Emotional responses and psychological health among young people amid climate change, Fukushima's radioactive water release, and wars in Ukraine and the Middle East, and the mediating roles of media exposure and nature connectedness: a cross-national analysis

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Summary

Background New global crises are emerging, while existing global crises remain unabated. Coping with climate change, the radioactive water released into the Pacific Ocean subsequent to the Fukushima nuclear accident in Japan, and the wars in Ukraine and the Middle East (hereafter referred to as the wars) as individual crises can negatively affect the psychological health of young people, but little is known about the compounded impact of multiple crises. We aimed to examine: (1) the emotional responses of young people towards each individual crisis, (2) how aggregate levels of emotional engagement in global crises might pose different potential trajectories in psychological health, and (3) the protective or exacerbating role of media exposure and nature connectedness as mediators on psychological health outcomes of young people.

Methods We conducted a cross-national online survey among young people (aged 18–29 years) from China, Portugal, South Africa, the USA, and the UK. We adopted stratified purposive sampling and distributed the survey using online platforms (www.wenjuan.com and www.prolific.com). Individuals were eligible for inclusion in our analysis if they were literate in Chinese or English and had no mental disorders diagnosed within the past 12 months. Participants were asked questions on their demographic characteristics and time spent on social media, including proportion of time exposed to media pertaining to global crises of interest, and they completed surveys based on validated scales that measure depression, anxiety, stress, and wellbeing, as well as emotional responses to each global crisis and nature relatedness. We assessed the survey results using descriptive statistics, ANOVA tests, cluster analysis for individual emotional responses, and structural equation modelling for the aggregate measure of emotional engagement towards individual global crises.

Findings Between Oct 20 and Nov 3, 2023, 2579 individuals participated in the survey, of whom 400 participants from each country (200 male and 200 female participants) were included in our analysis (mean age 24·36 years [SD 2·86]). The mean emotional engagement varied between the global crises of interest (on a scale from 0 to 68, where 0 indicates no emotional response and 68 indicates strong emotional responses across 17 different emotions; wars: 32·42 [SD 14·57]; climate change: 28·79 [14·17]; radioactive water: 21·26 [16·08]), and emotional engagement also varied by country; for instance, for respondents from China, mean emotional engagement in radioactive water was relatively high (39·15 [10·72]) compared with the other countries, and for respondents from the USA, engagement with the wars was relatively low (29·45 [15·78]). We found significant variations in the level of emotional engagement between different crises, with distinct emotional profiles observed among individual countries. To assess the role of media exposure and nature connectedness on psychological outcomes, using structural equation modelling, we constructed a multi-country model comprising Portugal, South Africa, the USA, and the UK, and a standalone model for China. These models elucidated associations between emotional engagement and psychological distress and wellbeing, explaining substantial portions of the variance in both. Notably, while greater emotional engagement in the ecological crises (ie, climate change and radioactive water) generally predicted worse psychological health outcomes, we found the direction of effect for war crises to have positive outcomes for mental health in the standalone China model. Additionally, we found that media exposure mediated the negative effect of wars on psychological distress in the multi-country model, and positive psychological wellbeing in the standalone China model. Moreover, nature connectedness emerged as a potent mediator, effectively mitigating the adverse mental health effects of emotional engagement with some crises, such as radioactive water and climate change.

Interpretation Our findings offer valuable insights into the nuanced dynamics of emotional engagement in global crises and its implications for mental health outcomes among young people across diverse global contexts. Further research is needed to understand the contribution of ongoing and new global crises towards a compounded negative future outlook on young people's mental health to identify effective communication and intervention strategies that can mitigate the effect of this global challenge.

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Introduction

4 years since the COVID-19 pandemic exposed the vulnerabilities of communities worldwide, addressing mental health impacts on a global scale is more crucial than ever, especially with emergent and enduring global crises. Global crises pose a plethora of unfamiliar challenges that trigger economic, social, and environmental causal effects, which, in turn, affect personal wellbeing, public health, and safety of societies worldwide.[1–3] These global crises are not experienced in isolation. Climate change, ecological disasters, and wars or armed conflicts become an agglomeration of concurrent issues that collectively present global challenges, not only to the mental health of communities that have been directly affected, but also among individuals globally. In particular, young people in many parts of the world are experiencing intensified negative effects on their mental health as a consequence of these global crises. In the face of global crises, protecting the mental health of young people is crucially important to safeguard them through this vulnerable stage of their lives and to promote their development into future leaders who are cognisant of, but not overwhelmed by, global crises.[4]

The impact of concurrent global crises on young people's mental health, based on their awareness of and engagement in such crises, warrants urgent investigation. Few studies have compared the mental health impacts of multiple global crises on young people and examined the compounded effect across different geographical regions. Some studies investigating the mental health impacts of various global crises have been conducted in populations directly affected by such crises,[5–7] while other studies have provided a framework for cross-country comparisons of mental health outcomes subsequent to a specific global

Research in context

Evidence before this study

We searched Web of Science for publications between Jan 1, 2020, and Oct 20, 2023, to identify a suitable framework for studying the mental health impact of global crises on young people. We used the search terms "global", "mental health", "young", "climate change", and "COVID-19". We excluded articles on global mental health because this concept was beyond the expected scope of our study. We identified five key articles that investigated the mental health effects of world events interpreted on a global scale from various peer-reviewed journals. In the past few years, interest in studying the impact of climate change on a global scale has increased, encompassing cross-country studies and various susceptible target populations. Many studies have used climate anxiety or climate distress as the cornerstone of their analyses to understand the mental health impacts of global crises, such as the COVID-19 pandemic and the Russia–Ukraine war, relative to climate change. Moreover, young people have been identified as a susceptible population in the climate crisis, as this group is affected by both mental stressors and the disruptions caused by the COVID-19 pandemic to educational arrangements. Several studies with a cross-national purview have found that general views on climate change and how it relates to mental health have a collective consensus globally, but the strength of this relationship can vary from country to country. Comparison of the effects of climate change with the effects of other contemporaneous global crises allows identification of unique elements due to the differing nature of the crises. With the outbreak of war in the Middle East on Oct 7, 2023, and the discharge of radioactive wastewater from the Fukushima nuclear plant in Japan on Aug 24, 2023, the simultaneous impact of multiple global crises in addition to climate change and the ongoing war in Ukraine, presented a unique opportunity to investigate the impact of simultaneous global crises on the mental health of young people. Thus, studying and measuring the effects of these emerging global crises in comparison with the effects of climate change on mental health among young people is timely.

