Anger and Irritability Across Psychopathology: Implications for Alcohol Use Disorders and Suicide Risk

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Submitted in partial fulfilment of the requirements for the degree of Doctorate in Clinical Psychology

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September 2025

Table of Contents

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

I dedicate this work to my beautiful daughter, E. You mean the world to me.

This research wouldn't be possible without some amazing people who supported me along the way.

Thank you to my supervisor, Dr Jack Melson. You gave me so much support and reassurance throughout this entire process. It truly felt like a partnership putting this work together. I will always shout your praises as a phenomenally kind and encouraging supervisor. Thank you to Professor Hamish McLeod for being my research advisor and providing flexibility and guidance along the way.

Thank you to my friends and family who have been there for me during this intense period.

Saving best for last – thank you to my partner, F. You helped me in more ways I can name so that I can finish this work, and even more so in all the years you've been firmly by my side in my pursuit of becoming a clinical psychologist.

Chapter 1: Systematic Review

The Multidimensional Role of Anger in Alcohol Use Disorders: A systematic review

Prepared in accordance with the author requirements for:

Frontiers in Psychiatry – Addictive Disorder (Research Author Guidelines)

Abstract

Background: Alcohol use disorders (AUDs) are a significant global problem responsible for a wide range of psychological, physical and societal harms. Many risk factors have been investigated within a biopsychosocial framework as contributing to AUDs, but there is currently limited evidence examining the role of anger in AUDs, as there are at present no reviews of multidimensional anger focused on AUDs specifically. This systematic review aims to systematically identify and synthesise existing empirical literature using the State-Trait Anger Expression Inventory (STAXI; Spielberger 1988;1991) to understand the role of anger and its dimensions in those with AUDs.

Methods: Seven academic databases (PsychINFO, PsychARTICLES, Embase, Web of Science, Medline, CINAHL, Psychology and Behavioural Sciences Collection) were searched on the 12th May 2025 for this pre-registered review (PROSPERO ID: CRD420251028548). Studies using the STAXI (version I or II) with a between-groups comparison of AUD and a comparator were included for this review and narratively synthesised. Meta-analysis was not conducted due to heterogeneity of the study populations and analytical approaches. The Joanna Briggs Institute Analytical Cross-Sectional Checklist assessed quality and risk of bias of the included studies.

Results: A total of 14 articles were eligible for inclusion in the narrative synthesis. 'Trait anger' and 'anger expression' were consistently higher in those with AUDs compared to comparator groups including non-AUD patients, non-AUD veterans, non-AUD homicide offenders, non-AUD students, non-AUD intimate partner violence perpetrators and healthy individuals. Other STAXI anger dimensions, including 'state anger', 'anger control' and several subscales were not consistently higher in those with AUDs.

Conclusion: This review identified consistent evidence for higher elevated trait anger and anger expression in those with AUDs, however, inconsistencies in significant findings between groups of the other dimensions of anger highlight an important research gap. A more nuanced understanding of the role of anger in AUDs may lead to improved recognition

and treatment of AUDs. Clinical implications of this research include the need for multidimensional anger assessment in those with AUD, as well as targeted interventions focusing on ‘trait anger’ and ‘anger expression’.

Keywords: alcohol use disorders, anger, STAXI, systematic review

Introduction

Background

Alcohol use disorders (AUDs) are diagnosable mental health disorders characterised by repetitive alcohol use despite negative consequences (World Health Organisation, 2018). Depending on the classification system used, AUDs may refer to 'alcohol dependence', 'harmful patterns of alcohol use' (International Classification of Disease, ICD-11;World Health Organisation, 2022) or a broader diagnosis of 'Alcohol Use Disorder' (Diagnostic and statistical manual of mental disorders, DSM-V; American Psychiatric Association, 2013). Each of which is associated with significant cravings for alcohol, impaired control of use, increased prioritisation of use, and physiological symptoms present, such as tolerance and withdrawals (Saunders et al., 2019). Furthermore, AUDs are a significant public health concern and major risk factor for a wide range of communicable and non-communicable diseases and injuries (Shield et al., 2020). Alcohol is a leading contributor to the global burden of disease, with harmful effects extending beyond individuals' physical and mental wellbeing to a significant public health burden, including healthcare and judicial systems (Cargiulo, 2007; Schuckit, 2009; Carvalho, Heilig, Perez, Probst & Rehm, 2019).

AUDs remain one of the most undertreated mental health disorders globally (e.g. Kohn et al., 2004; Cohen et al., 2007; Mekonen et al., 2020; Rim et al., 2021; Koob, 2024). Alongside gaps in the availability of appropriate treatment services and limited awareness of and identification of potentially harmful levels of alcohol use, those with AUDs are severely stigmatised, even by comparison to other mental disorders (Schomerus et al., 2011; Killian et al., 2021). They are often the subject of stereotyped perceptions, where those with AUDs are seen as unpredictable, dangerous, violent, emotionally challenging and aggressive (Rehm et al., 2015; van Boekel et al., 2013; Carvalho et al., 2019; Schomerus et al., 2011; Killian et al., 2021). Individuals who are seen as more angry/emotionally distressed also have the added stigmatisation of being seen as being difficult to work with and having many

issues with their families, work life, health and legal difficulties (Del Vecchio & O'Leary, 2004). Deficits in emotional processing and social cognition also mean those with AUDs can struggle with emotional decoding and accurate recognition of emotions, such as anger (Le Berre, 2019). This dual-stigmatisation can create negative outcomes for the individual such as social rejection and elicits more negative emotions from others and towards oneself (Finn et al., 2023). This combination of stigmatisation could also lead to difficulties for those with AUD in seeking treatment (Finn et al, 2023; Del Vecchio & O'Leary, 2004). This highlights the hurdle for those with AUD and anger difficulties to receive dual-stigmatisation, which could impact their recovery.

Consistent with the biopsychosocial model, various factors are known to contribute to the risk of developing or worsening an AUD, such as socioeconomic factors and inequalities, early life adversity and trauma, and other physical and/or psychological comorbidities (Probst et al., 2020; Swan et al., 2021). Furthermore, a limited but growing body of research suggests that anger contributes to multiple areas of risk for individuals with AUDs. Anger, referring to a biopsychosocial emotional state or condition that is both experienced and expressed with differences in intensity and fluctuations over time (Spielberger & Reheiser, 2009), is associated with reduced inhibitory control, increased risk of violent behaviours towards self or others, as well as increasing severity of alcohol problems and consumption among individuals with AUDs (Gautier, Paubst & Maurage, 2023; Arseneault et al., 2002). Anger also negatively impacts others, with higher levels of anger and alcohol use associated with intimate partner violence (Norlander & Eckhart, 2005) and violent and aggressive crimes, including homicide (Landberg & Norstrom, 2011; Yeo et al., 2019). Anger is closely linked to related constructs such as hostility (negative and cynical beliefs and attitudes directed towards others) and aggression (destructive or punitive behaviours that results in harm to others) and may have a causal role in either (Gautier, Paubst & Maurage, 2023). Therefore, evidence that those with AUDs may also experience heightened levels of anger is

a particular concern given the potential interactive or combined effect of alcohol and anger on morbidity and mortality (Schonwetter & Janisse, 1991; Gautier, Paubst & Maurage, 2023).

Importantly, leading theories of anger emphasise its multidimensionality, which include cognitive, behavioural and regulatory components (e.g. Spielberger, 1991; Tafrate et al., 2002; Wilkowski & Robinson, 2008). Spielberger (1991) proposed the multidimensional State-Trait theory of Anger, where anger reflects both a transient state and relatively stable personality trait, and where there are important individual differences in how anger is expressed and regulated. Using a multidimensional model of anger offers a more nuanced understanding of the potential role of anger in AUDs and in due course may enable more precise and targeted interventions (Lee & DiGiuseppe, 2018). Specifically, distinguishing between anger as a relatively stable personality trait or a transient emotional state, either of which may be elevated or dysregulated in individuals with AUDs, may help clarify treatment needs and pathways. Moreover, given stigmatising beliefs that those with AUDs present a risk to safety (Rehm et al., 2015; van Boekel et al., 2013; Carvalho et al., 2019; Schomerus et al., 2011; Killian et al., 2021) enhancing understanding of how anger is expressed and controlled may also provide valuable insight for clinical formulation and risk assessment.

To date, numerous instruments have been developed to measure anger and are widely used by researchers (e.g., Buss-Perry Aggression Questionnaire, Buss & Perry, 1992; Buss-Durkee Hostility Inventory, BDHI, Buss & Durkee, 1957; State-Trait Anger Expression Inventory, STAXI I and II, Spielberger 1988, Spielberger 1991). Among these, the State-Trait Anger Expression Inventory [STAXI (I and II)] provides a multidimensional assessment of anger, capturing its experience, expression and control across both state and trait components (Spielberger 1988; Spielberger, 1991). The STAXI (I and II) comprises four reliable and valid subscales (Shahsavarani et al., 2015) and is the most extensively used dimensional measure of anger (Culhane & Morera, 2010). Other measures, such as the BDHI, have some subscales within their anger questionnaires that are linked concepts to

anger, such as ‘suspicion’ or ‘resentment’ (Buss & Durkee, 1957). This is helpful when assessing for an overall picture of someone’s mental state, but not when wanting to assess specifically for the multi-dimensions of anger. Therefore, the STAXI (I and II) is the best suited measurement to investigate the multidimensional model of anger with the potential for the widest scope used within research within the AUD population.

A limited number of systematic reviews have investigated anger in relation to alcohol related behaviour or substance use. These include reviews of aggression in the perpetration of intimate partner violence following anger management treatment or reviews of the role of anger in relation to substance use, rather than specifically AUDs (Gilchrist, Munoz & Easton, 2015; Latiano et al., 2022). Gilchrist et al. (2015) investigated individuals with AUDs who committed intimate partner violence and completed anger management treatment. They found that there was insufficient evidence to conclude that anger management treatment was effective in reducing physical aggression (Gilchrist et al., 2015). Latiano et al. (2022) carried out a meta-analysis of the role of trait-based anger in those who reported any substance use (including alcohol, Khat, Tobacco, Crack/Cocaine, Heroin and poly-substance use) and found higher levels of anger in those reporting substance use. While the review included studies of alcohol use and anger, eligibility criteria adopted a relatively low threshold of ‘any’ use of alcohol and measures of anger were limited to ‘trait based’ aspects of anger only. The review therefore offers limited insight into the potentially important role of different dimensions of anger in relation to more harmful and clinically relevant AUDs or alcohol-related problems (Latiano et al., 2022). To the author’s knowledge there has not been a systematic review of the role of different dimensions of anger in those with AUDs.

Aims

The overarching aim of the present review is to systematically identify and synthesise existing empirical literature on the role of anger and its dimensions in those with AUDs.

The specific questions the review will address are:

1. Is there an association between alcohol use disorders and anger when compared to a non-alcohol use disorder group?
2. Does the relationship of anger and alcohol use disorders differ across dimensions of anger?

Method

A systematic review of peer reviewed empirical literature reporting use of the State-Trait Anger Expression Inventory (STAXI I or II) to measure anger in those with AUDs was conducted in accordance with Preferred Reporting Item for Systematic Review and Meta-Analyses (PRISMA) guidelines (Page et al., 2021; see completed checklists in Appendix A, pp. 88). This review protocol was registered on PROSPERO: International Register of Systematic Reviews in May 2025 (registration number: CRD420251028548).

Eligibility Criteria

Peer reviewed primary empirical quantitative and mixed methods studies published in the English language from inception up until 12th May 2025 were eligible to be included in this review. Mixed method studies were eligible for inclusion, where quantitative information could be extracted. A variant of the search framework PICO was used to guide the search concepts and strategy (Schardt et al., 2007).

Participants:

Studies included participants aged 18+ years who met criteria for AUDs based on a professional diagnosis, the results of validated screening or diagnostic tools (e.g. AUDIT; Babor et al., 2001), self-identification or through treatment attendance. This broad and inclusive approach was adopted to account for differences in the terminology surrounding AUDs. This ensured that studies conducted in clinical and nonclinical service and community

settings, where different models of referral (including self-referral), assessment and treatment are common, were eligible for inclusion (Mekonen et al., 2020).

Comparator/Control:

A comparator group was required to be included in this review. Applicable studies included healthy controls or a non-AUD comparator group (e.g. substance use separate from alcohol use or abstinent from alcohol).

Outcome:

Included studies had to report a comparison of anger scores based on the STAXI (I or II) between the AUD group and the control/comparator group. Studies were eligible if they reported on any of the STAXI dimensions (state anger, trait anger, anger expression and anger control), either individually or in combination. See Table 1.1 below for detailed information of dimensions in the STAXI (I and II). STAXI I includes the main scales of state, trait, anger expression-in, anger expression-out, anger control and anger expression index. It also includes the subscales within the trait scale of angry temperament and angry reaction. STAXI II includes similar main scales and subscales as the STAXI I, but also includes subscales within the state scale of feeling angry, feel like expressing anger verbally, and feel like expressing anger physically. STAXI II also divides the anger control scale into anger control-in and anger control-out.

Table 1.1: STAXI-I and STAXI-II measures

STAXI - I Measure (Spielberger, 1988)	STAXI - II Measure (Spielberger, 1996)	Description of Domain Measured in Subscale
State (S)	State (S)	Intensity of angry feelings, how much a person feels like expressing it at a particular time
	S subscale - Feeling Angry (S-Ang/F)	Intensity of angry feelings person is currently experiencing
	S subscale - Feel like expressing anger verbally (S-Ang/V)	Intensity of current anger related to the verbal expression of anger
	S subscale - Feel like expressing anger physically (S-Ang/P)	Intensity of current anger related to the physical expression of anger
Trait (T)	Trait (T)	How often angry feelings are experienced over time
T subscale - Angry Temperament (T-Ang/T)	T subscale - Angry Temperament (T-Ang/T)	Disposition to experience anger without specific provocation
T subscale - Angry Reaction (T-Ang/R)	T subscale - Angry Reaction (T-Ang/R)	Experiencing angry feelings in settings involving frustration/negative evaluation
Anger Expression-in (AE-in)	Anger Expression-in (AE-in)	Angry feelings experienced but not expressed (i.e. suppressed)
Anger Expression-out (AE-out)	Anger Expression-out (AE-out)	Angry feelings expressed in verbally or physically aggressive behaviour
Anger Control (AC)	Anger Control-in (AC-in)	Person tries to control angry feelings by 'calming down' or 'cooling off'
	Anger Control-out (AC-out)	Person controls outward expression of angry feelings
Anger Expression Index (AEI)	Anger Expression Index (AEI)	General index of anger expression based on Anger Expression and Anger Control

Study Design:

Studies were required to be observational designs or have an observational element within the design, which compared STAXI (I or II) between an AUD group and the control/comparator group.

Exclusion:

Non-peer reviewed studies, and those reporting on polysubstance using populations where data cannot be extracted for those with an AUD specifically, were excluded. Non-peer reviewed and grey literature were ineligible to provide a stronger focus on higher quality empirical research conducted and reported according to conventional academic standards. Studies reporting on interventions or treatments that did not report pre-interventional data were also excluded, along with theoretical, secondary (e.g. review) studies, as well as dissertations/theses and conference abstracts. Studies reporting on populations in the absence of an AUD were excluded.

Search Strategy

A search of seven electronic databases was conducted for English-language articles published from date of journal inception to 12th May 2025. Databases searched included: PsychInfo, PsychArticles, Medline, Embase, CINAHL, Psychology and Behavioural Sciences Collection and Web of Science Core Collection (science citation index expanded and social science citation index). These databases were chosen as they provide good coverage of the peer reviewed psychological, social and health literature relevant to the review aims. To account for differences in terminology, conceptualisation and diagnostic classification systems used to describe AUDs, a wide range of relevant terms were identified from the existing literature. A university librarian was also consulted, leading to a wide-ranging search strategy that prioritised sensitivity. Box 1 provides an example of the search string for database Embase. The search was then adapted to the requirements of the other databases (Appendices B, pp. 95).

Search terms and their combination for database Embase.

Title or abstract: (Alcohol$ OR AUD OR ((alcohol$ or drink$) adj5 (abus$ or addict$ or crav$ or dependen$ or disease$ or disorder$ or excessiv $ or harmful or hazardo$ or heavy or intoxicat$ or use$ or misus$ or overdos$ or problem$))) AND

All fields: (STAXI OR STAXI-2 or state anger OR trait anger OR anger expression OR anger control).

Screening and Selection

Screening for this systematic review initially involved importing all records from databases into the systematic review management tool 'Rayyan' (Mourad et al., 2016). De-duplication was a combination of automatic, using the Rayyan de-duplication tool set to 95% similarity, and manual, with the main reviewer (VA) searching through any remaining duplicates on Rayyan. Reference lists of included studies were searched manually for relevant studies and citation checks were conducted for all studies included in this review by the main reviewer (VA). The reference lists of existing related systematic reviews and meta-analyses were also checked. Using Rayyan's blind review function, a randomly selected sample (10%) of the articles were screened by the second reviewer (RC) for the title and abstract screening stage, and a further randomly selected sample (10%) for the full text screening stage. Inter-rater reliability was determined by agreement on acceptance or exclusion to next stage of screening. A further random sample of 10% of the final included studies was quality assessed using the quality appraisal tool by the second reviewer (RC). Any disagreements between reviewers were discussed in an attempt to achieve consensus.

