

Gender Differences in the Impact of Climate Change Worry on General Health: The Moderating Role of Anxiety

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Abstract

Climate change significantly impacts mental health, with Uttarakhand offering a unique context due to its exposure and demographics. This study examined how Climate Change Worry (CCW) relates to psychological well-being and whether anxiety moderates this relationship. A sample of 430 participants (143 females, 287 males) completed CCW and PGWBI-22 measures. PROCESS Model 1 was applied, with gender-stratified analyses. Results showed high CCW and a significant negative correlation with well-being. Anxiety significantly moderated the CCW–health link in males, intensifying CCW’s negative effects, but no such interaction appeared in females. Findings suggest gender-specific pathways, emphasizing interventions that reduce anxiety in males and explore protective factors in females to mitigate climate change’s psychological impact.

Keywords: Climate change, Psychological Well-Being, Uttarakhand, Climate change worry, Gender differences, Anxiety

1. INTRODUCTION

1.1 Background

Climate change and mental health are two of the most significant challenges we face, yet there is little discussion on how these two interact and the common factors that contribute to both crises. According to reports from the World Health Organization (WHO, 2022), and the Intergovernmental Panel on Climate Change (IPCC, 2022), rising global temperatures are expected to lead to severe and catastrophic effects on humans. Studies show links between extreme heat and increased morbidity and mortality, serious cardiovascular issues, aggression, and rising suicide rates (Pailler et al., 2018) and the IPCC predicts a global temperature increase of more than 1.5° C. Moving towards the mental health effects, although the detrimental impact of climate change on physical health has been acknowledged for a considerable period, the repercussions for mental health are only beginning to be fully documented.

It is known that climate change worsens psychological well-being by increasing anxiety, depression, cognitive difficulties, and a sense of loss of control. Taking the case of India, this negative impact affects the social and economic landscape as psychological distress and depression are linked to low labor force

participation and may cause a substantial burden on households that rely on labor work and agriculture for sustenance (Lund et al., 2011). The economic concerns due to poor mental well-being, therefore, are a serious issue in India (Patel, Araya, DeLima, Ludermir & Todd, 1999; Ravi & Engler, 2015). Combined with its vulnerability to climate change, it is important to understand how people respond to this ongoing climate crisis.

The traits and conditions of a society, system, or asset that render it vulnerable to the negative consequences of a hazard are referred to as vulnerability. Inadequate infrastructure design, inadequate asset protection, low public awareness, limited official recognition of risks, and a lack of effective preparedness or environmental management measures are just a few of the physical, social, economic, and environmental factors that contribute to it. Vulnerability is dynamic, changing over time and among communities. In Uttarakhand, it can be seen that there are various problems, including frequent natural calamities, weak ecosystems, unregulated urbanization, and reliance on natural resources, which make the area more vulnerable. These circumstances not only subject the region to physical risks but also increase the likelihood of mental health effects, including trauma, stress, and eco-anxiety, resulting from climate change and its cascading consequences.

There has also been a visible surge in policy briefs and reviews on mental health concerning climate change over the last few years, which reflects an increasing awareness of this significant problem (Liu et al., 2020; WHO, 2022; Charlson et al., 2021; Lawrence et al., 2021), and the relationship between climate change and mental health remains multifaceted and works through multiple pathways. Another way that climate change affects society is by raising the rate of natural disasters. Natural disasters significantly contribute to mental health and can have immediate as well as long-term psychological consequences. After a disaster, numerous individuals experience acute reactions to stress, including anxiety and PTSD (Heanoy and Brown, 2024; Molua, 2024). The disturbance in customary livelihoods, social coherence, and cultural displacement leads to increased fear, hopelessness, and existential insecurity among the affected groups. Uttarakhand can be considered as a very sensitive state regarding the severe effects of climate change. The Uttarakhand state experiences a series of environmental threats, including flash flooding, landslides, and glacial lake outbursts (GLOF), fuelled by unpredictable weather patterns and accelerating glacial retreat as a result of temperature rise.