Added value of this study

In this large, multinational, cross-sectional study, we compared psychological health and the emotional responses of young people (aged 18–29 years) towards three concurrent global crises—climate change, radioactive water release, and wars. Our findings suggest that new emerging global crises might compound the mental health burden exerted by climate change on young people, such that different cultures exhibit intercorrelated emotions of feeling guilty and ashamed, disconnected and isolated, engaged and interested, or helpless or hopeful, between two or more global crises. This study is the first to investigate the simultaneous impact of these three global crises on young people, mediated by media exposure and nature connectedness.

Implications of all the available evidence

We found that enhancing nature connectedness and limiting media exposure to these crises can help reduce mental health risks in young people, depending on the nature of the crisis. Notably, our research highlights variations in the impact of these crises across different countries and between the Global North and Global South. These findings can guide the development of targeted interventions and policies, and could have implications for better service planning to support and enhance young people's mental health across countries, as well as their capacity as future leaders of solutions to ongoing and new global crises.

disaster.[7,8] Individuals with exposure to multiple local disasters in the course of their lives are known to be more prone to develop post-traumatic stress disorder, which reactivates or exacerbates in response to new disasters.[9] However, little research has been done into the effects of global crises on communities that are not directly affected.

In this study, we investigated three prevailing global crises and explored individual and compound impacts on the mental health of young people (age 18–29 years). We included the climate change crisis, which has become increasingly salient in the wake of the extreme natural disasters and record-breaking temperatures in the past few years. The absence of a unified, global effort to urgently mitigate climate change paints a bleak future of irreversible damage to our planet. We also included the release of radioactive water from the Fukushima nuclear power plant into the Pacific Ocean on Aug 24, 2023, which has provoked grave concern over the unknown short-term and long-term effects on marine ecosystems in Japan and beyond, and incites fears of uncontrolled radioactive water making its way from Japan to other Pacific Rim countries and beyond.[10] Finally, in addition to the ongoing war in Ukraine, the outbreak of the Middle East war in Gaza since Oct 7, 2023, exposes the global population to media representation of civilian casualties and has highlighted the powerlessness of global superpowers to intervene in such conflicts. Greater details of these global crises are given in the appendix (pp 1–2).

Rapid global urbanisation, combined with increasing digitisation, is central to the visibility of global crises. China, which has a social media engagement rate of 73·2%, with an approximate engagement of approximately 1·06 billion users in 2023, stands as the biggest consumer base for social media in the world, projected to increase to more than 1·2 billion by 2027.[11] Social media has allowed updates on global crises to be viewed instantaneously and from the perspective of bystanders, increasing awareness and concern, but it is also liable to result in second-hand mental health impacts.[12] Previous studies have found that social media exposure to various global crises has had a major influence on the mental health of young people, their level of engagement, their awareness of such crises, their emotional responses, how they interact with digital activism, and mass mobilisation.[13–16] Other studies have found that high levels of concern for climate change resulting from frequent browsing of social media are associated with poor psychological health.[17,18] Exposure to images and videos of wars on social media can have desensitising effects, leading to reduced compassion for those directly affected by human conflicts.[19]

Alongside increased urbanisation and digital expansion, opportunities for nature exposure are diminishing,[20] and human experience of nature appears to be declining.[21] Exposure to nature increases one's sense of connectedness, concern for the environment, and enjoyment of the natural world.[22,23] It has been proposed as a mitigating factor that helps to preserve positive mental health among urban populations, especially in high-income countries.[24] However, there is a distinct trend to underprioritise greenspace provisions in the Global North (eg, European countries, the USA, and Canada) despite the positive effects seen in countries in the Global South (eg, Brazil, India, and China).[25] An individual's perceived value of nature and their degree of nature connectedness can influence the way they emotionally respond to ecological disasters,[26] and might alter the protective function of nature and nature connectedness in safeguarding the mental health of individuals living in urbanised spaces. Only two of the crises considered as part of our analysis are specifically environmental, and whether nature connectedness has a role in both ecological and non-ecological crises is uncertain. Hence, we aimed to investigate the potential roles of digital media exposure and nature connection as mediators in psychological health outcomes in countries in both the Global North and the Global South.

Our objectives were as follows: (1) to investigate the intensity and patterns of emotional responses towards climate change, the radioactive water released into the Pacific Ocean, and the Russia–Ukraine and Israel–Hamas wars (hereafter referred to as wars) among young people (aged 18–29 years) in China, Portugal, South Africa, the USA, and the UK; (2) to examine the effect of multiple global crises on young people's emotional engagement; and (3) to determine the mediating roles of media exposure and nature connection on the relationship between emotional engagement in these global crises and psychological health impacts. Our proposed conceptual model centres around emotional engagement as the totality of positive and negative emotions towards a global crisis. By obtaining data related to engagement with multiple global crises during the same timeframe, and across a diverse range of countries, we can make robust comparisons between emotional engagement in three prevailing global crises to assess the mental health impacts of individual crises, explore evidence of the compounded mental health impacts, and determine whether these paths are mediated by media exposure and nature connectedness. Understanding the different effects these crises have on mental health among young people will enable the development of appropriate interventions and policies.

See Online for appendix

Methods

Study design and participants

In this cross-national analysis, we conducted an online survey titled the Global Crises Survey. We adopted stratified purposive sampling and targeted participants through online panel providers www.wenjuan.com for China and www.prolific.com in Portugal, South Africa, the USA, and the UK. These countries were selected because they represent diverse socioeconomic, cultural, geographical, and climate-risk profiles. The survey was presented in English, except in China where simplified Chinese was

used after a translation-back-translation procedure was completed.[27] Both versions were reviewed by a bilingual expert panel (including SSSL) and pilot tested among 20 bilingual young participants aged 18–29 years to ensure content, conceptual, linguistics, and cultural equivalence.

Participants were eligible for inclusion if they were aged 18–29 years, were literate in Chinese (if they resided in China) or English (if they resided in the other countries), and self-reported not being diagnosed with any mental disorders in the 12 months before completing the survey. We included the criterion specifying that participants were to have no mental disorders within the past 12 months to reduce individual difference dimensions that might affect reported psychological health.[28] By reducing these individual difference dimensions we hoped our analysis would focus on the cross-cultural effects of global crises outlined in our study objectives and avoid putting additional stress on susceptible individuals.

For each country, we had aimed to include at least 400 respondents, comprising 200 male and 200 female respondents. From responses received, we selected the first 200 from male respondents and the first 200 from female respondents for each of the five countries who met our inclusion criteria.