Data Extraction

Data extraction took place using a structured form. The form was used to standardise extraction of information on the following items: authors, methodology and design, sample

characteristics of both the AUD group and comparison group, STAXI anger dimensions, AUD measure used and main findings.

Synthesis

Given the methodological and clinical heterogeneity among the included studies across population characteristics, comparator/control group types, scoring and reporting of STAXI (I or II) subscales, a meta-analysis was deemed inappropriate (Popay et al., 2006; Campbell et al., 2020). Instead, a structured narrative synthesis was conducted to summarise and interpret findings across studies (Popay et al.. 2006).

The synthesis proceeded in several stages based on conceptual groupings for study and sample characteristics followed by STAXI dimensions. First, a descriptive summary of study and sample characteristics was tabulated. Key findings comparing STAXI dimensions (i.e. state anger, trait anger, anger expression, anger control) across study groups were then synthesised, highlighting patterns of commonalities/discrepancies across studies. Differences between the AUD and comparator groups were reported as statistically significant where the relevant statistical test indicated that $p<0.05$. Effect sizes were not reported in the main synthesis of findings as not all studies calculated them. Where reported, effect sizes and descriptive statistics (e.g. means or medians) are provided in Appendix D (pp 101). The synthesis also separately considered those studies reporting on all STAXI anger dimensions to capture the multidimensional anger profiles of individuals with AUDs, including the anger dimension with the largest observed difference between groups and the full profile of all dimensions. This approach facilitated a systematic comparison of findings while accommodating the diversity in measurement and sample contexts observed across the literature.

Quality Appraisal

Based on the scoping search of the literature, most studies were expected to be cross-sectional design. Quality of the included studies was therefore assessed using the checklist

from the Joanna Briggs Institute (JBI; Moola et al., 2020) for cross-sectional analytic studies (see Appendix C, pp. 96). The JBI tool prompts assessment across a range of indicators of study quality, such as clearly defined criteria and detailed description of sample and settings, valid and reliable measurement of exposure and outcomes, appropriate statistical analysis and information about confounding factors. While there are no specific scoring criteria for the JBI tool, to allow for direct descriptive comparison of studies included in this review, each 'yes' response will be scored 'one' while 'no', 'unclear', and 'not applicable' will be scored 'zero'. Total scores will be calculated with scores 0-3 rated 'low quality', 4-6 rated 'moderate quality', and '7-8' rated high quality. The findings of the quality assessment were used in the synthesis to support interpretation of study findings and gauge methodological weaknesses but will not determine whether studies are included in the final synthesis. Including all studies in the synthesis regardless of quality allows for a more comprehensive review of the current literature investigating the role of multidimensional anger in those with an AUD and allows recommendations to be made for future research.

Results

Screening

In total, searches from all seven databases yielded 1,738 results. Following de-duplication, a total of 1,040 articles remained and were screened for relevance by the main reviewer (VA) based on title and abstract. Following title and abstract screening, a total of 163 articles were then retrieved, and the full text of each article was assessed for eligibility using review inclusion and exclusion criteria. The most common reason for exclusion was not using the STAXI as the measurement tool for anger.

At title and abstract screening stage, a total of 104 articles were independently screened by the second reviewer (RC). At full text screening stage, a further 16 studies were independently screened by the second reviewer (RC). A small number of discrepancies (n=2) were identified at the title and abstract screening stage for whether the study should

be included to the next phase of screening and subsequently resolved through discussion. No discrepancies between reviewers were found at the full text screening stage.

See Figure 1.1 provides an overview of the study screening and selection process, including all exclusion reasons. Of note, the full text assessment of one study (Hwang et al.. 2014) identified major internal inconsistencies between the stated methods and results reported. The corresponding author for the study was contacted seeking clarification, but no response was received. Following discussion within the review team this article was excluded from the final synthesis.

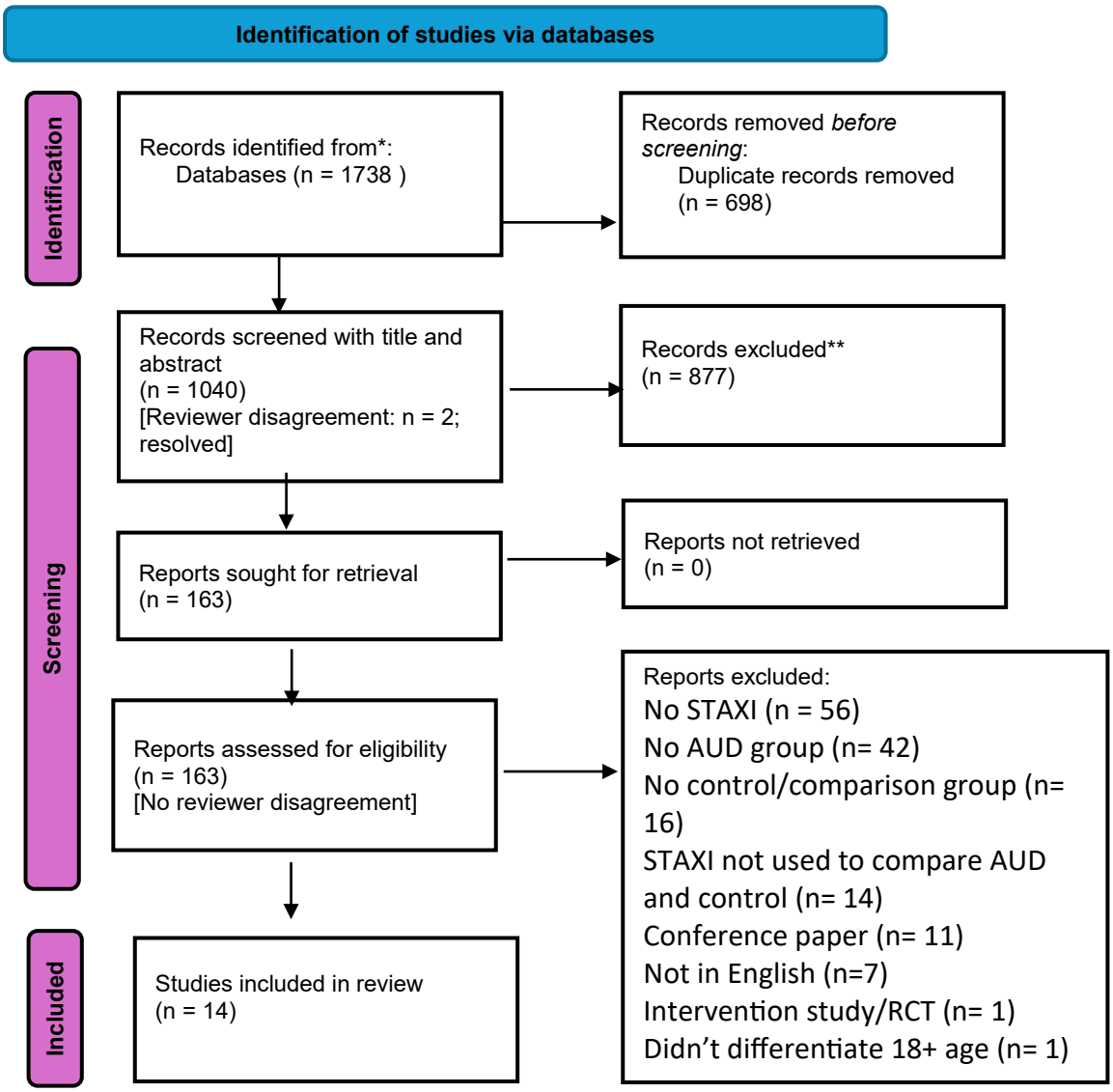

Figure 1.1: Flow chart of systematic search process and study selection using the PRISMA 2020 template.

Quality Assessment

As outlined in Table 1.2, the overall quality of studies included in this review was moderate (n= 10 studies) or high (n= 4 studies) quality. Compared to the high-quality studies, the ten moderate quality studies tended not to account for confounding factors and did not use statistical analysis to take covariates into consideration. As all studies included in this review were of moderate or high quality with limited risks of bias, the consistency of findings across studies is unlikely to be attributable to differences in methodological quality, supporting confidence in the overall conclusions. Other methodological limitations, identified in Table 1.2, include: Sharma et al. (2012) did not explicitly state that their participant group was all male, but this was inferred from their discussion. Babic et al. (2010) also adopted non-standard terminology when reporting on the STAXI anger scales, but which could nonetheless be interpreted with confidence as aligning with the standardised scales.

Additional methodological issues noted during assessment were present in three of the studies included in this review. Czermainski et al. (2020) reported on relatively small samples of AUD (n = 13) and controls (n = 13), lowering confidence in the reliability of observed differences between AUD and controls given chance variation that may not be representative of the wider population of those with AUDs. The study by Romero-Martinez et al. (2013) provided detailed sample and setting information, but the precision of the main analyses was limited by groups described as ‘high alcohol’ and ‘low alcohol’ to indicate a high likelihood of alcohol dependence versus lower likelihood of alcohol dependence. Tikka et al. (2014) reported using STAXI-I, but results were reported usings STAXI-II subscales for anger control.

The second reviewer (RC) assessed 2 of the included articles using the same checklist and one discrepancy was found between reviewers, which was resolved through discussion.

Table 1.2. JBI Cross-sectional Analytic Checklist for Quality Appraisal

Study ID	Authors (Year)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	JBI Score	Quality
1	Babic et al. (2010)	ü	ü	ü	ü	ü	û	û	ü	6/8	Moderate
2	Czermainski et al. (2020)	ü	ü	ü	ü	û	û	ü	ü	6/8	Moderate
3	Eriksson et al. (2020)	ü	ü	ü	ü	û	û	ü	ü	6/8	Moderate
4	Haw et al. (2001)	ü	ü	ü	ü	û	û	ü	ü	6/8	Moderate
5	Ilyuk et al. (2012)	ü	ü	ü	ü	û	û	ü	ü	6/8	Moderate
6	Kara et al. (2023)	ü	ü	ü	ü	û	û	ü	ü	6/8	Moderate
7	Körner et al. (2015)	ü	ü	ü	ü	ü	ü	ü	ü	8/8	High
8	Miyajimi et al. (2024)	ü	ü	ü	ü	û	û	ü	ü	6/8	Moderate
9	Romero-Martinez et al. (2013)	ü	ü	ü	ü	ü	ü	ü	ü	6/8	Moderate
10	Sharma et al. (2012)	ü	û	ü	ü	û	û	ü	ü	5/8	Moderate
11	Siria et al. (2022)	ü	ü	ü	ü	û	û	ü	ü	6/8	Moderate
12	Siria et al. (2021)	ü	ü	ü	ü	ü	ü	ü	ü	8/8	High
13	Tikka et al. (2014)	ü	ü	ü	ü	ü	ü	ü	ü	8/8	High
14	Tivis et al. (1998)	ü	ü	ü	ü	ü	ü	ü	ü	8/8	High

Q1 – criteria for sample inclusion clearly defined, Q2 – subjects and setting described, Q3 – valid and reliable measurement of exposure, Q4 – objecting, standard criteria use for measurement of condition, Q5 – confounding factors identified, Q6 – strategies used for confounding factors, Q7 – valid and reliable measurement of outcomes, Q8 – appropriate statistical analysis used.

Study Characteristics

Publication dates from the 14 included articles in this review ranged from 1998 to 2024. A summary of participant, methodological and key findings for STAXI anger dimensions are presented in Table 1.3. The studies were carried out in multiple global regions, with most in Europe (n=8), but others in Asia (n=3), South American (n=1), Australia (n=1) and the United States of America (n=1). Almost all (n=13) studies employed a cross-sectional comparative analytical design where those with an AUD were compared to those without. One study used a quasi-experimental cohort design (Siria et al., 2022), however, only the pre-interventional baseline STAXI anger measurements were included in the present review.

Participant Characteristics

Across the 14 included studies, sample sizes ranged from 67 to 1,067 participants, with a total of 4,545 participants included across the 14 studies (See Table 1.3 below and Appendix D for detailed summary, pp. 101). Gender was reported in most studies (n = 13), and among those that provided group-specific data, most participants with AUD were male (n = 773, 89.88%; female n = 87, 10.12%). Seven studies reported on male AUD participants only. Notably, the largest sample (n = 1,067; Miyajimi et al., 2024) did not report gender separately for AUD and comparison groups.

The mean age of the AUD group reported in 11 studies, was 38.72 years. Most AUD participants (n=397) came from eight studies involving a clinical population. Several studies included distinct subgroups: three studies focused on intimate partner violence (IPV) perpetrators, one study involved military veterans, one on students and one study sampled homicide offenders.

A majority of AUD classification (n=9) was based on a professional diagnosis using DSM/ICD criteria, while validated screening tools including the Alcohol Use Disorder Identification Test (AUDIT; n=4), CAGE questionnaire (n=3), and the Millon Clinical Multiaxial

Inventory-III (MCMI-III; n=3) were also used. Three studies used a combination of diagnostic tools and clinical assessment to determine AUD status.

Five studies included additional comparator groups aside from those with an AUD and no/low alcohol use. These other comparator groups included other groups using other substances (e.g. Czermainski et al., 2020; Ilyuk et al., 2012), a moderate alcohol use group (e.g. Eriksson et al., 2020; Miyajimi et al., 2024) and an abstaining group (e.g. Sharma et al., 2012).

STAXI Dimensions

Eight studies included in this review used the STAXI-I version, while the remaining five measured anger dimensions using the STAXI-II. Almost all studies (n=13) investigated the 'trait anger' scale, more than half considered 'state anger' (n=8), as well as 'anger expression-in/out' (n=8 each) and 'anger expression index' (n=8). The trait anger subscales 'angry temperament' (n=6) and 'angry reaction' (n=6) were also investigated across multiple studies. Relatively fewer studies investigated 'anger control' (n=4) from STAXI I or the conceptually similar 'anger control-in/out' (n=3) from STAXI II, as well as the state anger subscales from STAXI II: 'feeling angry' (n=2), 'feel like expressing anger verbally' (n=1) and 'feel like expressing anger physical' (n=1). As most studies reported on the STAXI I measure, it is to be expected that several of the subscales (e.g. anger control-in/out' and state anger subscales) would feature less frequently.

State Anger and State Anger Subscales:

'State anger' was investigated in 8/14 studies and the results of the studies were mixed. 'State anger' was significantly higher in the AUD group than the comparator group in 4/8 studies (Babic et al., 2010; Haw et al., 2001; Miyajimi et al., 2024; Sharma et al., 2012), while the other 4/8 did not find 'state anger' to differ significantly between groups (Czermainski et al., 2020; Ilyuk et al., 2012; Körner et al., 2015; Tikka et al., 2014). In 3/4

studies that reported no significant differences compared an AUD group with healthy individuals as the comparator group, while one study, Körner et al. (2015), compared individuals with an AUD who were abstaining from alcohol use versus a healthy control group. The four studies that found 'state anger' to be significantly higher in the AUD group each had different comparator groups to one another (e.g. students, healthy individuals, and clinical groups).

Of the smaller number of studies investigating state anger subscales ('feeling anger', n=2; 'feel like expressing anger verbally', n=1; 'feel like expressing anger physical', n=1), Sharma et al. (2012) found the AUD group had significantly higher 'feeling angry' scores than the control group, while Ilyuk et al. (2012) found no significant differences between groups. Sharma et al. (2012) was the only study that investigated the other two state subscales and reported significantly higher 'expressing anger verbally' scores in the AUD group but the groups did not differ for 'expressing anger physically'.

Trait Anger and Trait Anger Subscales:

'Trait anger' was investigated in 13/14 studies in this review, and 12/13 found that 'trait anger' was significantly higher in the AUD group compared to the comparator group. Only one study, Tikka et al. (2014) found no significant differences between the groups. The study by Tivis et al. (1998) found that the significantly higher 'trait anger' in the AUD group relative to controls was limited to males.

Of the six studies investigating the trait anger subscale, 'angry reaction', 4/6 studies found higher scores in the AUD group than the control (Babic et al.. 2010; Czermainski et al.. 2020; Sharma et al.. 2012; Siria et al.. 2021) while the remaining 2/6 studies found no differences between the AUD and control groups (Ilyuk et al.. 2012; Tikka et al., 2014). For the other trait anger subscale, 'angry temperament', 3/6 studies found significantly higher scores in the AUD group (Babic et al., 2010; Czermainski et al., 2020; Sharma et al., 2012) and the

remaining 3/6 found no significant differences between groups (Ilyuk et al., 2012; Siria et al., 2021; Tikka et al., 2014) .

Anger Expression:

Eleven studies in total investigated ‘anger expression’ via ‘anger expression-in’, ‘anger expression-out’ or the ‘anger expression index’. All eleven studies included the ‘anger expression index’ and found the AUD group had significantly higher scores than the control group (Babic et al., 2010; Cermainski et al., 2020; Ilyuk et al., 2012; Kara et al., 2023; Miyajimi et al., 2024; Romero-Martinez et al., 2013; Sharma et al., 2012; Siria et al., 2022; Siria et al., 2021; Tikka et al., 2014; Tivis et al., 1998). In 6/11 of the studies the individual subscales of ‘anger expression-in’ and ‘anger expression-out’ were also investigated (Babic et al., 2010; Czermainski et al., 2020; Kara et al., 2023; Sharma et al., 2012; Siria et al., 2021; Tikka et al., 2014). While these studies tended to show higher anger expression in the AUD group, Ilyuk et al. (2012) found that only ‘anger expression-in’ was significantly higher in the AUD group and Tivis et al. (1998) found elevated ‘anger expression-in’ was limited to males in the AUD group.

