

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

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Abstract

Climate change is a global threat, and Pakistan is one of the countries most severely affected by it. The study examines the status of knowledge, attitudes, and practices regarding extreme weather events among the general population in Pakistan. The data is collected using a cross-sectional design from participants (n=266), including females (n=142) and males (n=124). Descriptive statistics are presented, and the findings reveal that 88% of participants had good knowledge about extreme weather events, their threats, and potential impacts. More than 50% of participants depicted a 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 organizations should introduce environmental interventions and pragmatic measures to raise awareness among participants and help them cope with extreme weather events.

Keywords: Attitude, extreme weather, environmental interventions, Climate change, Pakistan

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1. INTRODUCTION

Research on climate change has progressed from evaluating its impacts to formulating measures for adaptation (Ali & Erenstein, 2017; Fahad & Wang, 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 (Best & Darby, 2020). Devastating floods, the opposite extreme of hydrological occurrences, have emerged more frequently and have had a lasting impact on the world's largest rivers (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 southern regions. With a predominantly arid desert climate, Pakistan frequently experiences severe heatwaves, including a notable event in early summer 2022, which is amplified by anthropogenic climate change (WWA, 2022). The country faces periodic catastrophic floods induced by rainfall, exemplified by the 2010 event. While there is compelling evidence indicating heavy rainfall across South Asia (Seneviratne et al., 2021) and a strengthening and westward movement of the monsoon over Pakistan, 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 identified as one of the most significant global health risks of the 21st century (Clayton, 2021). Health risks associated with climate change encompass the global temperature increase, changes in precipitation patterns, and increased frequency of extreme weather events (Martin et al., 2021). Heatwaves, hurricanes, tropical storms, floods, and droughts are widespread worldwide, and these disasters caused by environmental changes are considered 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 resulting from trend and event effects on ecosystem functions (Biggs et al., 2020).

Human health was previously impacted by extreme weather events in two primary ways. Firstly, they can result in direct injuries or fatalities. 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 et al., 2023). Extreme weather events, including extreme drought, heavy rainfall, and extreme heat, were observed to result in a reduction of plant biomass.

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., 2023a; Yiadom & Abdul-Mumuni, 2022; Wu et al., 2020; Luong et al., 2020). Additionally, extreme weather events have a very weak negative correlation (Yiadom et al., 2023a; Yiadom et al., 2023b; Tui & Fakhruddin, 2022; Ngcamuv & Chari, 2020). Extreme weather events have reinforced urbanization, leading to high temperature rises, droughts, floods, and a rise in sea levels (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 have been identified as common causes of changes in seascape and landscape. Those changes led to transformation and feelings of psychological desolation (Beggs et al., 2022). Extreme weather events have irreversible impacts on the Earth's biophysical systems, 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).

Recent studies indicate that the repercussions of climate change extend 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 the prevention of heat waves for migrant workers (Peng, 2019). Another study found that 79% of participants recognized climate as a major threat while exposed to extreme weather events (Peria et al., 2016).

Another KAP study found that high scores were obtained in knowledge

and practice 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 was conducted to improve knowledge and attitude to cope with heat waves. The study found interventions were significant in enhancing the 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, as well as effective climate change adaptation or mitigation practices (Rahman et al., 2021). Another study found that participants were interested in seeking more information about climate change and its association with infectious disease outbreaks (Sambath et al., 2022).

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

Climate change is perceived as a negative phenomenon among participants (83%), but some participants consider it controllable (67%). Most participants viewed extreme weather events as causing 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 knowledge, attitudes, and practices related to climate change. The participants had a higher level of awareness but lacked knowledge about the 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., 2021a). 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 intersect 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 had a more positive attitude 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 a high level of practice, while male teachers had a high level of knowledge and attitude about climate change education (Karami et al., 2017).

The literature reveals that numerous studies have been conducted on climate change in various regions of the world. However, a comprehensive literature review reveals that no study has been conducted on the Knowledge, Attitude, and practice regarding extreme weather events among the general population of Layyah. The aim of a Knowledge, Attitude, and Practice-based study on extreme weather events among the population of the 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 with extreme weather event 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, creating a comprehensive lens to examine 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 the district of Layyah, residing in both 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 employed to examine the Knowledge, Attitudes, and Practices (KAP) regarding extreme weather events among the District Layyah population in Pakistan. Data were collected from 25th November to 20th December 2023. Data were collected through a web-based survey from the participants of six cities (Layyah, Chowkizam, Choubara, Kot Sultan, Fatehpur, and Kror Lal-esan) from rural and urban areas of the 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's Alpha value, such that a higher value (greater than 0.7) indicates reliability. We checked the reliability of the 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's Alpha 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.

