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Investigating associations between climate change anxiety and mental health impact on vulnerable populations: A qualitative analysis

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Abstract

Climate anxiety has a negative impact on the mental health and psychological wellbeing of the vulnerable population. The goal is to assess many factors that affect mental health and psychological wellbeing, as well as how climate change affects mental health in Pakistan's vulnerable population. This study provides evidence-based insights on the long- and medium-term impacts of extreme weather events on mental health. We conducted semi-structured interviews with a sample of 72 students aged 10–16 years, employing an exploratory qualitative design. The resulting process identified themes and questions for future research on climate change and its psychological effects on children's mental health. As a result, positive emotions embedded in children's climate-strategic actions in parent and community contexts helped to mitigate children's perceptions of negative emotions (such as climate anxiety, phobias, fear, sleep disorders, depression, sadness, and substance abuse). Climate change's effects can have a significant impact on mental health. We will be discussing effective strategies to address the expected mental health issues among children caused by climate change. The discussion paper offers a set of recommendations for addressing the mental health impacts of climate change, including improving mental health support systems, integrating climate change education into services, and developing targeted interventions for vulnerable populations. *(Afr J Reprod Health 2024; 28 [8]: 108-121).*

Keywords: Climate change; Climate anxiety; Rural children; Mental health; Pakistan

Résumé

L'anxiété climatique a un impact négatif sur la santé mentale et le bien-être psychologique de la population vulnérable. L'objectif est d'évaluer de nombreux facteurs qui affectent la santé mentale et le bien-être psychologique, ainsi que la manière dont le changement climatique affecte la santé mentale de la population vulnérable du Pakistan. Cette étude fournit des informations fondées sur des données probantes sur les impacts à long et moyen terme des événements météorologiques extrêmes sur la santé mentale. Nous avons mené des entretiens semi-structurés avec un échantillon de 72 étudiants âgés de 10 à 16 ans, en utilisant une conception qualitative exploratoire. Le processus qui en a résulté a identifié des thèmes et des questions pour de futures recherches sur le changement climatique et ses effets psychologiques sur la santé mentale des enfants. En conséquence, les émotions positives intégrées dans les actions stratégiques climatiques des enfants dans les contextes parental et communautaire ont contribué à atténuer les perceptions des enfants concernant les émotions négatives (telles que l'anxiété climatique, les phobies, la peur, les troubles du sommeil, la dépression, la tristesse et la toxicomanie). Les effets du changement climatique peuvent avoir un impact significatif sur la santé mentale. Nous discuterons de stratégies efficaces pour résoudre les problèmes de santé mentale attendus chez les enfants causés par le changement climatique. Le document de travail propose un ensemble de recommandations pour faire face aux impacts du changement climatique sur la santé mentale, notamment en améliorant les systèmes de soutien en santé mentale, en intégrant l'éducation au changement climatique dans les services et en développant des interventions ciblées pour les populations vulnérables. *(Afr J Reprod Health 2024; 28 [8]: 1-8-121).*

Mots-clés: Changement climatique ; Anxiété climatique ; Enfants ruraux ; Santé mentale ; Pakistan

Introduction

Global societies recognize climate change and mental health as two significant challenges. Unfortunately, the interactions and common causes of these two crises have not received much attention. Experts in global health fields, such as the World Health Organization, have acknowledged the

significant impact of the climate crisis on human well-being. Recent reports from the Intergovernmental Panel on Climate Change (IPCC) have further emphasized the dire consequences that will arise from escalating global warming[1,2]. Although many people are aware of how climate change affects physical health, its effects on mental health have received less attention until recently, when a growing number of reviews and policy briefing reports have addressed the issue[3, 4]. Mental health covers a wide range of aspects, including mental illness, mental problems, and mental disorders, as well as mental wellness, emotional resilience, and psychological wellbeing[5, 6]. A combination of social and psychological factors impacts human welfare and influence psychological well-being. It encompasses various states of mental health, including both positive and negative experiences[4, 7].

Climate change is already having a negative impact on children in Pakistan and around the world, and it will only get worse in the future. Rising temperatures, severe storms, heat waves, floods, disruption of agricultural cycles, drought, and deteriorating water and air quality are just a few of the environmental concerns Pakistan is facing today. These problems have obvious socioeconomic consequences and have a significant impact on people's quality of life. Children are particularly vulnerable to the harmful effects of climate change because they are still growing physically and intellectually, as well as more susceptible to sickness and environmental stressors[8]. Children are particularly vulnerable to heat waves, and food shortages brought on by droughts can have a negative impact on children's nutrition and health. Young children may find extreme weather frightening and upsetting, which may impact their emotional and psychological health. More young children would be unable to go outside and play as a result of the prolonged length of heat waves, increasing their likelihood of becoming obese[9, 10].

