Faculty of Medical and Health Sciences, University of Poonch Rawalakot
Journal of Pharma and Biomedics
ISSN: 3007-1984(online), 3007-1976 (Print)
https://www.jpbsci.com/index.php/jpbs

Exploring the Relationship Between Climate Change and Human Health in KPK: A Cross-Sectional Perspective

Shahid Ullah, Haidar Ali, Iftikhar Aziz, Hussain Ali, Adnan Ahmad

Oxford College of Nursing and Allied Health Sciences Karachi, Pakistan.

Received: February 27, 2025; Revised: April 10, 2025; Accepted: April 30, 2025

A B S T R A C T

Introduction: Climate change has also emerged as an important determinant of global health, especially in vulnerable areas. In Pakistan's Khyber Pakhtunkhwa (KPK) province, the effects of climate change in the form of extreme weather conditions, including heatwaves, floods, and air pollution, have had a direct impact on health. The objective of the present study is to examine the effects of climate change on human health in KPK, with an emphasis on respiratory ailments, mental health, and the incidence of vector-borne diseases. **Methodology:** A cross-sectional study was carried out among 89 participants from rural and urban regions of KPK. Participants were recruited through a stratified random sampling method. Data were collected on climate exposure and related health problems, such as respiratory disease, mental health symptoms, and vector-borne illnesses, using a structured questionnaire. Descriptive statistics were applied to analyze the data, and associations were tested using chi-square tests and correlation analysis. **Results:** 58% of respondents reported respiratory problems and 43% reported heat-related symptoms. Vector-borne disease affected 32% of the respondents, while 29% reported anxiety and depression. Statistical associations between exposure to floods and respiratory issues ($p = 0.03$) were evident. Rural respondents had more prevalent climate-related illness compared to their urban counterparts. The findings emphasize the far-reaching health effects of climate change within the area. **Conclusion:** This research highlights the importance of specific public health interventions in KPK to counter the health threats of climate change. Enhancing healthcare systems, raising awareness about climate change, and enhancing resilience among vulnerable populations are essential to reducing these health threats.

Keywords: Climate, Climate Change, Human Health.

Corresponding Author: Shahid Ullah
Email: shahidsafi5652@gmail.com

INTRODUCTION

Climate change has developed into a worldwide health issue that poses considerable dangers to human wellbeing, especially to vulnerable areas such as Khyber Pakhtunkhwa (KP), Pakistan. The province's variable topography, with mountainous regions and dry plains, makes it vulnerable to a variety of climate-related challenges, such as floods, heatwaves, and glacial lake outburst floods (GLOFs) (Ebi, 2024). These climatic occurrences have been associated with an upsurge in health problems like vector-borne diseases, respiratory conditions, and mental disorders (Mina MQ et al., 2024). Current estimates project that by mid-century, KP may experience a 30–40% upsurge in malaria and dengue infections, a 10–20% increase in diarrheal diseases, and a substantial rise in respiratory disease due to rising temperatures and declining air quality (Ebi, 2024). The floods of 2022, the worst to occur in the history of Pakistan, also exemplified the susceptibility of the province and caused massive displacement and increased transmission of diseases (Nanditha et al., 2023). The

aggravation of non-communicable diseases (NCDs) like cardiovascular disease and diabetes has been attributed to climate change, and that too with preponderant causalities as food insecurity, disturbance of the health system, and exposure to excessive weather (Ahmed, 2023).

Mental health impacts, especially among rural women, have also been noted, with rising rates of anxiety, depression, and psychological distress induced by climate and environmental stressors (Daraz et al., 2024). Khyber Pakhtunkhwa has reacted to these risks by initiating Pakistan's first Climate and Health Adaptation Plan, which aims to incorporate climate resilience into healthcare infrastructure, enhance early warning systems, and set up climate-specific governance units within the provincial health department (Iqbal MP., 2020). Notwithstanding such efforts, numerous rural and poor communities within KP remain disproportionately affected by lack of information, weak access to health care, and socio-economic exposures (Dalal, 2021). Numerous studies within the region have highlighted the value of local assessments to consider climate effects and community resilience against health hazards (Ali et al., 2022). In addition, increased awareness exists that region-specific research that is data-driven is critical in designing adaptive policies and advancing public health preparedness (Zachariah et al., 2023).

