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Keywords: Gendered Time Poverty, Social Reproduction, Heatwaves, Informal Settlements, Feminist Political Ecology, Climate Adaptation, Urban Governance, South Asia

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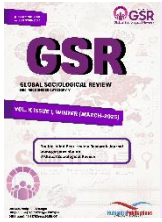

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Invisible Labor and Climate Shocks: Gendered Time Poverty in Heatwave-Affected Urban Informal Settlements in Karachi, Pakistan and Delhi, India

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Contents

Abstract

In South Asia, extreme heatwaves disproportionately affect the informal settlements in cities, but the gender aspect of time regarding such vulnerability is a highly significant subject that is critically neglected. This paper uses case study analysis using comparative cases to suggest that heatwaves act as temporal shocks, which heighten unpaid labor of women forming gendered time poverty in Karachi, Pakistan, and Delhi, India. The research finds, through the combined prism of feminist political ecology and gender time poverty theory, that infrastructural failure and gender ideals of time transfer climate stress into a time-starved crisis of time in women. The results show that heatwaves have the effect of unpaid domestic and care time of women by 1.53 hours a day and cut off income-generating, rest and leisure.

Keywords: Gendered Time Poverty, Social Reproduction, Heatwaves, Informal Settlements, Feminist Political Ecology, Climate Adaptation, Urban Governance, South Asia

Introduction

Climate change has been described as one of the most serious challenges facing the world of the twenty first century and South Asia is considered one of the global climate hotspots which are highly susceptible to extreme hot weather conditions. Having grown more

intense and frequent over the last ten years, Pakistan and India have recorded heatwave temperatures reaching up to 45 C in Karachi and 47 C in Delhi respectively in 2022 and 2023. Such drastic incidence events have led to a drastic state of health crisis, interference in urban infrastructures and a display of the susceptibility of people living in informal settlements as overcrowded, underprovided, and marginalized to formal urban planning and governance systems (Rizvi et al., 2023).

The slums or urban informal settlements are typified by low quality housing, lack of electricity supply, erratic water supply, poor sanitation and ventilation. In Karachi, 43 percent of the population is residing in informal settlements as compared to Delhi where close to 31 percent of the residents live in slum or unauthorized colonies. These settlements do not just consolidate vulnerability because of infrastructural shortfall but also indicative of wider disparity in socio-economic and poor welfare where low-income families can barely sustain daily existence amidst extreme heat. Women in such settlements are overworked with domestic and care duties and such tasks are very labor consuming during heatwaves (UN Women, 2023). Such activities as cooking in the houses with inadequate ventilation, carrying water to long distances, and looking after a child, the elderly and a sick relative demand more physical efforts, which worsen gendered time poverty even more.

The problem of time poverty, which could be considered as the absence of free time caused by the inability to have enough time because of being overworked, is especially acute among the women living in low-income urban environments. Karachi and Delhi women complain that they spend four to six hours daily in unpaid household work, with men spending less than 1.5. Such unpaid hours of labor augment 1-3 hours daily in the case of heatwaves, which indicates the escalation of efforts to sustain house operation at peak environmental pressure. This intensified work diminishes possibilities of rest, leisure, income generating work, and socialization hence impregnant pre-existing inequality on gender.

Although the available research deems quantification of health and economic effects of heatwaves, it mainly deems the household as a unified form, making the gendered division of labor (along with its intensification by weather changes) invisible(Anwar & Sur, 2021) . This gap strengthens an essential feminist gender-neutralist paradigm of policy that does not reflect absorption of environmental shocks by the most vulnerable, using the temporal resources available to them. The paper seeks to fill this gap by theorizing heatwaves not as a threat to the environment but as a time shock that builds upon existing inequalities of social life, in part due to time poverty being an important process which propagates gender forms of climate vulnerability.

The choice of Karachi and Delhi cities as the case studies enables that a comparative analysis of gendered labor burden in various contexts of governance should be done. The municipality of Karachi is not centralized and the city itself does not have a formal adoptation of an action plan in regard to heat making it respond improvisationally during extreme hot weather. Delhi in its turn has organized its action plan of heat action but is still gender-neutral with a primary emphasis put on early warnings and addressing people with health-related information without considering the fact that women unpaid labor is only enhanced by heatwaves (Khan, 2024). Nevertheless, these differences notwithstanding, women are depended upon in both cities on through informal means to adapt their household to extreme heat by having them apply their unpaid labor as one of the major sources of household adaptation.

