# Knowledge, Attitude and Practice based Study on Extreme Weather Events in Pakistan

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**Abstract**

*Climate change is the global threat, and Pakistan is the eighth most affected country from the climate change. The study analyzes the status of knowledge, attitude and practice about extreme weather events among general population in Pakistan. The data is collected using cross sectional design from participants (n=266), including female (n=142) and male (n=124). Descriptive statistics are presented, and the findings reveal that 88% of participants had good knowledge about extreme weather events, its threats and potential impacts. More than 50% of participants depicted good attitude to learn about extreme weather events and 93% participants engaged in good practices to mitigate the threats of extreme weather events. The Chi-Square test shows that gender and area are significantly associated with extreme weather events on the basis of knowledge, attitude and practice. The study suggests that state agencies and other non-governmental bodies should introduce environmental interventions and pragmatic measures to raise awareness among participants to cope with extreme weather events.*

**Key words:** Attitude, extreme weather, environmental interventions, Climate change, Pakistan

**Article history:** Received: Aug17 2024, Revised Dec 16 2024 Accepted: Dec 22 2024



**DOI:** https://doi.org/10.51732/njssh.v10i3.208

Journal homepage: www.njssh.nust.edu.pk

## 1. INTODUCTION

Research on climate change has progressed from evaluations of its impacts to the formulation of measures for adaptation (Ali et al., 2017; Ali & Erenstein, 2017; Gorst et al., 2018; Fahad & Wang, 2018; Ullah et al., 2018; Abid et al., 2019). The frequency and predictability of extreme weather events are increasing due to the combined effects of human activity and global warming on the hydrological cycle (Evans & Boyer-Souchet, 2012; Ummenhofer & Meehl, 2017; Best & Darby, 2020). Devastating floods, the opposite extreme of hydrological occurrences, have emerged more frequently and have had a lasting impact in the world's largest rivers (e.g. Arnell & Hirabayashi et al., 2013; Espinoza et al., 2022).

Pakistan faces heightened vulnerability due to the increasing variability induced by climate change. Unusually high temperatures during spring and throughout the summer season intensified a powerful depression originating from the Arabian Sea, resulting in substantial rainfall in the south regions. With a predominantly arid desert climate, Pakistan frequently contends with severe heat waves, including a notable event in early summer 2022, amplified by anthropogenic climate change (WWA, 2022). The country faces periodic catastrophic rainfall-induced floods, exemplified by the 2010 event. While there is compelling evidence pointing to heavy rainfall across South Asia (Seneviratne et al., 2021) and a

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strengthening and monsoon movements from the west over Pakistan (Hanif et al., 2013), there is low confidence regarding whether human influence on the climate is the primary driver of the extreme rainfall (Seneviratne et al., 2021).

## 2. LITERATURE REVIEW

Climate change has been labeled as "the most significant global health risk of the 21st century" (Borg et al., 2021; Clayton, 2021)). Health risks associated with climate change encompass the worldwide temperature increase, alterations in precipitation trends, and heightened occurrence of extreme weather phenomena (Massaza et al., 2022; Martin, 2021). Heatwaves, hurricanes, tropical storms, floods and drought are wide spreading worldwide, and these disasters caused by environmental changes are considered as extreme weather events (Elsner, 2020). Extreme weather events, primarily those related to climate and hydrology, have the potential to impact biodiversity and river ecosystems' ecological processes. The effects of extreme events on biodiversity and ecological processes vary (Bowler et al., 2020). Unknown repercussions for the linkages between biodiversity and ecosystem function may arise from changes in community structure brought about by trend and event effects on ecosystem functions (Biggs et al., 2020).

Human health used to be impacted by extreme weather events in two primary ways. Firstly, they can result in injuries or fatalities directly. Secondly, they indirectly contribute to mental health disorders, physical illness, water contamination, resurgence and redistribution of infectious diseases and property and infrastructure damage (Forzieri et al., 2017; Füssel et al., 2017). The intersection of extreme weather events and water quality also holds significant importance in the realm of climate change economics theory and related literature. The significant impact on water quality is evident in non-high-income countries and in nations with low technological innovation, particularly in areas unrelated to water resources (Zou at al., 2023). Extreme weather events, including extreme drought, heavy rainfall, and extreme heat, were observed to result in a reduction of plant biomass and C flux (Qu et al., 2023).

