 to 2.64)
1 - <2 hrs	26.9 (395)	2.10 (1.47 to 2.99)	2.17 (1.53 to 3.08)
≥2 hrs	37.2 (1,445)	3.38 (2.42 to 4.72)	3.36 (2.41 to 4.69)
B. Current or former e-cigarette use (ref: never used e-cigarette or tried once)			
No social media use	13.9 (88)	1.00	1.00
1 - <30 mins	13.8 (157)	0.99 (0.65 to 1.51)	1.06 (0.72 to 1.58)
30 mins - <1 hr	20.9 (262)	1.64 (1.10 to 2.46)	1.91 (1.30 to 2.80)
1 - <2 hrs	22.4 (351)	1.79 (1.22 to 2.64)	2.20 (1.53 to 3.15)
≥2 hrs	29.8 (1,200)	2.64 (1.85 to 3.77)	3.45 (2.47 to 4.83)
	Weighted prevalence % (observed n with outcome)	**RRR (95% CI)**	**ARRR (95% CI)[a]**
C. Current or former cigarette or e-cigarette use (ref: never used cigarette or e-cigarette or tried once)			
No social media use	15.0 (95)	1.00	1.00
1 - <30 mins	17.7 (186)	1.22 (0.84 to 1.79)	1.28 (0.89 to 1.83)
30 mins - <1 hr	23.8 (302)	1.83 (1.26 to 2.65)	2.02 (1.42 to 2.89)
1 - <2 hrs	24.8 (383)	2.00 (1.41 to 2.83)	2.22 (1.60 to 3.09)
≥2 hrs	33.5 (1,350)	3.22 (2.31 to 4.50)	3.56 (2.59 to 4.90)
C. Current dual use (ref: never used cigarette or e-cigarette or tried once)			
No social media use	4.2 (29)	1.00	1.00
1 - <30 mins	4.3 (46)	1.08 (0.53 to 2.18)	1.13 (0.58 to 2.21)
30 mins - <1 hr	6.0 (68)	1.64 (0.82 to 3.27)	1.91 (0.99 to 3.69)
1 - <2 hrs	8.7 (125)	2.53 (1.33 to 4.78)	3.07 (1.66 to 5.69)
≥2 hrs	10.5 (405)	3.65 (2.04 to 6.53)	4.65 (2.65 to 8.16)

Legend: Questionnaire imputed sample: n=8,987 (weighted sample: n=6,175). [a] Adjusted for sex, ethnicity, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref= Reference category; and RRR=Relative risk ratio.

Section B10 Differential effect of social media use on cigarette and e-cigarette use by socioeconomic circumstance

Table B10.1. Participant cigarette use according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk differences) within the questionnaire (n=8,954) and time-use diary (n=2,520) imputed samples (also shown in Chapter 5)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	10.1 (43/391)	22.1 (49/246)	20.3 (149/666)	30.4 (90/273)
1 - <30 mins	13.0 (95/617)	23.4 (78/352)	25.4 (75/279)	11.7 (19/124)
30 mins - <1 hr	23.7 (173/651)	22.8 (99/402)	26.6 (66/199)	30.9 (29/96)
1 - <2 hrs	26.8 (237/701)	27.0 (154/465)	25.7 (39/134)	36.2 (34/68)
≥2 hrs	36.8 (768/1,484)	38.6 (677/1,272))	31.0 (34/70)	44.3 (24/51)
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	2.9 (-1.9 to 7.8; 0.239)	1.3 (-12.1 to 14.7; 0.848)	5.1 (-0.7 to 10.9; 0.082)	-18.8 (-28.7 to -8.8; <0.0001)
30 mins - <1 hr	13.6 (7.7 to 19.4; <0.0001)	0.6 (-11.8 to 13.0; 0.921)	6.3 (-0.5 to 13.1; 0.071)	0.5 (-16.6 to 17.5; 0.957)
1 - <2 hrs	16.7 (12.1 to 21.3; <0.0001)	4.9 (-7.6 to 17.4; 0.442)	5.4 (-5.2 to 16.0; 0.318)	5.8 (-8.3 to 19.9; 0.423)
≥2 hrs	26.7 (22.0 to 31.4; <0.0001)	16.4 (5.0 to 27.8; 0.005)	10.7 (-1.1 to 22.5; 0.074)	13.8 (-4.0 to 31.6; 0.127)
Unadjusted RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	12.0 (0.4 to 23.7; 0.043)	Ref	10.1 (2.3 to 18.0; 0.012)
1 - <30 mins	2.9 (-1.9 to 7.8; 0.239)	13.3 (5.0 to 21.6; 0.002)	5.1 (-0.7 to 10.9; 0.082)	-8.6 (-15.9 to -1.4; 0.020)
No social media use	Ref	12.0 (0.4 to 23.7; 0.043)	Ref	10.1 (2.3 to 18.0; 0.012)
30 mins - <1 hr	13.6 (7.7 to 19.4; <0.0001)	12.6 (5.8 t19.5; <0.0001)	6.3 (-0.5 to 13.1; 0.071)	10.6 (-4.9 to 26.1; 0.179)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
No social media use	Ref	12.0 (0.4 to 23.7; 0.043)	Ref	10.1 (2.3 to 18.0; 0.012)
1 - <2 hrs	16.7 (12.1 to 21.3; <0.0001)	16.9 (10.3 to 23.5; <0.0001)	5.4 (-5.2 to 16.0; 0.318)	15.9 (2.7 to 29.1; 0.018)
No social media use	Ref	12.0 (0.4 to 23.7; 0.043)	Ref	10.1 (2.3 to 18.0; 0.012)
≥2 hrs	26.7 (22.0 to 31.4; <0.0001)	28.4 (23.6 to 33.3; <0.0001)	10.7 (-1.1 to 22.5; 0.074)	24.0 (7.2 to 40.7; 0.005)
Unadjusted measure of additive effect modification[a] and interaction[b] (95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	-1.6 (-15.8 to 12.6; 0.823)		-23.9 (-34.6 to -13.1; <0.0001)	
30 mins - <1 hr	-12.9 (-26.3 to 0.5; 0.059)		-5.8 (-24.2 to 12.6; 0.534)	
1 - <2 hrs	-11.8 (-25.1 to 1.4; 0.081)		0.4 (-17.4 to 18.2; 0.967)	
≥2 hrs	-10.3 (-22.4 to 1.9; 0.097)		3.1 (-18.0 to 24.2; 0.770)	
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	2.0 (-2.6 to 6.6; 0.386)	2.6 (-8.4 to 13.5; 0.646)	5.5 (-0.4 to 11.4; 0.067)	-14.9 (-24.7 to -5.2; 0.003)
30 mins - <1 hr	12.4 (6.9 to 18.0; <0.0001)	1.4 (-9.2 to 11.9; 0.799)	6.0 (-0.9 to 13.0; 0.089)	4.2 (-11.4 to 19.8; 0.598)
1 - <2 hrs	14.9 (10.5 to 19.3; <0.0001)	3.4 (-7.5 to 14.3; 0.541)	4.2 (-5.7 to 14.1; 0.405)	4.7 (-8.2 to 17.5; 0.476)
≥2 hrs	24.6 (20.0 to 29.2; <0.0001)	14.2 (3.9 to 24.5; 0.007)	10.2 (-1.7 to 22.0; 0.092)	13.9 (-1.2 to 29.1; 0.072)
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	4.6 (-4.9 to 14.2; 0.340)	Ref	5.4 (-0.9 to 11.7; 0.091)
1 - <30 mins	2.0 (-2.6 to 6.6; 0.386)	7.2 (0.3 to 14.1; 0.041)	5.5 (-0.4 to 11.4; 0.067)	-9.5 (-17.6 to -1.3; 0.023)
No social media use	Ref	6.4 (-3.1 to 15.8; 0.188)	Ref	3.4 (-2.8 to 9.6; 0.284)
30 mins - <1 hr	12.4 (6.9 to 18.0; <0.0001)	7.7 (1.7 to 13.8; 0.013)	6.0 (-0.9 to 13.0; 0.089)	7.6 (-7.2 to 22.3; 0.313)
No social media use	Ref	9.5 (-0.3 to 19.3; 0.057)	Ref	4.0 (-2.3 to 10.4; 0.211)
1 - <2 hrs	14.9 (10.5 to 19.3; <0.0001)	12.9 (6.7 to 19.2;<0.0001)	4.2 (-5.7 to 14.2; 0.405)	8.7 (-4.6 to 22.0; 0.198)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
No social media use	Ref	7.4 (-2.7 to 17.6; 0.149)	Ref	3.5 (-2.8 to 9.8; 0.276)
≥2 hrs	24.6 (20.0 to 29.2; <0.0001)	21.6 (17.1 to 26.1; <0.0001)	10.2 (-1.7 to 22.0; 0.092)	17.4 (3.5 to 31.3; 0.014)
Adjusted[c] measure of additive effect modification[a] and interaction[b] (95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	0.5 (-11.2 to 12.2; 0.929)		-20.4 (-31.1 to -9.8; <0.0001)	
30 mins - <1 hr	-11.1 (-22.7 to 0.5; 0.061)		-1.9 (-18.7 to 15.0; 0.829)	
1 - <2 hrs	-11.6 (-23.0 to -0.1; 0.048)		0.5 (-15.3 to 16.2; 0.953)	
≥2 hrs	-10.5 (-21.3 to 0.3; 0.057)		3.7 (-14.8 to 22.3; 0.691)	

Legend: Questionnaire imputed sample: n=8,954 (weighted sample: n=6,976). Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727). [a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant current or former cigarette use by time spent on social media within the low parental education group compared with baseline (high parental education group).[b] Measure of interaction on an additive scale represents the size of the difference between the RD in participants with: for example, low parental education and 1-<30 mins social media use compared with RD for participants with low parental education and no social media use plus the RD for those with high parental education and 1-<30 mins social media use. [c] Adjusted for: ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; RD=Risk differences; and Ref=Reference category.

Table B10.2. Participant e-cigarette use according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk differences) within the questionnaire (n=8,954) and time-use diary (n=2,520) imputed samples (also shown in Chapter 5)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	9.4 (43/391)	18.0 (42/253)	16.1 (118/697)	27.8 (86/277)
1 - <30 mins	9.6 (75/636)	20.4 (81/349)	17.4 (51/303)	20.9 (22/121)
30 mins - <1 hr	19.3 (152/672)	25.3 (109/393)	21.5 (44/221)	20.6 (27/98)
1 - <2 hrs	19.3 (188/751)	25.1 (160/459)	13.8 (31/143)	30.1 (30/72)
≥2 hrs	27.8 (590/1,662)	31.7 (607/1,343)	15.7 (21/83)	40.3 (25/50)
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	0.3 (-4.3 to 4.8; 0.913)	2.5 (-8.3 to 13.2; 0.652)	1.3 (-4.8 to 7.5; 0.670)	-6.8 (-22.7 to 9.1; 0.400)
30 mins - <1 hr	9.9 (4.9 to 14.9; <0.0001)	7.4 (-3.5 to 18.2; 0.182)	5.4 (-2.5 to 13.3; 0.182)	-7.2 (-18.2 to 3.8; 0.201)
1 - <2 hrs	10.0 (5.2 to 14.7; <0.0001)	7.2 (-3.9 to 18.3; 0.203)	-2.3 (-10.0 to 5.4; 0.559)	2.4 (-10.5 to 15.3; 0.716)
≥2 hrs	18.5 (14.2 to 22.8; <0.0001)	13.8 (3.6 to 23.9; 0.008)	-0.5 (-9.5 to 8.6; 0.922)	12.6 (-6.0 to 31.1; 0.184)
Unadjusted RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	8.6 (-1.7 to 18.9; 0.101)	Ref	11.6 (3.5 to 19.8; 0.005)
1 - <30 mins	0.3 (-4.3 to 4.8; 0.913)	11.1 (4.4 to 17.7; 0.001)	1.3 (-4.8 to 7.5; 0.670)	4.8 (-9.5 to 19.1; 0.507)
No social media use	Ref	8.6 (-1.7 to 18.9; 0.101)	Ref	11.6 (3.5 to 19.8; 0.005)
30 mins - <1 hr	9.9 (4.9 to 14.9; <0.0001)	16.0 (9.1 to 22.8; <0.0001)	5.4 (-2.5 to 13.3; 0.182)	4.5 (-5.6 to 14.5; 0.384)
No social media use	Ref	8.6 (-1.7 to 18.9; 0.101)	Ref	11.6 (3.5 to 19.8; 0.005)
1 - <2 hrs	10.0 (5.2 to 14.7; <0.0001)	15.8 (9.1 to 22.5; <0.0001)	-2.3 (-10.0 to 5.4; 0.559)	14.0 (3.1 to 25.0; 0.012)
No social media use	Ref	8.6 (-1.7 to 18.9; 0.101)	Ref	11.6 (3.5 to 19.8; 0.005))
≥2 hrs	18.5 (14.2 to 22.8; <0.0001)	22.4 (17.5 to 27.3; <0.0001)	-0.5 (-9.5 to 8.6; 0.922)	24.2 (7.0 to 41.4; 0.006)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Unadjusted measure of additive effect modification[a] and interaction[b] (95% CI; *p-values*)				
No social media use	Ref		Ref	
1 - <30 mins	2.2 (-9.1 to 13.5; 0.701)		-8.2 (-25.0 to 8.7; 0.343)	
30 mins - <1 hr	-2.5 (-14.2 to 9.1; 0.669)		-12.6 (-26.4 to 1.2; 0.074)	
1 - <2 hrs	-2.8 (-14.7 to 9.2; 0.647)		4.7 (-11.7 to 21.0; 0.574)	
≥2 hrs	-4.7 (-15.7 to 6.3; 0.399)		13.0 (-8.2 to 34.2; 0.228)	
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	-0.6 (-5.0 to 3.7; 0.772)	3.0 (-5.8 to 11.9; 0.501)	2.6 (-3.7 to 8.9; 0.417)	-4.6 (-17.2 to 8.1; 0.477)
30 mins - <1 hr	9.6 (4.6 to 14.6; <0.0001)	9.8 (0.4 to 19.3; 0.041)	7.2 (-1.0 to 15.5; 0.085)	-0.4 (-10.5 to 9.7; 0.935)
1 - <2 hrs	10.4 (5.6 to 15.2; <0.0001)	8.1 (-1.6 to 17.9; 0.101)	-1.0 (-9.2 to 7.1; 0.804)	3.4 (-8.1 to 15.0; 0.556)
≥2 hrs	21.6 (17.4 to 25.8; <0.0001)	18.0 (9.0 to 27.0; <0.0001)	1.9 (-7.5 to 11.3; 0.689)	13.2 (-3.4 to 29.7; 0.118)
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	3.0 (-5.5 to 11.4; 0.490)	Ref	7.7 (0.6 to 14.8; 0.035)
1 - <30 mins	-0.6 (-5.0 to 3.7; 0.771)	6.0 (0.1 to 11.9; 0.048)	2.6 (-3.7 to 8.9; 0.417)	3.1 (-8.3 to 14.4; 0.593)
No social media use	Ref	2.3 (-5.8 to 10.4; 0.578)	Ref	6.6 (-0.4 (13.7; 0.063)
30 mins - <1 hr	9.6 (4.6 to 14.6; <0.0001)	12.1 (5.8 to 18.5; <0.0001)	7.2 (-1.0 to 15.5; 0.085)	6.2 (-3.7 to 16.1; 0.216)
No social media use	Ref	4.3 (-4.4 to 12.9; 0.331)	Ref	7.3 (0.3 to 14.3; 0.041)
1 - <2 hrs	10.4 (5.6 to 15.2; <0.0001)	12.4 (6.4 to 18.4; <0.0001)	-1.0 (-9.2 to 7.1; 0.804)	10.7 (0.1 to 21.4; 0.049)
No social media use	Ref	3.1 (-5.6 to 11.7; 0.487)	Ref	6.4 (-0.6 to 13.3; 0.072)
≥2 hrs	21.6 (17.4 to 25.8; <0.0001)	21.1 (16.3 to 25.9; <0.0001)	1.9 (-7.5 to 11.3; 0.689)	19.5 (4.3 to 34.8; 0.012)
Adjusted[c] measure of additive effect modification[a] and interaction[b] (95% CI; *p-value*)				
No social media use	Ref		Ref	

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	Low parental education	High parental education	Low parental education
1 - <30 mins	3.7 (-5.7 to 13.0; 0.441)		-7.2 (-21.3 to 7.0; 0.319)	
30 mins - <1 hr	0.2 (-9.8 to 10.3; 0.965)		-7.6 (-21.0 to 5.7; 0.260)	
1 - <2 hrs	-2.3 (-12.4 to 7.9; 0.662)		4.5 (-10.0 to 19.0; 0.543)	
≥2 hrs	-3.6 (-13.2 to 6.1; 0.463)		11.3 (-7.9 to 30.4; 0.248)	

Legend: Questionnaire imputed sample: n=8,954 (weighted sample: n=6,976). Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727). [a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant current or former e-cigarette use by time spent on social media within the low parental education group compared with baseline (high parental education group). [b] Measure of interaction on an additive scale represents the size of the difference between the RD in participants with: for example, low parental education and 1-<30 mins social media use compared with RD for participants with low parental education and no social media use plus the RD for those with high parental education and 1-<30 mins social media use. [c] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; RD=Risk differences; and Ref=Reference category.

Table B10.3. Participant cigarette use according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education within the questionnaire (n=8,954) and time-use diary (n=2,520) imputed samples, using the relative excess risk due to interaction (RERI)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	10.1 (43/391)	22.1 (49/246)	20.3 (149/666)	30.4 (90/273)
1 - <30 mins	13.0 (95/617)	23.4 (78/352)	25.4 (75/279)	11.7 (19/124)
30 mins - <1 hr	23.7 (173/651)	22.8 (99/402)	26.6 (66/199)	30.9 (29/96)
1 - <2 hrs	26.8 (237/701)	27.0 (154/465)	25.7 (39/134)	36.2 (34/68)
≥2 hrs	36.8 (768/1,484)	38.6 (677/1,272))	31.0 (34/70)	44.3 (24/51)
Adjusted[a] measure of additive effect modification and interaction (RERI; 95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	-0.13 (-1.01 to 0.75; 0.779)		-0.97 (-1.50 to -0.44; 0.0003)	
30 mins - <1 hr	-1.23 (-2.40 to 0.05; 0.050)		-0.09 (-0.85 to 0.66; 0.806)	
1 - <2 hrs	-1.25 (-2.46 to -0.05; 0.041)		-0.06 (-0.72 to 0.60; 0.854)	
≥2 hrs	-1.24 (-2.43 to -0.05; 0.042)		-0.01 (-0.81 to 0.78; 0.974)	

Legend: Questionnaire imputed sample: n=8,954 (weighted sample: n=6,976). Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727). [a] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; Ref=Reference category; and RERI=Relative excess risk due to interaction.

Table B10.4. Participant e-cigarette use according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education within the questionnaire (n=8,954) and time-use diary (n=2,520) imputed samples, using the relative excess risk due to interaction (RERI)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	9.4 (43/391)	18.0 (42/253)	16.1 (118/697)	27.8 (86/277)
1 - <30 mins	9.6 (75/636)	20.4 (81/349)	17.4 (51/303)	20.9 (22/121)
30 mins - <1 hr	19.3 (152/672)	25.3 (109/393)	21.5 (44/221)	20.6 (27/98)
1 - <2 hrs	19.3 (188/751)	25.1 (160/459)	13.8 (31/143)	30.1 (30/72)
≥2 hrs	27.8 (590/1,662)	31.7 (607/1,343)	15.7 (21/83)	40.3 (25/50)
Adjusted[a] measure of additive effect modification and interaction (RERI; 95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	0.18 (-0.58 to 0.93; 0.642)		-0.32 (-1.17 to 0.53; 0.460)	
30 mins - <1 hr	-0.27 (-1.25 to 0.71; 0.589)		-0.44 (-1.31 to 0.43; 0.320)	
1 - <2 hrs	-0.44 (-1.45 to 0.57; 0.394)		0.27 (-0.55 to 1.08; 0.521)	
≥2 hrs	-0.67 (-1.73 to 0.39; 0.214)		0.59 (-0.41 to 1.58; 0.247)	

Legend: Questionnaire imputed sample: n = 8,954 (weighted sample: n=6,976). Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727). [a] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; Ref=Reference category; and RERI=Relative excess risk due to interaction.

Table B10.5. Participant cigarette use according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk ratios) within the questionnaire (n=8,954) and time-use diary (n=2,520) imputed samples

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	10.1 (43/391)	22.1 (49/246)	20.3 (149/666)	30.4 (90/273)
1 - <30 mins	13.0 (95/617)	23.4 (78/352)	25.4 (75/279)	11.7 (19/124)
30 mins - <1 hr	23.7 (173/651)	22.8 (99/402)	26.6 (66/199)	30.9 (29/96)
1 - <2 hrs	26.8 (237/701)	27.0 (154/465)	25.7 (39/134)	36.2 (34/68)
≥2 hrs	36.8 (768/1,484)	38.6 (677/1,272))	31.0 (34/70)	44.3 (24/51)
Unadjusted RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	1.29 (0.83 to 2.00; 0.262)	1.06 (0.59 to 1.93; 0.835)	1.25 (0.98 to 1.60; 0.072)	0.38 (0.21 to 0.70; 0.002)
30 mins - <1 hr	2.34 (1.54 to 3.54; <0.0001)	1.03 (0.59 to 1.80; 0.908)	1.31 (1.00 to 1.72; 0.054)	1.02 (0.58 to 1.77; 0.957)
1 - <2 hrs	2.65 (1.83 to 3.82; <0.0001)	1.23 (0.71 to 2.12; 0.459)	1.27 (0.84 to 1.91; 0.263)	1.19 (0.79 to 1.79; 0.402)
≥2 hrs	3.63 (2.52 to 5.25; <0.0001)	1.75 (1.06 to 2.90; 0.029)	1.53 (1.02 to 2.29; 0.042)	1.45 (0.94 to 2.25; 0.092)
Unadjusted RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	2.17 (1.17 to 4.03; 0.014)	Ref	1.50 (1.13 to 1.99; 0.006)
1 - <30 mins	1.29 (0.83 to 2.00; 0.262)	2.31 (1.42 to 3.77; 0.001)	1.25 (0.98 to 1.60; 0.072)	0.57 (0.33 to 1.01; 0.056)
No social media use	Ref	2.17 (1.17 to 4.02; 0.014)	Ref	1.50 (1.13 to 1.99; 0.006)
30 mins - <1 hr	2.34 (1.54 to 3.54; <0.0001)	2.42 (1.44 to 3.49; <0.0001)	1.31 (1.00 to 1.72; 0.054)	1.52 (0.91 to 2.55; 0.111)
No social media use	Ref	2.17 (1.17 to 4.02; 0.014)	Ref	1.50 (1.13 to 1.99; 0.006)
1 - <2 hrs	2.65 (1.83 to 3.82; <0.0001)	2.67 (1.76 to 4.05; <0.0001)	1.27 (0.84 to 1.91; 0.263)	1.78 (1.21 to 2.62; 0.003)
No social media use	Ref	2.17 (1.17 to 4.02; 0.014)	Ref	1.50 (1.13 to 1.99; 0.006)
≥2 hrs	3.63 (2.52 to 5.25; <0.0001)	3.81 (2.63 to 5.51; <0.0001)	1.53 (1.02 to 2.29; 0.042)	2.18 (1.45 to 3.28; <0.0001)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Unadjusted measure of multiplicative effect modification and interaction (95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	0.83 (0.40 to 1.73; 0.612)		0.31 (0.16 to 0.57; <0.0001)	
30 mins - <1 hr	0.44 (0.22 to 0.87; 0.019)		0.78 (0.42 to 1.44; 0.418)	
1 - <2 hrs	0.46 (0.24 to 0.89; 0.021)		0.94 (0.52 to 1.69; 0.836)	
≥2 hrs	0.48 (0.26 to 0.90; 0.021)		0.95 (0.53 to 1.72; 0.874)	
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	1.28 (0.85 to 1.93; 0.240)	1.10 (0.67 to 1.81; 0.699)	1.27 (0.99 to 1.63; 0.061)	0.44 (0.24 to 0.82; 0.010)
30 mins - <1 hr	2.30 (1.56 to 3.38; <0.0001)	1.04 (0.64 to 1.69; 0.877)	1.30 (0.99 to 1.72; 0.063)	1.18 (0.70 to 1.98; 0.536)
1 - <2 hrs	2.52 (1.80 to 3.52; <0.0001)	1.13 (0.70 to 1.83; 0.616)	1.22 (0.83 to 1.80; 0.309)	1.13 (0.77 to 1.66; 0.519)
≥2 hrs	3.47 (2.48 to 4.87; <0.0001)	1.64 (1.03 to 2.62; 0.037)	1.51 (0.99 to 2.30; 0.056)	1.42 (0.97 to 2.10; 0.074)
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	1.49 (0.87 to 2.56; 0.150)	Ref	1.25 (0.97 to 1.60; 0.083)
1 - <30 mins	1.28 (0.85 to 1.93; 0.240)	1.64 (1.07 to 2.52; 0.025)	1.27 (0.99 to 1.63; 0.061)	0.55 (0.30 to 1.00; 0.051)
No social media use	Ref	1.74 (1.03 to 2.95; 0.039)	Ref	1.16 (0.90 to 1.49; 0.256)
30 mins - <1 hr	2.30 (1.56 to 3.38; <0.0001)	1.81 (1.21 to 2.71; 0.004)	1.30 (0.99 to 1.71; 0.063)	1.36 (0.82 to 2.27; 0.235)
No social media use	Ref	2.02 (1.19 to 3.43; 0.009)	Ref	1.20 (0.93 to 1.56; 0.165)
1 - <2 hrs	2.52 (1.80 to 3.52; <0.0001)	2.28 (1.54 to 3.38; <0.0001)	1.22 (0.83 to 1.80; 0.309)	1.36 (0.91 to 2.05; 0.136)
No social media use	Ref	1.93 (1.10 to 3.37; 0.022)	Ref	1.17 (0.91 to 1.51; 0.223)
≥2 hrs	3.47 (2.48 to 4.87; <0.0001)	3.16 (2.26 to 4.43; <0.0001)	1.51 (0.99 to 2.30; 0.056)	1.67 (1.17 to 2.39; 0.005)
Adjusted[a] measure of multiplicative effect modification and interaction (95% CI; *p-value*)				
No social media use	Ref		Ref	

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	Low parental education	High parental education	Low parental education
1 - <30 mins	0.86 (0.46 to 1.62; 0.645)		0.35 (0.18 to 0.65; 0.001)	
30 mins - <1 hr	0.45 (0.25 to 0.83; 0.010)		0.91 (0.51 to 1.61; 0.735)	
1 - <2 hrs	0.45 (0.26 to 0.79; 0.006)		0.93 (0.55 to 1.56; 0.774)	
≥2 hrs	0.47 (0.27 to 0.84; 0.010)		0.94 (0.55 to 1.63; 0.834)	

Legend: Questionnaire imputed sample: n=8,954 (weighted sample: n=6,976). Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727). [a] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; Ref=Reference category; and RR=Risk ratio.