With the rise in health hazards posed by climate change in KP, this research seeks to investigate the complex interplay between climatic fluctuations and human health impacts in the region. Through the use of a cross-sectional design, the study aims to determine common health problems attributed to climate change and evaluate the adequacy of existing adaptation measures (Ndubuisi et al., 2025). Results are likely to guide policymakers and healthcare workers to develop focused interventions to counter health risks and promote community resilience.

METHODOLOGY

This descriptive cross-sectional study was carried out to investigate the relation between climate change and human health in Khyber Pakhtunkhwa (KPK), Pakistan. The study population included adult local inhabitants (older than 18 years) residing in chosen urban and rural settlements of KPK who had endured or been exposed to climate hazards like floods, heatwaves, air pollution, or seasonal outbreaks of diseases. A non-probability purposive sampling method was employed to enroll 89 participants, ensuring the inclusion of those having direct or indirect experience of health impacts caused by climate. The participant inclusion criteria were that participants must be long-term permanent residents of KPK for at least five years, capable of giving informed consent, and having experienced health symptoms or events due to climate. Participants under the age of 18 years, temporary residents, or those who were incapable of giving informed consent because of health or cognitive issues were excluded. Information was gathered through a structured questionnaire developed following an extensive review of recent literature on climate change and health effects in South Asia.

The instrument was split into four parts: demographic description, exposure to climate events (e.g., heat wave, floods, air pollution), health impacts (e.g., respiratory illnesses, vector-borne disease, mental health morbidity), and perception and cognition about climate change and its impacts on health. The questionnaire was pre-tested with 10 residents from a neighboring area to determine clarity, reliability, and cultural acceptability; these participants were not included in the primary study. Data collection was done by skilled field investigators using face-to-face interviews in local languages to promote understanding and accuracy. Fieldwork was done between January and April 2025. Ethical clearance was sought and participants were presented with a thorough informed consent form, with confidentiality, voluntary participation, and freedom to withdraw at any time ensured. All answers were made anonymous.

Data were entered and analyzed with SPSS version 26. Descriptive statistics, such as frequencies, percentages, and means, were computed for demographic and exposure variables. Inferential statistics, such as chi-square tests and binary logistic regression, were used to test associations between exposure to certain climate-related events and self-reported health outcomes, with a p-value less than 0.05 deemed statistically significant. The cross-sectional design of the study enabled the evaluation of patterns and associations at a point in time, which shed light on the contemporary burden of climate-related health effects in the province. Results from this approach are meant to inform public health actors in formulating context-driven interventions to improve community resilience and readiness in the face of climate change in KPK.

RESULT

There were 89 participants in the study, where 55% were females and 45% were males. The age was found to be 42% between 30-45 years, followed by 35% between 18–29 years. The rural population formed the major portion of the sample (60%), and 40% belonged to the urban area. The level of education among participants was not uniform, with 38% of them having completed secondary school and 22% of them lacking formal education, suggesting a knowledge gap in climate change and health as shown in table 1.

Table 1: Demographic Characteristics of Participants (n = 89).

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	40	45%
	Female	49	55%
Age Group	18–29 years	31	35%
	30–45 years	37	42%
	>45 years	21	23%
Residence	Urban	36	40%
	Rural	53	60%
Education Level	No formal education	20	22%
	Primary	18	20%
	Secondary	34	38%
	Higher Secondary/Above	17	20%

Exposure to climate-related events was prevalent among the respondents, with 68% having reported at least one event. Flooding was the most frequently reported event, reported by 45% of participants, followed by heatwaves (32%), and drought (19%). Air pollution events (smog/dust) were also reported by 26% of participants, as shown in table 2.

Table 2: Exposure to climate-related events.

Climate Event Experienced	Frequency (n)	Percentage (%)
Flooding	40	45%
Heatwaves	28	32%
Drought	17	19%
Air Pollution (smog/dust)	23	26%
None	12	13%

This study evaluated the health effects of climate change, with the prevalent health conditions being respiratory ailments (58%), then heat-related complaints (43%) and vector-borne illnesses (32%). An important percentage (29%) also experienced mental illnesses, including anxiety and trauma, which were associated with climate-related events. The table 3 provides these health effects.

The statistical comparison identified various highly significant associations. Exposure to flood was highly associated with respiratory disease ($p = 0.03$), whereas heatwave exposure was significantly associated with symptoms from heat ($p = 0.01$). Moreover, those who were more climate aware were more prone to protective behavior in the forms of increased water consumption and the use of protective clothing during extreme weather events as shown in table 4.