The impact of extreme weather events on wheat yields was observed to be time-specific, with the week of occurrence playing a crucial role in determining its effect on yields (Powell & Reinhard, 2016). Extreme weather events promoted urbanization (Yiadom et al., 2023; Qian et al., 2022; Yiadom & Abdul-Mumuni, 2022; Wu et al., 2020; Luong et al., 2020). Additionally, extreme weather events have very weak negative correlation (Yiadom et al., 2023; Yiadom et al., 2023; Tui & Fakhruddin, 2022; Ngcamuv & Chari, 2020). Extreme weather events reinforced urbanization which resulted in high temperature rise, drought, floods and rise in sea level (Chen et al., 2021). The application of imagery methods and remote sensing for monitoring and identifying the impacts of extreme weather events is an area that still requires further development (Cogato et al., 2021). Extreme weather events were found to be common causes of seascape and landscape changes. Those changes led to transformation and feelings of psychological desolation (Beggs et al., 2022). Extreme weather events have irreversible impacts on biophysical systems of earth causing mental and physical health risks (Whitemee et al., 2015).

Experiencing direct contact with severe weather phenomena like floods and hurricanes not

only poses an immediate threat to life but also leaves lasting effects on individuals' mental well-being. These effects encompass conditions such as mood disorders, depression, sleep disturbances, anxiety and post-traumatic stress (Palkinas & Wong, 2020).

The recent studies indicate that the repercussions of climate change reach beyond physical well-being, significantly impacting mental health (Cianconi et al., 2020; Stone et al., 2022). Intersectional analysis revealed that females in both younger and older age groups perceived higher risks of extreme weather events as compared to their male counterparts of the same age. Females exhibited significantly higher risk perception for all hazards compared to males with similar education levels (Cuesta et al., 2022). A KAP study found that workers have improved their knowledge on heatstroke treatment and daily life habits as well as interventions played a positive role in prevention of heat waves for migrant workers (Peng, 2019). Another study found that 79% of participants recognized climate as a major threat while exposing themselves to extreme weather events (Peria et al., 2016).

Another KAP study found high scores on knowledge and practice as compared to attitude in preventing sunstroke to avoid heat exposure and played a significant role in minimizing heat-related diseases (Li et al., 2016). The research revealed that visitors at Al-Mashar Park exhibit insufficient readiness to address the challenges posed by climate change, despite the evident climate variability in Hail (Said, 2022). An intervention-based study conducted to improve knowledge and attitude to cope with heat waves. The study found interventions were significant in enhancing level of knowledge and attitude towards heat waves in participants (Xu et al., 2018).

76% of respondents in the Dengue Fever (DF) expressed the belief that climate change could impact the transmission of DF and demonstrated commendable levels of understanding (76.7%), positive attitudes (87.9%), and practical application (39.1%) toward climate change. The analysis revealed statistically significant associations between robust knowledge and positive attitudes with effective climate change adaptation or mitigation practices (Rahman et al., 2021). Another study found participants were interested in seeking more about climate change and association between climate change and infectious disease outbreaks (Sambath et al., 2022).

The medical students had very poor knowledge about climate action and the Sustainable Developmental Goal. Most of the students (97.4%) agreed that global warming was the major consequence of human actions. Those students have greater knowledge were involved in environment-friendly practices and other (72%) were gaining information about climate change through internet sources (Reddy et al., 2022).

Climate change is believed to be bad among participants (83%) but some participants considered climate change as controllable (67%). Most participants viewed extreme weather events cause illness due to heat stress and poor air quality. Participants had very poor knowledge regarding the causes of climate change (Yang et al., 2018). Another study was conducted on the knowledge, attitude and practice of climate change. The participants had a higher level of awareness but had little knowledge about occurrences and repercussions of climate change (Gadzekpo et al., 2018).

