Journal of Affective Disorders 364 (2024) 37–40

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Do neuroticism and efficacy beliefs moderate the relationship between climate change worry and mental wellbeing?

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ARTICLE INFO

Keywords:
Climate change
Worry
Neuroticism
Climate anxiety
Wellbeing

ABSTRACT

Background: Research on the nature and prevalence of phenomena like climate anxiety (or eco-anxiety) is increasing rapidly but there is little understanding of the conditions under which climate change worry becomes more or less likely to significantly impact mental wellbeing. Here, we considered two plausible moderators of the relationship between climate change worry and mental wellbeing: neuroticism and efficacy beliefs.
Methods: Analysis was conducted with survey data gathered in six European countries in autumn 2019. Participants were recruited from universities in the participating countries using opportunity sampling.
Results: We found that climate change worry is negatively related to mental wellbeing at any level of perceived efficacy. In contrast, climate change worry is only significantly related to mental wellbeing at low and average levels of neuroticism. High neuroticism appears to have a masking, rather than amplifying, role in the relationship between climate change worry and mental wellbeing.
Limitations: The cross-sectional design of the study precludes verification of causal relationships among variables. The brief measure of neuroticism employed also did not allow for nuanced analysis of how different facets of neuroticism contribute to the observed interaction with climate change worry. Findings cannot be indiscriminately generalised to less privileged groups facing the worst impacts of the climate crisis.
Conclusion: Our findings lend to a view that harmful impacts of climate change worry on mental wellbeing cannot simply be ascribed to dispositional traits like neuroticism. We advocate for interventions that tackle negative climate-related emotions as unique psychological stressors.

1. Background

Negative affect is one of the most important predictors of climate change risk perceptions and willingness to engage in mitigation behaviours (Xie et al., 2019). However, strong affective responses to climate change, like 'climate anxiety' (or 'eco-anxiety') also have potential for harmful impacts on wellbeing. Climate anxiety may arise from direct experiences of climate change effects or heightened awareness of the issue. Clayton (2021) indicates that climate anxiety can be triggered by grief about the loss of valued places, activities and traditions, or worry about the uncertain scope, timing and location of dangerous climate change impacts. International polls show high levels of climate change worry around the world (Leiserowitz et al., 2021). Climate anxiety has also been linked to various indices of poor mental

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https://doi.org/10.1016/j.jad.2024.08.018
Received 3 October 2023; Received in revised form 28 June 2024; Accepted 9 August 2024
Available online 10 August 2024

health in children and adults across a range of cultural contexts (Léger-Goodes et al., 2022; Reyes et al., 2021).

Although climate anxiety is often used to collectively describe various negative feelings that people have about climate change (Ogunbode et al., 2022), as well as the psychological impairments that are sometimes associated with these feelings (Clayton and Karazsia, 2020), this article focuses specifically on the link between climate change worry and mental wellbeing. Uncontrolled worry lies at the root of many anxiety disorders (Newman et al., 2013). Research shows that climate change worry is positively related to climate action and negatively related to psychological wellbeing (McBride et al., 2021; Ogunbode et al., 2022). Habitual worry about climate change is not considered to be inherently pathological (Verplanken and Roy, 2013), but little is known about the conditions under which climate change worry becomes more or less likely to negatively affect people's wellbeing. The current research explored how two factors, neuroticism and efficacy beliefs, may plausibly moderate the relationship between climate change worry and mental wellbeing.

1.1. Neuroticism, worry and mental wellbeing

A meta-analytic study by Soutter et al. (2020) found that openness, honesty-humility, agreeableness, conscientiousness and extraversion correlate positively with pro-environmental attitudes and behaviours. Rothermich et al. (2021) also found that openness is associated with climate change risk perception. However, there has been no indication of a link between neuroticism and attitudes toward climate change. This is surprising because neuroticism is characterised by frequent experiences of negative emotions and a pervasive perception of the world as a threatening or dangerous place (Barlow et al., 2014). Consequently, individuals with high neuroticism would be expected to also demonstrate strong negative emotional responses to climate change. Furthermore, neuroticism shows consistent positive associations with anxiety disorders, major depressive disorders, and panic disorders (Lyon et al., 2021). Various theoretical explanations have been proposed for the role of neuroticism as a predictor of common mental health disorders, among which the vulnerability model stands out as having received significant empirical support. This model argues that neuroticism can act as a direct causal factor in the onset of common mental health disorders or exacerbate the causal effects of other stressors (Ormel et al., 2013). The focus on neuroticism in this study is further justified by research showing that the generalised tendency for negative affect that characterises neuroticism also predicts a higher likelihood of mental disorder symptoms among people experiencing climate change distress (Nezlek and Cypryańska, 2024). Therefore, we hypothesized that:

H1: Neuroticism is positively related to climate change worry.

