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Climate change news exposure, first and third-person effects, and eco-anxiety in the Chinese general population: a moderation model

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Abstract

Objective This study examines the relationship between exposure to climate change news and eco-anxiety in the Chinese general population, exploring the moderating effects of first-person effect (FPE) and third-person effect (TPE).

Methods Utilizing a non-representative sample of 1483 Chinese adults, we conducted an online survey assessing media consumption across traditional and digital platforms, FPE, TPE, and eco-anxiety. The survey included structured items measuring the frequency and impact of climate change news exposure, alongside scales for assessing eco-anxiety and perceptual biases (FPE and TPE).

Results Preliminary analyses indicate a significant correlation between higher exposure to climate change news and increased levels of eco-anxiety. Moderation analysis revealed that both FPE and TPE significantly influenced the relationship between news exposure and eco-anxiety, with FPE strengthening and TPE weakening this association.

Conclusion The findings suggest that the way individuals perceive the impact of climate change news—on themselves versus others—moderates the emotional response to such news. Specifically, those who perceive a greater personal impact (FPE) experience higher eco-anxiety, whereas those who perceive a greater impact on others (TPE) report lower anxiety levels. This study highlights the need for nuanced media communication strategies that consider these perceptual biases to manage public emotional responses to climate change effectively.

Keywords Climate change news, Eco-anxiety, First-person effect, Third-person effect, Media consumption

Introduction

Climate change is increasingly recognized as a multifaceted global challenge that necessitates innovative approaches to adaptation and mitigation [1]. This urgency has driven the development of various tools and methods aimed at fostering sustainable and affordable responses to climate fluctuations [2]. In the face of these challenges, public perception and behavioral responses play critical roles, influenced heavily by media exposure. As the global community grapples with these issues, the psychological impacts of climate change communication, particularly through media channels, emerge as pivotal areas of investigation [3]. This is especially pertinent in nations like China, where the scale of environmental change and the scope of media reach create a unique

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laboratory for studying the interconnections between media exposure, psychological impacts, and public reactions to climate change narratives.

Climate change represents one of the most pressing global challenges of our time, eliciting a wide range of public reactions and emotions, notably eco-anxiety—a form of distress caused by awareness of the looming environmental crises and their perceived threats to personal and communal futures [4]. As media play a pivotal role in disseminating information about climate change, understanding the psychological impact of media exposure on individuals becomes crucial. This is particularly significant in contexts like China, where rapid environmental changes and intense media coverage intersect with a large and diverse population [5].

Recent studies have emphasized the role of media in shaping perceptions through mechanisms known as the first-person effect (FPE) and third-person effect (TPE) [6]. The FPE occurs when individuals perceive media messages as having a greater impact on themselves than on others. At the same time, the TPE describes the opposite—perceiving greater media effects on others than on oneself [7]. These perceptual biases are not just academic constructs but have real-world implications, influencing individuals' readiness to engage in mitigation behaviors and their levels of anxiety related to environmental threats.

The interplay between these effects and eco-anxiety in the context of climate change news consumption has yet to be fully explored, especially within the Chinese general population [8, 9]. This study aims to fill this gap by examining how exposure to climate change news correlates with eco-anxiety and whether FPE and TPE moderate this relationship. We hypothesize that both FPE and TPE will moderate the relationship between news exposure and eco-anxiety, potentially offering insights into how different individuals process information and the emotional consequences of such processing.

This research employs a non-representative sample of the Chinese population to investigate these dynamics, incorporating a broad range of media consumption behaviors beyond traditional newspaper reading to include digital and social media platforms. By doing so, the study seeks to provide a more comprehensive understanding of the media's role in shaping public perceptions and emotional responses to climate change in one of the world's most populous and media-engaged societies.

Literature review

Eco-anxiety among Chinese population

As one of the world's largest emitters of greenhouse gases, China confronts significant environmental challenges due to climate change. Rising sea levels endanger major coastal cities, while increased drought, flooding, and extreme weather patterns threaten food and water security for millions [10]. Research indicates that awareness of these climatic shifts is not only a material concern but also a psychological burden, manifesting as eco-anxiety—a chronic fear of environmental doom [11].

Despite its large population and heightened vulnerability to climate impacts, the exploration of eco-anxiety among Chinese citizens remains sparse. However, the existing studies indicate that this phenomenon is widespread and influenced by specific cultural and social dynamics within China [12]. For instance, a study found significant levels of eco-anxiety among Chinese individuals, particularly among the younger and more educated demographics, who report feeling distressed about future environmental scenarios [13].

In China, traditional concepts that emphasize harmony between humans and nature, such as those derived from Taoist and Buddhist thought, may simultaneously exacerbate and alleviate eco-anxiety [14]. The emphasis on environmental stewardship within these philosophical frameworks could heighten fears concerning the disruption of this balance due to climate change. Conversely, cultural tendencies toward dialectical thinking might provide some Chinese with the psychological resilience to perceive environmental changes as part of natural cycles [15].

Urban air pollution, a significant issue in many Chinese cities, has been identified as a direct source of eco-anxiety, with individuals experiencing anger, hopelessness, and pessimism [16]. Empirical findings suggest that direct experiences of environmental degradation are significant predictors of anxiety levels, more so than merely an intellectual awareness of climate risks [5].

Moreover, concerns about resource insecurity, the burdens on future generations, and a perceived global responsibility are particularly acute among Chinese individuals grappling with eco-anxiety. With China's prominent economic and geopolitical role, many feel a moral obligation for the country to lead in environmental policies, while skepticism regarding governmental commitment exacerbates public anxiety [17].

In conclusion, while initial studies provide a glimpse into the nature of eco-anxiety in China, more extensive research is needed to understand its unique characteristics fully, moderating factors, and socio-cultural underpinnings. Given the significant threats posed by climate change to ecosystems, public health, and socio-economic stability in China, eco-anxiety is likely to increasingly influence environmental attitudes, policy preferences, and behavioral patterns among the Chinese populace. This body of literature highlights that eco-anxiety in China is driven not only by direct environmental

experiences but also by media consumption, which amplifies perceptions of environmental threats and personal vulnerability. To understand how media plays a role in shaping these perceptions, the relationship between media exposure and eco-anxiety must be explored, especially through the lens of perceptual biases such as first-person effects (FPE) and third-person effects (TPE).