The knowledge of climate change among participants was associated with their

socioeconomic status and level of education and the participants' attitude regarding climate change was significantly associated with internet usage and their residential status and their practices towards climate change were connected to socioeconomic status and their level of education (Rahman et al., 2021). Gender influences the adoption of climate change adaptation strategies. The socioeconomic and institutional factors played a significant role in determining adaptation strategies, with discernible variations between male and female farmers (Acheampong et al., 2023). Gender roles, educational background, age, knowledge level, marital status, dynamics of intra-household power, religious beliefs, social standing, and ethnic identity all intersected with gender in shaping perceptions and adaptation strategies regarding extreme weather events (Haque et al., 2023).

Female participants had more knowledge about climate change than male participants and they predisposed good attitude more than males. Females (57.8%) were found involved in good practices about climate change education than males (42.2%) (Chaudhry et al., 2024). Teachers had moderate knowledge about climate change education. Their attitude towards gaining climate change education was moderate but their practice level was not satisfactory. Female teachers were involved in high level of practice while, male had high level of knowledge and attitude about climate change education (Karami et al., 2017).

The literature showed that many studies conducted on climate change in different regions of the world. But it is evident from a vast literature review, not a single study was conducted on the Knowledge, Attitude and Practice-based on extreme weather events among general population of Layyah. The aim of a Knowledge, Attitude, and Practice-based study on extreme weather events among population of district Layyah, Punjab in Pakistan was to comprehensively examine the level of awareness regarding extreme weather events in participants, their disposition and practice towards coping extreme weather events threats. The objective was to provide interventions, educational initiatives, and policy measures aimed at enhancing public preparedness, fostering adaptive behaviors, and ultimately reducing the vulnerability of communities to the adverse effects of extreme weather events in Pakistan.

## 3. THEORETICAL FRAMEWORK

The study is grounded in Climate Change Adaptation Theory and enriched by a Gendered Vulnerability Perspective, examining individuals' knowledge, attitudes, and practices (KAP) regarding extreme weather events (EWEs). Climate Change Adaptation Theory highlights how individuals, communities, and systems adjust to actual or anticipated climatic changes through three essential processes: acquiring knowledge about the risks, impacts, and mitigation strategies for EWEs; experiencing shifts in attitudes, including perceptions of risk, self-efficacy, and willingness to adapt; and adopting behaviors that enhance resilience and mitigate vulnerabilities. Integrating the Gendered Vulnerability Perspective provides a deeper understanding of how adaptive capacities are shaped by gendered roles and experiences, ensuring a more inclusive exploration of the subject (IPCC, 2022; O'Brien et al., 2007).

### 3.1 Method: Participants

The participants were the population of district Layyah living in rural and urban areas. A sample of participants (n=266), male (n=124) and female (n=142) participated in the study**.** Convenient sampling was used to collect data from participants.

### 3.2 Study Design

A cross-sectional design was used to examine Knowledge, Attitude, and Practices (KAP) regarding extreme weather events of the District Layyah population in Pakistan. Data were collected from 25$^{th}$ November to 20$^{th}$ December 2023. Data were collected through web-based survey from the participants of six cities (Layyah, Chowkazam, Choubara, Kot Sultan, Fatehpur, and Kror Lal-esan) form rural and urban areas of district Layyah.

### 3.3 Instruments

A structured self-devised questionnaire of 15 items was administered to collect information on knowledge (awareness of the term extreme weather events and their causes and potential impacts), attitude (interest level to know more about extreme weather events and their threats) and practice (proactive steps taken against mitigating threats of extreme weather events) from the participants. The reliability of the items is checked through Cronbach Apha value such that a higher value (greater than 0.7) indicates reliability. We checked reliability of Knowledge variable comprising 5 items ($\alpha$=0.85), five questions of Attitude ($\alpha$=0.81), and five questions of Practice ($\alpha$=0.72) and the Cronbach Apha is in the acceptable range.