4. RESULTS

SPSS 27 was used to perform the statistical analysis of the collected data. Descriptive statistics were used to calculate the frequencies and percentages of demographic variables. The Chi-Square test was used to analyze the association between extreme weather events and gender, as well as the area of participants. Table 3 showed responses to the knowledge questions. 100% of participants knew about extreme weather events, and 88.3% knew the types of extreme weather events. 85.7% participants have recognized the warning signs of extreme weather events in their region and knew the potential impact of extreme weather events in Pakistan. 89.1% participants were familiar with safety precautions and measures used during extreme weather events. Table 4 showed that 61.3% participants (n=163) stated showing a good attitude in the case of extreme weather events.

Table 5 showed that 74.4% participants were concerned about the impact of extreme weather events in Pakistan, and 88.3% believed community preparedness and resilience are essential in mitigating the effects of extreme weather events. Moreover, 81.2% participants felt a 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 that 93.6% of participants were engaged in good practices to cope with the threats of extreme weather events in Pakistan.

Table 7 showed that 91.7% participants actively participated in community efforts to raise awareness about extreme weather preparedness. 86.8% participants 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 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 in area	less than 1 year	33	12.4
	2-10 years	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
	Own	188	70.7
	Rented	78	29.3
Home ownership	Alone	90	33.8
	<5 members	123	46.2
	>5 members	53	19.9
	Total	266	100

Table 2: Knowledge Variable

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

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.	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

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

Table 5: Attitude towards extreme weather event threat prevention

Attitude statements	Agree (%)	Disagree (%)
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

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

Practice statements	Yes <i>n</i> (%)	No <i>n</i> (%)
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 8 shows 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, the area also has a positive and significant association with the perception, attitude, and practices regarding extreme weather events ($\chi^2(1) = 6.366a$, $P < 0.05^*$).

Table 8: Cross-tabulation of gender and extreme weather events $p < 0.05^*$

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	Good	Bad	Total	Pearson Chi-Square	Sig.
Urban	92	75	167	$\chi^2 = 6.366^a$	0.008*
Rural	70	29	99		
Total	162	104	266		

5. DISCUSSION

Climate change is posing serious threats in the 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 aimed to analyze the knowledge, attitudes, and practices towards extreme weather events among participants in the district of Layyah, Pakistan. KAP scores were high at knowledge about extreme weather events among participants. 88% participants (n=266) had a high level of education about extreme weather events. The findings were similar to the previous KAP study, which found that high scores on knowledge and practice in preventing sunstroke to avoid heat exposure played a significant role in minimizing heat-related diseases (Li et al., 2016).

About 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 finding that 79% of participants recognized climate as a significant threat when exposed to extreme weather events (Peria et al., 2016). 89.1% participants were familiar with safety precautions and measures used during extreme weather events. Workers have a good understanding of heatstroke treatment and daily life habits, whereas intervention has enhanced their knowledge to prevent heatwaves (Peng, 2019). 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 scores 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 in seeking more about climate change and about linkages between infectious disease outbreaks and climate change (Sambath et al., 2022).

The findings showed that 93.6% of participants engaged in proactive practices to cope with the threats posed by extreme weather events in Pakistan. Robust knowledge and positive attitudes with effective climate change adaptation or mitigation practices were effective in coping with the threats of extreme weather events (Rahman et al., 2021b). 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 confirmed that gender is strongly associated with the knowledge, attitudes, and practices regarding

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 had a more positive attitude than males. This aligns with previous studies, which also found that females (57.8%) were more involved in good practices related to 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 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., 2021a). 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).

6. CONCLUSION

The study reported high scores on Knowledge and Practice regarding extreme weather events in Layyah. While KAP scores on Attitude were quite low compared to Practice. Overall, the proportions of participants regarding awareness, their predisposition to learn, and engagement in practices to eliminate the threats of extreme weather events were high. The study emphasized the awareness of physical, social, and psychological consequences of extreme weather events among participants, which could involve policymakers to play a 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 about learning and practicing measures to mitigate the impact of extreme weather events.

The study was conducted only in the district of Layyah. Closed-ended questions were asked of 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 across different divisions and districts of the country to yield better generalizable results. Open-ended questions and an interview survey should be adopted, in addition to closed-ended questions, to gather broader information regarding knowledge, attitude, and practice regarding extreme weather events and avoid the social desirability effect. Future studies should investigate the relationship between extreme weather events and factors such as education, age, knowledge, religious affiliation, marital status, intra-household power dynamics, ethnicity, and social status.