In this research, there are three important influences in this study. To start with, it highlights that time use is a crucial and unexplored aspect of urban climate vulnerability and aspects of how heatwaves impact the way women assign labor and discretionary time every day. Second, it presents a gender investigation on the effect of heatwave on informal settlements which is a setting that is overlooked in climate and urban studies (Nagdev, 2024). Third, it presents a comparative view between two megacities with comparable climatic vulnerabilities but with institutional variabilities, which brings out structural insights of gendered vulnerability that cut across each local policy setting.

This study will have four objectives: (1) to assess the adverse effects of heatwaves on Women as unpaid laborers and facing time poverty within informal settlements, (2) to contrast with the differences in impacts in Karachi and Delhi, (3) to examine the mediating effects of governance and infrastructure to understand the effects of such effects, and (4) to make policy suggestions that include consideration of gender-controlled methods of adapting to city climate.

In order to examine this process we bring together feminist political ecology and time poverty theory. The former provides the light on the mediation between environmental dangers and power relations and social norms by placing women in the central role of adjusting family units. The latter offers the working prism, and it understands time in terms of limited resources, which have scarcity due to labor intensification caused by heat and limiting well being and opportunity (Haque & Saxena, 2025). The combination of these frames enables us to follow the chain of events between time shock in climate and gendered deprivation of time and its ramifications on the long-term adaptive capacity.

The paper places the study in a context of greater socio-environmental and policy context. It offers extensive background information about the cities of Karachi and Delhi, brings out important dynamics of informal settlements vulnerability, and demands the clarification of the interaction of gender, labor, and heat exposure.

Urban Informal Settlements in Karachi and Delhi

The city of Karachi, which is the largest city in Pakistan, has had a fast urban development during the past thirty years, having a population of over 20 million. Several urban areas are known as informal settlements such as Orangi Town, Lyari and Korangi and they are home to the largest of the population in the city, living in extreme depth and lacking of infrastructural amenities. The dwellers mostly have poor housing, single room buildings fitted with low insulation material, and without proper ventilation (Rahman & Fatemi, 2025). There is consistent water scarcity and in most cases, most households use communal taps or tanker water supply which require more than one trip in a day, especially when there is a heatwave, where there is high demand of water.

The capital city of India known as Delhi also has a significant level of informal settlements e.g. Bhalswa, Seemapuri, and Sangam Vihar. Although the city has rolled out different initiatives of urban development, the illegal settlements are underserved in the water, electricity and waste collection services. High population density in housing, coupled with temperatures that are too high especially during the summer seasons, presents unsafe living conditions (Herrera, 2022). Women in these regions are mostly aware of home chores and care, hence they are more susceptible to heatwave. Lack of infrastructure and government services makes their labor heavier and leaves them with fewer opportunities to attend school, paid jobs and can leisure.

Gendered Division of Labor and Time Poverty

The informal segmentation of labor in the informal settlement is very systemic, with women doing the bulk of the unpaid domestic labor. According to the time-use surveys women have an average household time of 4- 6 hours in a day and other hours are devoted to childcare and water gathering. The role of women in household labor is significantly larger as compared to that of men, which is due to the existing social conditions and the patriarchal family structure. When there is a heatwave, the unpaid labor of women increases as they have to exert more physical effort in terms of cooking, cleaning, and taking care of their family during the heatwave (Hoque & Uddin, 2026). Such work increases time poverty, decreases time of rest and leisure as well as limiting the possibilities of earning income.

There are multidimensional implications of time poverty. In addition to physical exhaustion, it impacts on the capacity of women to participate in social and economic activities, restraining personal growth and supporting socio-economic inequalities. The combination of heat stress, gendered work and infrastructure shortages within the informal settlement forms a chain of vulnerability, which is not

very visible to policymakers and urban planners. Urban climate vulnerability is a significant issue with time poverty as its important dimension that is necessary to consider to design effective and equitable intervention.

Study Rationale and Objectives

Although there is an increased awareness concerning human costs of heatwaves, gender, unpaid labour, and time poverty in informal settlements have not been properly investigated. Available literature mainly focuses on the health and economic productivity outcomes, and most of the studies have approximated households as unitary entities and in individual distribution of labor. This gap is expected to be addressed by this study:

The study of the exacerbated unpaid household and care work of women in heatwaves.

- Examining gendered time poverty as an aspect of temporality of vulnerability.
- Comparing the experiences of women in Karachi and Delhi to draw a comparison on the structural, as well as governance-related aspects.
- Offering policy suggestions on gender sensitivity in city climate change adjustment with a focus on infrastructure, social security, and work identification.