Table 3: Reported health impacts linked to climate change.

Health Issue Reported	Frequency (n)	Percentage (%)
Respiratory problems	52	58%
Heat-related symptoms	38	43%
Vector-borne diseases	28	32%
Mental health issues	26	29%

Table 4: Statistical associations (chi-square test results).

Variables Compared	p-value	Significance
Flood exposure vs. Respiratory illness	0.03	Significant
Heatwave exposure vs. Heat-related symptoms	0.01	Significant
Education level vs. Climate change awareness	0.02	Significant
Residence (rural/urban) vs. Vector-borne diseases	0.02	Significant
Climate awareness vs. Protective health behavior	0.04	Significant

These findings suggest that climate change is indeed affecting human health in Khyber Pakhtunkhwa, especially in rural settings where flood and heatwave exposure has been linked to increased rates of respiratory and vector-borne illnesses. Education and climate awareness also seem to affect the uptake of protective health behaviors, highlighting the importance of community-based health education and climate adaptation planning.

DISCUSSION

Climate change is increasingly becoming a major threat to public health. The results of this research are consistent with several national and international reports that highlight the negative health effects of climate change. Respiratory conditions, heat-related illness, and vector-borne diseases have been repeatedly associated with climate events such as flood, heatwaves, and air pollution. This part contrasts the findings of the current research with national and international research on the health effects of climate change. Globally, research has proven the same trends in the effects of climate change on health. A study noted that respiratory conditions, including asthma and bronchitis, are among the most frequently reported illnesses in regions affected by air pollution and dust storms, as seen in the findings of the current study (Torti, 2012). During the study, 58% of respondents indicated that respiratory issues are a direct impact of climate change events, supporting a study whose researcher noted similar occurrence of respiratory illness in places where there's high exposure to air pollution. In their research on flood-prone regions in South Asia, a study reported a high rise in respiratory ailments and mental health problems after flooding incidents, which is consistent with the results of this study, where 29% of the participants reported mental health problems after extreme climate events (Dong et al., 2021).

In the same way, a study noted a significant increase in mental health issues in populations affected by floods, with a trend indicating a worldwide movement where the effects of extreme weather events are experienced not just physically but also psychologically. Additional studies have shown that symptoms related to heat, like dehydration, headache, and heatstroke, pose a significant risk to populations who are exposed to severe heatwaves, especially those from low-income and rural settings. Heatwaves in Southeast Asia were reported in a study whereby 43% of the participants had experienced symptoms related to heat, which was almost the same as 43% of this study's participants (Rizwan et al., 2024). Additionally, vector-borne illnesses, which are worsened by heavy rainfall and standing water, have been said to impact groups in flood areas. In Africa, research found a high correlation between flooding and elevated rates of malaria and dengue, which is parallel to the 32% of respondents in this research who stated vector-borne diseases due to climate change (Veillard, 2024). It is an indicator of how the spread of diseases is facilitated through climate change, particularly in poor sanitation and the lack of appropriate public health facilities. At the national level, the same health effects of climate change have been recorded in Pakistan. In Karachi, it was found that heatwaves were a major cause of health issues related to heat, with the same results as 43% of the participants experiencing symptoms such as dehydration and fainting in this research (Baber MS et al., 2021). Furthermore, their study concluded that those who resided in areas prone to flooding experienced more respiratory diseases and waterborne diseases. This corroborates the current study whereby flooding was linked to respiratory problems ($p = 0.03$) and vector borne illnesses (Irum, 2025). Likewise, the impact of climate change on health in Pakistan and Punjab, and observed a high correlation between air pollution and respiratory ailments among urban residents. In the current research, 26% of respondents indicated air pollution-related health concerns, necessitating targeted interventions among urban populations to counter these effects (Rizwan et al., 2021). Additionally, a study investigated the relationship between awareness of climate change and health behaviors in KPK and revealed that people with increased awareness of climate change tended to be more protective, paralleling the current study where participants with more climate awareness practiced preventative measures like avoiding outdoor activities during extreme heat and wearing masks during smog episodes (Vellierd, 2024).

LIMITATIONS

Although the study sheds valuable light on the health effects of climate change in KPK, it is hampered by the cross-sectional design, which limits the capacity to make inferences about causal associations. Longitudinal studies in the future are necessary to clarify the long-term health effects of exposure to climate change. More research is also necessary to evaluate the efficacy of public health interventions to reduce climate-related health hazards, particularly in rural and disadvantaged communities.