Climate change affects the frequency and intensity of these natural disasters directly and indirectly, resulting in severe psychological effects for the populations affected. Nevertheless, the mental health impact of these disasters does not fall equally across both sexes. Women tend to incur a greater proportion of the psychological burden because of their caregiving and livelihood roles reliant on natural resources in most rural and disadvantaged areas (Sultana, 2021). For instance, in Uttarakhand, women are more often in charge of the provision of household water and food, which exposes them to cascading impacts of disasters such as floods and landslides, which risk their lives and also affect access to basic resources. Men, conversely, more often experience psychological distress related to economic loss, for instance, loss of income or livelihood, which can lead to a sense of inadequacy and social withdrawal. Studies show that women, especially in susceptible areas, tend to feel the mental health consequences of climate change more intensely compared to men because of their socio-cultural roles, economic reliance, and caregiving burdens (Sultana, 2021; Tschakert and Machado, 2020). Added household burdens, water scarcity, food inadequacy, and other social restrictions in the climate crisis increase women's vulnerability to depression, PTSD, and anxiety (Rothschild and Hasse, 2022; Stone et al., 2024; Goudet et al., 2024).

In addition to the increased vulnerability to climate change, women in rural areas such as in Uttarakhand are also directly and equally engaged in farming and water gathering, which further enhances the vulnerability to environmental stressors such as drought or water shortages. This enhanced exposure results in increased anxiety due to ecological disasters, depression, and emotional loads (Pande et al., 2017). This increasing convergence of ecological and mental health dilemmas accentuates the imperative for holistic interventions in Uttarakhand to contend with the cascading effects of climate change.

1.2 Overview of the present study

Since climate change plays the role of a risk modifier, intensifying environmental and socioeconomic pressures, its psychological impact is as important as well. Evidence supports that intense weather phenomena and natural disasters, including hurricanes and floods, can contribute negatively to mental health as well as negative community health outcomes, such as increased localized incidence of PTSD, depression, and anxiety, alcohol abuse, domestic violence, and suicide (Bourque and Cunsolo Willox, 2014, Palinkas and Wong, 2020; Cianconi et al., 2020; Doherty and Clayton, 2011; Morgansteiin and Ursano, 2020).

Certain communities may be particularly at risk if their livelihoods or basic physical needs are threatened (Hayes & Poland, 2018; Morrissey & Reser, 2007; Usher et al., 2019). In the case of Uttarakhand, the region's livelihood is closely linked to climate-sensitive practices, as 71% of its people depend on rainfed agriculture through terrace farming on hill slopes (Das, 2021). Climate change influences some crops' cropping seasons and cultivation zones, making some fields fallow. This exacerbates existing pressures on farming including a decrease in land per person, lack of irrigation infrastructure, and crop damage by animals. Also, young people have a declining interest in farming because of irregular rainfall patterns, diminishing agricultural yields, and resource shortages that threaten food security and economic stability and force many people to move from the hills to the plains. (Das, 2021; Blocher et al., 2021).

Due to this migration, a startling number of villages are now vacant; according to a 2018 survey, 734 communities have been abandoned since 2011. This loss of home and harm to personal space, which forces displacement, has profound psychological impacts and manifests in various mental health problems such as emotional distress, anxiety, depression, and post-traumatic stress disorder (PTSD) (Doherty & Lykins, 2024; Kanwal et al., 2024). When we consider the majority of the population in Uttarakhand, the majority depend on agricultural practices, making them highly vulnerable to the severe negative effects of climate change. Coupled with inadequate access to mental health services, the psychological impacts can be extremely (Oliveria et al., 2024). It can be observed that the interlinked impacts of climate change and mental health are entwined very strongly within the socio-economic and ecological structure of the region. When referring to the catastrophic natural disasters the state has experienced, one can clearly see that the emotional reaction towards such a magnitude of destruction brings about grief and fear (Kumar et al., 2013). Thus, the recurring natural disasters, altering agricultural activities, and forced displacement point to the widespread influence of climate change on both the environment and on the well-being of people. This research postulates, to begin with, that the population of Uttarakhand experiences a high degree of climate change worry stemming from the enormous stress and insecurity caused by these issues. Second, it suggests that climate change concern harms psychological health, which adds a double burden to the communities of this region. Finally, the study seeks to examine whether the observation that there is a gendered reaction to climate change because it is known to impact women disproportionately (Khan, 2024) holds for women of Uttarakhand or not.

Through the analysis of these hypotheses, this study strives to enhance our insight into the psychological impact of climate change and offer essential information for the generation of holistic strategies that cultivate people's mental well-being and the resilience of the environment. Knowing the shared causes of the double threat of climate change and mental health, and creating common solutions that promote the well-being of people as well as the planet, will enable policymakers, leaders in the health sector, and mental health professionals to design systems and communities that are resilient to the persistent stresses of climate change.

