

## Climate anxiety, wellbeing and pro-environmental action: correlates of negative emotional responses to climate change in 32 countries

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## ABSTRACT

This study explored the correlates of climate anxiety in a diverse range of national contexts. We analysed cross-sectional data gathered in 32 countries ( $N = 12,246$ ). Our results show that climate anxiety is positively related to rate of exposure to information about climate change impacts, the amount of attention people pay to climate change information, and perceived descriptive norms about emotional responding to climate change. Climate anxiety was also positively linked to pro-environmental behaviours and negatively linked to mental wellbeing. Notably, climate anxiety had a significant inverse association with mental wellbeing in 31 out of 32 countries. In contrast, it had a significant association with pro-environmental behaviour in 24 countries, and with environmental activism in 12 countries. Our findings highlight contextual boundaries to engagement in environmental action as an antidote to climate anxiety, and the broad international significance of considering negative climate-related emotions as a plausible threat to wellbeing.

## 1. Introduction

Climate change is recognised as a major threat by most people around the world. In a 2021 survey of 76,328 Facebook users across 31 countries, most respondents reported that they were “somewhat” or “very” worried about climate change (Leiserowitz et al., 2021). As the acute and long-term effects of climate change become a lived experience for a growing proportion of the world’s population, there also appears to be a corresponding rise in the number of people experiencing psychological distress in relation to the environment and climate crisis (Ojala et al., 2021; Pihkala, 2020). Commonly termed “eco-anxiety” or “climate anxiety”, the experience of environment-related distress encompasses negative emotions like fear, worry, guilt, shame, hopelessness and despair (Ojala et al., 2021). It has been noted that anxiety has simply emerged as a concept used by researchers to represent a wide range of negative emotions people have about climate change (Clayton, 2020).

To date, mainstream discourse and research regarding negative emotional responses to climate change have predominantly focused on the experiences and perspectives of a white and Western demographic (Ray, 2021). Yet, the threat posed by climate change is by no means limited to the Global North. In a recent international poll of young adults, most respondents in four countries of the Global South: Brazil (86%), India (80%), Nigeria (70%), and the Philippines (92%), reported feeling frightened about the future because of climate change (Hickman et al., 2021). Climate anxiety has also been linked to poor mental health among a sample of Filipino young adults (Reyes et al., 2021). The current study advances emerging efforts to diversify climate-related emotions research. We explored plausible predictors of climate anxiety, and examined how climate anxiety relates to pro-environmental action and mental wellbeing in 32 countries.

### 1.1. Operationalising climate anxiety

Negative emotions are key drivers of human action (Weber, 2006). Therefore, widespread negative emotional responses to climate change are a positive indicator of the potential for large-scale social and political action on the climate crisis. However, negative emotions can also have adverse implications for human wellbeing and psychological functioning. Earlier research showed a link between climate change concern and psychological distress (Searle & Gow, 2010). More recent scholarship on the relationship between negative climate-related emotions and wellbeing have coalesced around the concept of climate anxiety – a concept closely related to fear and worry (Pihkala, 2020). Climate anxiety can be considered a subset of eco-anxiety which is

defined by (Clayton et al., 2017) as a chronic fear of ecological doom.

Scholars suggest that climate anxiety can be triggered by a loss of places, activities and traditions due to climate change or fear of the potential scope and impact of dangerous climate change (Clayton, 2021). It is not considered to be inherently pathological (i.e., it is not a clinical disorder). Nonetheless, Clayton and Karaszia (2020) developed a measure of climate anxiety that emphasizes the potential for psychological impairment. Their scale is based on clinical measures of functional impairment and rumination. It assesses the degree to which thinking about climate change makes it difficult for people to sleep, socialise, regulate their emotions, and concentrate on work or studying. In their studies of US residents, they found that around one-fifth of people experience these effects at least some of the time.

The current study diverges from Clayton and Karaszia’s (2020) approach by focusing on the negative emotionality embodied by climate anxiety.<sup>1</sup> We do not presume an overlap with psychological impairment. Instead, our approach aligns with Pihkala’s (2020) argument to avoid narrowly restricting conceptualisations of climate anxiety only to the stronger anxiety symptoms (pg. 12). We used a measure of negative climate-related emotions that is based on the ‘State Anxiety’ dimension of the State-Trait Anxiety Inventory (STAI; Spielberger, 1983). State anxiety captures the intensity of an individual’s feeling of anxiety as an emotional state *at a given point in time*. High levels of state anxiety are interpreted as reflecting negative emotional responses to situational influences such as anticipated or present danger, or past traumatic events associated with the present situation (Spielberger & Reheiser, 2009). Correspondingly, our operationalisation of climate anxiety reflects a state of heightened negative emotionality due to perceived threat from climate change.<sup>2</sup> This construct differs from concepts like climate change worry or concern by capturing not just the feeling of being

<sup>1</sup> Clayton’s (2020) account of the evidence for climate anxiety around the world details reports of strong emotional responses to climate, such as high levels of worry and emotional distress, among various populations. This account, as well as that of others such as Pihkala (2020), does not support the assumption of functional or emotional impairment as defining elements of climate anxiety.

<sup>2</sup> In addition to being based on the STAI, our climate anxiety measure also closely mirrors the ‘climate anxiety’ dimension (Thinking about climate change makes me feel – tense, anxious, worried, angry, concerned, stressed, sad, scared, depressed) of Searle and Gow’s (2010) climate distress scale. Anger is not represented in our climate anxiety measure because it reflects a different degree of activation than anxiety or worry and has been shown to have a different pattern of association with mental health and pro-environmental action (e.g., Stanley et al., 2021).

worried or anxious, but also the associated mental states of being tense, calm, peaceful or unrelaxed. It is therefore a more holistic representation of the experience of intense negative emotionality.

## 1.2. Antecedents of climate anxiety

One way negative emotions arise is from appraisals of events or situations in light of their implication for wellbeing (Moors et al., 2013). Here, implications for wellbeing encompass the potential fulfilment or obstruction of the appraiser's needs, values, goals, beliefs and other interests. Social cognitive theory (Bandura, 1986) indicates that individuals' emotions and cognitions are shaped by contextual influences that provide information through instruction, modelling and social persuasion. We propose that the knowledge that underlies feelings of climate anxiety may be acquired through direct personal experiences (Reser et al., 2014), or indirectly through social interaction and media consumption (Rosenthal, 2022). Below, we outline the empirical considerations that framed our hypotheses regarding the plausible antecedents of climate anxiety.

### 1.2.1. Personal experience

Exposure to ostensible climate change impacts, as well as people's perceived subjective experiences of climate change, are an integral aspect of risk perceptions and emotional engagement with the issue (Reser et al., 2014). People often draw on their personal experiences with extreme weather to make inferences about the reality of climate change (McDonald et al., 2015). Exposure to extreme events like flooding and hurricanes can heighten negative feelings about climate change by making climate change feel more concrete and immediate (Bergquist et al., 2019; Myers et al., 2013; Spence et al., 2011). Through a process of experiential learning, negative emotions triggered by extreme weather experiences often become intuitively associated with climate change and can subsequently feed into the way people perceive climate risks (Marx et al., 2007).