Table B10.6. Participant e-cigarette use according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk ratios) within the questionnaire (n=8,954) and time-use diary (n=2,520) imputed samples

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	9.4 (43/391)	18.0 (42/253)	16.1 (118/697)	27.8 (86/277)
1 - <30 mins	9.6 (75/636)	20.4 (81/349)	17.4 (51/303)	20.9 (22/121)
30 mins - <1 hr	19.3 (152/672)	25.3 (109/393)	21.5 (44/221)	20.6 (27/98)
1 - <2 hrs	19.3 (188/751)	25.1 (160/459)	13.8 (31/143)	30.1 (30/72)
≥2 hrs	27.8 (590/1,662)	31.7 (607/1,343)	15.7 (21/83)	40.3 (25/50)
Unadjusted RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	1.03 (0.63 to 1.67; 0.913)	1.15 (0.65 to 2.04; 0.633)	1.08 (0.76 to 1.55; 0.665)	0.75 (0.37 to 1.56; 0.445)
30 mins - <1 hr	2.06 (1.33 to 3.19; 0.001)	1.43 (0.82 to 2.48; 0.209)	1.33 (0.89 to 1.99; 0.159)	0.74 (0.45 to 1.21; 0.233)
1 - <2 hrs	2.06 (1.35 to 3.15; 0.001)	1.42 (0.80 to 2.50; 0.230)	0.86 (0.50 to 1.47; 0.577)	1.09 (0.70 to 1.69; 0.713)
≥2 hrs	2.98 (2.00 to 4.43; <0.0001)	1.79 (1.05 to 3.05; 0.034)	0.97 (0.55 to 1.72; 0.913)	1.45 (0.88 to 2.40; 0.144)
Unadjusted RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	1.90 (0.99 to 3.65; 0.054)	Ref	1.72 (1.21 to 2.45; 0.003)
1 - <30 mins	1.03 (0.63 to 1.67; 0.913)	2.18 (1.34 to 3.56; 0.002)	1.08 (0.76 to 1.55; 0.665)	1.30 (0.65 to 2.60; 0.458)
No social media use	Ref	1.90 (0.99 to 3.65; 0.054)	Ref	1.72 (1.21 to 2.45; 0.003)
30 mins - <1 hr	2.06 (1.33 to 3.19; 0.001)	2.71 (1.71 to 4.28; <0.0001)	1.33 (0.89 to 1.99; 0.159)	1.28 (0.77 to 2.12; 0.346)
No social media use	Ref	1.90 (0.99 to 3.65; 0.054)	Ref	1.72 (1.21 to 2.45l 0.003)
1 - <2 hrs	2.06 (1.35 to 3.15; 0.001)	2.69 (1.69 to 4.27; <0.0001)	0.86 (0.50 to 1.47; 0.577)	1.87 (1.25 to 2.80; 0.002)
No social media use	Ref	1.90 (0.99 to 3.65; 0.054)	Ref	1.72 (1.21 to 2.45; 0.003)
≥2 hrs	2.98 (2.00 to 4.43; <0.0001)	3.39 (2.25 to 5.12; <0.0001)	0.97 (0.55 to 1.72; 0.913)	2.50 (1.55 to 4.04; <0.0001)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Unadjusted measure of multiplicative effect modification and interaction (95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	1.12 (0.54 to 2.29; 0.760)		0.70 (0.31 to 1.55; 0.375)	
30 mins - <1 hr	0.69 (0.35 to 1.38; 0.295)		0.55 (0.29 to 1.06; 0.075)	
1 - <2 hrs	0.69 (0.34 to 1.38; 0.286)		1.27 (0.59 to 2.71; 0.543)	
≥2 hrs	0.60 (0.31 to 1.16; 0.130)		1.50 (0.68 to 3.31; 0.315)	
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	1.02 (0.65 to 1.61; 0.927)	1.14 (0.70 to 1.85; 0.588)	1.15 (0.80 to 1.66; 0.458)	0.88 (0.49 to 1.57; 0.658)
30 mins - <1 hr	2.13 (1.40 to 3.23; <0.0001)	1.59 (0.96 to 2.64; 0.071)	1.45 (0.96 to 2.19; 0.077)	1.01 (0.64 to 1.59; 0.979)
1 - <2 hrs	2.19 (1.47 to 3.27; <0.0001)	1.48 (0.88 to 2.49; 0.138)	0.92 (0.53 to 1.60; 0.772)	1.13 (0.76 to 1.69; 0.534)
≥2 hrs	3.36 (2.34 to 4.84; <0.0001)	2.05 (1.25 to 3.37; 0.005)	1.09 (0.61 to 1.97; 0.762)	1.50 (0.97 to 2.33; 0.067)
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	1.41 (0.80 to 2.48; 0.235)	Ref	1.41 (1.01 to 1.97; 0.041)
1 - <30 mins	1.02 (0.65 to 1.61; 0.927)	1.61 (1.02 to 2.53; 0.040)	1.15 (0.80 to 1.66; 0.458)	1.24 (0.71 to 2.17; 0.449)
No social media use	Ref	1.44 (0.83 to 2.50; 0.192)	Ref	1.36 (0.98 to 1.89; 0.067)
30 mins - <1 hr	2.13 (1.40 to 3.23; <0.0001)	2.29 (1.51 to 3.49; <0.0001)	1.45 (0.96 to 2.19; 0.077)	1.37 (0.84 to 2.24; 0.211)
No social media use	Ref	1.56 (0.88 to 2.78; 0.125)	Ref	1.40 (1.01 to 1.95; 0.041)
1 - <2 hrs	2.19 (1.47 to 3.27; <0.0001)	2.32 (1.51 to 3.55; <0.0001)	0.92 (0.53 to 1.60; 0.772)	1.59 (1.05 to 2.42; 0.030)
No social media use	Ref	1.61 (0.89 to 2.89; 0.113)	Ref	1.35 (0.98 to 1.86; 0.068)
≥2 hrs	3.36 (2.33 to 4.84; <0.0001)	3.30 (2.26 to 4.81; <0.0001)	1.09 (0.61 to 1.97; 0.762)	2.03 (1.33 to 3.11; 0.001)
Adjusted[a] measure of multiplicative effect modification and interaction (95% CI; *p-value*)				
No social media use	Ref		Ref	

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	Low parental education	High parental education	Low parental education
1 - <30 mins	1.12 (0.60 to 2.07; 0.721)		0.76 (0.39 to 1.51; 0.438)	
30 mins - <1 hr	0.75 (0.40 to 1.39; 0.359)		0.69 (0.37 to 1.29; 0.249)	
1 - <2 hrs	0.68 (0.37 to 1.25; 0.210)		1.23 (0.61 to 2.48; 0.562)	
≥2 hrs	0.61 (0.33 to 1.12; 0.110)		1.37 (0.66 to 2.86; 0.393)	

Legend: Questionnaire imputed sample: n=8,954 (weighted sample: n=6,976). Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727). [a] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; Ref=Reference category; and RR=Risk ratio.

Table B10.7. Participant cigarette use according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk differences) within the questionnaire (n=6,234) and time-use diary (n=2,109) complete case samples

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	13.0 (36/273)	18.8 (26/121)	20.3 (126/575)	31.6 (76/201)
1 - <30 mins	14.2 (77/467)	21.0 (45/209)	25.5 (65/243)	11.4 (13/95)
30 mins - <1 hr	23.9 (136/490)	27.0 (78/235)	24.0 (54/176)	21.7 (20/81)
1 - <2 hrs	26.5 (178/522)	26.8 (108/279)	29.0 (37/112)	40.1 (29/53)
≥2 hrs	37.7 (586/1,095)	39.4 (460/813)	33.3 (31/57)	49.9 (24/41)
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	1.2 (-4.9 to 7.4; 0.694)	2.2 (-8.0 to 12.5; 0.667)	5.2 (-1.1 to 11.5; 0.108)	-20.2 (-31.3 to -9.1; <0.0001)
30 mins - <1 hr	10.9 (3.5 to 18.2; 0.004)	8.3 (-1.1 to 17.6; 0.082)	3.7 (-3.7 to 11.1; 0.327)	-9.9 (-23.5 to 3.7; 0.153)
1 - <2 hrs	13.6 (7.4 to 19.7; <0.0001)	8.1 (-1.8 to 18.0; 0.111)	8.7 (-3.6 to 20.9; 0.164)	8.4 (-6.2 to 23.1; 0.258)
≥2 hrs	24.8 (18.5 to 31.0; <0.0001)	20.7 (12.1 to 29.3; <0.0001)	13.0 (0.6 to 25.4; 0.041)	18.2 (-1.0 to 37.5; 0.063)
Unadjusted RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	5.8 (-3.3 to 14.8; 0.211)	Ref	11.3 (3.1 to 19.5; 0.007)
1 - <30 mins	1.2 (-4.9 to 7.4; 0.694)	8.0 (-0.4 to 16.4; 0.061)	5.2 (-1.1 to 11.5; 0.108)	-8.9)-17.6 to -0.3; 0.042)
No social media use	Ref	5.8 (-3.3 to 14.8; 0.211)	Ref	11.3 (3.1 to 19.5; 0.007)
30 mins - <1 hr	10.9 (3.5 to 18.2; 0.004)	14.1 (6.5 to 21.6; <0.0001)	3.7 (-3.7 to 11.1; 0.327)	1.4 (-10.8 to 13.6; 0.824)
No social media use	Ref	5.8 (-3.3 to 14.8; 0.211)	Ref	11.3 (3.1 to 19.5; 0.007)
1 - <2 hrs	13.6 (7.4 to 19.7; <0.0001)	13.8 (5.9 to 21.8; 0.001)	8.7 (-3.6 to 20.9; 0.164)	19.7 (4.3 to 35.2; 0.012)
No social media use	Ref	5.8 (-3.3 to 14.8; 0.210)	Ref	11.3 (3.1 to 19.5; 0.007)
≥2 hrs	24.8 (18.5 to 31.0; <0.0001)	26.5 (20.2 to 32.8; <0.0001)	13.0 (0.6 to 25.4; 0.041)	29.5 (11.2 to 47.8; 0.002)

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Unadjusted measure of additive effect modification[a] and interaction[b] (95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	1.0 (-10.5 to 12.6; 0.864)		-25.4 (-37.9 to -12.8; <0.0001)	
30 mins - <1 hr	-2.6 (-14.1 to 8.9; 0.656)		-13.6 (-29.2 to 2.0; 0.087)	
1 - <2 hrs	-5.5 (-17.4 to 6.4; 0.365)		-0.2 (-19.5 to 19.0; 0.982)	
≥2 hrs	-4.0 (-14.5 to 6.5; 0.451)		5.2 (-18.0 to 28.4; 0.659)	
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	0.1 (-5.2 to 5.5; 0.965)	4.2 (-5.2 to 13.7; 0.381)	4.8 (-1.6 to 11.3; 0.143)	-16.6 (-27.3 to -5.9; 0.002)
30 mins - <1 hr	9.9 (3.4 to 16.5; 0.003)	9.4 (0.3 to 18.4; 0.042)	3.6 (-4.0 to 11.2; 0.355)	-5.8 (-18.4 to 6.9; 0.369)
1 - <2 hrs	12.2 (6.6 to 17.7; <0.0001)	8.3 (-1.1 to 17.8; 0.084)	4.3 (-7.3 to 16.0; 0.465)	3.1 (-11.7 to 18.0; 0.678)
≥2 hrs	22.5 (16.4 to 28.5; <0.0001)	17.7 (8.8 to 26.7; <0.0001)	11.6 (-1.6 to 24.7; 0.084)	18.0 (1.1 to 35.0; 0.037)
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	-1.1 (-9.6 to 7.4; 0.796)	Ref	7.2 (-0.3 to 14.7; 0.060)
1 - <30 mins	0.1 (-5.2 to 5.5; 0.965)	3.1 (-3.8 to 10.0; 0.377)	4.8 (-1.6 to 11.3; 0.143)	-9.4 (-18.5 to -0.4; 0.041)
No social media use	Ref	-0.9 (-9.5 to 7.7; 0.833)	Ref	5.5 (-1.9 to 12.9; 0.143)
30 mins - <1 hr	9.9 (3.4 to 16.5; 0.003)	8.5 (1.1 to 15.8; 0.024)	3.6 (-4.0 to 11.2; 0.355)	-0.3 (-11.9 to 11.4; 0.965)
No social media use	Ref	2.5 (-6.2 to 11.2; 0.576)	Ref	5.9 (-1.7 to 13.5; 0.125)
1 - <2 hrs	12.2 (6.6 to 17.7; <0.0001)	10.8 (3.3 to 18.3; 0.005)	4.3 (-7.3 to 16.0; 0.465)	9.1 (-7.0 to 25.1; 0.267)
No social media use	Ref	2.4 (-6.2 to 11.0; 0.585)	Ref	5.3 (-2.2 to 12.9; 0.163)
≥2 hrs	22.5 (16.4 to 28.5; <0.0001)	20.1 (14.0 to 26.; <0.0001)	11.6 (-1.6 to 24.7; 0.084)	23.4 (7.8 to 39.0; 0.003)
Adjusted[c] measure of additive effect modification[a] and interaction[b] (95% CI; *p-value*)				
No social media use	Ref		Ref	

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	Low parental education	High parental education	Low parental education
1 - <30 mins	4.1 (-6.3 to 14.5; 0.439)		-21.4 (-33.9 to -9.0; 0.001)	
30 mins - <1 hr	-0.5 (-11.2 to 10.1; 0.921)		-9.4 (-23.7 to 4.9; 0.196)	
1 - <2 hrs	-3.8 (-14.6 to 6.9; 0.483)		-1.2 (-19.0 to 16.6; 0.894)	
≥2 hrs	-4.7 (-14.4 to 4.9; 0.332)		6.4 (-14.8 to 27.7; 0.550)	

Legend: Questionnaire complete case sample: n=6,234 (weighted sample: n=4,851). Time-use diary complete case sample: n=2,109 (weighted sample: n=4,590). [a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant current or former cigarette use by time spent on social media within the low parental education group compared with baseline (high parental education group). [b] Measure of interaction on an additive scale represents the size of the difference between the RD in participants with: for example, low parental education and 1-<30 mins social media use compared with RD for participants with low parental education and no social media use plus the RD for those with high parental education and 1-<30 mins social media use. [c] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; RD=Risk differences; and Ref=Reference category.

Table B10.8. Participant e-cigarette use according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk differences) within the questionnaire (n=6,234) and time-use diary (n=2,109) complete case samples

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	9.8 (28/281)	12.2 (21/126)	15.1 (92/609)	29.7 (72/205)
1 - <30 mins	9.0 (55/489)	19.2 (46/208)	16.1 (42/266)	20.0 (14/94)
30 mins - <1 hr	18.6 (115/511)	27.0 (71/242)	19.3 (36/194)	21.6 (21/80)
1 - <2 hrs	18.2 (138/562)	21.7 (99/288)	12.9 (26/123)	32.5 (25/57)
≥2 hrs	27.2 (434/1,247)	29.6 (382/891)	15.8 (18/70)	39.0 (21/44)
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	-0.8 (-6.1 to 4.5; 0.770)	6.9 (-1.4 to 15.2; 0.101)	1.0 (-5.5 to 7.5; 0.759)	-9.7 (-29.3 to 9.9; 0.330)
30 mins - <1 hr	8.9 (2.7 to 15.0; 0.005)	14.8 (5.9 to 23.7; 0.001)	4.3 (-4.1 to 12.6; 0.315)	-8.1 (-20.9 to 4.6; 0.210)
1 - <2 hrs	8.5 (2.6 to 14.4; 0.005)	9.5 (1.3 to 17.7; 0.023)	-2.2 (-9.8 to 5.5; 0.581)	2.7 (-11.2 to 16.7; 0.699)
≥2 hrs	17.4 (12.1 to 22.7; <0.0001)	17.4 (10.3 to 24.5; <0.0001)	0.7 (-8.1 to 9.4; 0.879)	9.2 (-11.7 to 30.1; 0.387)
Unadjusted RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	2.5 (-5.3 to 10.3; 0.535)	Ref	14.7 (6.6 to 22.7; <0.0001)
1 - <30 mins	-0.8 (-6.1 to 4.5; 0.770)	9.4 (1.9 to 16.9; 0.014)	1.0 (-5.5 to 7.5; 0.759)	4.9 (-13.4 to 23.2; 0.596)
No social media use	Ref	2.5 (-5.3 to 10.3; 0.535)	Ref	14.7 (6.6 to 22.7; <0.0001)
30 mins - <1 hr	8.9 (2.7 to 15.0; 0.005)	17.3 (9.0 to 25.6; <0.0001)	4.3 (-4.1 to 12.6; 0.315)	6.5 (-5.5 to 18.5; 0.289)
No social media use	Ref	2.5 (-5.3 to 10.3; 0.535)	Ref	14.7 (6.6 to 22.7; <0.0001)
1 - <2 hrs	8.5 (2.6 to 14.4; 0.005)	12.0 (4.9 to 19.1; 0.001)	-2.2 (-9.8 to 5.5; 0.581)	17.4 (5.0 to 29.8; 0.006)
No social media use	Ref	2.5 (-5.3 to 10.3; 0.534)	Ref	14.7 (6.6 to 22.7; <0.0001)
≥2 hrs	17.4 (12.1 to 22.7; <0.0001)	19.8 (13.8 to 25.9; <0.0001)	0.7 (-8.1 to 9.4; 0.879)	23.9 (4.3 to 43.4; 0.017)

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Unadjusted measure of additive effect modification[a] and interaction[b] (95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	7.7 (-1.8 to 17.2; 0.110)		-10.7 (-31.2 to 9.7; 0.303)	
30 mins - <1 hr	6.0 (-4.6 to 16.5; 0.267)		-12.4 (-27.5 to 2.7; 0.107)	
1 - <2 hrs	1.0 (-8.8 to 10.8; 0.836)		4.9 (-12.6 to 22.4; 0.583)	
≥2 hrs	-0.0 (-8.8 to 8.7; 0.992)		8.5 (-15.1 to 32.1; 0.477)	
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	-1.3 (-5.9 to 3.3; 0.582)	8.2 (0.6 to 15.8; 0.035)	2.1 (-4.4 to 8.5; 0.531)	-9.6 (-23.0 to 3.8; 0.160)
30 mins - <1 hr	9.6 (4.0 to 15.3; 0.001)	17.1 (8.8 to 25.3; <0.0001)	6.7 (-1.9 to 15.3; 0.127)	-4.5 (-16.3 to 7.3; 0.451)
1 - <2 hrs	9.6 (3.8 to 15.3; 0.001)	11.7 (3.7 to 19.7; 0.004)	-1.2 (-9.2 to 6.8; 0.774)	-1.0 (13.3 to 11.3; 0.871)
≥2 hrs	20.6 (15.9 to 25.3; <0.0001)	21.2 (14.1 to 28.3; <0.0001)	0.8 (-9.4 to 11.0; 0.878)	8.0 (-11.0 to 26.8; 0.410)
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	-1.5 (-8.8 to 5.8; 0.682)	Ref	11.0 (3.3 to 18.8; 0.005)
1 - <30 mins	-1.3 (-5.9 to 3.3; 0.582)	6.7 (0.2 to 13.1; 0.042)	2.1 (-4.4 to 8.5; 0.531)	1.4 (-10.4 to 13.3; 0.811)
No social media use	Ref	-3.4 (-10.4 to 3.6; 0.341)	Ref	11.0 (3.3 to 18.6; 0.005)
30 mins - <1 hr	9.6 (4.0 to 15.3; 0.001)	13.7 (5.7 to 21.7; 0.001)	6.7 (-1.9 to 15.3; 0.127)	6.4 (-5.0 to 17.9; 0.268)
No social media use	Ref	-1.3 (-8.6 to 6.1; 0.737)	Ref	11.3 (3.6 to 19.0; 0.004)
1 - <2 hrs	9.6 (3.8 to 15.3; 0.001)	10.4 (3.5 to 17.3; 0.003)	-1.2 (-9.2 to 6.8; 0.774)	10.3 (-1.7 to 22.3; 0.091)
No social media use	Ref	-1.2 (-8.2 to 5.8; 0.732)	Ref	9.6 (2.1 to 17.2; 0.013)
≥2 hrs	20.6 (15.9 to 25.3; <0.0001)	20.0 (14.2 to 25.7; <0.0001)	0.8 (-9.4 to 11.0; 0.878)	17.6 (-0.1 to 35.2; 0.051)
Adjusted[c] measure of additive effect modification[a] and interaction[b] (95% CI; *p-value*)				
No social media use	Ref		Ref	

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	Low parental education	High parental education	Low parental education
1 - <30 mins	9.5 (0.8 to 18.2; 0.033)		-11.6 (-26.4 to 3.1; 0.122)	
30 mins - <1 hr	7.4 (-2.0 to 16.8; 0.120)		-11.2 (-25.3 to 2.8; 0.117)	
1 - <2 hrs	2.1 (-7.0 to 11.2; 0.648)		0.2 (-14.5 to 14.9; 0.983)	
≥2 hrs	0.6 (-7.2 to 8.5; 0.877)		7.1 (-14.4 to 28.7; 0.516)	

Legend: Questionnaire complete case sample: n=6,234 (weighted sample: n=4,851). Time-use diary complete case sample: n=2,109 (weighted sample: n=4,590). [a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant current or former e-cigarette use by time spent on social media within the low parental education group compared with baseline (high parental education group).[b] Measure of interaction on an additive scale represents the size of the difference between the RD in participants with: for example, low parental education and 1-<30 mins social media use compared with RD for participants with low parental education and no social media use plus the RD for those with high parental education and 1-<30 mins social media use. [c] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n= Number of participants; RD=Risk differences; and Ref=Reference category.