As evidence of climate change's impact on mental health and wellbeing grows and the issue becomes a pressing public health concern, the study examines the current interventions addressing psychological trauma and mental health issues related to it. In addition to its widely acknowledged physical health effects, the crisis has a significant impact on mental well-being[11]. Negative psychiatric outcomes such as depression, PTSD, and suicide have been associated with climate events, especially in vulnerable populations such as children, youth, older adults, pregnant women, chronic illness sufferers, and marginalized communities[12, 13]. Climate change anxiety has triggered various emotions in indigenous communities worldwide, including sadness, anger, grief, fear, and helplessness, and has led to challenges like forced migration and cultural disempowerment[14]. Researchers have linked climate change to psychological distress, especially in children during their physical, psychological, social, and neurological development. Indirect consequences like environmental anxiety disproportionately affect young children, negatively impacting their social and psychological health and potentially exacerbating pre-existing mental health issues. These findings highlight the vulnerability of mental health to climate change's effects[15]. We are already seeing the effects of wildfires, storms, floods, heat waves and droughts. The slow changes in average temperature, sea level, and precipitation patterns that determine the climate in the coming decades may not be as obvious, but ultimately, they are more important because they will harm more people. Despite the perception of polar bears as the primary victims of climate change in several cases[16], concern for human well-being is becoming increasingly evident. In addition to the severe impact of natural disasters and the social effects of forced migration and conflict, increased heat, vector-borne diseases, and malnutrition will threaten physical and mental health[16-18]. It is also important to consider that a rapidly growing body of research has identified links between climate change and a variety of negative impacts on children's mental health outcomes, particularly for children and youth[19]. There are several possible explanations for the relationship between the above-mentioned health outcomes. Researchers and experts in climate change and environmental education are becoming increasingly aware of their potential to encompass more than just skillful information, such as the affective and

attitudinal responses of children to climate change outcomes and their psychological well-being[20,21]. We aim to create education strategies on climate change that enhance children's overall welfare and encourage constructivist engagement in climate change. Instead, we should avoid discussing this topic in class and at school events. It is essential to have a comprehensive understanding of the various psychological experiences that children go through in relation to climate change[22-24]. In addition, exploring the emotional and attitudinal aspects of children's participation in climate change could provide insights into the specific impacts of climate change education in different contexts[19].

This study explores the impact of climate change on children's mental health, focusing on direct and indirect effects. It emphasizes the importance of understanding children's learning about climate change and their coping mechanisms, including fear, phobia, and stress[19]. This study covered climate change, climate anxiety, and the impact of climate change on children's mental health. We applied the present qualitative approaches to a multi-site program spanning across 25 schools. A total of 72 participants, boys and girls, aged ten to sixteen, participated in an activity program over a period of sixteen weeks. Consequently, we undertook this study to examine the importance of children's experiences, perceptions, and attitudes towards learning and action in relation to mental health outcomes affected by climate change. Understand and measure the full spectrum of historical, current, and anticipated psychological impacts on mental well-being that result from exposure to climate change-related factors in children's educational experiences. Gain insight into the various factors that contribute to children's mental health vulnerability and resilience in the face of climate change. Gain insight into the potential impacts of climate change education and communication on children's mental well-being. The study examines the link between children's exposure to climate change education, their involvement in climate change adaptation and mitigation efforts, the potential impact on their mental well-being, and the benefits of these strategies.

The psychological effects of climate change on Pakistani children

Climate change has a significant impact on the physical and mental health of adults, and there is a growing body of research on its psychological effects on children and youth. The impact is particularly significant in areas with poor infrastructure and fewer supports and services. It's important to note that not every child will experience the same effects[25]. The study looked at how extreme weather events had a negative impact on Pakistan's educational outcomes. Climate change impacts the mental health and anxiety of children. Powerful extreme weather events, such as heat waves, heavy rainfall, and droughts, demonstrate the increasing risks of climate change every year, severely affecting children and the public. The likelihood and severity of occurrences are increasing, which has detrimental repercussions for people, property, and the environment. Extreme weather events differ from other climate change consequences in that they are immediately noticeable and poorly defined by the climatological methods investigated in many projections[26]. Unfortunately, there are no standardized methods or efforts to systematically document the hazards associated with climate change. Severe monsoon weather has affected Pakistan since mid-June 2022. Since then, the situation has deteriorated significantly, as the rainfall has been equivalent to nearly three times the national 30-year average. In recent years, rapidly growing research has revealed a connection between climate change and schooling, as well as several psychological effects on children and adolescents. Floods are the main consequence of extreme rainfall. Changes in flood risk caused by heavy precipitation differ in other ways, including language changes, river management, and regional sensitivity to floods[27], furthermore, some factors are climate-related, such as snowmelt, soil moisture, and storm size[26]. Despite significant regional and subregional variations in river flow trends, only anthropogenic climate change can account for many of the observed changes. Research in attribution science has provided evidence that the frequency and severity of

