

Social Exclusion, Informal Urbanization, and Heatwave Vulnerability: Understanding Public Health Risks among Slum Populations

Taimoor Iftikhar ^a Tanzeel Ur Rehman Alvi ^b Furqan Yaseen ^c

Abstract: Rapid urbanization and rising global temperatures have increased the exposure of marginalized urban populations to extreme heat events, particularly within informal settlements lacking adequate infrastructure and public services. This qualitative study explored how social exclusion and informal urbanization shape heatwave vulnerability and public health risks among slum populations. Using in-depth interviews, focus group discussions, and community narratives, the study examined the lived experiences of residents residing in densely populated informal settlements affected by recurring heatwaves and environmental stress. The findings revealed that inadequate housing conditions, overcrowding, poor ventilation, limited access to clean water, and insufficient healthcare services significantly increased residents' exposure to heat-related illnesses and psychological distress. Social exclusion further intensified vulnerability, as economically disadvantaged groups lacked access to cooling resources, formal social protection systems, and climate-responsive urban planning initiatives. Women, elderly individuals, outdoor laborers, and children were identified as the most vulnerable groups facing severe physical exhaustion, dehydration, sleep disturbances, and anxiety during extreme heat conditions. The study also found that communities relied heavily on informal coping mechanisms, including shared water access, temporary shelter arrangements, altered work schedules, and neighborhood support networks to manage heat stress. However, these adaptive strategies remained limited due to persistent poverty and weak institutional support. The study concludes that heatwave vulnerability in informal urban settlements is deeply connected to structural inequality and environmental injustice. The findings highlight the urgent need for inclusive urban governance, climate-responsive public health policies, and socially equitable adaptation strategies to protect marginalized urban populations from escalating climate-related health risks.

Keywords: Social Exclusion, Informal Urbanization, Heatwave Vulnerability, Public Health Risks

Introduction

The rapid urbanization process in developing areas has resulted in the rapid growth in size of informal settlements, popularly known as slums, in which millions of people live in conditions of infrastructural inadequacy and social marginality. They are usually typified by congested housing, poor sanitation, inaccessibility to clean water, poor ventilation, and poor institutional service provision. Concurrently, global climatic change has escalated the intensity and frequency of heatwaves, giving rise to additional strata of ecological pressures to the already susceptible urban populations (Marcotullio, Keßler, & Fekete, 2022). Here, the vulnerability of heatwaves has become a major public health issue, especially in crowded informal urban regions, where the adaptive capacity is highly limited. The convergence of environmental risks and housing deprivation has predisposed slum residents in an unequal measure to heat diseases, water shortages, cardiovascular pressure, and mental anguish, thus turning climate change into an acute city health crisis (Aitken, 2025).

In this wider context, social exclusion, informal urbanization, and heatwave vulnerability are theoretically connected phenomena that simultaneously contribute to the formation of the level of public health among the marginalized groups of the population. Social exclusion can be defined as the process of systematically marginalizing some groups of people with regard to economic opportunities, the provision of social services, and decision-making procedures, hence restricting their chances of accessing resources

^a M.Phil. Sociology, Department of Sociology, University of Sargodha, Sargodha, Punjab, Pakistan.

^b Tehsil Manager, Punjab Rural Municipal Services, LG&CD, Government of the Punjab, Pakistan.

^c M.Phil. Sociology, Department of Sociology, University of Sargodha, Sargodha, Punjab, Pakistan.

that protect them in times of environmental shocks. Informal urbanization is the unplanned and, in some cases, unauthorized patterns of settlements that arise as a result of rural-urban migration and insufficient urban housing policies, which lead to physically and socially vulnerable living conditions (Fosudo, Bolukale, and Ibrahim, 2026). On the other hand, heatwave vulnerability is the extent to which individuals or communities are prone to negative health effects of exposure to extreme heat, which is affected by the environmental conditions and socio-economic capacities. These constructs are theoretically based on the paradigm of environmental justice and vulnerability theory, which claims that exposure to environmental risks is not distributed equally, but is a factor that is influenced by power, inequality, and institutional negligence. Social exclusion contributes to vulnerability by limiting access to adaptive infrastructure, and informal urbanization structurally incorporates risk by providing substandard housing and spatial marginalization, which eventually increases health burdens due to heat (Ilyas, 2025).