Some studies suggest that extreme weather experiences may have a transient effect on climate change concern (Konisky et al., 2016), or no effect at all (Whitmarsh, 2008). Others indicate that individuals' values, pre-existing beliefs and subjective attribution of their experiences often moderate how extreme weather experiences shape responses to climate change (Bruine de Bruin et al., 2014; Ogunbode et al., 2017, 2019, 2020b). Like climate-related emotions, much of the research on extreme weather experiences and climate change engagement has focused on Global North contexts. In the current study, we explored how personal experiences of extreme weather, particularly flooding experiences, relate to climate anxiety. We chose to focus on flooding experiences because flooding is the most common weather-related disaster occurring around the world (CRED, 2015). Specifically, we hypothesized that:

**H1.** Prior flooding experience is positively associated with climate anxiety

### 1.2.2. Social norms

Drawing from the focus theory of normative conduct (Cialdini et al., 1991), there are two categories of social norms. The first is *descriptive* norms, which refers to a person's perception of what most people do in a given situation. The second is *injunctive* norms, which refers to perceptions of what behaviours important social referents (e.g., family, friends, colleagues or neighbours) approve or disapprove of in specific situations. People are more likely to enact adaptive behavioural responses to climate change when they perceive social norms to be supportive of such behaviour (van Valkengoed & Steg, 2019).

Social norms also seem to matter for climate change perceptions and emotions more broadly. For example, people report a greater sense of threat from climate change when they believe that important social referents are engaging in climate action or when they feel social pressure to personally act on climate change (van der Linden, 2014). Similarly,

people are more likely to express worry about climate change when close others, such as friends and family members, are perceived to also care about climate change (Goldberg, van der Linden, Leiserowitz, & Maibach, 2020). Uncertainty about the specific timing, location and effects of climate change impacts is said to be an element of climate anxiety (Clayton, 2021). We also know that people are more likely to use the behaviour of others as guidance on how to behave in situations that are novel, uncertain or ambiguous (Cialdini, 2001). Therefore, perceiving strong negative emotional responses to climate change among key social referents like friends and family members (descriptive norms) may foster feelings of climate anxiety by emphasizing the threat posed by climate change, or in other words providing social proof that strong negative emotional responses are an appropriate response to the threat. We hypothesized that:

**H2.** Perceived descriptive norms of negative emotional responses to climate change among key social referents are positively associated with climate anxiety

### 1.2.3. Media exposure

Scholars have speculated that rising rates of exposure to environmental information via the media may be leading to increased negative emotions and poor wellbeing (Stokols et al., 2009), but this speculation has yet to be supported with empirical evidence in the context of climate anxiety. More broadly, evidence for the effect of media exposure on climate change attitudes is mixed. A prior study observed no significant effect of information exposure on climate change perceptions among an indigenous community in Bolivia (Fernández-Llamazares et al., 2015). Another study showed that exposure to climate change-related media through the television predicted greater risk perceptions in India, but internet use showed a negative effect and newspaper use showed no effect (Thaker et al., 2017). Exposure to climate change-related media has also been positively linked with climate change concern in Japan (Sampei & Aoyagi-Usui, 2009). In Norway, exposure to the 2018 IPCC report on 1.5 °C global warming was found to be associated with heightened climate change concern, and most respondents in the study encountered the report through the media (Ogunbode et al., 2020a).

The mixed evidence for the effects of media exposure on attitudes toward climate change may be a result of the fact that most prior studies fail to explicitly account for differences in the content and valence of information conveyed to audiences by the media. Where the focus of research has explicitly been on media coverage of events that might be described as plausible impacts of climate change, particularly natural disasters, significant associations have consistently been found with intensified negative emotions (Houston, First, & Danforth, 2018; Pfefferbaum et al., 2014). This association is especially prominent for post-traumatic stress responses, but other reactions like distress and anxiety have also been reported (Pfefferbaum et al., 2014). Exposure to media coverage of climate change impacts like natural disasters may foster strong negative emotional reactions by feeding extremely negative appraisals of the risks posed to oneself or valued others by such impacts (Ehlers & Clark, 2000; Houston, Spialek, & First, 2018). Therefore, we hypothesized that:

**H3a.** Rate of exposure to information about climate change impacts in the media is positively associated with climate anxiety

In addition, we also considered the possibility that exposure to information that focuses on climate change solutions could reduce negative climate-related emotions. For example, previous research has found that people report reduced levels of distress when presented with optimistic information about progress in reducing global carbon emissions (Hornsey & Fielding, 2016). Thus, we hypothesized that:

**H3b.** Rate of exposure to information about climate change solutions in the media is inversely related to climate anxiety

Over and above the mere rate of exposure to climate-related media,

levels of attention to such information may also significantly predict the intensity of negative emotional responses. Media exposure and media attention are conceptually distinct and have unique relationships with specific media effects (Drew & Weaver, 2016). While media exposure refers to the quantity of media viewed or heard regarding a specific topic, media attention refers to the inclination to channel cognitive resources into processing the messages conveyed via these media (Lee & Cho, 2019). Some studies suggest that attention to media may be a better predictor of media effects than media exposure alone. For example, attention to news about social risks, like crime, has been shown to be more strongly predictive of risk judgements than self-reported media use (Slater & Rasinski, 2005). Similarly, attention to sustainability media has been shown to predict pro-environmental behaviour and green consumerism more strongly than exposure to sustainability media (Lee & Cho, 2019). Hence, we hypothesized that:

**H3c.** Attention to climate change-related media is positively associated with climate anxiety

The literature is unclear about how media exposure and media attention interact. Nonetheless, it is not possible to attend to information to which one is not exposed, and media exposure is unlikely to have any significant effects if there is little motivation to attend to or process the information conveyed. Consequently, we tested two exploratory hypotheses:

**H3d.** Attention to climate change-related media interacts with exposure to information about climate change impacts in predicting climate anxiety, whereby exposure to information about climate change impacts has a stronger positive relationship climate anxiety when attention is high.

**H3e.** Attention to climate change-related media interacts with exposure to information about climate change solutions in predicting climate anxiety, whereby exposure to information about climate change solutions has a stronger inverse relationship with climate anxiety when attention is high.

### 1.3. Outcomes of climate anxiety: pro-environmental action and wellbeing

Some authors have suggested that climate anxiety often manifests itself as a form of 'practical anxiety' by engendering information-seeking and causing people to rethink their lifestyles and behaviour (Pihkala, 2020). Indeed, worry and anxiety about climate change have been linked with climate change policy support and pro-environmental behaviour (Bouman et al., 2020; Stanley et al., 2021; Wullenkord et al., 2021). However, it is important to distinguish between different categories of pro-environmental behaviours as different combinations of causal factors may be associated with each category. According to Stern (2000), environmentally-significant behaviours can be divided into four main categories: environmental activism (e.g., involvement in environmental protests or demonstrations), non-activist behaviours in the public sphere (e.g., petitioning on environmental issues), private-sphere behaviours (e.g., recycling and green consumerism) and behaviours in organisations (e.g., attendance to environmental criteria in decision-making and organisational practices). In the current study, we assessed how climate anxiety relates to private-sphere pro-environmental behaviours (henceforth termed pro-environmental behaviour) and engagement in environmental activism.