Table B10.9. Participant cigarette use according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk ratios) within the questionnaire (n=6,234) and time-use diary (n=2,109) complete case samples

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	13.0 (36/273)	18.8 (26/121)	20.3 (126/575)	31.6 (76/201)
1 - <30 mins	14.2 (77/467)	21.0 (45/209)	25.5 (65/243)	11.4 (13/95)
30 mins - <1 hr	23.9 (136/490)	27.0 (78/235)	24.0 (54/176)	21.7 (20/81)
1 - <2 hrs	26.5 (178/522)	26.8 (108/279)	29.0 (37/112)	40.1 (29/53)
≥2 hrs	37.7 (586/1,095)	39.4 (460/813)	33.3 (31/57)	49.9 (24/41)
Unadjusted RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	1.10 (0.69 to 1.74; 0.699)	1.12 (0.66 to 1.89; 0.670)	1.25 (0.96 to 1.64; 0.094)	0.36 (0.17 to 0.75; 0.007)
30 mins - <1 hr	1.84 (1.17 to 2.90; 0.009)	1.44 (0.92 to 2.26; 0.111)	1.18 (0.86 to 1.63; 0.308)	0.69 (0.38 to 1.23; 0.203)
1 - <2 hrs	2.04 (1.37 to 3.06; 0.001)	1.43 (0.90 to 2.28; 0.133)	1.43 (0.94 to 2.17; 0.097)	1.27 (0.87 to 1.85; 0.222)
≥2 hrs	2.91 (1.95 to 4.34; <0.0001)	2.10 (1.39 to 3.19; <0.0001)	1.64 (1.09 to 2.47; 0.018)	1.58 (1.03 to 2.42; 0.037)
Unadjusted RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	1.44 (0.83 to 2.53; 0.197)	Ref	1.56 (1.16 to 2.08; 0.003)
1 - <30 mins	1.10 (0.69 to 1.74; 0.699)	1.62 (0.98 to 2.68; 0.061)	1.25 (0.96 to 1.64; 0.094)	0.56 (0.28 to 1.14; 0.109)
No social media use	Ref	1.44 (0.83 to 2.53; 0.197)	Ref	1.56 (1.16 to 2.08; 0.003)
30 mins - <1 hr	1.84 (1.17 to 2.90; 0.009)	2.08 (1.33 to 3.25; 0.001)	1.18 (0.86 to 1.63; 0.308)	1.07 (0.61 to 1.88; 0.819)
No social media use	Ref	1.44 (0.83 to 2.53; 0.197)	Ref	1.56 (1.16 to 2.08; 0.003)
1 - <2 hrs	2.04 (1.37 to 3.06; 0.001)	2.07 (1.32 to 3.23; 0.002)	1.43 (0.94 to 2.17; 0.097)	1.97 (1.30 to 2.99; 0.001)
No social media use	Ref	1.44 (0.83 to 2.53; 0.197)	Ref	1.56 (1.16 to 2.08; 0.003)
≥2 hrs	2.91 (1.95 to 4.34; <0.0001)	3.04 (2.04 to 4.53; <0.0001)	1.64 (1.09 to 2.47; 0.018)	2.45 (1.63 to 3.68; <0.0001)

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Unadjusted measure of multiplicative effect modification and interaction (95% CI; p-value)				
No social media use	Ref		Ref	
1 - <30 mins	1.02 (0.52 to 2.01; 0.948)		0.29 (0.13 to 0.62; 0.002)	
30 mins - <1 hr	0.78 (0.42 to 1.47; 0.446)		0.58 (0.30 to 1.13; 0.109)	
1 - <2 hrs	0.70 (0.37 to 1.31; 0.266)		0.89 (0.50 to 1.57; 0.683)	
≥2 hrs	0.72 (0.41 to 1.29; 0.274)		0.96 (0.53 to 1.75; 0.897)	
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	1.09 (0.72 to 1.63; 0.692)	1.15 (0.70 to 1.88; 0.576)	1.24 (0.95 to 1.63; 0.120)	0.42 (0.20 to 0.87; 0.019)
30 mins - <1 hr	1.86 (1.24 to 2.78; 0.003)	1.47 (0.94 to 2.31; 0.092)	1.18 (0.85 to 1.64; 0.311)	0.83 (0.47 to 1.45; 0.506)
1 - <2 hrs	1.97 (1.38 to 2.82; <0.0001)	1.41 (0.90 to 2.21; 0.138)	1.21 (0.79 to 1.84; 0.377)	1.07 (0.71 to 1.61; 0.756)
≥2 hrs	2.77 (1.92 to 4.00; <0.0001)	1.95 (1.29 to 2.95; 0.002)	1.56 (0.99 to 2.47; 0.056)	1.62 (1.09 to 2.40; 0.016)
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	1.06 (0.63 to 1.78; 0.819)	Ref	1.33 (1.00 to 1.78; 0.052)
1 - <30 mins	1.09 (0.72 to 1.63; 0.692)	1.22 (0.80 to 1.86; 0.355)	1.24 (0.95 to 1.63; 0.120)	0.56 (0.27 to 1.14; 0.109)
No social media use	Ref	1.18 (0.70 to 1.98; 0.537)	Ref	1.23 (0.91 to 1.65; 0.177)
30 mins - <1 hr	1.86 (1.24 to 2.78; 0.003)	1.74 (1.14 to 2.65; 0.011)	1.18 (0.85 to 1.64; 0.311)	1.01 (0.58 to 1.77; 0.959)
No social media use	Ref	1.30 (0.78 to 2.17; 0.321)	Ref	1.27 (0.94 to 1.73; 0.116)
1 - <2 hrs	1.97 (1.38 to 2.82; <0.0001)	1.82 (1.21 to 2.76; 0.004)	1.21 (0.79 to 1.84; 0.377)	1.36 (0.83 to 2.22; 0.219)
No social media use	Ref	1.33 (0.79 to 2.23; 0.282)	Ref	1.24 (0.92 to 1.67; 0.155)
≥2 hrs	2.77 (1.92 to 4.00; <0.0001)	2.59 (1.80 to 3.74; <0.0001)	1.56 (0.99 to 2.47; 0.056)	2.01 (1.41 to 2.87; <0.0001)
Adjusted[a] measure of multiplicative effect modification and interaction (95% CI; p-value)				
No social media use	Ref		Ref	

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	Low parental education	High parental education	Low parental education
1 - <30 mins	1.06 (0.57 to 1.97; 0.857)		0.34 (0.15 to 0.73; 0.006)	
30 mins - <1 hr	0.79 (0.45 to 1.41; 0.430)		0.70 (0.37 to 1.31; 0.260)	
1 - <2 hrs	0.71 (0.41 to 1.25; 0.238)		0.88 (0.51 to 1.51; 0.651)	
≥2 hrs	0.70 (0.41 to 1.20; 0.195)		1.04 (0.57 to 1.88; 0.905)	

Legend: Questionnaire complete case sample: n=6,234 (weighted sample: n=4,851). Time-use diary complete case sample: n=2,109 (weighted sample: n=4,590).
[a] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; Ref=Reference category; and RR=Risk ratio.

Table B10.10. Participant e-cigarette use according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk ratios) within the questionnaire (n=6,234) and time-use diary (n=2,109) complete case samples

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	9.8 (28/281)	12.2 (21/126)	15.1 (92/609)	29.7 (72/205)
1 - <30 mins	9.0 (55/489)	19.2 (46/208)	16.1 (42/266)	20.0 (14/94)
30 mins - <1 hr	18.6 (115/511)	27.0 (71/242)	19.3 (36/194)	21.6 (21/80)
1 - <2 hrs	18.2 (138/562)	21.7 (99/288)	12.9 (26/123)	32.5 (25/57)
≥2 hrs	27.2 (434/1,247)	29.6 (382/891)	15.8 (18/70)	39.0 (21/44)
Unadjusted RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	0.92 (0.53 to 1.60; 0.765)	1.57 (0.88 to 2.80; 0.128)	1.07 (0.71 to 1.61; 0.756)	0.67 (0.26 to 1.72; 0.407)
30 mins - <1 hr	1.91 (1.12 to 3.24; 0.017)	2.21 (1.28 to 3.82; 0.005)	1.28 (0.81 to 2.03; 0.286)	0.73 (0.42 to 1.27; 0.258)
1 - <2 hrs	1.87 (1.11 to 3.14; 0.019)	1.78 (1.01 to 3.12; 0.045)	0.86 (0.48 to 1.53; 0.601)	1.09 (0.70 to 1.70; 0.693)
≥2 hrs	2.78 (1.72 to 4.51; <0.0001)	2.42 (1.45 to 4.05; 0.001)	1.04 (0.60 to 1.83; 0.878)	1.31 (0.75 to 2.30; 0.346)
Unadjusted RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	1.25 (0.62 to 2.53; 0.529)	Ref	1.97 (1.41 to 2.76; <0.0001)
1 - <30 mins	0.92 (0.53 to 1.60; 0.765)	1.96 (1.10 to 3.49; 0.022)	1.07 (0.71 to 1.61; 0.756)	1.33 (0.53 to 3.35; 0.548)
No social media use	Ref	1.25 (0.62 to 2.53; 0.529)	Ref	1.97 (1.41 to 2.76; <0.0001)
30 mins - <1 hr	1.91 (1.12 to 3.24; 0.017)	2.77 (1.61 to 4.77; <0.0001)	1.28 (0.81 to 2.03; 0.286)	1.43 (0.80 to 2.57; 0.227)
No social media use	Ref	1.25 (0.62 to 2.53; 0.529)	Ref	1.97 (1.41 to 2.76; <0.0001)
1 - <2 hrs	1.87 (1.11 to 3.14; 0.019)	2.22 (1.29 to 3.84; 0.004)	0.86 (0.48 to 1.53; 0.601)	2.15 (1.41 to 3.30; <0.0001)
No social media use	Ref	1.25 (0.62 to 2.52; 0.528)	Ref	1.97 (1.41 to 2.76; <0.0001)
≥2 hrs	2.78 (1.72 to 4.51; <0.0001)	3.03 (1.84 to 5.00; <0.0001)	1.04 (0.60 to 1.83; 0.878)	2.58 (1.49 to 4.47; 0.001)

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Unadjusted measure of multiplicative effect modification and interaction (95% CI; p-value)				
No social media use	Ref		Ref	
1 - <30 mins	1.70 (0.78 to 3.70; 0.178)		0.63 (0.23 to 1.74; 0.371)	
30 mins - <1 hr	1.16 (0.55 to 2.46; 0.699)		0.57 (0.28 to 1.15; 0.116)	
1 - <2 hrs	0.95 (0.45 to 2.03; 0.898)		1.27 (0.57 to 2.87; 0.557)	
≥2 hrs	0.87 (0.43 to 1.77; 0.698)		1.25 (0.54 to 2.91; 0.598)	
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	0.93 (0.56 to 1.54; 0.781)	1.57 (0.93 to 2.64; 0.093)	1.11 (0.74 to 1.67; 0.599)	0.69 (0.37 to 1.29; 0.244)
30 mins - <1 hr	2.14 (1.33 to 3.42; 0.002)	2.51 (1.47 to 4.30; 0.001)	1.44 (0.90 to 2.31; 0.132)	0.85 (0.50 to 1.43; 0.536)
1 - <2 hrs	2.12 (1.31 to 3.45; 0.002)	1.99 (1.15 to 3.44; 0.014)	0.91 (0.52 to 1.60; 0.749)	0.89 (0.58 to 1.36; 0.601)
≥2 hrs	3.21 (2.12 to 4.86; <0.0001)	2.79 (1.71 to 4.55; <0.0001)	1.04 (0.55 to 1.95; 0.904)	1.25 (0.76 to 2.07; 0.384)
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	Ref	1.06 (0.55 to 2.01; 0.869)	Ref	1.65 (1.16 to 2.34; 0.005)
1 - <30 mins	0.93 (0.56 to 1.54; 0.781)	1.65 (0.99 to 2.76; 0.055)	1.11 (0.74 to 1.67; 0.599)	1.13 (0.61 to 2.09; 0.688)
No social media use	Ref	0.98 (0.52 to 1.85; 0.946)	Ref	1.68 (1.20 to 2.34; 0.003)
30 mins - <1 hr	2.14 (1.33 to 3.42; 0.002)	2.46 (1.50 to 4.04; <0.0001)	1.44 (0.90 to 2.31; 0.132)	1.42 (0.80 to 2.53; 0.233)
No social media use	Ref	1.08 (0.57 to 2.02; 0.817)	Ref	1.70 (1.21 to 2.38; 0.002)
1 - <2 hrs	2.12 (1.31 to 3.45; 0.002)	2.14 (1.28 to 3.58; 0.004)	0.91 (0.52 to 1.60; 0.749)	1.52 (0.92 to 2.48; 0.099)
No social media use	Ref	1.13 (0.60 to 2.10; 0.709)	Ref	1.58 (1.13 to 2.21; 0.007)
≥2 hrs	3.21 (2.12 to 4.86; <0.0001)	3.14 (2.03 to 4.87; <0.0001)	1.04 (0.55 to 1.95; 0.904)	1.98 (1.21 to 3.25; 0.007)
Adjusted[a] measure of multiplicative effect modification and interaction (95% CI; p-value)				
No social media use	Ref		Ref	

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	Low parental education	High parental education	Low parental education
1 - <30 mins	1.68 (0.82 to 3.43; 0.153)		0.62 (0.29 to 1.30; 0.205)	
30 mins - <1 hr	1.18 (0.59 to 2.34; 0.640)		0.59 (0.31 to 1.14; 0.113)	
1 - <2 hrs	0.94 (0.47 to 1.87; 0.854)		0.98 (0.49 to 1.96; 0.950)	
≥2 hrs	0.87 (0.46 to 1.65; 0.669)		1.20 (0.53 to 2.72; 0.655)	

Legend: Questionnaire complete case sample: n=6,234 (weighted sample: n=4,851). Time-use diary complete case sample: n=2,109 (weighted sample: n=4,590).
[a] Adjusted for ethnicity, sex, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s= Minute/s; n=Number of participants; Ref=Reference category; and RR=Risk ratio.

Section B11 STROBE statement - checklist of items that should be included in reports of cohort studies

Table B11.1. Completed STROBE checklist

	Item No	Recommendation	Section
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Chapter 5 Abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Chapter 5 Abstract
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Chapter 5 Introduction
Objectives	3	State specific objectives, including any prespecified hypotheses	Chapter 5 Introduction
Methods			
Study design	4	Present key elements of study design early in the paper	Chapter 5 Abstract Chapter 5 Introduction Chapter 5 Methods
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Chapter 5 Methods Chapter 5 STROBE study flow diagram
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Chapter 5 Methods Chapter 5 STROBE study flow diagram
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	Not applicable
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Chapter 5 Methods Appendix B, Section B3 Appendix B, Section B4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Chapter 5 Methods Appendix B, Section B4
Bias	9	Describe any efforts to address potential sources of bias	Chapter 5 Methods Appendix B, Section B5 Appendix B, Section B6 Appendix B, Section B7

	Item No	Recommendation	Section
Study size	10	Explain how the study size was arrived at	Chapter 5 Methods Chapter 5 Results Chapter 5 STROBE study flow diagram
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Chapter 5 Methods Appendix B, Section B4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Chapter 5 Methods Appendix B, Section B3 Appendix B, Section B5 Appendix B, Section B7
		(*b*) Describe any methods used to examine subgroups and interactions	Chapter 5 Methods Appendix B, Section B7
		(*c*) Explain how missing data were addressed	Chapter 5 Methods Appendix B, Section B6
		(*d*) If applicable, explain how loss to follow-up was addressed	Chapter 5 Methods Appendix B, Section B5 Appendix B, Section B6
		(*e*) Describe any sensitivity analyses	Chapter 5 Methods Appendix B, Section B7
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Chapter 5 Results Chapter 5 STROBE study flow diagram Appendix B, Section B9 Appendix B, Section B10
		(b) Give reasons for non-participation at each stage	Chapter 5 Methods Chapter 5 STROBE study flow diagram
		(c) Consider use of a flow diagram	Chapter 5 STROBE study flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders	Chapter 5 Results Appendix B, Section B8
		(b) Indicate number of participants with missing data for each variable of interest	Chapter 5 Methods Chapter 5 STROBE study flow diagram Appendix B, Section B6

	Item No	Recommendation	Section
		(c) Summarise follow-up time (eg, average and total amount)	Chapter 5 Methods Chapter 5 STROBE study flow diagram
Outcome data	15*	Report numbers of outcome events or summary measures over time	Chapter 5 Results Appendix B, Section B9 Appendix B, Section B10

Appendix C Supplementary material accompanying Chapter 6

Section C1 Advisory group

An advisory group of policymakers and experts in the field of social media and adolescent health-risk behaviours was convened to provide guidance during development of the statistical analysis plan and the study stages. Members were recruited via expert stakeholders and included patient/public representatives and stakeholders from policy, non-governmental, and academic sectors (Table C1.1).

Advisory group members were provided with detailed background information on the study. During development of the statistical analysis plan, group members provided feedback on several aspects of the study, including study objective relevance, potential confounding factors of the relationship between time spent on social media and binge drinking/frequency of alcohol use in the past month, possible effect modifiers worthy of investigation, and ongoing or published studies. Following study completion, members supported the interpretation and transferability of study findings to the wider policy context. Feedback was received during in-person meetings, via Zoom or email.

Table C1.1. Advisory group members

Name	Organisation	Period of involvement
Kirsty Blenkins	UK Health Security Agency, Office for Health Improvement and Disparities, London, UK	2020 to present
Lee Carlton	Public Health Scotland, Glasgow, UK	2020 to January 2023
Neil Coles	We Are With You, Kent, UK	2020 to February 2021
Nicholas Hickmott	We Are With You, Kent, UK	2020 to present
Professor John Holmes	Alcohol Policy, University of Sheffield, UK	2020 to present
Rachel Macpherson	Scottish Government, Edinburgh, UK	2020 to present
Dr Ross Whitehead	Public Health Scotland, Edinburgh, UK	2020 to July 2021
Dr Richard Purves	University of Stirling, Stirling, UK	2020 to present

Section C2 Deviations from the published statistical analysis plan

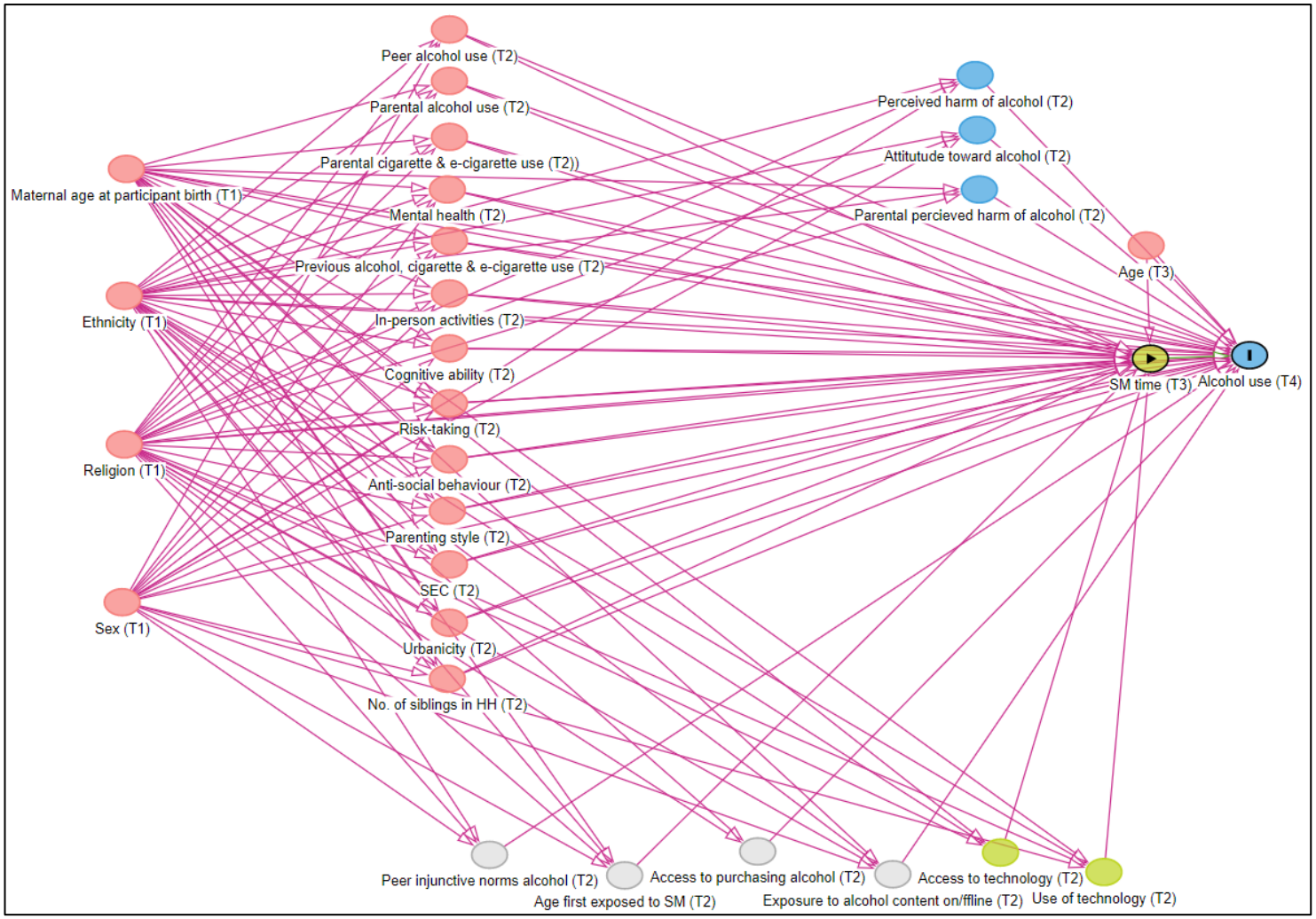
We anticipated generating a continuous variable, representing the average time spent on social media across a weekday and weekend day (assessed via time-use diary), adopting a fractional polynomial approach. However, following creation of the fractional polynomial, hypothesis tests comparing the generated fractional polynomial models with the linear models (where average time spent on social media across a weekday and weekend day was treated as continuous) showed no significant differences. However, a dose-response relationship was observed when this variable was categorised, suggesting some advantage of adopting a categorical variable; therefore, this variable was treated as categorical in all analyses.

We intended to treat the confounders number of siblings of participant in the household and age as continuous variables; however, due to the absence of a linear relationship with outcomes investigated, these variables were treated as categorical.

We anticipated using '1 to <30 minutes and high parental education' as the reference category for the investigation of effect measure modification and interaction. However, following assessment, the stratum with the lowest risk of binge drinking was 'no social media use and low parental education'; therefore, this was used as the reference category. Moreover, we planned to create a binary variable representing highest parental education in the household where National Vocational Qualification (NVQ) level 1, other academic qualifications (incl. Overseas), and none would refer to low parental education and NVQ levels 2,3,4 and 5, high parental education. Due to low frequencies, the following categorisation was used: low parental education (NVQ level 2, NVQ level 1, other academic qualifications (incl. Overseas), and none) and high parental education (NVQ levels 3,4 and 5).

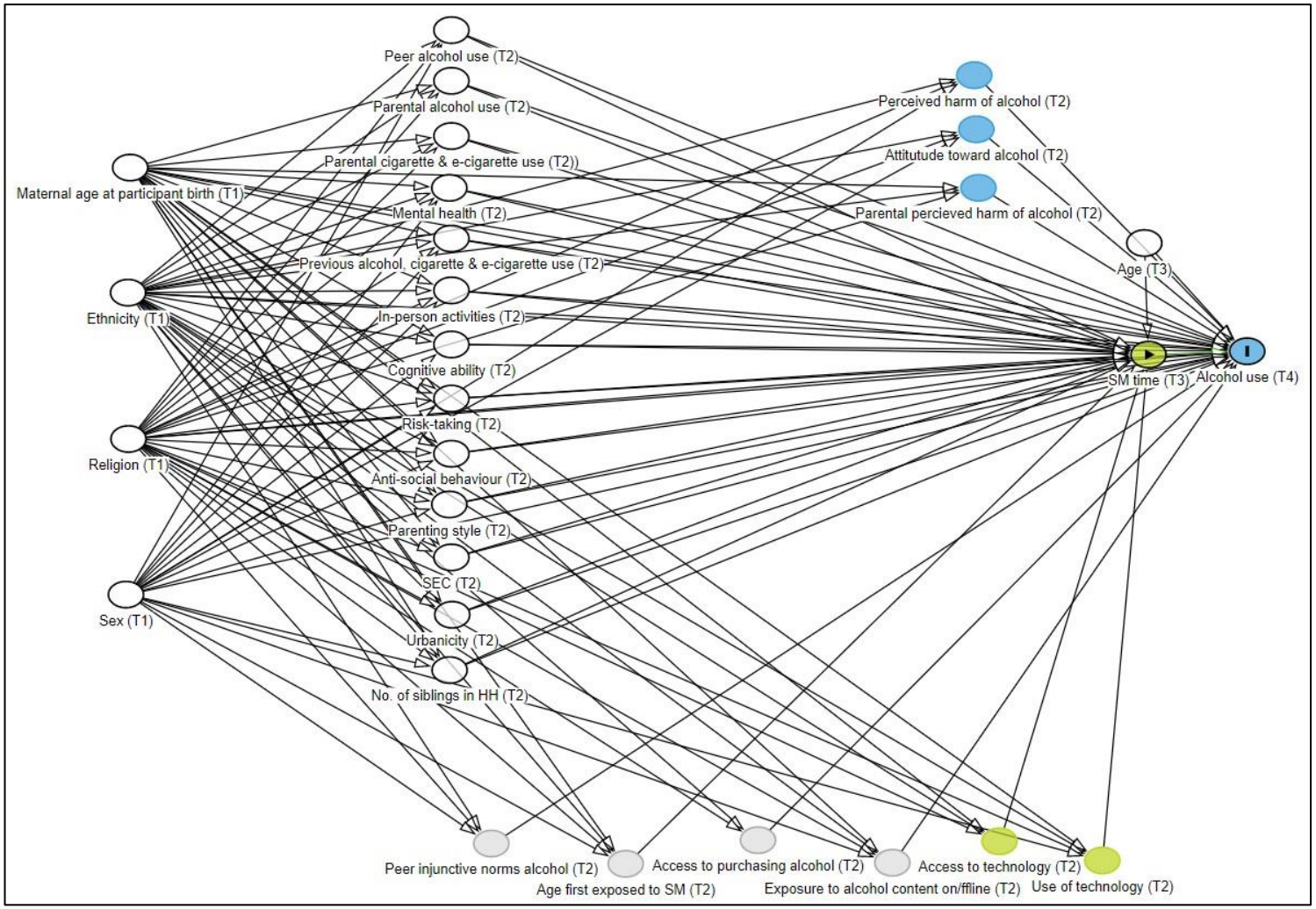
Section C3 DAGgity directed acyclic graphs

Figure C3.1. Saturated directed acyclic graph (DAG) illustrating the hypothesised relationship between social media use at 14 years and alcohol use at 17 years to inform adjustment



Legend: Observed confounders-red node. Unobserved confounders-grey node. Exposure-green node (➢). Ancestor of exposure-green node. Outcome-blue node (I). Ancestor of outcome-blue node. Green bold arrow indicates focal relationship under investigation. Abbreviation(s): HH=Household; No.=Number; SEC=Socioeconomic circumstance(s); SM=Social media; and T=Timepoint.