Although there is increasing interest in climate change and urban health, available literature has, to a large extent, considered macro-level climate effects or formal urban environment, without considering the realities of slum people in the Global South. The interaction between social exclusion and informal settlement structures to determine heatwave vulnerability at the community level has a big gap in understanding. The majority of the studies consider environmental risk and social inequality as different areas instead of addressing the impact of their intersection on population health (Bennett, Bell, Norman, Evans, and Veness, 2026). Moreover, there is scant qualitative data on the coping behaviors of slum dwellers and how the coping behaviors alleviate or replicate vulnerability in extreme circumstances of heat. Such disjointed knowledge limits the formulation of context-relevant policy-level responses, which consider not just environmental but also structural determinants of vulnerability (Sikhosana & Mashalaba, 2025).

The research problem, thus, is the absence of a combined understanding of the role of social exclusion and informal urbanization in increasing the vulnerability of heatwaves and the related risk to the public health of slum dwellers. This is especially problematic in urbanizing areas where informal settlements are growing at a pace that is not matched by increased climate resilience or health facilities. Unless these overlapping vulnerabilities are addressed, informal settlement residents of urban areas will remain disproportionately vulnerable to extreme heat events, which will exacerbate existing disparities (Boafo, 2026). The importance of the study is that it fills a gap by offering a qualitative investigation of lived experiences, vulnerability pathways, and coping mechanisms among slum communities. In this way, it can be used to both contribute to the theoretical development of literature on environmental justice and urban vulnerability, as well as provide practical implications to policy-makers, such as creating inclusive and climate-responsive urban governance and population health planning that gives priority to the populations most at-risk (Datta & Raman, 2026).

Literature Review

The interplay between environmental justice theory, vulnerability theory, and the social determinants of health framework can theoretically explain the vulnerability of urban heatwaves in informal settlements. The theory of environmental justice holds that environmental risks and risks related to climate are not evenly distributed among the population but rather are conditioned by structural disparities, political marginalization, and uneven urbanization. Likewise, the vulnerability theory frames vulnerability as an exposure-sensitivity-adaptive capacity relationship, highlighting the importance of socio-economic factors in shaping the way populations are exposed and respond to environmental stressors, like extreme heat (Hunter et al., 2021). The context of informal urbanization here refers to a type of space, which implies vulnerability, in which informal settlements are found in the high-risk regions with minimal infrastructure, and social exclusion determines unequal access to resources, services, and institutional security. This theoretical connection is further reinforced by the social determinants of health viewpoint, which shows how the living conditions, income disparity, quality of housing, and healthcare access influence the health outcomes in the face of climate stress (Baldi, Bernotti, Dall'Olio, Perrone, and Raviglione, 2025). These theories combine to reveal the social construction of heatwave vulnerability and are not necessarily climatic in nature, with slum populations being structurally disadvantaged in managing increased urban temperatures (Mangara & Dorasamy, 2026).

These theoretical assumptions are becoming more and more empirically supported, as it is shown that informal settlements are more severely impacted by heat stress because of poor housing, green infrastructure, and adaptive capacity. The South Asian and sub-Saharan African studies have consistently indicated that the slum population has more exposure to extreme temperatures related to high-density built environments and urban heat island effects that enhance both indoor and outdoor thermal stress. As an example, the study in Lahore and Karachi points out that any informal settlement has much more vulnerability indices than formal cities because of inadequate construction materials, congestion, and lack of cooling facilities (Khan, 2020). Recent findings also indicate that not only do heatwaves in informal settlements lead to mortality and morbidity, but also labor productivity and livelihood insecurity among low-income populations are worsened by the heatwave. In addition, the accumulation of qualitative literature suggests that residents are also highly dependent on such informal coping practices as social networks, water sharing, and modified work schedules, yet such measures do not always help with the extreme climate conditions (Ashrafi & Mallick, 2026). Besides, recent research highlights that the decisions of urban planning and the inequitable distribution of infrastructures increase the thermal inequality, which generates hotspots or centrally vulnerable locations in cities. Together, these works prove that the vulnerability in heatwaves is deeply ingrained in socio-spatial inequalities and is not a matter of purely climatic conditions (Ali, Pham, and Xuan, 2025).

