Psychological experiences of climate change: implications for youth mental health

Megan Veillard

MA (Joint-Hons) Psychology and English

Submitted in partial fulfilment of the requirements for the degree of

Doctorate in Clinical Psychology

School of Health and Wellbeing

College of Medical, Veterinary and Life Sciences

University of Glasgow

July 2024

Table of Contents

Acknowledgements **6**
Chapter 1 Systematic Review **7**
Abstract **8**
Introduction **9**
The Current Review: Aims and Objectives 11
Method **12**
Search Strategy 12
Inclusion and Exclusion Criteria 12
Screening Process 13
Quality Appraisal Process 13
Data Extraction and Synthesis of Findings 14
Results **15**
Screening and Selection 15
Study Characteristics 15
Design *15*
Sample *15*
Quality Assessment 17
Synthesis of Results 17
Affective Experiences *26*
Associations Between Affective Categories *27*
Cognitive Experiences *27*
Associations Between Cognitive Categories *29*
Behavioural Experiences *29*
Associations Between Domains *30*
Associations Between Affective and Cognitive Experiences *31*
Associations Between Affective and Behavioural Experiences *32*
Associations Between Behavioural and Cognitive Experiences *32*
Climate Change Coping Strategies 32
Discussion **34**
Strengths and Limitations 36
Implications and Future Directions 37
Conclusion 38
Statements and Declarations 39
References **40**
Chapter 2 Major Research Project **47**
Plain Language Summary **48**
Abstract **50**
Introduction **52**
Climate Change Impacts on Youth 52

Understanding Climate Change Anxiety..... 52
Climate Change Anxiety Associations with Youth Mental Health..... 54
The Current Study: Aims and Research Questions..... 55
Method..... 57
Design and Participants..... 57
Measures..... 58
Procedure..... 60
Ethics, Governance and Data Protection..... 60
Analysis..... 61
Sample Size..... 63
Results..... 64
Descriptive Statistics..... 64
Bivariate Correlations..... 67
Confirmatory Factor Analysis..... 68
Structural Equation Model..... 70
Discussion..... 71
Strengths and Limitations..... 73
Implications..... 75
Conclusion..... 76
Statements and Declarations..... 76
References..... 77
Appendices..... 84
Appendix 1: Systematic Review Reporting Checklist..... 84
Appendix 2: Systematic Review Search Terms..... 87
Appendix 3: Systematic Review Data Extraction and Qualitized Results..... 88
Appendix 4: Systematic Review Worksheet..... 89
Appendix 5: Major Research Project (MRP) Reporting Checklist..... 94
Appendix 6: MRP Approved Proposal..... 97
Appendix 7: MRP Project Approval Letter..... 98
Appendix 8: MRP Participant Information Sheet and Consent Form..... 99
Appendix 9: MRP Survey Questions..... 100

List of Tables

Chapter 1 Systematic Review

Table 1: Summarised Data Extraction for the Included Studies 18

Table 2: Quality Appraisal of Included Studies using the CCAT 24

Table 3: Key Categories Identified From the Synthesis of Results 25

Table 4: Key Associations Between Psychological Domains From the Synthesis of Results 30

Chapter 2 Major Research Project

Table 1: Demographic information for participants 57

Table 2: Descriptive Statistics for Climate Change Anxiety and Mental Health Domains 66

Table 3: Correlation Matrix Among All Variables 68

Table 4: General Factor Standardised Factor Loadings and Proportion of Variance Explained by the Best Fitting CFA Model: The Three-Factor Model 69

List of Figures

Chapter 1 Systematic Review

Figure 1: PRISMA Flow Diagram 16

Chapter 2 Major Research Project

Figure 1: Unidimensional Model 62

Figure 2: Two Factor Correlated Model 62

Figure 3: Three Factor Correlated Model 62

Figure 4: A Bar Chart Showing Participant Beliefs About Whether Climate Change Is a Global Threat 64

Figure 5: A Bar Chart Showing Participant Beliefs About the Impacts of Climate Change on Their Mental Health 65

Figure 6: A Bar Chart Showing Where Participants Get Their Climate Change Information From 65

Figure 7: A Bar Graph Showing the Spread of Mean Item Scores for the CCAS 67

Figure 8: SEM Testing the Unique Effect of Transdiagnostic Mental Health Factors (Distress and Uncertainty Intolerance) on Depression, Generalised Anxiety, and CCA 70

Acknowledgements

First, I would like to thank everyone who participated in this research for taking the time to share their experiences around climate change. Whilst researching this topic has been challenging at times, exploring how people are researching, networking, and campaigning for a better future for the planet has also been a meaningful experience.

A sincere thank you to my research supervisor, Dr Jala Rizeq. I could not have completed this thesis without you, and I am so grateful for all the time, interest, feedback, and support you gave to this project. I have learnt so much from you these past couple years, and your dedication and expertise have been truly inspirational.

I would also like to thank Professor Rory O'Connor for your support as the research advisor to this project, Dr Paul Cannon for providing guidance on the systematic review search strategy, and Naomi Hamilton for acting as the second rater for the systematic review.

Thank you dearly to my friends and family - for every cup of tea, kind word, and moment of joy that has helped keep me going. To Emily, thank you for all your encouragement and support. I'll endeavour to be there through all your training breakdowns the way you have been there for me. To Ryan, thank you for keeping me fed and alive whilst I completed this thesis. I am very lucky to have you, and I only hope I can uplift you as much as you uplifted me this past year.

Finally, I would like to dedicate this thesis to my Grandad, who sadly passed before its completion. I would not be the person I am today without the support that you, Grandma, and Mum have given me throughout my life and education, and I cannot thank you all enough.

Chapter 1

Youth's psychological experiences in relation to the climate change crisis: a systematic review

Prepared in accordance with the author requirements for the *Journal of Environmental Psychology*; https://www.sciencedirect.com/journal/journal-of-environmental-psychology/publish/guide-for-authors

Abstract

The unfolding consequences of climate change is largely acknowledged as a global stressor that can have a variety of impacts on psychological processes and outcomes, particularly for young people. The literature on youth's psychological experiences from indirect exposure to the climate change crisis is rapidly increasing but lacks a strong conceptual framework. Therefore, this review aimed to synthesise and appraise the current literature that captures psychological experience and stress responses in relation to climate change for youth (aged 15-24) globally. A mixed methods systematic review was conducted following PRISMA guidelines. Four databases were searched, 27 studies met the inclusion criteria, and their quality was assessed using the Crowe Critical Appraisal Tool (CCAT). Relevant results were extracted, integrated, and synthesised using a convergent integrated approach. Data synthesis yielded key categories of both positive and negative psychological experiences across affective, cognitive, and behavioural psychological domains, as well as demonstrating some ways that these psychological experiences were related. There are three main implications of this review: 1) Despite heterogeneity in measurement and terminology, there appears to be consistent categories to represent the three dimensions of youth's psychological experiences and reactions to climate change; 2) These dimensions intersect to a large degree, especially within the context of coping with climate change threat; 3) Characterising youth's psychological experiences around climate change allows us to systematically investigate factors that are involved in shaping those experiences and that are being shaped by them. Future directions for research and the potential applications of these findings for supporting youth and their communities are discussed.

Introduction

Young people's wellbeing and mental health is a current research priority globally (Mei et al., 2020). In England, 1 in 5 young people (aged 17 to 25) have a probable mental health disorder (NHS Digital, 2023), and this rate has roughly doubled since 2017 (The Children's Society, 2023; NHS Digital, 2023). Various interacting factors are understood to influence the stress and mental wellbeing of youth today. This includes developmental vulnerabilities within neural and cognitive systems, such as fear and stress regulation; early life experiences and adversity; social, technological, economic and political landscapes; and the multi-faceted impacts of the COVID-19 pandemic (Occhipinti et al., 2021; Uhlhaas et al, 2023). Youth today are in a unique social-cultural position whereby they are aware of and impacted by the uncertainty of many global socio-political stressors (Schweizer et al., 2023; Uhlhaas et al, 2023). There is a growing concern about the unfolding impacts of global climate change on youth, and how we might understand whether youth are psychologically impacted by this crisis (Vamvalis, 2023).

Climate change is already impacting millions of people and environments globally, and it will continue to cause harm unless worldwide governmental action is taken (Amnesty International, 2021). The unfolding consequences from climate change are largely acknowledged as an ongoing stressor that can have a variety of impacts on psychological processes and mental health (Reser & Swim, 2011; Ogunbode, 2021), particularly for young people (Hickman et al., 2021). Elucidating the cognitive, affective, and behavioural dimensions of psychological experiences that shape young people's stress responses related to climate change will be important, as it will provide a way forward for researchers and clinicians to conceptualise how the climate change crisis can impact wellbeing. A systematic review of this literature is timely given the ongoing, rapid expansion of research in the field of wellbeing and climate change (Hwong et al., 2022; Ma et al., 2022), as well as increasing public concern about how climate change impacts youth's mental health (APHA, 2019; Royal College of Psychiatrists, 2020).

The indirect psychological impacts from the threat of climate change are receiving increased attention (Ma et al., 2022; Clayton, 2021). Various interrelated concepts are being explored to describe cognitive-affective responses stemming from appraisals of climate change threat.

These include “climate anxiety” (Clayton, 2020), “eco-anxiety” (Soutar & Wand, 2022), “eco paralysis”, “ecological grief”, “solastalgia”, and “earth emotions” such as despair and hopelessness (Albrecht, 2019); although how we define and conceptualise these terms is still unclear (Coffey et al., 2021; Soutar & Wand, 2022). In addition, active hope, optimism, climate mitigation actions, and community engagement have also been documented in response to climate change threat (Bingley et al., 2022; Hayes et al., 2018). Understanding these psychological presentations can help inform the development of mitigation strategies that can promote resilience and wellbeing in the face of climate change (Hereen & Asmundon, 2022; Weissbecker, 2011).

Youth are particularly vulnerable to the psychological impacts of the climate crisis (Clayton, 2020; Gifford & Gifford, 2016), reporting the highest rates of concern, worry and anxiety about climate change, with certain levels associated with functional impairment (Clayton, 2020; Clayton & Karaczia, 2020). It is suggested that youth may be more vulnerable to negative impacts of climate change as their futures will be the most affected, and they may still be developing the coping abilities to manage the uncertainty and frustration linked to climate change (Ma et al., 2022; Ojala, 2012; Sanson et al., 2018).

Psychological responses to environments are typically characterised by three interacting domains: emotions, cognitions, and behaviours (Beck, 1970; Ellis, 1980; Lazarus, 1966). A psychological framing of human responses to climate change appears to involve various interactions and cyclical processes between these domains (Brosch, 2021; Homburg & Stolberg, 2006; van der Linden, 2014; Reser & Swim, 2011). To help us understand these psychological responses to the climate change crisis in youth, we draw on key elements from the stress and coping theory that explicates the cognitive, affective, and behavioural components of various stress responses (Lazarus & Folkman, 1984). Stress is conceptualised as “a relationship between the person and the environment that is appraised as personally significant and as taxing or exceeding resources for coping” (Lazarus, 1966). The theory suggests that our cognitive appraisal or how we think about a situation affects our levels of stress, and in turn accounts for the variability in emotional and behavioural responses that individuals can have to the same stressor (Lazarus & Folkman, 1984). Therefore, to make sense of the multifaceted psychological experiences related to climate change, this review

will focus on identifying the main affective, cognitive, and behavioural responses that shape youth's experience.

The Current Review: Aims and Objectives

The literature on youth's psychological experiences of the climate change crisis is rapidly increasing but lacks a strong conceptual framework, and would benefit from synthesis and quality appraisal, to advance both theory and practice in this field. This review will investigate how both the qualitative and quantitative literature is capturing the psychological experiences of youth related to their indirect exposure and awareness of the climate change crisis. It will focus on studies with youth aged 15-24 in line with the developmental definition of "youth" from World Health Organisation (WHO, 2014) and the United Nations (UNESCO, 2017). The main aim of this investigation is to synthesise and appraise the current literature, to identify a comprehensive conceptual framework that captures and characterises youth's psychological experience and stress responses in relation to climate change.

Specifically, two questions were addressed:

1. What are the cognitive, affective, and behavioural components of youth's psychological experiences in relation to the climate change crisis?
2. How do these cognitive, affective, and behavioural components relate to each other within the context of youth's psychological responses to the climate change crisis?

Method

This systematic review was planned, conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). The protocol for this systematic review was registered by the PROSPERO international prospective registry for systematic reviews on 31st July 2023 (reference CRD42023428632).

Search Strategy

Preliminary searches were carried out to explore an appropriate scope for this review topic. The search strategy was developed in consultation with a librarian at the University of Glasgow (see Appendix 2 for the search terms used). Four electronic databases were searched for studies published up until 27th October 2023: Embase, Ovid Medline, Psycinfo, and PsycArticles. These databases were chosen for their suitability in capturing this research area.

Inclusion and Exclusion Criteria

The following inclusion and exclusion criteria were used to select relevant quantitative, qualitative, or mixed method papers. Papers were not excluded based on publication date or location.

Inclusion criteria:

1. Papers reported in English.
2. Peer-reviewed and published research.
3. Participants aged 15-24 years old.
4. Measures the psychological experiences/responses (cognitions, affect, and/or behaviours) related to the indirect impact of the climate change crisis.

Exclusion criteria:

1. Does not research the direct self-report of youth.
2. There are no results that are focussed only on the participants within the 15-24 age range.
3. The age range of participants is not reported and cannot be determined.

4. The psychological experiences being explored are not directly or uniquely linked to climate change.
5. The paper only explores direct experiences of climate change related events.
6. The paper explores climate change knowledge but does not explore emotional, cognitive, or behavioural psychological experiences.
7. The paper is not published by a peer-reviewed journal.
8. The paper is a single case study or does not use methodological research.
9. The paper is not available in English.

Screening Process

All screening processes were conducted in EndNote. First, de-duplication identified all unique records. Next, the primary researcher independently searched titles and abstracts to identify relevant studies and exclude papers not meeting the eligibility criteria. Then the primary researcher independently screened the remaining studies by reading their full texts and making the selection based on the eligibility criteria. At this stage, excluded papers were annotated stating the reason for exclusion. Ten percent of papers at each stage of the screening process were reviewed by the second reviewer, a doctoral clinical psychology trainee, to check for reliability. The first and second reviewers had 99.38% agreement for title and abstract screening, with 2 disagreements out of the 320 papers reviewed. There was 97.62% agreement for full text-screening screening, with 1 disagreement out of the 42 papers reviewed. Cohen's kappa (κ) indicated almost perfect agreement between the two reviewers for the title and abstract screening, $\kappa = .925$ (95% CI, .822 to 1.00), $p < .05$; and for full text screening, $\kappa = .978$ (95% CI, .936 to 1.00), $p < .05$.

Quality Appraisal Process

Each publication included was appraised for methodological quality and risk of bias using the Crowe Critical Appraisal Tool (CCAT; Crowe, 2013). This tool is recommended for mixed method reviews as it is suitable for diverse study designs with evidence for its interrater reliability (Crowe & Sheppard, 2011). It assesses studies using 22 items on the following eight domains: preliminaries (such as title, abstract and writing clarity), introduction, design,

sampling, data collection, ethical matters, results, and discussion. Using the CCAT guidelines (Crowe, 2013), the reviewer scores each domain on a scale of 0 to 5, leading to a total score of 0 to 40. A score less than 20 (50%) is considered poor quality; a score of 20 to 30 (50-75%) is considered moderate quality; and score above 30 (75%) is considered high quality. The second reviewer randomly selected and appraised 10% of the included studies independently using the CCAT. There was 79% agreement between the first and second reviewers' appraisals for the 3 studies. Cohen's kappa (κ) indicated substantial agreement between the two reviewers for quality appraisal, κ = .725 (95% CI, .517 to .933), $p < .05$. All the discrepancies were only different by one point, and therefore did not impact the overall quality categories of the studies. Discrepancies were resolved through discussion and consensus.

Data Extraction and Synthesis of Findings

A table was created for extracting the following data from the included papers in this review: Author/s, year of publication, study location, aim/s relevant to this review, participant numbers and characteristics, study design, outcomes measures, data analysis, the psychological domains explored (cognitive, affective and/or behavioural), and the key findings relevant to these domains. The data was extracted independently by the primary researcher, and then the second reviewer checked 10% of the raw data extraction tables to ensure that data was being extracted accurately. There were no disagreements between the researchers. Data extraction was then summarised and tabulated for the review purposes.

As the review question can be answered by both quantitative and qualitative studies, this review followed a convergent integrated approach to its synthesis and integration to combine the extracted data from the quantitative studies and qualitative studies. Following current methodological recommendations for mixed-methods reviews (Stern et al., 2020), this was completed through 'qualitizing' the quantitative data, which involves forming a narrative interpretation of the quantitative data (i.e., using words/statements to represent the main findings), allowing it to be assembled with the qualitative data. Qualitative synthesis then took place through repeated and detailed examination of the assembled data, allowing for the identification of categories based on similarity in meaning. Categories were identified when two or more studies reported similar findings (Stern et al., 2020).

Results

Screening and Selection

The database searches were completed on 27th October 2023 and imported into Endnote. The screening and selection process is outlined in Figure 1 (PRISMA 2020, Page et al., 2021). A total of 27 studies were eligible for inclusion.

Study Characteristics

Table 1 outlines the key characteristics of the 27 included studies. All studies were published between 2013 to 2023 and completed in 14 different countries across 4 continents. Most were conducted in Sweden (six studies), four in Australia, two in each of Canada, China, Norway, United Kingdom and United States, and one in each of Austria, Czechia, Finland, Italy, Portugal, Switzerland, and Turkey (See Table 1).

Design

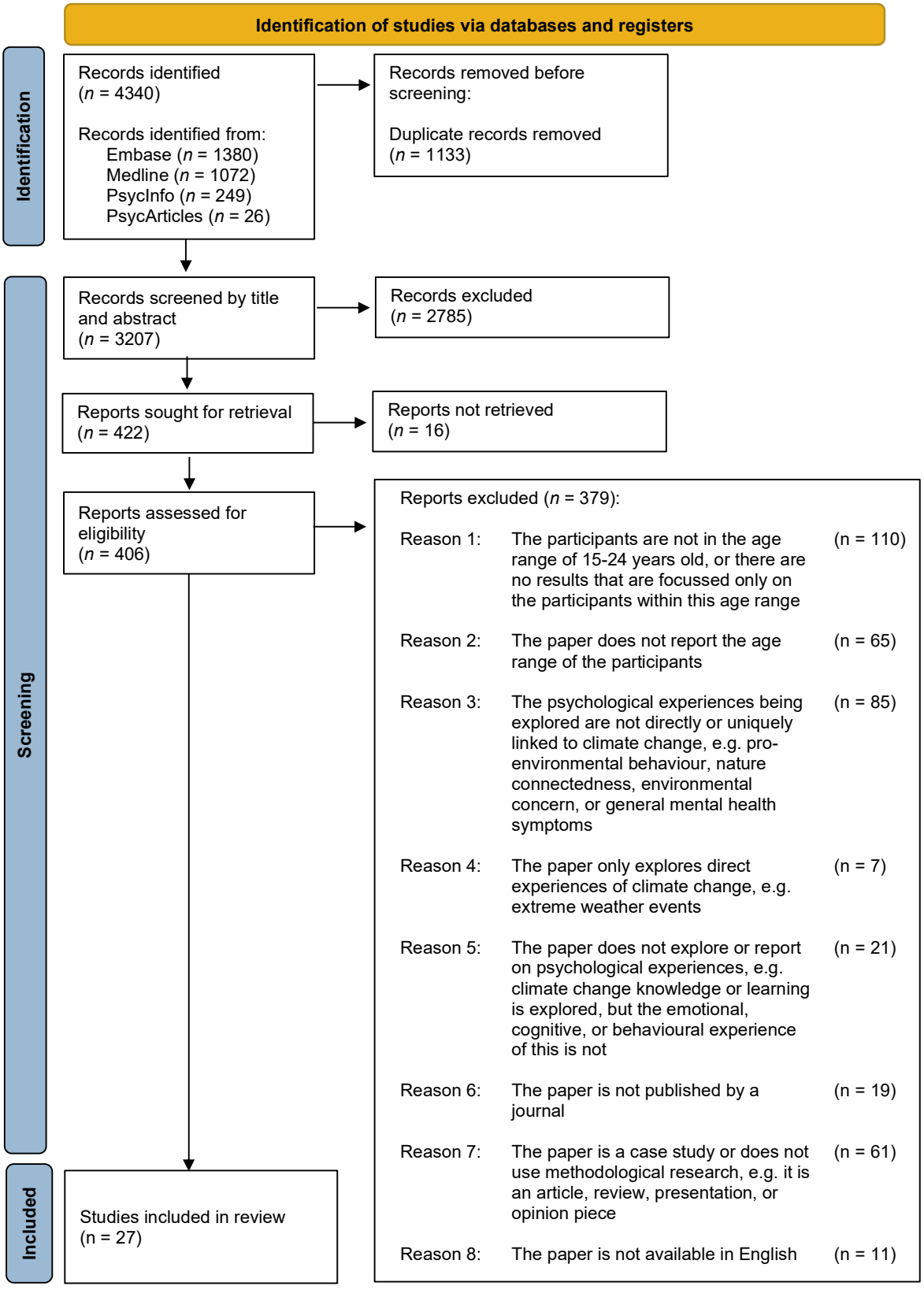
Three of the studies had qualitative designs using semi-structured interviews. Five studies had mixed method designs, with three using cross-sectional surveys, one using a cross-sectional survey and semi-structured interviews, and one using a field experiment design, with pre- and post- surveys of quantitative and qualitative questions. Nineteen studies used quantitative designs, sixteen of which used cross-sectional surveys and three used longitudinal surveys.