Anger Control:

Of the seven studies investigating ‘anger control’, results were mixed for whether the AUD and comparator group differed. Of these, 4/7 studies (Babic et al., 2010; Kara et al., 2023; Sharma et al., 2012; Siria et al., 2021) reported significantly higher ‘anger control’ (either as general ‘anger control’ or specifically ‘anger control-in’ or ‘anger control-out’) in the comparator group relative to the AUD group. The remaining 3/7 studies (Czermainski et al., 2020; Ilyuk et al., 2012; Tikka et al., 2014) found anger control did not differ between groups.

Full STAXI (I or II):

The four main scales of the STAXI (‘state’, ‘trait’, ‘expression-out/in’, ‘control’) were present in four studies (Babic et al., 2010; Czermainski et al., 2020; Sharma et al., 2012; Tikka et al.,

2014). Three of the four studies used the STAXI-I (Babic et al., 2010; Czermainski et al., 2020; Tikka et al., 2014). Amongst all four studies, the AUD group was shown to have significantly higher means or medians than the comparator groups for: anger expression-in, anger expression-out and anger expression index (Babic et al., 2010; Czermainski et al., 2020; Sharma et al., 2012; Tikka et al., 2014). In two of the studies, the comparator group was found to have significantly higher means in anger control (Babic et al., 2010; Sharma et al., 2012), while the other two studies found no significant differences in means or medians between groups (Czermainski et al., 2020; Tikka et al., 2014). State anger was shown to not have a significant difference in two of the four studies (Czermainski et al., 2020; Tikka et al., 2014), while Sharma et al. (2012) only found the state subscale 'feel like expressing anger physically' was not significantly different between groups. Tikka et al. (2014) found the most non-significant differences for the scales between groups, namely: state, trait, trait subscale angry temperament, trait subscale angry reaction and anger control. All four studies used different AUD sample populations and comparator group populations, including patients and veterans for the AUD group, and veterans, patients without substance abuse, social drinkers, and healthy controls as the comparator samples.

Of the four subscales Babic et al. (2010) found 'state anger' had the largest observed differences between the AUD group and controls. Czermainski et al. (2020) results showed that 'anger expression-in' had the largest difference between the AUD group and control. Similarly, Tikka et al. (2014) found that 'anger expression-in' had the largest changes between the AUD and control groups. Sharma et al. (2012) found that 'anger expression index' had the most significant differences between groups.

Table 1.3: Study characteristics and key findings comparing STAXI anger dimensions between AUD and comparators

Study ID	Authors (Year)	Country	Study Design	Sample: AUD group	Sample: Comparison group	STAXI Anger Dimensions	AUD Measure	Key Findings
1	Babic et al.. (2010)	Bosnia & Herzegovinia	Comparative Cross-sectional	Male war veterans with PTSD and AUD (n = 93)	Male war veterans with PTSD (n = 147)	STAXI - I : S, T, T-Ang/T, T-Ang/R, AE-in, AE-out, AC, AEI	CAGE, d/x, biomedical parameters	Significantly higher means were found in the AUD group for: S, T, T-Ang/T, T-Ang/T, AE-in, AE-out, AEI. Significantly higher means were found in comparator group for AC.
2	Czermainski et al.. (2020)	Brazil	Comparative Cross-sectional	Male patients (AUD n = 13)	Male patients with no history of substance abuse or treatment (n = 13)	STAXI - I : S, T, T-Ang/T, T-Ang/R, AE-in, AE-out, AC, AEI	d/x	Significantly higher medians were found in AUD group for: T,T-Ang/T, T-Ang/R. Significantly higher means were found in comparator group for: AE-in, AE-out, AEI No significant difference found between groups for S, AC.
3	Eriksson et al. (2020)	Australia	Comparative Cross-sectional	Homicide offenders (AUD group n = 107)	Homicide offenders with no or low alcohol problems (n = 103) and moderate alcohol problems (n = 66)	STAXI -II : T	AUDIT	Significantly higher means were found in AUD group for: T.

Study ID	Authors (Year)	Country	Study Design	Sample : AUD group	Sample : Comparison group	STAXI Anger Dimensions	AUD Measure	Key Findings
4	Haw et al.. (2001)	United Kingdom	Comparative Cross-sectional	Patients who were admitted due to DSH with an AUD (n = 40)	Patients who were admitted due to DSH with no AUD d/x (n = 110)	STAXI-I : S, T	d/x, CAGE	Significantly higher medians were found in in AUD group for: S, T.
5	Ilyuk et al.. (2012)	Russia	Comparative Cross-sectional	Patients with d/x (AUD group n = 38)	Healthy individuals (n = 90)	STAXI-I : S-Ang/F, T, T-Ang/T, ,T-Ang/R, AE-in, AE-out, AC	d/x	Significantly higher means were found in AUD group for: T, AE-in. No significant difference found between groups for: S-Ang/F, T, T-Ang/T, T-Ang/R, AE-out, AC.
6	Kara et al.. (2023)	Turkey	Comparative Cross-sectional	Patients with AUD (n =72)	Patients with no d/x of AUD (n=71)	STAXI-I : T, AE-in, AE-out, AC	d/x, AUDIT	Significantly higher means were found for AUD group for: T, AE-out, AE-in. Significantly higher means were found in comparator group for: AC.
7	Körner et al.. (2015)	Germany	Comparative Cross-sectional	Patients abstaining from AUD (n= 40)	Healthy individuals with no d/x of AUD (n=40)	STAXI-I : S, T	d/x	No significant difference found between groups for: S, T.

Study ID	Authors (Year)	Country	Study Design	Sample : AUD group	Sample : Comparison group	STAXI Anger Dimensions	AUD Measure	Key Findings
8	Miyajimi et al.. (2024)	Japan	Comparative Cross-sectional	Japanese university students with varying levels of alcohol risk (suspected AUD group n = 46)	Japanese students with low alcohol risk (n = 813) high alcohol risk group (n = 208)	STAXI-II (Japanese Version) : S, T, AEI	Japanese version of: AUDIT	Significantly higher means were found in AUD group for: S, T, AEI.
9	Romero-Martinez et al.. (2013)	Spain	Comparative Cross-sectional	Male IPV perpetrators with problematic alcohol use (n = 74)	Male IPV perpetrators with no/low Problematic Alcohol Use (n = 71)	STAXI-II (Spanish Version) : T, AEI	Spanish versions of: AUDIT, CAGE, MCMI-III	Significantly higher means were found in AUD group for: T, AEI.
10	Sharma et al.. (2012)	India	Comparative Cross-sectional	Male patients with AUD (n= 50,	Male social drinks (n = 50) and AUD abstaining (n = 50)	STAXI-II : S, S-Ang/F, S-Ang/V, S-Ang/P, T, T-Ang/T, T-Ang/R, AE-in, AE-out, AC-in, AC-out, AEI	d/x	Significantly higher means were found in AUD group for: S, S-Ang/F, S-Ang/V, T, T-Ang/T, T-Ang/R, AE-out, AE-in. Significantly higher means were found in comparator (social drinkers and abstainers) group for: AC-out, AC-in. No significant differences found between groups for: S-Ang/P.

Study ID	Authors (Year)	Country	Study Design	Sample : AUD group	Sample : Comparison group	STAXI Anger Dimensions	AUD Measure	Key Findings
11	Siria et al.. (2022)	Spain	Quasi-Experimental Cohort (Only Comparative Cross-Sectional data was used)	Male IPV perpetrators with problematic alcohol use (n = 64),	Male IPV perpetrators with no/low problematic alcohol use (n = 577)	STAXI-II : AEI	MCMI-III	Significantly higher means were found in AUD group for: AEI.
12	Siria et al.. (2021)	Spain	Comparative Cross-sectional	Male IPV perpetrators with problematic alcohol use (n = 125)	Male IPV perpetrators with no/low problematic alcohol use (n = 856)	STAXI-II : T, T-Ang/T, T-Ang/R, AE-in, AE-out, AC-in, AC-out, AEI	MCMI-III	Significantly higher means were found in AUD group for: T, T-Ang/T, T-Ang/R, AE-in, AE-out, AEI. Significantly higher means were found in comparator group for: AC-out, AC-in.
13	Tikka et al.. (2014)	India	Comparative Cross-sectional	Male patients with AUD (n = 40)	Healthy individuals (n = 40)	STAXI-I : S, T, T-Ang/T, T-Ang/R, AE-in, AE-out, AC-in, AC-out, AEI	d/x	Significantly higher means were found in AUD group for: AE-out, AE-in, AEI. No significant differences found between groups for: S, T, T-Ang/T, T-Ang/R, AC-in, AC-out.

Study ID	Authors (Year)	Country	Study Design	Sample : AUD group	Sample : Comparison group	STAXI Anger Dimensions	AUD Measure	Key Findings
14	Tivis, Parsons & Nixon (1998)	United States of America	Comparative Cross-sectional	Patients with AUD (n = 144)	Healthy individuals (n = 70)	STAXI-I : S, T, AE-in, AE-out	d/x	Significantly higher means were found in the male AUD group for: T, AE-in. Significantly higher means were found in the female AUD group for: AE-in. No significant differences found between groups for: S, AE-out. No significant differences found between female groups for: T.

SD = standard deviation, PTSD = Post-traumatic Stress Disorder, SUD = Substance Use Disorder, CAGE = four item brief alcohol problem screening questionnaire, d/x = medical diagnosis of AUD based on DSM or ICD criteria, AUDIT = alcohol use disorders identification test, MCMI-III = Millon Clinical Multiaxial Inventory-III with value set to detect alcohol dependence

Discussion

This systematic review has identified and synthesised the findings of 14 studies about the relationship between alcohol use disorders (AUDs) and dimensions of anger, as measured by the State-Trait Anger Expression Inventory (STAXI I or II; Spielberger 1988; Spielberger 1991). Compared to existing work, the present review provides a more focused investigation of the role of anger and its dimensions in individuals with AUDs (e.g. Gilchrist et al., 2015; Laitano et al., 2021). Amongst the studies included in this review, there was consistent evidence that individuals with AUD reported higher levels of trait anger and anger expression, particularly anger expression-in, than those without AUDs. A structured assessment of study quality indicated that studies were of moderate or high quality; moreover, these findings were robust across different versions of the STAXI and different comparator groups (e.g. healthy controls, low-risk drinkers, psychiatric controls, IPV perpetrators without problematic alcohol use, or individuals with other substance use disorders).

The consistent finding that trait anger is higher in individuals with AUD is consistent with the argument that individuals with AUD have stable personality attributes towards anger, but it is unclear from the present review whether trait anger should be interpreted as a risk factor for the development of problematic alcohol use and/or as a consequence of longer-term alcohol misuse and problems. Subscales of trait anger, including temperament and reaction, were also fairly consistently elevated in individuals with AUD (e.g. Babic et al., 2010; Czermainski et al., 2020; Sharma et al., 2012; Siria et al., 2021), indicating that those with AUD are prone to experience anger irrespective of the setting, environment or under provocation.

The multidimensional anger profiles of the four studies which investigated the full STAXI measure (I or II) showed inconsistent results. When full measure scales were investigated, the largest observed difference between groups in each of the four studies indicated a

discrepancy with what the remaining review studies largely investigated. The scales found to have the greatest differences from AUD to comparator group in the full STAXI studies were the anger expression index (n=2), anger expression-in (n=1) and state anger (n=1). This misaligns with most studies (n=13) investigating trait anger. This also indicates that when individuals with AUD have the full scope of anger dimensions investigated, they have more momentary and internal expressive difficulties with anger, as opposed to external anger expression, difficulties with controlling anger and having the personality trait of anger. As stigmatisation of individuals with AUD focuses on fears around violence and aggression, this discrepancy in anger dimensions tested versus what individuals with AUDs experience highlights the need to study full anger dimensions within this population to accurately examine biases (Rehm et al., 2015; van Boekel et al., 2013; Carvalho et al., 2019; Schomerus et al., 2011; Killian et al., 2021). Specifically, one of the key anger dimensions most prevalent in the AUD group is ‘anger expression-in’; therefore, indicating a discrepancy between the stigmatisation of individuals with AUD being violent and outwardly expressing anger to the evidence in this review indicating there is greater repression of feeling angry. This also intimates that treatment should focus on recognition of subtle signs of anger and offering strategies and tools to release the withheld anger in a safe and helpful manner. As shown in this review, the differences in state anger differences shows a further need for robust investigation around the relevance and differentiation between AUD groups and control groups with the experience of momentarily feeling anger. Further exploration of state anger versus trait anger would provide important context for further assessment and treatment and would shed light on the stigmatisation for individuals with AUD. This would further elucidate whether they are more likely to experience fleeting feelings of anger or have more fixed personality traits of and angry disposition. It should be noted that one of the four studies that investigated all of the main STAXI subscales (Czermainski et al., 2020) had a small sample size, and therefore, the largest difference scores for one of the ‘anger expression index’ scores may be less reliable and should be interpreted with caution.

Two studies included an AUD group who were abstaining from drinking (Koerner et al., 2015; Sharma et al., 2012). Sharma et al. (2012) found the abstaining AUD group were more similar to the control group than the AUD group who were not abstaining, and Körner et al. (2015) found no differences in anger dimension scores for state or trait anger between an abstaining AUD group and a control group. This suggests that alcohol use and abuse could be amplifying or driving higher levels of anger in AUD. While Körner et al. (2015) included information about length of abstinence, Sharma et al. (2012) did not, which limits interpretation of the impact of abstinence on anger expression for those with AUDs. As length of abstinence strengthens emotion regulation and awareness (Fox et al., 2008), the omission of this information also limits the strength of conclusions which can be drawn from these studies.

This review has several strengths, notably, a wide-ranging and inclusive search and selection strategy to capture a wide range of AUDs, terminology and classifications. Furthermore, the review protocol was registered, reporting standards were adhered to and an independent reviewer contributed to screening, selection and quality appraisal. These steps help to increase transparency and reduce potential for bias in key decisions (Page et al., 2021). However, there are a number of limitations of the review which should also be considered. Excluding articles in languages other than English may have led to relevant studies being missed. All included studies used a cross-sectional study design or element, limiting our ability to infer causality in the relationship between anger dimensions and AUDs. Therefore, whether dimensions of anger contribute to the development of an AUD or instead are elevated or exacerbated in the presence of an AUD is uncertain. Further investigation using longitudinal designs and multiple measurement points would enable stronger inferences about the casual relationship between anger dimensions and AUDs. Similarly, further examination into the differences between AUD, AUD abstaining and control groups would provide clarification on the impact of abstinence on anger. Lastly, study samples were predominantly male, which reflects the gender biases inherent within substance use

research (Greaves, 2020; Meyer et al., 2019; Tuchman, 2010) and future research should include greater diversity in participant samples.

Given the variability in how anger has been measured in relation to AUD, future research should examine the multidimensional nature of anger (e.g. trait, state, expression, control) and would greatly benefit from consistent reporting of effect sizes for more robust measurement of differences. For clinical practice, current evidence is insufficient to recommend specific anger-focussed interventions within AUD treatment. However, given the observed relationship between anger and AUD, clinicians may wish to consider routine screening for anger dimensions to support risk assessment and treatment planning. In particular, the strong evidence for increased rates of 'anger expression-in' indicates that assessment and treatment revolving around the feeling of anger that is being repressed could be beneficial to individuals with AUD. The evidence base is not yet robust enough to justify guideline or service changes, however, prioritisation of investment in high-quality research would inform future clinical and policy development.

Conclusion

In summary, this review highlights the significant relationship between anger and AUDs and the complexity of the dimensional interaction. While 'trait anger' and 'anger expression' had the largest and most consistent evidence base within the studies in this review, limited studies investigated the whole multidimensional range of anger within the STAXI (I or II), and mixed results were evident amongst those studies. Clinically, these findings suggest the importance of assessing anger dimensions as part of routine AUD treatment, with the potential for interventions targeting internalised anger to improve treatment outcomes. For training and service development, clinicians should be made aware of the nuance in anger profiles associated with AUD to reduce stigma and better tailor treatment plans. Future research should include the full STAXI (I or II) measure when investigating the difference between an AUD group and comparator. Further exploration into nuanced abstaining group

comparisons would be beneficial to better understanding the recovery processes with AUD treatment.

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Chapter 2: Major Research Project

The Role of Irritability on Suicidal Ideation and Behaviour: A Cross-Sectional Study

Prepared in accordance with the author requirements for:

BMC Psychiatry (Research Article Guidelines)

Plain Language Summary

Title

Investigating the Role of Irritability on Suicidal Ideation and Behaviour: A Cross-Sectional Study

Background

Suicide is a big concern around the world. Studies have often looked at mental health diagnoses as risk factors for suicide. There is less known about the role of everyday feelings like irritability. Irritability is defined as feeling easily annoyed or frustrated that can lead to feeling angry. There is even less known about how the links between irritability and suicide are changed by other factors. It is important to learn more about how some factors that have previously been linked to risk of suicide relate to irritability and suicide.