floods are on the rise because of climate change precipitation. In August 2022, an exceptionally powerful monsoon unleashed devastating floods across Pakistan, impacting an estimated 33 million individuals across the country[28]. As a result, 85 percent of children living in developing countries, as well as a small number of disadvantaged children in developed countries, will be the most severely affected.

The psychological effects of the direct impacts of climate change in Pakistan

We expect that the increase in severe extreme weather events will have a significant impact on the mental health and psychological well-being of children. The literature thoroughly discusses the effects of such traumatic events on children. Children are especially susceptible to the impacts of severe weather events, such as disasters that result in family strain, disruption of social support networks, and the displacement of homes and communities. Children are significantly at risk of developing additional mental health issues such as attachment disorders, phobias, anxiety, panic attacks, and depression[25]. There are numerous scientific indications suggesting that human-induced climate change is already having adverse effects on the ecosystem and jeopardizing the world's food security. The recent increase in the frequency of floods and other extreme events throughout South Asia and the rest of the world, particularly in Pakistan, has resulted in significant losses and destruction.

In addition to the effects of EWEs on mental health issues, traumatic experiences in climate-related anxiety and the disruptions they cause can have negative psychological effects on children's ability to control their emotions, as well as cognitive deficits, behavior issues, learning difficulties, mental development issues, language development issues, adjustment issues, and an understanding of academic performance[25]. The effects of EWEs and disasters on children's academic education range from complete destruction to negative impacts on children's mental health performance and dropout rates in schools[29, 30]. According to the available statistical data, heavy rainfall events have severely damaged several school buildings[31]. For approximately 1.6 billion students worldwide, unexpected and sudden transitions from physical activities in the classroom to online learning present a significant barrier. Therefore, it is crucial to understand the impact of natural disasters on students' mental health, psychological well-being, and safety, as well as their academic performance, and to identify and effectively address any potential learning quality losses.

Psychological trauma and mental health in the context of climate change

Extensive research has emphasized the increasing influence of climate change on mental health and overall well-being. This study seeks to assess the scope and features of current interventions addressing psychological trauma and mental health concerns associated with the psychological and mental health effects of climate change. There is an increasing recognition of the importance of public health emergencies related to climate change. Aside from its well-established impact on physical well-being, the crisis also has a notable effect on mental well-being[11]. Experts link climate events to increased psychiatric mortality outcomes, such as depression, PTSD, and suicide[12]. The majority of population groups, such as children and teens, the elderly, pregnant women, those with chronic conditions, and marginalized populations, are known to be particularly at-risk[12,13]. Indigenous communities around the world have spoken of sentiments of despair, rage, grief, fear, and powerlessness brought on by forced migration, worry due to climate change, broken cultural continuity, and past and present disempowerment[14]. Experts have conducted extensive research on the psychological response and coping mechanisms associated with climate change. Nevertheless, there is a dearth of widespread comprehension regarding evidence-based interventions that can effectively tackle adverse consequences and assist individuals and communities. We conducted a thorough review of the research on the correlation between climate change and mental health. We found a total of 120

original studies, the majority of which were cross-sectional studies. We conducted these studies to examine the effects of climate change exposure on mental health outcomes[12]. The eight studies that focused on interventions were primarily theoretical and lacked robust data. In all the assessments of eco-anxiety therapies, only two studies included an empirical evaluation component. The remaining studies primarily examined articles on conceptual reflection[32]. The evaluation was thorough, covering 23 studies. The study did not differentiate between interventions used for climate-related incidents and those for other contexts, such as armed conflicts, which are theoretically relevant to climate change[33]. The study primarily focused on scholarly works and activities addressing the treatment or prevention of established mental illnesses, as per the World Health Organization's definition of mental health[11]. A comprehensive conceptual framework can aid in identifying interventions that enhance psychological resilience and strength in response to climate stress.