This research can contribute to a deeper analytical coverage of climate research in urban areas by emphasizing time poverty and invisible labor, which shows the formulation of a basis of how gender can be incorporated into climate adaptation planning (UN Women, 2025) . The ability to envision women labor as an adjustment mechanism and as a point of social susceptibility is crucial to tackling human structural injustices in the urban informal settlements.

Literature Review – Heat, Labor, and Gender: Global Perspectives on Heatwaves and Urban Vulnerability

One of the worst problems in the world climate in relation to the heavy overpopulation is heatwave, especially in the large cities. The urban areas are prone to increased heat exposure created by the urban heat Island effect caused by the high density of housing, scarce vegetation, and the extensive use of heat trapping material in form of concrete and asphalt. Cities in South Asia, Africa, and Latin America experience a major challenge all around the world with informal settlements regularly cropping up in marginal and heat-prone areas, moreover, with lack of proper infrastructure. It has been found out that urban heatwaves are also associated with mortality, morbidity, and economic damages, but the consequences of urban heatwaves are disproportionately linked with those who have low incomes and have limited access to resources. Their special susceptibility is the informal settlements with their high density, fragile settlements, and services. Poor ventilation, absence of shading, and access to electricity and cooling mechanisms exposes the residents to high-temperature conditions. Females are particularly exposed to these dangers as they stay at home to do household chores and conduct care, whereas the work of the men can be disrupted because of the restrictions of working outdoors under the extreme heat. Social norms, which limit movement and powers of decision making among women and make them more vulnerable, compound on these dynamics.

Gendered Labor and Invisible Work

The issue of invisible labor, which is unpaid domestic and care work, is the essential element of household and community stability but is systematically underestimated and misrepresented in official statistics. In the overall case across the world, women devote considerably more time to unpaid labor than men, and it is even more acute in the low-income urban environment. South Asian research indicates that in informal settlements, women work between four and six hours daily without pay (cooking, cleaning, water collection, and care give), and men usually do not work more than two hours (Shimazaki, 2025).

These labor inequalities are aggravated by heatwaves. Women have to put extra efforts to keep the household operations going in the hot weather, such as having to make more trips to collect water, cooking food in harsh thermal conditions, and looking after the more susceptible family members. In Karachi, women said that the time spent on collecting

water would go as high as 40 percent during the hot seasons and in Delhi, caregiving became very high due to heat related diseases among children and the aged population(Shimazaki, 2025). These results explain the congruence of environmental stress, societal norms, and division of labour, showing the impact of heatwaves on the existing gender disparities.

Time Poverty and Climate Stress

Time poverty presents analytical insight into the social aspects of climate change with criticality. Time poverty is a lack of discretionary time to rest, take leisure time and income-making activities because of work, especially unrecompensated work. The time poverty of women in informal settlements is exacerbated by heatwaves because household and care work is more intensive, and any paid work, however, is constrained by hazardous and physically demanding circumstances.

Recent studies highlight the importance of highlighting multi-dimensional impacts of climate stress about time use. Both UN Women (2023) and Dasgupta et al. (2021) note that women suffer the cumulative time loss in cases of extreme heat events, which minimizes their engagement in paid work and socialization and generates fatigue and health risks. This time fallacy does not only impact women but also intergenerational, where a child might be lured into domestic activities in order to assist their overworked caregivers at the expense of schooling and growth. Converging heatwaves with unpaid labor and time poverty has not been studied in climate-adaptation policy, which points to a significant gap in the knowledge of the crisis and an urban policy-governing gap.

South Asian Context – Karachi and Delhi

The South Asian comparative studies have shown regional disparities in governance, infrastructure and social norms which define heatwaves vulnerability. The informal settlements in Karachi experience a lack of infrastructures, poor supply of water and inconsistent municipal authority. The lack of formal Heat Action plan leaves the residents to rely on informal coping mechanisms whereby they engage in more unpaid labor, which again is strongly biased to women. Research indicates that women dedicate 13 to 3 hours more of their time in domestic and care-giving activities during heatwaves which is directly related to time poverty and reduces their time to earn income (Rizvi et al., 2022).

Delhi Although the municipal government has introduced a well-organized Heart Action Plan based on the early warning, community health education and emergency response, the scheme does not pay much attention to gendered labour relations. Females in slums and illegal colonies still have to carry most of the domestic and care roles and most of them are seen to spend more time doing their house chores and taking care of their children during hot seasons. The absence of gender sensitive policies in the both cities demonstrates larger problems in incorporating social and time elements of vulnerability in city climate adaptation planning.

Policy, Governance and Adaptation.