Although there is an increasing body of literature, there are a number of research gaps that are critical. To start with, the majority of the current research is quantitative in nature, and that is, it uses index-related methods, with little focus on lived experiences and qualitative accounts of slum residents, which is key to comprehending the measures of coping and perceived risks. Second, despite some studies analyzing informal settlements and heat stress, a lack of integration of social exclusion and informal urbanization as explanatory variables with a combination of health outcomes is present (Abounaga, Badran, and Barakat, 2021). Third, the empirical evidence in the Global South is still scarce, and few comparative studies were conducted that could relate households' experiences on the micro level to the macro level governance failures in climate adaptation planning. Also, the psychological and social aspects of heatwave vulnerability, including stress, anxiety, and social isolation during extreme heat events, are not widely studied in the existing literature. The mentioned gaps demonstrate the necessity of a more holistic and interdisciplinary approach that would imply the integration of environmental, social, and institutional aspects of vulnerability (Majlingova & Kádár, 2025).

Based on these gaps, the current research fills the main research gap on how social exclusion and the informality of urbanization interact to influence the vulnerability to heat waves and the related public health outcomes in slum populations. In particular, it aims to comprehend the interactions between structural deprivation, poor infrastructure, and the insufficient institutional support in informal settlements to worsen heat-related health outcomes (Khan et al., 2025; Lak et al., 2022). The paper also examines the coping strategies embraced by residents and determines their effectiveness as the climate stress increases. By so doing, it seeks to make its contribution to a more subtle concept of vulnerability that transcends physical exposure to encompass socio-economic and institutional aspects. Regarding hypothesis formulation, the literature indicates a positive correlation between social exclusion and heatwave vulnerability that is likely to be strong since the marginalized populations have a low probability of accessing adaptive resources and governmental services (Veld, 2024). Equally, informal urbanization will have a direct positive impact on the vulnerability to heatwaves because of insufficient infrastructure, congestion, and poor environmental conditions. Moreover, indirectly, social exclusion is likely to increase the risks to public health due to insufficient adaptive capacity and access to healthcare services, which will result in heat-related morbidity and psychological distress (Chen & Delina, 2025). Lastly, the association between socio-spatial disadvantages and the outcome of public health is likely to be mediated by heatwave vulnerability, which implies that the more vulnerable a slum population, the more the negative health outcomes. All these hypothesized relationships provide the combined theoretical framework of the environmental justice and vulnerability theory, which directs the empirical research of the heat health risks in informal urban settlements (Cheshmehzangi, 2026).

Methodology

The research design adopted in this study was qualitative, as guided by researchers (Ahmad et al., 2026; Asim et al., 2021), as it aimed to explore the effects of social exclusion and informal urbanization on the vulnerability to heatwaves and the health risks faced by slum inhabitants. The qualitative approach was deemed suitable due to the objective of the study, which was to investigate the lived experiences and perceptions of the residents who were exposed to a recurring heatwave and environmental stress in the context of informal urban settlements and their coping behaviors. The work was informed by an interpretivist approach and aimed at comprehending the experience of urban marginalized communities facing climate-related health risks through the lens of poverty, overcrowding, poor housing, and poor urban infrastructure. The research was carried out in overcrowded informal settlements that had poor housing facilities, low access to public services, and inadequate sanitation systems, as well as high vulnerability to extreme heat events. These settlements were specifically chosen as they reflected highly vulnerable urban environments in which climate stress and social inequality were most visible. Special attention was paid to at-risk populations such as women, older citizens, outdoor workers, children, and low-income families who were disproportionately exposed to the impact of heatwaves on their health and environmental safety.