All participants were required to read an information page before consenting to take part in the study, outlining study expectations, approximate duration of completion, confidentiality and anonymity of data collected, as well as the withdrawal process. Participants had to click a button on the webpage to confirm their consent to participate before they could continue to the questionnaire. The study adhered to the Declaration of Helsinki, with consideration of ethical frameworks from each country. Approval for the study was obtained from the Research Ethics Committee of Hong Kong Baptist University, (REC/23-24/0068). We followed the STROBE guidelines when reporting this observational study.

Measures

We designed the questionnaire on the basis of previous research approaches.[5,29] Respondents were asked to provide information including their age, sex assigned at birth, education, housing, and time spent on social media, subdivided into proportions of time spent on exposure to media pertaining to the global crises of interest to our study. To address the objectives of the study, validated scales included in the questionnaire were the Patient Health Questionnaire-4 (PHQ-4), consisting of the PHQ-2 and Generalized Anxiety Disorder-2 scales for assessing the severity of symptomatic depression and anxiety, respectively; Perceived Stress Scale-4 (PSS-4) for measuring perceived stress; the WHO-5 Well-Being Index (WHO-5) for assessing psychological wellbeing; 18 emotional response items, scored on a 0–4 Likert scale in prevalence, to examine how global crises are emotionally processed;[5] and the Nature Relatedness Scale (NR-6) for evaluating subjective nature connectedness.[23] Participants gave responses to these validated scales in our online questionnaire. We constructed two composite measures from the scale items as latent variables: psychological distress, which contained all items from PHQ-4 and PSS-4, and emotional engagement, which was the aggregate of emotional response items towards the three global crises. Further details and the rationale of the measures used in this study are provided in the appendix (pp 3–5).

For more on **SPSS Amos** see https://www.ibm.com/products/structural-equation-modeling-sem

For more on **Matplotlib** see https://matplotlib.org/

For more on **SciPy** see https://scipy.org/

For more on **Seaborn** see https://seaborn.pydata.org/

Statistical analysis

We presented data as frequency and percentages for categorical variables and as mean (SD) for continuous variables. We calculated descriptive statistics and used ANOVA tests with effect size reported as η^2 (where a small effect is equivalent to 0·01, medium effect to 0·06, and a large effect to 0·14). Post-hoc Tukey's Honestly Significant Difference (known as Tukey's HSD) tests were conducted to test for significant differences in-between each country. We used hierarchical correlation clustering to group similar emotional responses towards each crisis into clusters and dendrograms were generated using the relative Euclidean distance to cluster discrete emotional responses together from all three global crises. We calculated Pearson's correlation coefficient (r) for the linear correlation of two different emotional response items. We hypothesised a theoretical path diagram that we tested using structural equation modelling to examine the effect of emotional engagement on mental health and wellbeing, with multigroup analysis and mediation analysis of media exposure and nature connectedness.

We assessed the internal consistency of validated scales and our composite measures made from combining multiple scales using Cronbach's α. Values closer to 1 indicate better internal consistency and values close to zero indicate poor internal consistency.

In one-way ANOVA tests and path analysis in structural equation modelling, a two-sided p value of less than 0·05 was considered significant. We used IBM's SPSS statistics (version 29.0) and SPSS Amos (version 29.0) software for data analysis and we used R (version 4.3) for data visualisation, and the Matplotlib (version 3.8) for data visualisation, SciPy (version 1.11) for dendrogram analysis, and Seaborn (version 0.13) for correlational clustering.

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the manuscript.

Results

Between Oct 20 and Nov 3, 2023, 2579 individuals completed our online surveys, among whom we retained a sample of 2000 responses for data analysis. The mean age of our dataset was 24·36 years (SD 2·86; table). There was a high prevalence of symptomatic anxiety (716 [36%] of 2000) and depression (854 [43%]). The mean score of psychological wellbeing was 68·01 (SD 19·67) out of 100

	Total respondents (N=2000)	China (n=400)	UK (n=400)	USA (n=400)	South Africa (n=400)	Portugal (n=400)	*F* value	p value	Effect size (η^2)	Cronbach's α
Demographics										
Age, years	24·36 (2·86)	22·79 (2·73)	25·12 (2·88)	24·91 (2·84)	24·84 (2·69)	24·12 (2·50)	48·91*	<0·0001	0·089	..
Education level										
Bachelor's degree or above	1513 (76%)	374 (94%)	288 (72%)	237 (59%)	292 (73%)	322 (81%)	..		..	..
Below bachelor's degree	487 (24%)	26 (7%)	112 (28%)	163 (41%)	108 (27%)	78 (20%)	..		..	..
Housing status										
Public housing	404 (20%)	192 (48%)	42 (11%)	57 (14%)	89 (22%)	24 (6%)	..		..	..
Private housing	1528 (76%)	208 (52%)	337 (84%)	326 (82%)	292 (73%)	365 (91%)	..		..	..
Other	68 (3%)	0	21 (5%)	17 (4%)	19 (5%)	11 (3%)	..		..	..
Psychological health										
Symptomatic anxiety†	2·09 (1·58)	2·42 (1·67)	1·91 (1·44)	1·71 (1·61)	2·51 (1·57)	1·90 (1·46)	20·79‡	<0·0001	0·040	0·751
Potential cases of anxiety	716 (36%)	186 (47%)	122 (31%)	102 (26%)	177 (44%)	129 (32%)	..		..	..
Symptomatic depression§	2·35 (1·70)	2·12 (1·64)	2·42 (1·68)	2·12 (1·77)	2·68 (1·76)	2·40 (1·59)	7·88¶	<0·0001	0·016	0·793
Potential cases of depression	854 (43%)	158 (40%)	182 (46%)	147 (37%)	200 (50%)	167 (42%)	..		..	..
Perceived stress‖	6·80 (3·16)	6·45 (3·44)	6·62 (3·11)	6·56 (3·31)	7·53 (2·95)	6·82 (2·86)	7·50**	<0·0001	0·015	0·717
Psychological wellbeing††	68·01 (19·67)	61·20 (21·54)	71·04 (18·44)	70·67 (19·80)	69·18 (19·31)	67·96 (17·47)	17·08‡‡	<0·0001	0·033	0·888
Composite variables										
Psychological distress§§	39·71 (20·46)	39·07 (22·00)	38·71 (19·68)	36·43 (21·14)	45·13 (19·48)	39·18 (18·89)	10·16¶¶	<0·0001	0·020	0·863
Emotional engagement‖‖										
Climate change	28·79 (14·17)	31·56 (12·84)	27·93 (14·40)	26·89 (14·48)	27·84 (15·17)	29·73 (13·42)	6·97***	<0·0001	0·014	0·924
Radioactive water	21·26 (16·08)	39·15 (10·72)	15·07 (13·38)	15·88 (13·98)	19·38 (14·82)	16·83 (13·22)	232·31†††	<0·0001	0·318	0·938
Wars	32·42 (14·57)	33·03 (13·15)	33·82 (14·04)	29·45 (15·78)	32·92 (16·12)	32·90 (13·17)	5·53‡‡‡	<0·0001	0·011	0·914
Mediators										
Media exposure, min										
Climate change	57·81 (87·35)	44·76 (43·71)	46·47 (85·58)	47·69 (75·14)	101·45 (129·79)	48·67 (64·09)	33·34§§§	<0·0001	0·062	..
Radioactive water	29·23 (57·73)	65·57 (63·87)	9·79 (31·66)	15·14 (40·53)	45·26 (73·92)	10·38 (44·60)	88·51¶¶¶	<0·0001	0·151	..
Wars	156·47 (200·59)	58·59 (56·73)	160·07 (196·43)	160·87 (215·22)	247·80 (251·58)	155·01 (179·34)	48·91‖‖‖	<0·0001	0·089	..
Total	243·50 (263·32)	168·93 (129·18)	216·33 (253·50)	223·69 (251·55)	394·51 (349·05)	214·07 (231·35)	47·51****	<0·0001	0·087	..
Nature connectedness††††	3·29 (0·85)	3·66 (0·69)	3·06 (0·84)	3·04 (0·92)	3·43 (0·85)	3·26 (0·75)	41·62‡‡‡‡	<0·0001	0·077	0·830