### 3.4 Ethical Considerations

Informed consent was sought from each participant before data collection, ensuring confidentiality and voluntary participation. The study participants were approached through physical meetings and telephone calls. The participants were briefed about the purpose of study and its implications.

### 3.5 Results

SPSS 27 was used to perform the statistical analysis from the collected data. Descriptive statistics were used to calculate the frequencies and percentages of demographic variables. Chi-Square was used to analyze the association between extreme weather events and gender and area of participants. Table 3 showed responses to the knowledge questions. 100% of participants knew about extreme weather events as well as 88.3% knew about extreme weather events. 85.7% participants have recognized the warning signs of extreme weather events of their region and knew the potential impact of extreme weather events in Pakistan. 89.1% of participants were familiar with safety precautions and measures used during extreme weather events.

Table 4 showed that 61.3% of participants (n=163) stated showing good attitude in the case of extreme weather events. Table 5 showed 74.4% participants were concerned about the impact of extreme weather events in Pakistan as well as 88.3% believed community preparedness and resilience are essential in mitigating the effects of extreme weather events. Moreover, 81.2% of participants felt responsibility to stay informed and 86.8% supported government initiatives aimed at addressing the challenges posed by extreme weather events. And 76.3% of participants were ready to help in preserving the environment. Table 6 showed 93.6% participants were engaged in good practices to cope with extreme weather events' threats in Pakistan.

Table 1: Demographic characteristics of participants *(n=266)*

| Variables | Characteristics | Frequency | Percentage |
|---|---|---|---|
| Gender | Female | 142 | 53.4 |
| | Male | 124 | 46.6 |
| Age | 18-25 | 13 | 4.9 |
| | 26-35 | 96 | 36.1 |
| | 36-45 | 102 | 38.3 |
| | above 45 | 55 | 20.7 |
| Education | Bachelor | 17 | 6.4 |
| | Master | 36 | 13.5 |
| | MPhil | 141 | 53.0 |
| | Ph.D. | 72 | 27.1 |
| Area | Urban | 167 | 62.8 |
| | Rural | 99 | 37.2 |
| Residency | near road | 74 | 27.8 |
| | near river | 63 | 23.7 |
| | near factory | 101 | 38.0 |
| | near market | 28 | 10.5 |
| Career | Student | 19 | 7.1 |
| | domestic worker | 90 | 33.8 |
| | govt. employee | 121 | 45.5 |
| | private employee | 36 | 13.5 |
| Years of living | less than1 year | 33 | 12.4 |
| in area | 2-10 year | 169 | 63.5 |
| | 11-20 years | 64 | 24.1 |
| City | Layyah | 66 | 24.8 |
| | Chowkazam | 54 | 20.3 |
| | Choubara | 49 | 18.4 |
| | Kot Sultan | 52 | 19.5 |
| | Kror Lal esan | 19 | 7.1 |
| | Fatehpur | 26 | 9.8 |
| Home ownership | Own | 188 | 70.7 |
| | Rented | 78 | 29.3 |
| | Alone | 90 | 33.8 |
| Household size | <5 members | 123 | 46.2 |
| | >5 members | 53 | 19.9 |
| | Total | 266 | 100 |

Table 2: Knowledge Variable (n=266)

| Knowledge status | Frequency | percentage |
|---|---|---|
| Good | 235 | 88.3% |
| Bad | 31 | 11.7% |
| Total | 266 | 100% |

Note: 88% of participants have a good knowledge of extreme weather events *n=235(88.3%).*

Table 3: Items on knowledge of extreme weather events *(n=266)*

| Knowledge statements | Yes (%) | No (%) |
|---|---|---|
| I know about extreme weather events. | 100% | 0.0% |
| I know the types of extreme weather events. | 88.3% | 10.5% |
| I know how to recognize early warning signs of extreme weather events in my region. | 92.9% | 7.1% |
| I understand the potential impact of climate change on the frequency and severity of extreme weather events in Pakistan. | 85.7% | 14.7% |
| I am familiar with the safety precautions and measures recommended during extreme weather events. | 89.1% | 10.9% |