The sampling methods employed in selecting the participants were purposive and snowball sampling to ensure that participants with firsthand experiences regarding heat stress, social exclusion, and informal settlement conditions were included. The sample consisted of slum dwellers, members of the local community, informal workers, women who manage the household, the elderly, and representatives of the local communities who are aware of local coping mechanisms and community health issues.

The data was collected using in-depth interviews, focus group discussions, and community stories in the Multan, Bahawalpur, and Dera Ghazi Khan districts of South Punjab, Pakistan, to gain a comprehensive understanding of the impacts of heat on the health, vulnerabilities, inequities, and adaptation among the people residing there. Semi-structured interviews were used with guides to encourage open discussions of the housing, water, and healthcare access, heat-related illnesses, psychological stress, livelihood disruptions, and community support systems in extreme heat events. Focus group discussions also enabled the participants to collectively contemplate common experiences of heatwave exposure, environmental injustice, and neighborhood-based coping strategies (Ahmad et al., 2026). The local languages were used to collect data to make the participants feel comfortable, communicate effectively, and understand the realities of the community.

Thematic analysis was used to analyze the collected data to establish recurrent patterns, meanings, and themes in the narratives and experiences of participants as guided by the researchers (Hussain et al., 2026; Rizwan et al., 2026; Sohail et al., 2021). The recordings of interviews and transcripts of the discussions were transcribed attentively and translated, as required, and coded in a systematic manner to generate major themes in the context of social exclusion, environmental inequality, heat-related public health risks, informal adaptation practices, and institutional neglect. The discussion focused on individual and community experiences to determine how structural inequalities determine exposure to climate-associated health problems in informal urban slums. To improve the validity and reliability of the results, triangulation was used through the comparison of the data collected during interviews, focus groups, and community narratives. Ethical issues were observed during the research, such as informed consent, voluntary participation, confidentiality, and anonymity of the participants as guided by researchers (Lak et al., 2025; Mutereko et al., 2021; Sohail et al., 2020). The participants were advised on the objective of the study and their right to abandon the study at any point without any repercussions.

Results

Themes: 1 – Poor Housing Conditions and Exposure to Extreme Heat

The results indicated that insufficient housing and high population density greatly exposed the residents to extreme heat in informal urban settlements. Respondents stated that the majority of houses were made with temporary materials like tin sheets, plastic covers, mud, and low-quality concrete that trapped heat in houses and resulted in unbearable indoor temperatures during heat waves. Inadequate ventilation, no

electricity, and the absence of green areas and crowded streets only added to the heat in slum areas. The residents complained that indoors were too hot even at night, disrupting their sleep, causing physical fatigue, dehydration, and acute discomfort. The problem of overcrowding also meant that people were prone to this, as several family members were frequently residing in single-room shelters without the necessary cooling systems. Women, children, and the elderly were found to be the most affected since they spend more time indoors in overheated homes. Respondents repeatedly highlighted that poverty inhibited their chances to better their housing situation or afford cooling devices like fans, air coolers, or continuous electricity. The results indicate that informal urbanization and poor housing infrastructure are the direct factors in the susceptibility of heatwaves and unequal exposure to climate-related health problems.

Participant Responses

"It gets so hot on our tin roofs in the afternoon, and the rooms feel like ovens".

"It is not well ventilated and thus we cannot sleep even at night".

"When the electricity is cut off, children cry due to the heat".

"We are all crowded into a small room, and on a hot day, you cannot even breathe".

"People who can afford air conditioners, but poor people are silent sufferers".

"The streets are very crowded, and there are no trees to reduce the heat."

"The old folks get weak very soon, as the houses are hot all day."

Theme 2: Heat-Related Health Problems and Psychological Distress

The researchers discovered that frequent heatwaves posed severe physical and psychological health issues to slum residents. Symptoms like dehydration, headaches, dizziness, fatigue, skin infections, breathing problems, and heat exhaustion were commonly reported by participants during high-intensity heat events. The outdoor workers such as construction workers, street vendors, and daily wage earners, had an especially high risk to health since they had to work in direct sunlight to keep the family going. Other health burdens reported by women include cooking in poorly ventilated kitchens and domestic tasks during heatwaves. Children and the elderly were seen as extremely vulnerable because of poor physical health and an inability to access health services. In addition to physical diseases, the participants mentioned the increasing levels of psychological stress, anxiety, irritability, and emotional exhaustion due to long-term exposure to heat, financial strain, and uncertainty about the future situation. The mental health and productivity of the day were also impacted by sleep disturbances due to nighttime high temperatures.