Data are mean (SD) or n (%). Percentages might add up to more than 100% due to rounding. Per study design, the population for each country and for the total respondents was 50% male and 50% female. Race and ethnicity was not recorded in our survey. *F* value and p value are presented to verify the one-way ANOVA test, with examples of various country comparisons. Cronbach's α is presented for the total population. Media exposure has no Cronbach's α because it was a single item measure. Effect sizes were calculated as η^2. Post-hoc test conducted by Tukey's Honestly Significant Difference test. PHQ-4=Patient Health Questionnaire-4. PSS-4=Perceived Stress Scale-4. WHO-5=WHO-5 Well-Being Index. *Result from a one-way ANOVA test across the samples country groups. †Measured with the Generalised Anxiety Disorder-2 subscale in PHQ-4, scored on a scale of 0–6; lower scores indicate fewer symptoms of anxiety disorders, higher scores indicate greater symptoms of anxiety disorders, and a score of 3 or higher suggests a probable anxiety disorder. ‡For China and South Africa *vs* the UK, the USA and Portugal. §Measured with the Patient Health Questionnaire-2 subscale in PHQ-4, scored on a scale of 0–6; lower scores indicate fewer symptoms of a depressive disorder, higher scores indicate greater symptoms of a depressive disorder, and a score of 3 or higher suggests a probable major depressive disorder. ¶For China and the USA *vs* South Africa. ‖Perceived stress was measured with the PSS-4, scored on a scale of 0–16; lower scores indicate less perceived stress in the past month and higher scores indicate more perceived stress in the past month. **For South Africa *vs* all other countries. ††Psychological wellbeing (WHO-5), is presented on scale of 0–100, where higher scores denote greater wellbeing and lower scores indicate worse wellbeing. ‡‡For China *vs* all other countries. §§Psychological distress is a composite measure of PHQ-4 and PSS-4 items; and has been normalised and presented in this table as scores in a range from 0–100, with higher scores indicating greater distress and lower scores indicating less distress. ¶¶For South Africa *vs* all other countries. ‖‖Emotional engagement uses the combined score of 17 of the 18 emotional response items (after removing disconnected); each emotional response was scored on a scale of 0–4 for a total score of 0–68; lower scores indicate less emotional engagement towards a global crisis and higher scores indicate more emotional engagement towards a global crisis. ***For South Africa *vs* all other countries. †††For China *vs* all other countries; South Africa *vs* all other countries. ‡‡‡For China *vs* all other countries; South Africa *vs* all other countries. §§§For China *vs* the UK, the USA, and South Africa; the USA *vs* Portugal. ¶¶¶For China *vs* all other countries; South Africa *vs* the USA and UK. ‖‖‖For the USA *vs* all other countries. ****For South Africa *vs* all other countries; China *vs* the USA. †††† Nature connectedness was measured by the Nature Relatedness Scale, which includes six items scored on a scale of 1–5, averaged for a final scale score of 1–5; lower scores indicate a weaker subjective connectedness with the natural environment and higher scores indicate stronger subjective connectedness with the natural environment. ‡‡‡‡For each individual country *vs* all other countries except the USA *vs* the UK.

Table: **Demographic characteristics, psychological health measures, emotional engagement towards global crises, and exposure to mediators of the cross-country survey respondent dataset**

Figure 1: **The mean score of self-rated emotional responses compared across global crises in individual countries (A); and by each global crisis among the five countries (B)**
Each emotional response was scored between 0 (not at all) and 4 (very much).

on the WHO-5 scale, while our combined measure of psychological distress had a mean score of 39·71 (20·46) out of 100. Both psychological distress and the emotional engagement of each global crisis had good-to-excellent internal reliability. Disconnected as an emotional response unanimously lowered the internal consistency of our composite measure of emotional engagement, including when reverse-scaled, and was therefore removed in the structural equation modelling analysis, in our total population (Cronbach's α >0·8). Mediators in our study showed large differences between countries—for instance, respondents from the UK and the USA held the lowest levels of nature connectedness of our countries (mean NR-6 scores 3·06 [SD 0·84] and 3·04 [0·92], respectively) and respondents from South Africa had the highest mean media exposure to global crises (394·51 min [SD 349·05]). Overall, respondents from China had the least media exposure to the three global crises (mean of 168·93 min [SD 129·18]) but accounted for the highest media exposure to radioactive water released into the Pacific Ocean (65·57 min [63·87]).

Overall, respondents of our study found wars to be the most emotionally evocative crisis (mean emotional

engagement 32·42 [SD 14·57]), compared with climate change (28·79 [14·17]) and radioactive wastewater discharge (21·26 [16·08]; table). This hierarchy in emotional engagement corresponded to the global search interest online for these crisis, illustrated by Google Trends data from Oct 20 to Nov 3, 2023 (appendix p 10). Wars held similar levels of emotional engagement in respondents from all countries apart from the USA, where emotional engagement was lower. The crisis that had the highest emotional engagement for China was radioactive water, which was much higher than the emotional engagement of all the other countries for all emotional response items comprising emotional engagement, apart from the emotional response of feeling disconnected, which was significantly lower than in other countries ($p<0·001$; one-way ANOVA tests of emotional response items between countries are presented in the appendix [pp 13–16]).