Figure C3.2. Saturated directed acyclic graph (DAG) illustrating the hypothesised relationship between social media use at 14 years and alcohol use at 17 years- and the minimal sufficient adjustment set



Legend: Observed confounders-white node. Unobserved confounders-grey node. Exposure-green node (➢). Ancestor of exposure-green node. Outcome-blue node (I). Ancestor of outcome-blue node. Green bold arrow indicates focal relationship under investigation. Abbreviation(s): HH=Household; No.=Number; SEC= Socioeconomic circumstance(s); SM=Social media; and T=Timepoint.

Section C4 Variables used in analysis

Table C4.1. Variables used in analysis

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
Time spent on social media on a normal weekday	MCS 6 (14 years)	Self-completion time-use diary Time spent browsing and updating social networking sites (e.g., Twitter, Facebook, BBM, Snapchat) on a normal weekday	Activity code Browsing and updating social networking sites (e.g., Twitter, Facebook, BBM, Snapchat) on a normal weekday	5-category variable On an assigned weekday, each participant recorded what they did from 04:00 to 04:00 the following day in 10-minute time slots (144 activity slots within 24 hours). The primary activity for each time slot was selected from a list of 44 predefined activity codes nested within 12 categories. The number of 10-minute activity slots recording social networking site activity on a weekday was summed to give total time (minutes) browsing and updating social networking sites on a normal weekday. The resulting continuous variable was collapsed into no social media use, 1-<30 mins, 30 mins-<60 mins, 1 hr-<2 hrs, and ≥2 hrs social media use. Adopting a similar approach to Atkin *et al.* (2021), diaries with ≥5 10-minute activity slots with no activity indicated were excluded from the analysis as these were deemed to be unreliable accounts of a complete day's activity.
Average time spent on social media across a normal weekday and weekend day	MCS 6 (14 years)	Self-completion time-use diary 1. Time spent browsing and updating social networking sites (e.g., Twitter, Facebook, BBM, Snapchat) on a normal weekday 2. Time spent browsing and updating social networking sites (e.g., Twitter,	Activity code Browsing and updating social networking sites (e.g., Twitter, Facebook, BBM, Snapchat) on a normal weekday and weekend day	5-category variable On an assigned weekday and weekend day, each participant recorded what they did from 04:00 to 04:00 the following day in 10-minute time slots (144 activity slots within 24 hours). The primary activity for each time slot was selected from a list of 44 predefined activity codes nested within 12 categories. The number of 10-minute activity slots recording social networking site activity on a weekday and weekend day was summed to give total time (minutes) browsing and updating social networking, this was then divided by two to give the average time spent across a weekday and weekend day. The resulting continuous variable was collapsed into no social media use, 1-<30 mins, 30 mins-

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
		Facebook, BBM, Snapchat) on a normal weekend day		<60 mins, 1 hr-<2 hrs, and ≥2 hrs social media use. Participants with missing data on 1or both days were classified as missing. Adopting a similar approach to Atkin *et al.* (2021), diaries with ≥5 10-minute activity slots with no activity indicated were excluded from the analysis as these were deemed to be unreliable accounts of a complete day's activity.
Time spent on social media on a normal weekday during term time	MCS 6 (14 years)	Self-completion online questionnaire Time spent on social media on a normal weekday during term time	No social media use/1-<30 mins/30-<60 mins/1 hr-<2 hrs/2 hrs-<3 hrs/3 hrs-<5 hrs/5 hrs-<7 hrs/≥7 hrs social media use/Don't know/Don't wish to answer/Not applicable	5-category variable Don't know, don't wish to answer and not applicable responses were coded as missing. Categories 2 hrs-<3 hrs, 3hrs-<5 hrs, 5 hrs-<7 and ≥7 hrs were collapsed to give ≥2 hrs social media use, with no changes made to the remaining categories. 4-category variable Don't know, don't wish to answer and not applicable responses were coded as missing. Categories 1-<30 mins and 30-<60 mins were collapsed to give 1 min-<1 hr social media use, and categories 2 hrs-<3 hrs, 3 hrs-<5 hrs, 5 hrs-<7 hrs and ≥7 hrs were collapsed to give ≥2 hrs social media use, with no changes made to the remaining categories.
Ever binge drinking	MCS 7 (17 years)	Self-completion online questionnaire Has participant ever had five or more alcoholic drinks at a time? A drink is half a pint of lager, beer or cider, one alcopop, a small glass of wine, or a measure of spirits	Yes/No/Do not know/I do not wish to answer/No answer	Binary variable Do not know, I do not wish to answer, and no answer responses were coded as missing. No alterations were made to the remaining categories.

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
Frequency of alcohol use in the past month	MCS 7 (17 years)	Self-completion online questionnaire How many times participant had an alcoholic drink in the last 4 weeks?	Never/1-2 times/3-5 times/ 6-9 times/10-19 times/20-39 times/40 or more times/ Do not know/I do not wish to answer/No answer	4-category variable Do not know, I do not wish to answer, and no answer responses were coded as missing. Categories were collapsed to give never, 1-2 times, 3-5 times, and 6 or more times (representing regular drinking), as per the Centre for Longitudinal Studies (Fitzsimons and Villadsen, 2021).
Maternal age at participant birth	MCS 1 (9 months)/ MCS 2 (3 years)	Parental interview 1. Respondent age at birth of participant (continuous) 2. Respondent ID and interview status	Continuous	Continuous variable No alterations were made to variable 1. Variable 2 was used to identify the mother of the participant, and a continuous variable was generated representing maternal age at birth of the participant.
Sex	MCS 1 (9 months)/ MCS 2 (3 years)	Parental interview Participant sex	Male/Female	No alterations were made to the existing variable.
Age	MCS 6 (14 years)	Parental interview Participant age at last birthday	13/14/15 years	No alterations were made to the existing variable.
Ethnic group	MCS 1 (9 months)/ MCS 2 (3 years)/ MCS 3 (5 years)	Parental interview Participant ethnic group (6 category Census class)	White/Mixed/Indian/ Pakistani & Bangladeshi/ Black or Black British/Other ethnic group (incl. Chinese, Other)/Refusal/Don't know/Not applicable	Binary variable Refusal, don't know, and not applicable responses were coded as missing. Categories were collapsed to give White and Other (Mixed, Indian, Pakistani & Bangladeshi, Black or Black British, or Other ethnic group).

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
Religion	MCS 1 (9 months)/ MCS 2 (3 years)/ MCS 3 (5 years)	Parental interview Main respondent religion (used as proxy for participant religion)	Christian/Muslim/Hindu/ Sikh/Jewish/Buddhist/ Other/None/Refusal/Don't know/Not applicable	Binary variable Refusal, don't know and, not applicable responses were coded as missing. Categories were collapsed to give religious affiliation (Christian, Muslim, Hindu, Sikh, Jewish, Buddhist, Other) and no religious affiliation (None).
SDQ total difficulties	MCS 5 (11 years)	Parental interview Participant mental health problems (SDQ total difficulties)	Continuous score	Continuous variable Calculated the total difficulties score made up of 20 items from the conduct disorders, hyperactivity/inattention, emotional and peer problem subscales of the SDQ. For each subscale variable (e.g., conduct disorders), if >2 items were completed by the parent, the scale average was imputed. Participants classified as missing are those who had some subscales completed where ≤2 items were completed or who had no SDQ information.
Previous cigarette use (also used as a proxy for previous e-cigarette use)	MCS 5 (11 years)	Self-completion online questionnaire Participant ever regularly smoked tobacco products	Yes/No/Refused/Don't know/Not applicable	Binary variable Refused, don't know, and not applicable responses were coded as missing. No further alterations were made to the existing variable.
Previous alcohol use	MCS 5 (11 years)	Self-completion online questionnaire Participant ever had an alcoholic drink	Yes/No/No answer/Not applicable	Binary variable No answer and not applicable responses were coded as missing. No further alterations were made to the existing variable.

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
Average days/week of in-person activity	MCS 5 (11 years)	Parental interview 1. Days per week participant attends a club or class to do sport or any other physical activity like swimming, gymnastics, football, or dancing 2. Days per week participant attends non club/class physical activities with friends/siblings (not including walking to school)	Variable 1 and 2: ≥5 days a week/4 days a week/3 days a week/2 days a week/1 day a week/Less often than once a week/Not at all/Don't know/ Refused/Not applicable	Continuous composite variable Don't know, refused, and not applicable responses were coded as missing. Variables 1 and 2 were recoded to represent number of days of activities per week. For each variable, categories not at all and less often than once a week were combined, as engagement less than once a week would imply no engagement in a week (=0 days), 1 day a week (=1 day), 2 days a week (=2 days), 3 days a week (=3 days), 4 days a week (=4 days). As per Twenge *et al.* (2019), and following observation of variable distributions, ≥5 days a week was coded as 6 days (the average of 5, 6, and 7 days). The sum of both frequency variables was calculated to create a composite variable representing weekly frequency of in-person activities, with no requirement to standardise as both variables were on the same scale. Cronbach alpha=0.31 (as we were not measuring the same activity explicitly and instead generalising to any in-person activity, a high alpha statistic was not expected). Participants were classified as missing if they had missing data on 1/both variables used to create the composite variable.
Cognitive ability	MCS 5 (11 years)	Participant assessment BAS II Verbal Similarities - verbal reasoning and verbal knowledge	Standardised score (adjusted for age and ability)	No alterations made to the existing variable.
Risk-taking	MCS 5 (11 years)	Participant assessment CGT-risk-taking	Continuous score	No alterations made to the existing variable.

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
Anti-social behaviour	MCS 5 (11 years)	Self-completion online questionnaire 1. Participant ever taken something from a shop without paying for it 2. Participant ever written things or sprayed paint on a building 3. Participant ever been noisy or rude in a public place 4. Participant ever purposely damaged anything in a public place	Variables 1-4: Yes No/No answer/Not applicable	Binary composite variable No answer and not applicable responses were coded as missing. Variables 1-4 were combined to create a composite variable with categories engagement in any anti-social behaviour and engagement in no anti-social behaviours (Cronbach alpha=0.95). Participants with missing data in ≥1 variables used to create the composite variable were coded as missing.
Number of siblings of participant in the household	MCS 5 (11 years)	Parental interview Participant siblings in the household	Continuous	4-category variable (used in imputed time-use diary analyses) Continuous variable categorised into 0, 1, 2-3 and 4-10 siblings due to issues with convergence of the imputation model. 5-category variable (used in remaining analyses) Following observation of variable distribution, variable was categorised into 0,1,2-3,4-5 and 6-10 siblings.
Parental alcohol use	MCS 5 (11 years)	Parental interview Parental frequency of alcohol consumption	4 or more times a week/2-3 times a week/2-4 times per month/Monthly or less/ Never/Refusal/Don't know/Not applicable	5-category variable Refusal, don't know, and not applicable responses were coded as missing. No alterations were made to the remaining categories.

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
Parental cigarette use (also used as a proxy for parental e-cigarette use)	MCS 5 (11 years)	Parental interview Parent current use of tobacco products	Yes/No/Not applicable	Binary composite variable Not applicable responses were coded as missing. Using both main parental respondent and partner variable information (where relevant), a binary variable was generated representing smoking habits across both parents in the household with categories 1+ smoker parents and non-smoker parents. For lone parents, their smoking status was captured. For 2 parent HHs if 1 parent was missing smoking status, the present parent's smoking status was captured. If both parents were missing smoking status, the variable was classified as missing. If a lone parent was missing smoking status, the variable was classified as missing.
Parenting style	MCS 5 (11 years)	Parental interview 1. Whether parent has rules for how early or late participant may watch TV & films, use a computer, access the internet, or play electronic games 2. Whether parent has rules about the kinds of programmes or films participant can watch, electronic games they may play, or internet sites they can access	Yes/No/Don't know/Refused/Not applicable	Binary composite variable Don't know, refused, and not applicable responses were coded as missing. Variables 1 and 2 were collapsed to generate a binary composite variable with categories parent has rules for how early or late participant can watch tv & films, use a computer, access the internet, or play electronic games or rules about the kinds of programmes or films, electronic games, internet sites they can watch, or access and parent does not have rules for either (Cronbach alpha=0.61).
Peer alcohol use	MCS 5 (11 years)	Self-completion online questionnaire How many of participants friends drink alcohol?	None of them Some of them/Most of them/All of them/Don't know/No answer/Not applicable	4-category variable Don't know, no answer and not applicable responses were coded as missing.

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
Urbanicity	MCS 5 (11 years)	Parental interview 1. ONS Rural Urban Classification (2005) England & Wales 2. Scottish Executive Urban Rural Classification 2005/6 (2005) Scotland 3. ONS Rural Urban Classification (2005) Northern Ireland	Variable 1: Urban > 10k-sparse/Urban > 10k-less sparse/Town and fringe – sparse/Village, hamlet, and isolated dwellings–sparse/ Town and fringe-less sparse/Village, hamlet, and isolated dwellings-less sparse Variables 2-3: Urban/Rural	Binary composite variable Collapsed variable 1 into urban and rural and combined variables 1, 2 and 3 to generate a binary variable with categories urban and rural.
Household income	MCS 5 (11 years)	Parental interview Household income (OECD Income Equivalised Quintiles-UK Whole)	Bottom/Second/Third/ Fourth/Top quintile	5-category variable No alterations were made to the existing variable.
Family structure	MCS 5 (11 years)	Parental interview Family structure	Both natural parents/ Natural mother and step-parent/Natural mother and other parent or carer/ Natural mother and adoptive parent/Natural father and step-parent/ Natural father and other parent or carer/Adoptive parents (x2)/Foster parents (x2)/ Grandparents (x2)/ Grandmother and other parent or carer/Other parents (x2)/Natural	3-category variable Categories were collapsed into natural parents, reconstituted and lone parent.

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
			mother only/Natural father only/Adoptive mother only/ Adoptive father only/Step-mother only/Other parent or carer only (foster/ sibling/relative)/ Step-father only/ Grandfather only/ Adoptive mother and step-parent	
Highest parental occupation in the household	MCS 5 (11 years)	Parental interview 1. NS-SEC 5 category 2. Whether respondent is in work or not	Variable 1: Managerial and professional/Intermediate/ Small employers and self-employed/Lower supervisory and technical/ Semi routine and routine/ Not applicable Variable 2: Respondent is in work or on leave/ Respondent is not in work nor on leave/Not applicable	6-category composite variable Variable 1 and 2 not applicable responses were coded as missing. Variable 1 and variable 2 were combined to give NS-SEC 5 category variable with an additional category representing unemployed respondents for both the main parental respondent and partner respondent (where applicable). The highest occupation of both parents in the household (where relevant) was then used for analysis. For lone parents, their occupation was captured. For 2 parent HHs if 1 parent was missing occupation, the present parent's occupation was captured. If both parents were missing occupation, the variable was classified as missing. If a lone parent was missing occupation, the variable was classified as missing.
Highest parental education in the household	MCS 5 (11 years)	Parental interview NVQ equivalent of highest academic level across sweeps	NVQ level 5: higher degree/ NVQ level 4: first degree, diplomas in higher education/NVQ level 3: A/AS/S levels/NVQ level 2: O level/GCSE grades A-C/ NVQ level 1: GCSE grades D-G/Other academic	Binary variable (used in imputed analyses) The above 7-category variable was dichotomised into high parental education (NVQ level 5, level 4, and level 3) and low parental education (NVQ level 2, level 1, Other academic qualifications (incl. Overseas), and None of these). 7-category variable (used in remaining analyses) Not applicable responses were coded as missing. The highest academic education level of both parents (where relevant) was used for analysis.

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
			qualifications (incl. Overseas)/None of these/ Not applicable	For lone parents, their academic qualification was captured. For 2 parent HHs, if 1 parent was missing academic qualifications, the present parent's academic qualification was captured. If both parents were missing academic qualification, the variable was classified as missing. If a lone parent was missing academic qualification, the variable was classified as missing
Area-level deprivation	MCS 5 (11 years)	Parental interview 1. IMD 2004 Overall Decile England 2. WIMD 2005 Overall Decile Wales 3. SIMD 2004 Overall Decile Scotland 4. IMD 2004 Overall Decile Northern Ireland 5. Country at interview	Variables 1-4: Most deprived/10-<20%/20-<30%/ 30-<40%/40-<50%/50-<60%/ 60-<70%/70-<80%/80-<90%/ Least deprived Variable 5: England/Wales/ Scotland/Northern Ireland	10-category composite variable Variables 1-4 were combined, and variable 5 was used to create indicator variables representing country.
Baseline binge drinking	MCS 6 (14 years)	Self-completion online questionnaire Has participant ever had 5 or more drinks at a time?	Yes/No/Don't want to answer/Don't know/Not applicable	Binary variable Don't want to answer, don't know and not applicable responses were coded as missing. No alterations were made to the remaining categories.
Baseline frequency of alcohol use past year	MCS 6 (14 years)	Self-completion online questionnaire In the last 12 months how many times has participant had an alcoholic drink?	Never/1-2 times/3-5 times/ 6-9 times/10-19 times/20-39 times/40 or more times/ Do not know/I do not wish to answer/No answer	4-category variable Do not know, I do not wish to answer, and no answer responses were coded as missing. Categories were collapsed to give never, 1-2 times, 3-5 times, and 6 or more times (representing regular drinking), as per the Centre for Longitudinal Studies (Fitzsimons and Villadsen, 2021).

Variable	MCS sweep (participant age)	Ascertainment Data item/survey question	Answer/category choices	Treatment in current study
Previous social media use	MCS 5 (11 years)	Self-completion online questionnaire How often participant visits a social networking website on the internet	Most days/At least once a week/At least once a month/Less often than once a month/Never/No answer/ Not applicable	4-category variable (used in imputed time-use diary effect modification and interaction analyses) No answer and not applicable responses were coded as missing. Categories at least once a month and less often than once a month collapsed to give at least once a month or less than once a month. No further alterations made to remaining categories. 5-category variable (used in remaining analyses) No answer and not applicable responses were coded as missing. No further alterations were made to existing categories.

Legend: Main parental respondent refers to the main parent of the participant completing the interview, and partner refers to the partner of the main respondent. Where variable structures differ between analyses (e.g., between complete case and imputed, or between the questionnaire and time-use diary), this was due to issues regarding imputation model convergence; thus, variable structures were amended as required ensuring appropriate/meaningful categorisation. Abbreviation(s): BAS=British Ability Scales; BBM=Blackberry Messenger; CGT=Cambridge Gambling Task; Hr/s=Hour/s; Incl=Including; IMD=Indices of Multiple Deprivation (England Index of Multiple Deprivation (IMD), Northern Ireland Multiple Deprivation Measure (IMD), Wales Index of Multiple Deprivation (WIMD) and Scottish Index of Multiple Deprivation (SIMD)); MCS=Millennium Cohort Study; Min/s=Minute/s; NS-SEC=The National Statistics Socio-economic Classification; NVQ=National Vocational Qualification; SDQ=Strengths and Difficulties Questionnaire; OECD=Organisation for Economic Co-operation and Development; ONS=Office for National Statistics.; and TV=Television.

Section C5 Weights used in analysis

To correct for cases having unequal probabilities of selection (due to the stratified cluster design), the MCS provides sample design weights as well as non-response weights (Fitzsimons *et al.*, 2020). The sample weights to be used depend on whether the analysis is restricted to data pertaining to a single country (MCS sweep 7: GOVWT1) or whether the analysis assesses all UK countries (MCS sweep 7: GOVWT2).

Questionnaire analyses

Area-level deprivation (and associated country-level indicator variables) was included as a confounder within the questionnaire primary analysis models; therefore, the single country analysis weight was used. Within the effect modification and interaction analysis models, as area-level deprivation was not included as a confounder, the whole UK analysis weight was used.

Time-use diary analyses

Due to the absence of an MCS time-use diary weight, for the time-use diary analyses models, we created time-use diary analyses specific weights to make the time-use diary sample representative of the entire sample. The weights also helped to account for participants which were excluded due to having ≥5 'no activity' slots recorded (therefore deemed as having unreliable diary entries) and those who did not complete the time-use diary at all.

A logistic regression approach to weighting was used when creating the weights (Johnson, 2008). Characteristics influencing a participant's ability to complete the time-use diary on both the weekday and weekend day as well as complete it reliably were identified. This was achieved by entering all identified characteristics as independent variables into a logistic regression model with the binary dependent variable 1=completed the diary on both days (and reliably thus did not have ≥5 slots recorded as 'no activity') and 0=did not complete the diary on both days reliably or did not complete at all. Characteristics not identified as significant predictors of our dependent binary variable were removed in a

sequential manner until left with a model with only significant predictors (listed below):

- Sex
- Mental health (assessed via Strengths and Difficulties Questionnaire)
- Cognitive ability (assessed via British Ability Scale II Verbal Similarities)
- Risk-taking (assessed via Cambridge Gambling Task)
- Anti-social behaviour
- Parental smoking
- Household income (assessed via Organisation for Economic Co-operation and Development Income Equivalised Quintiles)
- England country indicator variable

To ensure comparability with existing MCS weights, predictors used by the MCS when creating their non-response weights (ethnicity, age, highest parental education in the household, and family structure) were also included in the model (Mostafa and Ploubidis, 2017; Fitzsimons *et al.*, 2020).

In the final model, the predicted probabilities were obtained, and the inverse of the predicted probabilities calculated to obtain the time-use diary weight. The time-use diary weight was then multiplied by both the single country analysis weight (time-use diary weight*GOVWT1) and whole UK analysis weight (time-use diary weight*GOVWT2) to obtain the final weights to be used in the respective analyses (see above).

Section C6 Variables included within imputation models

When estimating the effect of time spent on social media (assessed via questionnaire and time-use diary) on binge drinking and frequency of alcohol use in the past month, the MCS single country analysis weight was included in the imputation models to account for the inclusion of area-level deprivation (and associated UK country indicator variables) in respective analyses.

Within imputation models (where imputed samples generated were used to assess effect modification and interaction), due to the absence of area-level deprivation in respective analyses, the MCS whole UK analysis weight was included. Additionally, an interaction term between time spent on social media and highest parental education in the household was included. Therefore, separate imputation models were run not only for each exposure but to accommodate for each analysis and the weight used.

Within imputation models, as recommended, predictive mean matching was used to account for the non-normal distribution of continuous variables instead of standard regression (Social Science Computing Operative, 2013). Where convergence was not achieved for nominal categorical variables (using multinomial and ordered logit) and binary variables (using logistic), predictive mean matching was used (Social Science Computing Operative, 2013).

Table C6.1 details the variables included within each of the imputation models.