In urban governance, intervention at the vulnerability to heatwaves is highly mediated, but current policies are still gender-neutral or aimed at reducing mortality. The Heat Action Plan of Delhi comprises of early warning systems, community notifications and the emergency cooling stations yet it lacks the aspect of the increased labor strains that women may experience in informal settlements. There is no formal city wide heats planning in Karachi, instead, the relief interventions are done ad hoc through water distribution and popular education campaigns, which lack a systematic approach to gender and time utilization.

The literature shows that gender-sensitive interventions should be incorporated in the adaptation of climate in urban areas. Some of the effective interventions can be; to improve infrastructure in informal settlement, provide community-based cooling facilities, increase water access, give social protection measures and give urban planning and policymaking frameworks an understanding of the unpaid work in urban areas (Shimazaki, 2025). Translating time poverty from the short-term perspective of health effects of heatwaves into long-term structural inequalities that lead to vulnerability will have a positive change on adaptation policy.

Theoretical Frameworks in Literature

Feminist political ecology and theory of time poverty offers more than necessary conceptual framework to analyze gendered work in times of climatic stress. The feminist political ecology explores social mediation processes of environmental threats, gender, and class relations, and power through labor of women, with the understanding that the female work is not only a strategy to cope with, but also a measure of inequality in the system (Olatunde-Aiyedun et al., 2022). The theory of time poverty adds to this perspective and emphasizes the aspects of vulnerability in terms of time, paying attention to the problem of unpaid labor to restrict the possibilities of women to find rest, to be economically active, and to be socially active.

By combining these frameworks, a complete picture can be gained on how the role of heatwaves is to be played as environmental and temporal shocks. The literature shows that heatwaves are not only enhancing the hustling of women in informal settlements but also render their work necessary to adapt households at the time of climatic stress, making visible the hitherto unknown roles that keep communities resilient to climate stresses (UNRISD, 2025). The conceptualization and solution of these dynamics is important in forming fair urban climate adaptation options that ease gendered vulnerabilities and bring social justice to the field.

Part 3: Comparative Qualitative Methodology:

Conceptual Framework

The paper is a combination of feminist political ecology and time poverty theory, as the researcher tries to conceptualize the challenges caused specifically by heatwaves to gendered labor and time occupation in urban informal settlements. Another concept in feminist political ecology is that gender, class, and domestic power structure mediate environmental risks highlighting the notion of unequal distribution of labor and susceptibility. The theory of time poverty is centered on the lack of discretion time which can be advanced because of the high level of unpaid work and argues that time is an important resource to wellbeing, economic involvement, as well as social interaction.

Heatwaves act as earthy and temporal shocks. They increase the amount of domestic labor especially to women who are the ones that do most household chores such as maintaining the home, collecting water, cooking, cleaning and taking care of the home. These augmented work pressure diminish discretionary time that worsen the time poverty and restrict the chance to earn money, rest, and have fun. According to the conceptual framework, the relationships between causal factors to augmented unpaid labor and time poverty relate to heat exposure, infrastructural scarcity, gender norms, and household accountability.

Figure 1

Conceptual Pathways Linking Heatwaves to Gendered Time Poverty

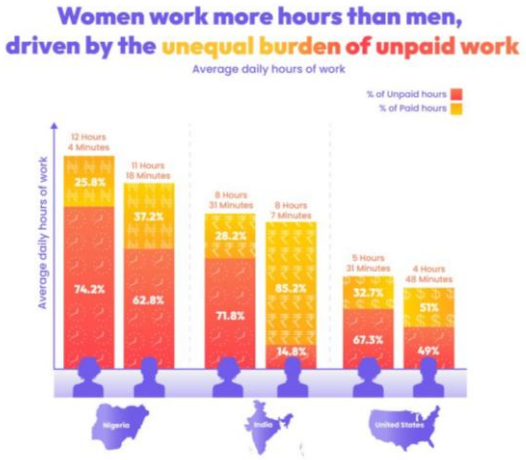

Figure 1 (Source: https://onebillionresilient.org/extreme-heat-inflames-gender-inequalities/)

1. Heatwave Exposure: Karachi and Delhi have been affected by intense temperatures that are aggravated by urban heat islands.
2. Infrastructure Shortcomings: bad ventilation, lack of water, un-reliable supply of electricity, weak waste disposal.
3. Gender Norms and Roles in the Home: Women have the major responsibilities of household chores and childcare.
4. Labor Intensification: Heatwaves will raise the time and physical efforts involved in household activities.
5. Time Poverty: Loss of discretionary moments to relax, work (income earning) and socializing and leisure.
6. Feedback Mechanisms: Adaptive capacity is again curtailed by limited resources and time which contributes to the possibility of the gendered vulnerability.