Exposure to climate change news

China, as one of the world's largest producers of greenhouse gases, is increasingly recognizing climate change as a critical issue, reflected in its growing media attention [18]. Historically, the Chinese public's direct exposure to climate change news has been relatively lower compared to other environmental concerns such as air pollution [19].

Research from earlier periods suggested that public engagement with climate change media was minimal. Studies suggested that only about 20% of respondents paid close attention to climate change coverage in Chinese media. Perceptions of climate change influenced this lack of attention as a distant and abstract threat and distrust of official sources, which often downplayed the risks [20].

However, recent studies indicate a significant shift. Song et al. [21] found a notable difference in how climate change is presented in the media across different countries, including China, highlighting a more extensive coverage in recent years. Similarly, Günay et al. [22] explored how media in rapidly growing economies like China handle climate change narratives compared to developed and developing countries, suggesting a nuanced portrayal influenced by developmental priorities.

Moreover, Barkemeyer et al. [23] identified various contextual factors that influence climate-related media coverage, with Chinese media increasingly acknowledging the global nature of climate change. The role of social media in engaging the public has also become significant, as highlighted by Yang and colleagues [24], who observed an updated picture of climate change perceptions among Chinese urban residents, influenced heavily by media framings and increased media coverage.

Despite that, in 2015, Eberhardt [25] noted that a public sphere for open discourse on climate change in China is still constrained, with media often linking human activity and climate change without fostering substantial public engagement, some studies reported later changes [13, 26, 27].

The diversity and objectivity of climate information sources in China remain areas of concern. Government control is still prevalent, focusing narratives on national actions rather than global cooperation. However, this has been slowly changing, with the considerable influence of independent online sources and international pressures leading to a broader discourse.

While absolute exposure to climate change news is growing, significant limitations and disparities in access to comprehensive, high-quality information still temper potential impacts on public understanding and attitudes. Given that individuals' media consumption patterns can shape their perceptions of environmental threats and affect their emotional responses, media exposure serves as a key mechanism through which eco-anxiety is influenced. The literature on first-person and third-person effects [28] further explains how individuals' subjective perceptions of media effects can moderate the relationship between news consumption and anxiety. For example, individuals with strong first-person effects (FPE) may internalize media messages more deeply, amplifying their eco-anxiety, while those with third-person effects (TPE) may downplay the threat, potentially reducing their emotional distress [6]. Thus, the present study builds on this literature to investigate how FPE and TPE moderate the relationship between exposure to climate change news and eco-anxiety, providing a theoretical bridge between media exposure and its psychological impacts.

Third-person vs. first-person effect

The third-person effect (TPE) theory suggests that individuals often believe mass media messages have a greater impact on others than on themselves, a concept initially proposed by Davison [29]. Recent research has expanded to include the first-person effect (FPE), which posits the opposite: individuals perceive that they are more influenced by media than others [28]. Both effects are important when considering how individuals process threatening media content, such as climate change news. TPE may act as a psychological defense mechanism by projecting vulnerability onto others, while FPE may intensify personal distress when individuals perceive themselves as more affected.

Scholars have hypothesized that FPE may stem from ego-enhancement motives, where individuals see themselves as more discerning and receptive to positive information, in contrast to others perceived as more self-centered or indifferent [30, 31]. This distinction between self and others has led to the development of separate constructs for TPE and FPE perceptions: TPE occurs with negative information perceived to influence others more, whereas FPE occurs when positive information is deemed more influential to the self [32]. However, in the context of climate change news, which is often framed in negative and threatening ways, FPE may increase eco-anxiety when individuals internalize these threats and perceive them as personally relevant.

Studies have shown that positive media, such as public service announcements and environmental documentaries, often elicit an FPE, with individuals believing they are more affected than the general population [33, 34]. This inversion of TPE is attributed to individuals' desire to see themselves in a positive light and be more open to beneficial influences [31].

However, with negative and distressing topics like climate change, FPE may heighten anxiety as individuals see themselves as personally vulnerable. Conversely, TPE may provide a buffer by allowing individuals to attribute the impact to others, reducing their emotional engagement [35]. As de Vreese and Neijens [36] explain, media exposure is complex and often involves both direct encounters and subjective recall of impactful messages. In the context of climate change news, individuals with high FPE are likely to recall and internalize negative content more intensely. In contrast, individuals with high TPE may exhibit more emotional detachment. This difference highlights the importance of examining both effects as moderators of the relationship between media exposure and eco-anxiety. Despite being a newer area of study compared to TPE, FPE provides valuable insights into perceptual biases toward positive versus negative media impacts, specifically related to environmental information and climate change [37, 38]. Notably, recent research by Wei et al. [6] investigated the drivers of the FPE in green advertising and its behavioral outcomes, focusing solely on FPE without comparing it to TPE or considering their ratio differences. In the context of climate change news, exposure to repeated, often negative media coverage may intensify FPE, especially when individuals perceive personal consequences related to climate threats. By contrast, individuals with a stronger TPE may dissociate themselves from such impacts, attributing them to others. This difference highlights the importance of considering how both FPE and TPE interact across varying levels of exposure. Hence, the present study aims to test the moderating role of both TPE and FPE in the context of media exposure frequency and its psychological impacts, such as eco-anxiety related to climate change news.

Moderating role of third-person and first-person effects

Both the third-person effect (TPE) and the first-person effect (FPE) may play critical roles as moderators in the relationship between exposure to climate change news and the experience of eco-anxiety. The TPE suggests that individuals perceive mass media messages as having a greater impact on others than on themselves [39]. When applied to climate change news, individuals with a strong TPE might understate the personal relevance of such messages, assuming that others are more likely to experience heightened anxiety and distress. This can reduce their likelihood of experiencing eco-anxiety by fostering a psychological distancing effect [40].

Conversely, the FPE, which posits that individuals see themselves as more influenced by certain messages than others [28], could lead people to perceive themselves as more emotionally affected by climate coverage compared to others, who may be viewed as less sensitive. Frequent exposure to negative or threatening media content can reinforce this perception, making individuals more likely to experience eco-anxiety. As Huang [34] notes, high levels of media exposure to threatening news often trigger heightened FPE, amplifying distress and internalization of environmental concerns.