We constructed radar charts of mean emotional engagement scores (figure 1). Individual emotional responses retain a discernible shape between different countries (figure 1A), which shows that global crises are evocative of a similar set of emotions cross-culturally. Greater emotional engagement in a global crisis entails an overall increase in both positive and negative emotions, aside from feeling disconnected. However, we identified some exceptions, such as respondents feeling more guilty with regard to climate change than wars, despite the higher level of emotional engagement in wars. Concern was the most common emotional response item reported towards global crises (climate change: mean score 2·63 [SD 1·23]; radioactive water: 1·97 [1·44]; wars: 2·85 [1·23]), whereas the least reported items were courageousness (climate change: 1·03 [1·09]; radioactive water: 0·66 [1·01]; wars: 0·87 [1·11]) and isolation (climate change: 0·91 [1·08]; radioactive water: 0·80 [1·14]; wars: 1·00 [1·20]; figure 1B). The most variation in emotional response was due to the nature of the global crisis, such as wars being naturally more evocative of emotions such as anger, disgust, or outrage than the other global crises. The severity of global crises can also be interpreted differently by individuals in different countries, for instance, with respondents from China having a much more evocative response than respondents from other countries (figure 1B).

We mapped affective meanings of each emotional response item to the word-emotion association Lexicon provided by the National Research Council Canada (appendix pp 6–9). While only four emotional response items could be categorised as high valence (ie, positive emotions), low valence emotions (ie, negative emotions) could be differentiated into groups of high and low levels of arousal or dominance, or both. Cross-national comparisons of clustered emotional responses to the global crises suggested commonalities in response. When plotted as a dendrogram, this is reflected by discrete emotions forming clusters across two or more global crises (figure 2). Respondents from China had the greatest extent of cross-crises clustering of emotional responses compared with the other sampled countries. For China, positive emotions were correlated between radioactive water and wars, and feeling engaged with these two crises formed a pair (r=0·57). Being concerned and interested were clustered closely together, whereby concern for the two ecological disasters, climate change and radioactive water, were paired (r=0·49), and interest in radioactive water was clustered in the same clade as interest in wars (r=0·36). Feeling isolated, as well as pairs of feeling guilty and ashamed, in all global crises formed a cluster together among Chinese respondents.

Cross-crises clustering of all three global crises was uncommon in countries other than China. Nonetheless, simultaneously feeling low levels of disconnected and isolated emotional responses towards climate change and wars was common across all countries, with the inclusion of radioactive water as part of the cluster for China, the UK, and South Africa. US respondents were not hopeful about both climate change and the radioactive water crisis (r=0·59), whereas Portugal respondents felt an associated degree of low hopefulness between climate change and wars (r=0·43).

Similarly, feeling helpless towards wars among US respondents was similar to how they felt helpless about climate change (r=0·52), the two of which formed a clade close to other negative emotions towards climate change. Respondents from South Africa had similar feelings of helplessness for radioactive water and wars (r=0·34), and they felt guilty and ashamed about the two crises, with these emotions closely clustered together. Portugal simultaneously experienced similar levels of helplessness, which formed a cluster across all three global crises.

Emotions strongly associated with wars showed less demarcation between being positive and negative; positive emotional response items such as interest and engaged were more similar to the cluster of negative emotions towards wars than the remaining positive emotions (ie, feeling hopeful or courageous), or positive emotions from other global crises reported by respondents from the USA, South Africa, and Portugal. To a lesser extent, respondents also found their level of interest in climate change to be paired with negative emotions—eg, interest that was clustered closely to feeling disappointed (r=0·44) and concerned (r=0·55) in South Africa. Similarly in Portugal, being interested and engaged with climate change was clustered with negative climate change emotions. This structure of clustered emotions was confirmed to be the norm for wars in our dendrogram analysis by global crisis (appendix p 12). Our dendrogram analysis indicates related emotions between seemingly unrelated global crises and a link between interest in wars and climate change with the negative emotions commonly associated