Participant Responses

"We are dizzy and weak, after spending long hours in the heat".

"It seems unsafe to work in summer, but we do not have an option as we need money".

"When the weather is very hot, children get sick very fast".

"During the night, we are unable to sleep as the rooms are too hot".

"The heat brings frustration and stress within families".

"Heat waves cause many senior citizens to have problems with breathing".

"Women who are cooking in small kitchens are victims of suffocation and exhaustion".

"The body is sometimes totally exhausted due to sustained heat."

Theme 3: Social Exclusion, Poverty, and Institutional Neglect

Another major theme that emerged as a result of the findings was the role of social exclusion and structural inequality that translated into the susceptibility of slum residents to heatwaves. The respondents indicated that poor neighborhoods lacked formal social protection structures, health facilities, clean water, and climate-sensitive facilities. Many of the respondents believed that the urban planning policies did not take into account the informal settlements and had little government concern in the event of extreme weather. The poor could not afford electricity, air conditioning, and even quality health services, and this exposed

them to more vulnerability during the heatwaves. Another issue that was reported by the residents was the lack of social care and marginalization, whereby the authorities were targeting the wealthier cities and leaving out the informal settlements. According to some of the respondents, some of the most notable factors that contributed to the increased levels of heat stress and health risks on the people were the inconsistent availability of water, poor waste disposal, and unreliability of electricity. The findings indicate that the vulnerability to heatwaves is closely related to structural inequity, environmental inequity, and inequalities in the formation of urban structures.

“The government focuses on rich areas while slums are ignored.”

“Electricity cuts become worse during heatwaves, making life unbearable.”

“We cannot afford coolers or proper medical treatment.”

“Water shortages during summer make heat conditions even more difficult.”

“There are no public cooling spaces or emergency services in our settlement.”

“Poor people suffer the most because they have no resources to protect themselves.”

“Urban authorities rarely visit our area unless there is a major problem.”

“We feel forgotten compared to other parts of the city.”

Theme 4: Informal Coping Mechanisms and Community Support Networks

Although there were dire environmental and socioeconomic situations, the study identified that slum communities actively adapted informal coping and a collective support system to deal with the effects of heat waves. People tended to share drinking water and shade, fans, and power outlets, as described by participants, when it was hot. Families have adjusted their daily routines by eliminating outdoor activities during hot days, sleeping out at night, and altering work schedules where possible. The role of community cooperation and social networks in helping vulnerable people like elderly residents, sick people, and children during heatwaves was critical. The women had particularly been busy in setting up household-based mechanisms like water storage, cooling, and caregiving. Participants also recognized that these adaptation strategies were only short-term and they were not enough due to endemic poverty, overcrowding, and poor institutional support. The results indicate that although informal community resilience can alleviate acute heat stress, it needs more robust urban governance, climate-responsive planning, and equitable public health interventions to make adaptation sustainable.

Participant Responses

“People live close to each other, and share water and assist one another on hot days”.

“Several families resort to sleeping outside due to the excessive heat at night in houses”.

“We try to change work timings to avoid the afternoon heat.”

“The people advocate for the elderly residents by making visits to them during heat waves”.

“Women keep water and wet cloths to cool children”.

“The cooperation of the community aids us to survive in hard situations”.

“The ways of coping that we have are merely temporary”.

“In the absence of appropriate government collaboration, it will be more difficult to handle future heatwaves.”