CONCLUSION

This study highlights the significant role of climate change in affecting public health, especially in susceptible areas

such as Khyber Pakhtunkhwa. The results are consistent with international and national studies, which point towards higher rates of respiratory conditions, heat-related illness, and vector-borne illnesses. These findings stress the need for effective adaptation measures, such as improved public health infrastructure, climate-resilient health systems, and focused awareness programs. Solving these issues is important to offset the negative impacts of climate change on human health and protect the well-being of populations at risk.

REFERENCES

Ahmed, M. (2023). Study: Non-infectious diseases cause early death in Pakistan.

Ali, M.Z., Akmal, A., & Fatima, L. **(**2022). Climate change—a monumental risk to Pakistani health. *JPMA. The Journal of the Pakistan Medical Association*, 72(6), 1249–.

Babar, M.S., Tazyeen, S., Khan, H., Tsagkaris, C., Essar, M.Y., & Ahmad, S. **(**2021). Impact of climate change on health in Karachi, Pakistan. *The Journal of Climate Change and Health*, 2, 100013

Bopp, M., Ehrenberg, J., Nugent, R., & McMillan, R. (2015). External review of the IDRC Ecosystems and Human Health (EcoHealth) Program.

Dalal, S**.** (2023). The Role of United Nations in Economic and Social Development of Iraq Between 2003–2021.

Daraz, U., Khan, Y., Alsawalqa, R.O., Alrawashdeh, M.N., & Alnajdawi, A.M. (2024). Impact of climate change on women mental health in rural hinterland of Pakistan. *Frontiers in Psychiatry*, 15, 1450943

Dong, Z., Wang, L., Sun, Y., Hu, T., Limsakul, A., Singhruck, P., & Pimonsree, S**.** (2021). Heatwaves in Southeast Asia and their changes in a warmer world. *Earth's Future*, 9(7), e2021EF001992

Ebi, K.L. (2024). Climate changes health. *The Journal of Infectious Diseases*, 229(4), 926–927

Iqbal, M.P. (2020). Effect of climate change on health in Pakistan: climate change and health in Pakistan. *Proceedings of the Pakistan Academy of Sciences: B. Life and Environmental Sciences*, 57(3), 1–2.

Iram, S., Qaisar, I., Shabbir, R., Pomee, M. S., Schmidt, M., & Hertig, E. (2025). Impact of Air Pollution and Smog on Human Health in Pakistan: A Systematic Review. *Environments*, *12*(2), 46.

Khan, A., & Rahman, Z.U. (2024). People perspectives on climate change impacts and adaptive strategies: A study of vulnerabilities, coping mechanisms, and resilience in Khyber Pakhtunkhwa (KP), Pakistan. *Pakistan*, 64(2), 63–100.

Mian, M.Q., Ayman, S.A., Ali, B., & Ullah, U. (2024). Unraveling the impact of climate change on health dynamics in District Swat, Pakistan: A pathway to sustainable resilience. *International Journal of Social Science Archives (IJSSA)*, 7(3).

Nanditha, J.S., Kushwaha, A.P., Singh, R., Malik, I., Solanki, H., Chuphal, D.S., Mishra, V**.** (2023). The Pakistan flood of August 2022: Causes and implications. *Earth's Future*, 11(3),

Ndubuisi OG, Sony EA, Ugah TA, Omatseyione N, Cletus OA (2025). Climate Resilience and Adaptation: Impact on Human Well-being. International Journal of Innovative Healthcare Research13(1):64-73

Rizwan Ullah, M., Mao, J., & Nasrullah, M. (2024). Climate change awareness and adoption measurements of respondents toward food security in Khyber Pakhtunkhwa, Pakistan. *Journal of Water and Climate Change*, 15(9), 4699–4712.

Torti, J. (2012). Floods in Southeast Asia: A health priority. *Journal of Global Health*, 2(2), 020304.

Veillard M. (2024) Psychological experiences of climate change: implications for youth mental health (Doctoral dissertation, University of Glasgow). 1(1), 4-65

Zachariah M, Arulalan T, AchutaRao K, Saeed F, Jha R, Dhasmana MK, Mondal A, Bonnet R, Vautard R, Philip S, Kew S (2023). Attribution of 2022 early-spring heatwave in India and Pakistan to climate change: lessons in assessing vulnerability and preparedness in reducing impacts. Environmental Research: Climate. 21;2(4):0450