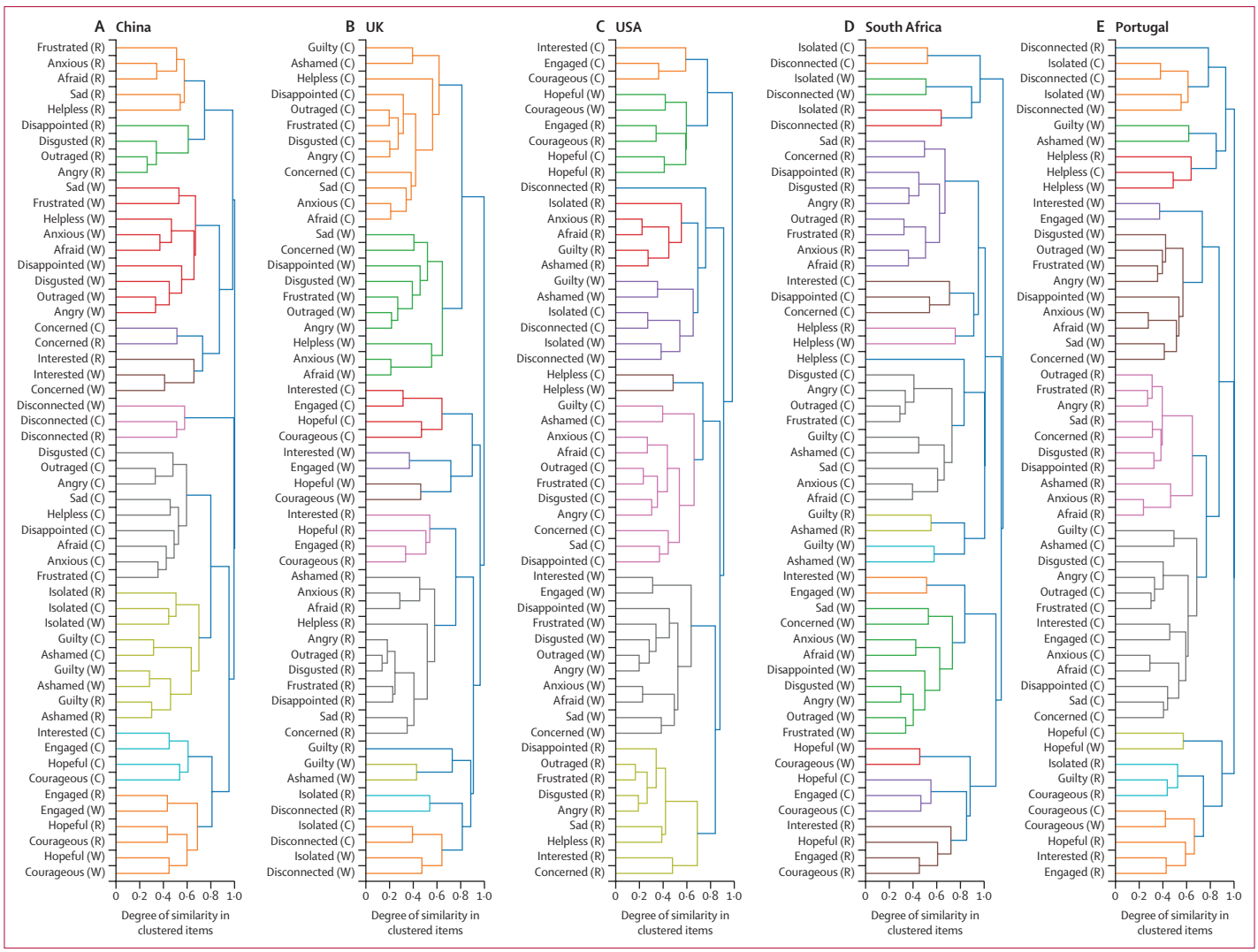

Figure 2: **Clustered emotional responses to the global crises across five countries**

Emotional responses are clustered on a scale of 0 to 1·0, indicative of the Euclidean distance. Clades created under lower Euclidean distance values indicate greater similarity between clustered items, and higher Euclidean distance values indicate less similarity of clustered items under the clade. C=climate change. R=radioactive wastewater released into Pacific Ocean. W=wars.

with these crises. However, the variation in emotional responses between countries by crisis also highlights the importance of considering national differences when attempting global analyses or devising policy solutions. A larger sample than the five countries considered here would enhance understanding of between country variation in emotional response.

To examine the effect of emotional engagement on psychological wellbeing and distress, we used structural equation modelling (figure 3). Our analysis included a composite measure of psychological distress (validated through internal reliability testing, N=2000; Cronbach's α=0·863) and psychological wellbeing (α=0·888; table).

In constructing our conceptual model for multigroup analysis, China was separated from the other countries to satisfy the recommended cutoffs for measurement variance (appendix p 17),[30] and comprised its own model. Coefficients of two groups were tested with structural equation modelling, consisting of the multi-country sample of Portugal, South Africa, the UK, and the USA (n=1600; figure 3A), and a standalone China model (n=400; figure 3B). Full model summaries are provided for these models, including the overall model with all five countries, in the appendix (pp 18–19). Additionally, all coefficients and total variances (R^2) explained by each global crisis using climate change, with media exposure and nature connectedness as mediators, as the base model are reported in the appendix for the two models (appendix pp 20–21).

A direct effect from emotional engagement in climate change was present for both models, which was associated with greater psychological distress (β_{multi}=0·153;

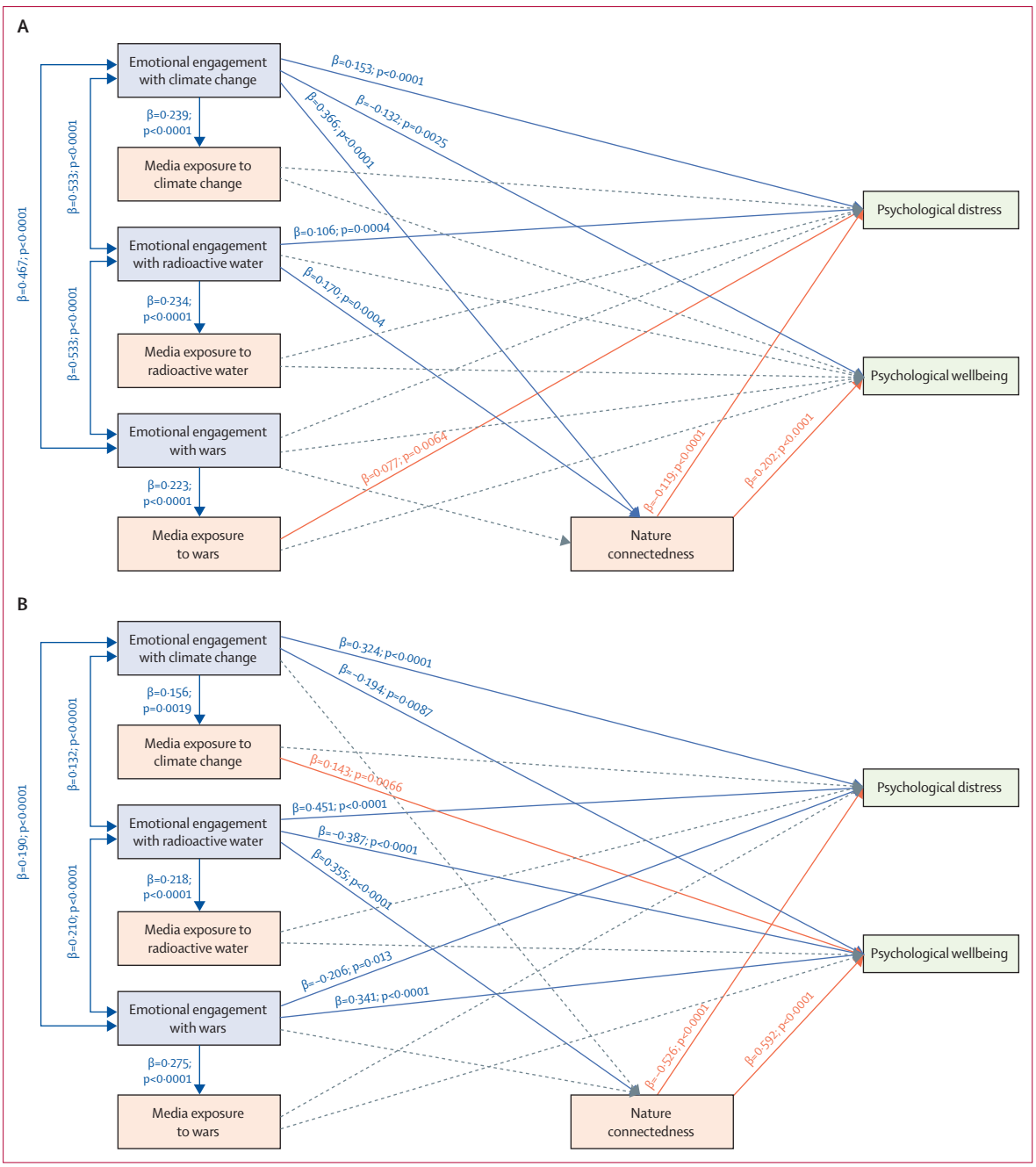

Figure 3: **Modelling the prediction from emotional engagement towards the three global crises to psychological distress and wellbeing in the combined sample of the UK, the USA, South Africa, and Portugal (A), and in the respondents from China (B), mediated by media exposure, and nature connectedness**
The solid lines indicate significant results, marked with standardised coefficients (β), and dotted lines indicate non-significant results.