Importantly, climate anxiety may also have significant negative implications for mental wellbeing (Ojala et al., 2021). A growing number of studies show that climate anxiety is related to depressive symptoms, poor mental health, and lowered psychological wellbeing (Ogunbode et al., 2021; Reyes et al., 2021; Stanley et al., 2021; Wullenkord et al., 2021). The nature of the relationship between climate anxiety and wellbeing is complicated, and the largely correlational nature of the available evidence makes it difficult to ascertain the direction

of causal influence between the two factors. Climate anxiety can be expected to have a degree of correlation with poor mental wellbeing due to the shared element of negative affect (Ojala et al., 2021). By and large, a significant relationship has more commonly been found between climate anxiety and mental health or mental wellbeing when the measure of climate anxiety also includes indices of pathology or dysfunction (e.g., Clayton & Karazsia, 2020; Reyes et al., 2021). Studies that focus purely on negative climate emotions like worry have tended to find no meaningful relationships with mental health (Berry & Peel, 2015; Verplanken & Roy, 2013). Considering that climate change has become more acute in the time since these latter studies were published, we were interested in exploring how our emotionality-focused measure of climate anxiety relates to mental wellbeing. Therefore, we hypothesized that:

**H4a.** Climate anxiety is positively associated with pro-environmental behaviour

**H4b.** Climate anxiety is positively associated with engagement in environmental activism

**H5.** Climate anxiety is inversely related to mental wellbeing.

## 2. Method

### 2.1. Participants and procedure

We gathered data in 32 countries ( $N = 12,246$ ;  $M_{age} = 23.1$  years,  $SD_{age} = 7.0$  years, Women = 63.9%, Men = 32.7%) using a structured questionnaire. Data collection was conducted in 25 of the countries in autumn 2019 but continued in three countries (India, Palestine, and the United Arab Emirates) until late summer 2020, and a further four countries until spring 2022 (Colombia, Egypt, Oman and Turkey) due to interruption by the onset of the COVID-19 pandemic. The questionnaire was administered in paper-and-pencil format or online, depending on what was most practical in each country. In all countries, we recruited respondents from university research participant pools or through opportunity sampling of university students (See Supplementary Data Table 1 for a country-wise demographic breakdown of the sample). Participation in the study was strictly by voluntary consent. Rewards (e.g., course credit, entry into a raffle) were offered to participants in a few countries in accordance with local conventions. At the outset, we set a minimum target of  $N = 200$  participants for each country, but the final sample size was determined by the number of accessible voluntary participants.

The questionnaire was originally prepared in English and subsequently translated to other relevant languages using a system of translation-back-translation involving at least one bilingual speaker. Where a language was spoken in more than one country (e.g., Arabic, Spanish, Portuguese), the translators worked in cross-country teams to develop and check the translations before fielding the survey. Ethical approval for the study was granted by the De Montfort University Health and Life Sciences Faculty Research Ethics Committee (Ref: 3434), with supplementary approval also obtained in countries where this was required.

### 2.2. Measures

#### 2.2.1. Climate anxiety

We measured climate anxiety with a 7-item scale based on the state anxiety component of the State-Trait Anxiety Inventory (Spielberger, 1983). Participants were instructed to collect their thoughts and focus on their feelings regarding climate change. Subsequently, they were directed to indicate the degree to which they felt *calm, tense, relaxed, anxious, peaceful, worried or terrified* about climate change at that moment in time. Ratings for each emotion were recorded with a 5-point response scale ranging from 1 (not at all) to 5 (extremely) and scores for

**Table 1**  
Descriptive statistics and reliability indices for climate anxiety across countries.

Country	$\alpha$	M(SD)	% very or extremely “tense”	% very or extremely “anxious”	%very or extremely “worried”	% very or extremely “terrified”	N
1. Australia	.90	3.22 (.90)	25.2	30.6	44.9	14.0	314
2. Brazil	.91	3.76 (.91)	51.4	43.6	73.6	33.3	280
3. Canada	.88	3.12 (.78)	18.4	21.7	40.1	14.9	309
4. Chile	.83	3.31 (.74)	22.5	30.7	47.8	21.5	391
5. China	.89	2.86 (.81)	19.1	22.1	33.7	15.0	267
6. Colombia	.79	3.13 (.68)	16.4	19.5	47.1	17.6	159
7. Egypt	.69	2.96 (.66)	28.5	26.0	31.8	25.0	428
8. Finland	.92	3.26 (.96)	29.1	38.7	65.7	12.3	633
9. Germany	.87	3.39 (.84)	32.1	27.6	63.0	36.2	246
10. Italy	.89	3.41 (.73)	15.6	23.8	45.6	24.1	294
11. India	.81	3.12 (.76)	25.3	22.3	37.6	21.4	228
12. Indonesia	.84	3.32 (.68)	14.8	28.7	42.9	29.6	345
13. Iran	.86	3.32 (.84)	34.7	28.5	42.1	26.6	322
14. Japan	.73	3.05 (.65)	8.6	25.8	29.8	11.6	302
15. Malaysia	.86	3.06 (.71)	14.8	15.2	33.3	18.9	264
16. Netherlands	.88	3.20 (.78)	21.7	24.5	57.7	11.8	415
17. Nigeria	.71	2.84 (.73)	22.0	26.8	27.2	25.1	584
18. Norway	.87	3.09 (.81)	15.6	27.5	48.5	9.5	262
19. Oman	.65	2.78 (.63)	19.8	20.9	23.7	18.4	278
20. Pakistan	.81	3.03 (.80)	26.5	21.6	37.6	26.9	245
21. Palestine	.80	2.98 (.78)	21.6	28.2	26.0	19.7	360
22. Philippines	.85	3.55 (.73)	28.4	37.1	63.0	44.5	1418
23. Portugal	.87	3.43 (.77)	31.8	30.2	68.2	16.3	258
24. Romania	.86	2.90 (.84)	13.9	14.4	30.6	17.7	395
25. Russia	.75	2.71 (.62)	7.5	5.0	9.6	7.8	477
26. Slovakia	.83	3.00 (.77)	11.2	27.1	32.6	14.7	258
27. Spain	.86	3.66 (.72)	35.8	24.6	77.6	34.9	590
28. Tanzania	.75	2.91 (.72)	19.0	19.0	28.6	21.4	248
29. Turkey	.83	3.56 (.68)	38.7	50.0	49.0	23.0	418
30. Uganda	.84	3.18 (.87)	27.0	31.4	45.6	35.1	653
31. UAE	.87	3.33 (.90)	29.2	39.4	48.7	32.7	219
32. UK	.88	3.26 (.80)	20.3	29.2	44.1	15.4	370
Total	.85	3.21 (.82)	24.2	28.2	45.9	24.0	12,246

‘calm’, ‘relaxed’, and ‘peaceful’ were reversed prior to analysis. The scale showed a good level of reliability across countries with Cronbach’s alpha scores ranging from 0.71 to 0.92 (Table 1).

### 2.2.2. Flooding experience

Past experience with flooding was measured with an item adopted from van der Linden (2014). Participants were asked to indicate how often they had experienced (a) flooding in their local area over the last five years. Responses were recorded on a 5-point scale ranging from

“never” to “more than 3 times”. Scores were subsequently truncated to create 3 categories (0 = no flood experience, 1 = experienced flooding once or twice, 2 = experienced flooding 3 times or more). Respondents who indicated that they could not remember if they had experienced any such event were coded as missing.

2.2.3. Descriptive norms

We measured descriptive norms regarding negative emotional responses to climate change with four items (e.g., “most people close to me are worried about the future effects of climate change”, “most people close to me express feelings of distress when talking about climate change”). These items were combined to obtain an aggregate indicator of perceived descriptive norms ( $\alpha$  range = 0.63–0.84) that surpassed the conventional reliability threshold ( $\alpha = 0.70$ ; Nunnally, 1970) in all but a very small minority of countries. A country-wise breakdown of the reliability indices for the perceived descriptive norms measure is provided as supplementary data (Supplementary Table 2).

2.2.4. Media exposure and attention

We asked participants to indicate the frequency at which they read or hear about climate change *impacts* and climate change *solutions*. Responses to these questions were recorded using the 9-point response scale ranging from “Never” to “More than 10 times per day”. We also asked participants to indicate the amount of *attention* they pay to climate change-related information on a 4-point scale ranging from ‘none’ to ‘a lot’ (Slater & Rasinski, 2005). Descriptive statistics for these measures are presented in Supplementary Table 3.