Theoretical evidence further suggests that individuals' subjective recall and perceived media effects, rather than purely objective exposure, play key roles in how eco-anxiety develops [36]. Those with strong FPE may recall negative environmental messages more vividly, leading to increased eco-anxiety, while TPE can serve as a buffer by reducing the perceived personal threat. However, at high levels of media exposure, even the protective effects of TPE may diminish, allowing for a net increase in eco-anxiety [35]. These perceptual biases regarding self-other media effects can significantly influence how exposure to climate news translates into eco-anxiety [41]. For instance, those with a pronounced TPE might experience a protective buffer against anxiety by minimizing the relevance of threatening climate information for themselves [40]. On the other hand, an FPE orientation might increase anxiety levels by causing individuals to internalize the implications of climate news more deeply [35].

Furthermore, complex interactions between TPE, FPE, and varying levels of media exposure could either cancel out or augment the effects on eco-anxiety [34]. High levels of media exposure are particularly important in this context, as they may lead to a point where even protective effects from TPE are diminished, resulting in a net increase in eco-anxiety. For example, high exposure to climate news might lead to a situation where TPE (which downplays personal effects) and FPE (which emphasizes personal effects) interact to either mitigate or exacerbate eco-anxiety depending on their relative strengths. Alternatively, these effects could initially buffer anxiety but then reverse at higher levels of media exposure.

Thus, the present study builds on this framework to test how FPE and TPE moderate the relationship between media exposure and eco-anxiety, reflecting the different pathways through which media content can either heighten or reduce anxiety.

Based on the previous revised literature, the present study is aimed to test the following hypotheses:

H1: There is a positive relationship between the frequency of exposure to climate change news and the level of eco-anxiety among participants.
H2: The relationship between exposure to climate change news and eco-anxiety is moderated by first-person effects, with higher FPE associated with higher eco-anxiety.
H3: The relationship between exposure to climate change news and eco-anxiety is moderated by third-person effects, with higher TPE associated with lower eco-anxiety.
H4: The interaction between first-person and third-person effects will significantly predict eco-anxiety, reflecting how differing perceptions of media effects shape emotional outcomes.

The full model of variables is depicted in Fig. 1.

Method

Participants

The present study was conducted on a non-representative sample of the Chinese general population, consisting of 1483 participants. The sample was predominantly female, with 69.5% of participants identifying as female and 30.5% as male. The age of participants ranged from 23 to 64 years, with a mean age of 41.47 years and a standard deviation of 10.799. The dataset contained a few missing values, with age data missing for 56 participants.

Participants were recruited primarily through WeChat and Weibo, two of the most widely used social media platforms in China. Given the digital recruitment strategy, the sample may reflect higher digital literacy and engagement with online news sources, which could influence media exposure and eco-anxiety levels. The sample was diverse in terms of education, employment, and professional background.

The majority of participants (82.5%) reported having university-level education. Other levels of education were less represented, with 6.2% having completed high school, 5.5% having vocational training, 4.9% reporting other forms of education, and 0.9% having only basic studies. In terms of employment status, a significant portion of the sample (70.0%) were employed as workers for others, making it the most common employment status. Students constituted 13.0% of the sample, while 8.6% were unemployed. Self-employed individuals made up 6.8%, and retirees accounted for 1.6%. The sample displayed a wide range of professions. The services sector was the most represented, comprising 26.8% of the participants. This was followed by individuals in the 'other' category (50.4%), which includes varied professions not classified under specific common categories. The healthcare sector had 9.4% representation, while the productive industry had 5.1%. Smaller proportions were seen in commerce/tourism (3.6%), finance/banking (1.8%), and technology/communications (0.9%). The food industry represented 2.0% of the sample. Regarding the reading of newspapers and various forms of digital and social media, half of the participants (50.3%) reported reading them infrequently (rated as one on the frequency scale), and 31.7% read them moderately frequently (rated as 2). Those who regularly engaged with overall media consumption (rated as 3 and 4) constituted 18.0% of the sample.

Procedure

The present research project was approved by the Institutional Ethical Committee of Jilin Engineering Normal University and conducted in accordance with the Helsinki Declaration and local ethical regulations. Participants were recruited using WeChat and Weibo, leveraging targeted social media advertisements and shared survey links. These platforms allowed for broad outreach, particularly among individuals with higher education levels and regular internet use, which may have influenced sample characteristics. Data collection was conducted

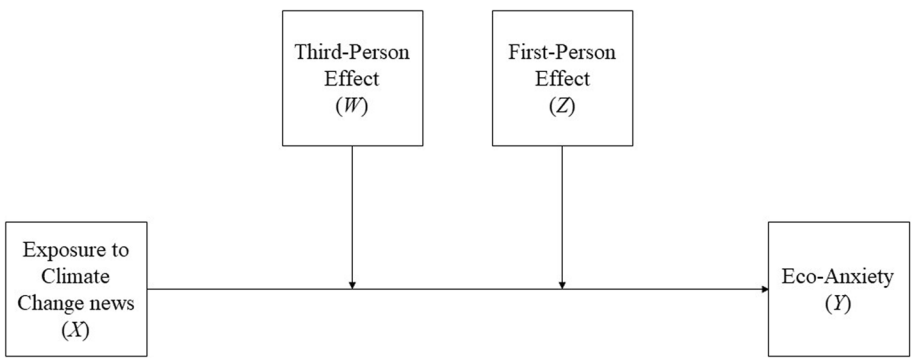

Fig. 1 Full conceptual model

through a structured online survey via Wenjuanxing (Questionnaire Star), a widely used Chinese survey platform. The survey was available for three months (January—March 2024) and included demographic questions on education, employment, and media consumption habits. The web-based survey was designed to ensure clarity, relevance, and ease of completion. The platform was chosen based on its user-friendliness, data security features, and compatibility with various devices, including smartphones, tablets, and computers. This ensured that participants could access the survey conveniently from their preferred devices. Informed consent was obtained from all individual participants included in the study. Participants were required to consent to the survey terms, which were clearly outlined at the beginning of the survey. This included information on the purpose of the study, the voluntary nature of participation, anonymity of responses, and how the data would be used. Once consent was obtained, participants proceeded to answer the questions. A support contact was provided within the survey so that participants could reach out if they encountered any problems or needed clarification on the survey questions.