Methods

We conducted a thorough qualitative study to collect insights from students regarding the impact of climate change anxiety on their mental health and psychological well-being. Additionally, we analyzed their personal perspectives on these experiences through the lens of climate change[34]. Exploratory qualitative research enables researchers to gain a deep understanding of a phenomenon or topic within a specific context. This approach allows them to thoroughly explore the subject matter and collect in-depth insights. We used a qualitative research design to gain a thorough understanding of how climate change affects children's mental well-being. This design involved conducting individual and focus group interviews with secondary and high school students in Sindh, Pakistan. We chose individual and focus group interviews as the most appropriate methods for this study, considering their established success in collecting qualitative data from children. We utilized a range of primary research methods to gather data for the children's activities program. Initially, the field study team conducted a site visit to carefully observe the location and identify individuals who would be valuable sources of information for the data collection focus group interviews.

We then contracted key informants through attractive in-class physical activity programs, discussed the research purpose with district educational departments, and set up an accessible time for focus group interviews. These interviews facilitate engaging discussions, trigger recollections, assist participants in articulating their thoughts, and allow for assessing the coherence of their statements[35]. Furthermore, we employed consensual qualitative research methods and conducted thematic analysis. As mentioned by Hill *et al*., the consensual qualitative research methodology emphasizes the diverse perspectives and insights of the research team members, enabling them to derive meaningful conclusions based on their assumptions[10]. The researchers conducted several visits to boys and girls over a period of 4 to 10 weeks to collect data for the study. Secondly, the education sector in Sindh was sampled to select a small portion of the total population. We ensured an equal distribution of the sample's ethnic composition. We applied snowball sampling to a few events.

Study setting, sampling and participants

We collected data from a group of 10–16-year-old children who were in their first year of government high school. We conducted a comprehensive series of 32 individual and focus group interviews, involving a total of 40 participants. In total, we gathered insights from 72 interactions. We selected participants from all types of secondary and high schools in different regions of Sindh province, particularly those most affected by floods, such as Dadu, Jacobabad, Qambar Shahdadkot, and Khairpur. Furthermore, we conducted this study in various areas of current working schools. For this program, we selected 12 secondary and 13 high schools, and participant interviews were voluntary for the entire program duration. We conducted the interviews with the participants in a systematic manner. We reached out to the district education department and school administration to request their participation. After receiving their approval, we

proceeded to obtain their informed consent. Next, we professionally engaged with the children and ensured that they fully understood and agreed to participate. All study participants were informed of the study's voluntary nature, data confidentiality, and right to withdraw. We used the questionnaires to collect sociodemographic background information about the children, such as their names, ages, educational levels, and duration of the study.

Procedures and measures

We conducted semi-structured and focus group interviews from December 2022 to March 2023, conducting face-to-face interviews in various regions of Sindh. Participants were recruited through multiple strategies to ensure effective access for eligible participants residing in urban and remote rural areas. First, the research team visited schools to organize a children's climate change activity program with teachers and two major local NGOs working in different regions on topics such as education, health, sustainability, and food. Additionally, the team recruited participants in the children's interviews who had recently experienced the full range of mental health outcomes impacted by climate change, ages 10–16. Second, we contacted the district education department teams, schools' teachers, community groups, and local NGOs working on education development. To recruit participants, we sent a brief letter outlining the members of the study group. Finally, when eligible participants approached our research team, we described the study's aims and objectives as well as any potential risks and benefits. We also covered the study's voluntary nature, confidentiality, and incentive for participation. The principal investigators obtained written informed consent from each participant in accordance with the regulations of the university's ethics committee.

Data analysis

We used qualitative research approaches to sequential explanatory design, which involved qualitative data collection with a single study[36]. Initially, the research team diligently reviewed transcripts, filed notes, segmented texts, and established codes. Each member individually generated the codes, and once the coding process was complete, they exchanged the coding outputs to cross-check the coding quality. Whenever disagreements or appeals regarding coding arose, the members would come together for professional coding meetings. During these meetings, they would carefully discuss and deliberate on any problematic codes until they reached a consensus on the final coding outputs. Additionally, the research team thoroughly examined codes that shared common themes, organizing them into various groups and sub-groups. Through extensive discussions, they collaboratively arrived at a consensus regarding the final thematic model. The model effectively identifies the factors that either hinder or facilitate the impact of climate change on children's mental health. The survey included socioeconomic demographic items and measures scales to assess children's attitudes toward and worry about climate change, as well as their experiences with the full range of mental health outcomes impacted by an environmental worldview[19]. The age range of study participants, the suitability of the climate change approach survey for completion, and the demographic indicators validation of participants under the age of 16. The purpose of data gathering was to determine family income, the number of children, and parents' educational backgrounds.