REFERENCES

- Abid, M., Scheffran, J., Schneider, U.A., and Elahi. E. (2019). Farmer perceptions of climate change, observed trends and adaptation of agriculture in Pakistan. *Environmental Management*, 63(1), 110-123. doi: 10.1007/s00267-018-1113-7.
- Acheampong, P. P., Yeboah, S., Adabah, R., Asibuo, J. Y., Nchanji, E. B., Opoku, M., Toywa, J., and Lutomia, C. K. (2023). Gendered perceptions and adaptations to climate change in Ghana: what factors influence the choice of an adaptation strategy? *Frontiers in Sustainable Food Systems*, 7, 1091812.
- Ali, A., & Erenstein, O. (2017). Assessing farmer use of climate change adaptation practices and impacts on food security and poverty in Pakistan. *Climate Risk Management*, 16, 183–194.
- Beggs, P. J., Zhang, Y., McGushin, A., Trueck, S., Linnenluecke, M. K., Bambrick, H., Capon, A. G., Vardoulakis, S., Green, D., Malik, A., et al. (2022). The 2022 report of the MJA–Lancet Countdown on health and climate change: Australia unprepared and paying the price. *Medical Journal of Australia*, 217, 439–458.
- Best, J. & Darby, S. E. (2020). The pace of human-induced change in large rivers: stresses, resilience, and vulnerability to extreme events. *One Earth* 2(6), 510–514.
- Biggs, C. R., Yeager, L. A., Bolser, D. G., Bonsell, C., Dichiera, A. M., Hou, Z., Keyser, S. R., Khursigara, A. J., Lu, K., Muth, A. F., Negrete, B. Jr. & Erisman, B. A. (2020). Does functional redundancy affect ecological stability and resilience? *A Review and Meta-Analysis. Ecosphere* 11(7), e03184.

- Bowler, D. E., Bjorkman, A. D., Dornelas, M., Myers-Smith, I. H., Navarro, L. M., Niamir, A., Supp, S. R., Waldock, C., Winter, M., Vellend, M., Blowes, S. A., Bo'hnig-Gaese, K., Bruelheide, H., Elahi, R., Antao, L. H., ET AL. (2020). Mapping human pressures on biodiversity across the planet uncovers anthropogenic threat complexes. *People and Nature* 2, 380–394.
- Chaudhry, A., Zubair, F., Arshad, F., Shaukat, H., Amin, B., & Fatima, I. (2024). Assessment of Knowledge, Attitudes and Practices (KAP) Towards Climate Change Education among Teaching Staff and Medical Students of CMH Lahore Medical College, Lahore. *Journal of Fatima Jinnah Medical University*, 17(4), 142–147.
- Chen, M., Xian, Y., Wang, P., & Ding, Z. (2021). Climate change and multi-dimensional sustainable urbanization. *Journal of Geographical Sciences*, 31(9), 1328–1348.
- Cianconi, P., Betrò, S., & Janiri, L. (2020). The impact of climate change on mental health: a systematic descriptive review. *Frontiers in Psychiatry*, 11, 490206.
- Clayton, S. (2021). Climate change and mental health. *Current Environmental Health Reports*, 8, 1-6.
- Cogato, A., Meggio, F., De Antoni Migliorati, M., & Marinello, F. (2019). Extreme weather events in agriculture: A systematic review. *Sustainability*, 11(9), 2547.
- Cuesta, A., Alvear, D., Carnevale, A., & Amon, F. (2022). Gender and public perception of disasters: a multiple hazards exploratory study of EU citizens. *Safety*, 8(3), 59.
- Elsner, J. B. (2020). Continued increases in the intensity of strong tropical cyclones. *Bulletin of the American Meteorological Society*. doi: 10.1175/BAMS-D-19-0338.1.
- Espinoza, J.-C., Marengo, J. A., Schongart, J., and Jime'nez, J. C. (2022). The new historical flood of 2021 in the Amazon River compared to major floods of the 21st century: atmospheric features in the context of the intensification of floods. *Weather and Climate Extremes*, 35, 100406.
- Fahad, S., & Wang, J. (2018). Farmers' risk perception, vulnerability, and adaptation to climate change in rural Pakistan. *Land Use Policy*, 79, 301–309. <https://doi.org/10.1016/j.landusepol.2018.08.018>.
- Forzieri, G., Cescatti, A., Fb, E.S., Feyen, L. (2017). Increasing risk over time of weather-related hazards to the European population: a data-driven prognostic study. *Lancet Planet Health* 1 (5), e200–e208.