Instruments

Exposure to climate change news

Following previous studies [42], the measure of Exposure to Climate Change News is designed to assess participants' interaction with and the nature of media coverage concerning climate change. In line with the evolving challenges in measuring media exposure highlighted by de Vreese and Neijens [36], we adopted a recall-based approach to capture meaningful engagement with media content. The complexities of today's fragmented media landscape, where exposure is often passive and difficult to quantify using behavioral frequency alone, necessitated this approach. Self-reports of media recall have been shown to reflect varying levels of exposure and attention, making them a widely used option in media effects research.

This measure comprises five items that evaluate various aspects of news consumption, using the following statements:

1. I recall reading a news article related to climate change in the past twelve months, either in print or digital media.
2. Some of the news articles I remember about climate change in recent months included the word "climate change" in their headlines.
3. Some of the news articles on climate change that I recall contained details in the text about the causes, effects, and implications of specific climate events.
4. Most of the news articles on climate change that I remember portray a negative impact on communities and environments.
5. Few of the news articles I recall depict positive actions or solutions related to combating climate change.

This recall-based approach allows for a nuanced understanding of how participants remember and process media content beyond merely encountering it. As de Vreese and Neijens [36] suggest, media recall can be an effective measure when detailed recall-based questions are used to account for varying attention levels and engagement with content. We recognize the inherent bias in self-reports, such as potential overestimation or underestimation of media exposure. Still, the recall framework minimizes this by capturing broader memory traces rather than strictly relying on frequency scales, which may be prone to inaccuracies in recall over extended periods.

The response type for the measure of Exposure to Climate Change News utilizes a Likert-type scale, which is commonly employed in surveys to gauge attitudes, perceptions, and behaviors. Each of the five items is answered on a 5-point scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). By capturing recall-based exposure, this method reflects both remembered encounters and the subjective impact of media content, addressing concerns about traditional frequency-based measures that may fail to capture meaningful media engagement.

Eco-anxiety

The participants in this study provided their responses using the Climate Change Anxiety Scale developed by Clayton and Karazsia [43]. The scale, which employs a 5-point Likert-type format ranging from 1 (Never) to 5 (Almost always), was administered in both English and a Chinese translation. The translation process followed standard forward and backward translation procedures to ensure semantic equivalence between the English and Chinese versions. The initial translation was conducted by a bilingual expert fluent in both English and Chinese, followed by a back-translation into English by a second independent translator. Any discrepancies were resolved through consultation among the translators and the research team to maintain conceptual equivalence. Originally, the scale was posited to encompass a two-factor structure as per the findings of Clayton and Karazsia. However, subsequent research identified a unidimensional structure [44]. Accordingly, the current study adopted this revised framework to conduct a comprehensive assessment of eco-anxiety.

Third-person effect

The measurement of the Third-Person Effect in this survey employs five specific items to assess respondents' perceptions of how climate change news impacts broader groups of people compared to themselves. The items were derived from previous studies [42, 45, 46]. Participants respond to each item by evaluating the extent to which they believe such news influences "other people in general." The responses are recorded on a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). This scale allows respondents to quantify their perception of the differential impact, assessing whether they consider others to be more significantly affected by the negative aspects of climate change coverage—such as feelings of distress, sadness, or helplessness. This methodological approach seeks to explore the classic communication theory that individuals may perceive a greater media effects on others than on themselves, highlighting the potential societal impact of media narratives on climate change. The items are the following: (1) Certain news reports on climate change negatively affect the mood of readers. (2) Press coverage that provides detailed accounts of climate change-related disasters disturbs or discomforts the reading public. (3) Some news reports on climate change can cause significant distress to readers. (4) Many readers may feel sadness when reading news about the impacts of climate change. (5) Reading news about climate change could potentially provoke feelings of helplessness or despair in some vulnerable readers.

First-person effect

The measurement of the First-Person Effect in this survey utilizes five items to assess respondents' personal perceptions of the impact of climate change news on themselves, based on previous studies [7, 42, 47, 48]. Participants are asked to respond to each item, reflecting on their individual views and feelings towards climate change reporting. The items are structured as follows: (1) *I personally believe that responsible reporting of climate change news that adheres to an ethical code can be a preventive factor for vulnerable populations.* (2) *I think that reporting on climate change can prompt public debate on social issues (e.g., environmental justice or policy inadequacies).* (3) *I personally believe that news about climate change is necessary in a well-informed, pluralistic society with a free public opinion.* (4) *Reading news about climate change makes me think that it is something that could happen to anyone.* (5) *I can personally understand or relate to the potential reasons behind certain climate events reported in the news.* Responses are recorded on a 5-point Likert scale, ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). This approach allows participants to express the degree to which they feel personally impacted by and engaged with media coverage of climate change, assessing their susceptibility to media effects as opposed to their perceptions of its effects on others.

Data analyses

Data analyses were conducted using SPSS software, version 26. Initial analyses included computing descriptive statistics to summarize the demographic and psychographic profiles of the participants. This involved calculating means, standard deviations, and percentages for variables such as age, gender, educational attainment, employment status, profession, and frequency of newspaper readership. Pearson correlation coefficients were calculated to examine the relationships between continuous variables. This step was crucial to identify and understand the linear associations between exposure to climate change news, third-person and first-person effect perceptions, and eco-anxiety. Multiple regression analyses were employed to assess the predictive relationships involving the main study variables. The model included exposure to climate change news as the independent variable, eco-anxiety as the dependent variable, and both third-person and first-person effect perceptions as moderators. Interaction terms were created to explore the potential moderating effects of third-person and first-person effect perceptions on the relationship between news exposure and eco-anxiety. The PROCESS macro for SPSS (Model 2) was used to conduct moderation analyses [49, 50]. This allowed for the investigation of the conditions under which third-person and first-person effect perceptions might alter the impact of news exposure on eco-anxiety. Specifically, the analysis focused on the interaction between the frequency of news exposure and third-person and first-person effect perceptions in predicting levels of eco-anxiety. Conditional effects were plotted to visually represent the interaction effects at various levels of the moderators. Missing values, particularly in the age variable, were addressed using listwise deletion, given the small proportion of missing data. This method was deemed appropriate as the missing data constituted less than 4% of the overall dataset, thus unlikely to bias the results significantly.