2.2.5. Pro-environmental behaviour and environmental activism

Pro-environmental behaviour was measured with a multi-item index of sustainable consumption behaviours adapted from Ojala (2012). Participants were asked to indicate how often they engage in each of

eight pro-environmental behaviours: (1) cycle or walk instead of driving, (2) restrain oneself from buying unneeded new clothes, (3) choose not to fly, (4) try to influence family and friends to act pro-environmentally, (5) save energy in the household, (6) take public transportation instead of the car, (7) avoid food waste, and (8) make climate-friendly food choices. Responses to these items were rated between “1 = almost never” and “5 = almost always”. The aggregated scale surpassed the conventional reliability threshold ( $\alpha = 0.70$ ) in 24 out of 32 countries ( $\alpha$  range = 0.56–0.85).

We also measured environmental activism by asking participants if they had attended a climate protest at any point in the past year up till the time of data collection. Responses to this question were coded as “No” = 0 and “Yes” = 1. A small minority (13.4%) of the total sample indicated that they had attended a climate protest (Table 2).

2.2.6. Mental wellbeing

We measured mental wellbeing using the WHO-5 wellbeing index (WHO, 1998). The scale includes 5 items in which participants are asked to rate how often over the preceding two weeks: (1) they have felt cheerful and in good spirits, (2) they have felt calm and relaxed, (3) they have felt active and vigorous, (4) they woke up feeling fresh and rested, and (5) their life has been filled with things that interest them. Responses to these questions are recorded on a 6-point scale ranging from 0 (At no time) to 5 (All of the time). The scale items were aggregated to form a reliable measure across all the countries ( $\alpha$  range = 0.71–0.89). Country-wise descriptive statistics for mental wellbeing are presented in Table 2.

2.3. Analysis

Due to the nested nature of the data (individuals within countries), we tested our hypotheses with hierarchical linear models using the R

**Table 2**  
Descriptive statistics and reliability indices for pro-environmental behaviour, environmental activism, and mental wellbeing across countries.

Country	Pro-environmental behaviour		Attended climate protest		WHO-5 wellbeing index		N
	$\alpha$	M(SD)	%Yes	$\alpha$	M(SD)		
1. Australia	.85	3.01 (0.87)	9.2	.89	2.72 (1.00)	314	
2. Brazil	.78	3.39 (0.81)	15.0	.86	2.37 (1.01)	280	
3. Canada	.81	2.99 (0.80)	5.8	.86	2.59 (0.99)	309	
4. Chile	.69	3.35 (0.74)	21.0	.85	2.63 (0.96)	391	
5. China	.79	3.54 (0.72)	0.4	.87	2.59 (0.86)	267	
6. Colombia	.70	3.45 (0.73)	10.7	.86	2.83 (0.97)	159	
7. Egypt	.68	3.31 (0.68)	11.4	.75	2.57 (1.05)	428	
8. Finland	.84	3.85 (0.76)	31.4	.82	2.73 (0.82)	633	
9. Germany	.79	3.48 (0.77)	28.5	.71	2.67 (0.79)	246	
10. Italy	.72	3.39 (0.70)	23.5	.80	2.44 (0.80)	294	
11. India	.72	3.57 (0.68)	19.7	.81	3.17 (0.98)	228	
12. Indonesia	.56	3.33 (0.53)	7.8	.82	2.65 (0.82)	345	
13. Iran	.69	3.37 (0.68)	5.3	.89	2.59 (1.17)	322	
14. Japan	.60	2.53 (0.66)	2.0	.81	2.86 (1.00)	302	
15. Malaysia	.75	3.22 (0.66)	5.3	.87	2.90 (0.90)	264	
16. Netherlands	.82	3.73 (0.75)	35.3	.85	2.80 (0.88)	415	
17. Nigeria	.72	3.07 (0.72)	10.3	.77	3.19 (0.93)	584	
18. Norway	.81	3.61 (0.75)	23.3	.79	2.90 (0.85)	262	
19. Oman	.65	2.87 (0.59)	16.5	.81	2.89 (0.98)	278	
20. Pakistan	.61	3.14 (0.64)	18.4	.75	2.59 (1.02)	245	
21. Palestine	.74	3.06 (0.71)	6.8	.75	2.94 (0.99)	360	
22. Philippines	.70	3.67 (0.63)	5.1	.85	2.65 (0.93)	1418	
23. Portugal	.72	3.52 (0.71)	13.6	.88	2.72 (0.97)	258	
24. Romania	.76	2.94 (0.78)	3.0	.80	2.85 (0.86)	395	
25. Russia	.69	3.43 (0.75)	7.8	.80	3.04 (0.89)	477	
26. Slovakia	.71	3.23 (0.74)	2.7	.78	2.47 (0.79)	258	
27. Spain	.70	3.79 (0.66)	32.0	.80	2.57 (0.80)	590	
28. Tanzania	.69	3.55 (0.69)	25.4	.76	3.42 (0.95)	248	
29. Turkey	.73	3.53 (0.70)	8.4	.82	2.27 (0.93)	418	
30. Uganda	.73	3.55 (0.73)	11.6	.74	2.99 (0.95)	653	
31. UAE	.70	2.96 (0.67)	5.8	.83	2.47 (0.89)	219	
32. UK	.76	3.14 (0.75)	7.6	.84	2.48 (0.94)	370	
Total	.75	3.39 (0.77)	13.4	.82	2.71 (0.96)	12,246	

package lme4 for mixed effects models (Bates et al., 2014). Level 1 fixed effects for the model predicting climate anxiety were individual-level variables: flooding experience, descriptive norms, media exposure and attention, with country-level random intercepts added. For models predicting pro-environmental behaviour, activism and mental wellbeing, climate anxiety was included as a Level 1 predictor. In the first step of model-building, we estimated unconstrained models for each dependent variable with no predictors. These models showed that the grouping factor (country), explained approximately 8% variance in mental wellbeing, 10% variance in negative climate-related emotions, 15% variance in pro-environmental behaviour, and 21% variance in environmental activism. This demonstrates a significant clustering effect in the data.

Additionally, the analysis accounted for potential cross-national variation in how climate anxiety relates to the behavioural and well-being outcomes. Therefore, we estimated a model containing Level 1 predictors and random country-level intercepts only for each outcome variable (pro-environmental behaviour, environmental activism, and mental wellbeing) and compared that with another model containing the Level 1 predictors, random country-level intercepts and random slopes for climate anxiety using a likelihood ratio test. The results of the model with random slopes for climate anxiety is reported where the likelihood ratio test shows that this model had a better fit to the data. Predictor variables were grand mean-centred prior to analysis and missing values were addressed with listwise deletion. The analyses controlled for participants' age and gender.

### 3. Results

#### 3.1. Preliminary observations

A considerable proportion of participants reported strong negative emotional responses to climate change, but there was notable variation between countries (Table 1). The highest proportion of participants indicating that they were 'very' or 'extremely' worried about climate change was recorded in Spain (77.6%) and the lowest proportion was recorded in Russia (9.6%). The average proportion of participants indicating that they were 'very' or 'extremely' worried about climate change across the total sample was 46.8%. As the samples are not nationally-representative, these observations do not necessarily reflect broader patterns of feeling about climate change in each country. Rather, they are presented here to illustrate the particular profile of individuals that volunteered to participate in the study.

#### 3.2. Predictors of climate anxiety

##### 3.2.1. Flooding experience

Our hypothesis (H1) was contradicted by the data (Table 3). We observed that prior experience of flooding in five years prior to the time of data collection did not significantly predict climate anxiety; irrespective of whether flooding had been experienced only one or two times ( $B = 0.003$ ,  $SE = 0.019$ ,  $p = .867$ ,  $CI: -0.034, 0.040$ ), or three times and more ( $B = -0.035$ ,  $SE = 0.018$ ,  $p = .051$ ,  $CI: -0.070, 0.000$ ).

##### 3.2.2. Descriptive norms

Our hypothesis (H2) was supported as we found a significant relationship between climate anxiety and perceived descriptive norms ( $B = .230$ ,  $SE = 0.009$ ,  $p < .001$ ,  $CI: 0.213, 0.247$ ). This means that the degree of climate anxiety expressed by participants in the study was significantly associated with the extent to which they observed other people around them expressing negative feelings about climate change.