2. Methodology

2.1 Ethical considerations

2.1.1 Approval statement: We ensured that the planning, conduct, and reporting of human research were in accordance with the Helsinki Declaration as revised in 2024. The first author collected the approval to conduct research from the Department of Applied Psychology, Manav Rachna International Institute of Research Studies (MRIIRS).

2.1.2 Consent to participate: All participants provided informed, written consent before participation. They were given a clear explanation of the study's purpose, procedures, interview topics, and expected duration, and were informed that participation was voluntary. Participants were informed that they could decline to answer any question and withdraw at any time without penalty; those who withdrew had the option to have their data removed. Permission was obtained to audio-record interviews; participants were informed that recordings and transcripts would be anonymised, that quotes used in the manuscript would be pseudonymised, and that identifying information would be removed to protect confidentiality.

2.1.3 Anonymous Data Usage: All data used in this study were anonymized to ensure participant confidentiality. Personal identifiers such as names, exact locations, and other potentially identifying details were removed or replaced with pseudonyms during transcription. Quotations included in the manuscript are presented in a way that preserves participants' voices while protecting their identity. Data are stored securely on password-protected devices and are accessible only to the research team. The anonymized data are used solely for academic and research purposes and will not be shared publicly in a manner that could reveal participant identities.

2.2 Aim

The current study aimed to investigate the links between Climate Change Worry (CCW) and Psychological General Well-being (PGWBI) among the population of Uttarakhand. Additionally, the study investigates the gender differences in the role of Anxiety as a moderator in the above relationship. The following are the current hypotheses:

H1. There will be a negative correlation between CCW and PGWBI, such that higher levels of CCW would be associated with lower levels of PGWBI.

H2. Anxiety will moderate the relationship between CCW and general health (GH), such that higher levels of anxiety will exacerbate the negative impact of CCW on GH.

H3. There will be gender differences in the role of anxiety as a moderator between the impact of CCW on GH.

2.3 Design

The study is descriptive and utilizes a non-experimental correlational design using purposive sampling. Data was collected using standardized self-report questionnaires to ensure the reliability and validity of

measurements. To explore the impact of climate change worry in a geographically sensitive area, the study included 430 participants who were all permanent residents of Uttarakhand and between 30 and 60 years of age. A robust assessment of the constructs of interest was ensured by using established scales—the Climate Change Worry Scale (CCWS) and the Psychological General Well-Being Index (PGWBI).

The primary objective was to analyze the association between climate change worry (measured by CCWS) and general health and psychological well-being (measured by PGWBI). Correlational analysis was used to establish the nature of the relationship between these variables. To ascertain the moderating effect of anxiety in the CCW-generally health relationship, moderation analysis was carried out with PROCESS by Andrew Hayes. This design was chosen for answering the research questions since it yields information on the psychological effect of climate change concern without experimental manipulation and thus acceptable for a naturalistic exploration of real-world events.

2.4 Measures

Participants were asked to complete the following questionnaires to measure the levels of climate change worry and to assess their level of psychological well-being:

2.4.1 Climate Change Worry Scale is a self-report measure for assessing the level of ruminating thoughts that people experience about climate change. The scale consists of ten items (e.g., “I worry about climate change more than other people”; “I worry that I might not be able to cope with climate change”), with a five-point Likert scale from 1 (“never”) to 5 (“always”), and a possible range from 10 to 50 (Stewart, 2021). There are no reverse-scored items. A higher score, calculated by summing all the items, indicates a higher level of worry experienced due to climate change. The scale was developed to assess proximal worry about climate change rather than social or global impacts. The items in the test were found to be internally consistent, constituted a single factor, and were appropriate for both men and women. Also, there is support for the convergent and divergent validity of the CCWS through its pattern of correlations with several established clinical and weather-related measures.

2.4.2 The Psychological General Well-Being Index is a measure of the level of subjective psychological well-being. In detail, it assesses self-representations of intrapersonal affective or emotional states reflecting a sense of subjective well-being or distress and thus captures what we could call a subjective perception of well-being. Consisting of 22 standardized items (6 items for the short form), the tool produces a single measure of psychological well-being. The full measure also provides subscales to assess the following domains: anxiety, depression, positive well-being, self-control, general health, and vitality. For this study, the subscales for Anxiety and General Health were used separately along with the complete scale.