Results

Descriptive statistics and correlations

As Table 1 shown, the variables presented moderate to high variability across the sample. The exposure to climate change news and the first-person effects on oneself and third-person effects on others exhibited moderate averages, while eco-anxiety showed a slightly lower mean value but with greater variability, indicating diverse anxiety levels among the participants. The estimated impact

Table 1 Descriptive statistics and correlation matrix among study variables

Variable	M	SD	1	2	3	4
1. Exposure to climate change news	3.36	0.88	*0.89*			
2. Eco-anxiety	3.01	1.47	0.083** (0.032, 0.133)	*0.79*		
3. Third-Person Effect	3.62	0.85	− 0.143** (− 0.193, − 0.093)	− 0.133** (− 0.183, − 0.083)	*0.78*	
4. First-Person Effect	3.78	0.80	0.157** (0.107, 0.206)	0.392** (0.348, 0.435)	− 0.240** (− 0.288, − 0.192)	*0.86*

P <.01. Values on the diagonal represent Cronbach's alpha coefficients for each scale. Correlation coefficients are presented below the diagonal, with 95% confidence intervals in parentheses

M Mean, *SD* Standard Deviation

of climate change news on others is slightly lower than on self.

The correlation analysis revealed several significant relationships among the variables. A positive correlation between the exposure to climate change news and eco-anxiety suggests that more frequent exposure is associated with higher levels of anxiety. In contrast, the exposure to climate change news and perceived media effects on others were negatively correlated, indicating that those who perceive a stronger media effects on others tend to report less frequent exposure. Conversely, a positive correlation between exposure and the first-person effect implies that individuals who perceive a higher personal media effects also report more exposure to climate change news.

Additionally, there was a strong positive correlation between eco-anxiety and first-person effects, highlighting that individuals who perceive greater media effects on themselves tend to experience higher eco-anxiety. Conversely, Third-Person Effect showed negative correlations with both eco-anxiety and first-person effects, suggesting a divergent perception of media effects on oneself versus on others, with those perceiving less media impact on others experiencing more personal anxiety and perceiving more personal media effects.

Moderation analyses

Model summary and overall effect

Our regression model successfully explained 21.14% of the variance in eco-anxiety (R^2 = 0.2114, $F(5, 1477)$ = 79.2020, $p < .0001$), indicating a significant fit. The analysis incorporated both the primary effects and the interactions between exposure to climate change news and perceptions of media effects, as Table 2 shows. However, while the model demonstrates statistical significance and explanatory power, we acknowledge that further diagnostic testing, such as assumption verification and sensitivity analyses, would be necessary to establish its robustness fully.

Conditional effects and interaction

Significant interactions were observed in the model. The interaction between the exposure to climate change news and first-person effects was particularly strong, explaining an additional 3.69% of the variance in eco-anxiety (R^2 change = 0.0369, $F(1, 1477)$ = 69.1213, $p < .0000$). While this may seem small, it is considered meaningful in the context of psychological research, where small effect sizes can indicate substantial psychological or behavioral outcomes, especially in complex phenomena such as eco-anxiety [51]. Given the incremental nature of moderating effects, even small R^2 changes reflect meaningful interactions worthy of further exploration. The interaction involving Third-Person Effect also demonstrated statistical significance, albeit less robustly, adding another 0.59% to the variance explained, as Table 3 shows (R^2 change = 0.0059, $F(1, 1477)$ = 11.0485, $p = .0009$). Although small, this interaction suggests that third-person perceptions still contribute to individual differences in eco-anxiety, supporting the theoretical claim that downplaying personal susceptibility (TPE) has protective but limited effects. The choice of analysis levels (mean ± 1 SD) follows the default settings of the Hayes Process Macro, which provides a meaningful way to test interactions by examining effects at representative low, medium, and high levels of the moderators (Hayes 2018). This approach allows for practical interpretations of how these interactions operate across different levels of FPE and TPE, reflecting diverse individual susceptibilities.

The detailed analysis of conditional effects revealed intricate patterns depending on the levels of perceived media effects on oneself and others. At a moderate level of first-person effects on oneself (3.0), an increase in exposure to climate change news corresponded with a stepwise increase in eco-anxiety as Third-Person Effect

Table 2 Regression coefficients for predicting eco anxiety

Predictor	Coefficient	SE	t	*P*-value	Lower CI	Upper CI
Constant	− 2.7176	0.9738	− 2.7907	.0053	− 4.6277	− 0.8074
Exposure to climate change news	1.0512	0.2847	3.6920	.0002	0.4927	1.6098
First-Person Effect	2.0166	0.1658	12.1628	<.0001	1.6914	2.3419
Interaction: Exposure to climate change news x First-Person Effect	− 0.4083	0.0491	− 8.3139	<.0001	− 0.5046	− 0.3119
Third-Person Effect	− 0.5493	0.1542	− 3.5634	.0004	− 0.8517	− 0.2469
Interaction: Exposure to climate change news x Third-Person Effect	0.1483	0.0446	3.3239	.0009	0.0608	0.2359

Regression coefficients represent unstandardized estimates. Confidence intervals are based on a 95% confidence level. *P*-values indicate statistical significance

SE Standard Error, *CI* Confidence Interval, *LLCI* Lower Limit Confidence Interval, *ULCI* Upper Limit Confidence Interval

Table 3 Test of highest order unconditional interactions

Interaction	R^2 Change	F	df1	df2	*P*-value
Exposure to climate change news x First-Person Effect	0.0369	69.1213	1	1477	<.0001
Exposure to climate change news x Third-Person Effect	0.0059	11.0485	1	1477	.0009
Both interactions	0.0555	51.9955	2	1477	<.0001

on Others increased, ranging from small to moderate effects (B =0.2121, p= .0090 to B= .5088, p< .0000). Conversely, at higher first-person effects on oneself levels (4.6), increased news exposure correlated with decreased eco-anxiety, especially when Third-Person Effect on Others was low (B =− 0.4411, p= .0000). This suggests that higher skepticism towards the media's influence on oneself might serve as a protective buffer against the anxiety induced by climate news.

As Table 4 displays, the conditional effects within our study elucidate the complex dynamics of how exposure to climate change news impacts eco-anxiety, significantly moderated by both first-person and third-person effects. At a baseline first-person effect of 3.0, the impact of news exposure on eco-anxiety intensifies progressively with an increase in third-person effects. Specifically, when the third-person effect is relatively low (2.6), the increase in eco-anxiety is modest. However, as the third-person effect rises to 3.8 and further to 4.6, the associated eco-anxiety notably increases, underscoring the amplified stress perceived from more significant news exposure.