Sample

The sample sizes of the qualitative studies ranged from 14 (Gunasiri et al., 2022) to 511 (Arnot et al., 2023), whilst the quantitative studies ranged from 46 (Gunasiri et al., 2022) to 2306 (Wu et al., 2023), with one study not reporting the sample size for the age group included in this review (Leonhardt et al., 2022). Seven studies did not report on participants' gender, and 10 studies had a roughly even split between males and females, leaving eight studies with a female majority sample and three studies with a male majority sample. Only seven studies reported on non-binary and gender minority demographics, which ranged from 0.8% (Jylha et al., 2023) to 4% (Pickering et al., 2021) of the sample populations. Most of the participants were recruited from high school or university student populations.

Figure 1

PRISMA Flow Diagram (adapted from Page et al., 2021)



Quality Assessment

The quality appraisal of each study is outlined in Table 2. Overall, seven studies were "good quality", 19 studies were "medium quality", and one study was "low quality". There were evident methodological limitations across many of the included studies. As can be seen in Table 1, many of the outcome measures used were either developed by the researchers or adapted versions from previous studies, leading to uncertainty around their validity and reliability. The data collection methods commonly lacked sufficient detail, limiting their potential for replicability, which is reflected in the data collection domain scores in Table 2. In terms of sampling design, none of the quantitative studies conducted an a-priori sample size calculations or justifications. There were some significant limitations to ethical matters, with six studies scoring 0 or 1 in this domain due to not reporting on participant considerations such as informed consent, and researcher considerations such as ethical approval. On the other hand, the studies scored highest overall in respect to their preliminaries, introductions, and discussions, indicating that the understanding of the wider literature and the interpretation of study results in this context were of high standards. Overall, all studies were deemed eligible for inclusion in the synthesis.

Synthesis of Results

The relevant psychological domains and measures are presented in Table 1. A summary of the extracted quantitative and qualitative results for the included studies is outlined in Appendix 3, including the narrative interpretations (word statements) of the quantitative results. Overall, the included studies explore a wide variety of psychological experiences related to climate change, across the cognitive, affective, and behavioural domains. Table 3 outlines the key categories identified in each of these domains across the studies.

Table 1

Summarised Data Extraction for the Included Studies

Author/s (year)	Country	Sample size (*N*)	Sample Characteristics	Study Design	Measure/s	Domain/s
Arnot et al. (2023)	Australia	511	Age 15-24 51.9% female Online sample	Qualitative Cross-sectional survey	**Qualitative survey:** questions about climate change advocacy and action	Cognitive and behavioural
Ediz & Yanik (2023)	Turkey	Group 1 103 Group 2 203	Group 1 Age 15-24 71.8% female Online sample of climate activists Group 2 Age 15-24 76.8% female Online sample of general population youth	Quantitative Cross-sectional survey	**Climate anxiety:** Climate Change Anxiety Scale (Clayton and Karazsia, 2020) **Participation in climate action:** one item developed for this study	Affective and behavioural
Gunasiri et al. (2022)	Australia	Survey 46 Interview 14	Survey Age 18-24 Online sample of climate organisations members and general population youth Interview Age 18-24 Climate activist sample	Mixed methods Cross-sectional survey and semi-structured interviews	Quantitative survey **Opinions and feelings about climate change and action:** 13 items developed for this study Qualitative interviews **Semi-structured interviews**: two rounds of interviews exploring the survey themes in more depth	Cognitive, affective, and behavioural

Haugestad et al. (2021) Study 2	Norway	362	Age 16-22 54.7% female High school sample and online sample	Quantitative Cross-sectional survey	**Past participation in climate protests:** two items developed for this study **Belief in anthropogenic climate change**: one item from a pre-existing survey **Collective guilt for climate change:** three items from a previous study **Activist group identification:** four items from a previous study **Future protest intentions:** three items adapted from a previous study	Cognitive and behavioural
Jylha et al. (2023)	Switzerland	474	Mean age 17.9 58.4% female Upper secondary high school sample	Quantitative Cross-sectional survey	**Intentions to make climate-friendly food choices (CFFC):** two items adapted from a previous study **Attitudes towards CFFC:** two items adapted from a previous study **Climate-change worry:** five items from a previous study **Climate-change optimism:** three items from a previous study **Outcome expectancy of CFFC** (belief that food choices can reduce climate impact): two items adapted from a previous study **Subjective norms of CFFC** (parents and peers' beliefs about CFFC): three items adapted from a previous study **Objective ambivalence for CFFC**: five items on positive thoughts/feelings and five items on negative thoughts/feelings about CFFC adapted from a previous study	Cognitive and behavioural
Korkala et al. (2014)	Finland	948	Age 20-23 Community sample	Quantitative Cross-sectional survey	**The degree of concern over climate change**: one question created for this study	Cognitive
Lawrance et al. (2022)	UK	530	Age 16-24 63% female Online sample	Quantitative Cross-sectional survey	**Climate distress:** Climate Change Distress Scale (Reser et al., 2014) **Climate change impacts**: one item **Emotional responses to climate change:** scale adapted from a previous study **Climate change agency and activism:** combined two scales from a previous study	Cognitive, affective, and behavioural
Lehnert et al. (2020)	Czechia	462	Age 18-19 Secondary school sample	Quantitative Cross-sectional survey	**Believed usefulness of climate change actions:** one item created for this study **Degree of willingness to act:** one item created for this study	Cognitive and behavioural

Leonhardt et al. (2022)	Norway	139,841 (of 13–19-year-olds)	Age 15-19 Secondary school sample	Quantitative Cross-sectional survey	**Climate change worry:** one item created for this study	Cognitive
Moser & Seebauer (2022) Study 2	Austria	113	Age 16-20 53.1% female High school sample	Quantitative Longitudinal survey	**Efficacy beliefs for climate change:** three items on self-efficacy (believing in one's individual ability to effect positive change on climate protection); three items on participatory efficacy (believing that one's contribution can significantly impact collective goals for climate protection), three items on collective efficacy (believing that collectives/groups can accomplish goals that impact climate protection) **Emotions associated with efficacy (emotions toward anticipated future outcomes of climate change)**: two items on positive efficacy affect (hopeful/motivated about climate change) and two items on negative efficacy affect (helpless/frustrated about climate change) from previous studies	Cognitive and affective
Ojala (2013)	Sweden	146	Mean age 16 64% female Senior high school sample	Mixed method Cross-sectional survey	<u>Quantitative questions</u> **Climate worry:** one item created for this study **Climate hope:** one item created for this study <u>Follow-up qualitative questions</u> **Coping with climate worry:** one question for respondents who worry fairly much/a lot/very about climate change **Advising a worried friend**: two questions for respondents who worry fairly little/little/not at all about climate change **Reasons for hope:** one question for respondents who experience climate hope much/a lot/very much	Cognitive, affective, and behavioural
Ojala (2015a)	Sweden	684	Mean age 16 50% female Senior high school sample	Quantitative Longitudinal survey	**Climate change scepticism:** three items on trend scepticism, impact scepticism, and attribution scepticism answered at two time points (one year apart)	Cognitive
Ojala (2015b)	Sweden	624	Mean age 18 59% female Senior high school sample	Quantitative Cross-sectional survey	**Climate change hope:** The Hope Scale, created for this study **Environmental engagement:** five items based on a previous study	Cognitive and behavioural

Ojala (2022)	Sweden	15	Age 17-19 67% female Senior high school sample	Qualitative Cross-sectional semi-structured interviews	**Semi-structured interviews:** based on an interview guide that was created aligning to research questions on climate-friendly food choices	Cognitive and behavioural
Ojala & Bengtsson (2019)	Sweden	705	Mean age 18 54% female Senior high school sample	Quantitative Cross-sectional survey	**Coping strategies for climate change worry/upset:** three items on problem-focused coping, seven items of emotion-focused coping, and six items on meaning-focused coping from a previous study **Communication on societal issues:** 13 items developed for the present study **Reported pro-environmental behaviour**: 10 items from a previous study	Cognitive and behavioural
Patrick et al. (2023)	Australia	Eco-anxiety 208 Pre-trauma stress 159	Age 18-24 Online sample	Quantitative Cross-sectional survey	**Eco-anxiety**: Climate Anxiety Scale (Clayton and Karazsia, 2020) **Pre-traumatic climate change stress**: respondents that selected 'no' or 'unsure' to direct climate change experiences answered an amended PTSD-8 scale about climate change threats	Affective
Pereira et al. (2023)	Portugal	499	Age 16-24 68.54% female Online sample	Quantitative Cross-sectional survey	**Climate change attitudes:** Climate Change Attitude Survey (Christensen & Knezek, 2015, Portuguese translation)	Cognitive
Pickering et al. (2021)	Canada	487	Age 17-18 54% female Online sample	Quantitative Cross-sectional survey	**Acceptance of climate change:** one item created for this study **Climate change scepticism/uncertainty:** four items created for this study **Belief in individual agency for climate change mitigation:** one item created for this study	Cognitive and behavioural
Rideout (2014)	United States	779	Age 17-22 52.9% female Five independent college samples over five-year period	Quantitative Repeated cross-sectional survey	**Climate change worry:** one item asked to participants, and compared to four items taken from earlier public opinion polls **Climate change denial:** one item created for this study	Cognitive

Schuetz et al. (2011)	United States	19	Age 18-22 47.4% female College sample of psychology students	Qualitative Cross-sectional semi-structured interviews	**Interviews:** four main questions on awareness, beliefs, feelings, and thoughts about global warming	Cognitive, affective, and behavioural
Sciberras & Fernando (2022)	Australia	2244	Age 16-19 49.8% female Community sample	Quantitative Longitudinal survey	**Climate change-related worry:** one item created for this study asked at four time points (from when participants were age 10-11 to 18-19)	Cognitive
Tasquier & Pongiglione (2017)	Italy	Group 1 23 Group 2 25	Group 1 Age 18-19 Extra-curricular volunteer sample Group 2 Age 16-17 Secondary school non-volunteer sample	Mixed methods Field experiment Cross-sectional surveys (pre- and post- the teaching experience)	**Pre-questionnaire on climate change action**: designed for this study **Post-questionnaire on willingness to change behaviour**: designed for this study	Cognitive and behavioural
Vercammen et al. (2023)	UK	539	Age 16-24 60.9% female Online sample	Mixed methods Cross-sectional survey	**Climate distress:** Climate Distress Scale with one modification (8 items), and one item on whether thoughts and feelings about climate change have impacted wellbeing/functioning **Climate impacts and experiences:** A scale of climate impacts based on previous studies and youth consultation, and a scale of climate emotions (18 items) based on a previous study **Future concerns and hopes:** a scale developed with youth consultations, and one open-ended question **Climate action:** one item and one open-ended question created for this study	Cognitive, affective, and behavioural
Wu et al. (2023)	Canada	Stage 1 34 Stage 2 2306	Stage 1 Age 16-17 High school sample Stage 2 Age 15-18 45.9% female High school sample	Mixed methods Cross-sectional survey	**Stage 1 - Climate anxiety:** Climate Change Anxiety Scale (Clayton & Karazsia, 2020), followed by qualitative youth consultations on the scale **Stage 2 - Climate anxiety:** The above scale was shortened and adapted based off the consultations to create the Climate Change Anxiety Scale short-form ("CCAS-S", five items) **Climate change concern:** adapted scale from a previous study	Cognitive and affective

Wu & Otsuka (2022)	China	624	Age 16-17 51.8% female High school sample	Quantitative Cross-sectional survey	**Leadership competence in climate change (LCCC):** five items of intrapersonal domain and four items of interpersonal domain developed for this study	Behavioural
Wullenkord & Ojala (2023)	Sweden	Study 1 321 Study 2 480	Study 1 321 Age 16-20 52.68% female High school sample in 2010 Study 2 Age 16-22 58.43% female High school sample in 2019/2020	Quantitative Repeated cross-sectional survey	**Climate worry:** five items from a previous study, loading onto two factors: macro worry (three items, worry about climate change impacts on wider systems and environments) and micro worry (two items, worry about personal impacts from climate change) **Climate optimism and pessimism:** six items from a previous study **Coping strategies for climate change worry:** 13 items based on previous studies: problem-focused coping (three items), meaning-focused coping (six items), and distancing (a form of emotion-focused coping; four items)	Cognitive, affective, and behavioural
Xiang et al. (2019)	China	Study 1 182 Study 3 156	Study 1 Age 17-24 44% female General university sample Study 3 Age 17-23 27.6% female University sample with individualist or collectivist orientations	Quantitative Repeated cross-sectional survey	**Belief in Climate Change:** three items from a previous study **Climate Change Risk Perception/Concern:** nine items from a previous study **Perceived Intractability of Climate Change:** four items developed for this study **Climate Change Inaction:** one item developed for this study	Cognitive and behavioural

Table 2

Quality Appraisal of Included Studies using the CCAT (Crowe, 2013)

Study	Preliminaries	Introduction	Design	Sampling	Data Collection	Ethical Matters	Results	Discussion	Total Score	Total %
Arnot et al. (2023)	5	5	2	3	3	4	3	3	28	70
Ediz & Yanik (2023)	4	3	3	3	4	3	2	3	25	62.5
Gunasiri et al. (2022)	4	3	1	3	2	2	3	2	20	50
Haugestad et al. (2021)	4	4	5	5	3	3	4	4	28	70
Jylha et al. (2023)	4	5	4	3	4	5	4	4	33	82.5
Korkala et al. (2014)	4	4	2	2	2	2	3	4	23	57.5
Lawrance et al. (2022)	4	4	4	3	2	4	4	5	30	75
Lehnert et al. (2020)	3	4	4	3	2	1	3	3	23	57.5
Leonhardt et al. (2022)	3	5	3	3	2	4	4	5	29	72.5
Moser & Seebauer (2022)	4	5	4	2	3	4	3	4	29	72.5
Ojala (2013)	4	5	4	3	2	2	3	4	27	67.5
Ojala (2015a)	4	5	3	4	4	4	3	4	31	77.5
Ojala (2015b)	3	5	3	2	1	2	3	3	22	55
Ojala (2022)	3	5	2	2	2	3	4	3	24	60
Ojala & Bengtsson (2019)	4	5	3	3	1	2	3	4	25	62.5
Patrick et al. (2023)	5	3	3	3	2	2	3	4	25	62.5
Pereira et al. (2023)	5	3	2	2	1	2	4	4	23	57.5
Pickering et al. (2021)	3	5	2	3	2	1	3	3	22	55
Rideout (2014)	3	4	3	3	4	0	3	4	24	60
Schuetz et al. (2011)	5	5	4	3	2	1	3	5	28	70
Sciberras & Fernando (2022)	4	5	3	4	3	4	3	5	31	77.5
Tasquier & Pongiglione (2017)	2	5	3	3	3	0	1	2	19	47.5
Vercammen et al. (2023)	4	4	4	4	5	3	4	5	33	82.5
Wu et al. (2023)	5	5	3	3	4	3	5	5	33	82.5
Wu & Otsuka (2022)	4	5	3	2	4	4	3	3	28	70
Wullenkord & Ojala (2023)	4	5	3	3	4	4	4	4	31	77.5
Xiang et al. (2019)	4	5	3	4	3	3	4	4	30	75

Table 3

Key Categories Identified From the Synthesis of Results

Indirect Psychological Experiences to Climate Change in Youth	Contributing Studies
Affective	
Climate change anxiety/distress	Ediz & Yanik (2023); Gunasiri et al. (2022), Lawrance et al. (2022); Patrick et al. (2023); Vercammen et al. (2023); Wu et al. (2023)
Climate change guilt	Haugestad et al. (2021); Lawrance et al. (2022); Vercammen et al. (2023)
Climate change emotions	Gunasiri et al. (2022); Lawrance et al. (2022); Moser & Seebauer (2022); Vercammen et al. (2023)
Cognitive	
Climate change worry and concern	Gunasiri et al. (2022); Jylha et al. (2023); Korkala et al. (2014); Leonhardt et al. (2022); Ojala (2013); Rideout (2014); Schuetz et al. (2011); Sciberras & Fernando (2022); Vercammen et al. (2023); Wu et al. (2023); Wullenkord & Ojala (2023); Xiang et al. (2019)
Climate change hope	Arnot et al. (2023); Moser & Seebauer (2022); Ojala (2013); Ojala (2015b); Vercammen et al. (2023)
Climate change optimism/pessimism	Gunasiri et al. (2022); Jylha et al. (2023); Wullenkord & Ojala (2023)
Climate change scepticism	Haugestad et al. (2021); Ojala (2015a); Ojala (2015b); Pereira et al. (2023); Pickering et al. (2021); Rideout (2014); Schuetz et al. (2011); Xiang et al. (2019)
Climate change agency	Lawrance et al. (2022); Pickering et al. (2021); Vercammen et al. (2023); Xiang et al. (2019)
Behavioural	
Individual climate change action	Jylha et al. (2023); Lehnert et al. (2020); Ojala (2022); Pereira et al. (2023); Tasquier & Pongiglione (2017); Vercammen et al. (2023); Xiang et al. (2019)
Collective climate change action	Arnot et al. (2023); Gunasiri et al. (2022); Haugestad et al. (2021); Wu & Otsuka (2022); Vercammen et al. (2023)

Affective Experiences

Climate change specific affective experiences were grouped into three categories: climate change anxiety and distress, climate change guilt, and climate change emotions (both positive and negative). All studies in this domain were of medium-high quality. Although some of these psychological experiences involve cognitive processes, they were largely conceptualised as emotional experiences in the respective studies.

Climate distress is measured by the 'Climate Distress Scale' (Reser et al., 2014) in Lawrance et al. (2022) and Vercammen et al. (2023), and climate change anxiety is measured by the 'Climate Change Anxiety Scale' (Clayton & Karazsia, 2020) in Ediz and Yanik (2023), Patrick et al. (2023), and Wu et al. (2023). However, these appear to be measuring the same concept across the studies reporting on this experience: heightened emotional, mental, and somatic difficulties and impairment from the apprehension of climate change threats. On average, youth report moderate experiences of climate anxiety (Ediz & Yanik, 2023; Gunasiri et al., 2022; Wu et al., 2023) and climate distress (Lawrance et al., 2022; Vercammen et al., 2023). High levels of climate anxiety appear in a quarter of youth (Ediz & Yanik 2023; Patrick et al., 2023; Wu et al., 2023), and high levels of climate distress in around a tenth of youth (Vercammen et al., 2023). Three studies also reported on climate change guilt, indicating that some youth appear to commonly report feeling some level of guilt and shame about humanity's collective contribution to climate change, as well as their own contributions (Haugestad et al., 2021; Lawrance et al., 2022; Vercammen et al., 2023).