3. RESULTS

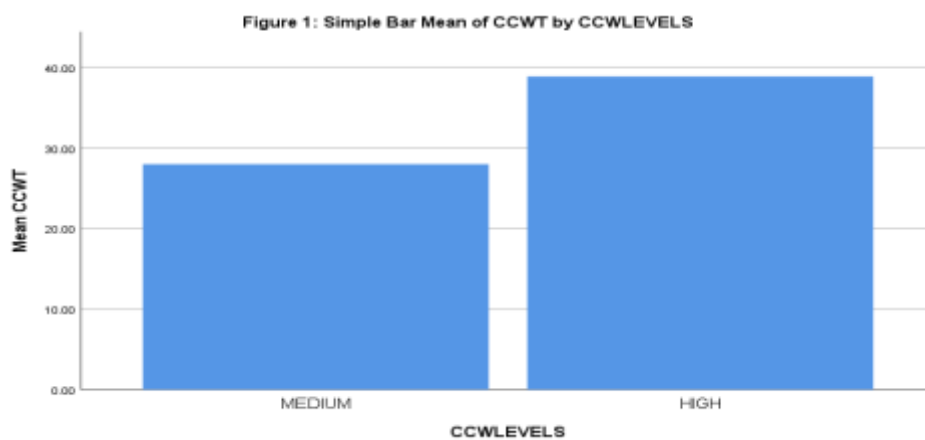
3.1 Descriptive statistics

The Climate Change Worry (CCW) scores in the sample of 430 participants ranged from a minimum of 17 to a maximum of 45. The mean score for CCW was 33.64, with a standard deviation of 6.31, indicating a moderate level of concern regarding climate change across the sample. The distribution suggests that most participants experienced a moderate degree of worry, with some variation in the intensity of concern. Table 1 provides an overview of the sample's overall level of climate change worry.

Table 1: Descriptive Statistics Of Climate Change Worry

	N	Minimum	Maximum	Mean	Std. Deviation
CCWT	430	17.00	45.00	33.6442	6.30694
Valid N (listwise)	430				

While there were no participants who scored in the low category of scores, ranging from 0-15, the bar chart below (Figure 1) shows the Climate Change Worry scores for two categories: Medium (16-32) and High (33-50) levels of CCW (represented as CCWLEVELS). The x-axis represents the two levels of CCW (Medium and High), while the y-axis shows the mean CCW total score. The High CCW level has a higher mean score, just above 35. The Medium CCW level has a mean score of around 25.



3.2 Correlation analysis

Table 2: Correlations between Climate Change Worry and Psychological General Well-Being

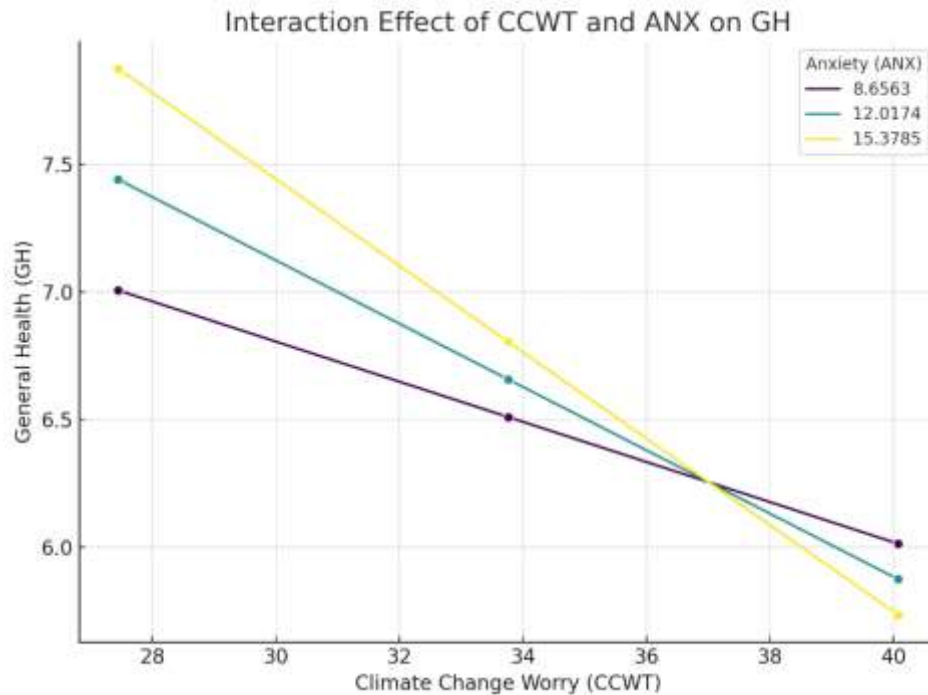
		CCWT	PGBT
CCWT	Pearson Correlation	1	-.497**
	Sig. (2-tailed)		.000
	N	430	429
PGBT	Pearson Correlation	-.497**	1
	Sig. (2-tailed)	.000	
	N	429	429