Discussion and Conclusion

This study has found that the heatwave vulnerability in informal urban settlements is not just a climatic or environmental problem, but a very structural one that is the result of social exclusion, informal urbanization, and inequalities in access to urban resources. The evidence demonstrates that poor housing facilities, overcrowding, bad ventilation, and thermal-retaining building materials greatly compound the exposure to indoor heat, and this makes slum dwellings thermally hazardous in cases of extreme weather events (Koyaro et al., 2026). These circumstances are indicative of more general trends in informal urban development, with migration to urban centers causing a faster growth in population than safe housing and basic infrastructural facilities. Sociologically, this illustrates how urban poverty is physically manifested

in terms of environmental exposure since the marginal groups are exposed to increased risks as they lack the ability to live well because of their limited living conditions (Hendricks & Van Zandt, 2021). The results correspond with the idea of environmental inequality, in which marginalized populations assume an unequal responsibility for climate risks and are the least active in their causes (Topaloglou & Nikolaidou, 2025).

The paper also unveils that exposure to heatwave is highly related to significant health hazards to the people, including dehydration, heat exhaustion, respiratory distress, sleeping disorders, and psychological stress. These health effects were more significant to outdoor workers, women, children, and the elderly, and differentiated vulnerability was experienced by the already marginalized groups. The fact that it is impossible to avoid outdoor work due to economic necessity proves how poverty makes individuals increasingly exposed to harmful environmental conditions that reinforce health risk-taking and economic insecurity patterns (Organization, 2025). Additional proof that heat waves are not only affecting the physical health but also mental health and social stability is mental distress inc, including anxiety, irritability, and emotional exhaustion. These results are in line with wider public health sources that identify extreme heat as a silent hazard that has immediate and long-term health impacts, especially in overcrowded and resource-strained urban settings (Qureshi & Cardenas, 2025).

The second important learning of the study is that social exclusion and inequality of access to adaptive resources go hand in hand. The participants cited the absence of the link to the electricity, clean water, healthcare facilities, and cooling facilities, which are all equally important in the process of coping with the extreme heat. The lack of communal cooling areas, poor emergency response mechanisms, and low incorporation of slums in cities is symptomatic of the systemic negligence and gaps in governance. This institutional marginalization enhances vulnerability since the marginalized groups are not able to have access to basic climate protection mechanisms. The result suggests that informal settlements are still mostly beyond formal urban resilience policies, thus continuing the cycles of environmental injustice and health disparity. The sense of abandonment as expressed by the respondents also means that the trust in urban governance systems is lost and may worsen the relationship between communities and states, as well as make any future adaptation interventions less effective.

Despite these structural problems, the research shows that informal communities actively develop adaptive capacities through the development of social networks and by exchanging coping strategies. Some of the practices that indicate that social capital is able to reduce heat stress to an enormous level include water sharing, adjustment of work schedules, outdoor sleeping, and mutual care giving. Adaptation of families is a major part of women, which highlights gender issues of resilience in informal settlements. However, the findings also support the notion that these coping mechanisms are quite reactive, short-term, and insufficient in reaction to the increasing intensity and frequency of heat. This is a pointer that, as much as resilience in the community is a major coping mechanism, it cannot substitute systematic interventions. To maintain sustainable adaptation, institutional toleration of informal settlements, financing of climate-resistant housing, expansion of the public health sector, and integrative development of the urban framework that engages vulnerable populations in formal resilience measures are needed. On the whole, the discussion highlights the fact that slum populations are vulnerable to heatwaves by the interplay of climate change, urban disparities, and institutional inattention. To overcome these issues, there is a need to leave short-term coping strategies and move to structural change of the urban governance and the public health systems on a long-term basis.