Conversely, when the first-person effect is stronger (4.6), an intriguing reversal occurs. Here, increased news exposure correlates with a decrease in eco-anxiety at lower levels of the third-person effect (2.6). This decrease becomes less pronounced as the third-person effect increases, suggesting that individuals with high personal media effects perception may initially find themselves less anxious, possibly due to a sense of informed empowerment or skepticism. However, this protective

Table 4 Conditional effects of exposure to climate change news on eco anxiety by first-person and third-person effects

First-Person Effect	Third-Person Effect	Effect	SE	t	p	LLCI	ULCI
3.0	2.6	0.2121	0.0811	2.6155	.0090	0.0530	0.3712
3.0	3.8	0.3901	0.0560	6.9731	<.0001	0.2804	0.4999
3.0	4.6	0.5088	0.0634	8.0264	<.0001	0.3845	0.6332
3.8	2.6	− 0.1145	0.0621	− 1.8446	.0653	− 0.2362	0.0073
3.8	3.8	0.0635	0.0399	1.5941	.1111	− 0.0146	0.1417
3.8	4.6	0.1822	0.0572	3.1878	.0015	0.0701	0.2943
4.6	2.6	− 0.4411	0.0649	− 6.7975	<.0001	− 0.5684	− 0.3138
4.6	3.8	− 0.2631	0.0560	− 4.6996	<.0001	− 0.3729	− 0.1533
4.6	4.6	− 0.1444	0.0748	− 1.9292	.0539	− 0.2912	0.0024

Conditional effects represent the estimated impact of exposure to climate change news on eco-anxiety at specific values of First-Person and Third-Person Effects. *P*-values are presented as <.0001 where applicable to denote significance at the 0.0001 level. Confidence intervals are based on a 95% confidence level

SE Standard Error, *CI* Confidence Interval, *LLCI* Lower Limit Confidence Interval, *ULCI* Upper Limit Confidence Interval

buffer diminishes as the perceived media effects on others grows.

The conditional effects also highlight a subtle but crucial interaction at a first-person effect of 3.8 across various third-person effects. Minimal changes in eco-anxiety are observed when the third-person effect is moderate (3.8). Still, as it extends to its higher boundary (4.6), a slight increase in anxiety is notable, although it is significantly less pronounced than at lower levels of personal effect.

These findings collectively illustrate the nuanced interplay between personal perceptions of media effects and its broader perceived impact on others, reshaping our understanding of how individuals emotionally process media content related to climate change based on their perceptions of its influence.

Effect sizes for significant results

To assess effect sizes, we computed Cohen's f^2 for each significant model component. The full model yielded a moderate-to-large effect size ($f^2 = 0.268$), indicating a substantial proportion of variance explained in eco-anxiety. For the interaction effects, the interaction between exposure to climate change news and the First-Person Effect showed a small-to-moderate effect size ($f^2 = 0.047$). The interaction between exposure and Third-Person Effect had a small effect size ($f^2 = 0.007$). The combined interaction effects contributed a moderate effect size ($f^2 = 0.070$), demonstrating their meaningful impact on eco-anxiety variation. Furthermore, standardized beta coefficients (β) were computed to quantify the relative strength of predictors. The First-Person Effect had the strongest impact on eco-anxiety ($\beta = 12.16$). The interaction between exposure to climate change news and the First-Person Effect also had a large negative effect ($\beta = -8.31$). Exposure to climate change news had a smaller, yet significant, positive effect ($\beta = 3.69$). The Third-Person Effect ($\beta = -3.56$) and its interaction with exposure to news ($\beta = 3.32$) were also statistically significant but of lesser magnitude. These findings suggest that while exposure to climate change news plays a role in eco-anxiety, perceptions of media effects (First-Person and Third-Person Effects) significantly moderate this relationship, particularly through their interaction effects. As Fig. 2 displays, the interaction effects suggest that the impact of exposure to climate change news on eco-anxiety diminishes or even reverses as personal skepticism about media effects increases, particularly when combined with high levels of perceived influence on others.

Discussion

The results of this study offer compelling insights into the psychological impacts of media exposure to climate change news. The observed moderate to high variability across the sample indicates a heterogeneous response to climate change stimuli, which is consistent with previous studies indicating diverse psychological responses to environmental issues [52]. The positive correlation between exposure to climate change news and eco-anxiety aligns with findings suggesting that greater media exposure is associated with heightened levels of stress and anxiety related to climate change [53]. Media effects research has increasingly emphasized how emotional responses, particularly negative emotions like fear and anxiety, mediate public engagement with climate change issues [54, 55]. This effect suggests that frequent engagement with climate change news might enhance awareness but at the cost of increased personal anxiety.

More recent studies highlight the role of specific types of media content—such as narratives focused on solutions, as opposed to disaster framings—in shaping these responses, suggesting opportunities for reducing anxiety through more balanced reporting [55, 56]. Previous research has extensively documented the psychological effects of environmental threats, emphasizing the role of media in shaping public perceptions and emotional responses [57, 58]. Consistent with these studies, our results underscore the significant role of media exposure in escalating eco-anxiety among individuals who perceive a direct personal impact from climate change news. At the same time, personality traits and environmental knowledge have been shown to influence individuals' susceptibility to media effects, particularly in relation to eco-anxiety and environmental action [59, 60].