##### 3.2.3. Media exposure

In line with our hypothesis (H3a), climate anxiety was significantly related to the rate of exposure to media information about climate change impacts ( $B = 0.032$ ,  $SE = 0.005$ ,  $p < .001$ ,  $CI = 0.022, 0.041$ ).

**Table 3**  
Predictors of climate anxiety.

Predictors	Estimates	95%CI (UL, CL)	<i>p</i>
(Intercept)	3.22	3.14, 3.30	<.001
<i>Flooding Exp.</i> (ref = no exp)			
Once or twice	.00	-.03, .04	.867
3 times or more	-.03	-.07, -.00	.051
<i>Media exposure</i>			
CC Impact	.04	.03, .05	<.001
CC Solution	.00	-.01, .01	.389
Attention	.12	.10, .14	<.001
CC Impact x Attention	.01	-.00, .02	.108
CC Solution x Attention	-.01	-.02, .00	.260
Descriptive norms	.23	.21, .25	<.001
<i>Demographic covariates</i>			
Age	-.00	-.01, -.00	<.001
Gender (Female)	.22	.19, .25	<.001
<b>Random effects</b>			
$\sigma^2$	.52		
$\tau_{00}$ Country	.05		
ICC	.09		
<i>N</i> Country	32		
Observations	11,461		
Marginal $R^2$ /Conditional $R^2$	.13/.21		

However, we found no significant association between climate anxiety and rate of exposure to information about climate change solutions in the media ( $B = 0.001$ ,  $SE = 0.005$ ,  $p = .895$ ,  $CI: -0.009, 0.010$ ); meaning that our hypothesis (H3b) was not supported.

In support of our hypothesis (H3c), we observed a significant association between climate anxiety and attention to climate change information ( $B = 0.120$ ,  $SE = 0.010$ ,  $p < .001$ ,  $CI: 0.102, 0.139$ ). Yet, attention did not significantly interact with rate of exposure to information about climate impacts ( $B = 0.009$ ,  $SE = 0.005$ ,  $p = .108$ ,  $CI: -0.002, 0.019$ ) or rate of exposure to information about climate change solutions ( $B = -0.006$ ,  $SE = 0.005$ ,  $p = .260$ ,  $CI: -0.016, 0.004$ ). This means that our hypotheses (H3d) and (H3e) were not supported by the data.

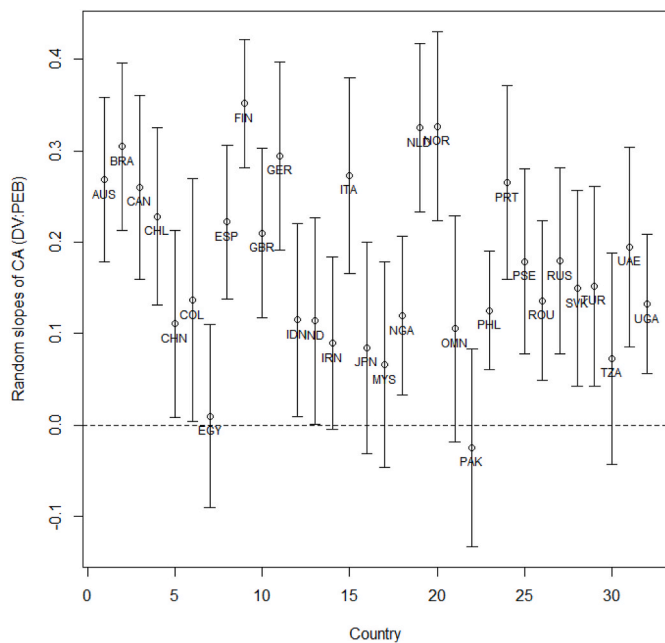
These results provide some support for the idea that the effect of media exposure on climate anxiety is at least partly subject to the content of the information. In this case, information about climate change impacts appears to be a more important predictor of climate anxiety than information about climate change solutions.

#### 3.3. Climate anxiety as a predictor of pro-environmental behaviour, environmental activism and mental wellbeing

Overall, climate anxiety showed a significant positive relationship with pro-environmental behaviour (H4a:  $B = 0.174$ ,  $SE = 0.021$ ,  $p < .001$ ,  $CI: 0.132, 0.216$ ) and with environmental activism (H4b:  $B = 0.250$ ,  $SE = 0.080$ ,  $p = .002$ ,  $CI: 0.083, 0.407$ ) – which was represented by participation in climate protests (Table 4). A likelihood ratio test showed that adding random slopes for negative climate-related emotions to the model predicting pro-environmental behaviour produced a significantly better fit to the data than a model with only random intercepts ( $\chi^2 = 100.82$ ,  $p < .001$ ). This means that the relationship between climate anxiety and pro-environmental behaviour varies significantly across countries. Inspecting the plot of random slopes across countries (Fig. 1) shows that climate anxiety had a significant positive relationship with pro-environmental behaviour in all countries except Egypt, Iran, Japan, Malaysia, Oman, Pakistan, and Tanzania – meaning that the hypothesis (H4a) was supported in 25 out of 32

**Table 4**  
Pro-environmental actions and mental wellbeing regressed on climate anxiety.

Predictors	DV: Pro-environmental behaviour			DV: Environmental activism			DV: Mental wellbeing (WHO-5)		
	Estimate	95%CI (UL, CL)	p	Odds ratio	95%CI (UL, CL)	p	Estimate	95%CI (UL, CL)	p
(Intercept)	3.36	3.23, 3.42	<.001	0.11	.08, .16	<.001	2.70	2.62, 2.78	<.001
Climate anxiety	.17	.13, .21	<.001	1.28	1.10, 1.50	.002	-.24	-.28, -.20	<.001
<i>Demographic covariates</i>									
Age	.00	-.00, .00	.069	1.01	1.00, 1.02	.039	.01	.00, .01	<.001
Gender (Female)	.05	.02, .08	.001	.95	.83, 1.08	.414	-.09	-.13, -.06	<.001
<i>Random effects</i>									
$\sigma^2$	.48			3.29			.81		
$\tau_{00}$ Country	.08			.77			.06		
$\tau_{11}$ Country.CA	.01			.13			.01		
ICC	.15			.20			.07		
$\rho_{01}$ Country	.24			.62			.40		
N Country	32			32			32		
Observations	11,503			11,485			11,503		
Marginal R <sup>2</sup> /Conditional R <sup>2</sup>	.04/.18			.01/.21			.05/.12		

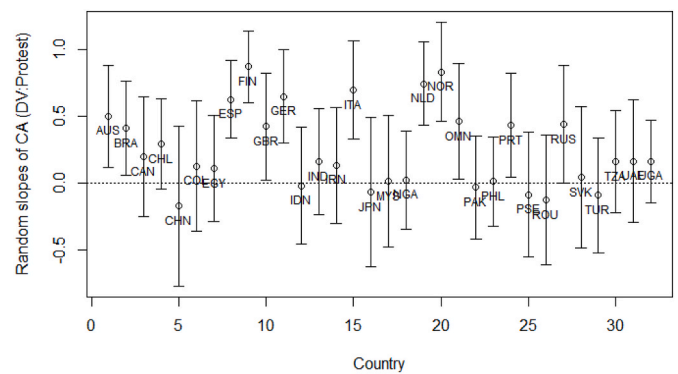


**Fig. 1.** Random slopes of climate anxiety (CA) as a predictor of pro-environmental behaviour (PEB). Countries are identified by their three-letter alpha-3 country codes. Confidence intervals crossing zero indicates a non-significant relationship between CA and PEB in the specified country.

countries. The weakest association between climate anxiety and pro-environmental behaviour was observed in Pakistan and the strongest association was observed in Finland.