References

- Aboulnaga, M. M., Badran, M. F., & Barakat, M. M. (2021). Comprehension of informal settlements: an outlook on sprawl factors, challenges, and upgrading process—role of policies for slums' resilience and governance. In *Resilience of Informal Areas in Megacities—Magnitude, Challenges, and Policies: Strategic Environmental Assessment and Upgrading Guidelines to Attain Sustainable Development Goals* (pp. 53–94). Springer.
- Ahmad, Q., Lak, T. A., Malik, A. S., & Hussain, M. (2026). Perks and perils of policing in transition: A qualitative institutional inquiry to assess Weberian model of bureaucracy at police offices of Punjab Pakistan. *The Critical Review of Social Sciences Studies*, 4(1), 903–919. <https://doi.org/10.59075/svft8r79>
- Aitken, W. W. (2025). *Environmental Greenness and Cardiovascular Health*. Academic Press.
- Ali, S. A., Pham, Q. B., & Xuan, Y. (2025). *Climate change and disadvantaged communities: Challenges and opportunities*. CRC Press. <https://doi.org/10.1201/9781003620747>
- Asim, M., Raza, M., Abid, A., Ahsan, M., & Hussain, M. (2021). Effect of social media on Academic Learning Achievement of the University Students: A case study of UOS Bhakkar Campus Students. (2021). *Journal of Management Practices, Humanities and Social Sciences*, 5(1). <https://doi.org/10.33152/jmphss-5.1.2>
- Ashrafi, S., & Mallick, B. (2026). Staying at low-income urban informal settlements despite heat stress. In *Handbook on Climate Mobility* (pp. 398–419). Edward Elgar Publishing.
- Baldi, S. L., Bernotti, I., Dall'Olio, L., Perrone, P. M., & Raviglione, M. C. B. (2025). Global health: Principles and perspectives. In *Handbook of Concepts in Health, Health Behavior and Environmental Health* (pp. 1–26). Springer.
- Bennett, N. C., Bell, A., Norman, P., Evans, C., & Veness, R. (2026). Intersectional inequalities in neighbourhood air pollution concentration in England: A quantitative analysis of ecological data using Eco-Intersectional Multilevel (EIM) modelling. *Applied Spatial Analysis and Policy*, 19(1), 23. <https://doi.org/10.1007/s12061-025-09787-8>
- Boafo, Y. A. (2026). Environment, climate change and health of vulnerable population in Africa. In *Climate Change in Africa: Financing and Management* (pp. 597–620). Springer.
- Chen, J., & Delina, L. L. (2025). Understanding the impacts of extreme heat on the mental well-being of older adults: a systematic review. *Environmental Research Communications*, 7(1), 012002. <https://doi.org/10.1088/2515-7620/ada735>
- Cheshmehzangi, A. (2026). Sustainable built environments at the climate-health nexus: Mitigating heat risks for urban well-being. *Encyclopedia*, 6(3), 60. <https://doi.org/10.3390/encyclopedia6030060>
- Datta, U., & Raman, R. (2026). Climate-responsive urban design: Integrating nature-based solutions in smart cities. In *Future Smart Cities* (pp. 193–224). Elsevier.
- Fosudo, O., Bolukale, O., & Ibrahim, O. (2026). Informal settlements and poverty dynamics: Conceptual insights for sustainable urban planning. *Urban and Regional Planning*, 11(1), 1–11. <https://doi.org/10.11648/j.urp.20261101.11>
- Hendricks, M. D., & Van Zandt, S. (2021). Unequal protection revisited: Planning for environmental justice, hazard vulnerability, and critical infrastructure in communities of color. *Environmental Justice*, 14(2), 87–97. <https://doi.org/10.1089/env.2020.0054>
- Hunter, L. M., Koning, S., Fussell, E., King, B., Rishworth, A., Merdjanoff, A., Muttarak, R., Riosmena, F., Simon, D. H., Skop, E., & Van Den Hoek, J. (2021). Scales and sensitivities in climate vulnerability, displacement, and health. *Population and Environment*, 43(1), 61–81. <https://doi.org/10.1007/s11111-021-00377-7>
- Hussain, M., Usman, A., Tariq, J., Ahmed Lak, T., Seemi Malik, A., & Nadeem, M. A. (2026). Spirituality, altruism, and resilience of older patient's informal caregivers: investigating the moderating effect of the context of care in Pakistan. *Journal of Religion, Spirituality & Aging*, 38(1), 88–99. <https://doi.org/10.1080/15528030.2023.2251916>
- Ilyas, A. (2026). Urban climate stress and human health: A scoping review. *Premier Journal of Environmental Science*. <https://doi.org/10.70389/pjes.100022>