There were additional climate change emotional experiences reported in four studies. Gunasiri et al. (2022) note how Australian youth commonly report feelings of hopelessness and powerlessness around climate change, whilst Moser and Seebauer (2022) report that Austrian youth tend to disagree with feeling helpless and frustrated towards anticipated future outcomes of climate change. Lawrance et al. (2022) detail how UK youth reported feeling moderately helpless, afraid, outraged, frustrated, disgusted, angry, disappointed, and concerned when thinking about climate change, as well as feeling slightly sad, ashamed, and anxious. They also noted positive feelings

associated with climate change, feeling moderately interested, and slightly hopeful and engaged.

Associations Between Affective Categories. One study found positive climate change affect was positively related to negative climate change affect (Lawrence et al., 2022). Levels of climate distress were also found to be strongly related to feelings of guilt in youth and to other negative climate change emotions (Lawrance et al., 2022; Vercammen et al., 2023).

Cognitive Experiences

Five cognitive categories were identified: climate change worry/concern, climate change hope, climate change optimism/pessimism, climate change scepticism, and climate change agency. All the studies exploring cognitive experiences of climate change were of medium-high quality. Climate change worry, hope, and optimism/pessimism are all cognitive-affective concepts that concern appraisal of future events (Ojala, 2013). The cognitive elements and appraisals of these experiences are noted in this section.

The terms for climate change 'worry,' 'concern', and 'risk perception' appear to be used interchangeably in the included studies. This was the psychological experience explored the most across the studies (reported in 12 studies), conceptualised as a cognition that the state of the world will worsen as the result of climate change, diverging from its desired state (Wullenkord & Ojala, 2023). Overall, youth are commonly reporting moderate to high levels of worry about climate change (Gunasiri et al., 2022; Jylha et al., 2023; Korkala et al., 2014; Ojala, 2013; Rideout, 2014; Wu et al., 2023; Wullenkord & Ojala, 2023; Xiang et al., 2019). The trajectory of climate change worry also appears to be increasing over time (Sciberras & Fernando, 2022; Wullenkord & Ojala, 2023).

Climate change hope is conceptualised as a motivational state with related positive feelings about the future, involving a cognitive appraisal pattern of wishing or expecting positive outcomes of climate change whereby societal actors will do their part in reaching a sustainable future (Ojala, 2013; Ojala 2015b). Levels of climate change hope vary across the included studies. Arnot et al. (2023) reported that hope for government

climate action was a major theme amongst protesting youth, Vercammen et al. (2023) reported roughly a quarter of participants had hope about climate change, and Ojala (2013) reported that roughly a third of participants felt much climate hope. Climate change optimism, on the other hand, is characterised as a certain belief that climate change will be solved (Jylha et al., 2023), and climate change pessimism is the belief that climate change will destroy the world (Wullenkord & Ojala, 2023). Wullenkord and Ojala (2023) found that on average, students appear to have higher levels of climate optimism than climate pessimism.

Climate change scepticism is conceptualised as the cognitive appraisal that climate change is not happening (trend scepticism), not as big a problem as researchers claim (impact scepticism) or not caused by anthropogenic factors (attribution scepticism) (Ojala, 2015a). Overall, it seems that only a small portion of youth report climate change scepticism (Pereira et al., 2023; Pickering et al., 2021; Rideout, 2014). Other climate change related cognitive processes that are explored in the literature are beliefs related to climate change agency (whether one believes that their actions towards climate change are impactful). It appears that most youth believe that their individual actions and lifestyle choices can help to lessen climate change (Lawrance et al., 2022; Pickering et al., 2021; Vercammen et al., 2023). However, Xiang et al. (2019) report that on average, youth have high levels of perceived intractability of climate change. Moser and Seebauer (2022) report that youth tend to hold neutral beliefs about the efficacy of their individual actions towards climate protection but have stronger beliefs in the efficacy of collective efforts with other young people.

The only disagreement with the above results was Schuetz et al. (2011), whose qualitative study indicated that youth's attitudes towards climate change in the United States involves high levels of scepticism and contradictory reports around levels of concern and guilt. Whilst the qualitative nature of this study may allow for more in depth understanding of these cognitive processes, quality appraisal indicated that the generalisability is limited by a small sample size. This weakens its ability to contradict the findings of the larger studies on youth climate appraisals that are highlighted above, including the other United States study from Rideout (2014).

Associations Between Cognitive Categories. Whilst levels of climate worry appear to not be related to levels of climate optimism (Jylha et al., 2023; Wullenkord & Ojala, 2023), higher levels of climate optimism do appear to buffer levels of climate pessimism in those with high climate worry (Wullenkord & Ojala, 2023). Climate change worry appears to have no significant relationship to climate change scepticism (Xiang et al., 2019). Ojala (2015b) identified two factors of climate change hope: constructive hope, and hope based on denial, whereby constructive hope involves positive appraisals of trust in oneself and other societal actors to combat climate change, whilst hope based on denial comes from the appraisal that climate change is not as big a problem as researchers claim. Therefore, climate change scepticism could be conceptualised as a mechanism for hope.

Behavioural Experiences

The behavioural domain included two categories: individual climate change action and collective climate change action. All studies exploring behavioural experiences of climate change were of medium-high quality, except for Tasquier & Pongiglione (2017) which was rated as low quality. This was a small-scale field experiment assessing change in climate action that was limited in its reporting of ethical matters and results.

Climate change individual actions aim to help mitigate climate change, with the majority of youth reporting already engaging in them or a willingness to engage in them (Jylha et al., 2023; Lehnert et al., 2020; Ojala, 2022; Pereira et al., 2023; Vercammen et al., 2023; Xiang et al., 2019). Lehnert et al. (2020) found that although youth considered the most useful direct actions for climate change were less use of a car or using cars with less fuel consumption, the actions that students were most willing to do were to recycle more and switch off unused electrical devices. One of the individual actions explored in more depth in the included studies and commonly reported among youth was climate friendly food choices (Jylha et al., 2023; Ojala, 2022).

Collective climate action was explored in the included studies through climate change protest attendance and engagement in organised campaigns such as the #FridaysForFuture (#FFF) movement. Arnot et al. (2023) found that climate activist

youth believe that protests are an important and highly visible mechanism for drawing attention to the need for climate action, but also reported some barriers to protest engagement such as negative perceptions, systemic and structural barriers, and beliefs that it does not necessarily lead to government action. Haugestad et al. (2021) found that roughly half of the Norwegian youth surveyed had attended school strikes as part of the #FridaysForFuture (#FFF) movement. Wu and Otsuka (2022) explored collective climate action through the concept of 'climate change leadership', finding that youth are commonly engaging in interpersonal and intrapersonal climate change actions.

Associations Between Domains

The following sections synthesise associations reported between the domains across the studies reviewed, with the key categories outlined in Table 4. Overall, 15 of the included studies reported on associations between the psychological domains of youth's climate change experiences.

Table 4

Key Associations Between Psychological Domains From the Synthesis of Results

Associations between Psychological Experiences of Climate Change in Youth	Contributing Studies
Affective relationships	
Climate change anxiety/distress is positively related to negative climate emotions and climate change guilt	Lawrance et al. (2022); Vercammen et al. (2023)
Cognitive relationships	
Climate change worry is not related to climate change optimism	Jylha et al. (2023); Wullenkord & Ojala (2023)
Affective and cognitive relationships	
Climate change worry is positively related to climate change anxiety/distress	Wu et al. (2023); Vercammen et al. (2023)
Climate change agency is related to climate change anxiety/distress	Lawrance et al. (2022); Vercammen et al. (2023)
Affective and behavioural relationships	
Climate change action engagement is positively related to climate change anxiety/distress	Ediz & Yanik (2023); Vercammen et al. (2023)

Climate change action engagement is positively related to climate change guilt	Haugestad et al. (2021); Ojala (2022)
Cognitive and behavioural relationships	
Climate change action engagement is negatively related to climate change scepticism	Haugestad et al. (2021); Pickering et al. (2021); Schuetz et al. (2011); Xiang et al. (2019)
Climate change action engagement is positively related to climate change worry	Jylha et al. (2023); Xiang et al. (2019)
Climate change action engagement is positively related to climate change hope	Arnot et al. (2023); Gunasiri et al. (2022)
Beliefs and attitudes about climate action are related to climate action engagement	Lehnert et al. (2020); Xiang et al. (2019); Vercammen et al (2023); Jylha et al. (2023)
Cross-domain coping strategies	
Youth utilise emotion-focussed, meaning-focussed and problem-focussed coping strategies around climate change	Ojala (2013); Ojala & Bengtsson (2019); Wullenkord & Ojala (2023)
Use of meaning-focused coping strategies is positively related to climate change hope	Ojala (2013); Wullenkord and Ojala (2023)
Use of problem-focussed coping strategies is positively related to climate change worry	Ojala (2013); Wullenkord and Ojala (2023)

Associations Between Affective and Cognitive Experiences. Wu et al. (2023) report that climate anxiety is weakly related to more climate concern. They argue that the small magnitude of this correlation suggests that climate anxiety is a unique construct separate from climate change concern, and that climate anxiety could be conceptualised as an extreme outcome of the general climate concern seen in most youth. Further, higher levels of climate worry are linked to experiencing more climate distress (Vercammen et al., 2023). Whilst Vercammen et al. (2023) found that youth who feel a lack of control and agency around climate change tend to experience more climate distress, Lawrance et al. (2022) found that youth with high climate distress also had higher climate agency. Moser and Seebauer (2022) found that youth who believe that both individual and collective efforts for climate protection are effective are more likely to feel hopeful and motivated about climate change.

Associations Between Affective and Behavioural Experiences. Higher climate action engagement in youth is related to having more climate anxiety (Ediz & Yanik, 2023), guilt (Haugestad et al., 2021;, Ojala, 2022), distress and negative climate emotions (Vercammen et al., 2023), and improved positive emotional experiences (Gunasiri et al., 2022). Some of these relationships appear to also be impacted by cognitive processes. Specifically, the association between climate guilt and protest participation was mediated by having higher group identification to the strike movement (Haugestad et al., 2021), and lower levels of climate distress was associated with social factors and gaining a sense of purpose/identity through climate action (Vercammen et al., 2023).

Associations Between Behavioural and Cognitive Experiences. Higher climate action engagement in youth is related to having both more climate optimism (Gunasiri et al., 2022) and more climate worry (Jylha et al., 2023; Xiang et al., 2019). Climate action is also described as a mechanism for hope in youth that can provide a sense of control (Arnot et al., 2023; Gunasiri et al., 2022), whereas climate scepticism is related to less engagement and beliefs in climate-friendly behaviours (Haugestad et al., 2021; Pickering et al., 2021; Schuetz et al., 2011; Xiang et al., 2019). Importantly, perceived usefulness of climate actions is generally associated with increased willingness to act (Lehnert et al., 2020; Xiang et al., 2019), however, this is not the case for certain actions that appear to conflict with personal preferences (e.g. use a car less, buy fewer new items) (Lehnert et al., 2020). Vercammen et al. (2023) found that the most common barrier to individual climate actions in youth was deferring of responsibility, followed by the perception that individual actions were simply ineffective or pointless. Jylha et al. (2023) found that an extended Theory of Planned Behaviour model can best explain the cognitive factors that relate to the variance seen in climate-friendly food intentions in youth, showing strong relationships between intentions to make climate friendly choices with attitudes and outcome expectancy of these choices for effective climate mitigation.

Climate Change Coping Strategies. Another important intersection between the psychological domains is found in the strategies that youth use to cope with the negative impacts from climate change. These coping strategies involve cycles of cognitive

processes and motivational states which can influence behaviour and affect, and those behaviours can in turn impact cognitive-affective states. Gunasiri et al. (2022) report that the most frequently used coping strategy for climate change was "contact with nature," whereby behaviours such as being in nature can help to alleviate climate distress. Three studies (Ojala, 2013; Ojala & Bengtsson, 2019; Wullenkord & Ojala, 2023) explored how youth engage in emotion-focussed, meaning-focussed and problem-focussed coping strategies around climate change. Emotion-focussed coping involves cognitive and behavioural strategies to regulate or rid of emotional distress from climate change, such as distancing oneself from the issue; problem-focussed coping involves addressing the issue of climate change and planning behavioural actions that aim to resolve negative climate emotions; and meaning-focussed coping involves acknowledging that climate change won't be immediately solved, but reappraising climate change problems in a hopeful manner, drawing on values and beliefs to activate positive climate emotions rather than trying to reduce negative climate emotions. Wullenkord and Ojala (2023) found that students coped with climate change by employing medium-low levels of emotion-focussed and problem-focused coping, and medium-high levels of meaning-focused coping. Ojala (2013) also found this pattern amongst youth who had some hope about climate change, however youth who reported more climate change worry reported engaging with less meaning-focussed coping and instead used more emotion-focussed and problem-focussed strategies. Wullenkord and Ojala (2023) also found that higher use of problem-focused and meaning-focused coping was related to having more climate worry, whilst emotion-focussed coping was not related to climate worry.

Discussion

The purpose of this review was to understand how the literature is capturing youth's psychological experiences around indirect exposure to climate change. Across the 27 included studies, data synthesis yielded key categories of psychological experiences across affective, cognitive, and behavioural domains, as well as demonstrating some ways that these psychological experiences were related. There are three main implications of this review: 1) Despite heterogeneity in measurement and terminology, there appears to be consistent categories to represent the three dimensions of youth's psychological experiences and reactions to climate change; 2) These dimensions intersect to a large degree, especially within the context of coping with climate change threat; 3) Characterising youth's psychological experiences around climate change allows us to systematically investigate factors that are involved in shaping those experiences and that are being shaped by them.

Climate change is expected to continue to be a major global stressor for youth (Hickman et al., 2021; Reser & Swim, 2011). Having identified the key psychological responses that shape youth's experience in relation to climate change in this review is an essential step forward in ensuring that ongoing research has a strong conceptual foundation. The affective and cognitive domains include both positive and negative emotions and cognitions, and the behavioural domain is distinguished by individual-level and collective-level climate friendly behaviours and engagement. This conceptual framework can be used to inform educational curricula or in community initiatives that engage youth, or even in informing climate change policy in relation to youth wellbeing (see Appendix 4 for a worksheet with key definitions and questions generated from this review). Identifying these key psychological experiences, their independence and interdependence, allowed us to further investigate how those aspects separately and together shape youth's overall indirect experiences of climate change.

As the stress and coping theory (Lazarus & Folkman, 1984) postulates, interactions between young people's cognitive, affective, and behavioural responses form their overall stress response towards climate change (Brosch, 2021; Homburg & Stolberg, 2006; van der Linden, 2014). In examining the associations highlighted in this review, it

was apparent that climate change engagement was associated with both negative and positive cognitive-affective responses. Nonetheless, the correlational design of many of the included studies means that we are unable to infer whether engaging in climate activism or action has these impacts on youth's cognitions, affect, and behaviors; whether youth are more likely to engage in activism or climate friendly behavior because of these psychological experiences; or whether a third factor such as social influence may be contributing to both outcomes. The qualitative and mixed-method studies were able to provide some context to potential causal pathways, with youth reporting that climate action is a mechanism for hope that ignites more positive psychological experiences around climate change (Arnot et al., 2023; Gunasiri et al., 2022; Ojala, 2022).

Ojala (2013) explores these associations in depth, outlining youth's coping strategies for climate change, and the cognitive-affective and behavioural mechanisms that they employ in response to the psychological impacts from climate change. These strategies are conceptualised as either helpful or unhelpful, in terms of whether they are helping youth to acknowledge their problems and engage with climate change more constructively and appropriately (constructive climate hope), or lead youth to disengaging from climate change information and mitigation actions (climate hope based on denial) (Ojala, 2015b). Helping youth reflect on where they view themselves on those dimensions and explaining some of the associations between them could potentially help in climate change awareness and engagement campaigns.

To lead on sustainable large-scale climate change mitigation, and support and empower youth to respond adaptively to increased climate change anxiety and distress (Sanson et al., 2018), we also need to situate youth's psychological responses within system-level responses and resources (Ma et al., 2022; Crandon et al., 2022). This is especially important because climate change anxiety and worry in youth has been linked to worse mental health, lower life satisfaction, and more negative emotional experiences (Vercammen et al., 2023; Wu et al., 2023; Wullenkord & Ojala, 2023). Regulating stress-induced responses involves social and systemic processes, such as how we interact with others and systems around these issues (Folkman, 2009). Some notable social influences include collective climate efficacy attitudes (Moser & Seebauer, 2022), the

role of group identification in supporting climate protest engagement (Haugestad et al., 2021), exploring system-level barriers to climate protest participation (Arnot et al., 2023; Vercammen et al., 2023), and how communication from family/peers/teachers can influence climate change worry and coping (Ojala, 2015a; Ojala, 2015b; Ojala, 2022). Future research could explore the effect of these factors and processes on the separate psychological domains explicated in this review in order to best inform community initiatives for youth engagement and wellbeing within the context of the worsening climate change crisis.

Strengths and Limitations

The combination of quantitative and qualitative studies reviewed allowed us to understand these experiences from large, generalisable samples of surveyed youth (particularly in Australia, Canada, and Sweden) alongside in-depth interviews of smaller youth samples. In general, studies conducted across different countries and designs tended to agree with each other, increasing our confidence in the relevance of the identified categories. Nonetheless, most of the included studies were conducted in W.E.I.R.D countries (western, educated, industrialised, rich, and democratic; Henrich et al., 2010), limiting the generalisability of this framework globally. This is likely because poorer countries and the global south increasingly experience direct climate change impacts such as extreme weather and temperature changes (Bathiany et al., 2018), and therefore research in these countries is understandably prioritising the physical and psychological outcomes of direct climate change events (Cianconi et al., 2020; Walinski et al., 2023).

Another strength was the broad nature of the review questions, allowing us to capture a large body of the literature for screening, and understand a wide range of the psychological experiences in youth regarding climate change. A further strength of this review is the rigour in screening, data extraction, and quality appraisal, all of which included a subset that was independently reviewed by a second reviewer. Although the interrater agreement of the quality appraisal process was in line with the standard for the CCAT tool (Crowe & Sheppard, 2011), there were still some discrepancies, highlighting how there is a recognised element of subjectivity in the process of the

CCAT, which may lead to some bias in the quality assessment of the studies in this review.

We were only able to review studies published in English, which is an important limitation on a global topic such as climate change experiences, and future reviews in other languages would help to widen our understanding of these concepts even further. The exclusion of grey literature from this review also means that other articles and non-published papers that may have been relevant have not been included. It is also important to note that 65 papers were excluded from the screening process as they did not report the age range of their participants. Although surely those studies have valuable insights, it is beyond the scope of this review to include studies that are not clearly targeting the experience of youth.

Implications and Future Directions

The psychological dimensions and categories identified in this review can be used as a guiding framework from which to understand and examine youths' psychological responses to climate change and their impact on other relevant domains, such as wellbeing and mental health. This framework aims to add clarity to the literature base which has been noted to lack conceptual clarity in understanding the relevant phenomena (Soutar & Wand's, 2022). Having a unified conceptual framework of climate change psychological experiences in youth means that these experiences can be situated within wider social, political, and systemic perspectives, so that we can understand how various structures and systems can support youth moving forward (Ma et al., 2022; Crandon et al., 2022). The worksheet created from this framework (Appendix 4) has potential to provide youth and their communities with unified terminology and understanding, so that they can recognise and reflect on the psychological consequences of climate change, and on what support might be available to the young people struggling most. This worksheet would benefit from evaluation through future research, such as consultations with young people and their communities.