We used a 5-point Likert scale to rank each item in the survey, ranging from 1 (strongly disagree) to 5 (strongly agree). To calculate the total PSI score, we add up the scores from each sub-scale. The overall score can range from 36 to 180. We chose the 5-point scale to provide a wide range of options, and we chose a natural alternative to fully address and understand the various mental health consequences caused by climate change. The researchers conducted semi-structured interviews and organized three focus groups, each comprising 4–8 children, with participants who were available for a 35–50-minute interview. During the school program, different classroom activities were conducted to explore whether and how the climate change education awareness program impacts children's perceptions about climate anxiety and the world. For instance, we conducted discussions and

interviews with children to understand their perceptions of environmental challenges, attitudes towards global climate change, and concerns about climate anxiety. We also inquired about how these perceptions changed after the implementation of the awareness program, and whether they considered climate change education to safeguard strategic actions. Children's psychological anxiety, fear, depression, and sadness can be alleviated in various ways following extreme weather events and disasters. We utilized NVivo 10 qualitative analysis software to examine the data. We digitally recorded, verbatim transcribed, and anonymized each focus group session to ensure participant confidentiality. We analyzed the data from focus group discussions using thematic analysis, a method previously employed in another school region. The data processing involved becoming acquainted with and initially categorizing the data. We used open-ended questions in this section to gather a wide range of information about how climate change and recent environmental changes have affected children's mental health outcomes.

To gain a deeper understanding of the participants' experiences and perspectives on the impact of climate change on children's mental health, the interviewer utilized open-ended questions. This approach encouraged the participants to provide unrestricted responses to all inquiries. We conducted the interviews in Urdu and Sindhi, the native languages of these areas where all textbooks are available. The researchers recorded the interviews using smartphones. We then transcribed the recordings to facilitate data analysis. The data and interview analysis looked at the theme, relationships between variables, and patterns based on the content. We examined the interview data to draw conclusions. We analyzed the content of the interview transcript to uncover the deeper meaning behind the interviews. At last, we employed a coding technique to efficiently sort and retrieve the data. We processed the data based on thematic descriptions, ranked and combined thematic categories, and ultimately developed thematic story descriptions to depict children's experiences in stories about mental health outcomes linked to the impacts of climate change. Table 1.

Table 1: Socio-demographic characteristics of participants research sites average aged 10-16 years

Characteristics Group	N	%
Gender		
Boys	52	72.2%
Girls	20	27.8%
10 years	05	6.9%
11 years	07	9.7%
12 years	09	12.5%
13 years	10	13.8%
14 years	12	16.6%
15 years	13	18.0%
16 years	16	22.2%
School types (grade)		
Secondary school (6-8)	41	56.9%
High school (9-10)	31	43.1%
Urban	42	58.3%
Rural	30	41.7%

Results

Survey results

Regarding our initial research question, we conducted face-to-face interviews and focus groups with children to explore their emotional, cognitive, and functional responses to climate change. Through qualitative analysis, we delved into children's perceptions, recent mental health outcomes, and the influence of climate change-related attitudes. We also examined the variations in these attitudes regarding climate change, psychological issues, and concerns about their involvement.

Children's perception about climate change and nature

Children's perceptions of learning climate change activities and programs in Pakistan are closely linked to climate change education. The survey consists of nine items that assess respondents' thoughts on climate change and the knowledge they have gained through courses and class activities both within and outside of schools. Respondents provided ratings on a scale of 1 (strongly disagree) to 5 (strongly agree), with the highest rating indicating a stronger connection with CCE learning and knowledge through class activities.

Table 2: Descriptive statistics analysis of the climate change impact on mental health school children in Pakistan (n = 72) Climate Change attitude statement

Children's perception of climate change and nature		
	M	**SD**
Climate change is real concerns for my country.	1.38	.719
I learned CCE I feel people must obey the laws of nature.	1.58	.793
All schools and universities should offer space for CCE.	2.10	.994
My school has properly embedded CC into teaching and learning activities.	1.44	1.33
I am aware of an-going program developed by schools and NGOs in field of CC.	2.50	1.29
Students in my schools are keen to receive training program on CC.	2.50	1.29
Effective CCE can guide policy and action.	2.99	1.11
I learned CCE I should pay attention to climate change as a top priority.	1.00	.000
Students can have a better career pathway if they have good CC literacy	3.00	1.58
Children's perception and experiences of climate anxiety		
Climate change is threat to the world.	1.78	1.06
People worry too much about CC and disasters.	2.27	1.33
Children affect mental health climate change.	2.44	1.42
Direct impacts on Children's capacity to Learn by CC.	2.44	1.42
Climate change's real effects on normal Life.	2.13	1.12
Climate change real threat for children.	1.75	.886
I realized CC severely damaged our capacity to learning.	1.50	.837
Children's perception of climate change and experiences of mental health		
I have psychological anxiety fear, phobia about climate change.	1.55	1.01
Often, I am thinking about CC makes it difficult for me to sleep.	1.60	.843
I have anxiety about CC and physical or mental harm.	1.60	.843
I have anxiety, depression, and mental conditions after flooded.	1.43	.787
I feel psychological problems from flooded or heavy rainfall.	1.44	.726
I feel climate change hurts our lives.	2.00	.894
CC affects my mental health as well as our education and schools.	1.50	.756

Before school program activities participation through that (M = 2.50, SD = 1.29), schools on-going children CCE organizing training events program about climate change (M = 3.00, SD = 1.58), students children expressed the strong connections with CC literacy if they have more awareness program, they can get knowledge and information to better understand climate change. Table 2.