- Khan, M. (2020). *Assessment of intra-city urban heat island effect in relation to vulnerable stakeholders in Karachi, Pakistan via LCZ classification and land surface temperature analysis* [Thesis].
- Khan, M. M., Yasin, G., & Hussain, M. (2025). Moderating role of social support in the relationship between perceived discrimination and subjective well-being among Afghan refugees in Pakistan. *Qlantic Journal of Social Sciences*, 6(4), 233–242. <https://doi.org/10.55737/qjss.vi-iv.25453>
- Koyaro, M., Njoroge, N., Raido, M., Banana, E., Nyamangara, T., & Muganyizi, S. (2026). Heat impacts on informal settlements. *Urban Climate*.
- Lak, T. A., Dr, Shoaib, M., Malik, A. S., Dr, Nadeem, M. A., & Hussain, M., Dr. (2025). Visualizing masculinity: A photovoice analysis of Pakistani men's self-presentation on Facebook. *Regional Lens*, 4(1), 215–224. <https://doi.org/10.55737/rl.2025.41075b>
- Lak, T. A., Yasin, G., & Hussain, M. (2022). Role of intergroup contact as relational initiative to alleviate prejudice among faith based groups. *Journal of Management Practices, Humanities and Social Sciences*, 6(6). <https://doi.org/10.33152/jmphss-6.6.3>
- Majlingova, A., & Kádár, T. S. (2025). From risk to resilience: Integrating climate adaptation and disaster reduction in the pursuit of Sustainable Development. *Sustainability*, 17(12), 5447. <https://doi.org/10.3390/su17125447>
- Mangara, F., & Dorasamy, N. (2026). Climate change adaptation and urban resilience in Southern Africa. In *Sustainable Urban Development in Southern Africa* (pp. 147–180). Springer.
- Marcotullio, P. J., Keßler, C., & Fekete, B. M. (2022). Global urban exposure projections to extreme heatwaves. *Frontiers in Built Environment*, 8. <https://doi.org/10.3389/fbuil.2022.947496>
- Mutereko, S., Hussain, A., & Sohail, A. (2021). Assessment of individual and institutional investor's investment behavior during covid-19. A case of emerging economy. *Gomal University Journal of Research*, 37(03), 267–277. <https://doi.org/10.51380/gujr-37-03-02>
- Organization, W. H. (2025). *Understanding the health and tourism nexus*.
- Qureshi, N. S., & Cardenas, C. M. (2025). Recognizing carceral health as a public health discipline. *Critical Public Health*, 35(1). <https://doi.org/10.1080/09581596.2025.2575808>
- Rizwan, M., Haq, I. U., Ranjha, A. N., Lak, T. A., Hussain, M., & Usman, M. (2026). Suicidal ideation and suicide attempts among the Pakistani population, and reason for attempting suicide among suicide survivors. *Health & Social Care in the Community*, 2026(1). <https://doi.org/10.1155/hsc/2948037>
- Sikhosana, P., & Mashalaba, Y. (2025). Rethinking rural development research: Gaps, frameworks, and emerging directions (2010–2025). *Town and Regional Planning*, 87, 7–23. <https://doi.org/10.38140/trp.v87i.9898>
- Sohail, A., Ahmad, A., & Khan, M. M. (2021). An exploratory study to investigate the role of Shariah governance in Islamic financial institutions. *Turkish Online Journal of Qualitative Inquiry*, 12(10).
- Sohail, A., Hussain, A., & Qurashi, Q. A. (2020). Impact of COVID-19 on investment decision of individual investors in emerging stock market. *Electronic Research Journal of Social Sciences and Humanities*, 2, 1–13.
- Topaloglou, L., & Nikolaidou, K. (2025). Exploring climate, energy, and environmental justice in climate. *Sustainable Built Environment for People and Society*, 3. <https://doi.org/10.5772/intechopen.1010123>
- Veld, S. d. (2024). *Understanding vulnerability: Climate change risk perceptions of environmental non-migrants in coastal Bangladesh*. <https://studenttheses.uu.nl/handle/20.500.12932/47033>