Like pro-environmental behaviour, we found that adding random slopes for climate anxiety to the model predicting environmental activism showed a better fit to the data than a model only comprising random intercepts ( $\chi^2 = 58.36, p < .001$ ), which again suggests that the relationship between climate anxiety and engagement in environmental activism varies significantly across countries. Inspecting the plot of random slopes across countries (Fig. 2) revealed that climate anxiety only significantly predicted engagement in environmental activism in 12 countries (Australia, Brazil, Finland, Germany, Italy, Netherlands, Norway, Oman, Portugal, Russia, Spain, and the UK). The weakest association between climate anxiety and engagement in environmental activism was observed in China, while the strongest association was observed in Finland.

Finally, in support of our hypothesis (H5), we found that climate



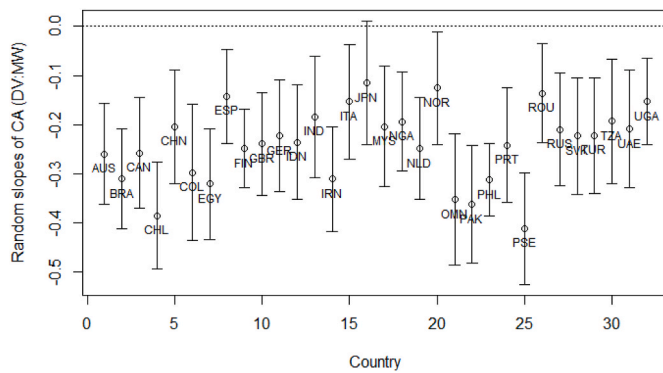
**Fig. 2.** Random slopes of climate anxiety (CA) as a predictor of environmental activism (participation in climate protests). Countries are identified by their three-letter alpha-3 country codes. Confidence intervals crossing zero indicates a non-significant relationship between CA and environmental activism in the specified country.

anxiety had a significant inverse relationship with mental wellbeing ( $B = -.240, SE = 0.020, p < .001, CI: -.281, -.199$ ). However, adding random slopes for climate anxiety also fit the data better than only having random intercepts in the model predicting mental wellbeing ( $\chi^2 = 33.02, p < .001$ ). This suggests that the relationship between climate anxiety and mental wellbeing varies across countries. Inspecting the random slopes plot showed that the relationship between climate anxiety and mental wellbeing was significant in every country represented in the dataset except Japan. The magnitude of the relationship also varied significantly across countries – with the strongest association between climate anxiety and mental wellbeing observed in Palestine and the weakest observed in Japan (Fig. 3).

### 3.4. Supplementary analyses

We conducted some further analyses to explore potential explanations for the country-level differences in associations of climate anxiety with pro-environmental actions and mental wellbeing. Previous research has shown that cultural orientations have a significant role in the relationship between environmental concern and pro-environmental behaviours such that concern is more strongly linked to pro-environmental behaviour in societies with higher levels of individualism (Tam & Chan, 2017). Therefore, we expected that cross-national differences in individualism-collectivism may be significantly linked to the relationship between climate anxiety and pro-environmental action. We did not have any expectations for how individualism-collectivism





**Fig. 3.** Random slopes of climate anxiety (CA) as a predictor of mental wellbeing (MW). Countries are identified by their three-letter alpha-3 country codes. Confidence intervals crossing zero indicates a non-significant relationship between CA and environmental activism in the specified country.

affect the relationship between climate anxiety and mental health. To explore this, we computed partial correlations of climate anxiety with pro-environmental behaviour, activism and mental wellbeing for each country while controlling for participant age and gender. Next, we plotted these correlations estimates against the individualism-collectivism scores for each country in the dataset (Fig. 4). We found that individualism was positively correlated with the strength of the relationship between climate anxiety and pro-environmental behaviour across countries ( $r = .54, p < .001, N = 29$ ), as well as the relationship between climate anxiety and climate activism ( $r = .59, p < .001, N = 29$ ). However, individualism was not significantly correlated with the relationship of climate anxiety to mental health at the country level ( $r = .05, p = .775, N = 29$ ). These results suggest that climate anxiety tends to be more strongly associated with pro-environmental behaviour and climate activism in countries with higher levels of individualism.

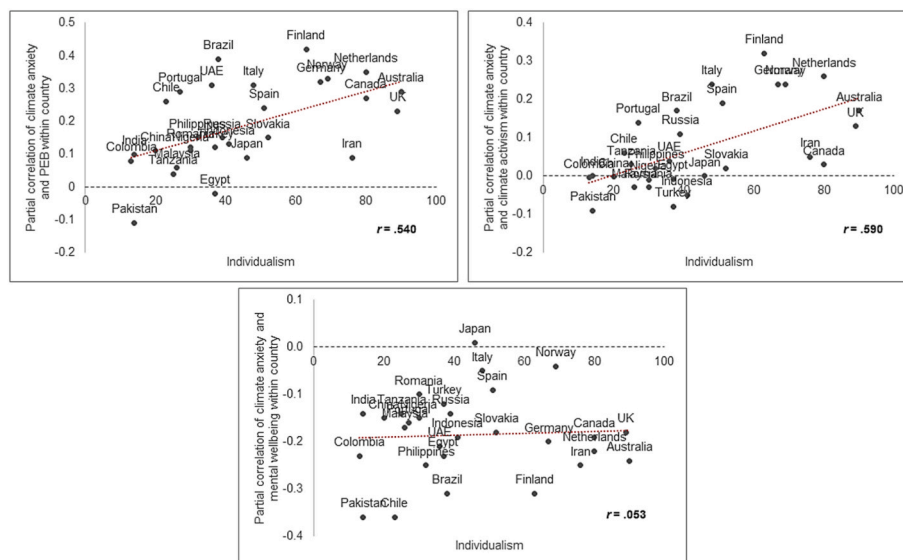
Next, we explored a potential role of national level affluence (Fig. 5). Recent research by Pohjolainen et al. (2021) shows that concern about climate change is more strongly associated with climate policy support and personal climate actions in European countries with higher gross domestic product (GDP). Consequently, we anticipated that GDP may also show significant correlations with the association of climate anxiety

with pro-environmental behaviour and engagement in climate activism. Our data showed that GDP is positively correlated with the relationship of climate anxiety to pro-environmental behaviour ( $r = .59, p < .001, N = 31$ ), as well as the relationship of climate anxiety to climate activism ( $r = 0.53, p < .001, N = 31$ ). There was however no significant correlation of GDP with the relationship between climate anxiety and mental health at the country level ( $r = 0.10, p = .600, N = 31$ ).

Finally, a plausible role of physical conditions, specifically vulnerability to climate risk as reflected in the climate risk index (CRI) developed by GermanWatch (Eckstein et al., 2019), was explored (Fig. 6). The CRI indicates a country’s level of exposure and vulnerability to extreme events. It is based on four indicators: number of deaths due to extreme events, number of deaths per 100,000 inhabitants, sum of losses in \$US purchasing power parity (PPP), and losses per unit of GDP. The CRI values used in this study reflect an average of vulnerability estimates for two decades (2000–2019) leading up to the start of data collection. We found that the CRI did not significantly correlate with the association of climate anxiety and pro-environmental behaviour ( $r = .05, p = .768, N = 31$ ), climate anxiety and engagement in climate activism ( $r = 0.05, p = .768, N = 31$ ), or climate anxiety and mental wellbeing ( $r = 0.05, p = .782, N = 31$ ). These results suggest that exposure to objective climate change impacts may not necessarily have a strong role in shaping how emotional responses to climate change relate to behavioural and wellbeing outcomes.