Children's perceptions and experiences of climate anxiety

The 7-item connection with climate anxiety was used to assess children's perceptions of climate anxiety worldwide: climate change is a threat to the world, it has direct impacts on children and normal life, it is a real threat to children, and it has damaged their capacity to learn. Table 2. The respondents' responses ranged from 1 (strongly disagree) to 5 (strongly agree). The highest proportions indicated a greater association with climate change affecting children's mental health (M = 2.44, SD = 1.42), as well as direct effects on children's learning capacity (M = 2.44, SD = 1.42). All 7 items trended towards a stronger climate anxiety and its impact on children's mental health.

Children's perceptions of climate change and experiences of mental health

The 7-item study examines the psychological impact of climate change on children. Recent evidence demonstrates children's exposure to extreme weather events, including flash flooding, hazards, and disasters. In August 2022, Pakistan experienced the most devastating floods in its history, triggered by torrential monsoon rains. The floodwater directly

and indirectly affected over 33 million people and children. Floods have damaged or destroyed at least 18,590 schools across Pakistan, with initial estimates placing the number of impacted children at least 670,000. Children severely affected by climate change have reported psychological impacts on their mental health, including anxiety, depression, displacement stress, sleep disorder, fear, phobia, physical and mental disorders, as well as climate anxiety. Table 2. The respondents' responses varied from 1 (strongly disagree) to 5 (strongly agree), with the highest rate suggesting a stronger association between climate anxiety and its negative impact on their lives (M = 2.00, SD =.094), as well as the direct effects of anxiety, sleep disorders, and physical and mental harm due to climate change (M = 1.60, SD =.843). All 7 items demonstrated a stronger correlation between climate change and its psychological effects on the children's mental health. Table 2

Focus groups findings and results

In this section, we present the findings of the study. To address the research questions of this study, we present the results of a thematic analysis[19]. First, we examine how children learn about climate change education (CCE) in grade 6–10 classrooms during school activities and participate in research. We emphasize the impact of children's learning about climate change and its psychological effects on their mental health, as well as the pedagogical practices incorporated into the CCE, to better understand the mental health and climate-related anxiety of children in the classroom. Finally, we investigate students' outcomes through the CCE, analyzing their psychological well-being and perceptions of climate change.

Children's perception and experiences of climate anxiety

As they observed the changing environment, children viewed climate anxiety through a lens of tangible elements, including animals, wildfires, plants, rising sea levels, and humans. One of the reasons I cried was because I was genuinely upset. Children that participated in the study had many reasons for knowing how human actions affect the environment and climate change.

"Burning fossil fuels like coal and oil causes the pollution. If there are more than 30 people, the train pollutes much less because it only carries the weight of a tram plus a few more people. But if everyone has a [small car], it pollutes even more and weighs a lot more." Ali (15)

"I'm curious about my father's decision to become a vegetarian. What are his motives?" Oh. Could climate change be the cause, or is there another factor I haven't considered? At home, we typically prioritize food and its potential impact on the climate and environment. It's intriguing that the focus group didn't even mention it during their discussion. Munir Ali, age 16.

Some of the respondents provided a list of limited possibilities that allowed the participants to see and identify their potential causes from the perspective of climate anxiety.

"My parents have never discussed climate change; we often hear about it from teachers and social media." Saba (9)

"Climate change causes air pollution, the burning of fossil fuels, deforestation, and greenhouse emissions." Salam (10)

"I read in books and heard on social media that global warming is an average increase in the earth's temperature, which can contribute to changes in global climate patterns. The effects of global warming include ice melting, ozone depletion, global crises and warfare, as well as natural disasters. Touqeer (15)

Some respondents reported that both direct and indirect experiences, like the yearly flash floods in Sindh, affect how young people perceive climate change. Climate change-induced weather patterns link to the increase in flooding events in Sindh. Most children's traditional knowledge has influenced their perception of climate change. Some children attending urban city schools find themselves largely isolated from the natural environment. People no longer directly experience environmental changes

due to urban living and lifestyles; instead, they are completely dependent on information concerning climate change and the nature of weather through social media, documentaries, television programs, and stories told by others.