- [https://doi.org/10.1016/s2542-5196\(17\)30082-7](https://doi.org/10.1016/s2542-5196(17)30082-7).
- Gadzekpo, A., Tietaah, G. K. M., & Segtub, M. (2018). Mediating the Climate Change Message: Knowledge, Attitudes and Practices (KAP) of Media Practitioners in Ghana. *African Journalism Studies*, 39(3), 1–23.
- Haque, A. S., Kumar, L., & Bhullar, N. (2023). Gendered perceptions of climate change and agricultural adaptation practices: a systematic review. *Climate and Development*, 15(10), 885-902.
- Haque, A. T. M. S., Kumar, L., & Bhullar, N. (2023). Gendered perceptions of climate change and agricultural adaptation practices: A systematic review. *Climate and Development*, 15(10), 885-902.
- IPCC Change, I. C. (2022). Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change; Pörtner, H. O., Roberts, DC, Tignor, M., Poloczanska, ES, Mintenbeck, K., Alegría, A., Craig, M., Langsdorf, S., Löschke, S., Möller, V., et al., Eds, 3056.
- Karami, S., Shobeiri, S.M., Jafari, H. and Jafari, H. (2017). Assessment of knowledge, attitudes, and practices (KAP) towards climate change education (CCE) among lower secondary teachers in Tehran, Iran. *International Journal of Climate Change Strategies and Management*, 9 (03), 402-415.
- Li, J., Xu, X., Ding, G., Zhao, Y., Zhao, R., Xue, F., Li, J., Gao, J., Yang, J., Jiang, B., et al. (2016). A cross-sectional study of heat wave-related knowledge, attitude, and practice among the public in the licheng district of Jinan City, China. *International Journal of Environmental Research and Public Health*, 13(7), 648. <https://doi.org/10.3390/ijerph13070648>.
- Luong, T. M., Dasari, H. P., & Hoteit, I. (2020). Impact of urbanization on the simulation of extreme rainfall in the city of Jeddah, Saudi Arabia. *Journal of Applied Meteorology and Climatology*, 59(5), 953–971.
- Martin, G., Reilly, K., Everitt, H., Gilliland, J.A. (2021). The impact of climate change awareness on children’s mental well-being and negative emotions-ascoping review. *Child Adolesc. Ment. Health*, 27(1), 59–72. <https://doi.org/10.1111/camh.12525>.
- O’Brien, K., Eriksen, S., Nygaard, L. P., & Schjolden, A. (2007). Why different interpretations of vulnerability matter in climate change discourses. *Climate Policy*, 7(1), 73–88. <https://doi.org/10.1080/14693062.2007.9685639>
- Palinkas, L. A., & Wong, M. (2020). Global climate change and mental health.

Current Opinion in Psychology, 32, 12–16.

- Peng, C. (2019). Study of KAP investigation and interventions on the impact of migrant workers under heatwaves. *Environmental Epidemiology*, 3(307).
- Peria, A. S., Pulhin, J. M., Tapia, M. A., Predo, C. D. Jr., Peras, R. J. J., Evangelista, R. J. P., Lasco, R. D., & Pulhin, F. B. (2016). Knowledge, risk attitude, perception on extreme weather events of small holders' farmers in Ligao City, Albay, Bicol, Philippines. *Journal of Environmental Science and Management, Special Issue, 1*, 31-41.
- Powell, J.P., S. Reinhard, S. (2016). Measuring the effects of extreme weather events on yields. *Weather and Climate Extremes*, 12, 69–79.
- Rahman, M. S., Karamelic-Muratovic, A., Baghbanzadeh, M., Amrin, M., Zafar, S., Rahman, N. N., Shirina, S. U., Haque, U. (2021a). Climate change and dengue fever knowledge, attitudes, and practices in Bangladesh: a social media-based cross-sectional survey. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 115(1), 85–93. <https://doi.org/10.1093/trstmh/traa093>.
- Rahman, M. S., Overgaard, H. J., Pientong, C., Mayxay, M., Ekalaksananan, T., Aromseree, S., Phanthanawiboon, S., Zafar, S., Shipin, O., Paul, R. E., Phommachanh, S., Pongvongsa, T., Vannavong, N., & Haque, U. (2021b). Knowledge, attitudes, and practices on climate change and dengue in Lao People's Democratic Republic and Thailand. *Environmental Research*, 193, 110509. <https://doi.org/10.1016/j.envres.2020.110509>
- Reddy, G. P., Rajamouli, J., Arora, K. D., Jothula, K. Y., Amaravadi, S., & Boda, A. (2022). Knowledge, perceptions and practices of medical students towards climate change and global warming: A cross-sectional study. *Journal of family medicine and primary care*, 11(6), 2557–2564. https://doi.org/10.4103/jfmpc.jfmpc_1782_21
- Said, M. A. (2022). Visitors' Knowledge, Awareness, and Perception (KAP) of Climate Change in Mashar National Park, Hail-Saudi Arabia. *Engineering, Technology & Applied Science Research*, 12(5), 9404–9408. <https://doi.org/10.48084/etasr.5234>.
- Sambath, V., Narayan, S., Kumar, P., Kumar, P., Pradyumna, A. (2022). Knowledge, attitudes and practices related to climate change and its health aspects among the healthcare workforce in India – A cross-sectional study. *The Journal of Climate Change and Health*, 6, 100147.
- Seneviratne, S. I., Zhang, X., Adnan, M., Badi, W., Dereczynski, C., Luca, A.