H2: Neuroticism moderates the relationship between climate change worry and mental wellbeing, whereby the negative relationship between climate change worry and mental wellbeing is stronger among people who are high on neuroticism.

1.2. Efficacy beliefs, worry and mental wellbeing

Negative emotions, like worry, can motivate action on climate change. However, for constructive action to occur, these feelings also need to be accompanied by belief in the efficacy of one's personal actions or the efficacy of actions taken together with others to address the issue (Bostrom et al., 2019). Low perceived efficacy can thwart the motivational influence of worry and increase the likelihood of negative impacts on mental wellbeing. Likewise, high perceived efficacy can mitigate against the negative impacts of worry on mental wellbeing by enabling worry to fulfil its motivational goal of preventing undesirable outcomes. This argument is supported by evidence from an international study showing that worry about COVID-19 risk was more strongly linked with diminished wellbeing among people who felt they had little or no control over their risk of contracting coronavirus (Howell et al., 2022). We therefore hypothesized that:

H3: Efficacy beliefs moderate the relationship between climate change worry and mental wellbeing, whereby the negative relationship between climate change worry and mental wellbeing is stronger among people with low perceived efficacy.

2. Method

2.1. Participants and procedure

We tested our hypotheses using survey data gathered across six European countries in autumn 2019 as part of a larger international study investigating media exposure, climate anxiety, and mental health. Participants ($N = 2452$) were recruited from voluntary research participant pools at universities in each country. The questionnaire used for the study was originally developed in English language before being translated into other languages by competent bilingual speakers using the translation-back-translation method. Participants completed the survey online.

The sample comprised participants from Finland ($N = 633$, $M_{age} = 26.9$ years, $SD_{age} = 7.1$, Female = 74 %), Italy ($N = 294$, $M_{age} = 21.5$ years, $SD_{age} = 2.5$, Female = 76 %), Netherlands ($N = 416$, $M_{age} = 24.2$ years, $SD_{age} = 6.0$, Female = 64 %), Norway ($N = 261$, $M_{age} = 24.0$ years, $SD_{age} = 4.7$, Female = 71 %), Portugal ($N = 258$, $M_{age} = 32.2$ years, $SD_{age} = 13.9$, Female = 74 %), and Spain ($N = 633$, $M_{age} = 23.7$ years, $SD_{age} = 6.2$, Female = 81 %). Ethics approval for the study was granted by the De Montfort University Health and Life Sciences Faculty Research Ethics Committee (ref: 3434).

2.2. Measures

Climate change worry was measured with a 5-item scale developed by Ojala (2012) to capture how worried people are about the negative consequences of climate change for themselves, people close to them, future generations, people in economically deprived countries, and animals/nature. Responses were recorded on a Likert scale (1 = Not at all, 5 = Very much). The scale showed good reliability in all six countries (see Supplementary data: Table S1).

Neuroticism was measured with two items from the Big Five Inventory 10-item (BFI-10) scale (Rammstedt and John, 2007). Participants were asked to rate their level agreement with two statements: "I see myself as someone who is relaxed, handles stress well" (reversed) and "I see myself as someone who gets nervous easily". Responses were recorded with a Likert scale (1 = Strongly disagree, 5 = Strongly agree). The scale showed acceptable reliability in all countries (Table S1).

Efficacy beliefs were measured with a six-item scale developed specifically for this study. The items captured personal (e.g., "Through my everyday behaviours, I can make an important contribution to mitigating climate change") and collective efficacy perceptions (e.g., "Through our own everyday behaviours, we as young people can make an important contribution to mitigating climate change"). Responses were recorded on a Likert scale (1 = Strongly disagree, 5 = Strongly agree). The scale showed a good level of reliability across countries (Table S1).