β_{China}=0·324) and worse psychological wellbeing (β_{multi}=–0·132; β_{China}=–0·194; figure 3). In our multi-country model, emotional engagement in climate change alone was able to explain 4·3% and 0·5% of psychological distress and wellbeing variances, respectively, which further improved to 6·4% and 4·0% with the inclusion of mediators (appendix p 20). In our China-only model, climate change did not have a significant direct effect on psychological wellbeing without mediators, but independently explained 6·2% of variance in psychological distress (appendix p 21). These data suggest that the association between emotional engagement in climate change and psychological health was strongly mediated by media exposure, but nature connectedness independently predicted psychological health and all together, explaining 20·7% and 22·2% of variances (appendix p 21). Emotional

engagement towards the radioactive water and wars crises in the multi-country model individually accounted for additional variances for psychological distress ($\Delta R^2_{\text{radioactive water}}$=0·013; ΔR^2_{wars}=0·012; appendix p 20), but had unremarkable effects on psychological wellbeing ($\Delta R^2_{\text{radioactive water}}$<0·001; ΔR^2_{wars}=0·002). Respondents from China were greatly affected by their emotional engagement in the radioactive water crisis in terms of psychological distress (ΔR^2=0·087) and psychological wellbeing (ΔR^2=0·075), while emotional engagement in wars was unexpectedly associated with a positive effect on psychological wellbeing (β=0·341; figure 3B) and also explained an additional 2·1% of variance in psychological wellbeing (appendix p 21). Nature connectedness mediated substantial protective effects from emotional engagement in climate change and radioactive water for the multi-country model (β_{distress}=–0·119, $\beta_{\text{wellbeing}}$=0·202) and in radioactive water only for China (β_{distress}=–0·526, $\beta_{\text{wellbeing}}$=0·592; figure 3). Emotional engagement was correlated with greater media exposure to wars in both models; however, only greater media exposure was associated with more psychological distress (β=0·077) in the multi-country model and only with better psychological wellbeing in the standalone China model through media exposure to climate change (β=0·143; figure 3). Overall, the full model using all three global crises accounted for 8·7% and 4·2% of variance in psychological distress and psychological wellbeing for the multi-country model, and 33·0% and 34·9% of this variance for the China-only model, respectively (appendix pp 20–21).

Discussion

To our knowledge, this cross-national, cross-sectional study is the first to concurrently examine the mental health impacts of three prevailing global crises—climate change, radioactive water, and wars—adding timely evidence on how these global crises have affected emotional and psychological health outcomes in young people from multiple countries. We found that the impact of the three global crises on psychological health was not equivalent as, hierarchically, all countries (except China) were most emotionally engaged in wars, then climate change, and then the radioactive water crisis, which corresponded with the average global media exposure of respondents. We found that high levels of emotional engagement did not necessarily translate to increased psychological health risks. The overall mental health impact of emotional engagement in wars was found to be small, absent, or associated with minor positive mental health outcomes for respondents in comparison with the clear negative psychological effects of the two ecological disasters of our study.

We found similarities in how global crises were emotionally processed across different countries. The climate change crisis evoked separate clusters of positive and negative emotions reported at moderate levels, consistent with previous studies that have found profound guilt towards climate change compared with other global crises.[5] With the exclusion of China, the scarce media coverage of the release of radioactive water into the Pacific Ocean might explain the low emotional engagement of respondents in the other countries, which might have contributed to the similar low-level and highly clustered emotions among these countries. Nevertheless, high emotional engagement in China did not prevent respondents from feeling highly disconnected. Finally, media coverage on wars was notably associated with high levels of interest and engagement, and increased levels of these emotional response items correlated with an increase in levels of items corresponding to anger, sadness, fear, and disgust emotions.

Respondents from China reported the largest set of overlapping emotions between different global crises in our study, uniquely in reporting self-blaming emotions (eg, ashamed and guilty) and feeling isolated from all global crises. Our findings suggest that moral conflicts commonly arise with global crises in China. Moral injury can occur from the combination of powerlessness to alter global crises, high moral attitudes, and anticipated guilt in response to thinking about climate disasters or consequences that affect their societal group (eg, highly concerned climate activists),[31] sometimes leading to willingness to proactively mitigate these consequences (eg, reducing their own carbon footprint).[32] Part of the explanation for this cluster, especially for crises without immediate local effects, could be inferred by their strong nationalistic support for their government to spearhead climate change as an international leader, which might translate into feeling invested in the outcomes of other global crises.[33] For other countries, evidence of moral injury was less clear, although participants from all countries still reported feeling low levels of disconnectedness and isolation, alongside low hopefulness and moderate helplessness between two or more global crises.

Common to all countries, we found a clustered set of moderately prevalent angry, fearful, and disgusted emotions that had low cross-crisis correlations and were never clustered between multiple global crises. These encompassed all high arousal, high dominance emotions, which implies that participants formed an in-control, directed emotional response towards individual global crises, such as the high levels of angry and disgusted emotional response items from each countries towards wars. We suggest that thinking about global crises evokes two distinct pathways of emotions: one characterised by unique levels of aroused emotions corresponding to the perceived effect of the global crisis and another comprising shared, internalised emotions that are sensitive to compounded effects of multiple contemporary global crises.