Aims and Questions

This study plans to explore the link between irritability and suicidal ideation and suicide attempt. This study will also look at whether that link is changed by sex, age, alcohol risk, impulsivity, or traumatic experiences.

Methods

Participants: This study used the Adult Psychiatric Morbidity Survey (APMS; 2014) dataset. This dataset had a total of 7,546 adults aged 16+ from typical households in England.

Design: This study is a cross-sectional study using an anonymised dataset.

Measures: The APMS (2014) dataset has many different surveys that were filled out by participants. People answered questions about their age, sex, irritability, alcohol risk, impulsivity, and if they had any traumatic experiences. They also answered if they had ever thought about or attempted suicide.

Main Findings and Recommendations

Main Findings: Irritability was the biggest risk factor for suicidal thoughts and attempts. People who said they felt more irritability were more than twice as likely to also say they had suicidal thoughts or attempts. This was seen even when adjusting for other factors. People who were more likely to have suicidal thoughts were younger, women, impulsive, and had more alcohol risk and trauma experiences. This was also the case with people who had more suicide attempts. The link between irritability and suicide was reduced when people had more trauma experiences or higher alcohol risk. But this effect disappeared when depression was considered. That means depression likely explains the effect of trauma and alcohol risk weakens the link of irritability and suicide.

Recommendations: Testing for irritability may help detect people at higher risk of suicide. More research would help to better understand how irritability fits into current models of suicide. This is so it can be better addressed in prevention and treatment plans.

Abstract:

Background and aims: Suicide is a global public health concern driven by a complex interplay of factors. While studies have reported the increased risk of suicidal ideation with increased irritability, there has been limited research on the impact of irritability with suicide risk in large community samples. Moreover, the extent to which other established risk factors such as alcohol risk, impulsivity, history of trauma experiences, and demographics may strengthen or weaken the relationship between irritability and suicidality is also unclear. The present study aims to clarify the role of irritability on suicidal ideation and behaviour using a large general population sample, including potential moderators of the relationship.

Methods: This study analysed data from the 2014 Adult Psychiatric Morbidity Survey (APMS: 2014), a cross-sectional probability survey of 7,546 adults (aged ≥16 years) in the general population of England. Variables used in the analysis included lifetime suicidal ideation and attempts, demographics (age, sex), irritability (based on Clinical Interview Schedule - Revised irritability subscale), Alcohol Use Disorder Identification Test (AUDIT) scores, trauma experiences, and impulsivity. Univariate and multivariable logistic regression analyses quantified the associations between irritability and lifetime suicidal ideation and attempts. Potential moderation of the irritability-suicidal ideation/attempts associations by sex, age, AUDIT score, trauma experiences and impulsivity were also investigated using logistic regression-based moderation analysis.

Results: Amongst all variables investigated, irritability showed the strongest risk of suicidal ideation and attempt, predicting over a four-fold increased risk in univariate models. In multivariable analysis, irritability remained independently associated with suicidal ideation (OR = 2.52, 95% CI [2.14-2.96], $p < 0.001$) and attempts (OR = 2.11, 95% CI [1.68-2.65], $p < 0.001$), independent of sociodemographic, psychosocial and behavioural variables. AUDIT scores and trauma experiences significantly moderated the relationship, weakening the

association between irritability and suicidality. Sensitivity analyses showed that irritability continued to have a robust association with suicidal risk even when controlling for depression.

Conclusion: Irritability is an independent risk factor for both suicidal ideation and attempt. These findings suggest irritability could be a clinically important marker of suicide risk, supporting its inclusion in suicide risk models and prevention strategies. Clinicians may consider screening patients for irritability in clinical practice and using suicide-risk mitigation strategies where irritability is present.

Keywords: suicidal ideation, suicide attempt, irritability

Introduction:

Suicide

Age standardised suicide mortality rates declined between 1990 and 2016 by 32.7% (Naghavi, 2019). However, suicide mortality remains a significant global burden and is one of the top 10 leading causes of 'years of life lost' in the Global Burden of Disease study (Naghavi, 2019). In England, between 2014 and 2023, the prevalence of common precursors to suicide, suicidal thoughts and attempts, rose from 20.6% to 25.2% (lifetime suicidal thoughts) and from 6.7% to 7.8% (lifetime suicidal attempts) (Morris et al., 2025; McManus et al., 2016). In Scotland, suicide prevention has been a key priority, supported by successive strategies and delivery plans that emphasise the importance of suicide protective environments, community awareness and understanding, access to support and collaborative working (The Scottish Government & COSLA, 2022).

While there is a no clear international consensus among researchers on how suicide and suicidal behaviours should be defined (Goodfellow et al., 2019), this study uses the definition derived from the International Study of Definitions of English-Language Terms for Suicidal Behaviours, wherein, suicidal thoughts and behaviours (STBs) may include suicidal ideation ('to think of suicide with or without suicidal intent, or hope for death by killing oneself, or state suicidal intention without engaging in behaviour') and suicide attempts ('an act in which a person harms himself or herself, with the intention to die, and survives') (de Leo et al., 2021).

Risk of suicide is multifactorial, the culmination of historical and current social, psychological, psychiatric and genetic contributory factors (Turecki et al., 2019). Psychiatric disorders, such as depression, are among the strongest risk factors for suicide. However, while mental health conditions greatly increase the risk of death by suicide (Brådvik, 2018), most deaths by suicide occur among individuals who have had no contact with mental health services or have any formally diagnosed psychiatric condition (Tang et al., 2021; Walby et al.. 2018). A recent systematic review of over 50 years of research confirmed that, while many risk factors

for STBs have been studied, most of these, including psychiatric disorders, do not improve our ability to predict who will die by suicide beyond chance (Franklin et al., 2017). Consequently, to improve our understanding of who is more likely to attempt or die by suicide, there is increasing interest in understanding the role of novel psychological factors and their interplay with other risk factors that contribute to the suicidal process.

Irritability and suicide

Irritability, broadly defined as a 'mood state characterised by being easily annoyed and provoked to anger, out of proportion to the circumstances' [World Health Organisation (WHO), 2022], is a construct of increasing interest to suicide researchers. While anger is typically considered a discrete emotional response to a perceived provocation or threat, irritability represents a more persistent affective state, encompassing both elevated irritability and disproportionate outbursts of anger (e.g. Liu & Cole, 2021). Irritability can be understood as a vulnerability or dispositional factor, whereas anger is the episodic manifestation of the disposition in response to stimuli (which can be internal or external). A tendency towards irritability is included in diagnostic criteria for as many as 15 Diagnostic and Statistical Manual (DSM-V) mental health disorders, including post-traumatic stress disorder and depression (American Psychiatric Association, 2013; Orri et al., 2018; Krysinska & Lester, 2010). Irritability is also considered a transdiagnostic phenotype within the National Institute of Health's Research Domain Criteria project (RDoc; Brotman et al., 2017); highlighting its potential as an important marker across diverse mental health conditions. The transdiagnostic nature of irritability presents an important opportunity for identifying elevated levels of risk and intervening independently of professional diagnoses. Indeed, a limited but growing body of research suggests that higher levels of irritability are associated with STBs; however, there are clear gaps in our knowledge. One systematic review of 39 studies, wherein the minority investigated adult community populations, reported evidence that higher levels of irritability were associated with STBs, but a similar relationship was less consistently found in clinical populations, which were the majority of studies reviewed (Orri et

al.., 2018). Based on a formal assessment of study quality, the review authors concluded that most studies were of low or only moderate quality and were cautious about over-generalising their findings based on the existing literature. One other study researched the concepts of tonic (persistent irritability) and phasic irritability (explosive outbursts) and their associations with STBs (i.e. suicidal ideation, suicide attempt and suicide planning) within a large general population study of depression subtypes (Liu & Cole, 2021). The findings of this study also presented a mixed picture of the relationship of irritability with STBs, noting that both tonic and phasic types of irritability increased odds for suicidal ideation, but only phasic irritability was associated with suicide plans and attempts. Further research is therefore warranted to clarify the role of irritability in STBs, particularly in community populations where the majority of suicides occur (Tang et al., 2021; Walby et al.. 2018).

Moderators of Suicidality

Suicidality is complex and its causes are multifactorial (O'Connor & Nock, 2014). Although irritability has not featured in contemporary suicide models and theories, these models emphasise a complex interplay of risk factors that may contribute to suicidal risk (e.g., Baumeister, 1990; O'Connor & Kirtley, 2018; Van Orden et al., 2010). The association of irritability with STBs may therefore be influenced or moderated by a range of other factors that are independently associated with STBs. Better understanding of these relationships could offer more precise accounts of who is at risk, why and the potential for better targeted interventions.

Alcohol misuse and related problems are associated with suicidal behaviour (Amiri & Behnezhad, 2020). For example, Ledden et al. (2022) investigated the association between scores on the widely used Alcohol Use Disorders Identification Test ('AUDIT'), alcohol-related risk categories and a range of different domains of alcohol use (binge drinking, dependence symptoms, harmful effects and concern from others) with suicidal ideation and behaviour. Using a nationally representative household sample from England, they found each alcohol-related marker was associated with relatively greater odds of the suicide

outcomes. Irritability is also significantly associated with increased aggression following consumption of alcohol, particularly for men (Giancola, 2002). Additionally, related concepts such as anger and aggression are also associated with alcohol use disorders and contribute towards greater violence directed towards others and oneself (Gautier, Paubst & Maurage, 2023). However, while there is some evidence of bivariate relationships among irritability, alcohol use/problems and suicide risk, no studies to date have explored these relationships multivariately and whether alcohol use/problems may moderate the relationship between irritability and suicide risk.

Impulsivity, broadly defined as a tendency to act without adequate forethought (Huang et al., 2024) is frequently cited as a key risk factor for STBs (Brokke et al., 2022). While there is a degree of consensus that impulsivity is likely to contribute to STBs, the literature overall is inconsistent and the nature of the relationship between impulsivity and STBs is unclear (Gvion & Apter, 2011; Moore et al., 2023; Moore et al., 2022). For example, some studies have shown a relationship between increased impulsivity traits and higher likelihood of suicidal ideation and attempts (Nock et al., 2008), while others conclude the association between impulsivity and STBs is small (Anestis et al., 2014). Furthermore, some theoretical models propose that impulsivity is likely to play a stronger role in suicidal behaviour relative to suicidal thoughts (O'Connor & Kirtley, 2018). While impulsivity and irritability are both linked with STBs, either as independent constructs (Conner et al., 2004) or in some cases interchangeably as 'impulsive aggression' (Orri et al., 2018; Moore et al., 2023; Moore et al., 2022), whether impulsivity may moderate the association between irritability and suicidality has not been investigated.

There is substantial evidence that experiencing life stresses, significant traumatic life events that impact both physical and/or mental wellbeing, increases the likelihood of a range of mental health problems, including Post Traumatic Stress Disorder and STBs (Howarth et al., 2020; Gold et al., 2005; Favril et al., 2022). While some research indicates that traumatic experiences in adolescence are associated with irritability (Harrison et al., 2025), the

relationship of traumatic experiences, irritability and STBs within an adult community sample has not been investigated. There is some evidence that irritability is associated with traumatic experiences, either directly through adverse experiences that incite irritability (Harrison et al., 2025) or indirectly as a symptom of depression or anxiety stemming from adverse childhood experiences (Archer et al., 2024, Losiewicz et al., 2023; Zhan et al., 2024). Experience of adverse childhood experiences have been associated with an increased risk of suicide and significantly linked to diagnoses such as depression and anxiety, therefore highlighting the continued link of depression or anxiety and suicidality (Archer et al., 2024, Losiewicz et al., 2023; Zhan et al., 2024).

Demographic factors such as age and sex are associated both with STBs and irritability (Miranda-Mendizabal et al., 2019; Steele et al., 2017). While men disproportionally account for most suicide deaths (Sher, 2020), women are more likely to report suicidal ideation and to attempt suicide, and reportedly experience irritability for longer durations than men (Toohey, 2020; Ardani et al., 2017). On the other hand, males are associated with greater physical aggressive behaviour, which is a related construct to irritability (Bjorkqvist, 2018; Gautier, Paubst & Maurage, 2023). One study has also reported that younger adults report higher rates of irritability and suicidal ideation than older adults (Cooper et al., 2015). While age and sex have been investigated in relation to irritability and suicidality separately, no study to date has investigated whether these demographic factors interact with the relationships between STBs and irritability.

Rationale and Research Questions:

Research and theory have established the importance of a wide range of factors that contribute to the development of suicidal ideation and attempts (e.g. O'Connor & Kirtley, 2018; Nock et al., 2008; Franklin et al., 2017). However, our ability to accurately predict suicide is limited and there is a need to enhance our understanding by investigating novel risk factors and their interplay. Irritability, the proneness to anger, is a potentially promising line of investigation that may enhance our understanding of the reasons people think about

and attempt suicide. Furthermore, understanding the circumstances or conditions that may increase or decrease the strength of association between irritability and STBs is crucial and will make important new contributions to our understanding. Specifically, a range of risk factors may moderate the relationship between irritability and suicidal thoughts and behaviours, including those that are potentially modifiable such as risky patterns of alcohol risk (e.g. Ledden et al., 2022), impulsivity (e.g. Gvion & Apter, 2011; Nock et al., 2008) and traumatic experiences (e.g. Howarth et al., 2020), as well as non-modifiable factors such as age and sex (e.g. Cooper et al., 2015; Miranda-Mendizabal et al., 2019; Steele et al., 2017).

Using an already existing large general population dataset, this research will address two overarching research questions and five sub questions:

Research question 1: To what extent is irritability associated with suicidal ideation and attempts in a large community sample?

Research question 2: Is the relationship between irritability and suicidal ideation and attempt moderated (i.e. modified or dependent) on other risk factors? Specifically, in tests of simple moderation, with irritability as the focal predictor variable and both suicidal ideation and attempts as dependent variables, is the association of irritability on suicidal ideation or attempt moderated by: i) AUDIT score, ii) Impulsivity, iii) Trauma experiences, iv) Age, v) gender.

Methods:

Design and Data Source

This research will be a quantitative cross-sectional study using secondary data from the English Adult Psychiatric Morbidity Survey (APMS) 2014 (McManus et al., 2016). The APMS was chosen for use in the present research because its dataset comprises a large national probability sample of the general population aged 16+ years who responded to a range of

socio-demographic, psychological and psychiatric measures relevant to understanding treated and untreated psychiatric morbidity in the community. Although an APMS survey report has recently been published (e.g. Morris et al., 2025), at the time this research was conceived and executed, the 2014 dataset was the most recent data available. APMS data were weighted in four steps to account for selection probabilities and non-response, enabling results which are nationally representative of English households and individuals aged 16 years and over. Further information about weighting can be found within the APMS 2014 user guide (McManus et al., 2016).

For this study the dataset was obtained via application to the UK Data Service, which holds the original dataset, and permission granted to use the anonymised dataset for this research project. The UK Data Service reviewed the application to ensure that the proposed use of the data was appropriate, meeting the necessary ethical and governance standards. As such, no additional ethical approval was required from the University of Glasgow (see Appendix F, pp. 116). All procedures adhered to the UK Data Service's terms of use and relevant national guidelines for handling sensitive participant data. A STROBE checklist was completed to assess risk of bias within this study (see Appendix E, pp. 113).

Participants

The APMS (2014) comprises 7,546 participants (unweighted: female N = 4488, male = 3058) drawn from the English general population. Participants were recruited from private households using a multi-stage stratified probability sampling design. This involved using the Postcode Address File, which covers 97% of private households in England, and then using the Kish grid method (Kish, 1965) to randomly select one resident aged 16 and over from each eligible household. Interviews were administered by trained interviewers and participants completed a variety of questionnaires on a laptop and some elements of the APMS was completed with face-to-face interviews. Further details of the sampling method, procedure, quality control and derived variable list are published on the NHS Digital website (McManus et al., 2016).

Measures

The APMS dataset contains variables based on a wide range of sociodemographic, health, psychological and psychiatric measures. Only those relevant to the current study are described below.

Socio-demographics characteristics

Demographic factors that were used include age, sex, ethnicity and socioeconomic status (SES). Age is banded in 9 or 10-year intervals (1 = 16-24, 2 = 25-34, 3 = 35-44, 4 = 45-54, 5 = 55-64, 6 = 65-74, 7 = 75+). Sex is a binary variable (1 = 'male' and 2 = 'female') matching the options available to APMS respondents. Ethnicity was based on the latest Census and the Office for National Statistics (ONS) questions for use in national surveys at the time of the APMS 2014 data collection, and included the following five ethnicities: white British, white other, black/African/Caribbean/black British, Asian/Asian British, mixed/multiple ethnic groups/other ethnic groups (McManus et al., 2016). SES quintiles (1 - 5) are based on the index of multiple deprivation (QIMD), with low scores indicating relatively less area-based deprivation and high scores representing greater area-based deprivation scores across indicators of household income, employment, education, housing tenure, and social class/occupation.

Depression

Mood is strongly associated with increased suicide risk (Orsolini et al., 2020). APMS participants reported whether they have any of 17 lifetime mental health disorders (either self-diagnosed or professionally diagnosed). In the present study the presence of depression was included, coded 1 = yes (if 'yes' to either item of self or professionally diagnosed) or 0 = no (if 'no' to both self and professional diagnosis).