This review also sheds light on how interactions between psychological processes may act as mechanisms for how youth experience climate change threat. Nonetheless,

further research is needed to understand the causal directions and mechanisms of these psychological processes (Brosch, 2021), as this could help to further inform support strategies for youth struggling with climate change threat. There is ongoing work to systematically review mental health outcomes of climate change threat responses that will bring to light important future considerations to youth wellbeing, and these findings can be directly linked to psychological experiences identified in this review. Another important direction could be to systematically investigate how these domains vary as a function of sociodemographic variables. There is some work highlighting differences in youth's climate change psychological experiences across genders (Jylha et al., 2023; Lehnert et al., 2020; Ojala, 2015a; Ojala 2015b; Pereira et al., 2023; Wu & Otsuka, 2022), political affiliations (Haugestad et al., 2021; Pickering et al., 2021), and membership to climate change organisations (Ediz & Yanik, 2023; Gunasiri et al., 2022; Haugestad et al., 2021, Vercammen et al., 2023).

It would also be of benefit for this review to be repeated in the coming years, to understand how youth's psychological experiences around climate change may change alongside the ongoing development of the climate crisis and our global understanding of its consequences. Further reviews of climate change psychological experiences across the lifespan will also be important, to develop a developmental perspective of how we understand, assess and provide support for these experiences to children and adults of all ages (Sanson et al., 2018; Vergunst & Berry, 2022).

Conclusion

Youth are experiencing a wide variety of positive and negative psychological experiences from their awareness and understanding of the climate change crisis. There are complex interactions between the cognitive, affective, and behavioural dimensions of these experiences. The findings from this review help us to understand these interactions and how they shape youths' overall psychological experiences. This review provides us with a unified conceptual framework that brings together varied and complex psychological phenomena to best understand how youth are impacted by the indirect threat of climate change. This framework will help us expand our understanding

of factors and processes that shape youth's psychological experiences of climate change and their related outcomes.

Statements and Declarations

There was no funding associated with this review. The authors have no competing interests to declare.

References

Albrecht, G.A. (2019). *Earth emotions: New words for a new world.* Cornell University Press.

Amnesty International (2021); https://www.amnesty.org/en/what-we-do/climate-change/

APHA (2019). *Making the connection: Climate changes children's health.* Washington, DC: American Public Health Association.

Arnot, G., Thomas, S., Pitt, H., & Warner, E. (2023). "It shows we are serious": Young people in Australia discuss climate justice protests as a mechanism for climate change advocacy and action. *Australian and New Zealand journal of public health*, 47(3), 100048.

Bathiany, S., Dakos, V., Scheffer, M., & Lenton, T.M. (2018). Climate models predict increasing temperature variability in poor countries. *Science advances*, 4(5), eaar5809.

Beck, A.T. (1970). Cognitive therapy: Nature and relation to behavior therapy. *Behavior therapy*, 1(2), 184-200.

Bingley, W.J., Tran, A., Boyd, C.P., Gibson, K., Kalokerinos, E.K., Koval, P., ... & Greenaway, K.H. (2022). A multiple needs framework for CCA interventions. *American Psychologist,* 77(7), 812.

Brosch, T. (2021) Affect and emotions as drivers of climate change perception and action: a review. *Current Opinion in Behavioral Sciences* 42, 15-21.

Cianconi, P., Betrò, S., & Janiri, L. (2020). The impact of climate change on mental health: a systematic descriptive review. *Frontiers in psychiatry*, 11, 74.

Clayton, S. (2020). Climate anxiety: Psychological responses to climate change. *Journal of anxiety disorders*, 74, 102263.

Clayton, S. (2021). Climate change and mental health. *Current Environmental Health Reports*, 8, 1-6.

Clayton, S., & Karazsia, B.T. (2020). Development and validation of a measure of climate change anxiety. *Journal of environmental psychology,* 69, 101434.

Coffey, Y., Bhullar, N., Durkin, J., Islam, M.S., & Usher, K. (2021). Understanding eco-anxiety: A systematic scoping review of current literature and identified knowledge gaps. *The Journal of Climate Change and Health*, 3, 100047.

Crandon, T.J., Scott, J.G., Charlson, F.J., & Thomas, H.J. (2022). A social–ecological perspective on climate anxiety in children and adolescents. *Nature Climate Change*, 12(2), 123-131.

Crowe, M. (2013). *Crowe critical appraisal tool (CCAT) user guide*. Conchra House, 10.

Crowe, M., & Sheppard, L. (2011). A general critical appraisal tool: an evaluation of construct validity. *International journal of nursing studies,* 48(12), 1505-1516.

Ediz, C., & Yanik, D. (2023). The effects of climate change awareness on mental health: Comparison of climate anxiety and hopelessness levels in Turkish youth. *The International journal of social psychiatry*, 207640231206060.

Ellis, A. (1980). Rational-emotive therapy and cognitive behavior therapy: Similarities and differences. *Cognitive therapy and research*, 4, 325-340.

Gifford, E., & Gifford, R. (2016). The largely unacknowledged impact of climate change on mental health. *Bulletin of the Atomic Scientists*, 72(5), 292-297.

Gunasiri, H., Wang, Y., Watkins, E.M., Capetola, T., Henderson-Wilson, C., & Patrick, R. (2022). Hope, Coping and Eco-Anxiety: Young People's Mental Health in a Climate-Impacted Australia. *International Journal of Environmental Research and Public Health.*

Haugestad, C.A.P., Skauge, A.D., Kunst, J.R., & Power, S.A. (2021). Why do youth participate in climate activism? A mixed-methods investigation of the #FridaysForFuture climate protests. *Journal of Environmental Psychology,* 76.

Heeren, A., & Asmundson, G. J. (2022). Understanding climate anxiety: What decision-makers, health care providers, and the mental health community need to know to promote adaptative coping. *Journal of Anxiety Disorders*, 102654.

Henrich, J., Heine, S.J., & Norenzayan, A. (2010). The weirdest people in the world?. *Behavioral and brain sciences*, 33(2-3), 61-83.

Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, R.E., Mayall, E.E., ... & van Susteren, L. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey. *The Lancet Planetary Health*, 5(12).

Homburg, A., & Stolberg, A. (2006). Explaining pro-environmental behavior with a cognitive theory of stress. *Journal of Environmental Psychology*, 26(1), 1-14.

Hwong, A.R., Wang, M., Khan, H., Chagwedera, D.N., Grzenda, A., Doty, B., ... & Compton, W.M. (2022). Climate change and mental health research methods, gaps, and priorities: a scoping review. *The Lancet Planetary Health*, 6(3).

Jylha, K.M., Ojala, M., Odisho, S., & Riise, A. (2023). Climate-friendly food-choice intentions among emerging adults: extending the theory of planned behavior with objective ambivalence, climate-change worry and optimism. *Frontiers in Psychology*, 14, 1178449.

Korkala, E.A.E., Hugg, T.T., & Jaakkola, J.J.K. (2014). Awareness of climate change and the dietary choices of young adults in Finland: a population-based cross-sectional study. *PLoS ONE*, 9(5).

Lawrance, E.L., Jennings, N., Kioupi, V., Thompson, R., Diffey, J., & Vercammen, A. (2022). Psychological responses, mental health, and sense of agency for the dual challenges of climate change and the COVID-19 pandemic in young people in the UK: an online survey study. *The Lancet Planetary Health,* 6(9).

Lazarus, R.S. (1966). *Psychological stress and the coping process*. New York: McGraw Hill.

Lazarus, R.S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Springer.

Lehnert, M., Fiedor, D., Frajer, J., Hercik, J., & Jurek, M. (2020). Czech students and mitigation of global warming: Beliefs and willingness to take action. *Environmental Education Research*, 26(6), 864-889.

Leonhardt, M., Granrud, M.D., Bonsaksen, T., & Lien, L. (2022). Associations between Mental Health, Lifestyle Factors and Worries about Climate Change in Norwegian Adolescents. *International Journal of Environmental Research and Public Health*, 19(19), 12826.

Ma, T., Moore, J., & Cleary, A. (2022). Climate change impacts on the mental health and wellbeing of young people: A scoping review of risk and protective factors. *Social Science & Medicine*, 301, 114888.

Mei, C., Fitzsimons, J., Allen, N., Alvarez-Jimenez, M., Amminger, G.P., ... & McGorry, P.D. (2020). Global research priorities for youth mental health. *Early intervention in psychiatry*, 14(1), 3-13.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group, (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of internal medicine*, 151(4), 264-269.

Moser, S., & Seebauer, S. (2022). Has the COVID-19 pandemic strengthened confidence in managing the climate crisis? Transfer of efficacy beliefs after experiencing lockdowns in Switzerland and Austria. *Frontiers in Psychology*, 13, 892735.

NHS Digital. (2023). *Mental health of children and young people in England, 2023: Wave 4 follow-up to the 2017 survey.* Available from: https://digital.nhs.uk/data-and-

information/publications/statistical/mental-health-of-children-and-young-people-in-england/2023-wave-4-follow-up

Occhipinti, J.A., Skinner, A., Freebairn, L., Song, Y.J.C., Ho, N., ... & Hickie, I.B. (2021). Which social, economic, and health sector strategies will deliver the greatest impacts for youth mental health and suicide prevention? Protocol for an advanced, systems modelling approach. *Frontiers in psychiatry,* 12, 759343.

Ogunbode, C.A., Pallesen, S., Böhm, G., Doran, R., Bhullar, N., Aquino, S., ... & Lomas, M. J. (2021). Negative emotions about climate change are related to insomnia symptoms and mental health: Cross-sectional evidence from 25 countries. *Current Psychology*, 1-10.

Ojala, M. (2012). How do children cope with global climate change? Coping strategies, engagement, and well-being. *Journal of Environmental Psychology*, 32(3), 225-233.

Ojala, M. (2013). Regulating worry, promoting hope: How do children, adolescents, and young adults cope with climate change? *International Journal of Environmental and Science Education*, 8(1), 537-561.

Ojala, M. (2015a). Climate change skepticism among adolescents. *Journal of Youth Studies*, 18(9), 1135-1153.

Ojala, M. (2015b). Hope in the face of climate change: Associations with environmental engagement and student perceptions of teachers' emotion communication style and future orientation. *The Journal of Environmental Education*, 46(3), 133-148.

Ojala, M. (2022). Prefiguring sustainable futures? Young people's strategies to deal with conflicts about climate-friendly food choices and implications for transformative learning. *Environmental Education Research*, 28(8), 1157-1174.

Ojala, M., & Bengtsson, H. (2019). Young people's coping strategies concerning climate change: Relations to perceived communication with parents and friends and proenvironmental behavior. *Environment and Behavior*, 51(8), 907-935.

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International journal of surgery*, 88, 105906.

Patrick, R., Snell, T., Gunasiri, H., Garad, R., Meadows, G., & Enticott, J. (2023). Prevalence and determinants of mental health related to climate change in Australia. *Australian and New Zealand Journal of Psychiatry*, 57(5), 710-724.

Pereira, T., Freire, T., & Tavares, D. (2023). Portuguese validation of the Climate Change Attitude Survey: Psychometric properties and relations with positive youth development. *European Journal of Developmental Psychology*, 20(5), 875-888.

Pickering, G.J., Schoen, K., & Botta, M. (2021). Lifestyle decisions and climate mitigation: current action and behavioural intent of youth. *Mitigation And Adaptation Strategies For Global Change*, 26(6), 25.

Reser, J.P., Bradley, G.L., & Ellul, M.C. (2014). Public risk perceptions, understandings and responses to climate change. *Applied studies in climate adaptation*, 43-50.

Reser, J.P., & Swim, J.K. (2011). Adapting to and coping with the threat and impacts of climate change. *American Psychologist*, 66(4), 277.

Rideout, B.E. (2014). The liberal arts and environmental awareness: Exploring endorsement of an environmental worldview in college students. *International Journal of Environmental and Science Education*, 9(1), 59-76.

Royal College of Psychiatrists (2020). *The climate crisis is taking a toll on the mental health of children and young people*. Available from: https://www.rcpsych.ac.uk/news-and-features/latest-news/detail/2020/11/20/the-climate-crisis-is-taking-a-toll-on-the-mental-health-of-children-and-young-people

Sanson, A.V., Wachs, T.D., Koller, S.H., & Salmela-Aro, K. (2018). Young people and climate change: The role of developmental science. *Developmental science and sustainable development goals for children and youth,* 115-137.

Schuetz, S., Bhattarai, J., Mealy, B., Schuetz, S., Swopes, N., Harvey, D., . . . Ohlms, K. (2011). What? The earth is sick? Undergraduate students awareness of environmental problems: A qualitative study. *Ecopsychology*, 3(4), 269-276.

Schweizer, S., Lawson, R. P., & Blakemore, S. J. (2023). Uncertainty as a driver of the youth mental health crisis. *Current Opinion in Psychology*, 53, 101657.

Sciberras, E., & Fernando, J.W. (2022). Climate change-related worry among Australian adolescents: an eight-year longitudinal study. *Child and Adolescent Mental Health*, 27(1), 22-29.

Soutar, C., & Wand, A.P. (2022). Understanding the Spectrum of Anxiety Responses to Climate Change: A Systematic Review of the Qualitative Literature. *International Journal of Environmental Research and Public Health*, 19(2), 990.

Stern, C., Lizarondo, L., Carrier, J., Godfrey, C., Rieger, K., Salmond, S., ... & Loveday, H. (2020). Methodological guidance for the conduct of mixed methods systematic reviews. *JBI evidence synthesis*, 18(10), 2108-2118.

Tasquier, G., & Pongiglione, F. (2017). The influence of causal knowledge on the willingness to change attitude towards climate change: Results from an empirical study. *International Journal of Science Education*, 39(13), 1846-1868.

The Children's Society. (2023). *The Good Childhood Report 2023.* Available from: https://www.childrenssociety.org.uk/sites/default/files/2023-09/The%20Good%20Childhood%20Report%202023.pdf

Uhlhaas, P.J., Davey, C.G., Mehta, U.M., Shah, J., Torous, J., ... & Wood, S.J. (2023). Towards a youth mental health paradigm: a perspective and roadmap. *Molecular Psychiatry*, 28(8), 3171-3181.

UNESCO (2017). *Definition of Youth.* Available from: https://www.unesco.org/en/youth

Vamvalis, M. (2023). "We're fighting for our lives": Centering affective, collective and systemic approaches to climate justice education as a youth mental health imperative. *Research in Education*, 117(1).

van der Linden, S. (2014). On the relationship between personal experience, affect and risk perception: The case of climate change. *European journal of social psychology*, 44(5), 430-440.

Vercammen, A., Oswald, T., & Lawrance, E. (2023). Psycho-social factors associated with climate distress, hope and behavioural intentions in young UK residents. *PLOS Global Public Health*, 3(8).

Vergunst, F., & Berry, H.L. (2022). Climate change and children's mental health: a developmental perspective. *Clinical Psychological Science*, 10(4), 767-785.

Walinski, A., Sander, J., Gerlinger, G., Clemens, V., Meyer-Lindenberg, A., & Heinz, A. (2023). The effects of climate change on mental health. *Deutsches Ärzteblatt International,* 120(8), 117.

Weissbecker, I. (2011). *Climate change and human well-being: Global challenges and opportunities.* Springer Science & Business Media.

WHO (2014). *Recognizing adolescence.* Available from: http://apps.who.int/adolescent/second-decade/section2/page1/recognizing-adolescence.html

Wu, J., Long, D., Hafez, N., Maloney, J., Lim, Y., & Samji, H. (2023). Development and validation of a youth climate anxiety scale for the Youth Development Instrument survey. *International Journal of Mental Health Nursing*.

Wu, J., & Otsuka, Y. (2022). Adaptation of leadership competence to climate change education: Conceptual foundations, validation, and applications of a new measure. *Leadership*, 18(2), 247-265.

Wullenkord, M.C., & Ojala, M. (2023). Climate-change worry among two cohorts of late adolescents: Exploring macro and micro worries, coping, and relations to climate engagement, pessimism, and well-being. *Journal of Environmental Psychology*, 90, 1-12.

Xiang, P., Zhang, H., Geng, L., Zhou, K., & Wu, Y. (2019). Individualist-Collectivist Differences in Climate Change Inaction: The Role of Perceived Intractability. *Frontiers in Psychology*, 10, 187.

Chapter 2

Exploring the degree to which climate change anxiety differentiates from other mental health problems in youth: a confirmatory factor analysis approach

Prepared in accordance with the author requirements for the *Journal of Anxiety Disorders*; https://www.sciencedirect.com/journal/journal-of-anxiety-disorders/publish/guide-for-authors

Plain Language Summary

Background

Climate change anxiety (CCA) is a new term that describes how worrying about climate change affects people's emotions and daily lives. Researchers are creating new tools, like the Climate Change Anxiety Scale (Clayton & Karazsia, 2020) to measure this anxiety. There is ongoing debate about what CCA really means and whether it is a mental health disorder, and there is a need for more theories and research on this (Heeren & Asmundson, 2023). Young people appear to have more worry and negative emotions about climate change than adults, and so it is important for more research to improve our understanding of CCA in young people (Burke et al., 2018).

Aims and Questions

The aim of the study was to find out how much CCA in young people is related to other mental health problems like general anxiety and depression. Our main questions were: How different is CCA from depression and general anxiety in young people; and should these be conceptualised as three separate issues, or as part of the same group of mental health difficulties? We also wanted to know if CCA is connected to other factors that impact mental health, such as how well young people handle distress and uncertainty, which we know can impact anxiety and depression.

Method

Participants: Young people aged 16-25 in the UK.

Recruitment: An anonymous survey was advertised online.

Study design: The survey asked self-report questions to measure CCA, generalised anxiety, depression, and the ability to handle distress and uncertainty. We then compared and analysed these scores to see if CCA, generalised anxiety, and depression appear to be separate issues, or part of the same group of mental health difficulties. We also looked at how strongly these issues relate to each other, and how much they relate to the ability to handle distress and uncertainty.

Main Findings and Conclusions

Survey results from 316 young people were analysed. These results show that CCA, depression, and general anxiety in young people are best understood as three separate issues that are related, rather than being part of the same group of mental health difficulties. We found that higher CCA in young people is only slightly linked to a lower ability to handle distress and uncertainty, while general anxiety and depression are more strongly linked to these abilities. This suggests that CCA is different from other mental health problems in young people, which means we might need to research, assess, and support CCA in young people differently.

References

Burke, S.E., Sanson, A.V., & Van Hoorn, J. (2018). The psychological effects of climate change on children. *Current psychiatry reports*, 20(5).

Clayton, S., & Karazsia, B.T. (2020). Development and validation of a measure of CCA. *Journal of Environmental Psychology*, 69, 101434.

Heeren, A., & Asmundson, G.J. (2023). Understanding climate anxiety: What decision-makers, health care providers, and the mental health community need to know to promote adaptative coping. *Journal of Anxiety Disorders*, 93, 102654.

Abstract

Background

A rapidly growing research base is emerging around psychological responses to climate change, showing emotional and functional impairments. The concept of "climate change anxiety" (CCA) is still being developed, and more research is needed to explore it and how it interacts with mental health, particularly in youth.

Objectives

The main aim of this study was to explore the degree to which CCA differentiates from other mental health problems in youth, specifically generalised anxiety and depression. As a secondary aim, this study also explored how CCA relates to transdiagnostic mental health factors of distress tolerance and uncertainty tolerance.

Method

An anonymous online survey recruited a volunteer sample of youth aged 16-24 in the UK (*N* = 316). This survey included quantitative measures for CCA, depression, generalised anxiety, distress intolerance, and uncertainty intolerance. Confirmatory factor analysis (CFA) explored the underlying structure of CCA alongside depression and generalised anxiety; and the best fitting model was expanded on as a structural equation model to explore relationships with the transdiagnostic factors.