** . Correlation is significant at the 0.01 level (2-tailed).

The correlation analysis between Climate Change Worry (CCWT) and Psychological General Well-Being (PGBT) reveals a moderate negative correlation with a Pearson correlation coefficient of -0.497. This indicates that psychological well-being tends to decrease as climate change worry increases, and vice versa. In other words, individuals who report higher levels of worry about climate change tend to experience lower levels of psychological well-being. The correlation is statistically significant at the 0.01 level (2-tailed), with a p-value of 0.000, which is well below the commonly used significance threshold of 0.01, indicating that the observed relationship is highly unlikely to be due to chance. The sample size of 430 participants strengthens the reliability of these findings. The moderate correlation coefficient of -0.497 suggests a notable but not overwhelmingly strong negative relationship between climate change worry and psychological well-being. This implies that increased concern about climate change is associated with a decrease in psychological well-being, highlighting the potential psychological toll that

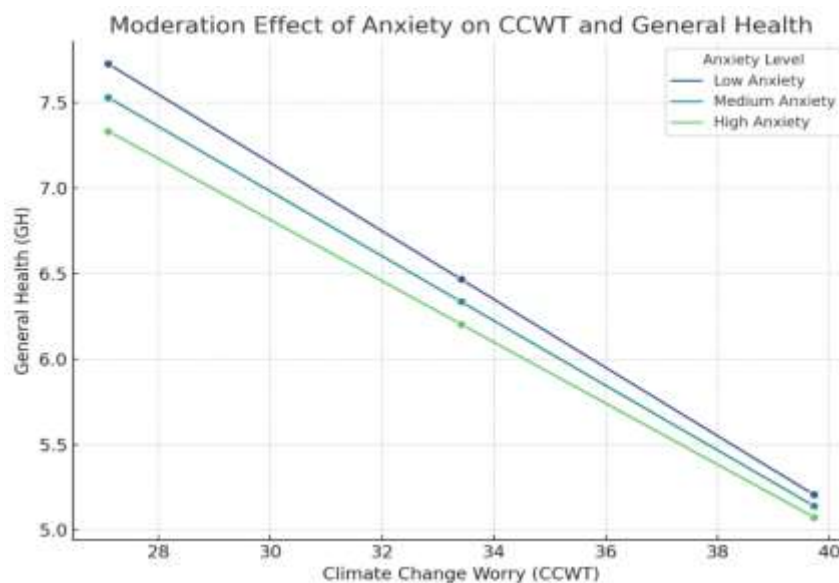
eco-anxiety may have on individuals. The result underscores the importance of addressing environmental concerns, as these may significantly impact mental health and well-being, especially in regions or populations highly sensitive to climate-related issues.