Irritability

Irritability was measured using the irritability subscale from the Clinical Interview Schedule – Revised (CIS-R; Lewis et al., 1992). The CIS-R is a standardised interview to screen for

common mental health disorders. The CIS-R has shown excellent internal consistency (α ≈ 0.9) and good test-retest reliability (r = 0.9) (Lewis et al., 1992). One of the domains within the CIS-R is 'irritability', operationalised as 'feeling short tempered and angry to the extent that it results in arguments or quarrels'. Following the APMS scoring, the CIS-R symptom score for irritability is based on questions assessing the presence, frequency, intensity and perceived justification of recent irritability experiences. Responses to a subset of initial questions determine whether the full range of questions are administered and when a respondent indicates an absence of irritability on these initial items, they are coded as low irritability within the variable. An irritability symptom score is then derived with scores '<2' indicating low irritability and scores '2+' indicating high irritability. Further details can be found in the APMS 2014 dataset and documentation (McManus et al., 2016).

Alcohol Use

The Alcohol Use Disorders Identification Test (AUDIT) is a widely used 10-item questionnaire designed to measure alcohol consumption and related problems (Saunders et al., 1993). Total scores ranging 0-40 can be used to indicate increasing risk of harm due to drinking, with cut-off scores also established for classifying drinkers as 'low' (0-7), 'hazardous' (8-14), harmful (15-19) and possibly dependent (20+) drinkers (Babor et al., 2001). The 10 questions address different domains including alcohol consumption, problems, harms and symptoms of dependence. The AUDIT has demonstrated high internal consistency (α = 0.8 – 0.9) and good sensitivity and specificity for identifying problematic alcohol use (Babor et al., 2001; Meneses-Gaya et al., 2009). In the present study, AUDIT total scores (range 0-40) will be used as a continuous measure of increasing risk.

Impulsivity

Impulsivity is measured using a single item from the Structured Clinical Interview for DSM-IV (SCID), which asks 'Have you often done things impulsively?' with binary response option 'No = 0' and 'Yes = 1'. This single-item measure has been used successfully in previous

studies (e.g. Peters et al., 2015; de Cates et al., 2019). Only those aged 16-64 years completed this item.

Trauma Experiences

Trauma will be measured using 15 items from the Stressful Life Events section of the APMS. This includes 12 items from the List of Threatening Experiences (LTE) questionnaire (Brugha et al., 1985), which has shown satisfactory test-retest reliability (κ = 0.61 – 0.87) and good predictive validity for psychiatric outcomes (Brugha & Cragg, 1990; Motrico et al., 2013): experiences of injury, illness or assault (to self or others), death of a family member or close relative, divorce or separation, problem with friend/neighbour, loss of job, major financial crisis, unsuccessful looking for work, sexual abuse, violence in the home or work, bullying, and an item of value being lost or stolen, and lastly problems with police. An additional three items included in the Stressful Life Events measure are running away from home, being expelled from school and being homeless. Responses (No = 0, Yes = 1) to the 15 items are summed with higher scores indicating greater trauma experiences.

Outcomes

Suicidal history

Two items will be used to indicate a lifetime history of suicidal ideation and attempt: have you ‘ever thought about taking your life, but not actually attempted to do so?’ and ‘ever made an attempt to take your life, by taking an overdose of tablets or in some other way?’ (binary response options ’yes’ or ‘no’). These items have been used to indicate a lifetime history of suicidal ideation or attempt across a range of research studies (O’Connor et al., 2018; Melson & O’Connor, 2019; Cleare et al., 2018; Wetherall et al., 2022). These outcomes are considered separately and a ‘yes’ response to suicide attempt history is not contingent on a ‘yes’ response to suicidal ideation history.

Statistical Analysis

Consistent with other similar studies using the APMS 2014 dataset (e.g. Humpston et al., 2021; Qassem et al., 2021) weighting was applied to account for the complex survey design, non-response, and selection probabilities. The overall amount of missing data was limited, with missing data for most key variables <1%. An exception here is missing data on impulsivity which was direct consequence of the <65 year age restriction on this item. Analyses were based on complete-case analysis and was completed twice both including and excluding impulsivity to assess any impact this missing data might have had. No additional exclusion criteria (e.g. psychiatric comorbidity, extreme scores) were applied.

All analyses were conducted in SPSS (Version 29) with Hayes PROCESS Macro (Hayes, 2013) for moderation analysis. Sociodemographics (age, sex, ethnicity and socioeconomic status) are tabulated and reported using frequency counts and percentages. Key study variables are also presented using frequency counts and percentages for suicidal history, irritability and impulsivity, and means (and standard deviations) for AUDIT scores and trauma experiences.

To address the first research question, the extent to which irritability is associated with suicidal ideation and attempts, separate univariate logistic regression analyses were conducted to determine whether irritability and each of the other study variables are associated with suicidal ideation and attempt outcomes. Multivariable logistic regression analyses were conducted to examine the associations of the study variables simultaneously. Other study variables were included in the multivariable regression to assess their independent association with both suicidal ideation and attempt. These included age, sex, AUDIT score, impulsivity and trauma scores due to their established associations with both or either irritability and suicidality. For each analysis odds ratios (OR) with 95% confidence intervals (95% CI) was reported, with the significance level set at the conventional $p < 0.05$. Assumptions for logistic regression analyses were assessed prior to analysis, in which all variance inflation factors (VIFs) were below 2, suggesting multicollinearity was not a

concern. Model fit was assessed using the area under the receiver operating characteristic curve (AUC-ROC) to evaluate discriminant ability, with an AUC closer to 1 indicating better model performance distinguishing cases and non-cases.

To address the second research question, Hayes PROCESS Macro (Hayes, 2013) Model 1 was used to test simple moderation of the relationship between irritability and the two potential outcomes (suicidal ideation or suicide attempt) for each of: sex, age, AUDIT scores, impulsivity and trauma scores. Significant moderation effects were examined by calculating simple slopes based on the conditional effect of irritability at high (+1 SD), average (mean), and low (-1 SD) values of each moderator. To account for potential violations of the normal distribution, moderation analyses were bootstrapped using 5,000 resamples (Hayes, 2013).

Finally, to assess whether any associations between irritability and suicide outcomes exist independently of common mental health problems, additional sensitivity analyses were carried out which adjusted the multivariable regression and moderation analyses for depression.

Results:

Sociodemographic and descriptive statistics for key study variables

Table 2.1 presents sociodemographic and descriptive information for the study sample overall with weighted scores and according to lifetime history of suicidal ideation and attempts.

Table 2.1. Sociodemographic and descriptive information for key study variables

		n (%)	Suicidal Ideation Lifetime, n(%)	Suicide Attempt Lifetime, n(%)
Socio-demographic				
Gender	Male	3686 (48.8%)	689 (18.7%)	200 (5.4%)
	Female	3860 (51.2%)	863 (22.4%)	309 (8.0%)
Ethnicity	White British	6066 (80.4%)	1277 (21.1%)	407 (6.7%)
	White Other	501 (6.6%)	96 (19.2%)	31 (6.2%)
	Black/African/Caribbean/Black British	232 (3.1%)	56 (24.1%)	21 (9.1%)
	Asian/Asian British	524 (6.9%)	75 (14.3%)	33 (6.3%)
	Mixed/Multiple ethnic groups/Other ethnic groups	196 (2.6%)	39 (19.9%)	13 (6.6%)
Age (9 or 10 year bands)	16-24	1065 (14.1%)	285 (26.8)	96 (9.0%)
	25-34	1273 (16.9%)	288 (22.6%)	109 (8.6%)
	35-44	1218 (16.1%)	267 (21.9%)	98 (8.1%)
	45-54	1309 (17.3%)	310 (23.7%)	89 (6.8%)
	55-64	1046 (13.9%)	237 (22.7%)	73 (7.0%)
	65-74	885 (11.7%)	104 (11.8%)	32 (3.6%)
	75+	750 (9.9%)	60 (8.0%)	13 (1.7%)
QIMD	0.53-8.49 (least deprived)	1492 (19.8%)	225 (15.1%)	60 (4.0%)
	8.49-13.79	1522 (20.2%)	297 (19.5%)	63 (4.1%)
	13.79-21.35	1511 (20.0%)	292 (19.3%)	92 (6.1%)
	21.35-34.17	1510 (20.0%)	336 (22.3%)	113 (7.5%)
	34.17-87.80 (most deprived)	1510 (20.0%)	401 (26.6%	180 (11.9%)
Psychosocial/ Behavioural				
Irritability	<2	6414 (85%)	1042 (16.3%)	301 (4.7%)
	2+	1132 (15.0%)	510 (45.1%)	207 (18.3%)
Impulsivity	Yes	1712 (22.7%)	605 (35.3%)	249 (14.5%)
	No	3866 (51.2%)	727 (18.8%)	195 (5.0%)
Alcohol (AUDIT)	(Mean, SD)	7259 (96.7%)	5.61 (6.32)	6.10 (7.63)
Trauma	(Mean, SD)	7512 (99.4%)	5.77 (2.96)	6.75 (3.27)

n: number of participants, SD: Standard Deviation; QIMD: Quintile Index of Multiple Deprivation, AUDIT: Alcohol Use Disorders Identification Test

The sample consisted of 7,546 participants, with a slightly higher proportion of females (51.2%) than males (48.8%). Lifetime suicidal ideation was reported by 22.4% of females and 18.7% of males, while suicide attempts were reported by 8.0% and 5.4%, respectively.

The majority of participants identified as White British (80.4%), followed by Asian/Asian British (6.9%), White Other (6.6%), Black/African/Caribbean/Black British (3.1%), and Mixed/Other ethnic backgrounds (2.6%). Suicidal ideation was most prevalent among participants identifying as Black/African/Caribbean/Black British (24.1%), followed by White British (21.1%). Suicide attempts were most common in the Black/African/Caribbean/Black British group as well (9.1%).

Age was distributed across seven 9 or 10-year bands, with the largest age groups being 25–34 (16.9%), 45–54 (17.3%), and 35–44 (16.1%). The highest prevalence of suicidal ideation occurred in the 16–24 age group (26.8%), with decreasing prevalence observed in older age groups. Similarly, suicide attempts were most prevalent among those aged 16–24 (9.0%) and decreased steadily with age.

Participants were evenly distributed across quintiles of the Quintile Index of Multiple Deprivation (QIMD). Rates of suicidal ideation and suicide attempts increased with higher levels of deprivation. People in the most deprived group were nearly twice as likely to report suicidal thoughts (26.6%) and about three times as likely to report suicide attempts (11.9%) compared to those in the least deprived group (15.1% and 4.0%, respectively).

Regarding psychosocial/behavioural variables, 15% of participants met the threshold for high irritability (score ≥2), among whom 45.1% reported suicidal ideation and 18.3% reported suicide attempts. Of the subsample aged 16-64 years who were asked about impulsivity, a positive response was reported by 22.7%, among whom 35.3% reported suicidal ideation and 14.5% reported a history of suicide attempts. Trauma experiences had a mean score of 5.77 (SD = 2.96) among those reporting suicidal ideation and 6.75 (SD = 3.27) for those reporting suicide attempts. AUDIT showed a mean score of 5.61 (SD = 6.32) for the individuals who reported lifetime suicidal ideation and 6.10 (SD = 7.63) for those who reported suicide attempt.

Univariate Analyses

Univariate logistic regression analyses examined individual associations between each variable and lifetime suicidal ideation or attempt (see Table 2.2). Irritability was the most strongly associated with suicidal ideation and attempt, with an approximately four-fold increase in the odds of both lifetime suicidal ideation (OR = 4.24, 95% CI [3.71 - 4.85], $p <$ 0.001*)* and suicide attempt (OR = 4.56, 95% CI [3.77 - 5.51], $p < 0.001$). Impulsivity and trauma experiences were also strongly associated with both suicidal ideation (impulsivity: OR = 2.35, 95% CI [2.07 - 2.68], $p < .001$; trauma: OR = 1.36, 95% CI [1.33 - 1.39], $p <$ 0.001) and suicide attempts (impulsivity: OR = 3.20, 95% CI [2.63 - 3.90], $p < 0.001$; trauma: OR = 1.40, 95% CI [1.36 - 1.45], $p < 0.001$). Greater alcohol risk as measured by AUDIT scores, was significantly, but more modestly, associated with suicidal ideation (OR = 1.07, 95% CI [1.05 - 1.08], $p < 0.001$) and suicide attempt (OR = 1.07, 95% CI [1.05 - 1.09], $p <$ 0.001).

Sociodemographic variables were also associated with suicidal ideation and attempts, but again the associations were more modest. Females were relatively more likely to report both ideation (OR = 1.25, 95% CI [1.12 - 1.40], $p < 0.001$) and attempts (OR = 1.51, 95% CI [1.26 - 1.82], $p < 0.001$), while age was inversely related to suicidal ideation (OR = 0.85, 95% CI [0.83 - 0.88], $p < 0.001$,) and suicide attempt (OR = 0.83, 95% CI [0.79, 0.87], $p < 0.001$).

Table 2.2: Univariate logistic regression analysis for each variable with suicidal ideation and attempts

	Suicidal Ideation			Suicide Attempt		
	OR	95 %CI	P	OR	95% CI	P
Irritability	4.24	3.71-4.85	<0.001	4.56	3.77-5.51	<0.001
Sex	1.25	1.12-1.40	<0.001	1.51	1.26-1.82	<0.001
Age (9 or 10 year bands)	0.85	0.83-0.88	<0.001	0.83	0.79-0.87	<0.001
AUDIT score	1.07	1.05-1.08	<0.001	1.07	1.05-1.09	<0.001
Impulsivity	2.35	2.07-2.68	<0.001	3.20	2.63-3.90	<0.001
Trauma score	1.36	1.33-1.39	<0.001	1.40	1.36-1.45	<0.001

95% CI: 95% Confidence Interval, OR: Odds Ratio; AUDIT: Alcohol Use Disorders Identification Test, P: probability

Multivariable Analyses

The next step of the analysis sought to determine whether the study variables were independently associated with each suicidal outcome alongside irritability. The multivariable logistic regression models therefore included sex, age, AUDIT score, impulsivity, and trauma experiences (See table 2.3) for each outcome. This was completed using a hierarchical (blockwise) approach, wherein irritability was entered in Block 1, and the remaining potential covariates (sex, age, AUDIT score, impulsivity and trauma score) were entered in Block 2. This order of entry was chosen to examine the main predictor, irritability, unadjusted association with suicidal outcomes. In the second block, additional variables were entered to assess whether the relationship between irritability and the suicidal outcomes remained significant while considering the other variables that have previously been evidenced as being significantly associated with suicidality. As the single-item impulsivity measure was only asked of those aged 16-64 years of age, this resulted in a reduced sample size for the multivariable logistic regression analyses. Models were run with and without the impulsivity variable, with comparable results; therefore, reported analyses include the impulsivity

variable in the full multivariable logistic regression analysis. The multivariable regression models for suicidal ideation and attempt both demonstrated acceptable discriminatory ability (AUCs of 0.762 and 0.797 for ideation and attempt, respectively), indicating that irritability and all other variables assessed for risk of suicidality, meaningfully contributes to the prediction of suicidality above chance.

In the multivariable models, all variables were independently associated with suicidal ideation and attempt. However, the strongest associations were for irritability and impulsivity for the suicidal ideation (OR = 2.52, 95% CI [2.14, 2.96], $p < 0.001$; OR = 1.61, 95% CI [1.39-1.86], $p < 0.001$) and suicide attempt (OR = 2.11, 95% CI [1.68, 2.65], $p < 0.001$; OR = 2.08, 95% CI [1.67, 2.58], $p < 0.001$), respectively.

Table 2.3. Multivariable analyses with odds ratio for risk of suicidality

	Suicidal Ideation			**Suicide Attempt**		
	OR	95% CI	P	OR	95% CI	P
Irritability	2.52	2.14-2.96	<0.001	2.11	1.68-2.65	<0.001
Sex	1.55	1.35-1.79	<0.001	1.88	1.51-2.36	<0.001
Age (9 or 10 year bands)	0.86	0.81-.090	<0.001	0.82	0.76-0.89	<0.001
AUDIT score	1.04	1.02-1.05	<0.001	1.03	1.01-1.05	<0.001
Impulsivity	1.61	1.39-1.86	<0.001	2.08	1.67-2.58	<0.001
Trauma score	1.34	1.30-1.38	<0.001	1.35	1.30-1.40	<0.001

n: number of sample, 95% CI: 95% Confidence Interval, OR: Odds Ratio; AUDIT: Alcohol Use Disorders Identification Test, P: probability

Moderation Effects

To assess whether the relationships between irritability and suicidal ideation or attempt were moderated by sex, age, AUDIT score, impulsivity, or trauma experiences, a series of logistic regression-based moderation analyses were conducted using Hayes PROCESS Macro

Model 1 (Hayes, 2013). In each model, irritability served as the independent variable (x), suicidal ideation or attempt as the dependent variable (y), with each potential moderator (w) examined in a separate model. To reduce repetition, Table 2.4 summarises the tests of moderation, presenting coefficients and confidence intervals using log-odds. Additionally, conceptual models are only presented to aid interpretation of statistically significant moderation effects. The simple slopes for significant moderation effects using probability of suicidality are also presented.