"It's challenging to articulate narratives, but this is my current perspective on the world." I believe that young people should cease discarding items into the sea and refrain from causing harm to the environment. We are all affected by climate change and the natural environment around us." Rafiq (16)
"Often, when we visit Karachi and enjoy the sea view, I find myself embarrassed and saddened by the sight of people littering. This reminds me of a video I've seen where people typically throw waste into the sea, which then ends up entangling fish." It helps them die sooner, and then we don't have food sooner." Sabeen Ali (15)

Children's perceptions of climate change and experiences of mental health

Children experience more climate anxiety because of climate change, and these feelings may include anger, fear, sadness, despair, concern, guilt, shame, and hope, although their presence varies between individuals. Certain emotions, particularly grief, anxiety, and worry related to recent and upcoming losses, have gained increased attention as the area of study develops. There has only recently been research on other emotions, such as guilt over one's role in climate change or shame over the greater harm that humans have caused to the environment[15]. Most children's perceptions of climate-related anxiety have significant negative effects on mental health and psychological well-being among participants. Some children expressed concerns about climate-related issues, such as extreme weather events, flooding, disasters, and drought, and there was an increase in discussions about environmental issues.

"Climate change directly affects our lives because we didn't have enough resources to live in the [city]. The last few months [flooded] our village, our community was severely affected, homes and schools were destroyed, and severe deaths, including land and animals, increased diseases, and a mental health problem with people." Waqar (14).
"When I was studying at school, I often realized [climate anxiety], I didn't sleep well, and I experienced depression, anxiety, fear, phobia, and mental illness due to climate change." Zakir Ali (16)
"Thinking about climate change makes it difficult for me to sleep," or "I find myself crying because of climate change," according to Faiza (9).
"Climate phobia [OMG]: I've experienced apprehension, sorrow, and anxiety due to the threat of climate change." Nazia (13).

These relational emotions, as well as cultural, psychological, legal, ethical, and political aspects, are necessary for a thorough understanding of climate anxiety in children. The current narrative risks personalizing the so-called problem of climate change and climate anxiety by suggesting that individuals should act. In addition, to understand climate change, we asked children to experience and perceive climate anxiety, physical and mental health, and people's well-being. Teenagers expressed similar feelings when they spoke of climate anxiety, fear and worry. Sea levels will rise excessively, potentially leading to flooding situations once again. After the event, some children reported feeling more confident.

"Climate change negatively impacts our lives and negatively impacts our mental and physical health, causing me concern as it could potentially increase the risk of disasters and flooding in our community." Akhtar Ali (9).
"I am so happy to learn from these activities about the climate change awareness program, now I feel like I can do stuff to protect the environment." Asiya (10)
"The climate change program increased my confidence in my ability to be more interested in the outside world." It encouraged me and made me confident that I could learn more about the world outside climate change. I should understand that learning about climate change can be exciting. Zara (10).
"*No, I didn't think about that. I was genuinely terrified of the effects of climate change and flash*

flooding, and the intense rainfall I was experiencing in the classroom left me completely paralyzed. Despite observing teachers and students outside in the rain, I chose not to leave the classroom. Regrettably, this event resulted in the destruction of the classroom building, leaving me severely injured. I now experience severe phobia, anxiety, fear, and stress due to climate change. Mehwish (13).

Discussion

Although long-term effects are more difficult, reactions to extreme weather events are comparable to the trauma caused by natural catastrophes. Climate change pressures could result in climate-related mental diseases (CRMD), new adoptions, and new types of mental health and misery, all of which could result from the pressures of climate change[37]. The study highlights the profound influence of climate change on the mental well-being of children in Pakistan, impacting both those in rural and urban areas. Climate change poses a significant threat to our psychological, physical, and mental well-being in the 21st century[38]. We urgently need to improve our understanding of the impact of climate change on mental health and develop effective strategies to prevent mental health issues. We aim to promote mental health through a comprehensive approach that encompasses clinical, political, and social work. Our goal is to reach out to children, parents, communities, and society while taking climate change into account. Many qualitative researchers consider open-ended questions to be a reliable method for obtaining more detailed and narrative-rich data. This study examined the CCE school children's program, which encourages children to learn and act, as well as children's perceptions of the psychological effects of climate change on their mental health. The literature's open-versus-closed questions and focus groups offered a comprehensive understanding of children's perspectives in the interviews. During focus groups, children shared their experiences with the CCE program's activities, discussing how they developed a greater awareness of the importance of addressing climate change, a stronger appreciation for the environment, and a range of emotions related to the issue. Recent research suggests that daily experiences and thoughts about the issue of climate change, which they unfortunately bear the brunt of, greatly affect the emotional well-being of disadvantaged communities. The study's findings show that when kids learned more about project activities and the urgency of climate change worldwide, their opinions underwent a variety of adjustments. The effects of climate change on children's mental health and general wellbeing emphasize the need for careful planning and preventative actions. The psychological repercussions of climate change have a significant influence on children's negative feelings and mental health.