Mental wellbeing was measured with the World Health Organisation's 5-item wellbeing scale (WHO-5; Topp et al., 2015). The WHO-5 wellbeing scale captures the balance of general positive and negative affect and is argued to primarily be a measure of hedonic wellbeing. The scale showed good reliability in all countries surveyed (Table S1).

2.3. Analysis

We tested our hypotheses with multilevel modelling given the nested nature of the data (people in countries). All predictor variables were grand mean-centred prior to analysis. The R package, lme4 (Bates et al., 2014), was used to estimate linear multilevel regression models with

random intercepts for country.

3. Results

In support of our hypothesis (H1), neuroticism was positively related to climate change worry when controlling for age and gender (B = 0.10, SE = 0.02, $t = 6.53$, $p < .001$). We also observed a significant interaction between neuroticism and climate change worry as predictors of mental wellbeing (Table 1). However, contrary to expectation (H2), climate change worry did not have a significant relationship with mental wellbeing (B = −0.01, SE = 0.03, $t = -0.33$, $p = .740$) at high levels of neuroticism (mean + 1 SD), whereas climate change worry had a significant negative relationship with mental wellbeing (B = −0.09, SE = 0.02, $t = -4.12$, $p < .001$) at low levels of neuroticism (mean – 1 SD). Simple slopes analysis showed the slope of mental wellbeing regressed on climate change worry becomes non-significant at higher levels of neuroticism (Fig. 1). Efficacy beliefs had a significant positive relationship with mental wellbeing (Table 1). However, contrary to our hypothesis (H3), there was no significant interaction between climate change worry and efficacy beliefs in predicting mental wellbeing.

4. Discussion and conclusion

The aim of this study was to explore boundary conditions shaping when feelings of worry about the climate crisis may become more or less likely to impair people's mental wellbeing. We hypothesized that neuroticism and beliefs about one's efficacy to act on climate change operate as moderators of the relationship between climate change worry and mental wellbeing. Our findings showed no significant interaction between efficacy beliefs and climate change worry when predicting mental wellbeing. However, we found that climate change worry only has a significant negative relationship with mental wellbeing among people with low or average neuroticism. The relationship is non-significant among those with high neuroticism.

4.1. Implications

The observed interaction between climate change worry and neuroticism in this study was unexpected, but intuitive. It suggests that high neuroticism may have a masking rather than amplifying role in the relationship between climate change worry and mental wellbeing. In other words, the effects of climate change worry on mental wellbeing among people with high neuroticism may be obscured by a generally high susceptibility to negative emotionality, whereas these effects may be more pronounced among people with low neuroticism. Although neuroticism positively predicted climate change worry, an implication of our finding is that interventions that address the generalised anxiety

Table 1
Mental wellbeing regressed on neuroticism and efficacy beliefs.

Fixed effects	B (SE)	*t*	df	*p*
Intercept	2.68 (0.04)	75.76	5.61	<0.001
Climate change worry	−0.05 (0.02)	−2.64	1601.35	0.008
Neuroticism	−0.31 (0.02)	−18.15	2346.73	<0.001
Efficacy beliefs	0.11 (0.02)	6.59	2346.97	<0.001
Climate worry*Neuroticism	0.04 (0.02)	2.72	2346.31	0.007
Climate worry*Efficacy beliefs	−0.00 (0.01)	−0.37	2346.56	0.714
Age	0.03 (0.02)	1.54	1483.34	0.124
Gender (Female)	−0.01 (0.02)	−0.30	2345.02	0.763
Random effects				
σ2	0.59			
τ00 country	0.01			
ICC	0.01			
k	6			
N	2347			
Marginal R^2/Conditional R^2	0.17/0.17			