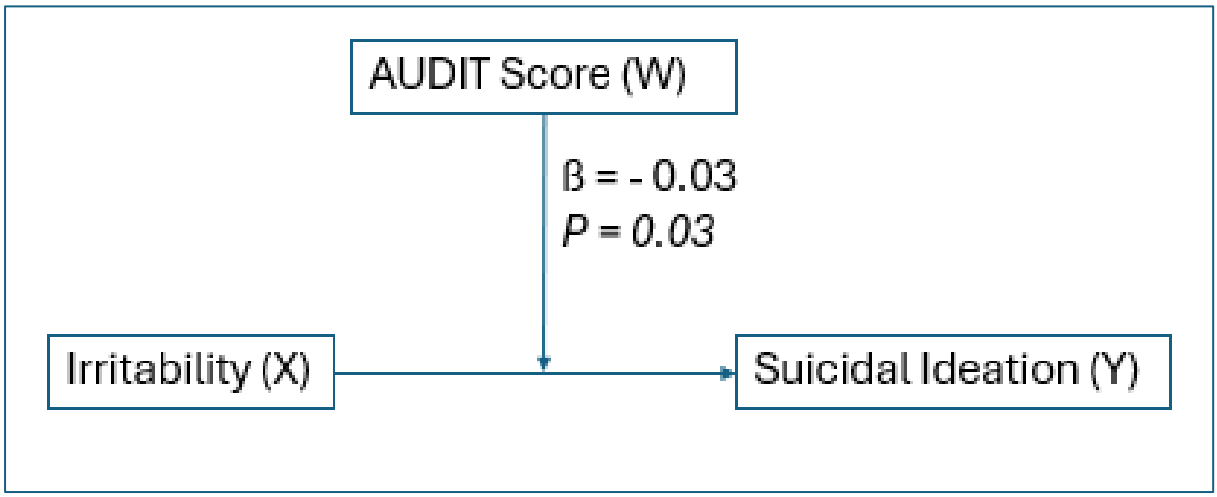
Table 2.4. Coefficients and confidence intervals for the interaction of each moderator with irritability for suicidal ideation and attempt using log-odds.

	Suicidal Ideation			**Suicide Attempt**		
	B	*95% CI*	*P*	*B*	*95% CI*	*P*
Sex	-0.07	-0.36 - 0.21	0.63	-0.37	-0.44 - 0.36	0.86
Age (9 or 10 year bands)	0.02	-0.06 - 0.10	0.62	0.08	-0.04 - 0.19	0.19
AUDIT score	-0.03	-.05 - -0.00	0.03	-0.03	-0.06 - 0.05	0.10
Impulsivity	0.12	-0.19 - 0.44	0.44	0.12	-0.30 - 0.54	0.58
Trauma score	-0.09	-0.14 - -0.04	0.001	-0.10	-0.16 - -0.03	0.002

B: coefficient, P: probability, 95% CI: 95% confidence interval

As can be seen in Table 2.4, sex, age and impulsivity did not moderate the relationship of irritability and suicidal ideation or suicide attempt. This suggests that the association of irritability and suicidal ideation and attempt is relatively stable across sex, age groups, and impulsivity. AUDIT score also did not significantly moderate the association between irritability and suicide attempt. In contrast when AUDIT score was tested as a moderator of the relationship between irritability and suicidal ideation (see Model 1a), the interaction of AUDIT score on the relationship of irritability and suicidal ideation was significant (B = –0.03, *p* = .03, 95% CI [–0.05, –0.00]). Figure 2a presents the simple slopes, representing the conditional effects of irritability on the probability of suicidal ideation at high, average and low

levels of AUDIT score. Figure 2a presents the simple slopes analysis and shows that high irritability is associated with greater probability of suicidal ideation, and that this effect becomes stronger as alcohol risk increases, but noting the negative log-odds coefficient this likely shows a minimal effect of moderation.



MODEL 1a: Conceptual model of the relationship of irritability with suicidal ideation, with AUDIT score as a moderator

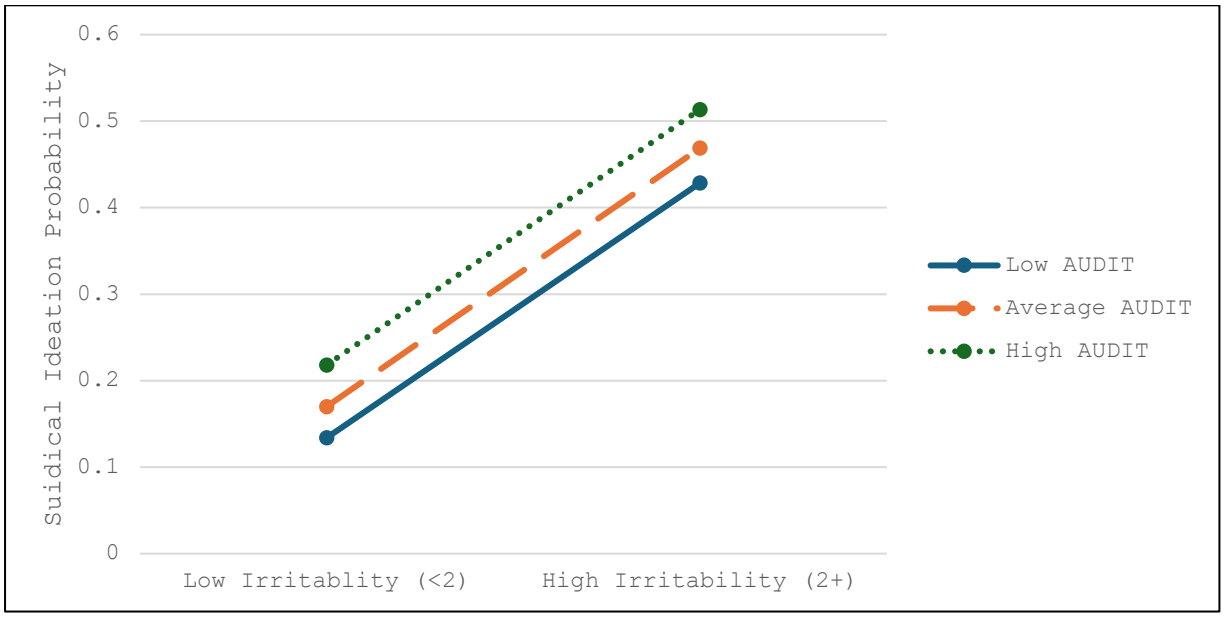
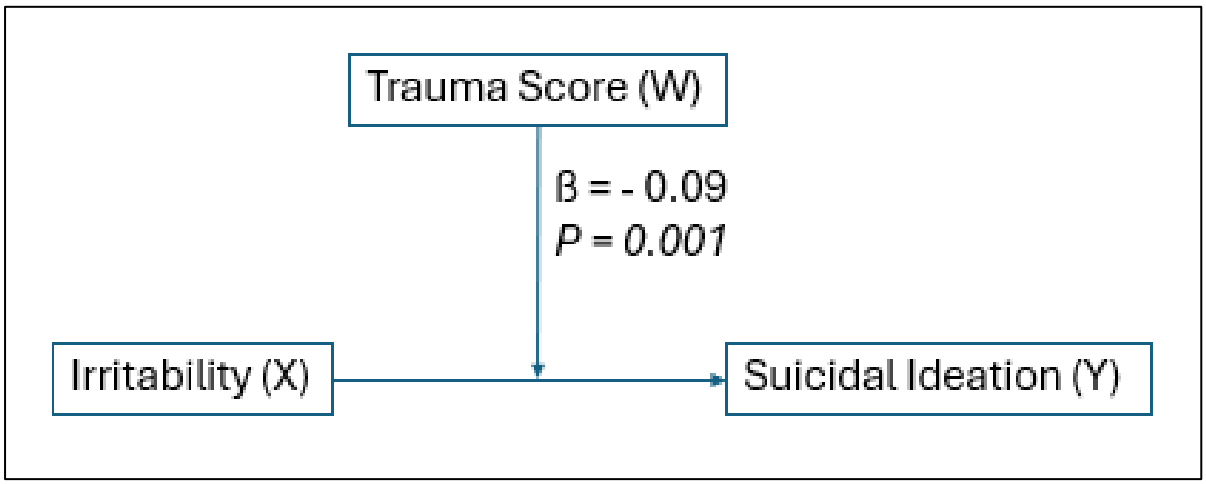


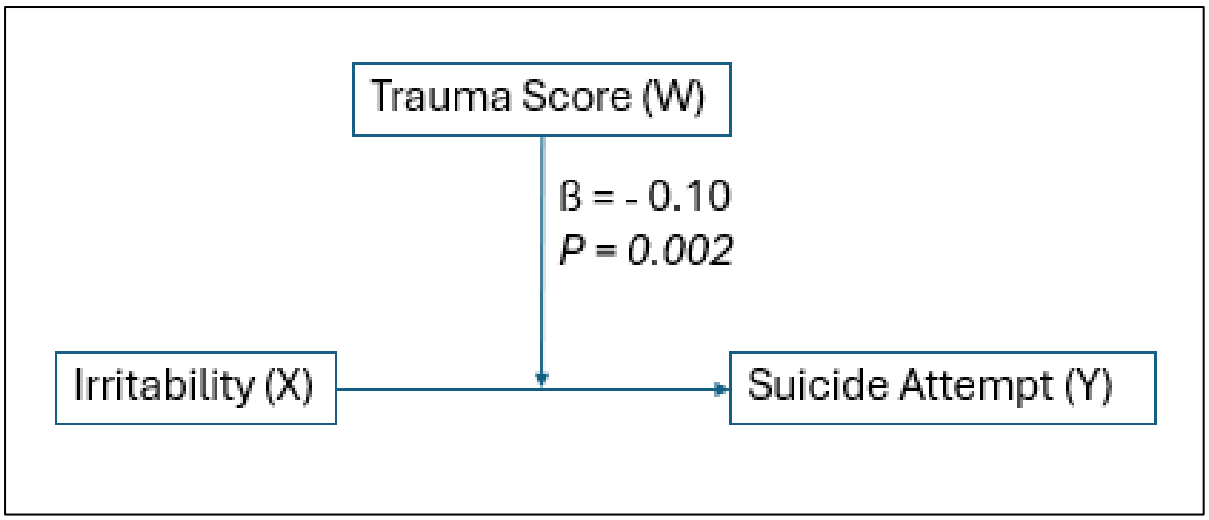
Figure 2a: Simple slopes of the relationship between irritability and suicidal ideation at low (-1SD), average (mean) and high (+1SD) values of AUDIT score

Trauma experiences also moderated the irritability–suicidal ideation relationship (B = –0.09, SE = 0.03, *p* = .00, 95% CI [–0.143, –0.04]) (see Model 1b), as well as the irritability-suicide

attempt relationship (B = -0.10, SE = 0.03, *p* = 0.002, 95% CI [-0.16, -0.03]) (see Model 1c). The simple slopes representing the conditional effects of irritability on the probability of suicidal ideation or suicide attempt at high, average and low levels of trauma are presented in Figure 2b (suicidal ideation) and Figure 2c (suicide attempt). The simple slopes show that higher irritability is associated with greater probability of suicidal ideation or attempt, and that this association becomes progressively stronger with increasing trauma experiences, again noting that the log-odds coefficients are negative. Therefore, the main effects of irritability and trauma experiences on suicidality are so strong that this minimises the weakening moderating effect.



MODEL 1b: Conceptual model of the relationship of irritability with suicidal ideation, with trauma score as a moderator



MODEL 1c: Conceptual model of the relationship of irritability with suicidal attempt, with trauma score as a moderator

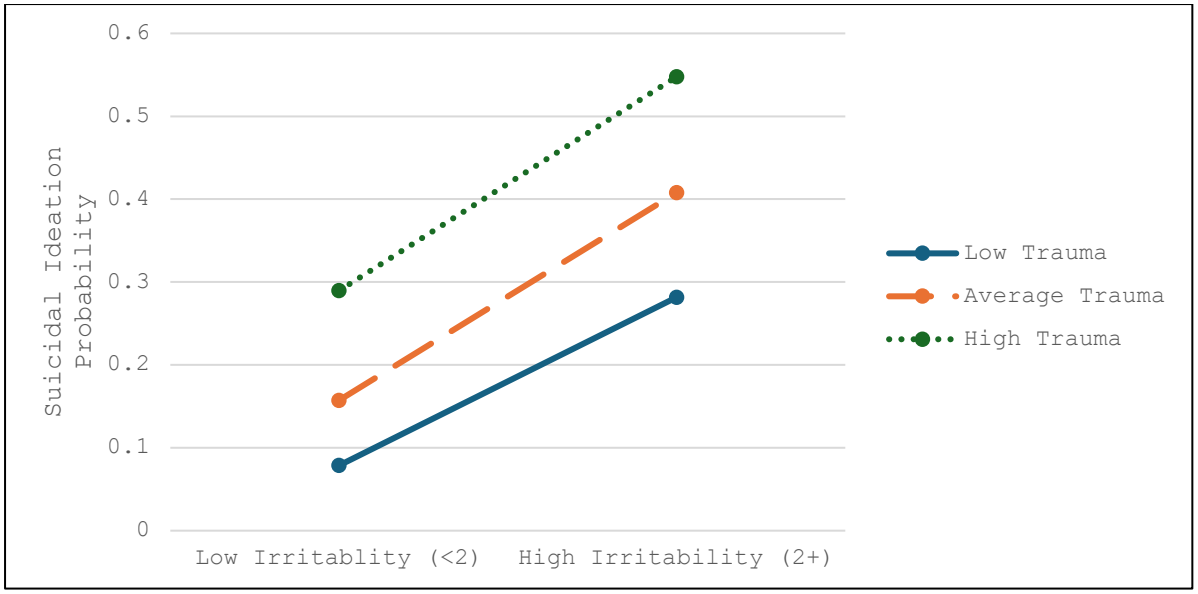


Figure 2b: Simple slopes of the relationship between irritability and suicidal ideation at low (-1SD), average (mean) and high (+1SD) values of trauma score

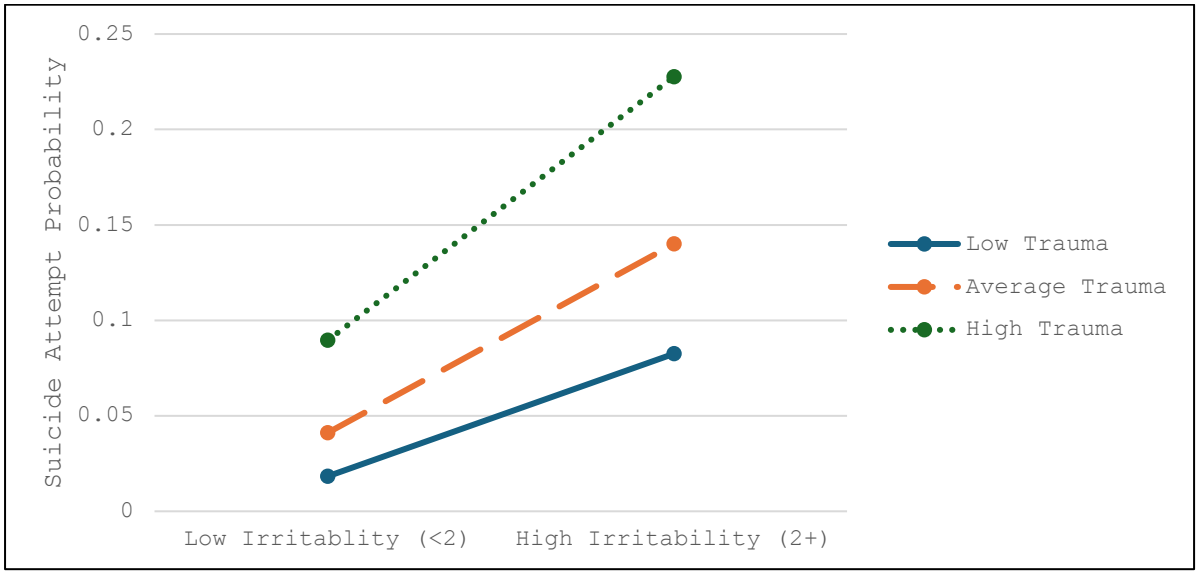


Figure 2c: Simple slopes of the relationship between irritability and suicide attempt at low (-1SD), average (mean) and high (+1SD) values of trauma score

Sensitivity Analyses

Sensitivity analyses were performed to assess the strength of the results, specifically whether the associations of irritability with suicidal ideation and attempt are independent of depression. Presence of a depression diagnosis was seen in 49.7% of individuals who reported suicidal ideation, and 19.2% of those who reported suicide attempt. Both the multivariable regression and moderation analyses were repeated adjusting for depression. In

the multivariable models depression was strongly associated with odds of suicidal ideation (OR = 7.23, 95% CI [6.19-8.43]; $p < 0.001$) and suicide attempt (OR = 7.40, 95% CI [5.70-9.62]; $p < 0.001$); however, while the strength of association was attenuated, irritability remained significantly independently associated with suicidal ideation (OR = 1.93, 95% CI [1.61-2.30]; $p < 0.001$*)* and suicide attempts (OR = 1.58, 95% CI [1.24-2.00]; $p < 0.001$). Similarly, all other variables included in the multivariable models continued to be significantly associated with suicidal ideation and attempt. When the moderation analyses adjusted for depression, the significant interaction effects were reduced and no longer statistically significant.