Results

The best fitting CFA model was found to be a three-factor model, suggesting that CCA, depression and generalised anxiety are not best represented as a unidimensional construct, but as three separate domains. CCA had moderate positive correlations with depression and generalised anxiety. The transdiagnostic factors were found to have weak relationships with CCA, whilst they had stronger relationships with depression and generalised anxiety. Taken together, these results suggest that CCA differentiates from other mental health problems in youth and might not fit within current conceptualisations of psychological disorders that youth experience.

Implications

These results support the idea that CCA should not be pathologized or incorporated into diagnostic models of psychopathology. Alternative approaches for understanding, researching, and supporting youth with climate anxiety in line with current theory and research is discussed.

Introduction

Climate Change Impacts on Youth

Millions of people around the world are affected by climate change, and there is overwhelming scientific consensus that it will continue to cause harm unless worldwide governmental action is taken (Amnesty International, 2021; Intergovernmental Panel on Climate Change, 2022). There is growing evidence into the impacts of climate change on mental health, particularly in relation to expressed and experienced climate change-related worry, fear, helplessness, stress, and grief (Albrecht, 2011; Ojala et al., 2021). Understanding and assessing the mental health impacts of climate change is urgent, as they are expected to be widespread and profound (Cianconi et al., 2020; Doherty & Clayton, 2011).

Climate change exacerbates existing inequalities globally, including between generations, with younger people facing the threat of worsening climate change over time (Amnesty International, 2021; Ursano et al., 2017; Watts et al., 2017). Children and youth may not have developed the coping abilities to manage the sense of uncertainty, anxiety and frustration that is linked to the impending climate change which will affect their futures (Ojala, 2012; Sanson et al., 2018). It could be harder for younger people to deal with climate change worry due to having even less control over the issue than adults (Calyton, 2020; Ojala, 2012), and therefore they are susceptible to both the direct and indirect impacts of climate change on their wellbeing (Burke et al., 2018). Young people are also shown to be highly aware of climate change issues, which can increase their levels of concern and anxiety (Hornsey et al., 2016). Nonetheless, the impact of the climate change crisis on youth's mental health, wellbeing and emotions remains understudied and requires further empirical research (APHA, 2019; Burke et al., 2018; Crandon et al., 2022; Martin et al., 2022).

Understanding Climate Change Anxiety

Clinically relevant "psychological responses to negative changes to the state of the Earth" was introduced by environmental philosopher Glenn Albrecht (Albrecht, 2011, p. 48). Albrecht noted the importance of understanding these "earth emotions"

(Albrecht, 2019) and their impacts on psychological wellbeing and functioning, and there has been a growing body of literature exploring the climate change crisis as a risk factor for mental health difficulties. Numerous terms such as “climate change anxiety”, “eco-anxiety”, “environmental distress”, “eco-grief” and “solastalgia” have been used to try and capture this experience. Reviews by Coffey et al. (2021) and Soutar and Wand (2022) conclude that these terms have been operationalised as a broad range of negative emotions related to climate change that are still poorly understood conceptually. This paper will use the term “climate change anxiety” (CCA) to describe the emotional, cognitive, and functional difficulties related to the threat of climate change. CCA can be characterised as a spectrum of responses with common themes of anxiety symptoms, feeling helpless and disempowered, and worrying about threats to livelihood, future generations, apocalyptic futures, and the lack of response to climate change (Pihkala, 2020; Soutar & Wand, 2022).

Researchers have recently developed measures of CCA, with an aim to operationalise this concept and achieve consistency in its measurement and understanding. Clayton and Karaczia’s (2020) empirical study developed the Climate Change Anxiety Scale (CCAS), which appears to be the most used measure of CCA globally. They grounded their scale in existing measures and models of stress and anxiety which indicate important interactions between climate change awareness; cognitive processes such as rumination, appraisals of threat and coping; emotional responses and regulation; and behavioural engagement and functioning. They found that 18–35-year-old participants scored significantly higher (i.e., more difficulties) on their measure of CCA than older age groups. Heeren et al. (2023) examined the network structure of CCA using the CCAS, finding that the cognitive-emotional subscale is the hallmark characteristic of CCA, and a potential tipping pathway that may yield either adaptive responses (i.e., pro-environmental behaviours) or maladaptive responses (i.e., functional impairments) to climate change.

Whilst Clayton and Karaczia (2020) define CCA as a “clinically significant ‘anxious’ response”, there is an ongoing debate about whether CCA should be acknowledged as a mental disorder (Bhullar et al., 2022; Pihkala, 2020; Sampaio & Sequeira, 2022; Vukičević & Liu, 2024). It is important to clarify that experiencing cognitive-affective

responses such as anxiety about climate change is a normative and functional reaction to this serious issue, which can help motivate people to take action (Bhullar et al., 2022; Clayton, 2020; Kovacs et al., 2024; Royal College of Psychiatrists, 2020). However, for some these negative emotional responses may be overwhelming and potentially maladaptive, interfering with their ability to engage in climate action or to function well in daily life (Clayton, 2020; Reser et al., 2014; Royal College of Psychiatrists, 2020). In both cases, the identification and exploration of CCA remains important for helping individuals to identify their experiences, and for encouraging systems to find suitable coping mechanisms and support for those struggling most with CCA (Newnham et al., 2020; Vukičević & Liu, 2024). There is an urgent call for the development of theoretical principles and hypothesis-driven research for understanding how we both operationalise and conceptualise CCA (Hereen & Asmundson, 2023; Heeren et al., 2023), which is important to establish before research on this topic continues to rapidly grow.

Climate Change Anxiety Associations with Youth Mental Health

This growing research base is suggesting that young people could be developmentally vulnerable to struggling with CCA (Vergunst & Berry, 2022), and CCA appears to be having widespread impacts on youth globally (Hickman et al., 2021). There has been some exploration into how CCA relates to other common mental health difficulties experienced by youth, with preliminary support for the co-occurrence of generalised anxiety and depressive symptoms in those experiencing CCA based on small to moderate strength correlational data (Clayton & Karaczia, 2020; Hogg et al., 2021; Wullenkord et al., 2021). These researchers suggest that the small magnitude of these correlations provides preliminary evidence for discriminant validity between CCA and other mental health domains. There is limited knowledge about potential cause-effect relationships between CCA and youth mental health (Sampaio & Sequeira, 2022), and the possible overlap between generalised anxiety disorder, depression and CCA has led some researchers to question whether CCA is a unique construct (Helm et al., 2018; Hogg et al., 2021). No previous studies have investigated how CCA fits within current dimensional models of psychopathology, particularly internalising psychopathology

(Patalay et al., 2015). This is important if we are to distinguish CCA from other related domains of psychopathology in youth.

The literature has also begun to explore the relationship between CCA and transdiagnostic mental health factors – psychological processes relevant to various psychopathology domains that help to explain the common comorbidity between mental health problems (Rodriguez-Seijas et al., 2015; Dalgleish et al., 2020). Distress tolerance is a transdiagnostic factor conceptualised as the perceived capacity to withstand internal distress or negative emotional states (Bernstein et al., 2011; Simons & Gaher, 2005), and uncertainty tolerance is characterised as the tendency to react emotionally, cognitively, or behaviourally to uncertain situations (Hillen et al., 2017). These psychological processes have been shown to predict anxiety and depressive symptoms (Keough et al., 2010.; Lass & Winer, 2020; Strout et al., 2018). Distress and uncertainty tolerance also significantly mediated the effect of global disasters such as the COVID-19 pandemic on depression and anxiety (Korkmaz & Güloğlu, 2021; Rettie & Daniels, 2021). There are indications that high rates of distress and fears of uncertainty are related to higher levels of CCA (Doherty & Clayton, 2011). Goldwert et al. (2024) found a moderate correlation between CCA and intolerance of uncertainty in a sample of Floridian adults, concluding that there is currently a key gap in the literature around understanding how transdiagnostic mechanisms of psychological difficulty may relate to and impact CCA. Therefore, we expect that anxiety, depression and CCA may have shared transdiagnostic mental health factors.

The Current Study: Aims and Research Questions

Considering the current evidence and gaps in our understanding of CCA in youth as identified above, this study looked at the mental health domains of generalised anxiety and depression, to assess the extent to which they differ from CCA in young people. We aimed to test competing models of the underlying structure of these domains using a confirmatory factor analysis (CFA) approach; examining whether any shared variance among them is best represented as a unitary underlying construct of internalising psychopathology driving the observed associations, or as unique but related constructs each representing a separate domain (see Figures 1 through 3 in the Method, p. 71). To

further explore the construct of CCA, this study will also consider it in relation to known transdiagnostic mental health factors, to further our understanding of CCA and the extent to which it differentiates from other mental health domains experienced by youth. The following are the main research questions:

1. Does CCA represent a unique construct that differentiates from other mental health domains in youth, specifically depression and generalised anxiety?
2. To what degree is CCA associated with transdiagnostic mental health factors in youth, specifically distress tolerance or uncertainty tolerance?
3. Are these transdiagnostic mental health factors uniquely associated with CCA, and how do they compare to their associations with depression and generalised anxiety in youth?

Method

Design and Participants

A quantitative, cross-sectional survey design with online participant recruitment was used for this study. This design was chosen to support the recruitment of a large sample that would increase the generalisability of results to youth in the UK.

The inclusion criteria for participants were young people (aged 16-24) living in the UK. Definitions of "young people" or "youth" can vary in terms of specific age, with The World Health Organisation (WHO) and the United Nations definitions being between the ages of 15 and 24 years (WHO, 2014; UNESCO, 2017). We chose to not recruit 15-year-olds as they are unable to consent to participate without parent or carer permission, which is difficult to monitor through online survey formats.

A total of 491 participants started this survey. 167 participants had incomplete responses (more than 50% missing data) and were removed. In line with the inclusion criteria, all participants stated that they lived within the UK, but a further eight participants were removed for reporting they were older than 24. Further response quality procedures were then completed as features of the survey software (Qualtrics, Provo, UT), such as identifying "speeders" as participants who took less than two standard deviations from the median duration to complete the survey. However, no further participants were identified as having poor response quality. This left a total of 316 participants for analysis. Participants had a mean age of 20.69 (SD = 2.13). Further demographic information can be found in Table 1.

Table 1

Demographic information for participants

	Frequency	%
Gender		
Men	77	24.4%
Women	212	67.1%
Non-binary	23	7.3%
Transgender men	1	0.3%

Transgender women	0	0.0%
Prefer not to say	3	0.9%
Ethnicity		
Arab or Arab British	5	1.6%
Asian or Asian British	31	9.8%
Black or Black British	10	3.2%
Mixed or multiple groups	13	4.1%
White or White British	250	79.1%
Any other ethnic group	6	1.9%
Prefer not to say	1	0.3%
Area in the UK		
England	64	20.3%
Northern Ireland	1	0.3%
Scotland	243	76.9%
Wales	8	2.5%

Note. N = 316

Measures

Preliminary Questions. Four demographic questions were asked on participant age, gender, ethnicity, and the area of the UK they lived in. Three preliminary climate change questions were then asked: "Where do you get your information about climate change from?"; "To what extent do you think that climate change is a global threat?"; and "To what extent do you think that climate change threat has impacted your mental health?" The first question was answered by a list of information sources and a free text option to write other sources not listed, whilst the latter two questions were answered on Likert rating scales.

Climate Change Anxiety. The 13-item Climate Change Anxiety Scale (CCAS; Clayton and Karazsia, 2020) was used. It has two subscales identified as two distinct factors: cognitive-affective impairment and functional impairment. The cognitive-affective impairment subscale consists of eight items and explores the symptoms of CCA (e.g. "Thinking about climate change makes it difficult for me to concentrate"). The functional impairment subscale consists of five items and is used to determine the extent to which these symptoms interfere with daily functioning (e.g. "My concerns about climate change make it hard for me to have fun with my family or friends"). The

measure is scored using a rating scale of how often each statement is true of the participant, from 1 (“Never”) to 5 (“Almost always”), where higher scores indicate more difficulties.

Depression. The nine-item Patient Health Questionnaire (PHQ-9; Kroenke and Spitzer, 2002) was used, which is a validated diagnostic screening tool for depression in adolescents (Richardson et al., 2010). It asks patients to rate how often they have been bothered by problems typical of depression (e.g. “Feeling down, depressed, or hopeless?”) over the past two weeks. Items are scored on a scale of 0 (“Not at all”) to 3 (“Nearly every day”), where higher scores indicate more difficulties and a score of 10 or higher indicates clinical concerns.

Generalised Anxiety. The seven-item Generalised Anxiety Disorder Questionnaire (GAD-7; Spitzer et al., 2006) was used, which is a validated diagnostic screening tool for generalised anxiety in adolescents (Mossman et al., 2017). It asks patients to rate how often they are bothered by problems typical of generalised anxiety disorder (e.g. “Feeling nervous, anxious or on edge?”) over the past two weeks. Items are scored on a scale of 0 (“Not at all”) to 3 (“Nearly every day”), where higher scores indicate more difficulties and a score of 10 or higher indicates clinical concerns.

Distress Tolerance. The four-item Distress Tolerance Scale short-form (DTS-SF; Simons & Gaher, 2005) was used, which has been validated for use with adolescents (Tonarely & Ehrenreich-May, 2020). The items ask participants to think of times that they feel distressed or upset and describe their beliefs (e.g. “I can't handle feeling distressed or upset”). The items are scored on a scale from 1 (“Strongly agree”) to 5 (“Strongly disagree”), where higher scores indicate higher intolerance of distress.

Uncertainty Tolerance. The 12-item Intolerance of Uncertainty Scale short-form (IUS-SF; Carleton et al., 2007) was used, which has been validated for use with adolescents (Boelen et al., 2010). It lists a series of statements which describe how people may react to the uncertainties of life (e.g. “Unforeseen events upset me greatly”). Items are scored on a scale from 1 (“Not at all characteristic of me”) to 5 (“Entirely characteristic of me”), where higher scores indicate higher intolerance of uncertainty.

Procedure

The survey was conducted using Qualtrics software (Qualtrics, Provo, UT), a web-based survey tool approved by the University of Glasgow. Participants were recruited through volunteer sampling and the survey was advertised online using platforms such as Twitter, Facebook, Instagram, and Reddit, which are regularly utilised in online research recruitment (Darko et al., 2022). The survey was also advertised through mental health charity participant platforms, and various college and university platforms, such as the University of Glasgow psychology research participation website. The survey was open for seven months from 1st September 2023 until 1st April 2024.

The survey began with a participant information sheet and informed consent (Appendix 8), followed by demographic questions and preliminary climate change questions. This was then followed by the measures assessing CCA, depression, generalised anxiety, distress intolerance, and uncertainty intolerance. These measures were presented in a randomised order to mitigate potential sequence effects. The survey ended with a debrief page, including contact details for the researchers, and signposting for support around mental health difficulties and climate change anxiety. A copy of the survey can be found in Appendix 9.

Ethics, Governance and Data Protection

Ethics approval was granted through the University of Glasgow Medical, Veterinary and Life Sciences (MVLS) Research Ethics Committee on 24th August 2023, project number: 200220399 (Appendix 7).

The online questionnaire was anonymous and required participants to provide informed consent before commencing. As participants are 16+ they can consent to research on their own accord. Participants were informed that because the data they provided was anonymous and unidentifiable, they were unable to access it or request withdrawal once their survey was submitted. The results of the questionnaire were exported as Microsoft Excel files, and all data files were stored on a secure University of Glasgow One Drive server. A Data Protection Impact Assessment (DPIA) was

completed, and all storage and processing of participant data was conducted in line with the University of Glasgow and GDPR guidelines.

Analysis

Descriptive statistics were generated for all variables. Univariate distributions were visualised using histograms and bivariate associations visualised using scatterplots. For the first research question, CFA was used to test competing models of the underlying constructs of generalised anxiety, depression, and CCA. The dimensional structure of these domains was examined using the validated symptom measures PHQ-9 and GAD-7, and the cognitive-affective symptom subscale of the CCAS, modelling the associations between them at an item level. Three separate estimated CFA models were used to test competing models regarding the structure of these domains: a) A one-factor model of psychopathology to examine whether all three domains may be explained by a unified underlying construct of internalising psychopathology (Figure 1); b) A model with two correlated factors to examine CCA as a unique but related domain to the construct of internalising psychopathology (Figure 2); c) A model with three correlated factors to examine the multidimensional nature of the three domains (Figure 3).

For the secondary research questions, bivariate correlations were used to explore the association between CCA and the transdiagnostic factors (distress intolerance and uncertainty intolerance). The best fitting CFA model was expanded on as a structural equation model (SEM), whereby the transdiagnostic factors are the observed predictors and the outcomes are the psychopathology domains - the latent factors from the optimal CFA model. This allows us to explore the unique associations between distress and uncertainty tolerance with the latent factors in the best fitting CFA model, free of measurement error.

All models were estimated using R software with the lavaan package (version 0.5-17; Rosseel, 2012). Robust maximum likelihood estimation was used to account for multivariate non-normality, and Full Information Maximum Likelihood (FIML) to handle any missing data.

Figure 1

Unidimensional Model

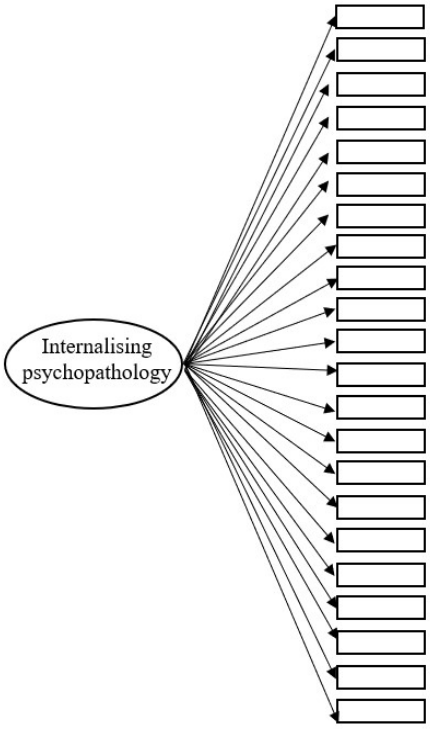


Figure 2

Two Factor Correlated Model

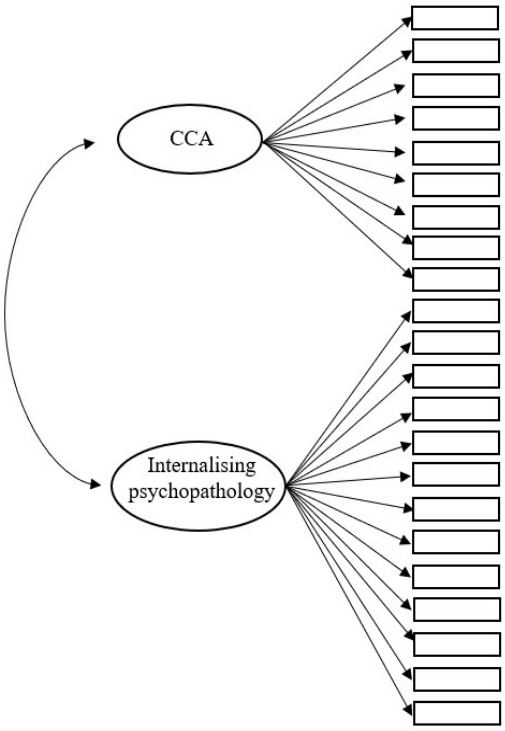
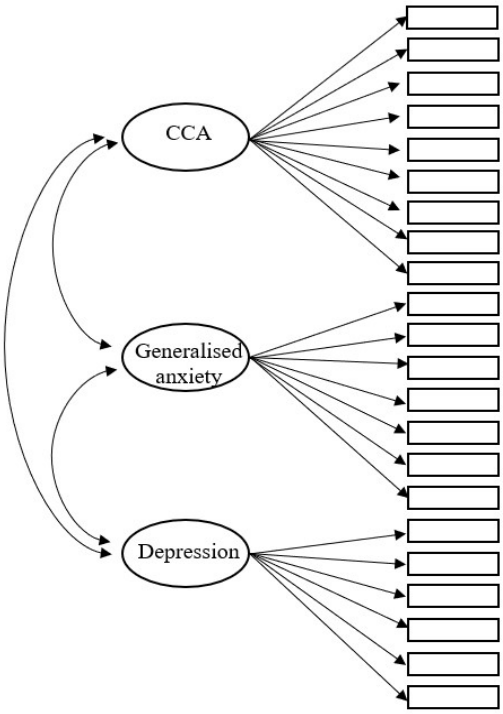


Figure 3

Three Factor Correlated Model



Note. Ovals are latent factors and rectangles are observed indicators (the symptom measure items). Single head arrows represent standardised factor loadings and double head arrows represent correlation coefficients.