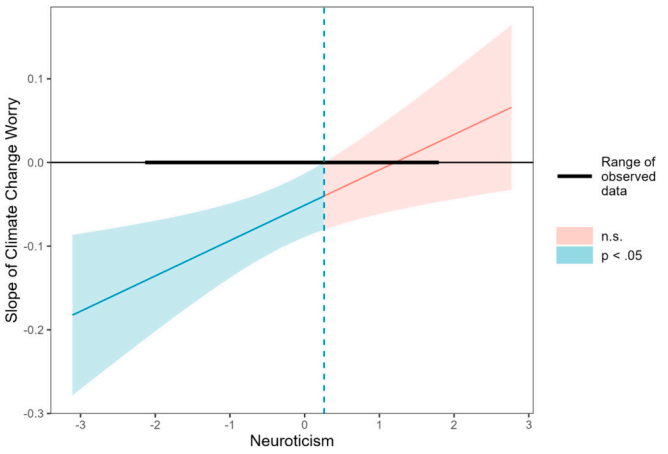

Fig. 1. Simple slope relating climate change worry to mental wellbeing at different values of neuroticism. The vertical dashed line indicates the value of neuroticism at which the relationship between climate change worry and mental wellbeing becomes non-significant and the shaded area indicates the 95 % confidence region.

that is commonly associated with neuroticism will not necessarily address the adverse effects of climate change worry on mental wellbeing. Relatedly, a recent review showed that interventions that help people process their emotional experiences regarding climate breakdown contribute effectively to building resilience and limiting distress (Baudon and Jachens, 2021).

Furthermore, we observed in this study that climate change worry shows a significant negative relationship with mental wellbeing irrespective of people's beliefs about the efficacy of their actions to address climate change. This observation aligns with previous indications of the importance of facilitating avenues for people to express and process their climate emotions (e.g., through group work) as a separate process from engaging people with individual or collective climate action. Interventions that encourage action as a way of reducing climate change worry or distress without enabling people to process their negative emotions are unlikely to be effective in the long term (Randall, 2009).

4.2. Limitations

We were unable to establish causal relationships between variables with the cross-sectional design of this study. Further research using longitudinal designs is necessary to fully establish the moderating role of neuroticism and efficacy beliefs in the link between climate change worry and mental wellbeing. Additionally, the two-item measure of neuroticism, while enabling a rough assessment of the general role played by neuroticism, does not allow nuanced analysis of neuroticism's different facets (e.g., anger-hostility, vulnerability, self-consciousness). The selection of instruments used in this study was constrained by a need to keep demand on participants' time and effort low during data collection. We recommend future replication of this study with more holistic measures like the revised Neuroticism-Extraversion-Openness Personality Inventory (NEO-PI-R; Costa and McCrae (2008)). Furthermore, findings from the current sample of Europeans, comprising mostly students with relatively high socioeconomic status, cannot be indiscriminately generalised to more vulnerable groups at the frontline of the climate crisis (e.g., people in developing countries).

4.3. Conclusion

Nonetheless, this study lends to an understanding that harmful effects on people's mental wellbeing arising from climate change worry cannot simply be ascribed to a function of dispositional traits like neuroticism. Heightened worry about the climate crisis is continually

validated by evidence of ongoing climate change impacts occurring around the world. We recommend that increased effort and resources be directed at identifying effective interventions to help people manage their negative emotional responses to climate change in ways that minimise harmful impacts on mental wellbeing.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2024.08.018.

Contributor statement

CAO conceived of the study. CAO, KSA, DAM, KvdB, RD, SL, JTM, GNC & JAS collected data for the study. CAO conducted the data analysis. CAO & GR prepared an initial draft of the manuscript. All authors contributed to editing of multiple drafts and approved the final submitted version of the manuscript.

Role of funding source

No funding was received for this research.

CRediT authorship contribution statement

Charles A. Ogunbode: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Visualization, Writing – original draft, Writing – review & editing. **Katariina Salmela-Aro:** Investigation, Methodology, Resources, Writing – review & editing. **Daniela Acquadro Maran:** Investigation, Methodology, Resources, Writing – review & editing. **Karlijn van den Broek:** Investigation, Methodology, Resources, Writing – review & editing. **Rouven Doran:** Investigation, Methodology, Resources, Writing – review & editing. **Samuel Lins:** Investigation, Methodology, Writing – review & editing. **Jorge Torres-Marín:** Investigation, Methodology, Writing – review & editing. **Ginés Navarro-Carrillo:** Investigation, Methodology, Resources, Writing – review & editing. **Giulia Rocchi:** Investigation, Writing – review & editing. **Julie Aitken Schermer:** Investigation, Methodology, Writing – review & editing.

Declaration of competing interest

None.

Acknowledgments

The authors are grateful to Daniel Hanss for devising the measure of efficacy beliefs used in the study, and to Kieran Lyon for helpful pointers on the neuroticism and wellbeing literature.

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