Conversely, the negative correlation between exposure to climate change news and perceived media effects on others underscores a complex interaction between media consumption and perception. This result diverges from the hypothesis proposed by previous studies [61], which argued that increased media exposure would correlate with an increased perception of its effect on both oneself and others. The current findings suggest that individuals who are highly exposed to climate change news might develop skepticism toward the media's influence on others, potentially due to a perceived overrepresentation or dramatization of climate issues [62]. This aligns with recent findings indicating that individuals can develop selective skepticism as a result of overexposure to repetitive narratives, a process associated with both defensive psychological responses and cognitive fatigue [56, 63]. Contrasting with some existing studies that suggest a desensitization effect with increased media exposure

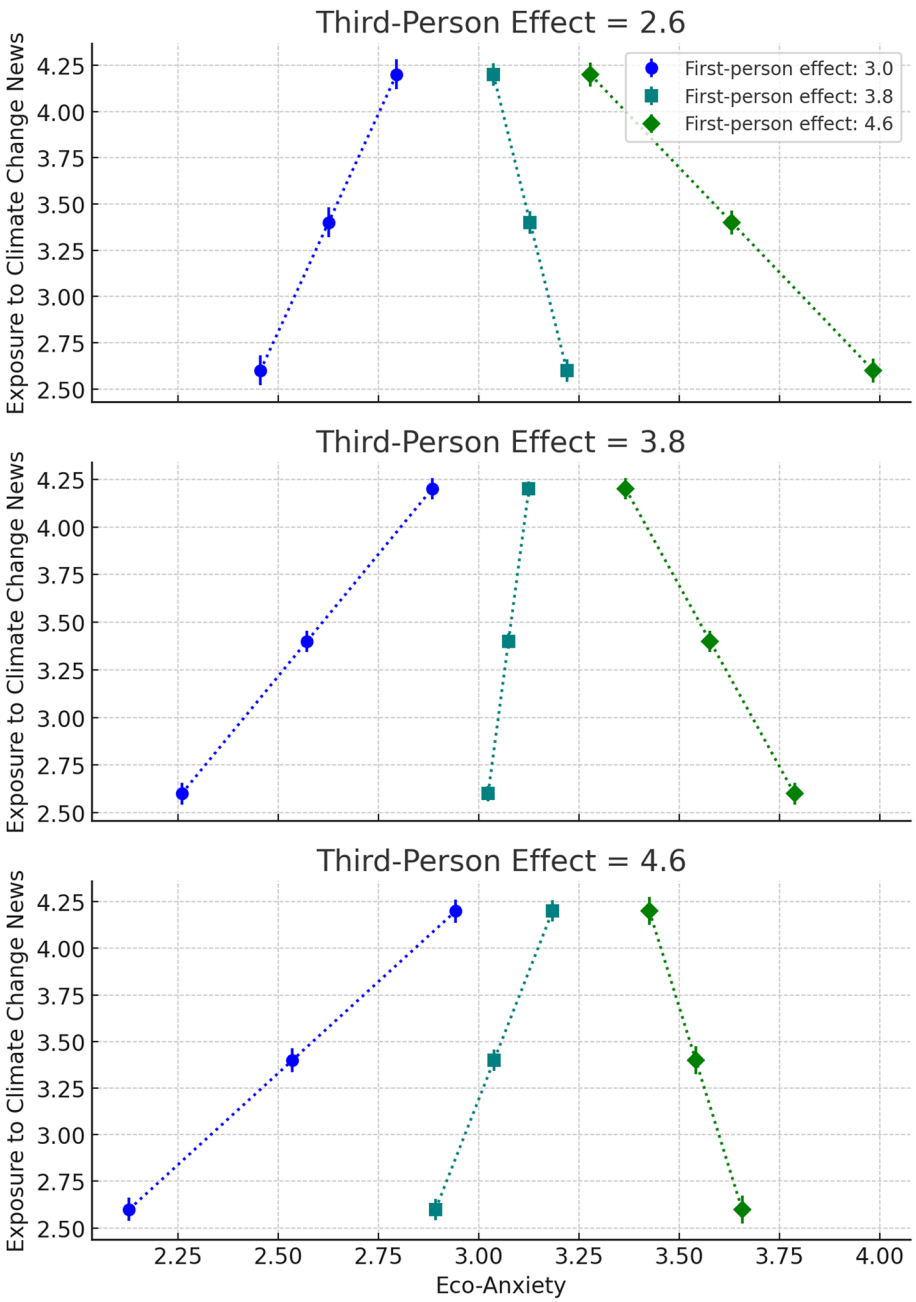

Fig. 2 Scatterplot for the conditional effect of exposure to climate change news on eco-anxiety across third-person effect levels. Note: This figure illustrates the conditional effect of exposure to climate change news on eco-anxiety at three levels of the Third-Person Effect on Others (2.6, 3.8, and 4.6). Each panel represents a different Third-Person Effect level, with separate trend lines for varying First-Person Effect levels (3.0, 3.8, and 4.6). Error bars represent standard errors (SE)

[64], our findings reveal a more nuanced interaction where increased exposure correlates with heightened anxiety but also a decreased perception of media effects on others. This suggests sophisticated cognitive processing where individuals might recognize the potential over-saturation of media messages yet still find themselves affected by the content.

The strong positive correlation between eco-anxiety and first-person effects further suggests that personal identification with media content significantly influences anxiety levels. This finding is in agreement with previous

studies that found a similar association in their study on environmental crises [65]. Furthermore, recent meta-analyses have shown that individuals who perceive themselves as personally impacted by environmental issues are more likely to internalize negative media messages, leading to stronger emotional responses [66]. However, it contradicts some previous findings that did not observe a significant direct relationship between these variables but rather a mediated effect through other psychological factors [67, 68].

The significant interactions identified in the model, particularly between exposure to climate change news and first-person effects, highlight the nuanced nature of media effects. The increased variance explained by these interactions suggests that individual differences in perceived media impact play a critical role in moderating the psychological effects of climate change news. This is a critical addition to the literature, as it suggests that the impact of media exposure on eco-anxiety is not uniform but depends on personal perceptions of media credibility and relevance. Additionally, emerging research has highlighted the importance of understanding these personal differences to design effective climate communication strategies, particularly for younger audiences who engage with digital media more frequently [69].

The negative correlations between the perceived influence on others and personal exposure challenge some earlier findings where higher media consumption generally increased perceptions of its impact on both oneself and others [70]. Our study adds a layer of complexity by suggesting that individuals who frequently engage with climate change news might develop a skepticism of the media's influence on the general public, potentially as a psychological defense mechanism to maintain a sense of control or unique insight. This supports broader findings that overexposure to environmental news can lead to cognitive dissonance and defensive mechanisms, which aim to protect individuals from the distress caused by perceived large-scale environmental threats [71].

Theoretical implications

The strong correlations observed between eco-anxiety and personal media effects highlight the critical role of personal relevance in the processing of media messages. This aligns with the Media Dependency Theory, which posits that the more an individual depends on media information to meet their needs, the more significant its influence on them [72]. In our study, individuals who perceive climate change as directly impacting them rely more on the media for information, which, in turn, elevates their levels of anxiety.