Using our structural equation modelling model, we were able to clarify the association between mental health and overlapping emotional engagement in the form

of compounded effects on psychological distress and wellbeing. Climate change had a centralising effect in our multi-country model, when excluding China, which we expected because it is a global issue intertwined with youth participation and advocacy.[13–15] Despite receiving much less emotional engagement in all countries except China, the radioactive water crisis had a small negative direct effect on psychological distress. Complementing the effect of the climate change crisis, Japan's radioactive wastewater discharge crisis also might have been interpreted as an ecological crisis that could have exacerbated respondents' so-called eco-anxiety, the chronic fear of irrevocable environmental damage that might have consequences for one's future.[34] A third of the variance in psychological health and wellbeing was accounted for by our complete model of all three global crises for Chinese respondents; however, individual nature connectedness levels could directly explain half of the variance in psychological wellbeing, so the effects of global crises on the mental health of young people should not be overestimated. Chinese respondents' psychological health outcomes were affected by emotional engagement in all three global crises, albeit with a positive effect of the war crisis on psychological health outcomes. Emotional desensitisation to the experiences of others affected by wars can plausibly explain the direction of the association between diminished emotional engagement in tandem with improved psychological health outcomes.[19] However, the cultural component should be further examined in terms of how wars are viewed by the young Chinese population versus other countries, as all countries share a similar emotional profile towards wars, but this positive effect was exclusively found for Chinese respondents. We also found that emotional engagement with the radioactive water crisis also affected the psychological health of Chinese respondents to a greater extent than climate change, which is reflected in higher emotional responses of feeling sad, afraid, or helpless, but also much greater high dominance emotions, such as anger and outrage. The recency, volume, and negativity of Chinese media coverage of the radioactive water crisis might have spurred greater emotional engagement than from the respondents in the other countries, but also a probable cause of worse psychological health outcomes.

Greater emotional engagement was significantly linked with spending more time browsing for respective social media related to each of the global disasters in our study. Only two paths were significantly associated with media exposure as a mediator: in the standalone China model, the negative effect of climate change emotional engagement on wellbeing was alleviated by increased media exposure, and in the multi-country model, the negative effect of higher media exposure on psychological distress fully mediated the association between emotional engagement in wars and psychological health outcomes. In other words, Chinese respondents who had in-depth knowledge of climate change, or who had greater interest in climate change, had better coping mechanisms to mitigate the negative effect on psychological wellbeing than did those who were more disconnected from the crisis. In the USA, South Africa, and Portugal in particular from our multi-country model, we found that feeling interested and engaged in the wars was correlated with negative emotions, which suggests that excessive and, presumably, intentional media exposure to wars was potentially the catalyst for negative psychological health outcomes. Compulsively searching for new developments in the war situations might have occurred as part of problematic news consumption patterns,[35] which, when perpetuated by addictive and emotionally immersive news stories, can evoke additional symptoms of psychological distress. In comparison, nature connectedness carried stronger indirect effects on mental health, mediating the association between emotional engagement in the radioactive water crisis for both models, and climate change for the multi-country model. We did not identify an indirect effect of nature connectedness through emotional engagement in wars, suggesting that the protective effect of nature connectedness as a mediator might be limited to ecological crises. However, nature connectedness resulted in a generally substantial reduction in negative psychological health symptoms and improved psychological wellbeing, and both of our models underpin its importance as a potent safeguard against negative psychological outcomes. Our findings reinforce existing research emphasising that including opportunities for the experience of nature and enhancing nature connectedness will help to build young people's resilience to the consequences of an increasingly unstable climate.[36]

Our study's main strength is its inclusion of three global crises together to compare their effects on young people's mental health. We used a large, multinational sample from five countries across four continents of varying socioeconomic, cultural, and climate-risk profiles to increase the external validity of our study findings. We also used previously validated measures such as PHQ-4, PSS-4, and WHO-5 scales. Nevertheless, there are several limitations to our study. For instance, we could not construct a valid model with structural equation modelling encompassing all countries because of the different magnitudes and unexpected directions elicited by global crises in China (ie, radioactive water and wars). The generalisability of our results are limited by our sample size of 400 respondents per country; however, increased consideration for sociodemographic factors (eg, education levels, rural *vs* urban living, and high *vs* low social support), country-level differences (eg, high *vs* low climate risk, rate of urbanisation, and extent of smartphone use), and media interactions (eg, media literacy, media trust, volume, and language used in news reporting) could be improved to strengthen the reliability of our findings. Recognising that cultural differences cannot easily be operationalised as individ-

ual variables, we assumed homogeneity of within-country samples in order to not overcomplicate our analysis and to strengthen the generalisability of our sample sizes. The cross-sectional nature of our study and aforementioned unmeasured variables precludes drawing causal or temporal inferences from structural equation modelling. Longitudinal studies are recommended to capture the trajectory of the psychological impact of global crises with more uniform media coverage on young people from more diverse settings.

Young people are susceptible to most, if not all, emerging global crises, and solutions from individual countries cannot effectively solve this alone. The collective bleak outlook brought on by these global crises can influence long-term decision making among young people, such as reluctance to have children in an unstable world, further stagnating birth rates in most high-income countries.[8,37] In essence, all global crises elicit fears of an unpredictable future, which we posit will contribute to individuals' future anxiety.[38] We urge policy makers to be cautious in how global crises are disseminated, because negative emotions, such as anger and fear, usually outweigh positive emotions, such as courage or hopefulness. Global crises can easily lead to demonising other countries for involvement, which would invariably reduce opportunities of international cooperation. For example, the COVID-19 pandemic was a global challenge for young people in particular and opportunistic media coverage and short-term political gamesmanship resulted in spiralling misinformation and anti-Chinese sentiments, such that individuals worldwide displaced their fears of the unknown through stigmatisation and exclusion of Chinese societal participation.[39] Nevertheless, more attention from policy makers and investment in multilateral solutions is urgently needed, especially for policy measures and intervention at the organisational, national, and international levels to improve the mental health of young people. Controlling media exposure at a macro or micro level, even if feasible, is unlikely to have a great effect; however, nature connectedness might be pivotal in mitigating the mental health effects of some global crises. Fortifying young people's resilience and their ability to cope with compound mental health risks posed by multiple global crises is imperative for future generations as they navigate this era of increased media exposure and decreased nature connectedness.

Contributors

SSSL conceived, designed, and supervised the study and oversaw the data collection. All authors contributed to data analysis, data interpretation, data visualisation, writing and development of the manuscript, and critically revising the manuscript for important intellectual content. All authors approved the final version of the manuscript and agreed to submit it for publication. SSSL and JWLF directly accessed and verified the underlying study data. All authors have full access to all the data in the study and accept full responsibility to submit for publication.

Declaration of interests

We declare no competing interests.

Data sharing

Data will be made available, from 1 year after publication of this Article, on bona fide request to the corresponding author; requests for access should include a clearly articulated plan for third-party use of data. Requests for access to data will be reviewed by a panel.

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