Table C6.1. Variables included within the imputation models

Variable	Questionnaire imputed sample (n=8,987)		Questionnaire imputed sample (n=8,954)		Time-use diary imputed sample (n=2,520)		Time-use diary imputed sample (n=2,520)	
	Primary analysis		Effect modification and interaction analysis		Primary analysis		Effect modification and interaction analysis	
	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed
Time spent on social media on a normal weekday (time-use diary)	-	-	-	-	Complete	0 (0)	Complete	0 (0)
Average time spent on social media across a normal weekday and weekend day (time-use diary)	-	-	-	-	Complete	0 (0)	Complete	0 (0)
Time spent on social media on a normal weekday (questionnaire)	Ordered logit	105 (1.2)	Ordered logit	105 (1.2)	-	-	-	-
Ever binge drinking	Logistic	198 (2.2)	Logistic	197 (2.2)	Logistic	23 (0.9)	Logistic	23 (0.9)
Frequency of alcohol use in the past month	Ordered logit	349 (3.9)	Ordered logit	348 (3.9)	Ordered logit	59 (2.3)	Ordered logit	59 (2.3)
Maternal age at participant birth	Predictive mean matching	15 (0.2)	Predictive mean matching	13 (0.1)	Predictive mean matching	5 (0.2)	Predictive mean matching	5 (0.2)
Mental health	Predictive mean matching	336 (3.7)	Predictive mean matching	322 (0.0)	Complete	0 (0)	Complete	0 (0)
Previous cigarette use (also used as a proxy for previous e-cigarette use)	Logistic	261 (2.9)	Logistic	256 (2.9)	Logistic	13 (0.5)	Predictive mean matching	13 (0.5)
Previous alcohol use	Logistic	346 (3.9)	Logistic	340 (3.8)	Logistic	33 (1.3)	Predictive mean matching	33 (1.3)
Average days/week of in-person activity	Predictive mean matching	48 (0.5)	Predictive mean matching	34 (0.4)	Predictive mean matching	4 (0.2)	Predictive mean matching	4 (0.2)
Cognitive ability	Predictive mean matching	121 (1.3)	Predictive mean matching	120 (1.3)	Complete	0 (0)	Complete	0 (0)

Variable	Questionnaire imputed sample (n=8,987)		Questionnaire imputed sample (n=8,954)		Time-use diary imputed sample (n=2,520)		Time-use diary imputed sample (n=2,520)	
	Primary analysis		Effect modification and interaction analysis		Primary analysis		Effect modification and interaction analysis	
	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed
Risk-taking	Predictive mean matching	420 (4.7)	Predictive mean matching	418 (4.7)	Complete	0 (0)	Complete	0 (0)
Anti-social behaviour	Logistic	314 (3.5)	Logistic	312 (3.5)	Complete	0 (0)	Complete	0 (0)
Peer alcohol use	Ordered logit	1,370 (15.2)	Ordered logit	1,362 (15.2)	Ordered logit	320 (1.7)	Ordered logit	320 (1.7)
Parental cigarette use (also used as a proxy for parental e-cigarette use)	Logistic	28 (0.3)	Logistic	14 (0.2)	Complete	0 (0)	Complete	0 (0)
Parental alcohol use	Predictive mean matching	314 (3.5)	Predictive mean matching	298 (3.3)	Predictive mean matching	10 (0.4)	Ordered logit	10 (0.4)
Parenting style	Logistic	46 (0.5)	Logistic	32 (0.4)	Logistic	3 (0.1)	Predictive mean matching	3 (0.1)
Urbanicity	Logistic	1,476 (16.4)	Logistic	1,470 (16.4)	Logistic	320 (12.7)	Logistic	320 (12.7)
Highest parental occupation in the household	Ordered logit	121 (1.3)	Ordered logit	107 (1.2)	Ordered logit	24 (1.0)	Ordered logit	24 (1.0)
Highest parental education in the household	Logistic	33 (0.4)	Complete: interaction by()	0 (0)[a]	Complete	0 (0)	Complete: interaction by()	0 (0)
Area-level deprivation	Ordered logit	5 (0.1)	Ordered logit	5 (0.1)	Ordered logit	1 (0.0)	Ordered logit	1 (0.0)
Baseline binge drinking	Logistic	237 (2.6)	-	-	Logistic	22 (0.9)	-	-
Baseline frequency of alcohol use in the past year	Ordered logit	235 (2.7)	-	-	Ordered logit	20 (0.8)	-	-
Previous social media use	Ordered logit	202 (2.2)	-	-	Ordered logit	18 (0.7)	-	-

Variable	Questionnaire imputed sample (n=8,987)		Questionnaire imputed sample (n=8,954)		Time-use diary imputed sample (n=2,520)		Time-use diary imputed sample (n=2,520)	
	Primary analysis		Effect modification and interaction analysis		Primary analysis		Effect modification and interaction analysis	
	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed	Regression model	n (%) imputed
Sex	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
Age	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
Ethnic group	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
Religion	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
Number of siblings in the household	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
Household income	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
Family structure	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
UK country indicator variable	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)	Complete	0 (0)
GOVWT1 (MCS single country weight)	Complete	0 (0)	-	-	-	-	-	-
GOVWT2 (MCS whole UK country weight)	-	-	Complete	0 (0)	-	-	-	-
Time-use diary weight*GOVWT1 (MCS single country weight)	-	-	-	-	Complete	0 (0)	-	-
Time-use diary weight*GOVWT2 (MCS whole UK country weight)	-	-	-	-	-	-	Complete	0 (0)

Legend: [a] To facilitate inclusion of interaction between time spent on social media and highest parental education in the imputation model for effect modification and interaction analyses, n=33 with missing data on highest parental education were excluded prior to imputation. Abbreviation(s): Complete=Complete variable; MCS=Millennium Cohort Study; and n=Number of participants.

Section C7 Differential effect of social media on binge drinking by socioeconomic circumstance - effect measure modification and interaction analyses

Effect modification – association between social media use and binge drinking, according to strata of parental education

We estimated risk differences (RDs) representing the absolute difference in participant binge drinking by social media use within the low and high parental education groups. Measures of effect modification on the additive scale represent the size of the absolute difference between RDs for binge drinking by social media use, within the high and low parental education groups, compared with the baseline (low parental education). A measure greater (or less) than zero indicates the presence of a positive (or negative) additive interaction.

Interaction - risk of binge drinking according to 'combinations' of social media use and parental education

We estimated RDs for participant binge drinking according to the combination of social media use and parental education (baseline: low parental education and no social media use (stratum with the lowest risk of binge drinking; Knol *et al.* (2011)). The measure of interaction represents the size of the difference between the RD in participants with (e.g.) high parental education and 1-<30 minutes social media use, compared with the RD for participants with high parental education and no social media use, plus the RD for those with low parental education and 1-<30 minutes social media use.

Additional/sensitivity analyses

When the effect modifier is a potential cause of the outcome, as is likely for parental education and participant social media use, interaction should be examined alongside effect modification; thus, interactions were also examined (Knol and VanderWeele, 2012). A key assumption in analysis of effect modification is that the exposure (in this case, social media use) is not a cause of the effect modifier (parental education). We theorise that participant social media use does not influence parental education (Vanderweele, 2009).

We report results on both additive and multiplicative scales, in line with epidemiological recommendations (Knol and VanderWeele, 2012). Using the methodology of Andersson *et al*. (2005) to supplement our investigation of additive effect measure modification and interaction, we report the relative excess risk due to interaction (RERI) for imputed adjusted estimates. Where we hypothesise the combined effect of parental education and social media use would be greater than the simple additive effects of each factor separately. In this case, the RERI would be greater than zero. Models were repeated using complete case samples.

Section C8 Characteristics of complete case and imputed samples

Table C8.1. Characteristics of complete case and imputed questionnaire samples

	Questionnaire complete case sample (n=5,317)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Time spent on social media on a normal weekday (questionnaire)				
No social media use	382	7.5 (6.6 to 8.4)	734	8.4 (7.6 to 9.1)
1 - <30 mins social media use	671	12.7 (11.7 to 13.8)	1,147	12.8 (12.0 to 13.6)
30 mins - <1 hr social media use	811	15.3 (14.2 to 16.3)	1,330	14.9 (13.9 to 15.8)
1 - <2 hrs social media use	925	17.5 (16.3 to 18.7)	1,562	17.3 (16.4 to 18.3)
≥2 hrs social media use	2,528	47.1 (45.5 to 48.8)	4,214	46.6 (45.4 to 47.8)
Time spent on social media on a normal weekday (time-use diary)				
No social media use	-	-	-	-
1 - <30 mins social media use	-	-	-	-
30 mins - <1 hr social media use	-	-	-	-
1 - <2 hrs social media use	-	-	-	-
≥2 hrs social media use	-	-	-	-
Average time spent on social media across a normal weekday and weekend day (time-use diary)				
No social media use	-	-	-	-
1 - <30 mins social media use	-	-	-	-
30 mins - <1 hr social media use	-	-	-	-
1 - <2 hrs social media use	-	-	-	-
≥2 hrs social media use	-	-	-	-

	Questionnaire complete case sample (n=5,317)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Frequency of alcohol use in the past month				
Never	1,776	29.8 (28.2 to 31.5)	3,455	32.8 (31.2 to 34.4)
1 - 2 times	1,745	34.5 (32.9 to 36.1)	2,804	33.6 (32.1 to 35.0)
3 - 5 times	1,063	21.0 (19.7 to 22.4)	1,615	19.9 (18.7 to 21.0)
≥6 times	733	14.7 (13.5 to 16.1)	1,112	13.7 (12.8 to 14.7)
Ever binge drinking				
No	2,312	39.7 (37.9 to 41.5)	4,299	42.5 (40.9 to 44.2)
Yes	3,005	60.3 (58.5 to 62.1)	4,688	57.5 (55.8 to 59.1)
Confounding variables				
Maternal age at participant birth				
Mean (SD)	29.7 (5.56)	29.9 (5.50)	29.3 (5.69)	29.4 (5.67)
Sex				
Male	2,556	48.8 (47.2 to 50.4)	4,383	49.6 (48.4 to 50.8)
Female	2,761	51.2 (49.6 to 52.8)	4,604	50.4 (49.2 to 51.6)
Age				
13 years	1,359	25.4 (23.9 to 26.8)	2,282	25.1 (23.9 to 26.2)
14 years	3,910	73.5 (72.0 to 75.0)	6,610	73.7 (72.5 to 74.8)
15 years	48	1.1 (0.7 to 1.8)	95	1.3 (0.9 to 1.6)
Ethnic group				
White	4,638	93.2 (91.7 to 94.5)	7,346	91.0 (89.3 to 92.6)
Other	679	6.8 (5.5 to 8.3)	1,641	9.0 (7.4 to 10.7)

	Questionnaire complete case sample (n=5,317)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Religion				
Religious affiliation	3,240	59.7 (57.7 to 61.7)	5,517	58.0 (56.3 to 59.7)
No religious affiliation	2,077	40.3 (38.3 to 42.3)	3,470	42.0 (40.3 to 43.7)
Mental health (SDQ total difficulties)				
Mean (SD)	6.85 (5.30)	6.86 (5.43)	7.41 (5.68)	7.46 (5.89)
Previous cigarette use (also used as a proxy for previous e-cigarette use)				
No	5,232	98.3 (97.9 to 98.7)	8,800	97.8 (97.4 to 98.3)
Yes	85	1.6 (1.3 to 2.1)	187	2.2 (1.7 to 2.6)
Previous alcohol use				
No	4,761	88.9 (87.8 to 89.9)	8,001	88.1 (87.2 to 89.0)
Yes	556	11.1 (10.1 to 12.2)	986	11.9 (11.0 to 12.8)
Average days/week of in-person activities				
Mean (SD)	3.06 (1.52)	3.14 (1.50)	2.93 (1.56)	3.04 (1.54)
Cognitive ability				
Mean (SD)	60.3 (9.32)	60.2 (9.36)	59.4 (10.0)	59.6 (9.87)
Risk-taking				
Mean (SD)	0.52 (0.17)	0.52 (0.17)	0.52 (0.17)	0.52 (0.17)
Anti-social behaviour				
No	4,308	80.9 (79.5 to 82.2)	7,158	79.7 (78.6 to 80.8)
Yes	1,009	19.1 (17.8 to 20.5)	1,829	20.3 (19.2 to 21.4)
Peer alcohol use				
None of them drink alcohol	4,892	91.7 (90.8 to 92.6)	8,244	91.3 (90.5 to 92.1)

	Questionnaire complete case sample (n=5,317)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Some of them drink alcohol	372	7.3 (6.5 to 8.2)	644	7.6 (6.9 to 8.4)
Most of them drink alcohol	29	0.6 (0.4 to 0.9)	57	0.7 (0.4 to 0.9)
All of them drink alcohol	24	0.4 (0.2 to 0.7)	40	0.4 (0.2 to 0.6)
Number of siblings of participant in the household				
0	538	10.7 (9.7 to 11.7)	984	11.7 (10.9 to 12.5)
1	2,513	48.3 (46.8 to 49.8)	4,018	46.9 (45.5 to 48.3)
2 - 3	2,059	37.3 (35.8 to 38.8)	3,490	37.0 (35.8 to 38.3)
4 - 5	180	3.2 (2.6 to 4.0)	435	3.9 (3.3 to 4.5)
6 - 10	27	0.5 (0.3 to 0.8)	60	0.5 (0.3 to 0.6)
Parental alcohol use				
Never	1,049	15.8 (14.5 to 17.2)	2,224	18.4 (16.9 to 19.9)
Monthly or less	1,304	24.9 (23.3 to 26.6)	2,133	24.8 (23.5 to 26.2)
2 - 4 times a month	1,165	22.8 (21.4 to 24.1)	1,854	22.5 (21.4 to 23.5)
2 - 3 times a week	1,315	26.4 (24.8 to 28.0)	2,026	24.9 (23.6 to 26.2)
≥4 times a week	484	10.1 (9.1 to 11.3)	749	9.4 (8.6 to 10.3)
Parental cigarette use (also used as a proxy for parental e-cigarette use)				
Non-smoker parents	3,857	73.4 (71.7 to 75.1)	6,416	72.1 (70.7 to 73.5)
1+ smoker parents	1,460	26.6 (24.9 to 28.3)	2,571	27.9 (26.5 to 29.3)
Parenting style				
Parent has rules	5,194	97.3 (96.5 to 98.0)	8,726	97.1 (96.6 to 97.6)
Parent does not have rules	123	2.7 (2.0 to 3.5)	261	2.9 (2.4 to 3.4)
Urbanicity				

	Questionnaire complete case sample (n=5,317)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Urban	3,892	69.1 (65.1 to 72.8)	6,818	71.0 (67.8 to 74.2)
Rural	1,425	30.9 (27.2 to 34.9)	2,169	29.0 (25.8 to 32.2)
Household income				
Top quintile	1,414	29.9 (27.5 to 32.4)	2,075	27.1 (25.0 to 29.1)
Fourth quintile	1,333	26.3 (24.6 to 28.0)	2,062	25.0 (23.6 to 26.4)
Third quintile	1,168	20.9 (19.6 to 22.3)	1,883	20.6 (19.4 to 21.8)
Second quintile	831	14.3 (13.0 to 15.7)	1,514	15.4 (14.4 to 16.5)
Bottom quintile	571	8.6 (7.5 to 9.9)	1,453	11.9 (10.5 to 13.3)
Family structure				
Natural parents	3,879	71.2 (69.3 to 73.0	6,397	69.2 (67.6 to 70.8)
Reconstituted	470	9.4 (8.4 to 10.6)	810	10.0 (9.1 to 10.9)
Lone parent	968	19.4 (17.9 to 20.9)	1,780	20.9 (19.7 to 22.1)
Highest parental occupation in the household				
Managerial and professional	2,743	53.0 (50.6 to 55.3)	4,166	49.0 (46.9 to 51.1)
Intermediate	651	12.6 (11.5 to 13.7)	1,069	12.6 (11.7 to 13.5)
Small employers and self-employed	483	9.0 (8.1 to 10.0)	873	9.2 (8.4 to 10.0)
Lower supervisory and technical	205	3.6 (3.1 to 4.3)	370	3.9 (3.4 to 4.4)
Semi routine and routine	591	10.9 (9.7 to 12.3)	1,129	12.0 (10.9 to 13.0)
Unemployed	664	10.9 (9.8 to 12.1)	1,380	13.4 (12.2 to 14.5)
Highest parental education in the household				
NVQ level 5 - higher degree	904	17.2 (15.6 to 18.9)	5,168	59.1 (56.9 to 61.4)
NVQ level 4 - first degree, diplomas in higher education	1,985	37.5 (35.7 to 39.3)		

	Questionnaire complete case sample (n=5,317)		Questionnaire imputed sample (n=8,987)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
NVQ level 3 - A/AS/S levels	458	8.8 (7.9 to 9.8)		
NVQ level 2 - O level/GCSE grades A-C	1,320	25.5 (23.5 to 27.5)		
NVQ level 1 - GCSE grades D-G	276	4.9 (4.2 to 5.8)	3,819	40.9 (38.6 to 43.1)
Other academic qualifications (incl. Overseas)	99	1.4 (1.1 to 1.8)		
None of the above	275	4.7 (4.0 to 5.5)		
Area-level deprivation				
Least deprived	748	16.7 (13.9 to 19.9)	1,037	14.2 (11.8 to 16.7)
80 - <90%	648	14.5 (12.7 to 16.6)	929	13.0 (11.3 to 14.6)
70 - <80%	534	11.0 (9.5 to 12.8)	795	10.2 (8.8 to 11.6)
60 - <70%	533	10.7 (9.4 to 12.1)	809	10.3 (9.0 to 11.6)
50 - <60%	534	10.7 (9.1 to 12.6)	866	10.8 (9.3 to 12.3)
40 - <50%	525	9.2 (7.9 to 10.7)	833	9.2 (8.0 to 10.4)
30 - <40%	479	7.9 (6.8 to 9.1)	822	8.3 (7.3 to 9.3)
20 - <30%	474	7.7 (6.6 to 9.0)	901	8.6 (7.4 to 9.7)
10 - <20%	515	7.3 (6.2 to 8.5)	999	8.4 (7.3 to 9.4)
Most deprived	327	4.3 (3.5 to 5.4)	996	7.0 (5.7 to 8.4)

Legend: [a] Weighted to account attrition and sample design at the MCS 7 (17 year survey). Values may not add up due to rounding. Abbreviation(s): -=Not measured; CI=Confidence interval; GCSE=General Certificate in Secondary Education; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; NVQ=National Vocational Qualifications; SD=Standard deviation; and SDQ=Strengths and Difficulties Questionnaire.

Table C8.2. Characteristics of complete case and imputed time-use diary samples

	Time-use diary complete case sample (n=1,826)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Time spent on social media on a normal weekday (questionnaire)				
No social media use	-	-	-	-
1 - <30 mins social media use	-	-	-	-
30 mins - <1 hr social media use	-	-	-	-
1 - <2 hrs social media use	-	-	-	-
≥2 hrs social media use	-	-	-	-
Time spent on social media on a normal weekday (time-use diary)				
No social media use	1,110	62.7 (60.2 to 65.2)	1,548	63.8 (61.7 to 65.9)
1 - <30 mins social media use	168	8.4 (7.2 to 9.8)	230	8.3 (7.2 to 9.5)
30 mins - <1 hr social media use	195	9.7 (8.3 to 11.3)	269	9.9 (8.6 to 11.1)
1 - <2 hrs social media use	197	10.1 (8.8 to 11.7)	277	10.2 (8.9 to 11.5)
≥2 hrs social media use	156	9.0 (7.4 to 11.0)	196	7.8 (6.5 to 9.1)
Average time spent on social media across a normal weekday and weekend day (time-use diary)				
No social media use	831	47.2 (44.6 to 49.9)	1,178	49.0 (46.8 to 51.2)
1 - <30 mins social media use	355	18.8 (16.7 to 21.1)	497	18.8 (17.1 to 20.6)
30 mins - <1 hr social media use	294	14.5 (12.9 to 16.3)	390	14.3 (12.7 to 15.8)
1 - <2 hrs social media use	200	11.1 (9.4 to 13.1)	276	10.7 (9.2 to 12.2)
≥2 hrs social media use	146	8.4 (6.9 to 10.1)	179	7.2 (5.9 to 8.5)
Frequency of alcohol use in the past month				
Never	607	32.7 (30.0 to 35.5)	895	34.6 (32.1 to 37.0)
1 - 2 times	639	35.1 (32.5 to 37.9)	849	34.2 (32.1 to 36.4)

	Time-use diary complete case sample (n=1,826)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
3 - 5 times	347	18.7 (16.8 to 20.9)	472	18.5 (16.8 to 20.3)
≥6 times	233	13.4 (11.6 to 15.5)	304	12.7 (11.0 to 14.3)
Ever binge drinking				
No	840	43.9 (41.2 to 46.7)	1,190	45.5 (43.1 to 48.0)
Yes	986	56.1 (53.3 to 58.8)	1,330	54.5 (52.0 to 56.9)
Confounding variables				
Maternal age at participant birth				
Mean (SD)	30.3 (5.16)	30.0 (5.30)	30.0 (5.29)	29.7 (5.46)
Sex				
Male	802	49.7 (46.9 to 52.5)	1,123	49.9 (47.5 to 52.3)
Female	1,024	50.3 (47.5 to 53.1)	1,397	50.1 (47.7 to 52.5)
Age				
13 years	467	24.7 (22.3 to 27.2)	658	26.2 (23.9 to 28.5)
14 years	1,347	74.7 (72.1 to 77.1)	1,843	73.0 (70.7 to 75.4)
15 years	12	0.6 (0.3 to 1.2)	19	0.8 (0.4 to 1.2)
Ethnic group				
White	1,646	92.7 (90.5 to 94.5)	2,228	92.1 (90.2 to 94.0)
Other	180	7.3 (5.5 to 9.5)	292	7.9 (6.0 to 9.8)
Religion				
Religious affiliation	1,142	59.4 (56.5 to 62.3)	1,577	58.7 (56.1 to 61.2)
No religious affiliation	684	40.6 (37.8 to 43.5)	943	41.3 (38.8 to 43.9)

	Time-use diary complete case sample (n=1,826)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Mental health (SDQ total difficulties)				
Mean (SD)	6.02 (4.73)	6.82 (5.36)	6.23 (4.93)	7.22 (5.81)
Previous cigarette use (also used as a proxy for previous e-cigarette use)				
No	1,809	98.6 (97.6 to 99.2)	2,495	98.4 (97.7 to 99.2)
Yes	17	1.4 (0.8 to 2.4)	26	1.6 (0.8 to 2.3)
Previous alcohol use				
No	1,667	90.0 (88.2 to 91.5)	2,282	89.4 (87.8 to 91.0)
Yes	159	10.0 (8.5 to 11.8)	238	10.6 (9.0 to 12.2)
Average days/week of in-person activities				
Mean (SD)	3.13 (1.52)	3.15 (1.51)	3.07 (1.53)	3.07 (1.53)
Cognitive ability				
Mean (SD)	61.6 (8.67)	60.4 (8.77)	61.3 (8.84)	60.1 (9.02)
Risk-taking				
Mean (SD)	0.50 (0.17)	0.52 (0.17)	0.50 (0.17)	0.52 (0.17)
Anti-social behaviour				
No	1,545	80.7 (78.2 to 83.0)	2,131	80.4 (78.1 to 82.6)
Yes	281	19.3 (17.0 to 21.8)	389	19.6 (17.4 to 21.9)
Peer alcohol use				
None of them drink alcohol	1,709	91.7 (89.8 to 93.3)	2,342	91.2 (89.5 to 93.0)
Some of them drink alcohol	104	7.3 (5.8 to 9.3)	159	7.8 (6.1 to 9.4)
Most of them drink alcohol	10	0.8 (0.4 to 1.7)	14	0.8 (0.2 to 1.4)

	Time-use diary complete case sample (n=1,826)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
All of them drink alcohol	3	0.2 (0.1 to 0.5)	4	0.2 (-0.0 to 0.3)
Number of siblings of participant in the household				
0	170	9.5 (8.1 to 11.1)	266	11.5 (9.9 to 13.1)
1	911	46.8 (44.2 to 49.4)	1,237	46.3 (44.0 to 48.5)
2 - 3	693	39.8 (37.0 to 42.5)	929	38.1 (35.8 to 40.5)
4 - 5	45	3.3 (2.1 to 5.0)	88	4.1 (2.9 to 5.3)
6 - 10	7	0.7 (0.3 to 1.8)		
Parental alcohol use				
Never	17.0 (15.0 to 19.2)	477	18.1 (16.1 to 20.1)	17.0 (15.0 to 19.2)
Monthly or less	24.0 (21.5 to 26.7)	567	23.9 (21.7 to 26.0)	24.0 (21.5 to 26.7)
2 - 4 times a month	22.5 (20.4 to 24.7)	586	23.1 (21.3 to 24.9)	22.5 (20.4 to 24.7)
2 - 3 times a week	25.1 (22.8 to 27.6)	637	24.4 (22.3 to 26.6)	25.1 (22.8 to 27.6)
≥4 times a week	11.4 (9.8 to 13.3)	253	10.5 (9.2 to 11.9)	11.4 (9.8 to 13.3)
Parental cigarette use (also used as a proxy for parental e-cigarette use)				
Non-smoker parents	1,434	73.3 (70.6 to 75.9)	1,949	72.1 (69.7 to 74.5)
1+ smoker parents	392	26.7 (24.1 to 29.4)	571	27.9 (25.5 to 30.3)
Parenting style				
Parent has rules	1,783	97.6 (96.6 to 98.3)	2,453	97.5 (96.8 to 98.2)
Parent does not have rules	43	2.4 (1.7 to 3.5)	67	2.5 (1.8 to 3.2)
Urbanicity				
Urban	1,288	68.7 (64.1 to 73.1)	1,825	70.7 (66.7 to 74.7)