#### 4. Discussion

Emotions shape the way we process information and determine appropriate courses of action. They are consequently an integral element of how we engage with climate change (Davidson & Kecinski, 2021). The number of people reporting psychological distress about the climate crisis has been rising in tandem with the growing visibility of adverse climate change impacts around the world. In this study, we explored plausible antecedents and outcomes of such emotional responses across a diverse range of national contexts. Specifically, we examined if and how climate anxiety relates to personal experience of flooding, perceived descriptive norms and exposure to climate change-related media. We also explored how climate anxiety relates to pro-environmental behaviour, environmental activism and mental wellbeing.



**Fig. 4.** Association between individualism and magnitude of partial correlation between climate anxiety, pro-environmental actions and mental wellbeing. Individualism scores were obtained from [www.hofstede-insights.com](http://www.hofstede-insights.com). Oman, Palestine and Uganda were not included in this set of analyses due to a lack of individualism data.

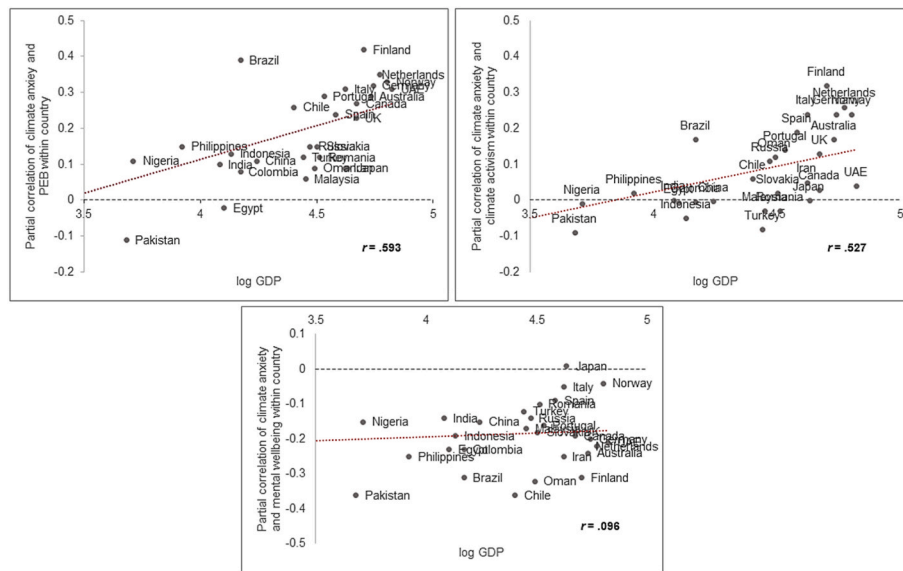


Fig. 5. Association between gross domestic product (GDP) and magnitude of partial correlation between climate anxiety, pro-environmental actions and mental wellbeing. GDP estimates were obtained from <https://data.worldbank.org> and are in 2020 INT\$. Due to unavailable GDP estimates for the territory, Palestine is not included in this set of analyses.

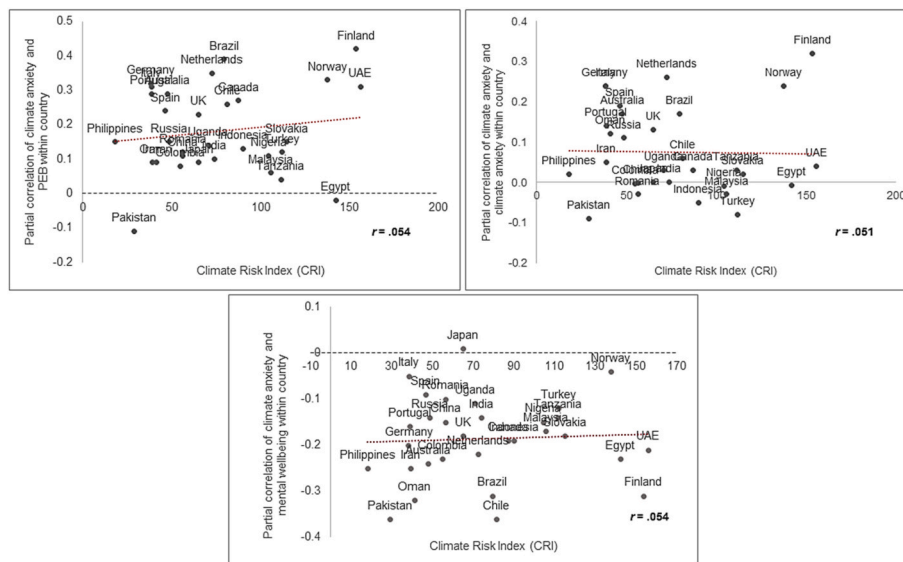


Fig. 6. Association between climate risk index (CRI) and magnitude of partial correlation between climate anxiety, pro-environmental actions and mental wellbeing. Due to unavailable CRI estimates for the territory, Palestine is not included in this set of analyses.

4.1. Implications

4.1.1. Personal experience

Contrary to previous findings (e.g., Bergquist et al., 2019; Spence et al., 2011; Zanocco et al., 2018), prior flooding experience did not predict climate anxiety. Considering that extreme weather experiences typically have a negative emotional valence, it is reasonable to expect them to be directly related with climate anxiety. Yet, there are important nuances in how people interpret their extreme weather experiences including politically-motivated biased cognition (Bruine de Bruin et al., 2014; Ogunbode et al., 2017), and the fact that climate change is only one of several interpretive lenses with which people can choose to make sense of their experiences (Reser et al., 2014). Further, the degree of distress evoked by extreme weather experiences is modulated by people’s ability to cope with adverse impacts (Ogunbode et al., 2019), which may in turn translate to the level of negative emotions they

express about climate change. In other words, the relationships we observed between flooding experience and climate anxiety in this study may be explained by any combination of the specific profile of political orientations, causal/sensemaking interpretive lenses, and coping capacities of the individuals represented in our sample. A more nuanced investigation of the flooding experience and climate anxiety relationship was beyond the scope of this study. Nonetheless, there is a need for more purposive inquiry into how extreme weather experiences shape emotional responses to climate change using culturally-diverse samples to determine which findings broadly generalise (Sisco, 2021).

4.1.2. Social norms

The current study also generated an important finding regarding the role of perceived descriptive norms as a predictor of climate anxiety. We found that climate anxiety is positively related to belief that significant others are also anxious or distressed about climate change. Much focus

has been directed at establishing the rationality of negative emotional responses to climate change (Verplanken et al., 2020; Verplanken & Roy, 2013), but it is also important to understand the experience and expression of climate anxiety as a normative phenomenon.

Research suggests that climate anxiety is especially prevalent among young people (Clayton & Karazsia, 2020; Hickman et al., 2021). It seems plausible that this trend is at least partly driven by normative processes whereby the expression of strong negative emotions by key social referents signals to the individual that this is an appropriate response to the climate crisis. In other words, descriptive norms regarding the expression of negative climate emotions may serve to bolster the subjective rationality of personal feelings of climate anxiety.

#### 4.1.3. Media effects

The role of climate change awareness as a precursor for negative climate-related emotions underlies a previous speculation that the prevalence of negative eco-emotions relates to increasing access or exposure to information about climate change (Clayton, 2020; Reser & Swim, 2011; Stokols et al., 2009). However, this speculation has yet to be supported in the empirical literature. We argued that some of the inconsistencies in the literature may be due to inadequate account for the content of climate change-related media people are exposed to.

Here, we found that rates of exposure to information about climate change impacts had a significant relationship with climate anxiety, whereas exposure to information about climate change solutions did not show a significant relationship. We interpret this as an indication that the valence of new information about climate change impacts may be better matched to the pre-existing (negative) feelings people have about climate change (Bloodhart et al., 2019). In other words, impact-themed information may modulate people's anxieties about climate change more easily than solutions information which have a greater likelihood of being neutral or opposed in valence to people's existing emotions.