Discussion:

This study explored the relationship between irritability and suicidality, both ideation and attempt, in a large sample representative of the general population of England. The findings extend our knowledge of the role of irritability in suicidal risk in important ways. First, irritability was consistently strongly associated with suicidal ideation and attempt, even when accounting for other established risk factors such as sex, age, trauma experiences, AUDIT score and impulsivity. This suggests that irritability may play a role in the complex interplay of risk factors for suicidality, separate from other high-risk variables, such as impulsivity. To provide nuanced evidence in relation to Orri et al.'s (2018) review around irritability, this review shows clear evidence of the relationship between higher rates of irritability with higher risks of suicidal ideation and attempt within a large general population.

The findings emphasise the importance of emotional dysregulation, specifically irritability, within suicidal risk profiles. Similar to impulsivity, which is a strongly evidenced transdiagnostic factor in various suicide theoretical models, such as the IMV model (O'Connor & Kirtley, 2018), irritability appears to be an important transdiagnostic link for risk of suicidal thoughts and behaviours (STBs). This means that beyond well-established diagnoses linked to suicidality, such as depression, irritability presents as a strong association with suicidal ideation and attempts. Furthermore, the findings from this research

support a dimensional, transdiagnostic approach to mental health risk, in line with the Research Domain Criteria framework (RDoc; Brotman et al., 2017). Prioritisation should be given to underlying processes over categorical diagnoses when identifying risk and evidencing treatment options (Yager, 2020).

Several risk variables were found to moderate the association of irritability with suicidal ideation and attempts in the main analyses. Moderation analysis and simple slopes indicated that due to the significant effect of irritability and traumatic experiences/AUDIT scores on suicidal ideation/attempts, the statistically significant weakening moderation effect was minimal. This is broadly consistent with the contention that alcohol is likely to exacerbate or worsen emotional dysregulation and impulsive cognition, potentially amplifying distressing mood states (Hufford, 2001). Further moderation analyses revealed that age, sex and impulsivity did not significantly moderate the relationship between irritability and either suicidal ideation or suicide attempt. Given the large population-representative sample of the APMS 2014, these null findings are unlikely to reflect insufficient statistical power. Instead, these results suggest that the association of irritability with suicidality is largely consistent and uniform effect across demographic groups and levels of impulsivity. While prior research has shown each of these variables to be associated with both irritability and suicidality (Cooper et al., 2015; Mirande-Mendizabal et al., 2019), the interplay of each with irritability did not add to the independent associations observed in this general population sample. This suggests irritability may present a consistent risk or co-occur with STBs across sociodemographic characteristics and degree of impulsivity, which is an important finding given gendered expressions of irritability and suicidality (Toohey, 2020; Bjorkqvist, 2018). Importantly, sensitivity analyses found the moderating effects of trauma experiences and AUDIT were no longer significant in adjusted moderation analyses. This suggests that depression may account for the observed moderation patterns. This may be due to shared variance between trauma experiences or alcohol risk, with depression, consistent with wider evidence that trauma experiences and alcohol misuse contribute to the development of

depression and comorbidities (Nanni et al., 2012; Grant et al., 2021). Importantly, the interaction effects within the significant moderation analyses were modest, particularly with the AUDIT scores and suicidal ideation, therefore it is unsurprising that depression reduced the effect to non-significance. As the moderation effects were small given the large sample size, once depression was included into the analysis, the small amount of variance explained by the interactions was nullified by the covariate.

Irritability does not feature in existing suicide theoretical frameworks. One of the most comprehensive suicide models, the IMV Model of Suicide, refers broadly to 'diathesis' factors, which could encompass trait irritability as a vulnerability to suicidal risk, but does not position it explicitly within pre-motivational, motivational or volitional phases (O'Connor & Kirtley, 2018). The present research suggests that irritability may warrant greater emphasis as a potentially important factor contributing or presenting alongside suicidal risk within suicide models, although further research, including longitudinal designs, is needed to clarify its role and the direction of any relationship. From a clinical perspective, these findings suggest that screening for irritability may help identify those who are more likely to report suicidal thoughts or behaviours. Irritability is a modifiable factor, meaning it is responsive to intervention via emotion regulation strategies using interventions such as cognitive behaviour therapy (e.g. Kircanski et al., 2018). To the extent that future work establishes a causal relationship between irritability and suicidal risk, irritability could be integrated into suicide prevention treatment plans. Emphasising irritability as a modifiable factor allows clinicians to target specific psychological processes rather than solely focusing on diagnostic categories, in line with dimensional approaches such as the RDoc framework.

This study benefits from a large, general population sample, with substantial statistical power, and generalisable findings across different ages and sexes. The inclusion of potential moderators of the irritability-suicide risk relationship offers a more nuanced understanding of the conditions under which irritability may increase STB risk. At the same time, there are some limitations that should be considered when interpreting these study findings. This

includes potential concerns over the measure of irritability used in this study, which has not been validated as a standalone instrument. The CIS-R, from which the irritability measure was drawn, does not distinguish irritability from overlapping constructs like anger or aggression, and internal and external validity has not been established. Furthermore, the measurement of impulsivity relied on a single item which was not administered to individuals over 65 years, reducing the analytic sample size and potentially leading to an underrepresentation of older adults in relevant analyses. Although the sensitivity analyses sought to address the robustness of the relationships between irritability and suicidal risk, further work is needed to clarify the independence of irritability from depression, especially as irritability may be a measurable symptom of depression. Lastly, the sex within the APMS 2014 dataset was limited to a binary outcome of male and female. Thus, this research was not able to take into consideration non-binary and transgender outcomes, which have exceedingly higher risks associated with STBs (Santos et al., 2025; Haas et al., 2011).

Future research would benefit from using validated, irritability-specific measures such as the Brief Irritability Test (BITe; Holtzman et al., 2015), and multi-item measures of impulsivity. Crucially, longitudinal or ecological momentary assessment designs should be a priority to help clarify the causal direction between irritability and suicidality, which remains uncertain given the cross-sectional analysis and lifetime reference period for suicidality outcomes used in this study. Finally, expanding this work to clinical subgroups (e.g. post-traumatic stress disorder, bipolar disorder, borderline personality disorder) in comparison to a general population, could determine whether irritability functions similarly across populations or interacts uniquely with other psychiatric features.

Conclusion

The study reports evidence that irritability is associated with elevated odds of reporting a lifetime history of suicidal ideation and attempt in the general population of England. This association exists independently of other established risk factors, but evidence of moderation by trauma experiences and AUDIT scores is not robust to further adjustment by

depression. The present study highlights the importance of irritability as a potential risk factor for suicidal ideation and attempt. Subject to further research using robust designs and measures, irritability may be an important target for screening and treatment management to mitigate risk. Clinically, these findings suggest that screening for irritability may help identify and support individuals at elevated risk of suicidal thoughts and behaviours. Implementing interventions to manage emotional dysregulation, especially irritability, may help identify and support individuals at elevated risk of suicidal thoughts and behaviours.

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Appendices

APPENDIX A: PRISMA Checklist and Prisma for Abstract Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	6
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	7
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	9
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	13
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	13
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.	16
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	16-17
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.	13-16

Section and Topic	Item #	Checklist item	Location where item is reported
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.	17
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, time points, analyses), and if not, the methods used to decide which results to collect.	13-15
	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.	13-15
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.	17-18
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.	n/a
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)).	18
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	n/a

Section and Topic	Item #	Checklist item	Location where item is reported
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	18
	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.	18
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	18
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	n/a
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	n/a
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	n/a
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.	19-20
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	19-20
Study	17	Cite each included study and present its characteristics.	23-24

Section and Topic	Item #	Checklist item	Location where item is reported
characteristics			
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	21-22
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.	n/a
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	19-24
	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.	24-32
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	n/a
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	n/a
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	n/a
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	n/a
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	33
	23b	Discuss any limitations of the evidence included in the review.	33-34

Section and Topic	Item #	Checklist item	Location where item is reported
	23c	Discuss any limitations of the review processes used.	34
	23d	Discuss implications of the results for practice, policy, and future research.	36
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	13
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	13
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	n/a
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	n/a
Competing interests	26	Declare any competing interests of review authors.	n/a
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.	n/a

PRISMA 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

Section and Topic	Item #	Checklist item	Reported (Yes/No)
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.	N/A
Registration	12	Provide the register name and registration number.	YES

APPENDIX B: Search strategy

Search terms and their combination for database PsychoInfo, PsychArticles, Medline, CINAHL and Psychology and Behavioural Sciences Collection:

Title or abstract: (Alcohol$ OR AUD OR ((alcohol$ or drink$) adj5 (abus$ or addict$ or crav$ or dependen$ or disease$ or disorder$ or excessiv $ or harmful or hazardo$ or heavy or intoxicat$ or use$ or misus$ or overdos$ or problem$))) AND

All text: (STAXI OR STAXI-2 or state anger OR trait anger OR anger expression OR anger control).

Search terms and their combination for database Web of Science Core Collection:

Title or abstract: (Alcohol$ OR AUD OR ((alcohol$ or drink$) adj5 (abus$ or addict$ or crav$ or dependen$ or disease$ or disorder$ or excessiv $ or harmful or hazardo$ or heavy or intoxicat$ or use$ or misus$ or overdos$ or problem$))) AND

All fields: (STAXI OR STAXI-2 or state anger OR trait anger OR anger expression OR anger control).

Search terms and their combination for database Embase.

Title or abstract: (Alcohol$ OR AUD OR ((alcohol$ or drink$) adj5 (abus$ or addict$ or crav$ or dependen$ or disease$ or disorder$ or excessiv $ or harmful or hazardo$ or heavy or intoxicat$ or use$ or misus$ or overdos$ or problem$))) AND

All fields: (STAXI OR STAXI-2 or state anger OR trait anger OR anger expression OR anger control).

APPENDIX C: JBI Critical Appraisal Checklists

JBI Critical Appraisal Checklist for analytical cross sectional studies

	Yes	No	Unclear	Not applicable
1. **Were the criteria for inclusion in the sample clearly defined?**	□	□	□	□
2. **Were the study subjects and the setting described in detail?**	□	□	□	□
3. **Was the exposure measured in a valid and reliable way?**	□	□	□	□
4. **Were objective, standard criteria used for measurement of the condition?**	□	□	□	□
5. **Were confounding factors identified?**	□	□	□	□
6. **Were strategies to deal with confounding factors stated?**	□	□	□	□
7. **Were the outcomes measured in a valid and reliable way?**	□	□	□	□
8. **Was appropriate statistical analysis used?**	□	□	□	□

Overall appraisal: Include □ Exclude □ Seek further info □

Comments (Including reason for exclusion)

Explanation of analytical cross sectional studies critical appraisal

How to cite: Moola S, Munn Z, Tufanaru C, Aromataris E, Sears K, Sfetcu R, Currie M, Qureshi R, Mattis P, Lisy K, Mu P-F. Chapter 7: Systematic reviews of etiology and risk . In: Aromataris E, Munn Z (Editors). *JBI Manual for Evidence Synthesis.* JBI, 2020. Available from https://synthesismanual.jbi.global

Analytical cross sectional studies Critical Appraisal Tool

Answers: Yes, No, Unclear or Not/Applicable

1. Were the criteria for inclusion in the sample clearly defined?

The authors should provide clear inclusion and exclusion criteria that they developed prior to recruitment of the study participants. The inclusion/exclusion criteria should be specified (e.g., risk, stage of disease progression) with sufficient detail and all the necessary information critical to the study.

2. Were the study subjects and the setting described in detail?

The study sample should be described in sufficient detail so that other researchers can determine if it is comparable to the population of interest to them. The authors should provide a clear description of the population from which the study participants were selected or recruited, including demographics, location, and time period.

3. Was the exposure measured in a valid and reliable way?

The study should clearly describe the method of measurement of exposure. Assessing validity requires that a 'gold standard' is available to which the measure can be compared. The validity of exposure measurement usually relates to whether a current measure is appropriate or whether a measure of past exposure is needed.

Reliability refers to the processes included in an epidemiological study to check repeatability of measurements of the exposures. These usually include intra-observer reliability and inter-observer reliability.

4. Were objective, standard criteria used for measurement of the condition?

It is useful to determine if patients were included in the study based on either a specified diagnosis or definition. This is more likely to decrease the risk of bias. Characteristics are another useful approach to matching groups, and studies that did not use specified diagnostic methods or definitions should provide evidence on matching by key characteristics

5. Were confounding factors identified?

Confounding has occurred where the estimated intervention exposure effect is biased by the presence of some difference between the comparison groups (apart from the exposure investigated/of interest). Typical confounders include baseline characteristics, prognostic factors, or concomitant exposures (e.g. smoking). A confounder is a difference between the comparison groups and it influences the direction of the study results. A high quality study at the level of cohort design will identify the potential confounders and measure them (where possible). This is difficult for studies where behavioral, attitudinal or lifestyle factors may impact on the results.

6. Were strategies to deal with confounding factors stated?

Strategies to deal with effects of confounding factors may be dealt within the study design or in data analysis. By matching or stratifying sampling of participants, effects of confounding factors can be adjusted for. When dealing with adjustment in data

analysis, assess the statistics used in the study. Most will be some form of multivariate regression analysis to account for the confounding factors measured.

7. Were the outcomes measured in a valid and reliable way?

Read the methods section of the paper. If for e.g. lung cancer is assessed based on existing definitions or diagnostic criteria, then the answer to this question is likely to be yes. If lung cancer is assessed using observer reported, or self-reported scales, the risk of over- or under-reporting is increased, and objectivity is compromised. Importantly, determine if the measurement tools used were validated instruments as this has a significant impact on outcome assessment validity.

Having established the objectivity of the outcome measurement (e.g. lung cancer) instrument, it's important to establish how the measurement was conducted. Were those involved in collecting data trained or educated in the use of the instrument/s? (e.g. radiographers). If there was more than one data collector, were they similar in terms of level of education, clinical or research experience, or level of responsibility in the piece of research being appraised?

8. Was appropriate statistical analysis used?

As with any consideration of statistical analysis, consideration should be given to whether there was a more appropriate alternate statistical method that could have been used. The methods section should be detailed enough for reviewers to identify which analytical techniques were used (in particular, regression or stratification) and how specific confounders were measured.

For studies utilizing regression analysis, it is useful to identify if the study identified which variables were included and how they related to the outcome. If stratification was the analytical approach used, were the strata of analysis defined by the

specified variables? Additionally, it is also important to assess the appropriateness of the analytical strategy in terms of the assumptions associated with the approach as differing methods of analysis are based on differing assumptions about the data and how it will respond.

APPENDIX D: Sample Characteristics and Detailed Findings Figures

Study ID	Authors (Year) - Country	Study Design	Sample and Population Characteristics	Comparison Group	STAXI version used and Anger Dimensions	Alcohol Use Measures	Analyses
1	Babic, D., Martinac, M., Bjelanovic, V., Babic, R., Sutovic, A. & Sinanovic, O. (2010) - Bosnia & Herzegovinia	Cross-sectional	Male war veterans with PTSD and AUD (n =93). Mean age =41.87 (SD 8.44). Single = 19. married = 71, widower = 2, divorced =1. Education completed (elementary = 11, secondary = 74, high school = 6, college = 2), employed =33.	Male war veterans with PTSD (n=147). Mean age = 37.52 (SD 6.19). Single = 34, married = 110, divorced = 3. Education completed (elementary = 22, secondary = 108, high school = 8, college = 9). Employed = 89.	STAXI - I : State, trait, angry reaction (trait subscale), angry temperament (trait subscale), anger expression index, anger expression-out, anger expression-in, anger control	auto-diagnosis questionnaire for detecting alcoholism (CAGE), medical diagnosis, biomedical parameters	AUD group significantly higher mean scores for state (2.09 v 1.69, t=4.48, p<0.001), trait (2.53 v 2.16, t=3.96, p<0.001), trait subscale angry reaction (2.49 v 2.17, t=3.19, p=0.002), trait subscale angry temperament (2.73 v 2.36, t=3.74, p<0.001). anger expression-out (2.46 v 2.19, t=3.77, p=0.002), anger expression-in (2.25 v 1.92, t=4.38, p<0.001), anger expression index (2.34 v 2.22, t=3.16, p<0.001). The control group had a trend of higher mean scores than the AUD group for anger control (2.59 v 2.42, t=1.95, p=0.053).