	Time-use diary complete case sample (n=1,826)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
Rural	538	31.3 (26.9 to 35.9)	695	29.3 (25.3 to 33.3)
Household income				
Top quintile	594	29.7 (27.0 to 32.6)	776	28.0 (25.6 to 30.4)
Fourth quintile	522	26.7 (24.2 to 29.4)	658	25.6 (23.4 to 27.8)
Third quintile	390	21.7 (19.8 to 23.8)	533	21.6 (19.7 to 23.5)
Second quintile	211	13.9 (11.9 to 16.3)	312	14.5 (12.6 to 16.4)
Bottom quintile	109	7.9 (6.0 to 10.2)	214	10.4 (8.4 to 12.3)
Family structure				
Natural parents	1,454	71.8 (68.7 to 74.6)	1,969	69.3 (66.8 to 71.9)
Reconstituted	126	8.3 (6.7 to 10.2)	178	9.1 (7.4 to 10.8)
Lone parent	246	19.9 (17.5 to 22.7)	373	21.6 (19.2 to 23.9)
Highest parental occupation in the household				
Managerial and professional	1,036	51.3 (47.8 to 54.8)	1,382	49.3 (46.3 to 52.4)
Intermediate	247	14.3 (12.4 to 16.4)	329	13.8 (12.1 to 15.5)
Small employers and self-employed	170	10.0 (8.3 to 11.9)	231	9.3 (7.8 to 10.8)
Lower supervisory and technical	48	3.3 (2.2 to 4.8)	79	3.5 (2.5 to 4.5)
Semi routine and routine	177	10.9 (9.0 to 13.1)	262	11.5 (9.8 to 13.3)
Unemployed	148	10.3 (8.4 to 12.5)	237	12.6 (10.6 to 14.5)
Highest parental education in the household				
NVQ level 5 - higher degree	350	16.0 (14.0 to 18.2)	1,712	61.6 (58.5 to 64.7)
NVQ level 4 - first degree, diplomas in higher education	759	38.6 (35.8 to 41.5)		

	Time-use diary complete case sample (n=1,826)		Time-use diary imputed sample (n=2,520)	
Characteristic	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**	**n/mean & SD**	**Weighted % (95% CI)/ mean & SD[a]**
NVQ level 3 - A/AS/S levels	180	9.9 (8.5 to 11.5)		
NVQ level 2 - O level/GCSE grades A-C	392	25.4 (22.6 to 28.5)		
NVQ level 1 - GCSE grades D-G	73	4.7 (3.6 to 6.1)	808	38.4 (35.3 to 41.5)
Other academic qualifications (incl. Overseas)	26	1.6 (1.0 to 2.4)		
None of the above	46	3.8 (2.6 to 5.5)		
Area-level deprivation				
Least deprived	296	16.7 (13.6 to 20.4)	353	14.5 (11.7 to 17.3)
80 - <90%	243	14.9 (12.5 to 17.7)	306	13.4 (11.2 to 15.5)
70 - <80%	205	11.3 (9.2 to 13.8)	270	10.9 (8.9 to 12.8)
60 - <70%	206	11.3 (9.5 to 13.4)	275	11.4 (9.7 to 13.2)
50 - <60%	176	10.3 (8.3 to 12.8)	247	10.3 (8.4 to 12.2)
40 - <50%	190	10.3 (8.2 to 12.9)	260	10.1 (8.2 to 12.1)
30 - <40%	165	8.3 (6.7 to 10.3)	227	8.9 (7.2 to 10.6)
20 - <30%	136	7.3 (5.8 to 9.0)	213	8.5 (6.9 to 10.1)
10 - <20%	130	6.0 (4.7 to 7.5)	201	6.7 (5.4 to 7.9)
Most deprived	79	3.5 (2.6 to 4.8)	167	5.3 (3.8 to 6.8)

Legend: [a] Weighted to account for time use diary non-response at MCS 6 (14 year survey) and for attrition and sample design at the MCS 7 (17 year survey). Values may not add up due to rounding. Abbreviation(s): -=Not measured; CI=Confidence interval; GCSE=General Certificate in Secondary Education; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; NVQ=National Vocational Qualifications; SD=Standard deviation; and SDQ=Strengths and Difficulties Questionnaire.

Section C9 Effect of social media use on frequency of alcohol use in the past month and binge drinking

Table C9.1. Time spent on social media on a normal weekday on risk of (A) frequency of alcohol use in the past month (relative risk ratios), and (B) binge drinking (odds ratios) within the questionnaire imputed sample (n=8,987) (also displayed in Chapter 6)

	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]
A. Frequency of alcohol use in the past month (ref: never)			
1 - 2 times			
No social media use	23.0 (160)	0.54 (0.41 to 0.72)	0.60 (0.44 to 0.80)
1 - <30 mins	31.6 (335)	1.00	1.00
30 mins - <1 hr	33.7 (404)	1.32 (1.06 to 1.64)	1.32 (1.05 to 1.67)
1 - <2 hrs	35.9 (515)	1.79 (1.44 to 2.22)	1.80 (1.43 to 2.26)
≥2 hrs	35.0 (1,391)	1.96 (1.65 to 2.32)	2.10 (1.73 to 2.55)
3 - 5 times			
No social media use	10.0 (35)	0.48 (0.32 to 0.73)	0.55 (0.36 to 0.85)
1 - <30 mins	15.7 (89)	1.00	1.00
30 mins - <1 hr	19.2 (151)	1.59 (1.18 to 2.13)	1.69 (1.24 to 2.30)
1 - <2 hrs	22.8 (204)	2.42 (1.86 to 3.15)	2.63 (1.98 to 3.50)
≥ 2 hrs	24.1 (584)	2.75 (2.18 to 3.48)	3.45 (2.68 to 4.45)
≥6 times			
No social media use	8.5 (28)	0.63 (0.38 to 1.04)	0.71 (0.42 to 1.20)
1 - <30 mins	10.8 (61)	1.00	1.00
30 mins - <1 hr	12.9 (98)	1.53 (1.14 to 2.05)	1.62 (1.20 to 2.20)
1 - <2 hrs	14.9 (132)	2.28 (1.69 to 3.08)	2.61 (1.90 to 3.58)
≥2 hrs	17.3 (414)	3.26 (2.51 to 4.24)	4.80 (3.65 to 6.32)
	Weighted prevalence % (observed n with outcome)	**OR (95% CI)**	**AOR (95% CI)[a]**
B. Binge drinking (ref: no binge drinking)			
No social media use	28.7 (188)	0.51 (0.39 to 0.67)	0.54 (0.41 to 0.72)
1 - <30 mins	43.9 (433)	1.00	1.00
30 mins - <1 hr	53.1 (630)	1.44 (1.18 to 1.77)	1.51 (1.22 to 1.87)
1 - <2 hrs	60.5 (857)	1.96 (1.62 to 2.36)	2.06 (1.69 to 2.52)
≥2 hrs	66.7 (2,581)	2.55 (2.15 to 3.03)	3.07 (2.54 to 3.70)

Legend: Questionnaire imputed sample: n=8,987 (weighted sample: n=6,175). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table C9.2. Time spent on social media on a normal weekday on risk of (A) frequency of alcohol use in the past month (relative risk ratios), and (B) binge drinking (odds ratios) within the questionnaire imputed sample (n=8,987), stratified by sex

	Males (n=4,383)			Females (n=4,604)		
	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]
A. Frequency of alcohol use in the past month (ref: never)						
1 - 2 times						
No social media use	22.7 (113)	0.53 (0.38 to 0.74)	0.57 (0.40 to 0.81)	23.9 (47)	0.57 (0.36 to 0.90)	0.64 (0.39 to 1.06)
1 - <30 mins	31.6 (220)	1.00	1.00	31.7 (115)	1.00	1.00
30 mins - <1 hr	33.6 (243)	1.37 (1.01 to 1.84)	1.34 (0.98 to 1.82)	33.9 (160)	1.28 (0.92 to 1.78)	1.37 (0.95 to 1.97)
1 - <2 hrs	33.8 (250)	1.68 (1.27 to 2.22)	1.69 (1.24 to 2.29)	38.2 (265)	1.98 (1.40 to 2.82)	2.03 (1.40 to 2.95)
≥2 hrs	30.9 (431)	1.75 (1.34 to 2.28)	1.87 (1.39 to 2.50)	37.4 (959)	2.21 (1.66 to 2.94)	2.41 (1.77 to 3.30)
3 - 5 times						
No social media use	9.7 (44)	0.48 (0.28 to 0.82)	0.57 (0.33 to 0.99)	8.9 (17)	0.48 (0.25 to 0.91)	0.54 (0.27 to 1.09)
1 - <30 mins	14.8 (93)	1.00	1.00	14.0 (46)	1.00	1.00
30 mins - <1 hr	19.8 (146)	1.72 (1.14 to 2.60)	1.84 (1.19 to 2.85)	16.9 (75)	1.44 (0.92 to 2.24)	1.57 (0.97 to 2.54)
1 - <2 hrs	22.7 (172)	2.41 (1.73 to 3.35)	2.58 (1.77 to 3.76)	22.0 (140)	2.57 (1.65 to 4.02)	2.70 (1.67 to 4.37)
≥2 hrs	22.9 (324)	2.76 (2.00 to 3.81)	3.50 (2.48 to 4.93)	22.5 (559)	3.00 (2.03 to 4.43)	3.42 (2.23 to 5.24)
≥6 times						
No social media use	9.8 (38)	0.65 (0.37 to 1.13)	0.77 (0.43 to 1.38)	2.7 (7)	0.38 (0.14 to 1.01)	0.42 (0.16 to 1.11)
1 - <30 mins	11.1 (69)	1.00	1.00	5.4 (19)	1.00	1.00
30 mins - <1 hr	13.4 (98)	1.55 (1.10 to 2.19)	1.57 (1.09 to 2.26)	8.1 (39)	1.80 (1.02 to 3.17)	2.00 (1.11 to 3.61)
1 - <2 hrs	16.3 (125)	2.30 (1.63 to 3.25)	2.34 (1.59 to 3.42)	10.1 (68)	3.09 (1.75 to 5.45)	3.41 (1.90 to 6.14)
≥2 hrs	22.3 (303)	3.58 (2.58 to 4.96)	4.34 (3.05 to 6.16)	13.9 (345)	4.84 (2.94 to 7.97)	6.01 (3.60 to 10.0)

	Males (n=4,383)			Females (n=4,604)		
	Weighted prevalence % (observed n with outcome)	**OR (95% CI)**	**AOR (95% CI)[a]**	**Weighted prevalence % (observed n with outcome)**	**OR (95% CI)**	**AOR (95% CI)[a]**
B. Binge drinking (ref: no binge drinking)						
No social media use	32.4 (146)	0.50 (0.36 to 0.69)	0.56 (0.39 to 0.80)	19.5 (42)	0.46 (0.29 to .075)	0.51 (0.31 to 0.84)
1 - <30 mins	48.8 (319)	1.00	1.00	34.4 (114)	1.00	1.00
30 mins - <1 hr	59.3 (429)	1.53 (1.19 to 1.97)	1.53 (1.18 to 2.00)	43.2 (200)	1.45 (1.04 to 2.02)	1.58 (1.11 to 2.50)
1 - <2 hrs	67.3 (503)	2.16 (1.70 to 2.74)	2.16 (1.66 to 2.80)	53.2 (353)	2.17 (1.58 to 2.98)	2.18 (1.56 to 3.03)
≥2 hrs	70.4 (971)	2.50 (1.99 to 3.13)	2.67 (2.11 to 3.38)	64.5 (1,609)	3.47 (2.64 to 4.56)	3.62 (2.70 to 4.87)

Legend: Questionnaire imputed sample: n=8,987 (weighted sample: n=6,175). [a] Adjusted for ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table C9.3. Average time spent on social media across a normal weekday and weekend day on risk of (A) frequency of alcohol use in the past month (relative risk ratios), and (B) binge drinking (odds ratios) within the time-use diary imputed sample (n=2,520) (also displayed in Chapter 6)

	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]
A. Frequency of alcohol use in the past month (ref: never)			
1 - 2 times			
No social media use	31.7 (367)	0.80 (0.59 to 1.09)	0.88 (0.64 to 1.20)
1 - <30 mins	37.2 (183)	1.00	1.00
30 mins - <1 hr	38.2 (149)	1.42 (0.93 to 2.17)	1.45 (0.97 to 2.17)
1 - <2 hrs	31.9 (85)	1.03 (0.64 to 1.64)	1.02 (0.62 to 1.67)
≥2 hrs	39.0 (65)	1.26 (0.78 to 2.03)	1.48 (0.91 to 2.40)
3 - 5 times			
No social media use	17.7 (210)	1.00 (0.69 to 1.45)	1.13 (0.75 to 1.71)
1 - <30 mins	16.7 (88)	1.00	1.00
30 mins - <1 hr	20.3 (79)	1.69 (1.09 to 2.60)	1.80 (1.14 to 2.82)
1 - <2 hrs	22.2 (63)	1.60 (0.95 to 2.68)	1.71 (0.98 to 2.96)
≥2 hrs	20.0 (33)	1.44 (0.76 to 2.75)	1.94 (0.98 to 3.83)
≥6 times			
No social media use	12.4 (140)	1.18 (0.75 to 1.84)	1.15 (0.71 to 1.86)
1 - <30 mins	9.9 (50)	1.00	1.00
30 mins - <1 hr	15.5 (53)	2.15 (1.25 to 3.68)	2.50 (1.47 to 4.25)
1 - <2 hrs	15.9 (39)	1.91 (1.04 to 3.48)	2.22 (1.17 to 4.20)
≥2 hrs	11.1 (22)	1.33 (0.67 to 2.65)	2.15 (1.03 to 4.51)
	Weighted prevalence % (observed n with outcome)	**OR (95% CI)**	**AOR (95% CI)[a]**
B. Binge drinking (ref: no binge drinking)			
No social media use	50.8 (581)	0.77 (0.60 to 1.00)	0.73 (0.55 to 0.96)
1 - <30 mins	57.2 (270)	1.00	1.00
30 mins - <1 hr	58.3 (218)	1.05 (0.78 to 1.42)	1.10 (0.80 to 1.52)
1 - <2 hrs	59.6 (162)	1.10 (0.76 to 1.61)	1.13 (0.75 to 1.70)
≥2 hrs	57.1 (99)	1.00 (0.66 to 1.51)	1.33 (0.87 to 2.05)

Legend: Time-use diary imputed sample: n=2,520 (weighted sample: n=5,005). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s= Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table C9.4. Average time spent on social media across a normal weekday and weekend day on risk of (A) frequency of alcohol use in the past month (relative risk ratios), and (B) binge drinking (odds ratios) within the time-use diary imputed sample (n=2,520), stratified by sex

	Males (n=1,123)			Females (n=1,397)		
	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]
A. Frequency of alcohol use in the past month (ref: never)						
1 - 2 times						
No social media use	30.8 (216)	1.06 (0.67 to 1.68)	1.11 (0.68 to 1.79)	33.5 (151)	0.66 (0.45 to 0.99)	0.67 (0.44 to 1.01)
1 - <30 mins	31.6 (64)	1.00	1.00	41.6 (119)	1.00	1.00
30 mins - <1 hr	34.9 (42)	1.60 (0.79 to 3.25)	1.56 (0.79 to 3.11)	39.9 (107)	1.26 (0.79 to 2.01)	1.37 (0.86 to 2.20)
1 - <2 hrs	27.9 (22)	1.15 (0.45 to 2.93)	1.46 (0.56 to 3.80)	34.0 (63)	0.91 (0.56 to 1.46)	0.89 (0.53 to 1.50)
≥2 hrs	30.8 (11)	1.23 (0.44 to 3.46)	2.03 (0.71 to 5.79)	41.2 (54)	1.10 (0.64 to 1.91)	1.19 (0.66 to 2.13)
3 - 5 times						
No social media use	17.4 (126)	1.39 (0.78 to 2.48)	1.65 (0.86 to 3.14)	18.2 (85)	0.79 (0.49 to 1.26)	0.75 (0.46 to 1.24)
1 - <30 mins	13.7 (28)	1.00	1.00	19.0 (59)	1.00	1.00
30 mins - <1 hr	18.5 (22)	1.96 (0.87 to 4.38)	1.77 (0.76 to 4.15)	21.2 (57)	1.47 (0.86 to 2.50)	1.53 (0.87 to 2.71)
1 - <2 hrs	22.9 (22)	2.19 (0.82 to 5.85)	3.44 (1.27 to 9.33)	21.8 (40)	1.27 (0.72 to 2.24)	1.24 (0.67 to 2.32)
≥2 hrs	24.0 (4)	2.22 (0.40 to 12.34)	2.66 (0.71 to 9.98)	18.9 (29)	1.11 (0.61 to 2.03)	1.57 (0.76 to 3.24)
≥6 times						
No social media use	14.6 (99)	1.11 (0.60 to 2.06)	1.16 (0.61 to 2.22)	8.5 (41)	1.03 (0.58 to 1.85)	1.12 (0.58 to 2.17)
1 - <30 mins	14.3 (26)	1.00	1.00	6.8 (24)	1.00	1.00
30 mins - <1 hr	18.6 (23)	1.88 (0.84 to 4.20)	1.87 (0.84 to 4.13)	13.8 (30)	2.69 (1.29 to 5.62)	3.17 (1.58 to 6.34)
1 - <2 hrs	18.2 (13)	1.67 (0.57 to 4.85)	2.03 (0.66 to 6.22)	14.6 (26)	2.40 (1.19 to 4.82)	2.73 (1.34 to 5.57)
≥2 hrs	13.2 (5)	1.16 (0.32 to 4.20)	1.91 (0.57 to 6.46)	10.5 (17)	1.73 (0.77 to 3.89)	2.59 (1.04 to 6.46)

	Males (n=1,123)			Females (n=1,397)		
	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]
B. Binge drinking (ref: no binge drinking)						
No social media use	55.6 (385)	0.79 (0.53 to 1.16)	0.91 (0.59 to 1.40)	42.0 (197)	0.62 (0.45 to 0.86)	0.62 (0.44 to 0.88)
1 - <30 mins	61.5 (111)	1.00	1.00	53.9 (158)	1.00	1.00
30 mins - <1 hr	64.4 (78)	1.13 (0.66 to 1.95)	1.11 (0.62 to 1.98)	55.2 (140)	1.05 (0.71 to 1.56)	1.06 (0.70 to 1.60)
1 - <2 hrs	61.7 (51)	1.01 (0.49 to 2.06)	1.21 (0.59 to 2.48)	58.4 (111)	1.20 (0.80 to 1.81)	1.17 (0.73 to 1.86)
≥2 hrs	58.8 (17)	0.90 (0.33 to 2.46)	1.24 (0.51 to 3.03)	56.7 (82)	1.12 (0.72 to 1.74)	1.27 (0.78 to 2.06)

Legend: Time-use diary imputed sample: n=2,520 (weighted sample: n=5,005). [a] Adjusted for ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table C9.5. Time spent on social media on a normal weekday on risk of (A) frequency of alcohol use in the past month (relative risk ratios), and (B) binge drinking (odds ratios) within the questionnaire complete case sample (n=5,317)

	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]
A. Frequency of alcohol use in the past month (ref: never)			
1 - 2 times			
No social media use	25.6 (98)	0.60 (0.44 to 0.83)	0.62 (0.45 to 0.86)
1 - <30 mins	31.6 (212)	1.00	1.00
30 mins - <1 hr	34.5 (260)	1.36 (1.06 to 1.75)	1.33 (1.02 to 1.72)
1 - <2 hrs	35.9 (312)	1.80 (1.36 to 2.38)	1.79 (1.37 to 2.33)
≥2 hrs	36.1 (863)	2.12 (1.70 to 2.63)	2.22 (1.76 to 2.81)
3 - 5 times			
No social media use	10.0 (35)	0.48 (0.30 to 0.74)	0.51 (0.33 to 0.80)
1 - <30 mins	15.7 (89)	1.00	1.00
30 mins - <1 hr	19.2 (151)	1.53 (1.08 to 2.17)	1.56 (1.08 to 2.56)
1 - <2 hrs	22.8 (204)	2.31 (1.67 to 3.19)	2.54 (1.81 to 3.56)
≥2 hrs	24.1 (584)	2.85 (2.14 to 3.78)	3.61 (2.72 to 4.80)
≥6 times			
No social media use	8.5 (28)	0.58 (0.32 to 1.07)	0.60 (0.34 to 1.06)
1 - <30 mins	10.8 (61)	1.00	1.00
30 mins - <1 hr	12.9 (98)	1.49 (1.07 to 2.07)	1.49 (1.07 to 2.09)
1 - <2 hrs	14.9 (132)	2.19 (1.49 to 3.20)	2.55 (1.72 to 3.79)
≥2 hrs	17.3 (414)	2.97 (2.23 to 3.97)	4.45 (3.29 to 6.02)
	Weighted prevalence % (observed n with outcome)	**OR (95% CI)**	**AOR (95% CI)[a]**
B. Binge drinking (ref: no binge drinking)			
No social media use	29.3 (109)	0.47 (0.34 to 0.64)	0.46 (0.33 to 0.64)
1 - <30 mins	46.9 (284)	1.00	1.00
30 mins - <1 hr	56.5 (430)	1.47 (1.17 to 1.83)	1.52 (1.21 to 1.92)
1 - <2 hrs	62.8 (549)	1.91 (1.52 to 2.39)	2.07 (1.65 to 2.60)
≥2 hrs	69.1 (1,633)	2.53 (2.10 to 3.05)	3.21 (2.64 to 3.91)

Legend: Questionnaire complete case sample: n=5,317 (weighted sample: n=3,818). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table C9.6. Average time spent on social media across a normal weekday and weekend day on risk of (A) frequency of alcohol use in the past month (relative risk ratios), and (B) binge drinking (odds ratios) within the time-use diary complete case sample (n=1,826)

	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]
A. Frequency of alcohol use in the past month (ref: never)			
1 - 2 times			
No social media use	32.5 (269)	0.85 (0.58 to 1.24)	0.96 (0.66 to 1.40)
1 - <30 mins	37.3 (136)	1.00	1.00
30 mins - <1 hr	40.9 (116)	1.51 (0.95 to 2.41)	1.61 (1.03 to 2.51)
1 - <2 hrs	31.6 (64)	1.11 (0.62 to 1.97)	1.06 (0.61 to 1.84)
≥2 hrs	40.0 (54)	1.21 (0.70 to 2.08)	1.45 (0.84 to 2.51)
3 - 5 times			
No social media use	17.4 (142)	0.97 (0.61 to 1.52)	1.04 (0.65 to 1.66)
1 - <30 mins	17.5 (67)	1.00	1.00
30 mins - <1 hr	20.2 (62)	1.60 (0.97 to 2.64)	1.66 (1.00 to 2.77)
1 - <2 hrs	25.0 (51)	1.87 (0.99 to 3.56)	1.72 (0.92 to 3.19)
≥2 hrs	18.2 (25)	1.17 (0.55 to 2.49)	1.36 (0.69 to 2.71)
≥6 times			
No social media use	14.2 (110)	1.32 (0.76 to 2.29)	1.34 (0.76 to 2.38)
1 - <30 mins	10.5 (38)	1.00	1.00
30 mins - <1 hr	13.7 (39)	1.81 (1.00 to 3.28)	2.27 (1.26 to 4.09)
1 - <2 hrs	16.8 (29)	2.11 (1.01 to 4.40)	2.29 (1.08 to 4.86)
≥2 hrs	11.0 (17)	1.18 (0.54 to 2.59)	1.99 (0.90 to 4.43)
	Weighted prevalence % (observed n with outcome)	**OR (95% CI)**	**AOR (95% CI)[a]**
B. Binge drinking (ref: no binge drinking)			
No social media use	52.7 (415)	0.74 (0.56 to 1.00)	0.72 (0.53 to 0.99)
1 - <30 mins	60.0 (203)	1.00	1.00
30 mins - <1 hr	52.3 (166)	0.89 (0.63 to 1.27)	0.99 (0.68 to 1.44)
1 - <2 hrs	62.3 (123)	1.10 (0.69 to 1.77)	1.16 (0.73 to 1.85)
≥2 hrs	55.7 (79)	0.84 (0.54 to 1.31)	1.13 (0.72 to 1.78)

Legend: Time-use diary complete case sample: n=1,826 (weighted sample: n=3,601). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table C9.7 Comparison of estimates for time spent on social media on a normal weekday on risk of (A) frequency of alcohol use in the past month (relative risk ratios) and (B) binge drinking (odds ratios) within the questionnaire (n=8,987) and time-use diary imputed samples (n=2,520)