- D., Ghosh, S., Iskandar, I., Kossin, J., Lewis, S., Otto, F., Pinto, I., Satoh, M., Vicente-Serrano, S. M., Wehner, M., Zhou, B. and Allan, R. (2021). Weather and climate extreme events in a changing climate in climate change: The Physical Science Basis (pp. 1513–1766). Cambridge: Cambridge University Press.
- Stone, K., Blinn, N., & Spencer, R. (2022). Mental health impacts of climate change on women: a scoping review. *Current Environmental Health Reports*, 9(2), 228-243. <https://doi.org/10.1007/s40572-022-00346-8>.
- Tui, S., & Fakhruddin, B. (2022). Food for thought: Climate change risk and food (in) security in Tuvalu. *Progress in Disaster Science*, 16, 100255.
- Weilnhammer, V., Schmid, J., Mittermeier, I., Schreiber, F., Jiang, L., Pastuhovic, V., Herr, C., Heinze, S., (2021). Extreme weather events in Europe and their health consequences—A systematic review. *International Journal of Hygiene and Environmental Health*, 233, 113688.
- Wu, X., Wang, L., Yao, R., Luo, M., Wang, S., & Wang, L. (2020). Quantitatively evaluating the effect of urbanization on heat waves in China. *Science of the Total Environment*, 731, 13
- WWA (2022). Rapid Attribution Study Heatwave India and Pakistan. World Weather Attribution, Working Paper. Retrieved from www.worldweatherattribution.org/climate-change-made-devastating-early-heat-in-india-and-pakistan-30-times-more-likely. World Weather Attribution.
- Xu, X., Li, J., Gao, J., Liu, K., & Liu, Q. (2018). Effective analysis of a community-based intervention during heatwaves to improve knowledge, attitude, and practice in a population in Licheng District, Jinan City, China. *Journal of Public Health*, 40(3), 573–581. <https://doi.org/10.1093/pubmed/idx1218857>.
- Yang L, Liao W, Liu C, Zhang N, Zhong S, Huang C. (2018). Associations between Knowledge of the Causes and Perceived Impacts of Climate Change: A Cross-Sectional Survey of Medical, Public Health and Nursing Students in Universities in China. *Int J Environ Res Public Health*.15(12):2650. doi: 10.3390/ijerph15122650. PMID: 30486282; PMCID: PMC6313669.
- Yiadom, E.B., & Abdul-Mumuni, A. (2022). Pandemics and stock markets reactions: A panel analysis of emerging markets. *African Journal of Economic and Management Studies*, 13(4), 636–650.
- Yiadom, E.B., Dziwornu, R.K., & Yalley, S. (2021). Financial inclusion,

- poverty and growth in Africa: Can institutions help? *African Journal of Economic and Sustainable Development*, 8(2), 91–110.
- Yiadom, E.B., Mensah, L., & Bokpin, G.A. (2023a). Environmental risk and foreign direct investment: The role of financial deepening, access, and efficiency. *Sustainability Accounting, Management and Policy Journal*, 14(2), 369–395.
- Yiadom, E.B., Mensah, L., Bokpin, G.A., & Dziwornu, R.K. (2023b). Analyzing financial and economic development thresholds for carbon emission reduction: A dynamic panel regime-switching study across income levels. *Management of Environmental Quality: An International Journal*. <https://doi.org/10.1108/MEQ-12-2022-0338>.
- Zou, X. Y., Peng, X. Y., Zhao, X. X., et al. (2023). The impact of extreme weather events on water quality: International evidence. *Natural Hazards*, 115(1), 1–21. <https://doi.org/10.1007/s11069-022-05548-9>.