2	Czermainski, F.R., Lopes, F.M., Ornell, F., Guimaraes, L.S.P., Von Diemen, L., Kessler, F. & Martins de Almeida, R.M. (2020) - Brazil	Cross-sectional	Male patients with diagnosis of SUD (AUD n= 13, Crack cocaine = 25, crack cocaine+AUD = 16). Mean age of AUD group = 42.38 (11.66). Mean IQ of AUD group = 85.46 (9.64)	Male patients with no history of substance abuse or treatment (n=13) Mean age = 22.69 (7.20) IQ = 100.46 (5.22)	STAXI - I : state, trait, temperament (trait subscale), trait reaction (trait subscale), anger expression-in, anger expression-out, control, AEI	diagnosis from DSM-IV for substance use disorders	AUD group showed higher median scores than the control group for trait (23 v 16.15), trait subscale angry reaction (10.92 v 7.53) and trait subscale angry temperament (7.92 v 5.69). AUD group also showed higher mean scores than the control group for anger expression-out (16.61 v 12.61), anger expression-in (22.61 v 15), anger expression index (32.07 v 23.38). There was no significant difference in the median scores between the AUD and control group for state anger(12.00 v 11.84) or control (23.15 v 20.23, p=0.71))
3	Eriksson, L., Bryant, S., McPhedran, S., Mazerolle, P. & Wortley,	Cross-sectional	Homicide offenders (n= 302; AUD group = 107, moderate alcohol problem = 66), Mean age at homicide of AUD group = 27.3 (7.6), moderate group = 30.1 (10.4)	Homicide offenders with no or low alcohol problems (0-7) (n=103) Mean age at homicide = 34.2 (12.1), Male = 80.6%,	STAXI -II : trait	10-item Alcohol Use Disorder Identification Test (AUDIT)	AUD group had significantly higher mean scores than the control low/none and moderate alcohol group for trait anger (23 v 18.3, x^2 =28.06, p=0.000).

	R. (2020) - Australia		Male AUD = 89.7%, male moderate = 90.9, Unemployed AUD = 41.1%, unemployed moderate = 19.7%, AUD did not complete high school = 76.6%, moderate did not complete high school = 70.8%	Unemployed = 15.5%, did not complete high school = 53.9%			
4	Haw, C., Houston, K., Townsend, E. & Hawton, K. (2001) - United Kingdom	Cross-sectional	Patients who were admitted due to DSH with an AUD (n= 40) Male = 22, female = 18 Age median = 36.5 Single = 13, married = 8, widowed/divorced/separated = 19 Living alone = 12 Employed = 9, unemployed = 13, sick/disabled = 15, student/retired/ housewife = 3	Patients who were admitted due to DSH with no (n=110) Male = 36, female = 74 Median age = 25 Single = 64, married = 21, widowed/divorced/separated = 25 Living alone = 13 Employed = 47, unemployed = 14, sick/disabled = 25, student/retired/ housewife = 22	STAXI-I : state, trait	ICD-10 diagnosis of harmful use of alcohol or alcohol dependence, CAGE questionnaire	AUD group had significantly higher median scores than the control for state (14.5 v 11, z=2.34, p< 0.05) and trait (22.5 v 20, z=2.229, p<0.05).

6	Ilyuk, R.D., Gromyco, D.I., Kiselev, A.S., Torban, M.N. & Krupitsky, E.M. (2012) - Russia	Cross-sectional	Patients with diagnosis of substance use disorder (SUD) (AUD group = 38, stimulant = 42, opioid=91, polysubstance = 50)	Healthy individuals with no psychiatric diagnoses of SUDs (n=90)	STAXI-I : Feeling Angry (State Subscale), Trait Anger, Angry Temperment (Trait subscale), Angry Reaction (Trait subscale), Anger Expression-in, Anger Expression-out, Anger control	Clinical based diagonses of substance use disorders	AUD group had significantly higher mean scores than the control for trait (20.21 v 17.86, p<0.05), anger expression-in (19.67 v 14.87, p<0.05).
			AUD mean age = 33.71 (0.90)	Mean age = 21.74 (0.79)			
			AUD male = 33, AUD female = 5	Male = 54, female = 36			AUD group had significant lower mean scores than the polysubstance group for trait (20.21 v 23.23, p<0.05), the trait subscale of angry reaction (10 v 11.77, p<0.05), and anger expression-out (15.27 v 18.58, p<0.05).
			AUD middle school = 1, AUD high school = 19, AUD some university-level = 2, AUD university = 16	Middle school = 7, high school = 45, some university-level = 26, university =12			There were no significant differences between the AUD group and any of the other groups for the state subscale feeling angry, the trait subscale angry temperament, and anger control.
7	Kara, N., Sarigedik, E. & Ataoglu, A.	Cross-sectional	Patients with AUD (n =72)	Paitents with no psychiatric diagnoses of AUD (n=71)	STAXI-I : Trait, Anger control,	Clinical based diagnosis of	AUD group had significantly higher mean scores than the control group for trait (23.10 v 19.04, t=3.966, p<0.001), anger expression-out (17.50 v 14.49,

	(2023) - Turkey				Anger Expression-in, Anger Expression-out	AUD based on DSM-V, AUDIT	t=3.374, p=0.001), anger expression-in (18.57 v 16.38, t=3.306, p=0.001). Control group had significantly higher mean scores than the AUD group for anger control (22.94 v 20.74, t=-2.493, p=0.014).
			Mean age = 44.06 (9.71)	Mean age = 44.42 (9.57)			
			Male = 66 (91.7%), female = 6 (8.3%)	Male = 65 (91.5%), female = 6 (8.5%)			
			Married = 46 (63.9%), single = 17 (23.6%), divorced/separated = 9 (12.5%)	Married = 64 (90.1%), single = 4 (5.6%), divorced/separated = 3 (4.2%)			
8	Körner, N., Schmidt, P. & Soyka, M. (2015) - Germany	Cross-sectional	Patients abstaining from AUD (n= 40)	Healthy individuals with no psychiatric diagnoses of AUD (n=40)	STAXI-I : state, trait	ICD-10 diagnosis of dependency syndrome currently abstinent or depdenency sundrome currently abstinent but	AUD group had no signficant mean score differences to the control for state (1.25 v 1.14) or trait (1.90 v 1.86).
			Mean age = 48.15 (10.51)	Mean age = 45.40 (10.73)			
			Male = 27, female= 13	Male = 27, female = 13			

			Married = 12, divorced = 7, single = 19, separated = 1, widowed = 1	Married = 12, divorced = 7, single = 19, separated = 1, widowed = 1		in a sheltered environment	
			Mean yrs of education = 15.15 (2.76)	Mean yrs of education = 15 (2.70)			
9	Miyajimi, M., Miyata, T., Murakami, Y., Yotsumoto, K., Ukita, A., Morimoto, T., Kobayashi, M., Tanaka, H., Yamada, S., Matsusaki, Y. & Inoue, T. (2024) - Japan	Cross-sectional	Japanese university students with varying levels of alcohol risk (suspected AUD group = 46, high alcohol risk group = 208)	Japanese students with low alcohol risk (n=813)	STAXI-II (Japanese Version) : state, trait, anger expression index	AUDIT (Japanese Version)	AUD group had significantly higher mean scores than the low alcohol risk control group for state (17.43 v 15.83, p<0.001, effect size moderate= 0.57), trait (17.85 v 15.00, p<0.001, effect size moderate= 0.65), and anger expression index (43.72 v 38.60, p<0.001, effect size moderate =0.52).
			Mean age = 21.25 (1.41)	Mean age = 21.25 (1.41)			
			Male = 392 (32.5%), female = 790 (65.6%)	Male = 392 (32.5%), female = 790 (65.6%)			
10	Romero-Martinez, A., Lila, M.,	Cross-sectional	Male IPV perpetrators with problematic alcohol use (n= 74)	Male IPV perpetrators with no/low Problematic Alcohol Use (n=71)	STAXI-II (Spanish Version) :	AUDIT (Spanish Version),	AUD group had significantly higher mean scores than the control group for trait (18.23 v 14.13, p<0.05) and anger expression index (29.14 v 22.70, p<0.05).

	Catala-Minana, A., Williams, R.K. & Moya-Albiol, L. (2013) - Spain		Mean age = 38.34 (10.47) Single = 20 (27%), married (19 (26%), divorced = 35 (47%) Education completed (basics = 43 (58%), graduate = 25 (34%), college = 6 (8%)) Working full/part time = 37 (50%) Unemployed (37 (50%)	Mean age = 41.67 (11.21) Single = 18 (25%), married = 34 (48%), divorced = 19 (27%) Education completed (basics = 41 (58%), graduate = 23 (32%), college = 7 (10%)) Working full/part time = 39 (55%), unemployed = 32 (45%)	trait, anger expression index	CAGE (Spanish Version), Millon Clinical Multiaxial Inventory-III (MCMI-III) (Spanish Version) with alcohol dependence scales used	
11	Sharma, M.K., Suman, L.N., Murthy, P. & Marimuthu, P. (2012) - India	Cross-sectional	Male patients with AUD or abstaining (AUD group = 50, Currently abstaining AUD group = 50)	Male social drinks (n = 50)	STAXI-II : State, Feel Anger (State Subscale), Feel Like Express Anger Verbal (State Subscale), Feel Like Express	ICD-10 diagnosis of alcohol dependence	AUD group had significantly higher mean scores than the control group for state (49.00 v 45.24, p=0.000), state subscale feeling angry (47.48 v 42.96, p=0.002), state subscale feel anger verbally (45.76 v 42.40, p=0.002), trait anger (71.32 v 61.64, p=0.000), trait subscale angry temperament (66.20 v 56.20, p=0.000), trait subscale angry reaction (66.96 v 61.64, p=0.004), anger expression-out (63.28 v 55.88, p=0.011), anger expression-in (56.12 v 50.12, p=0.001), and anger expression index (61.96 v 53.56, p=0.001).

					Physical Anger (State Subscale), Trait, Anger Temperament (Trait Subscale), Anger Reaction (Trait Subscale), Anger Expression-out, Anger Expression-in, Anger Control-in, Anger Control-out, Anger Expression Index		The control group had significantly higher mean scores than the AUD group for anger control-out (44.80 v 40.04, p=0.018) and anger control-in (50.28 v 45.08, p=0.007). There were no significant differences between the AUD or control group for state subscale feeling anger physically (42.60 v 41.36, p=0.71).

12	Siria, S., Fernandex-Montalvo, J., Echauri, J., Azkarate, J., Martinez, M., Olabarrieta, L. & Rivera, D. (2022) - Spain	Quasi-Experimental Cohort (Only Cross-Sectional data was used)	Male IPV perpetrators with problematic alcohol use (n = 64) Mean age = 37.84 (10.88) Education completed (primary = 33 (51.6%), secondary = 31 (48.4%)) Employed = 27 (42.2%), unemployed = 34 (53.1%), retired = 3 (4.7%)	Male IPV perpetrators with no/low problematic alcohol use (n=577) Mean age = 38.25 (11.05) Education completed (primary = 289 (50.1%), secondary = 258 (44.7%, university = 30 (5.2%)) Employed = 315 (54.6%), unemployed = 235 (40.7%), retired = 27 (4.7%)	STAXI-II : Anger Expression Index	MCMI-III with BR value ≥75 on alcohol dependence scale	AUD group had significantly higher mean scores than the control group for anger expression index (29.34 v 19.79, t=6.71, p<0.001).
13	Siria, S., Leza, L., Fernandez-Montalvo, J., Echauri, J.A., Azkarate, J.M. & Martinez, M. (2021) - Spain	Cross-sectional	Male IPV perpetrators with problematic alcohol use (n = 125) Mean age = 35.98 (10.89)	Male IPV perpetrators with no/low problematic alcohol use (n = 856) Mean age = 37.76 (10.81)	STAXI-II : Trait, Anger Temperament (Trait Subscale), Anger Reaction (Trait Subscale), Anger Expression-	MCMI-III with BR value ≥75 on alcohol dependence scale	AUD group had significantly higher mean scores than the control group for trait (19.21 v 15.68, d=0.69, t=5.94, p=0.000), trait subscale anger temperament (8.82 v 6.71, d=0.78, t=6.25, p=0.000), trait subscale anger reaction (10.46 v 8.92, d=0.49, t=5.21, p=0.000), anger expression-out (10.89 v 8.83, d=0.69, t=6.42, p=0.000), anger expression-in (13.09 v 11.22, d=0.53, t=5.07, p=0.000), and anger expression index (29.39 v 20.71, d=0.75, t=7.18, p=0.000).

			Education completed (primary = 64 (51.2%), secondary = 60 (48%), university = 1 (0.8%))	Education completed (primary = 432 (50.5%), secondary = 374 (43.7%), university = 50 (5.8%))	in, Anger Expression-out, Anger Control-in, Anger Control-out, Anger Expression Index		Control group had significantly higher mean scores than the AUD group for anger control-out (18.91 v 16.13, d=0.54, t=5.16, p=0.000) and anger control-in (16.38 v 14.50, d=0.36, t=3.77, p=0.000).
			Employed = 47 (37.6%), unemployed = 73 (58.4%), retired = 5 (4%)	Employed = 461 (53.8%), unemployed = 356 (41.6%), retired = 39 (4.6%)			
14	Tikka, D.L., Ram, D., Dubey, I. & Tikka, S.K. (2014) - India	Cross-sectional	Male patients with AUD (n = 40)	Healthy individuals with no psychiatric diagnoses of AUD (n = 40)	STAXI-I : State, Trait, Anger Temperament (Trait Subscale), Anger Reaction (Trait Subscale), Anger Expression-in, Anger Expression-out, Anger	ICD-10 diagonsis of alcohol dependence	AUD group had significantly higher mean scores than the control group for anger expression-out (16.58 v 13.80, t=2.65, p=0.010), anger expression-in (18.75 v 14.92, t=3.63, p=0.001) and anger expression index (27.85 v 21.20, t=3.24, p=0.002). There were significant differences in mean scores between the AUD v control group for state, trait, trait subscale angry temperament, trait subscale angry reaction, and anger control.
			Mean age = 38.20 (7.74)	Mean age = 36.88 (7.37)			
			Education level (low = 22 (55%), middle = 14 (35%), high = 4, 10%))	Education level (low = 13 (32.5%), middle = 23 (57.5%), high = 4 (10%))			
			Employed = 34 (85%), unemployed = 6 (15%)	Employed = 40 (100%)			

					Control-in, Anger Control-out, Anger Expression Index		
15	Tivis, L.J., Parsons, O.A. & Nixon, S.J. (1998) - United States of America	Cross-sectional	Patients with AUD (n = 144)	Healthy individuals without history of treatment for substance abuse and reported drinking less than 3 drinks per day over the last year (n = 70)	STAXI-I : State, Trait, Anger Expression-in, Anger Expression-out	DSM-III-R diagnosis of alcohol abuse or dependence.	AUD males had significantly higher mean scores than control male group for trait (19.26 v 14.70, $p<0.05$) and anger expression-in (18.38 v 12.70, $p<0.05$). AUD females had significantly higher mean scores than control female group for anger expression-in (17.91 v 13.00, $p<0.05$).
			Mean age (male) = 36.37 (7.47), (female) = 37.59 (7.28)	Mean age (male) = 36.03 (7.73), (female) = 37.91 (9.04)			
			Male = 70, female = 34	Male = 36, female = 34			
			Mean yrs of education (male) = 12.99 (1.69), (female) = 12.47 (1.64)	Mean yrs of education (male) = 13.28 (1.11), (female) = 13.62 (1.41)			

							There were no significant difference in mean scores between the AUD male/female and control male/female group for state and anger expression-out. There were no significant differences in mean scores for AUD females v control females for trait anger.

Appendix E: STROBE Checklist for 'Investigating the Role of Irritability on Suicidal Ideation and Behaviour' (2025)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No.
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	49
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	49-50
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	51-55
Objectives	3	State specific objectives, including any prespecified hypotheses	55-56
Methods			
Study design	4	Present key elements of study design early in the paper	56
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	56-58
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	56-57
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	58-60
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	58-60
Bias	9	Describe any efforts to address potential sources of bias	62
Study size	10	Explain how the study size was arrived at	n/a
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	61-62
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	61-62
		(*b*) Describe any methods used to examine subgroups and interactions	61-62
		© Explain how missing data were addressed	61
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n/a

		(*e*) Describe any sensitivity analyses	62
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	n/a
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	62-64
		(b) Indicate number of participants with missing data for each variable of interest	n/a
Outcome data	15*	Report numbers of outcome events or summary measures	64-66
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	64-71
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	671-72
Discussion			
Key results	18	Summarise key results with reference to study objectives	72-73
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	75
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	76
Generalisability	21	Discuss the generalisability (external validity) of the study results	75
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	n/a

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

APPENDIX F: Relevant correspondence regarding Ethical Approval

Relevant correspondence regarding Ethical Approval removed due to confidentiality issues.

Appendix G: Links to External Documents

The original MRP proposal can be accessed online. However, after gaining access to the dataset and documentation it was decided that the project should be amended and an alternative set of RQs and analyses were developed – see Amended MRP proposal. UK Data Service Application link attached is for the amended proposal that was approved (see email above).

Approved MRP Proposal:

https://osf.io/t29rn

Amended MRP Proposal:

https://osf.io/3d5f6

UK Data Service Application

https://osf.io/7ej36

Data Analysis Plan

https://osf.io/tnhy8

SPSS Syntax

https://osf.io/xb4rt

SPSS Output

https://osf.io/8q7gy

APPENDIX H: Data Availability Statement

The data used for the Major Research Project was obtained from UK Data Service from the Adult Psychiatric Morbidity Survey (2014). This data is held centrally by the UK Data Service, and accessible via their application process which is assessed for suitability by the data holder (NHS Digital). As no new data was gathered for this study, and in adherence with the UK Data Service ethical standards, the dataset will be deleted from the researcher's University One Drive upon completion of the research.