3.3 Moderating Role of Anxiety in Males



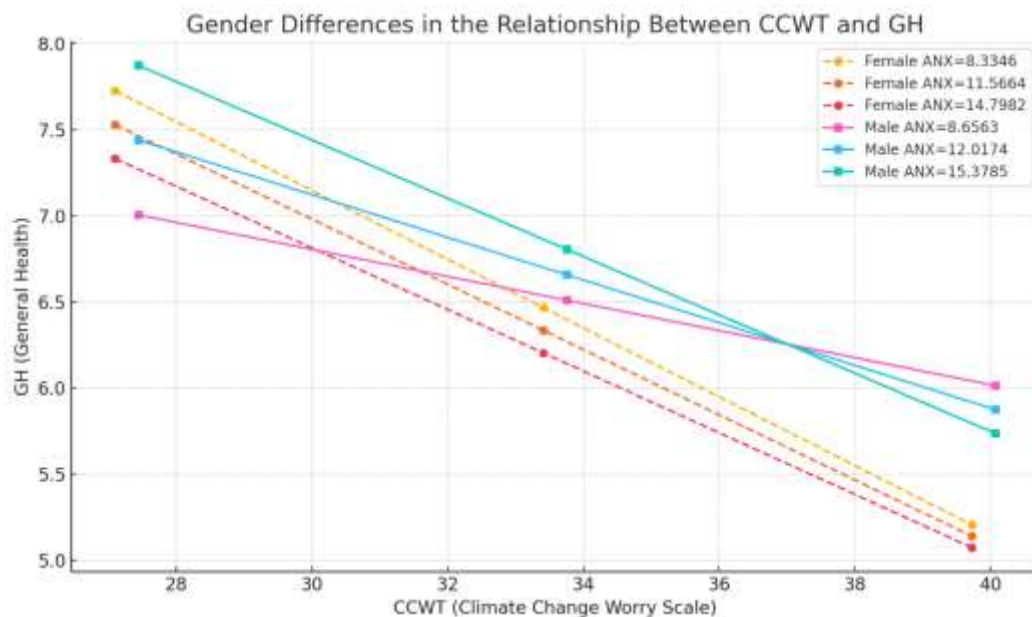
The results indicate that climate change worry (CCWT) alone is not a significant predictor of general health (GH) ($p=.6206$). When combined with anxiety (ANX), CCWT significantly ($p= 0.0225$) and negatively moderates the effect of CCWT on GH. Results show that males with moderate to high levels of ANX are more vulnerable to the negative impact of CCWT.

3.4 Moderating Role of Anxiety in Females



For females, CCWT negatively predicts GH, but this effect is non-significant ($p = 0.0625$), ANX does not predict GH ($p = 0.6705$) and the interaction between CCWT and ANX has no significant impact on GH ($p = 0.7798$). Across all ANX levels, the negative impact of CCWT on GH is consistent but not significant and it does not change how CCWT impacts GH.

3.5 Gender differences



The graph above visualizes the relationship between climate change worry total scores (CCWT) and general health (GH), moderated by anxiety (ANX), highlighting gender differences. Results show that the interaction term ($CCWT \times ANX$) is insignificant for females ($p = .7798$), indicating that anxiety does not significantly moderate the relationship between climate change worry and general health in females. Whereas for males, the interaction term is significant ($p = .0225$), suggesting that anxiety moderates the relationship between climate change worry and general health. Specifically, as anxiety increases, the negative effect of climate change worry on general health in males becomes stronger.

4. Discussion

With no participants falling into the low category, the descriptive statistics showed that the sample had a moderate level of concern about climate change. This suggests that the populace is widely concerned about climate change, which is probably affected by Uttarakhand's environmental vulnerabilities, which include regular natural disasters like landslides and flash floods. The difference between medium and high levels of climate change worry (CCW) emphasizes the diversity in how people react to environmental stressors and raises the possibility that some people may feel more anxious because they are more aware of the risks associated with climate change, are directly exposed to them, or are personally vulnerable to them.

These results concur with global trends that indicate a rise in eco-anxiety and climate change-related psychological distress, particularly among regions that are significantly affected by it (Clayton and Karazia, 2020). Such findings prove the necessity of community-based resilience-building interventions and mental health interventions geared towards treating climate change anxiety in vulnerable populations. Climate change concern and psychological well-being were moderately negatively correlated. PGBT deteriorates as CCW increases, showing that individuals who are highly concerned about climate change

tend to experience poor mental health outcomes. This study lends support to the growing body of research signalling the psychological impacts of eco-anxiety, including existential fear, terror, and hopelessness (Whitmarsh et al., 2022).

Although CCW is a significant predictor of psychological well-being, other elements, including coping strategies, social support, and individual resilience, may also be very essential, according to the statistical significance and moderate strength of the correlation (-0.497). These results highlight the significance of tackling the psychological effects as well as the underlying reasons for climate change anxiety through all-encompassing treatments that involve community education, mental health support, and policy-level climate action.