Table 4: Attitude status among participants *(n=266)*

| Attitude status | Frequency | Percentage |
|---|---|---|
| Good | 163 | 61.3.% |
| Bad | 103 | 38.7% |
| Total | 266 | 100% |

Table 5: Attitude towards extreme weather events threat prevention *(n=266)*

| Attitude statements | Agree n (%) | Disagree n (%) |
|---|---|---|
| I am concerned about the impact of extreme weather events on vulnerable populations in Pakistan | 74.4% | 25.4 |
| I believe that community preparedness and resilience are essential in mitigating the effects of extreme weather events | 88.3% | 11.7% |
| I feel a sense of personal responsibility to stay informed about extreme weather events and take necessary precautions | 81.2% | 18.2% |
| I support government initiatives aimed at addressing the challenges posed by extreme weather events. | 86.8% | 13.2% |
| I am ready to do whatever I can help preserve the environment. | 76.3% | 23.3% |

Table 6: Practice status among participants (n=266)

| Practice status | Frequency | Percentage |
|---|---|---|
| Good | 249 | 93.6.% |
| Bad | 17 | 6.4% |
| Total | 266 | 100% |

Table 7: Practice to cope with extreme weather events threats *(n=266)*

| Practice statements | Yes<br>*n* (%) | No<br>*n* (%) |
|---|---|---|
| I actively participate in community efforts to raise awareness about extreme weather preparedness. | 91.7% | 8.3% |
| I regularly monitor weather forecasts and warnings issued by relevant authorities. | 86.8% | 13.2% |
| I actively engage with local and national initiatives that promote climate adaptation and disaster risk reduction | 92.5% | 7.5% |
| I engage in practices that reduce my environmental impact and contribute to climate resilience. | 97.7% | 2.3% |
| I educate my family members and friends about the importance of preparedness for extreme weather events. | 98(98.0%) | 2(2.0) |

Table 7 showed 91.7% participants actively participated in community efforts to raise awareness about extreme weather preparedness. 86.8% participants were agreed they regularly monitored weather forecasts and warnings issued by relevant authorities. And 92.5% participants were actively engaged with local and national initiatives that promote climate adaptation and disaster risk reduction. 97.7% participants were engaged in practices to reduce environmental impact and contribute to climate resilience. 98.0% educated their family members and friends about the importance of preparedness for extreme weather events.

Table 7 showed 91.7% participants actively participated in community efforts to raise awareness about extreme weather preparedness. 86.8% participants were agreed they regularly monitored weather forecasts and warnings issued by relevant authorities. And 92.5% participants were actively engaged with local and national initiatives that promote climate adaptation and disaster risk reduction. 97.7% participants were engaged in practices to reduce environmental impact and contribute to climate resilience. 98.0% educated their family members and friends about the importance of preparedness for extreme weather events. Table 8 showed the association between gender and perception of extreme weather events. So, cross-tabulation of Chi-Square proved that gender is significantly associated with extreme weather events variable $\chi 2$ (1) = 6.970a, P<0.05*. Moreover, area has also positive significant association with extreme weather events' perception, attitude and practices ($\chi 2$ (1) = 6.366a, P<0.05*).

## 4. DISCUSSION

Climate change is posing serious threats in form of extreme weather events in Pakistan. Earthquakes, heat waves, floods, cyclones, thunderstorms and hailstorms are deteriorating the natural environment in Pakistan. Extreme weather events are instilling fear and anxiety among participants. The study was aimed at analyzing the knowledge, attitude and practice towards extreme weather events among

participants of district Layyah in Pakistan. KAP scores were high at knowledge about extreme weather events among participants. 88% of participants (n=266) had a high level of education about extreme weather events. The findings were found like a previous KAP study that high scores on knowledge and practice in preventing sunstroke to avoid heat exposure and played significant role in minimizing heat-related diseases (Li et al., 2016).