In Pakistan, a developing nation, most marginalized children encounter a range of educational challenges, including inadequate infrastructure, insufficient awareness, a scarcity of textbooks, a deficiency in scientific and social science knowledge, a shortage of qualified teachers, inadequate instruction on climate change, and environmental issues that affect the vulnerable population at all levels. Several scholars have highlighted these issues. The vulnerable population, particularly children aged 10-20, suffers from climate anxiety, and in 2022, they experienced the most severe floods in Pakistan's history. Climate anxiety is a fundamentally distressing concern about climate change and its impacts on the landscape and human existence. However, climate change can also have an impact on our mental well-being, causing climate anxiety or, more generally, eco-concern, which can affect individuals who are deeply worried about the condition of the climate and the environment. Therefore, we need to improve climate education for children to better understand the issues impacting their psychological and mental health. However, our study found significant differences in how to cope with climate change and its psychological impacts based on gender, education, and socioeconomic level. The girls appeared to be more sensitive to thought and action than the boys; this may be a result of their likely pro-environmental sentiments.

Limitations

This study's limitations include the use of qualitative methodologies and a non-experimental design, which pose challenges in drawing definitive conclusions about the observed changes in children's perspectives as measured. We aim to explore how children's encounters with climate change heighten their anxiety towards it, and how they perceive the government and stakeholders. Children's responses to climate change, particularly in cases of mental health problems, are intricate and multifaceted subjects. Furthermore, this study measures children's perceptions of climate change education programs and mental health issues discussed during class activities to provide knowledge about climate change and psychological well-being. Unfortunately, our study shows that many children report difficult thoughts, mental health, anxiety, fear, sadness, sleep disturbances, mood and functional impairments related to climate change, and we are unable to show how severe this is compared to a normal sample.

Recommendation, Children can take an active role in combating climate change by promoting new regulations and implementing environmentally friendly practices in public and private schools, neighborhoods, and community initiatives at the local level. Educators can help raise children's awareness of climate change. They could gather tools and resources to assist students in discussing the impacts of climate change, seamlessly incorporating climate change education into regular teaching and learning activities, and much more. To effectively educate children about the psychological impacts of climate change and motivate them to act, it would be beneficial for the government, stakeholders, and education scholars to collaborate on organizing training and workshop sessions at schools. Experts can work together with policymakers, NGOs, and stakeholders to advance sustainable practices and address the psychological effects of climate change. The government and stakeholders have a vital role to play in tackling climate change and promoting mental health awareness among children through school training programs.

Conclusion

There is an increasing recognition of the negative impact that climate change has on mental health and psychological well-being. This study has investigated the possible factors contributing to climate-related anxiety and its effects on the mental health and psychological well-being of children in Pakistan. In summary, our research indicates that climate anxiety has significant effects on the mental well-being of young children, highlighting the psychological challenges they face. Furthermore, climate-related anxiety makes clear the critical importance of children's changing attitudes towards climate change education. Children's emotional, psychological, and mental health realities inevitably play a role beyond academic development in various environments, including classroom learning. Our analysis suggests that giving children the opportunity to engage in thoughtful conversations, self-reflection, and action can lead to more nuanced perspectives on climate change. The study's findings uncovered a noteworthy connection, both direct and indirect, between climate change and the mental well-being of children in urban and rural areas. Efficient climate change education programs have alleviated children's climate concerns.

However, we found significant differences in terms of gender, qualifications, and socio-economic status. Environmental experts and mental health professionals have significantly contributed to mitigating climate change and assisting children in coping with its effects. Future research should focus on the impact of climate change on children's public health and psychological well-being. The study revealed that children between the ages of 10 and 16 displayed a heightened understanding of how climate change impacts their mental well-being, as well as a stronger inclination towards environmental respect and responsibility. There is a lack of awareness among young people regarding the connection between climate change education and its impact on mental health. Given the growing concern, it's crucial to consider the potential harm to psychological and mental health. Environmental experts and psychological professionals should be

aware of climate change and incorporate it into children's school-level training, as well as parents' and community education through psychology and health clinical training. This approach aims to help children and adolescents experiencing climate change and psychological anxiety reflect on and act on best practices.

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