Model fit was evaluated using the standardised root mean square residual (SRMR), the root mean square error of approximation (RMSEA), the comparative-fit index (CFI), the Tucker-Lewis index (TLI). Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were then used to measure comparative fit of the models. Higher CFI and TLI (.90 and above); lower SRMR and RMSEA (lower than .10); and lower AIC and BIC indicates better model fit.

Sample Size

Sample size recommendations for factor analysis were followed. The literature varies in its recommendations for CFA sample size, with some suggesting a minimum of 150, 200, or 300 participants, and some suggesting a ratio approach such 10-participants-per-item (Costello and Osborne, 2005; Tabachnick and Fidell, 2013; Wang and Wang, 2012). We aimed for the highest sample size recommendation, a minimum of 300 participants in total.

Results

Descriptive Statistics

The preliminary climate change questions were examined for contextual information. Figures 4 through 6 provide a summary of this information, showing that most participants believe that climate change is a major global threat (89.2%) and that climate change has negatively impacted their mental health (72.8%). The most common ways that participants obtained their information on climate change were social media (85.1%) and the news (71.2%). Out of the participants who provided free text responses, three stated that they didn't engage with climate change information, and the remainder gave responses such as podcasts, academic literature, online news articles, newsletters, email subscriptions, and volunteering organisations.

Figure 4

A Bar Chart Showing Participant Beliefs About Whether Climate Change Is a Global Threat

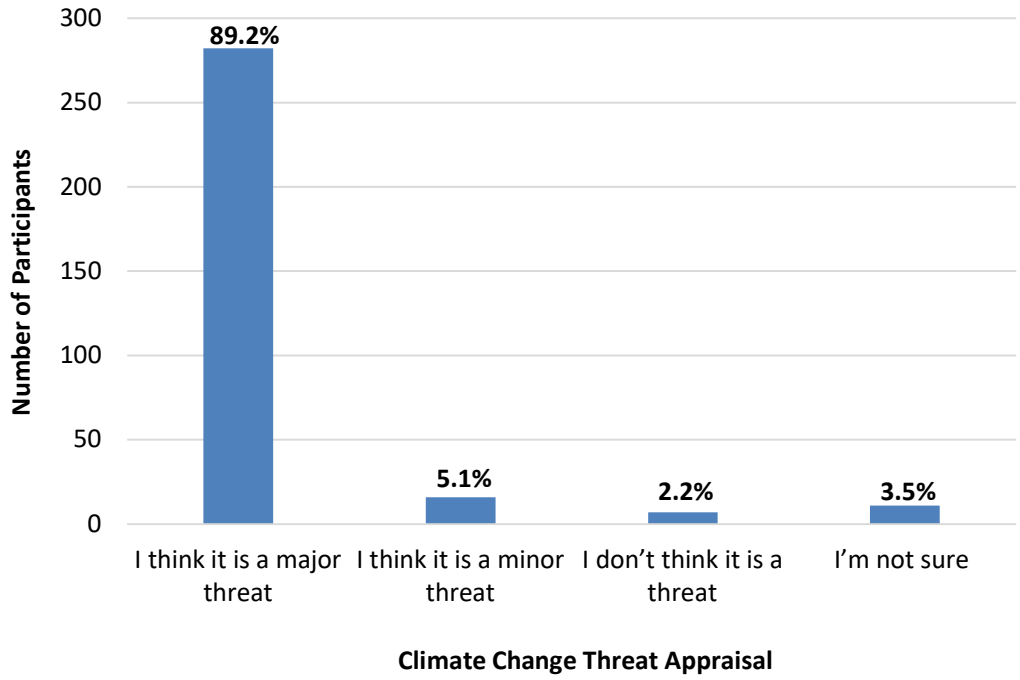


Figure 5

A Bar Chart Showing Participant Beliefs About the Impacts of Climate Change on Their Mental Health

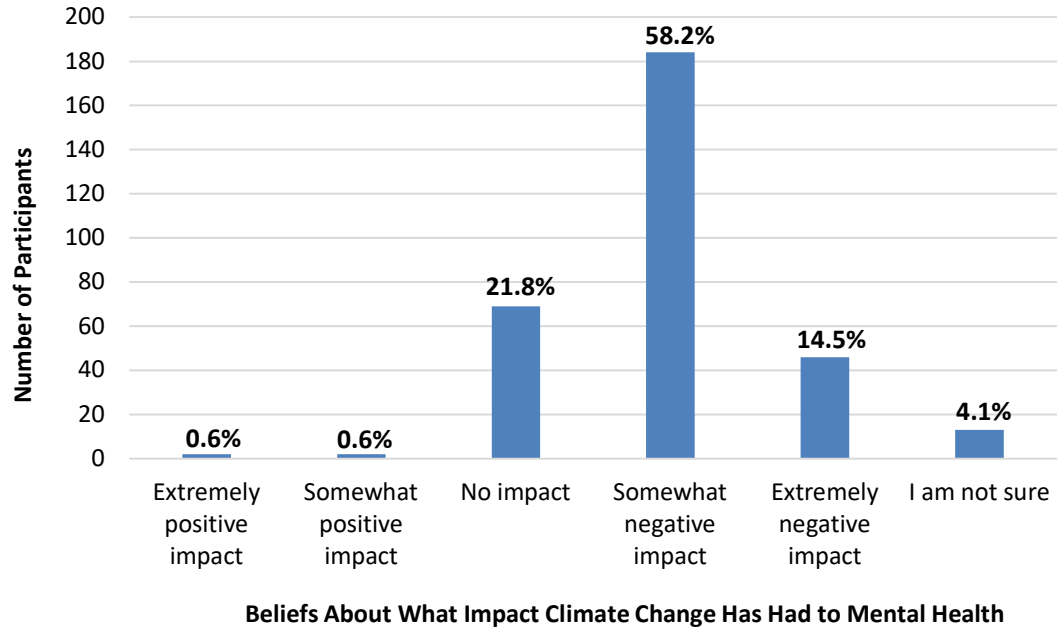
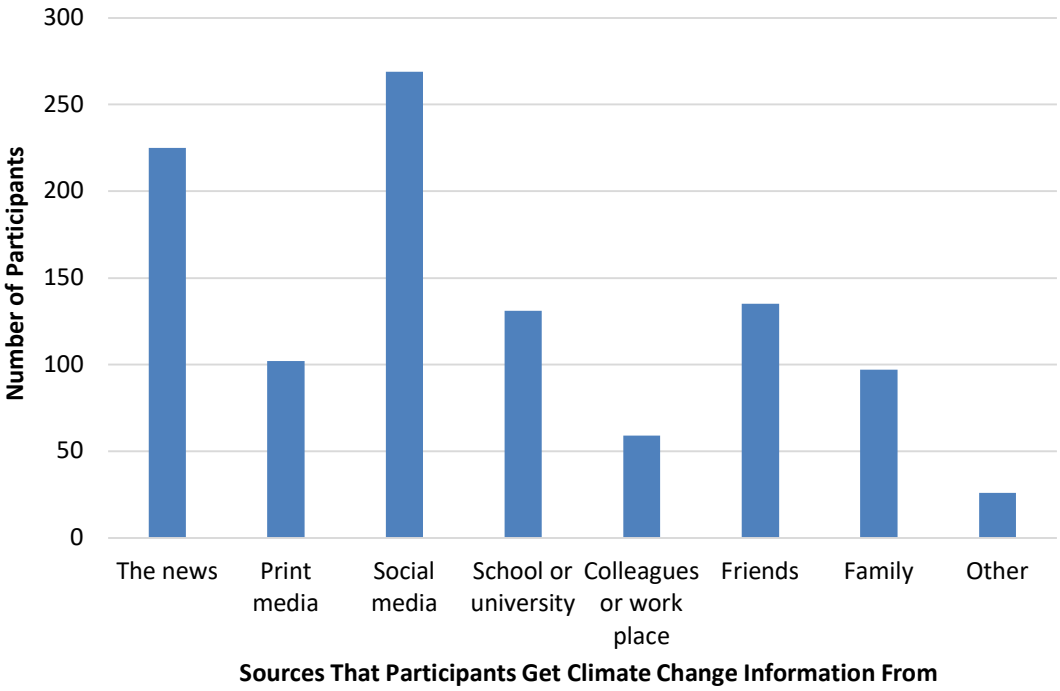


Figure 6

A Bar Chart Showing Where Participants Get Their Climate Change Information From



Descriptive statistics for the examined measures can be found in Table 2. In total, 144 participants (45.6%) scored above the clinical cutoff for depression and 125 participants (39.6%) scored above the clinical cutoff for generalised anxiety. Mean scores of CCA were relatively low in the sample, averaging between 'never' and 'rarely' experiencing cognitive-emotional or functional impairment from climate change (Table 2). The CCA scores were not normally distributed and displayed significant floor effects (Figure 7), however, the statistical analysis methods used are robust to multi-variate non-normality violations. The visualised scatterplots of the outcome measures showed no other concerns or violations. Although there is no cut-off point for the CCAS, Clayton and Karazscia (2020) suggest that "if 25% of a sample report that climate change makes it difficult for them to function more often than 'sometimes', this indicates that climate change is beginning to have a significant effect on mental health." In our sample, mean scores of "sometimes" or higher were seen in 26 participants (8.2%) for the cognitive-emotional subscale; 40 (12.7%) for the functional impairment subscale; and 28 (8.9%) for the total CCA scale (Figure 7).

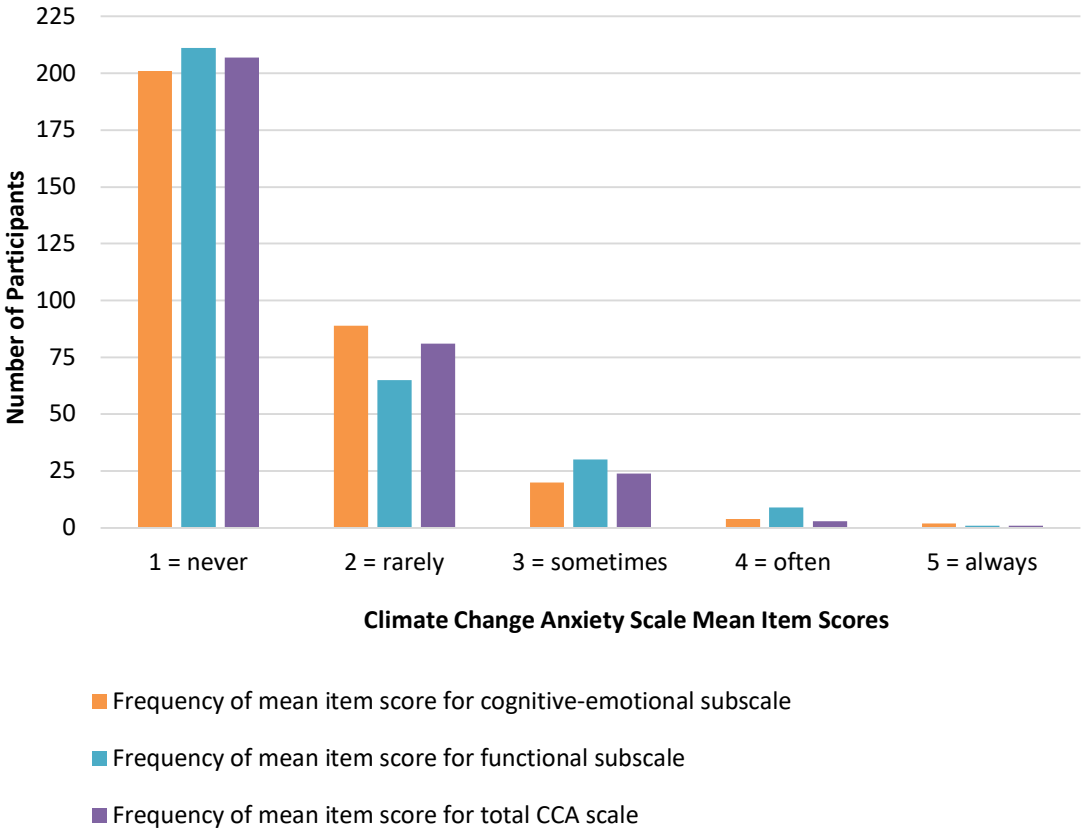
Table 2

Descriptive Statistics for Climate Change Anxiety and Mental Health Domains

Psychological Domain	*N*	Item Level Mean	Total Scale Mean	Total Scale SD	Total Scale Min	Total Scale Max
CCA total	316	1.79	23.32	9.72	13.00	65.00
CCA cognitive-emotional	316	1.81	14.48	5.96	8.00	40.00
CCA functional	316	1.77	8.84	4.37	5.00	25.00
Depression	316	1.27	10.16	6.86	0.00	27.00
Generalised anxiety	316	1.13	8.92	5.78	0.00	21.00
Intolerance of distress	316	2.90	11.61	4.02	4.00	20.00
Intolerance of uncertainty	316	3.01	36.13	9.62	12.00	60.00

Figure 7

A Bar Graph Showing the Spread of Mean Item Scores for the CCAS



Bivariate Correlations

Table 3 presents the correlations among all the scales measured, including comparisons between the two subscales of the CCAS. All the domains were positively and significantly correlated at $p < .001$ significance. The strengths of the correlational data were interpreted according to Cohen's (1988) conventions. The two CCA subscales were strongly correlated ($r = .77$), and their correlations with generalised anxiety and depression were all moderate in strength. CCA also had small relationships with the transdiagnostic mental health factors of distress intolerance ($r = .31$) and uncertainty intolerance ($r = .24$). However, these are weaker than the moderate relationships between depression and generalised anxiety with distress intolerance ($r = .49$ and $r = .49$, respectively) and uncertainty intolerance ($r = .39$ and $r = .45$, respectively).

Table 3

Correlation Matrix Among All Variables

	CCA Total	CCA Cog-emotional	CCA Functional	Depression	Generalised Anxiety	Distress Intolerance	Uncertainty Intolerance
CCA Total	-						
CCA Cog-emotional	0.96	-					
CCA Functional	0.92	0.77	-				
Depression	0.39	0.37	0.35	-			
Generalised Anxiety	0.35	0.34	0.31	0.74	-		
Distress Intolerance	0.31	0.29	0.30	0.49	0.49	-	
Uncertainty Intolerance	0.24	0.26	0.16	0.39	0.45	0.53	-

Note. All correlations are significant at p <.001.

Confirmatory Factor Analysis

The CFA of depression, generalised anxiety, and CCA (cognitive-emotional impairment) revealed that the three-factor model fit the data the best (CFI = .91, TLI = .90, RMSEA = .07, SRMR = .06), better than the two-factor model (CFI = .84, TLI = .83, RMSEA = .09, SRMR = .06) and the unidimensional model (CFI = .65, TLI = .62, RMSEA = .14, SRMR = .12). The AIC and BIC values also revealed that the three factor model (AIC = 18017.53, BIC = 18299.21) was better than the competing two-factor model (AIC = 18293.94, BIC = 18568.11) and one-factor model (AIC = 19118.09, BIC = 19388.51). Table 4 presents the completely standardised factor loadings and the proportion of item-level variance explained by the three-factor model. All standardised factor loadings were above .5 and significant at p < .001, indicating acceptable associations between the latent factors and observed indicators (Black et al., 2010). Furthermore, the three factors all had significant, positive correlations with each other (p < .001): CCA was moderately correlated with depression (r = .40) and generalised anxiety (r = .37), whilst depression and generalised anxiety were strongly correlated (r = .78). The total score reliability of the three domains were good: Depression had omega .90, Generalised anxiety had omega .91, and CCA had omega .88. This indicates that the three factors account for a large proportion of reliable variance in the sum of their respective items (Rodriguez et al., 2016).

Table 4

General Factor Standardised Factor Loadings and Proportion of Variance Explained by the Best Fitting CFA Model: The Three-Factor Model

General Factor Item	Standardised Factor Loadings	Proportion of Variance Explained (R-Square)
Depression		
1. Little interest or pleasure in doing things?	0.79	0.62
2. Feeling down, depressed, or hopeless?	0.82	0.68
3. Trouble falling or staying asleep, or sleeping too much?	0.65	0.43
4. Feeling tired or having little energy?	0.72	0.52
5. Poor appetite or overeating?	0.67	0.44
6. Feeling bad about yourself - or that you are a failure or have let yourself or your family down?	0.71	0.52
7. Trouble concentrating on things, such as reading the newspaper or watching television?	0.68	0.47
8. Moving or speaking so slowly that other people could have noticed? Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual?	0.66	0.44
9. Thoughts that you would be better off dead, or of hurting yourself in some way?	0.63	0.40
Generalised Anxiety		
1. Feeling nervous, anxious or on edge?	0.83	0.69
2. Not being able to stop or control worrying?	0.90	0.82
3. Worrying too much about different things?	0.86	0.74
4. Trouble relaxing?	0.75	0.56
5. Being so restless that it is hard to sit still?	0.69	0.47
6. Becoming easily annoyed or irritable?	0.60	0.36
7. Feeling afraid as if something awful might happen?	0.66	0.44
Climate Change Anxiety - Cognitive-emotional Impairment		
1. Thinking about climate change makes it difficult for me to concentrate.	0.80	0.64
2. Thinking about climate change makes it difficult for me to sleep.	0.86	0.74
3. I have nightmares about climate change.	0.73	0.53
4. I find myself crying because of climate change.	0.68	0.46
5. I think, “why can't I handle climate change better?”	0.61	0.37
6. I go away by myself and think about why I feel this way about climate change.	0.67	0.45
7. I write down my thoughts about climate change and analyse them.	0.53	0.28
8. I think, “why do I react to climate change this way?”	0.60	0.36

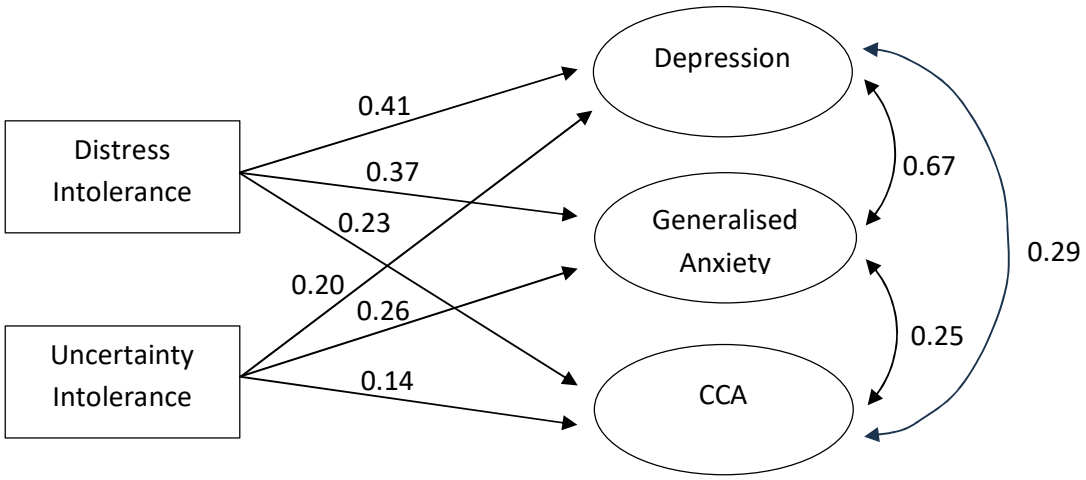
Note. N = 316; All standardised factor loadings were significant at $p < .001$.