85.7% participants recognized the warning signs of extreme weather events of their region and knew the potential impact of extreme weather events in Pakistan. Another study supported the findings that 79% of participants recognized climate as a major threat while exposing to extreme weather events (Peria et al., 2016). 89.1% of participants were familiar with safety precautions and measures used during extreme weather events. Workers have good knowledge on heatstroke treatment and daily life habits, whereas intervention has enhanced knowledge to prevent heat waves (Peng, 2019).

Table 8: Cross-tabulation of gender, area and extreme weather events *(n=266)*

| 1. Gender | Good | Bad | Total | Pearson Chi-Square | Sig. |
|---|---|---|---|---|---|
| Female | 76 | 66 | 142 | $\chi^2=6.970^a$ | 0.006* |
| Male | 86 | 38 | 124 | | |
| Total | 162 | 104 | 266 | | |
| 2. Area | | | | | |
| Urban | 92 | 75 | 167 | $\chi^2=6.366^a$ | 0.008* |
| Rural | 70 | 29 | 99 | | |
| Total | 162 | 104 | 266 | | |

P<0.05*

KAP scores were low at attitude (61%) towards extreme weather events among participants as compared to scores at knowledge and practice as the previous study found attitude score were low on KAP among participants (Li et al., 2016). Participants exhibited insufficient readiness to address the challenges posed by climate change, despite the evident climate variability in Hail (Said, 2022). Another study found participants were interested to seek more about climate change and about linkages between infectious disease outbreaks and climate change (Sambath et al., 2022).

The findings showed 93.6% participants were involved in proactive practices to cope with extreme weather events' threats in Pakistan. Robust knowledge and positive attitudes with effective climate change adaptation or mitigation practices were effective to cope with the threats of extreme weather events (Rahman et al., 2021). The study found interventions were significant in enhancing coping practices towards preventing heat waves (Xu et al., 2018).

Chi-Square was used to analyze the association between gender and extreme weather events. The findings affirmed that gender is strongly associated with knowledge, attitude and practices of extreme weather events among participants. The results were congruent with previous research as gender is associated with risk perception, attitude towards preparedness of disasters (Cuesta et al., 2022). Female participants had more knowledge about climate change than male participants and they predisposed good attitude more than males as previous studies also showed females (57.8%) were found involved in good practices about climate change education than males (Chaudhry et al., 2024). Female teachers were

involved in high level of practice while, male had high level of knowledge and attitude about climate change education (Karami et al., 2017).

The findings also showed that area was positively associated with extreme weather events' knowledge, attitude and practice among participants. The findings were in line with the past studies that the knowledge of climate change among participants was associated with their socioeconomic status and the participants' attitude regarding climate change was significantly associated with their residential status and their practices towards climate change were connected to socioeconomic status and their level of education (Rahman et al., 2021). Gender roles, education, age, knowledge, religious affiliation, marital status, intra-household power dynamics, ethnicity, and social status were identified as intersecting factors shaping perceptions and adaptation strategies related to climate change (Acheampong et al., 2023; Haque et al., 2023).

## 5. CONCLUSION

The study reported high scores on Knowledge and Practice regarding extreme weather events in Layyah. While KAP scores on Attitude were quite low as compared to Practice. Overall, the proportions of participants regarding awareness, their predisposition to learn and in engaging practices in eliminating the threats of extreme weather events were high. The study emphasized upon the awareness of physical, social, psychological consequences of extreme weather events among participants which could involve policy makers to play role in engaging in the primary and secondary prevention against extreme weather events' threats. Furthermore, social media campaigns should be launched to promote attitude-based awareness among people towards learning and practicing against extreme weather events.

The study was conducted only in district Layyah. Close-ended questions were asked from the participants, their answers may result in higher proportions. All potential participants were encouraged to participate in the study which may lead to response bias. Higher estimates of practice related questions may be the outcomes of social desirability effect due to close ended responses. Future studies can be conducted from different divisions and districts of country to generalize the better results. Open ended questions and interview survey should be adopted besides close ended question to get broader information regarding knowledge, attitude, and practice about extreme weather events to avoid social desirability effect. Future studies should examine the association among extreme weather events and education, age, knowledge, religious affiliation, marital status, intra-household power dynamics, ethnicity, and social status.

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