Varying trends in the way anxiety moderates the association between climate change worry and general health were found when gender differences were analyzed. Anxiety considerably increases the detrimental impact of CCW on overall health in males, whereas this moderating effect was negligible in females. These findings contrast with the majority of the literature currently in publication, which frequently claims that women are more susceptible to the psychological effects of climate change because of their gendered roles, caregiving obligations, and reliance on natural resources (Sultana, 2021). The observed tendency may have its roots in Uttarakhand's societal norms and expectations. The association between CCW and general health is made worse by the fact that men, who are frequently seen as primary providers, may feel more stressed out due to resource depletion and unstable economies. Women, on the other hand, might depend on social networks or group coping mechanisms to mitigate the moderating impact of worry on their health results.

The necessity for specialized mental health interventions in Uttarakhand is highlighted by an understanding of these gender-specific coping strategies. To improve resilience, future studies should investigate culturally aware approaches that build women's social support networks while addressing men's financial strain and social pressures. Policymakers and community leaders should also concentrate on developing gender-inclusive initiatives that support sustainable resource management, economic stability, and the reduction of the psychological effects of climate change. To guide more successful, evidence-based initiatives, longitudinal research could shed more light on how concerns about climate change alter shifts and its long-term consequences on psychological well-being across genders.

5. Future directions

The conclusions have significant implications for interventions that respond to the mental health effects of climate change. Gender-sensitive strategies are essential, as it is understood that males and females not only experience and perceive climate change anxiety differently but also respond to it differently. Interventions directed toward males should emphasize stress coping, livelihood resilience, and responding to the psychological toll of economic climate-related issues. For women, activation of social support systems and mental health literacy will be more effective.

Future studies would benefit from examining the mechanisms behind these gender differences, such as cultural, social, and psychological ones. Longitudinal designs might shed further light on how these associations develop over time, especially with the ongoing aggravation of climate change. Qualitative studies might also be useful for capturing people's lived experiences with climate change anxiety, broadening our perspective of its psychological effects.

6. Conclusion

The findings of this research offer insight into how inhabitants of Uttarakhand, a state that is particularly vulnerable to the impacts of climate change, are psychologically impacted by their fears. The findings in statistics revealed that the sample population is general apprehensive about climate issues, where moderate to high levels of concern for climate change were signalled by the mean score. Interestingly enough, no one participant performed poorly on climate change concern, which hints that the population in this area views the problem as urgent and inevitable. This is in line with a greater number of studies that indicate heightened anxiety and environmental consciousness in areas that are directly impacted by climate change. Increased concern about climate change is associated with more depressive symptoms, according to the association between climate change concerns and depressed mood (-0.319). Despite this relationship's moderate strength, its reliability and statistical significance suggest that mental health issues are more prevalent in the setting of climate change. This result is consistent with earlier studies showing that the emotional strain of caring about environmental problems throughout the world can result in depressive symptoms, pessimism, and unhappiness. Future studies should concentrate on other psychological aspects, such as eco-anxiety and mood disorders that may affect their resilience and day-to-day functioning, that are linked to excessive concern about climate change.

Regarding the issue of climate change, it is undeniable that natural occurrences have caused the current Himalayan tragedy; however, the speed of these changes is enhanced by human activities. Talking about the different man-made drivers, there is a wealth of scientific data showing that the Himalayan watersheds have seen long-term, unparalleled deforestation (Kumar & Chopra, 2009). Environmental deterioration is occurring as a result of power projects and it is most likely that no ecological or environmental audit is being conducted.

Additionally, a variety of land-use activities, including agriculture, urbanization, and human settlements, have caused forests to be diverted (NSE, 2006). Large-scale infrastructural development has occurred and is still being completed, including the construction of roads and hydropower. According to scientific research, the Indian Himalayas' overall forest cover will drop from 84.9 percent (of its 1970 value) in 2000 to no more than 52.8 percent in 2100 if current rates of deforestation continue, making Uttarakhand the most disaster-prone state in India because of rising deforestation, excessive tourism, and over-exploitation of natural resources (Kumar, 2013).

The premise that Uttarakhand is experiencing a climate crisis is supported by the considerable correlation between higher degrees of climate change fear and worse psychological well-being, as well as a modest correlation with increased depression symptoms. To assist people deal with the ongoing effects of climate change and address the larger environmental, social, and economic issues that contribute to it, the results highlight the critical need for focused mental health interventions. Furthermore, encouraging group environmental action, educating people about adaptive coping mechanisms, and supporting community-based resilience initiatives could lessen the psychological toll that climate change concerns take. Lastly, an integrated strategy that acknowledges the connection between ecological and psychological well-being is necessary to address the twin issues of environmental deterioration and mental health.

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