The regression model's ability to explain a significant portion of the variance in eco-anxiety (21.14%) is noteworthy. This level of explanatory power is higher than in some prior studies, such as those by Brown and Kasser [73], which reported lower R^2 values in similar models. The present study's findings underscore the importance of considering both direct effects and interactions between media exposure and perceived media effects, which have been underexplored in previous research.

Furthermore, the interaction effects observed in our regression models suggest that media effects on eco-anxiety is not merely additive but conditional upon personal perceptions of influence. This finding is particularly relevant for the development of communication theories that seek to understand how individuals integrate media content with personal and social identities to form their perceptions and emotional responses.

To sum up, the conditional effects and interaction patterns observed suggest a complex relationship between exposure levels, personal influence perceptions, and psychological outcomes. These findings extend previous work, which explored media effects but did not examine interactive effects in depth (74). The current study fills this gap by demonstrating how different levels of perceived influence can alter the impact of media exposure on anxiety.

Limitations of the present study

The study's reliance on a non-representative sample poses a significant limitation to the generalizability of the findings. Predominantly female participation may skew perceptions, particularly in understanding gender-related nuances in media consumption and environmental anxiety. Furthermore, the age distribution, although spanning a broad range, does not include younger adults and seniors, which may overlook specific generational perspectives on climate change and media effects. The overrepresentation of individuals with university-level education could bias the results, as higher education often correlates with specific media consumption habits and environmental awareness. This educational skew may not accurately reflect the broader cognitive and informational processing behaviors of the general population. The employment status profile, heavily weighted towards individuals employed by others, similarly limits the applicability of the findings across different economic and professional contexts. The presence of missing data, particularly in age information, also constrains the study's robustness. While the proportion of missing data was relatively small, the approach to handling these gaps—listwise deletion—might have led to a loss of valuable information that could influence the overall analysis results, particularly in understanding age-related trends

in media effects and eco-anxiety. These limitations suggest that while the study provides valuable insights into the interactions between media exposure and perceptions of climate change, caution should be exercised in extrapolating these findings to the broader population. Future research could address these gaps by employing a more demographically balanced sample, expanding the age range, and incorporating a wider array of media consumption metrics, such as television, to enhance the representativeness and depth of the analysis.

A further limitation of this study is the absence of geographic location data for participants. While the sample included a diverse range of demographic characteristics, the lack of regional information limits our ability to assess potential geographic differences in climate change news exposure, eco-anxiety, and perceived media effects. Understanding how regional factors may shape these psychological responses is an important direction for future research. Future studies should consider including geographic data to enhance the contextual relevance and generalizability of findings.

Implications for future research and practical advice for media strategy

Given the significant impact of perceived media on psychological outcomes, future research should investigate further the mechanisms through which media exposure affects individual perceptions and reactions to climate change. Additionally, these insights have practical implications for media practitioners and policymakers. Tailoring communication strategies that consider the heterogeneity in media effects perceptions could help in crafting more effective public engagement strategies that mitigate undue anxiety while promoting informed and constructive engagement with climate issues. Given the potent impact of media on individual anxiety levels and perceptions, there is a crucial need for responsible media reporting on climate change. Media outlets should consider balancing informative content with coping strategies and positive actions individuals can take to combat climate change. This could help mitigate the feelings of helplessness and anxiety that often accompany the consumption of stark climate change news. Additionally, media practitioners should focus on framing content that emphasizes collective efficacy—the belief that communities working together can make a difference. Including stories of local and global successes in addressing climate challenges can foster optimism and counterbalance fear-driven narratives.

Our findings also suggest a potential for targeted communication strategies that address different segments of the audience based on their exposure levels and perceived influences. For those highly exposed to climate change news, media strategies that reinforce community action, individual empowerment, and solution-oriented messages could help counteract the negative impacts of heightened anxiety. Moreover, providing clear, actionable advice on how individuals can contribute, such as reducing carbon footprints or participating in community-driven initiatives, could shift the focus from passive worry to active engagement.

In the Chinese context, cultural factors such as the emphasis on collective responsibility and government-driven environmental initiatives play a crucial role in shaping media effects and public perception. The concept of "collective action" resonates strongly, making community-oriented media messages particularly effective. Additionally, societal respect for authority and trust in state-sponsored campaigns suggest that collaboration between media outlets and government initiatives could enhance the effectiveness of public communication strategies. Addressing eco-anxiety in China may benefit from emphasizing both personal responsibility and coordinated societal efforts, creating a balanced approach that aligns with cultural norms.

Further research is needed to explore the long-term effects of media exposure on eco-anxiety and whether these effects are sustained or fluctuate with changes in media consumption patterns. It would also be beneficial to examine the role of different types of media (e.g., social media vs. traditional news outlets) and content (e.g., catastrophic vs. solution-focused news) in shaping both perceptions and emotional responses to climate change.

Investigating these areas will provide deeper insights into the complex interplay between media exposure, personal perception, and emotional response, ultimately aiding in the development of more targeted, balanced, and empowering communication strategies for environmental issues.

Conclusion

This study contributes to the growing body of literature on media effects and environmental psychology by highlighting the nuanced ways in which individuals respond to climate change news. Understanding these dynamics is essential for crafting media messages that not only inform the public but also support them in managing the psychological burden of such global challenges.

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None.

Authors' contributions
YY and ZD have made substantial contributions to the conception and design of the work; contributed to the acquisition, analysis, and interpretation of data;

and have drafted the work and substantively revised it. Both authors have approved the submitted version and agreed both to be personally accountable for the author's own contributions.

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Data availability
The data that support the findings of this study are available from the Jilin Engineering Normal University, but restrictions apply to the availability of these data, which were used under license for the current study and so are not publicly available. The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The present research project has been assessed and approved by the Institutional Ethical Committee of the Jilin Engineering Normal University. The study was conducted in accordance with the Helsinki Declaration and Chinese regulations, ensuring ethical standards were maintained throughout the research process. Informed consent was obtained from all individual participants included in the study. Participants were required to consent to the survey terms, which were clearly outlined at the beginning of the survey. This included information on the purpose of the study, the voluntary nature of participation, anonymity of responses, and how the data would be used. Once consent was obtained, participants proceeded to answer the questions. A support contact was provided within the survey so that participants could reach out if they encountered any problems or needed clarification on the survey questions.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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