	Questionnaire imputed sample			Time-use diary imputed sample		
	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]
A. Frequency of alcohol use in the past month (ref: never)						
1 - 2 times						
No social media use	23.0 (160)	0.54 (0.41 to 0.72)	0.60 (0.44 to 0.80)	32.6 (505)	0.99 (0.68 to 1.44)	1.09 (0.74 to 1.61)
1 - <30 mins	31.6 (335)	1.00	1.00	33.2 (78)	1.00	1.00
30 mins - <1 hr	33.7 (404)	1.32 (1.06 to 1.64)	1.32 (1.05 to 1.67)	40.5 (98)	1.53 (0.91 to 2.56)	1.46 (0.86 to 2.50)
1 - <2 hrs	35.9 (515)	1.79 (1.44 to 2.22)	1.80 (1.43 to 2.26)	36.4 (93)	1.54 (0.90 to 2.61)	1.76 (1.00 to 3.10)
≥2 hrs	35.0 (1,391)	1.96 (1.65 to 2.32)	2.10 (1.73 to 2.55)	38.2 (75)	1.53 (0.96 to 2.45)	1.73 (1.03 to 2.90)
3 - 5 times						
No social media use	9.4 (61)	0.48 (0.32 to 0.73)	0.55 (0.36 to 0.85)	17.6 (282)	1.06 (0.65 to 1.74)	1.26 (0.74 to 2.15)
1 - <30 mins	14.5 (139)	1.00	1.00	16.7 (40)	1.00	1.00
30 mins - <1 hr	18.7 (221)	1.59 (1.18 to 2.13)	1.69 (1.24 to 2.30)	20.0 (54)	1.50 (0.85 to 2.64)	1.48 (0.79 to 2.79)
1 - <2 hrs	22.4 (311)	2.42 (1.86 to 3.15)	2.63 (1.98 to 3.50)	23.4 (64)	1.96 (1.08 to 3.55)	2.42 (1.25 to 4.66)
≥2 hrs	22.7 (883)	2.75 (2.18 to 3.48)	3.45 (2.68 to 4.45)	19.4 (33)	1.54 (0.78 to 3.05)	2.10 (1.05 to 4.21)
≥6 times						
No social media use	7.7 (45)	0.63 (0.38 to 1.04)	0.71 (0.42 to 1.20)	12.8 (181)	1.01 (0.61 to 1.68)	1.01 (0.61 to 1.67)
1 - <30 mins	9.2 (89)	1.00	1.00	12.8 (29)	1.00	1.00
30 mins - <1 hr	11.4 (138)	1.53 (1.14 to 2.05)	1.62 (1.20 to 2.20)	9.7 (31)	0.95 (0.49 to 1.82)	0.97 (0.50 to 1.88)
1 - <2 hrs	13.3 (194)	2.28 (1.69 to 3.08)	2.61 (1.90 to 3.58)	13.6 (36)	1.49 (0.77 to 2.88)	1.74 (0.91 to 3.34)
≥2 hrs	17.0 (648)	3.26 (2.51 to 4.24)	4.80 (3.65 to 6.32)	14.2 (28)	1.47 (0.69 to 3.13)	2.18 (1.01 to 4.71)

	Questionnaire imputed sample			Time-use diary imputed sample		
	Weighted prevalence % (observed n with outcome)	**OR (95% CI)**	**AOR (95% CI)[a]**	**Weighted prevalence % (observed n with outcome)**	**OR (95% CI)**	**AOR (95% CI)[a]**
B. Binge drinking (ref: no binge drinking)						
No social media use	28.7 (188)	0.51 (0.39 to 0.67)	0.54 (0.41 to 0.72)	53.1 (794)	0.81 (0.59 to 1.10)	0.75 (0.53 to 1.07)
1 - <30 mins	43.9 (433)	1.00	1.00	58.4 (131)	1.00	1.00
30 mins - <1 hr	53.1 (630)	1.44 (1.18 to 1.77)	1.51 (1.22 to 1.87)	53.8 (139)	0.83 (0.56 to 1.22)	0.79 (0.51 to 1.24)
1 - <2 hrs	60.5 (857)	1.96 (1.62 to 2.36)	2.06 (1.69 to 2.52)	57.0 (152)	0.94 (0.62 to 1.43)	1.03 (0.64 to 1.65)
≥2 hrs	66.7 (2,581)	2.55 (2.15 to 3.03)	3.07 (2.54 to 3.70)	59.1 (115)	1.03 (0.67 to 1.58)	1.19 (0.74 to 1.91)

Legend: Questionnaire imputed sample n=8,987 (weighted sample: n=6,175). Time-use diary imputed sample: n=2,520 (weighted sample: n=5,005). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table C9.8. Time spent on social media on a normal weekday on risk of (A) frequency of alcohol use in the past month (relative risk ratios), and (B) binge drinking (odds ratios) within the questionnaire imputed sample (n=8,987) with additional adjustment for baseline outcome measures and previous social media use

	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]	ARRR (95% CI)[b]	ARRR (95% CI)[c]
A. Frequency of alcohol use in the past month (ref: never)					
1 - 2 times					
No social media use	23.0 (160)	0.54 (0.41 to 0.72)	0.60 (0.44 to 0.80)	0.64 (0.47 to 0.86)	0.62 (0.46 to 0.84)
1 - <30 mins	31.6 (335)	1.00	1.00	1.00	1.00
30 mins - <1 hr	33.7 (404)	1.32 (1.06 to 1.64)	1.32 (1.05 to 1.67)	1.31 (1.03 to 1.66)	1.31 (1.04 to 1.65)
1 - <2 hrs	35.9 (515)	1.79 (1.44 to 2.22)	1.80 (1.43 to 2.26)	1.71 (1.36 to 2.16)	1.77 (1.41 to 2.22)
≥2 hrs	35.0 (1,391)	1.96 (1.65 to 2.32)	2.10 (1.73 to 2.55)	1.80 (1.48 to 2.20)	2.03 (1.67 to 2.46)
3 - 5 times					
No social media use	10.0 (35)	0.48 (0.32 to 0.73)	0.55 (0.36 to 0.85)	0.61 (0.39 to 0.96)	0.57 (0.37 to 0.88)
1 - <30 mins	15.7 (89)	1.00	1.00	1.00	1.00
30 mins - <1 hr	19.2 (151)	1.59 (1.18 to 2.13)	1.69 (1.24 to 2.30)	1.60 (1.17 to 2.18)	1.66 (1.22 to 2.26)
1 - <2 hrs	22.8 (204)	2.42 (1.86 to 3.15)	2.63 (1.98 to 3.50)	2.34 (1.75 to 3.12)	2.59 (1.94 to 3.45)
≥2 hrs	24.1 (584)	2.75 (2.18 to 3.48)	3.45 (2.68 to 4.45)	2.54 (1.96 to 3.29)	3.34 (2.59 to 4.30)
≥6 times					
No social media use	8.5 (28)	0.63 (0.38 to 1.04)	0.71 (0.42 to 1.20)	0.84 (0.49 to 1.42)	0.76 (0.45 to 1.29)
1 - <30 mins	10.8 (61)	1.00	1.00	1.00	1.00
30 mins - <1 hr	12.9 (98)	1.53 (1.14 to 2.05)	1.62 (1.20 to 2.20)	1.47 (1.07 to 2.01)	1.58 (1.17 to 2.13)
1 - <2 hrs	14.9 (132)	2.28 (1.69 to 3.08)	2.61 (1.90 to 3.58)	2.11 (1.52 to 2.93)	2.53 (1.84 to 3.47)
≥2 hrs	17.3 (414)	3.26 (2.51 to 4.24)	4.80 (3.65 to 6.32)	2.86 (2.12 to 3.87)	4.43 (3.36 to 5.82)

	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]	AOR (95% CI)[b]	AOR (95% CI)[c]
B. Binge drinking (ref: no binge drinking)					
No social media use	28.7 (188)	0.51 (0.39 to 0.67)	0.54 (0.41 to 0.72)	0.59 (0.44 to 0.79)	0.57 (0.42 to 0.76)
1 - <30 mins	43.9 (433)	1.00	1.00	1.00	1.00
30 mins - <1 hr	53.1 (630)	1.44 (1.18 to 1.77)	1.51 (1.22 to 1.87)	1.43 (1.15 to 1.79)	1.48 (1.20 to 1.83)
1 - <2 hrs	60.5 (857)	1.96 (1.62 to 2.36)	2.06 (1.69 to 2.52)	1.81 (1.46 to 2.23)	2.01 (1.64 to 2.46)
≥2 hrs	66.7 (2,581)	2.55 (2.15 to 3.03)	3.07 (2.54 to 3.70)	2.17 (1.78 to 2.65)	2.91 (2.41 to 3.51)

Legend: Questionnaire imputed sample: n=8,987 (weighted sample: n=6,175). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). [b] Additional adjustment for baseline binge drinking (age 14 years) and baseline frequency of alcohol use in the last year (age 14 years). [c] Additional adjustment for previous social media use (age 11 years). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table C9.9. Average time spent on social media across a normal weekday and weekend day on risk of (A) frequency of alcohol use in the past month (relative risk ratios), and (B) binge drinking (odds ratios) within the time-use diary imputed sample (n=2,520) with additional adjustment for baseline outcome measures and previous social media use

	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]	ARRR (95% CI)[b]	ARRR (95% CI)[c]
A. Frequency of alcohol use in the past month (ref: never)					
1 - 2 times					
No social media use	31.7 (367)	0.80 (0.59 to 1.09)	0.88 (0.64 to 1.20)	0.82 (0.60 to 1.12)	0.89 (0.65 to 1.21)
1 - <30 mins	37.2 (183)	1.00	1.00	1.00	1.00
30 mins - <1 hr	38.2 (149)	1.42 (0.93 to 2.17)	1.45 (0.97 to 2.17)	1.31 (0.87 to 1.96)	1.43 (0.96 to 2.15)
1 - <2 hrs	31.9 (85)	1.03 (0.64 to 1.64)	1.02 (0.62 to 1.67)	0.93 (0.57 to 1.50)	1.04 (0.64 to 1.69)
≥2 hrs	39.0 (65)	1.26 (0.78 to 2.03)	1.48 (0.91 to 2.40)	1.23 (0.75 to 2.02)	1.40 (0.87 to 2.30)
3 - 5 times					
No social media use	17.7 (210)	1.00 (0.69 to 1.45)	1.13 (0.75 to 1.71)	1.01 (0.66 to 1.55)	1.12 (0.74 to 1.69)
1 - <30 mins	16.7 (88)	1.00	1.00	1.00	1.00
30 mins - <1 hr	20.3 (79)	1.69 (1.09 to 2.60)	1.80 (1.14 to 2.82)	1.53 (0.97 to 2.40)	1.71 (1.09 to 2.68)
1 - <2 hrs	22.2 (63)	1.60 (0.95 to 2.68)	1.71 (0.98 to 2.96)	1.37 (0.78 to 2.40)	1.69 (0.97 to 2.94)
≥2 hrs	20.0 (33)	1.44 (0.76 to 2.75)	1.94 (0.98 to 3.83)	1.39 (0.71 to 2.70)	1.72 (0.89 to 3.35)
≥6 times					
No social media use	12.4 (140)	1.18 (0.75 to 1.84)	1.15 (0.71 to 1.86)	1.01 (0.62 to 1.66)	1.12 (0.69 to 1.79)
1 - <30 mins	9.9 (50)	1.00	1.00	1.00	1.00
30 mins - <1 hr	15.5 (53)	2.15 (1.25 to 3.68)	2.50 (1.47 to 4.25)	2.10 (1.21 to 3.62)	2.29 (1.37 to 3.84)
1 - <2 hrs	15.9 (39)	1.91 (1.04 to 3.48)	2.22 (1.17 to 4.20)	1.57 (0.82 to 3.00)	2.17 (1.13 to 4.16)
≥2 hrs	11.1 (22)	1.33 (0.67 to 2.65)	2.15 (1.03 to 4.51)	1.38 (0.63 to 2.00)	1.77 (0.83 to 3.80)

	Weighted prevalence % (observed n with outcome)	OR (95% CI)	AOR (95% CI)[a]	AOR (95% CI)[b]	AOR (95% CI)[c]
B. Binge drinking (ref: no binge drinking)					
No social media use	50.8 (581)	0.77 (0.60 to 1.00)	0.73 (0.55 to 0.96)	0.62 (0.46 to 0.84)	0.74 (0.56 to 0.97)
1 - <30 mins	57.2 (270)	1.00	1.00	1.00	1.00
30 mins - <1 hr	58.3 (218)	1.05 (0.78 to 1.42)	1.10 (0.80 to 1.52)	0.89 (0.64 to 1.24)	1.05 (0.77 to 1.45)
1 - <2 hrs	59.6 (162)	1.10 (0.76 to 1.61)	1.13 (0.75 to 1.70)	0.88 (0.57 to 1.36)	1.13 (0.75 to 1.69)
≥2 hrs	57.1 (99)	1.00 (0.66 to 1.51)	1.33 (0.87 to 2.05)	0.91 (0.58 to 1.44)	1.18 (0.77 to 1.81)

Legend: Time-use diary imputed sample: n=2,520 (weighted sample: n=5,005). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). [b] Additional adjustment for baseline binge drinking (age 14 years) and baseline frequency of alcohol use in the last year (age 14 years). [c] Additional adjustment for previous social media use (age 11 years). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Table C9.10. Time spent on social media on a normal weekday on risk of (A) frequency of alcohol use in the past month (relative risk ratios), and (B) binge drinking (odds ratios) within the questionnaire imputed sample (n=8,987) replacing '1-<30 minutes' reference category with 'no social media use'

	Weighted prevalence % (observed n with outcome)	RRR (95% CI)	ARRR (95% CI)[a]
A. Frequency of alcohol use in the past month (ref: never)			
1 - 2 times			
No social media use	23.0 (160)	1.00	1.00
1 - <30 mins	31.6 (335)	1.84 (1.39 to 2.43)	1.68 (1.25 to 2.25)
30 mins - <1 hr	33.7 (404)	2.42 (1.83 to 3.20)	2.22 (1.66 to 2.96)
1 - <2 hrs	35.9 (515)	3.29 (2.50 to 4.31)	3.02 (2.28 to 3.99)
≥2 hrs	35.0 (1,391)	3.59 (2.83 to 4.56)	3.52 (2.70 to 4.59)
3 - 5 times			
No social media use	10.0 (35)	1.00	1.00
1 - <30 mins	15.7 (89)	2.07 (1.37 to 3.13)	1.82 (1.18 to 2.81)
30 mins - <1 hr	19.2 (151)	3.29 (2.17 to 4.97)	3.07 (1.98 to 4.75)
1 - <2 hrs	22.8 (204)	5.01 (3.37 to 7.45)	4.79 (3.14 to 7.31)
≥2 hrs	24.1 (584)	5.69 (3.96 to 8.18)	6.28 (4.22 to 9.35)
≥6 times			
No social media use	8.5 (28)	1.00	1.00
1 - <30 mins	10.8 (61)	1.59 (0.96 to 2.62)	1.41 (0.84 to 2.37)
30 mins - <1 hr	12.9 (98)	2.43 (1.53 to 3.86)	2.28 (1.39 to 3.75)
1 - <2 hrs	14.9 (132)	3.63 (2.32 to 5.68)	3.67 (2.26 to 5.96)
≥2 hrs	17.3 (414)	5.18 (3.40 to 7.89)	6.75 (4.28 to 10.67)
	Weighted prevalence % (observed n with outcome)	**OR (95% CI)**	**AOR (95% CI)[a]**
B. Binge drinking (ref: no binge drinking)			
No social media use	28.7 (188)	1.00	1.00
1 - <30 mins	43.9 (433)	1.95 (1.50 to 2.55)	1.85 (1.38 to 2.46)
30 mins - <1 hr	53.1 (630)	2.82 (2.19 to 3.63)	2.79 (2.11 to 3.69)
1 - <2 hrs	60.5 (857)	3.82 (2.99 to 4.88)	3.81 (2.88 to 5.02)
≥2 hrs	66.7 (2,581)	4.98 (3.97 to 6.26)	5.66 (4.34 to 7.37)

Legend: Questionnaire imputed sample: n=8,987 (weighted sample: n=6,175). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, risk-taking, and socioeconomic circumstances (family structure, household income, highest parental education in household, highest parental occupation in household, and area-level deprivation). Values may not add up due to rounding. Abbreviation(s): AOR=Adjusted odds ratio; ARRR=Adjusted relative risk ratio; CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; OR=Odds ratio; Ref=Reference category; and RRR=Relative risk ratio.

Section C10 Differential effect of social media use on binge drinking by socioeconomic circumstance

Table C10.1. Participant binge drinking according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk differences) within the questionnaire (n=8,954) and time-use diary (n=2,520) imputed samples (also displayed in Chapter 6)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	28.1 (124/310)	31.5 (64/232)	53.3 (408/407)	47.9 (172/191)
1 - <30 mins	46.4 (296/415)	36.6 (135/295)	60.8 (201/153)	51.6 (69/75)
30 mins - <1 hr	57.1 (430/394)	47.6 (198/303)	63.1 (157/108)	49.7 (61/64)
1 - <2 hrs	63.4 (575/364)	52.7 (278/341)	61.1 (107/67)	51.6 (54/48)
≥2 hrs	69.2 (1,478/774)	61.6 (1,092/857)	52.5 (58/46)	57.3 (41/34)
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	18.3 (11.1 to 25.4; <0.0001)	5.1 (-8.1 to 18.3; 0.45)	7.4 (0.5 to 14.4; 0.037)	3.6 (-10.7 to 18.0; 0.62)
30 mins - <1 hr	28.9 (22.3 to 35.6; <0.0001)	16.1 (4.0 to 28.1; 0.009)	9.7 (2.7 to 16.8; 0.007)	1.8 (-12.5 to 16.2; 0.80)
1 - <2 hrs	35.3 (29.5 to 41.0; <0.0001)	21.2 (9.0 to 33.5; 0.001)	7.8 (-5.4 to 21.0; 0.25)	3.7 (-10.1 to 17.4; 0.60)
≥2 hrs	41.0 (35.8 to 46.3; <0.0001)	30.1 (19.2 to 41.0; <0.0001)	-0.9 (-14.1 to 12.3; 0.90)	9.4 (-8.8 to 27.6; 0.31)
Unadjusted RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	-3.4 (-14.9 to 8.2; 0.57)	Ref	5.4 (-3.2 to 14.1; 0.22)	Ref
1 - <30 mins	14.9 (3.0 to 26.9; 0.014)	5.1 (-8.1 to 18.3; 0.45)	12.8 (3.7 to 22.0; 0.006)	3.6 (-10.7 to 18.0; 0.62)
No social media use	-3.4 (-14.9 to 8.2; 0.57)	Ref	5.4 (-3.2 to 14.1; 0.22)	Ref
30 mins - <1 hr	25.6 (14.1 to 37.1; <0.0001)	16.1 (4.0 to 28.1; 0.009)	15.2 (5.6 to 24.8; 0.002)	1.8 (-12.5 to 16.2; 0.80)
No social media use	-3.4 (-14.9 to 8.2; 0.57)	Ref	5.4 (-3.2 to 14.1; 0.22)	Ref

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
1 - <2 hrs	31.9 (20.9 to 42.9; <0.0001)	21.2 (9.0 to 33.5; 0.001)	13.2 (-0.9 to 27.4; 0.067)	3.7 (-10.1 to 17.4; 0.60)
No social media use	-3.4 (-14.9 to 8.2; 0.57)	Ref	5.4 (-3.2 to 14.1; 0.22)	Ref
≥2 hrs	37.7 (26.7 to 48.7; <0.0001)	30.1 (19.2 to 41.0; <0.0001)	4.5 (-8.9 to 18.0; 0.51)	9.4 (-8.8 to 27.6; 0.31)
Unadjusted measure of additive effect modification[a] and interaction[b] (95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	13.2 (-1.3 to 27.7; 0.074)		3.8 (-11.9 to 19.4; 0.64)	
30 mins - <1 hr	12.8 (-0.8 to 26.5; 0.064)		7.9 (-7.6 to 23.4; 0.32)	
1 - <2 hrs	14.0 (0.7 to 27.4; 0.040)		4.1 (-16.3 to 24.6; 0.69)	
≥2 hrs	10.9 (-1.0 to 22.9; 0.073)		-10.3 (-32.0 to 11.4; 0.35)	
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	15.2 (8.3 to 22.1; <0.0001)	3.4 (-7.8 to 14.7; 0.55)	7.4 (0.8 to 14.0; 0.029)	2.4 (-9.7 to 14.4; 0.70)
30 mins - <1 hr	27.4 (21.2 to 33.7; <0.0001)	12.1 (1.1 to 23.1; 0.031)	10.0 (3.1 to 16.9; 0.005)	1.9 (-11.2 to 15.1; 0.77)
1 - <2 hrs	33.0 (26.9 to 39.2; <0.0001)	15.6 (4.7 to 26.4; 0.005)	8.4 (-4.4 to 21.2; 0.20)	4.6 (-8.8 to 18.0; 0.50)
≥2 hrs	40.0 (34.7 to 45.3; <0.0001)	23.8 (13.6 to 34.0; <0.0001)	6.4 (-5.9 to 18.8; 0.31)	11.7 (-2.8 to 26.2; 0.11)
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	-9.5 (-19.1 to 0.2; 0.055)	Ref	1.2 (-7.1 to 9.6; 0.77)	Ref
1 - <30 mins	5.8 (-4.5 to 16.0; 0.27)	3.4 (-7.8 to 14.7; 0.55)	8.6 (-0.4 to 17.5; 0.060)	2.4 (-9.7 to 14.4; 0.70)
No social media use	-11.3 (-20.8 to -1.8; 0.020)	Ref	1.3 (-6.6 to 9.4; 0.74)	Ref
30 mins - <1 hr	16.1 (6.4 to 25.8; 0.001)	12.1 (1.1 to 23.1; 0.031)	11.3 (1.8 to 20.8; 0.020)	1.9 (-11.2 to 15.1; 0.77)
No social media use	-8.9 (-18.6 to 0.8; 0.073)	Ref	0.8 (-7.7 to 9.3; 0.85)	Ref
1 - <2 hrs	24.2 (14.4 to 33.9; <0.0001)	15.6 (4.7 to 26.4; 0.005)	9.2 (-5.9 to 24.4; 0.23)	4.6 (-8.8 to 18.0; 0.50)
No social media use	-12.2 (-22.4 to -1.9; 0.020)	Ref	0.8 (-7.4 to 9.0; 0.85)	Ref

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
≥2 hrs	27.8 (17.8 to 37.8; <0.0001)	23.8 (13.6 to 34.0; <0.0001)	7.2 (-5.3 to 19.8; 0.26)	11.7 (-2.8 to 26.2; 0.11)
Adjusted[c] measure of additive effect modification[a] and interaction[b] (95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	11.8 (-0.6 to 24.2; 0.063)		5.0 (-8.6 to 18.6; 0.47)	
30 mins - <1 hr	15.3 (3.2 to 27.5; 0.014)		8.0 (-6.4 to 22.5; 0.27)	
1 - <2 hrs	17.5 (5.6 to 29.3; 0.004)		3.8 (-14.8 to 22.5; 0.69)	
≥2 hrs	16.2 (5.2 to 27.2; 0.004)		-5.3 (-22.7 to 12.1; 0.55)	

Legend: Questionnaire imputed sample: n=8,954 (weighted sample: n=6,976). Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727). [a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant binge drinking by time spent on social media within the high parental education group compared with baseline (low parental education group).[b] Measure of interaction on an additive scale represents the size of the difference between the RD in participants with: for example, high parental education and 1-<30 mins social media use compared with RD for participants with high parental education and no social media use plus the RD for those with low parental education and 1-<30 mins social media use. [c] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; RD=Risk differences; and Ref=Reference category.

Table C10.2. Participant binge drinking according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education within the questionnaire (n=8,954) and time-use diary (n=2,520) imputed samples, using the relative excess risk due to interaction (RERI)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	28.1 (124/310)	31.5 (64/232)	53.3 (408/407)	47.9 (172/191)
1 - <30 mins	46.4 (296/415)	36.6 (135/295)	60.8 (201/153)	51.6 (69/75)
30 mins - <1 hr	57.1 (430/394)	47.6 (198/303)	63.1 (157/108)	49.7 (61/64)
1 - <2 hrs	63.4 (575/364)	52.7 (278/341)	61.1 (107/67)	51.6 (54/48)
≥2 hrs	69.2 (1,478/774)	61.6 (1,092/857)	52.5 (58/46)	57.3 (41/34)
Adjusted[a] measure of additive effect modification and interaction (RERI; 95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	0.28 (-0.05 to 0.60; 0.095)		0.09 (-0.18 to 0.37; 0.51)	
30 mins - <1 hr	0.33 (0.02 to 0.64; 0.038)		0.16 (-0.14 to 0.45; 0.31)	
1 - <2 hrs	0.42 (0.12 to 0.71; 0.0054)		0.09 (-0.29 to 0.46; 0.66)	
≥2 hrs	0.33 (0.06 to 0.59; 0.016)		-0.14 (-0.53 to 0.25; 0.48)	

Legend: Questionnaire imputed sample: n=8,954 (weighted sample: n=6,976). Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; Ref=Reference category; and RERI=Relative excess risk due to interaction.