Interestingly, although attention to climate change media was also positively related to climate anxiety, it did not significantly interact with exposure to climate change impacts or solutions information. It seems unintuitive that information would have an impact on people's emotional responses irrespective of how much attention they pay to the information. Further research is needed to better address the relationship between climate media exposure and attention.

Given the cross-sectional design, the evidence from the current study is insufficient to establish the direction of causality between climate anxiety and attention to climate-related media. However, theory and empirical evidence suggest a potential reciprocal relationship whereby attention to information about climate change heightens negative emotions about the issue on one hand (e.g., Ogunbode et al., 2020), and negative emotions elevate attention to climate change information on the other (e.g., Yang & Kahlor, 2013).

#### 4.1.4. Climate anxiety as a predictor of pro-environmental action and wellbeing

Finally, this study provided a unique opportunity to compare how climate anxiety predicts different domains of environmentally-significant behaviour, and mental wellbeing in different countries. As expected, climate anxiety was, overall, positively related to private-sphere pro-environmental behaviours, including actions like saving energy at home, using public transportation, and avoiding food waste. This reflects the well-known role of negative emotions as motivation for action (Weber, 2006). Climate anxiety also positively predicted participation in climate protests – although this relationship was only present in 12 out of 32 countries. Further, the majority of countries in which a significant link was observed between climate anxiety and environmental activism were European, democratic, and relatively affluent.

Our supplementary analyses suggest that culture may play a role in explaining the cross-national variation in the association of climate anxiety with pro-environmental actions. In line with previous research on environmental concern (Tam & Chan, 2017), climate anxiety appears

to be more strongly linked with pro-environmental actions in more individualistic societies. Drawing from Eom et al. (2016), this is potentially the case because people in individualistic societies have a greater tendency to act on their personal convictions and preferences while people in collectivistic societies may be more inclined to simply comply with social norms.

Engagement in pro-environmental action is one of the most widely advocated strategies for alleviating climate anxiety (Baudon & Jachens, 2021), but our findings highlight the need to consider contextual barriers to channelling negative emotions into climate action. Feelings about climate change more readily translate to pro-environmental action among privileged groups, such as people with high socioeconomic status (Eom et al., 2018). Our data also shows that climate anxiety is more strongly related to pro-environmental actions in richer countries. In many parts of the world, particularly in countries of the Global South, people may be unable to engage in climate action due to facing financial or political barriers, having insufficient knowledge, or simply lacking opportunities (Deane, 2009; González-Hernández et al., 2019; Seth, 2021; Simpson et al., 2021), irrespective of how they feel about climate change.

Importantly, the barriers to climate action do not stop people's anxieties about the climate crisis from negatively impacting their mental wellbeing. As our data shows, climate anxiety had a significant inverse relationship with mental wellbeing in 31 out of the 32 countries we obtained data. There was some cross-national variation in the magnitude of the relationship between climate anxiety and mental wellbeing but this does not appear to be explained by individualism, country-level affluence or objective vulnerability to climate change impacts. Consequently, there remains a need for further investigation of factors that may shape the way climate anxiety affects people's wellbeing in different societies and social groups.

#### 4.2. Limitations

We cannot completely rule out a possibility that heightened negative emotional responses to climate change is simply a manifestation, rather than a cause, of compromised mental wellbeing (Ogunbode et al., 2021) as heightened worry can be symptomatic of a range of common mental health disorders (Hirsch & Mathews, 2012). Some authors have attempted to dissociate climate-specific worries from trait-like or dispositional pathological worrying by controlling for the extent to which research participants typically worry about other relevant issues like the world economy or 'personal issues' (e.g., Verplanken et al., 2020). It is unclear how strictly climate change is delineated from other worrying issues in public perception. For example, an individual can be worried about the likelihood of suffering severe impacts from flooding due to the poor quality of the housing they live in, while also being aware that climate change has increased the chances of severe flooding happening in their area. Can we dissociate their worry about poor housing (a personal issue) from their worry about climate change?

Given the prevalence of negative feelings about climate change observed in our data, we believe that this is unlikely to be explained in any major part by mere dispositional anxiety. A recent longitudinal study has also demonstrated a negative effect of climate change concern on psychological wellbeing among a national sample of New Zealanders over the course of a year (McBride et al., 2021). We therefore advocate an ethic of care in the deployment of emotive climate change engagement strategies. Climate change advocates have a responsibility to ensure that their efforts at promoting climate action do not end with activating people's emotions about climate change. Appropriate support must also be provided to minimise potential harmful effects of climate anxiety on people's wellbeing.

The cross-sectional nature of the current research precludes causal inferences about the relationships among the factors we investigated. Further research using experimental and/or longitudinal designs is needed to better establish the role of climate anxiety as a pathway for

indirect wellbeing impacts from climate change.

A further limitation pertains to the timing of data collection, which was unavoidably impacted by the COVID-19 pandemic. Data were gathered in 7 countries – Colombia, Egypt, India, Oman, Palestine, Turkey and the UAE under different circumstances than in the other countries where data collection was completed before the imposition of national lockdowns. Research continues to emerge showing the negative impact of the COVID-19 crisis on people's mental health and wellbeing around the world (Chen et al., 2021; Hossain et al., 2021; Singh et al., 2020). This raises a question about the degree to which the data from the 7 countries might reflect unusually elevated levels of anxiety or lower levels of mental wellbeing. Our analysis did not reveal any significant differences in the pattern of results obtained from the samples recruited before and after the onset of the pandemic. Further, the COVID-19 affected samples are only a small proportion of the overall dataset. Therefore, any impact of COVID-19 is unlikely to have significantly influenced the main findings of the study.

Lastly, our samples are not representative of the countries from which they were drawn. Due to our reliance on university research participant pools and opportunity sampling, the total sample over-represents female, young, educated individuals studying non-STEM subjects (See Supplementary Table 1), and possibly people with high engagement with climate change who self-selected into the study. While we controlled for the effects of gender and age in our analyses, it is still possible that the effects of climate anxiety manifests differently for the demographic sub-groups that are over-/under-represented in the study. Therefore, replication with representative national samples is needed to determine the degree to which our findings generalise more broadly.

## 5. Conclusion

This study is the most international investigation conducted to date on climate anxiety, its predictors, and how climate anxiety relates to pro-environmental action and mental wellbeing. We found that climate anxiety is related to the nature of information people receive through the media. Not the mere volume of media exposure, but the content of the information and the amount of attention people pay to it. Information about climate change impacts appears more strongly linked to climate anxiety than information about climate change solutions. Perceived descriptive norms about emotional responding to climate change also appear to have a role in determining how people experience climate anxiety.

Importantly, our data indicates that the way climate anxiety relates to pro-environmental action differs across countries. Significant relationships between climate anxiety and environmental activism in particular were largely confined to Western and relatively affluent countries. In contrast, climate anxiety had a significant inverse relationship with mental wellbeing in all but one of the countries represented; suggesting that climate anxiety can undermine mental wellbeing irrespective of where people live, and the social/political affordances enabled (or not) by country of residence.

Understanding of the inter-connections between climate change and mental wellbeing is at an early stage of development (Romeu, 2021). The current study provides an important foundation for a more global outlook on the significance of climate anxiety for pro-environmental action and wellbeing. Little systematic evidence currently exists regarding the wellbeing implications of climate-related emotions, especially in the Global South. However, as our data suggests, climate anxiety has broad international significance as a plausible challenge to mental wellbeing. Therefore, greater priority needs to be accorded to developing a correspondingly broad understanding of the scope, nature and distribution of wellbeing impacts potentially arising from negative climate-related emotions.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jenvp.2022.101887>.

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