Structural Equation Model

The SEM is presented in Figure 8, demonstrating the unique associations between the transdiagnostic factors with the latent factors in the best fitting CFA model, the three-factor model. The SEM demonstrated an acceptable fit to the data (CFI = .91, TLI = .90, RMSEA = .07, SRMR = .06), and the model explained 29.1% of the variance in depression, 30.6% in generalised anxiety, and 10.9% in CCA (cognitive-emotional impairment). The residual variance in mental health domains, not accounted for by the predictors in the model, were significantly positively correlated ($p < .001$): depression and generalised anxiety were strongly correlated ($r = .67$), whilst CCA had weaker correlations with depression ($r = .29$) and generalised anxiety ($r = .25$). Intolerance to distress and intolerance to uncertainty both had significant unique effects on all three factors of depression, generalised anxiety and CCA. As shown in Figure 8, distress intolerance has stronger unique associations with all three factors than uncertainty intolerance. It also demonstrates how distress intolerance and uncertainty intolerance have weaker unique associations with CCA than they do with depression and generalised anxiety.

Figure 8

SEM Testing the Unique Effect of Transdiagnostic Mental Health Factors (Distress and Uncertainty Intolerance) on Depression, Generalised Anxiety, and CCA



Note. Ovals are latent variables and rectangles are observed variables. Single head arrows represent standardised regression coefficients and double head arrows represent correlation coefficients. All coefficients were significant at $p < .05$.

Discussion

In the current study, we examined the dimensional structure of CCA alongside the two mental health domains of generalised anxiety and depression. We also examined the unique effects of two transdiagnostic factors on these domains. Overall, this research advances our theoretical understanding of CCA by exploring the underlying structure of CCA and well-known mental health domains, and the associations with transdiagnostic mental health mechanisms, showing us how CCA fits within current dimensional models of internalising psychopathology.

The current findings support the multidimensional structure of the examined domains, constituting three correlated factors of CCA, generalised anxiety, and depression. Our CFA results suggest that these factors are not unidimensional, but that the underlying structure of these domains consist of three separate factors, implying that differences among these domains are the result of their distinct underlying dimensions. Therefore, in answer to Research Question 1, this suggests that CCA represents a unique construct that differentiates from other mental health domains in youth. Our findings showed moderate positive correlations between CCA with generalised anxiety and depression factors. This is the first study to examine these associations at the factor level, free of measurement error. The strength of these associations is consistent with other research exploring correlations between depression, generalised anxiety, and the CCAS in youth (Wu et al., 2023) and in adults (Cruz & High, 2022; Schwartz et al., 2022; Wullenkord et al., 2021). These studies report that the weak-moderate strength of these correlations provided preliminary evidence of divergent validity between the domains, and our CFA analysis has been able to provide more rigorous statistical evidence in support of this, by supporting a three-factor model.

The mean PHQ-9 and GAD-7 scores and strong correlations between them are similar findings to other recent studies on young adults in the UK (Lantos et al., 2023; Shevlin et al., 2022). The skewed trend of CCA and average low scores observed in the present sample are also in line with previous research on CCA in adults and youth (Wullenkord et al., 2021; Schwartz et al., 2022; Wu et al., 2023). In the only other study on CCA in UK youth that the authors are aware of, Daeninck et al. (2023) surveyed university students

(*N* = 473) and found similar CCA total scale, subscale, and item level means as the present study. Only a few other studies have explored CCA in young people aged 15-24. Ediz and Yanik (2023) studied CCA in Turkish youth that identified as climate activists (*N* = 103) and non-activists (N = 203) through online surveys. Their total sample showed average subscale item scores similar to those in our sample. Patrick et al.'s (2023) study of CCA in a representative sample of Australian adults followed Clayton and Karacsia's (2020) suggestion that CCA begins to have a significant impact on mental health when it is experienced more often than 'sometimes'. They found that 9.4% of their total sample (aged 18-74, *N* = 5370) and 23.5% of their young adult sample (aged 18-24, *N* = 208) had mean CCA scores of "sometimes" or higher, whilst this result was seen in only 8.9% of our youth sample. The variability in how researchers constitute an elevated CCAS score makes it difficult to compare results across studies (Daeninck et al., 2023). Overall, it appears that our sample broadly shows the pattern of CCA seen in other youth samples in western countries, showing that some experiences of CCA are widespread. However, the number of youth experiencing very high levels of CCA appears to be lower in the present study than expected.

One possible explanation for this could be that our UK sample may present with lower levels of CCA than other countries that are at higher risk of climate change impacts, such as Australia. Another possibility reported by Schwartz et al. (2023) is that university students may experience less CCA than other populations, perhaps because they may have greater support opportunities for climate related distress. The sampling methods used in the present study may have led to a population bias of youth who receive higher education, particularly as the CCA results are comparable to findings from Daeninck et al.'s (2023) UK university population. The present study's results did indicate that most participants believe climate change is a global threat and that it has a negative impact on their mental health however, which is in line with levels of climate-related distress reported by youth globally (Hickman et al., 2021). When comparing this to the 8.9% of our sample had mean CCA scores of "sometimes" or higher, this would suggest that the mental health impacts from climate change reported by young people may not be fully explained by the concept of CCA or by the CCAS (Hogg et al., 2021).

In answer to Research Question 2, this study explored the construct of CCA further by examining its associations with transdiagnostic mental health factors in youth. Results showed that whilst there were unique effects of distress intolerance and uncertainty intolerance on CCA, the small magnitudes suggest that they are only weakly related. In answer to Research Question 3, when we compare these findings with the unique associations of the transdiagnostic factors with depression and generalised anxiety, we found that distress intolerance and uncertainty intolerance both have stronger associations with depression and anxiety than they did with CCA. Transdiagnostic approaches suggest that psychological disorders are facilitated or maintained by similar underlying vulnerabilities that should be represented across diagnostic categories, which is the case when we review our results in relation to depression and anxiety, consistent with previous research (Carleton et al., 2012). However, these mechanisms do not seem to have the same relevance for CCA, providing further evidence that CCA differs from other mental health domains experienced by youth.

Taken together, these findings suggest that CCA might not fit within current conceptualisations of psychological disorders in youth. Exploring transdiagnostic factors in relation to CCA is relatively new, limiting our ability to compare this result to previous literature. The only other study exploring this that the authors are aware of found a stronger positive correlation between CCA and intolerance of uncertainty in Floridian adults recruited online (N = 441; r = .43, p <.01) (Goldwert et al., 2023). The location and/or age of participants may explain the discrepancies in CCA results observed between these studies, but future work is needed to explore these associations further.

Strengths and Limitations

The statistical models used were a strength of this study, as CFA allowed for the underlying structure of CCA to be explored alongside well-known mental health domains, expanding on the previous bivariate correlational research found between observed scale scores of CCA, generalised anxiety, and depression. This was also the first study to examine potential relevant underlying mechanisms of CCA in youth by exploring how it relates to transdiagnostic mental health factors. Other transdiagnostic

factors that have not yet been considered may have other relationships with CCA in youth however, and further studies on this would be beneficial.

The study had a large sample that wielded good power in line with CFA recommendations. However, demographic data revealed that most participants were white females from Scotland, therefore limiting the generalisability of findings for understanding CCA in all youth across the UK. The study design had strengths in allowing for the use of reliable and valid quantitative measures, increasing the reliability of results (Choy, 2014). However, this methodology is also vulnerable to unmeasured confounding factors. In addition, the self-report nature of the measures can inflate associations between domains or can lead to social desirability effects whereby youth may not answer the questionnaire truthfully. However, measures were taken to reduce this where possible, such as anonymity of participants and voluntary participation. Other data quality procedures were in place to ensure quality data was obtained, like checking for 'speeders' and randomising the order of survey measures to reduce sequence effects. A weakness of quantitative designs is they can lack the depth and nuance of qualitatively exploring psychological phenomena, and the literature would benefit from further qualitative research to understand how youth experience CCA and how this interacts with their mental health (Ojala et al., 2021).

Another limitation to our study design is that quantitative methods and CFA assume that the measures analysed are valid representations of their constructs, and there is some ongoing debate around the validity of the CCAS (Hepp et al., 2023, Hogg et al., 2021). The face validity of the CCAS has been questioned by Mouguiama-Daoudaet et al. (2022) and Wullenkord et al. (2021), who report scepticism as to whether it captures the true experiences and emotional core of CCA. They suggest that consultation with experts and people who identify with having CCA is needed to create a more theoretically sound scale. Since the present study was conducted, Wu et al. (2023) has adapted the CCAS for youth following qualitative consultations with Canadian eleventh graders (*N* = 34), with the purpose if then using the adapted measure in a population-level youth well- being survey. They found that students reported some items were too extreme and unrealistic of how they believe themselves and their peers react to climate change. Further consultations with larger samples would be beneficial for improving

how we define and measure CCA in youth, which may differ according to culture and context, and need continuous adaptation as climate change progresses over time.

Implications

Finding that CCA differs from other mental health domains in youth has theoretical implications, supporting the idea that CCA should not be pathologized or incorporated into diagnostic models of psychopathology (Bhullar et al., 2022; Pikhala, 2020; Wullenkord et al., 2021). There are also potential clinical implications to these findings. These results suggest that transdiagnostic approaches to treating the core pathology of various anxiety and negative affect disorders (Norton & Philipp, 2008) may not be suitable for supporting youth with CCA. Whilst some recommendations present transdiagnostic cognitive-behavioural principles to conceptualise CCA and how it could link to psychological distress (Marks & Hudson, 2024), our findings suggest that this approach may face limitations. Instead, our findings support the view that a complete understanding of climate anxiety in youth requires us to go beyond an individualistic perspective of internalising psychopathology. This supports the growing perspective that understanding CCA and supporting young people with CCA needs to encompass a holistic, systemic perspective that includes relational, psychosocial, cultural, ethical, and political factors (Berry et al., 2018; Berse, 2017; Crandon et al., 2022; Hickman et al., 2021). Some elements of existential and third-wave approaches may therefore be suitable for supporting youth around experiences of CCA, as these emphasise how worries about climate change are legitimate and normative rather than solely as a symptom of a disorder (Schwartz et al., 2021; Budziszewska & Jonsson, 2021; Pihkala, 2020). Feather and Williams (2022) have begun to explore how the ACT framework could allow for enhancing acceptance and even embracing distressing thoughts and feelings about climate change without invalidating them, while also encouraging value-driven behaviours that resist the pathologizing or individualising of climate-related distress. Rather than CCA being a target by individual interventions for internalising psychopathology mechanisms, such as the cognitive biases and dispositional characterises of intolerance of uncertainty or distress, our findings support the growing evidence that people experiencing CCA can benefit from systemic supports that foster connection and meaning (Bingley et al., 2022; Vamvalis, 2023) which could be facilitated

by the meaning-based frameworks of these existential or third wave approaches. Further exploration into how CCA may be understood within these frameworks and how young people may respond to CCA support through this approach would be beneficial. As the climate crisis continuously changes, ongoing investigation into the relationships between CCA and mental health domains will be important, as CCA is expected to continue increasing in youth over time (Hickman et al., 2021; Wullenkord & Ojala, 2023).

Conclusion

Overall, it appears that in UK youth, CCA is moderately correlated with generalised anxiety and depression, but that these represent three separate domains. Our findings also suggest that CCA is only weakly correlated to the transdiagnostic mental health factors of uncertainty and distress intolerance in youth, and that these factors do not have the same strength of relationship with CCA as they do with generalised anxiety and depression. This further supports the idea that CCA is distinct from current conceptual models of internalising psychopathology. This has implications for how CCA is assessed, conceptualised, and supported in youth, and should be considered in future research that hopes to understand this concept further. How we measure, define, and interpret CCA still remains a topic of debate, and further consultations with youth around their experiences of CCA would help to corroborate the findings of the present study, and advance our understanding of how CCA is impacting and interacting with youth's mental health.

Statements and Declarations

There was no funding associated with this study. The authors have no competing interests to declare.

References

Albrecht, G. (2011). Chronic environmental change: Emerging 'psychoterratic' syndromes. *Climate change and human well-being*. Berlin: Springer.

Albrecht, G.A. (2019). Earth emotions: New words for a new world. *Cornell University Press.*

Amnesty International (2021); https://www.amnesty.org/en/what-we-do/climate-change/

APHA (2019). Making the connection: Climate changes children's health. *American Public Health Association*.

Bernstein, A., Marshall, E.C., & Zvolensky, M.J. (2011). Multi-method evaluation of distress tolerance measures and construct(s): Concurrent relations to mood and anxiety psychopathology and quality of life. *Journal of Experimental Psychopathology*, 2(3).

Berse, K. (2017). Climate change from the lens of Malolos children: perception, impact and adaptation. *Disaster Prevention and Management: an international journal*, 26(2).

Berry, H.L., Waite, T.D., Dear, K.B., Capon, A.G., & Murray, V. (2018). The case for systems thinking about climate change and mental health. *Nature climate change,* 8(4).

Bhullar, N., Davis, M., Kumar, R., Nunn, P., & Rickwood, D. (2022). Climate anxiety does not need a diagnosis of a mental health disorder. *The Lancet Planetary Health*, 6(5).

Bingley, W. J., Tran, A., Boyd, C. P., Gibson, K., Kalokerinos, E. K., Koval, P., ... & Greenaway, K. H. (2022). A multiple needs framework for climate change anxiety interventions. American Psychologist, 77(7), 812.

Budziszewska, M., & Jonsson, S.E. (2021). From climate anxiety to climate action: An existential perspective on climate change concerns within psychotherapy. *Journal of Humanistic Psychology*.

Burke, S.E., Sanson, A.V., & Van Hoorn, J. (2018). The psychological effects of climate change on children. *Current psychiatry reports,* 20(5).

Black, W.C., Babin, B.J., & Anderson, R.E. (2010). *Multivariate data analysis: A global perspective.* Pearson.

Boelen, P.A., Vrinssen, I., & van Tulder, F. (2010). Intolerance of uncertainty in adolescents: Correlations with worry, social anxiety, and depression. *The Journal of nervous and mental disease*, 198(3).

Carleton, R.N., Norton, M.P.J., & Asmundson, G.J. (2007). Fearing the unknown: A short version of the Intolerance of Uncertainty Scale. *Journal of anxiety disorders*, 21(1).

Choy, L.T. (2014). The strengths and weaknesses of research methodology: Comparison and complimentary between qualitative and quantitative approaches. *IOSR journal of humanities and social science*, 19(4).

Cianconi, P., Betrò, S., & Janiri, L. (2020). The impact of climate change on mental health: a systematic descriptive review. *Frontiers in psychiatry*, 11, 74.

Clayton, S. (2020). Climate anxiety: Psychological responses to climate change. *Journal of Anxiety Disorders*, 74.

Clayton, S., & Karazsia, B.T. (2020). Development and validation of a measure of CCA. *Journal of Environmental Psychology*, 69.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. *Lawrence Erlbaum.*

Coffey, Y., Bhullar, N., Durkin, J., Islam, M.S., & Usher, K. (2021). Understanding eco-anxiety: A systematic scoping review of current literature and identified knowledge gaps. *The Journal of Climate Change and Health*, 3.

Costello, A.B., & Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical assessment, research, and evaluation,* 10(1).

Crandon, T.J., Scott, J.G., Charlson, F.J., & Thomas, H.J. (2022). A social–ecological perspective on climate anxiety in children and adolescents. *Nature Climate Change*, 12(2).

Cruz, S.M., & High, A.C. (2022). Psychometric properties of the CCAS. *Journal of Environmental Psychology*, 84.

Dalgleish, T., Black, M., Johnston, D., & Bevan, A. (2020). Transdiagnostic approaches to mental health problems: Current status and future directions. *Journal of consulting and clinical psychology*, 88(3).

Daeninck, C., Kioupi, V., & Vercammen, A. (2023). Climate anxiety, coping strategies and planning for the future in environmental degree students in the UK. *Frontiers in psychology*, 14.

Darko, E.M., Kleib, M., & Olson, J. (2022). Social media use for research participant recruitment: integrative literature review. *Journal of Medical Internet Research*, 24(8).

Doherty, T.J., & Clayton, S. (2011). The psychological impacts of global climate change. *American Psychologist*, 66(4).

Ediz, Ç., & Yanik, D. (2023). The effects of climate change awareness on mental health: comparison of climate anxiety and hopelessness levels in Turkish youth. *International Journal of Social Psychiatry*, 69(8).

Feather, G., & Williams, M. (2022). The moderating effects of psychological flexibility and psychological inflexibility on the relationship between climate concern and climate-related distress. *Journal of Contextual Behavioral Science*, 23.

Goldwert, D., Dev, A.S., Broos, H.C., Broad, K., & Timpano, K.R. (2024). The impact of anxiety and intolerance of uncertainty on climate change distress, policy support, and pro-environmental behaviour. *British Journal of Clinical Psychology*, 63(1).

Hepp, J., Klein, S.A., Horsten, L.K., Urbild, J., & Lane, S.P. (2023). Introduction and behavioral validation of the climate change distress and impairment scale. *Scientific Reports*, 13(1).

Helm, S.V., Pollitt, A., Barnett, M.A., Curran, M.A., & Craig, Z. R. (2018). Differentiating environmental concern in the context of psychological adaption to climate change. *Global Environmental Change*, 48.

Heeren, A., & Asmundson, G.J. (2023). Understanding climate anxiety: What decision-makers, health care providers, and the mental health community need to know to promote adaptative coping. *Journal of Anxiety Disorders*, 93.

Heeren, A., Mouguiama-Daouda, C., & McNally, R.J. (2023). A network approach to climate change anxiety and its key related features. *Journal of Anxiety Disorders*, 93.

Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, R.E., ... & Van Susteren, L. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey. *The Lancet Planetary Health*, 5(12), e863-e873.

Hillen, M.A., Gutheil, C.M., Strout, T.D., Smets, E.M., & Han, P.K. (2017). Tolerance of uncertainty: Conceptual analysis, integrative model, and implications for healthcare. *Social Science & Medicine*, 180.

Hogg, T.L., Stanley, S.K., O'Brien, L.V., Wilson, M.S., & Watsford, C.R. (2021). The Hogg Eco-Anxiety Scale: Development and validation of a multidimensional scale. *Global Environmental Change*, 71.

Hornsey, M.J., Harris, E.A., Bain, P.G., & Fielding, K.S. (2016). Meta-analyses of the determinants and outcomes of belief in climate change. *Nature climate change*, 6(6).

Intergovernmental Panel on Climate Change (IPCC). (2022). *Climate change 2022: Impacts, adaptation and vulnerability (Sixth Assessment Report, Working Group II)*. Available from: https://www.ipcc.ch/report/ar6/wg2/

Keough, M.E., Riccardi, C.J., Timpano, K.R., Mitchell, M.A., & Schmidt, N.B. (2010). Anxiety symptomatology: The association with distress tolerance and anxiety sensitivity. *Behavior therapy*, 41(4).

Kovacs, L.N., Jordan, G., Berglund, F., Holden, B., Niehoff, E., ... & Kökönyei, G. (2024). Acting as we feel: which emotional responses to the climate crisis motivate climate action. *Journal of Environmental Psychology*, 102327.

Korkmaz, H., & Güloğlu, B. (2021). The role of uncertainty tolerance and meaning in life on depression and anxiety throughout Covid-19 pandemic. *Personality and individual differences*, 179.

Kroenke, K. & Spitzer, R.L. (2002). The PHQ-9: A new depression and diagnostic severity measure. *Psychiatric Annals*, 32.

Lantos, D., Moreno-Agostino, D., Harris, L. T., Ploubidis, G., Haselden, L., & Fitzsimons, E. (2023). The performance of long vs. short questionnaire-based measures of depression, anxiety, and psychological distress among UK adults: A comparison of the patient health questionnaires, generalized anxiety disorder scales, malaise inventory, and Kessler scales. *Journal of Affective Disorders*, 338.

Lass, A.N., & Winer, E.S. (2020). Distress tolerance and symptoms of depression: A review and integration of literatures. *Clinical Psychology: Science and Practice*, 27(3).