Table C10.3. Participant binge drinking according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk ratios) within the questionnaire (n=8,954) and time-use diary (n=2,520) imputed samples

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	28.1 (124/310)	31.5 (64/232)	53.3 (408/407)	47.9 (172/191)
1 - <30 mins	46.4 (296/415)	36.6 (135/295)	60.8 (201/153)	51.6 (69/75)
30 mins - <1 hr	57.1 (430/394)	47.6 (198/303)	63.1 (157/108)	49.7 (61/64)
1 - <2 hrs	63.4 (575/364)	52.7 (278/341)	61.1 (107/67)	51.6 (54/48)
≥2 hrs	69.2 (1,478/774)	61.6 (1,092/857)	52.5 (58/46)	57.3 (41/34)
Unadjusted RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	1.65 (1.34 to 2.03; <0.0001)	1.16 (0.78 to 1.74; 0.45)	1.14 (1.01 to 1.29; 0.035)	1.08 (0.81 to 1.43; 0.61)
30 mins - <1 hr	2.03 (1.67 to 2.46; <0.0001)	1.51 (1.06 to 2.16; 0.023)	1.18 (1.05 to 1.33; 0.006)	1.04 (0.78 to 1.39; 0.80)
1 - <2 hrs	2.25 (1.89 to 2.69; <0.0001)	1.68 (1.18 to 2.40; 0.005)	1.15 (0.92 to 1.43; 0.22)	1.08 (0.82 to 1.41; 0.60)
≥2 hrs	2.46 (2.07 to 2.92; <0.0001)	1.96 (1.40 to 2.75; <0.0001)	0.98 (0.49 to 0.58; <0.0001)	1.20 (0.86 to 1.66; 0.28)
Unadjusted RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	0.90 (0.62 to 1.30; 0.56)	Ref	1.11 (0.93 to 1.33; 0.23)	Ref
1 - <30 mins	1.48 (1.03 to 2.11; 0.033)	1.16 (0.78 to 1.74; 0.45)	1.27 (1.06 to 1.51; 0.009)	1.08 (0.81 to 1.43; 0.61)
No social media use	0.90 (0.62 to 1.30; 0.56)	Ref	1.11 (0.93 to 1.33; 0.23)	Ref
30 mins - <1 hr	1.82 (1.28 to 2.57; 0.001)	1.51 (1.06 to 2.16; 0.023)	1.32 (1.10 to 1.58; 0.003)	1.04 (0.78 to 1.39; 0.80)
No social media use	0.90 (0.62 to 1.30; 0.56)	Ref	1.11 (0.93 to 1.33; 0.23)	Ref
1 - <2 hrs	2.02 (1.44 to 2.84; <0.0001)	1.68 (1.18 to 2.40; 0.005)	1.28 (1.00 to 1.63; 0.051)	1.08 (0.82 to 1.41; 0.60)
No social media use	0.90 (0.62 to 1.30; 0.56)	Ref	1.11 (0.93 to 1.33; 0.23)	Ref
≥2 hrs	2.20 (1.57 to 3.10; <0.0001)	1.96 (1.40 to 2.75; <0.0001)	1.09 (0.84 to 1.42; 0.50)	1.20 (0.86 to 1.66; 0.28)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Unadjusted measure of multiplicative effect modification and interaction (95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	1.42 (0.92 to 2.19; 0.16)		1.06 (0.78 to 1.43; 0.71)	
30 mins - <1 hr	1.34 (0.90 to 1.99; 0.15)		1.14 (0.84 to 1.55; 0.41)	
1 - <2 hrs	1.34 (0.91 to 1.98; 0.14)		1.06 (0.73 to 1.55; 0.74)	
≥2 hrs	1.25 (0.86 to 1.82; 0.23)		0.82 (0.55 to 1.23; 0.34)	
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	1.51 (1.23 to 1.85; <0.0001)	1.11 (0.79 to 1.57; 0.54)	1.13 (1.01 to 1.27; 0.037)	1.04 (0.81 to 1.33; 0.75)
30 mins - <1 hr	1.93 (1.60 to 2.32; <0.0001)	1.37 (0.99 to 1.90; 0.054)	1.20 (1.06 to 1.35; 0.003)	1.05 (0.80 to 1.37; 0.74)
1 - <2 hrs	2.13 (1.77 to 2.57; <0.0001)	1.49 (1.09 to 2.06; 0.014)	1.17 (0.94 to 1.45; 0.15)	1.09 (0.84 to 1.41; 0.53)
≥2 hrs	2.42 (2.04 to 2.86; <0.0001)	1.77 (1.29 to 2.43; 0.001)	1.15 (0.90 to 1.47; 0.25)	1.29 (1.00 to 1.68; 0.054)
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	0.77 (0.56 to 1.05; 0.095)	Ref	1.03 (0.87 to 1.22; 0.740)	Ref
1 - <30 mins	1.16 (0.85 to 1.56; 0.35)	1.11 (0.79 to 1.57; 0.54)	1.16 (0.98 to 1.38; 0.081)	1.04 (0.81 to 1.33; 0.75)
No social media use	0.76 (0.56 to 1.03; 0.080)	Ref	1.03 (0.87 to 1.21; 0.75)	Ref
30 mins - <1 hr	1.46 (1.10 to 1.95; 0.010)	1.37 (0.99 to 1.90; 0.054)	1.23 (1.02 to 1.48; 0.028)	1.05 (0.80 to 1.37; 0.74)
No social media use	0.80 (0.58 to 1.11; 0.18)	Ref	1.02 (0.86 to 1.21; 0.83)	Ref
1 - <2 hrs	1.72 (1.28 to 2.31; <0.0001)	1.49 (1.09 to 2.06; 0.014)	1.19 (0.91 to 1.56; 0.20)	1.09 (0.84 to 1.41; 0.53)
No social media use	0.77 (0.55 to 1.09; 0.14)	Ref	1.01 (0.86 to 1.20; 0.88)	Ref
≥2 hrs	1.86 (1.36 to 2.55; <0.0001)	1.77 (1.29 to 2.43; 0.001)	1.17 (0.90 to 1.50; 0.23)	1.29 (1.00 to 1.68; 0.054)
Adjusted[a] measure of multiplicative effect modification and interaction (95% CI; *p-value*)				
No social media use	Ref		Ref	

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	Low parental education	High parental education	Low parental education
1 - <30 mins	1.35 (0.93 to 1.97; 0.11)		1.09 (0.83 to 1.42; 0.55)	
30 mins - <1 hr	1.40 (0.98 to 2.01; 0.063)		1.14 (0.86 to 1.53; 0.36)	
1 - <2 hrs	1.43 (1.00 to 2.03; 0.048)		1.08 (0.76 to 1.51; 0.68)	
≥2 hrs	1.37 (0.96 to 1.94; 0.081)		0.89 (0.64 to 1.23; 0.48)	

Legend: Questionnaire imputed sample: n=8,954 (weighted sample: n=6,976). Time-use diary imputed sample: n=2,520 (weighted sample: n=5,727). [a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; Ref=Reference category; and RR=Risk ratio.

Table C10.4. Participant binge drinking according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk differences) within the questionnaire (n=5,317) and time-use diary (n=1,826) complete case samples

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	29.3 (78/188)	35.4 (31/85)	54.2 (296/305)	54.7 (119/111)
1 - <30 mins	49.6 (205/255)	39.7 (79/132)	65.0 (159/104)	51.3 (44/48)
30 mins - <1 hr	59.3 (307/243)	54.5 (123/138)	61.5 (126/83)	44.2 (40/45)
1 - <2 hrs	64.4 (387/213)	55.5 (162/163)	56.7 (82/51)	61.6 (41/26)
≥2 hrs	71.0 (991/480)	65.5 (642/415)	48.5 (45/38)	57.3 (34/29)
Unadjusted RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	20.3 (11.3 to 29.3; <0.0001)	4.3 (-10.2 to 18.8; 0.56)	10.8 (2.5 to 19.2; 0.011)	-3.4 (-21.2 to 14.4; 0.71)
30 mins - <1 hr	30.1 (21.9 to 38.2; <0.0001)	19.1 (4.6 to 33.7; 0.010)	7.3 (-1.1 to 15.8; 0.090)	-10.5 (-25.8 to 4.9; 0.18)
1 - <2 hrs	35.2 (27.9 to 42.5; <0.0001)	20.1 (5.1 to 35.1; 0.009)	2.5 (-14.4 to 19.5; 0.77)	7.0 (-10.5 to 24.4; 0.43)
≥2 hrs	41.7 (34.8 to 48.6; <0.0001)	30.1 (17.1 to 43.2; <0.0001)	-5.7 (-20.1 to 8.7; 0.44)	2.6 (-17.5 to 22.7; 0.80)
Unadjusted RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	-6.1 (-19.6 to 7.4; 0.38)	Ref	-0.5 (-11.7 to 10.7; 0.93)	Ref
1 - <30 mins	14.2 (0.7 to 27.7; 0.039)	4.3 (-10.2 to 18.8; 0.56)	10.3 (-1.2 to 21.8; 0.078)	-3.4 (-21.2 to 14.4; 0.71)
No social media use	-6.1 (-19.6 to 7.4; 0.38)	Ref	-0.5 (-11.7 to 10.7; 0.93)	Ref
30 mins - <1 hr	24.0 (10.7 to 37.2; <0.0001)	19.1 (4.6 to 33.7; 0.010)	6.8 (-5.3 to 18.9; 0.27)	-10.5 (-25.8 to 4.9; 0.18)
No social media use	-6.1 (-19.6 to 7.4; 0.38)	Ref	-0.5 (-11.7 to 10.7; 0.93)	Ref
1 - <2 hrs	29.1 (16.0 to 42.1; <0.0001)	20.1 (5.1 to 35.1; 0.009)	2.0 (-16.7 to 20.8; 0.83)	7.0 (-10.5 to 24.4; 0.43)
No social media use	-6.1 (-19.6 to 7.4; 0.38)	Ref	-0.5 (-11.7 to 10.7; 0.93)	Ref
≥2 hrs	35.6 (23.1 to 48.2; <0.0001)	30.1 (17.1 to 43.2; <0.0001)	-6.2 (-21.2 to 8.9; 0.42)	2.6 (-17.5 to 22.7; 0.80)

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Unadjusted[c] measure of additive effect modification[a] and interaction[b] (95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	16.0 (-1.3 to 33.3; 0.069)		14.2 (-5.3 to 33.8; 0.15)	
30 mins - <1 hr	10.9 (-5.0 to 26.8; 0.18)		17.8 (1.1 to 34.4; 0.036)	
1 - <2 hrs	15.1 (-1.1 to 31.2; 0.067)		-4.4 (-29.2 to 20.3; 0.73)	
≥2 hrs	11.6 (-2.8 to 26.0; 0.12)		-8.3 (-33.1 to 16.5; 0.51)	
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	18.4 (10.4 to 26.4; <0.0001)	4.3 (-7.3 to 15.8; 0.47)	9.9 (1.8 to 17.9; 0.016)	-5.5 (-19.1 to 8.2; 0.43)
30 mins - <1 hr	29.0 (21.3 to 36.8; <0.0001)	16.4 (4.1 to 28.8; 0.009)	9.7 (2.0 to 17.4; 0.013)	-6.1 (-20.6 to 8.5; 0.42)
1 - <2 hrs	34.4 (26.9 to 41.9; <0.0001)	14.8 (2.0 to 27.6; 0.023)	2.9 (-11.7 to 17.6; 0.69)	7.9 (-7.8 to 23.6; 0.32)
≥2 hrs	41.9 (35.2 to 48.6; <0.0001)	27.5 (16.0 to 39.0; <0.0001)	1.4 (-12.8 to 15.6; 0.85)	4.9 (-10.8 to 20.5; 0.54)
Adjusted[c] RD (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	-11.9 (-22.9 to -0.8; 0.036)	Ref	-2.1 (-12.7 to 8.4; 0.69)	Ref
1 - <30 mins	6.5 (-4.7 to 17.6; 0.25)	4.3 (-7.3 to 15.8; 0.47)	7.7 (-2.9 to 18.4; 0.15)	-5.5 (-19.1 to 8.2; 0.43)
No social media use	-12.2 (-23.7 to -0.8; 0.037)	Ref	-1.7 (-11.9 to 8.5; 0.75)	Ref
30 mins - <1 hr	16.8 (5.7 to 27.9; 0.003)	16.4 (4.1 to 28.8; 0.009)	8.0 (-3.2 to 19.2; 0.16)	-6.1 (-20.6 to 8.5; 0.42)
No social media use	-10.8 (-21.4 to -0.1; 0.047)	Ref	-1.4 (-12.0 to 9.2; 0.79)	Ref
1 - <2 hrs	23.6 (12.6 to 34.7; <0.0001)	14.8 (2.0 to 27.6; 0.023)	1.5 (-15.3 to 18.4; 0.86)	7.9 (-7.8 to 23.6; 0.32)
No social media use	-12.6 (-24.1 to -1.1; 0.032)	Ref	-2.0 (-12.5 to 8.5; 0.71)	Ref
≥2 hrs	29.3 (18.6 to 40.0; <0.0001)	27.5 (16.0 to 39.0; <0.0001)	-0.6 (-14.3 to 13.2; 0.94)	4.9 (-10.8 to 20.5; 0.54)
Adjusted[c] measure of additive effect modification[a] and interaction[b] (95% CI; *p-value*)				
No social media use	Ref		Ref	

	Questionnaire complete case sample		Time-use diary complete case sample	
	High parental education	Low parental education	High parental education	Low parental education
1 - <30 mins	14.1 (-0.0 to 28.2; 0.050)		15.3 (-0.3 to 30.9; 0.054)	
30 mins - <1 hr	12.6 (-0.9 to 26.1; 0.068)		15.8 (-0.5 to 32.0; 0.058)	
1 - <2 hrs	19.6 (6.4 to 32.8; 0.004)		-4.9 (-25.9 to 16.1; 0.64)	
≥2 hrs	14.4 (1.7 to 27.1; 0.026)		-3.5 (-23.9 to 17.0; 0.74)	

Legend: Questionnaire complete case sample: n=5,317 (weighted sample: n=4,095). Time-use diary complete case sample: n=1,826 (weighted sample: n=3,902). [a] Measure of effect modification on an additive scale represents the size of the absolute difference between the RDs for participant binge drinking by time spent on social media within the high parental education group compared with baseline (low parental education group).[b] Measure of interaction on an additive scale represents the size of the difference between the RD in participants with: for example, high parental education and 1-<30 mins social media use compared with RD for participants with high parental education and no social media use plus the RD for those with low parental education and 1-<30 mins social media use. [c] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; RD=Risk differences; and Ref=Reference category.

Table C10.5. Participant binge drinking according to time spent on social media, within strata of parental education and according to 'combinations' of time spent on social media and parental education (risk ratios) within the questionnaire (n=5,317) and time-use diary (n=1,826) complete case samples

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Weighted prevalence % (observed n with outcome/without outcome)				
No social media use	29.3 (78/188)	35.4 (31/85)	54.2 (296/305)	54.7 (119/111)
1 - <30 mins	49.6 (205/255)	39.7 (79/132)	65.0 (159/104)	51.3 (44/48)
30 mins - <1 hr	59.3 (307/243)	54.5 (123/138)	61.5 (126/83)	44.2 (40/45)
1 - <2 hrs	64.4 (387/213)	55.5 (162/163)	56.7 (82/51)	61.6 (41/26)
≥2 hrs	71.0 (991/480)	65.5 (642/415)	48.5 (45/38)	57.3 (34/29)
Unadjusted RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	1.69 (1.32 to 2.18; <0.0001)	1.12 (0.75 to 1.67; 0.57)	1.20 (1.04 to 1.38; 0.011)	0.94 (0.67 to 1.32; 0.71)
30 mins - <1 hr	2.03 (1.60 to 2.57; <0.0001)	1.54 (1.06 to 2.24;.0.024)	1.14 (0.98 to 1.31; 0.087)	0.81 (0.58 to 1.13; 0.21)
1 - <2 hrs	2.20 (1.77 to 2.74; <0.0001)	1.57 (1.07 to 2.29; 0.020)	1.05 (0.78 to 1.41; 0.76)	1.13 (0.84 to 1.51; 0.42)
≥2 hrs	2.43 (1.95 to 3.02; <0.0001)	1.85 (1.30 to 2.64; 0.001)	0.90 (0.67 to 1.20; 0.45)	1.05 (0.73 to 1.49; 0.80)
Unadjusted RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	0.83 (0.55 to 1.23; 0.35)	Ref	0.99 (0.81 to 1.22; 0.93)	Ref
1 - <30 mins	1.40 (0.98 to 2.01; 0.068)	1.12 (0.75 to 1.67; 0.57)	1.19 (0.97 to 1.45; 0.089)	0.94 (0.67 to 1.32; 0.72)
No social media use	0.83 (0.55 to 1.23; 0.35)	Ref	0.99 (0.81 to 1.22; 0.93)	Ref
30 mins - <1 hr	1.68 (1.17 to 2.40; 0.005)	1.54 (1.06 to 2.24; 0.024)	1.12 (0.91 to 1.39; 0.28)	0.81 (0.58 to 1.13; 0.21)
No social media use	0.83 (0.55 to 1.23; 0.35)	Ref	0.99 (0.81 to 1.22; 0.93)	Ref
1 - <2 hrs	1.82 (1.28 to 2.59; 0.001)	1.57 (1.07 to 2.29; 0.020)	1.04 (0.74 to 1.45; 0.83)	1.13 (0.84 to 1.51; 0.42)
No social media use	0.83 (0.55 to 1.23; 0.35)	Ref	0.99 (0.81 to 1.22; 0.93)	Ref
≥2 hrs	2.01 (1.42 to 2.84; <0.0001)	1.85 (1.30 to 2.64; 0.001)	0.89 (0.66 to 1.19; 0.43)	1.05 (0.73 to 1.49; 0.80)

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
Unadjusted measure of multiplicative effect modification and interaction (95% CI; *p-value*)				
No social media use	Ref		Ref	
1 - <30 mins	1.51 (0.94 to 2.42; 0.086)		1.28 (0.88 to 1.85; 0.19)	
30 mins - <1 hr	1.31 (0.86 to 2.02; 0.21)		1.40 (0.99 to 1.99; 0.055)	
1 - <2 hrs	1.40 (0.92 to 2.14; 0.12)		0.93 (0.61 to 1.42; 0.73)	
≥2 hrs	1.31 (0.87 to 1.97; 0.19)		0.85 (0.54 to 1.35; 0.50)	
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media within strata of parental education				
No social media use	Ref	Ref	Ref	Ref
1 - <30 mins	1.60 (1.26 to 2.03; <0.0001)	1.12 (0.82 to 1.53; 0.48)	1.17 (1.02 to 1.35; 0.021)	0.89 (0.68 to 1.17; 0.40)
30 mins - <1 hr	1.96 (1.56 to 2.47; <0.0001)	1.47 (1.06 to 2.02; 0.019)	1.19 (1.04 to 1.36; 0.014)	0.87 (0.63 to 1.20; 0.39)
1 - <2 hrs	2.15 (1.72 to 2.69; <0.0001)	1.40 (1.01 to 1.94; 0.043)	1.05 (0.81 to 1.37; 0.69)	1.12 (0.86 to 1.47; 0.40)
≥2 hrs	2.44 (1.97 to 3.01; <0.0001)	1.78 (1.30 to 2.44; <0.0001)	1.03 (0.77 to 1.37; 0.86)	1.11 (0.84 to 1.48; 0.45)
Adjusted[a] RR (95% CI; *p-value*) for time spent on social media and parental education				
No social media use	0.72 (0.52 to 1.00; 0.047)	Ref	0.96 (0.79 to 1.17; 0.71)	Ref
1 - <30 mins	1.15 (0.86 to 1.54; 0.35)	1.12 (0.82 to 1.53; 0.48)	1.13 (0.94 to 1.36; 0.19)	0.89 (0.68 to 1.17; 0.40)
No social media use	0.74 (0.52 to 1.04; 0.084)	Ref	0.97 (0.80 to 1.17; 0.73)	Ref
30 mins - <1 hr	1.45 (1.08 to 1.95; 0.014)	1.47 (1.06 to 2.02; 0.019)	1.15 (0.93 to 1.41; 0.19)	0.87 (0.63 to 1.20; 0.39)
No social media use	0.75 (0.54 to 1.04; 0.084)	Ref	0.98 (0.80 to 1.19; 0.83)	Ref
1 - <2 hrs	1.61 (1.20 to 2.16; 0.002)	1.40 (1.01 to 1.94; 0.043)	1.03 (0.76 to 1.40; 0.84)	1.12 (0.86 to 1.47; 0.40)
No social media use	0.74 (0.52 to 1.06; 0.11)	Ref	0.96 (0.79 to 1.17; 0.67)	Ref
≥2 hrs	1.82 (1.34 to 2.46; <0.0001)	1.78 (1.30 to 2.44; <0.0001)	0.98 (0.74 to 1.30; 0.90)	1.11 (0.84 to 1.48; 0.45)
Adjusted[a] measure of multiplicative effect modification and interaction (95% CI; *p-value*)				
No social media use	Ref		Ref	

	Questionnaire imputed sample		Time-use diary imputed sample	
	High parental education	**Low parental education**	**High parental education**	**Low parental education**
1 - <30 mins	1.43 (0.96 to 2.11; 0.075)		1.32 (0.97 to 1.78; 0.073)	
30 mins - <1 hr	1.34 (0.93 to 1.93; 0.12)		1.37 (0.97 to 1.94; 0.078)	
1 - <2 hrs	1.53 (1.07 to 2.19; 0.019)		0.94 (0.65 to 1.36; 0.74)	
≥2 hrs	1.37 (0.95 to 1.98; 0.095)		0.92 (0.63 to 1.35; 0.68)	

Legend: Questionnaire complete case sample: n=5,317 (weighted sample: n=4,095). Time-use diary complete case sample: n=1,826 (weighted sample: n=3,902).
[a] Adjusted for sex, ethnicity, religion, peer alcohol use, parental alcohol use, parental smoking (proxy for parental e-cigarette use), parenting style, previous cigarette use (proxy for previous e-cigarette use), anti-social behaviour, previous alcohol use, urbanicity, age, number of siblings in household, maternal age at participant birth, in-person activities, cognitive ability, mental health, and risk-taking. Values may not add up due to rounding. Abbreviation(s): CI=Confidence interval; Hr/s=Hour/s; Min/s=Minute/s; n=Number of participants; Ref=Reference category; and RR=Risk ratio.

Section C11 STROBE statement - checklist of items that should be included in reports of cohort studies

Table C11.1. Completed STROBE checklist

	Item No	Recommendation	Section
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Chapter 6 Abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Chapter 6 Abstract
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Chapter 6 Introduction
Objectives	3	State specific objectives, including any prespecified hypotheses	Chapter 6 Introduction
Methods			
Study design	4	Present key elements of study design early in the paper	Chapter 6 Abstract Chapter 6 Introduction Chapter 6 Methods
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Chapter 6 Methods Chapter 6 STROBE study flow diagram
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Chapter 6 Methods Chapter 6 STROBE study flow diagram
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	Not applicable
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Chapter 6 Methods Appendix C, Section C3 Appendix C, Section C4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Chapter 6 Methods Appendix C, Section C4
Bias	9	Describe any efforts to address potential sources of bias	Chapter 6 Methods Appendix C, Section C5 Appendix C, Section C6 Appendix C, Section C7

	Item No	Recommendation	Section
Study size	10	Explain how the study size was arrived at	Chapter 6 Methods Chapter 6 Results Chapter 6 STROBE study flow diagram
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Chapter 6 Methods Appendix C, Section C4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Chapter 6 Methods Appendix C, Section C3 Appendix C, Section C5 Appendix C, Section C6
		(*b*) Describe any methods used to examine subgroups and interactions	Chapter 6 Methods Appendix C, Section C6
		(*c*) Explain how missing data were addressed	Chapter 6 Methods Appendix C, Section C7
		(*d*) If applicable, explain how loss to follow-up was addressed	Chapter 6 Methods Appendix C, Section C5 Appendix C, Section C7
		(*e*) Describe any sensitivity analyses	Chapter 6 Methods Appendix C, Section C6
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Chapter 6 Results Chapter 6 STROBE study flow diagram Appendix C, Section C9 Appendix C, Section C10
		(b) Give reasons for non-participation at each stage	Chapter 6 Methods Chapter 6 STROBE study flow diagram
		(c) Consider use of a flow diagram	Chapter 6 STROBE study flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders	Chapter 6 Results Appendix C, Section C8
		(b) Indicate number of participants with missing data for each variable of interest	Chapter 6 Methods Chapter 6 STROBE study flow diagram Appendix C, Section B7

	Item No	Recommendation	Section
		(c) Summarise follow-up time (eg, average and total amount)	Chapter 6 Methods Chapter 6 STROBE study flow diagram
Outcome data	15*	Report numbers of outcome events or summary measures over time	Chapter 6 Results Appendix C, Section C9 Appendix C, Section C10