Marks, E., & Hudson, K. (2024). Cognitive Behavioral Principles for Conceptualizing Young People's Eco-Emotions and Eco-Distress. *Climate Change and Youth Mental Health: Multidisciplinary Perspectives,* 148.

Martin, G., Reilly, K., Everitt, H., & Gilliland, J.A. (2022). The impact of climate change awareness on children's mental well-being and negative emotions–a scoping review. *Child and Adolescent Mental Health*, 27(1), 59-72.

Mossman, S.A., Luft, M.J., Schroeder, H.K., Varney, S.T., Fleck, D.E., Barzman, D.H., ... & Strawn, J.R. (2017). The generalized anxiety disorder 7-item (GAD-7) scale in adolescents with generalized anxiety disorder: Signal detection and validation. *Annals of clinical psychiatry*, 29(4).

Mouguiama-Daouda, C., Blanchard, M.A., Coussement, C., & Heeren, A. (2022). On the measurement of climate change anxiety: French validation of the climate anxiety scale. *Psychologica Belgica,* 62(1).

Newnham, E.A., Titov, N., & McEvoy, P. (2020). Preparing mental health systems for climate crisis. *The Lancet Planetary Health*, 4(3).

Norton, P.J., & Philipp, L.M. (2008). Transdiagnostic approaches to the treatment of anxiety disorders: A quantitative review. *Psychotherapy: Theory, Research, Practice, Training*, 45(2).

Ojala, M., Cunsolo, A., Ogunbode, C.A., & Middleton, J. (2021). Anxiety, Worry, and Grief in a Time of Environmental and Climate Crisis: A Narrative Review. *Annual Review of Environment and Resources*, 46.

Ojala, M. (2012). Regulating Worry, Promoting Hope: How Do Children, Adolescents, and Young Adults Cope with Climate Change?. *International Journal of Environmental and Science Education*, 7(4).

Patalay, P., Fonagy, P., Deighton, J., Belsky, J., Vostanis, P., & Wolpert, M. (2015). A general psychopathology factor in early adolescence. *The British Journal of Psychiatry*, 207(1).

Patrick, R., Snell, T., Gunasiri, H., Garad, R., Meadows, G., & Enticott, J. (2023). Prevalence and determinants of mental health related to climate change in Australia. *Australian & New Zealand Journal of Psychiatry*, 57(5).

Pihkala, P. (2020). Anxiety and the ecological crisis: An analysis of eco-anxiety and climate anxiety. *Sustainability*, 12(19).

Qualtrics software (Version 2005) [Software]. Copyright © 2020 Qualtrics, Provo, UT, USA. Available from: https://www.qualtrics.com

Richardson, L.P., McCauley, E., Grossman, D.C., McCarty, C.A., Richards, J., ... & Katon, W. (2010). Evaluation of the Patient Health Questionnaire-9 Item for detecting major depression among adolescents. *Pediatrics,* 126(6).

Reser, J.P., Bradley, G.L., & Ellul, M.C. (2014). Public risk perceptions, understandings and responses to climate change. *Applied studies in climate adaptation*, 43-50.

Rettie, H., & Daniels, J. (2021). Coping and tolerance of uncertainty: Predictors and mediators of mental health during the COVID-19 pandemic. *American Psychologist*, 76(3).

Rodriguez, A., Reise, S.P., & Haviland, M.G. (2016). Evaluating bifactor models: Calculating and interpreting statistical indices. *Psychological methods*, 21(2), 137.

Rodriguez-Seijas, C., Eaton, N.R., & Krueger, R.F. (2015). How transdiagnostic factors of personality and psychopathology can inform clinical assessment and intervention. *Journal of personality assessment*, 97(5).

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of statistical software*, 48.

Royal College of Psychiatrists (2020). *The climate crisis is taking a toll on the mental health of children and YP.* Available from: https://www.rcpsych.ac.uk/news-and-features/latest-news/detail/2020/11/20/the-climate-crisis-is-taking-a-toll-on-the-mental-health-of-children-and-young-people

Sampaio, F., & Sequeira, C. (2022). Climate anxiety: trigger or threat for mental disorders?. *The Lancet Planetary Health*, 6(2).

Sanson A.V., Wachs T.D., Koller S.H., Salmela-Aro K. (2018). Young people and climate change: the role of developmental science. *Sustainable development goals for children: using developmental science to improve young lives globally*. Springer.

Schwartz, S.E., Benoit, L., Clayton, S., Parnes, M.F., Swenson, L., & Lowe, S.R. (2023). Climate change anxiety and mental health: Environmental activism as buffer. *Current Psychology*, 42(20).

Shevlin, M., Butter, S., McBride, O., Murphy, J., Gibson-Miller, J., Hartman, T. K., ... & Bentall, R. P. (2022). Measurement invariance of the Patient Health Questionnaire (PHQ-9) and Generalized Anxiety Disorder scale (GAD-7) across four European countries during the COVID-19 pandemic. *BMC psychiatry*, *22*(1).

Simons, J.S., & Gaher, R.M. (2005). The Distress Tolerance Scale: Development and validation of a self-report measure. *Motivation and emotion*, 29(2).

Soutar, C., & Wand, A.P. (2022). Understanding the Spectrum of Anxiety Responses to Climate Change: A Systematic Review of the Qualitative Literature. *International Journal of Environmental Research and Public Health*, 19(2).

Spitzer, R.L., Kroenke, K., Williams, J.B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine*, 166(10).

Strout, T.D., Hillen, M., Gutheil, C., Anderson, E., Hutchinson, R., ... & Han, P.K. (2018). Tolerance of uncertainty: A systematic review of health and healthcare-related outcomes. *Patient Education and Counselling,* 101(9).

Tabachnick, B.G., & Fidell, L.S. (2013). Using multivariate statistics (6th ed.). *Boston: Pearson Education, Inc.*

Tonarely, N.A., & Ehrenreich-May, J. (2020). Confirming the factor structure and validity of the distress tolerance scale (DTS) in youth. *Child Psychiatry & Human Development*, 51(4).

UNESCO (2017). *Definition of Youth*. Available from: https://www.unesco.org/en/youth
Ursano R.J., Morganstein J.C., Cooper R. (2017). APA Resource Document on Mental Health and Climate Change. *American Psychiatric Association.*

Vamvalis, M. (2023). "We're fighting for our lives": Centering affective, collective and systemic approaches to climate justice education as a youth mental health imperative. *Research in Education*, 117(1).

Vergunst, F., & Berry, H. L. (2022). Climate change and children's mental health: a developmental perspective. *Clinical Psychological Science*, 10(4).

Vukičević, T., & Liu, S. (2024). Diagnosing climate anxiety? Environmental mental health challenges. *The Lancet Planetary Health*, 8(6).

Wang, J., & Wang, X. (2012). Structural Equation Modeling: Applications Using Mplus. *Wiley, Higher Education Press.*

Watts, N., Amann, M., Ayeb-Karlsson, S., Belesova, K., Bouley, T., ... & Costello, A. (2018). The Lancet Countdown on health and climate change: from 25 years of inaction to a global transformation for public health. *The Lancet*, 391(10120).

Wu, J., Long, D., Hafez, N., Maloney, J., Lim, Y., & Samji, H. (2023). Development and validation of a youth climate anxiety scale for the Youth Development Instrument survey. *International journal of mental health nursing*, 32(6), 1473-1483.

Wullenkord, M.C., & Ojala, M. (2023). Climate-change worry among two cohorts of late adolescents: Exploring macro and micro worries, coping, and relations to climate engagement, pessimism, and well-being. *Journal of Environmental Psychology,* 90.

Wullenkord, M.C., Tröger, J., Hamann, K.R., Loy, L.S., & Reese, G. (2021). Anxiety and climate change: A validation of the Climate Anxiety Scale in a German-speaking quota sample and an investigation of psychological correlates. *Climatic Change,* 168(3).

WHO (2014). *Recognizing adolescence*. Available from: http://apps.who.int/adolescent/second-decade/section2/page1/recognizing-adolescence.html

WHO (2018): *Climate change and health*. Available from: https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

Appendices

Appendix 1: Systematic Review Reporting Checklist

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	p. 10
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	p. 11
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	pp.12-13
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	p. 14
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	pp. 15-16
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.	p. 15
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Appendix 2
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.	pp. 16-17
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.	p. 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.	p. 17
	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.	p. 17

Section and Topic	Item #	Checklist item	Location where item is reported
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.	pp. 16-17
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)).	N/A
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	p. 17
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	p. 17
	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.	p. 17
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	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).	pp. 16-17
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.	p. 18-19
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	p. 19
Study characteristics	17	Cite each included study and present its characteristics.	p. 18, p. 21-35
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	p. 20, p. 35
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.	p. 21-35 Appendix 3

Section and Topic	Item #	Checklist item	Location where item is reported
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	pp. 36-43
	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.	N/A
	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.	pp. 36-43
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.	pp. 44-46
	23b	Discuss any limitations of the evidence included in the review.	pp. 45-47
	23c	Discuss any limitations of the review processes used.	pp. 46-47
	23d	Discuss implications of the results for practice, policy, and future research.	pp. 47-48
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.	p. 15
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	p. 15
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	p. 15
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	p. 15
Competing interests	26	Declare any competing interests of review authors.	p. 49
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.	p. 21-35 Appendix 3

From: Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International journal of surgery*, 88, 105906.

Appendix 2: Systematic Review Search Terms

The following search terms were employed in title and abstract searches for the Ebscohost databases (PsycInfo and PsycArticles):

> child or adolescen* or youth or "young person*" or "young people" or “young adult” or "school*" or "student*" or teen*
>
> (climate n2 chang*) or "global warming" or "climate crisis" or "pro environmental behav*" or (anxi* n2 climate) or (stress n2 climate) or (distress n2 climate) or (grief n2 climate) or "eco-anxiety" or "eco-stress" or "eco-distress" or "eco-grief" or "eco-angst"
>
> "mental health" or wellbeing or "well being" or psych* or cogniti* or thought* or think* or belie* or emoti* or behav* or cope* or coping or appraise or appraisal* or stress* or distress* or anxi* or grie* or mood* or feel* or perception* or perceiv*

The following search terms were employed in title and abstract searches for the Ovid databases (Embase and Medline):

> (child* or adolescen* or youth or "young person*" or "young people" or “young adult” or school* or student* or teen*)
>
> ((climate adj3 chang*) or "global warming" or (climate adj3 warming) or "climate crisis" or "pro environmental behav*" or (anxi* adj3 climate) or (stress adj3 climate) or (distress adj3 climate) or (grief adj3 climate) or "eco-anxiety" or "eco-stress" or "eco-distress" or "eco-grief" or "eco-angst" or "greenhouse effect")
>
> ("mental health" or "mental disorder*" or "mental function*" or wellbeing or "well being" or psych* or cogniti* or thought* or think* or belie* or emoti* or behav* or cope* or coping or appraise or appraisal* or stress* or distress* or anxi* or grie* or mood* or feel* or perception* or perceiv*)

The search terms were combined using AND. Truncations (*) were used to increase search sensitivity.

Appendix 3: Systematic Review Summary of Data Extraction and Qualitized Results

Hosted online via Open Science Framework:

https://osf.io/2j3eh/files/osfstorage/66efe8ad5f9c16139829e24b

Appendix 4: Systematic Review Worksheet

Young people's experiences of climate change

This worksheet has been created as part of the systematic review conducted by Veillard et al. (2024). Climate change is a global crisis, one that is dubbed as a child rights crisis (UNICEF, 2021). To properly serve our young generations and ensure a healthy future, we hope to facilitate a shared understanding of the climate change crisis by offering youth and their communities a worksheet with relevant terminology that can guide discussion and reflection around the psychological consequences of the climate change crisis.

The worksheet below includes key domains and definitions identified from the literature that summarize youth's psychological experience of climate change threats. It includes experiences that represent emotions, thoughts, and behaviours in response to climate change threat that are typically reported by youth. The purpose of this worksheet is to communicate the key findings to young people, schools, and communities and to be used for self-reflection or group-reflection regarding the psychological experience of climate change threat. In addition to identifying the key psychological domains, we provide some questions for reflection.

Psychological domains	**Definition** **Individual rating scale (for self-reflection)**
Emotions	
Climate change anxiety or distress	Heightened emotional and mental difficulties from awareness and apprehension of climate change threats that can impact our daily life *Examples: "I'm scared because I do not know what's going to happen to the world because of climate change"* *"it is difficult for me to concentrate or sleep when I'm thinking about climate change"* *Not at all like me* *Very much like me* 0 1 2 3 4 5 6 7 8 9 10
Climate change guilt	Feeling some level of guilt or shame around your personal contributions and/or humanity's collective contribution to climate change

	Not at all like me *Very much like me* 0 1 2 3 4 5 6 7 8 9 10
Climate change emotions	Positive emotions felt in response to climate change *Examples: hopefulness, interest, engaged* *Not at all like me* *Very much like me* 0 1 2 3 4 5 6 7 8 9 10 Negative emotions felt in response to climate change *Examples: sadness, anger, disgust, frustration, fear, helplessness, disappointment, hopelessness, powerlessness* *Not at all like me* *Very much like me* 0 1 2 3 4 5 6 7 8 9 10
Thoughts	
Climate change worry or concern	Patterns of worried, repetitive thoughts about the negative impacts of climate change to your personal life and/or to the wider world *Not at all like me* *Very much like me* 0 1 2 3 4 5 6 7 8 9 10
Climate change hope	A thought pattern of wishing or expecting positive outcomes of climate change where world leaders, societies and individuals will do their part in reaching a sustainable future *Not at all like me* *Very much like me* 0 1 2 3 4 5 6 7 8 9 10
Climate change optimism/pessimism	Optimism – a belief that climate change will be solved

	Not at all like me *Very much like me* 0 1 2 3 4 5 6 7 8 9 10 Pessimism – a belief that climate change will destroy the world *Not at all like me* *Very much like me* 0 1 2 3 4 5 6 7 8 9 10
Climate change scepticism	Thought patterns that climate change is not happening and/or not as big a problem as researchers claim and/or not caused by human factors *Not at all like me* *Very much like me* 0 1 2 3 4 5 6 7 8 9 10
Climate change agency	Individual agency - the belief that your individual actions can help prevent climate change *Not at all like me* *Very much like me* 0 1 2 3 4 5 6 7 8 9 10 Collective agency - the belief that collective actions with others can help prevent climate change *Not at all like me* *Very much like me* 0 1 2 3 4 5 6 7 8 9 10
Behaviours	
Individual climate change action	Individual actions made by a person with an aim to help prevent climate change and increase climate awareness *Examples: climate friendly food choices, recycling, using less fuel* *Not at all like me* *Very much like me* 0 1 2 3 4 5 6 7 8 9 10

Collective climate change action	Actions made by a person through participation in a group activity with an aim to help prevent climate change and increase climate awareness *Examples: climate change protests, organized campaigns* *Not at all like me* *Very much like me* 0 1 2 3 4 5 6 7 8 9 10

Questions for reflection

1. What are the top three domains that characterize your experience of climate change threat?
   -
   -
   -

2. How do these domains interact to shape your experience of the climate crisis?
   For example: how do your thoughts about climate change make you feel? how do the ways you think and feel about climate change link to your motivation for action? how does engaging/not engaging in climate change actions make you feel or think about climate change?

3. Are there other experiences that are important to you but, at this time, you are currently not experiencing? If so, why?

4. What resources do you have in place (at school, home, community, with friends) that you can use to express your experiences and views on the climate crisis? Would you like to see anything else be put in place?
   For more ideas on managing distress or anxiety around climate change, please visit: https://www.rcpsych.ac.uk/mental-health/parents-and-young-people/eco-distress-for-young-people **(**Australian Psychological Society, 2024) and https://psychology.org.au/getmedia/cf076d33-4470-415d-8acc-75f375adf2f3/coping_with_climate_change.pdf.pdf **(**Royal College of Psychiatrists, 2022).

References

Australian Psychological Society (2024). *Coping with CLIMATE CHANGE DISTRESS.* Available from: https://psychology.org.au/getmedia/cf076d33-4470-415d-8acc-75f375adf2f3/coping_with_climate_change.pdf.pdf

Royal College of Psychiatrists (2022). *Eco distress for children and young people.* Available from: https://www.rcpsych.ac.uk/mental-health/parents-and-young-people/eco-distress-for-young-people

UNICEF (2021). *The Climate Crisis is a Child Rights Crisis: Introducing the Children's Climate Risk Index.* New York: United Nations Children's Fund.

Veillard, M., Hamilton, N. & Rizeq, J. (2024). *Young people's psychological experiences in relation to the climate change crisis: a systematic review.* [Unpublished manuscript].

Appendix 5: Major Research Project (MRP) Reporting Checklist

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	p. 56
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	pp. 59-60
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	pp. 61-64
Objectives	3	State specific objectives, including any prespecified hypotheses	pp. 64-65
Methods			
Study design	4	Present key elements of study design early in the paper	p. 66
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	p. 66, p. 69
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	pp. 66-67
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	pp. 67-68
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	pp. 67-68
Bias	9	Describe any efforts to address potential sources of bias	p. 66, p. 69
Study size	10	Explain how the study size was arrived at	p. 72
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	pp. 67-69
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	pp. 70-72

		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	p. 66
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	p. 66
		(*e*) Describe any sensitivity analyses	p. 70
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	p. 66
		(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	pp. 66-67
		(b) Indicate number of participants with missing data for each variable of interest	p. 75
Outcome data	15*	Report numbers of outcome events or summary measures	p. 75
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	pp. 76-79
		(*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	p. 79
Discussion			
Key results	18	Summarise key results with reference to study objectives	pp. 80-82
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	pp. 82-83

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	pp. 83-84
Generalisability	21	Discuss the generalisability (external validity) of the study results	pp. 81-83
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	p. 85

*Give information separately for exposed and unexposed groups.

From: von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. *The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.*

Appendix 6: MRP Approved Proposal

Hosted online via Open Science Framework:

https://osf.io/2j3eh/files/osfstorage/66efea573a55423a8a29dc79

Appendix 7: MRP Project Approval Letter

University of Glasgow

24th August 2024

MVLS College Ethics Committee

Project Title: Exploring the degree to which climate change anxiety differentiates from other mental health problems in young people.
Project No: 200220399

Dear Dr Rizeq

The College Ethics Committee has reviewed your application and has agreed that there is no objection on ethical grounds to the proposed study. It is happy therefore to approve the project.

- Project end date: As stated in application.
- The data should be held securely for a period of ten years after the completion of the research project, or for longer if specified by the research funder or sponsor, in accordance with the University's Code of Good Practice in Research:
- https://www.gla.ac.uk/media/media_490311_en.pdf
- The research should be carried out only on the sites, and/or with the groups defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment, except when it is necessary to change the protocol to eliminate hazard to the subjects or where the change involves only the administrative aspects of the project. The Ethics Committee should be informed of any such changes.
- You should submit a short end of study report to the Ethics Committee within 3 months of completion.
- For projects requiring the use of an online questionnaire, the University has an Online Surveys account for research. To request access, see the University's application procedure at https://www.gla.ac.uk/research/strategy/ourpolicies/useofonlinesurveystoolforresearch/.

Yours sincerely,

Jesse Dawson
MD, BSc (Hons), FRCP, FESO
Professor of Stroke Medicine
Consultant Physician
Chair MVLS Research Ethics Committee

Institute of Cardiovascular and Medical Sciences
College of Medical, Veterinary & Life Sciences
University of Glasgow
Room M0.05
Office Block
Queen Elizabeth University Hospital
Glasgow
G51 4TF

jesse.dawson@glasgow.ac.uk

Appendix 8: MRP Participant Information Sheet and Consent Form

Hosted online via Open Science Framework:

https://osf.io/2j3eh/files/osfstorage/669a95d16068db0a21dde2a5

Appendix 9: MRP Survey Questions

Web link hosted online via Open Science Framework:

https://osf.io/2j3eh/files/osfstorage/669beb0f2acc4900abfd83ad