The framework would allow the analysis of environmental, social, and temporal aspects of vulnerability in integrated and prioritizing the interaction of structural inequalities and climatic strains in informal settlements. It also gives a reason of comparative analysis between Karachi and Delhi and the differences in the governance, infrastructure and social norms.

Research Design & Data Synthesis Protocol

This paper is based on a case study qualitative design of comparative study based on synthesis of secondary data. Because the research does not provide any direct data collection, the study sums up national time-use surveys, heatwave reports, policy documents, peer-reviewed literature (20202025) and local case studies. The comparative method can be applied to discuss the differences and similarities between cities, providing new information about the mediation of heat-related time poverty by governance, infrastructure, and social norms (Upadhyay & Bastola, 2024).

The research was carried out in a procedural manner:

1. Case Selection: Karachi and Delhi were selected because of numerous cases of high heatwave exposure, large numbers of informal settlements, and opposite systems of governance, allowing a most different systems comparison to identify structures commonality.
2. Data Identification & Collection: A specific search of the academic databases (Scopus, Web of Science), institutional repositories were employed to find literature (2020-2025) based on keywords: "gendered time use," "heatwave," "informal settlement," "unpaid labor," with the addition of Karachi and Delhi. This was coupled with the examination of national surveys on time-use (NSSO, PBS) and urban climate vulnerability analysis, as well as official policy documents (e.g. the Heat Action Plan of Delhi).
3. Analysis Framework: The thematic synthesis was used to analyze data. The content was coded based on the main concepts of our framework, i.e., labor intensification, time allocation, infrastructural stressor, coping strategies, and policy recognition. The use of this coding in both contexts of cities was consistent to allow comparison of the data and determine cross-cutting themes.

Data Sources and Reliability

The sources of secondary data were considered based on their reliability, timeliness, and significant discussion on urban informal settlements. The national time-use surveys will offer an in-depth account of gender labor allocation, whereas the heatwave reports and peer-reviewed studies will provide information on environmental and infrastructural background. The policy documents such as the Heat Action Plan of Delhi contain the information pertaining to the governance and adaptation strategies.

Although secondary data does not allow us to obtain primary ethnographic information, we counteracted this by methodological triangulation the cross-verification of trends in quantitative surveys, qualitative case study, and policy analysis. We clearly admit that national surveys might not reflect the true extent of unpaid care work. Nevertheless, the overall flow and the overall effect of results obtained in several independent sources make our main argument about labor intensification be stronger.

Comparative Approach

The comparative approach is necessary to have an insight into the way in which different governance and social norms relate to analogous climatic stressors. Karachi and Delhi are two megacities with large exposure to heatwave that exhibit institutional differences. The disorganized city and absence of formal policies that address heat in Karachi leads to informal methods of survival whereas the Delhi Heat Action Plan adopts formal interventions but is not gender-biased. (Craft et al., 2025) The comparative design sheds light on the mediation of structural variables on the experience of time poverty and unpaid labor during heatwaves.

Ethical Considerations

Though this is a research using secondary data, ethical standards in this case are how to give a responsible interpretation of gendered experience, not to make generalizations, and limitations of the data source. The research makes certain that the experiences of women in labor and time poverty are reflected in an appropriate way and put in a broader framework of social, economic, and environmental factors.

Strengths and Limitations:

Strengths

- Combines feminist political ecology and theory of time poverty to analyze on a multidimensional level.
- Comparison analysis offers information on cross city variation and structural determinants of vulnerability.
- Reliability and validity are improved by the triangulation of various secondary data.

Limitations

- Lack of micro-level information because of lack of primary data.
- Secondary data can either be underreporting on unpaid labour or miss certain specific coping strategies in the local settings.
- The results are contextually specific to Karachi and Delhi and might not reflect the entire South Asian cities.

The conceptual framework and research methodology clearly outlined have provided the analytical backgrounds upon which the empirical results would be presented. Through the framework, the most important pathways of heatwaves worsening gendered time poverty are highlighted, with the methodology involving a systematic comparative and rigorous analysis of the credible secondary data.

Results and Analysis:

Overview of Findings

It is explained that heatwaves have a notable effect on gendered time poverty by placing more burden on women of informal settlements by overworking them with domestic and care duties, which is not paid. Women across both Karachi and Delhi noted that their daily labor load of between 1.5 and 3 hours when it is peak heat. The extra time is used in collecting water, preparing meals and washing and taking care of children, the elderly and heat victims within the family. The findings point towards an obvious gender inequality in the division of time, as men deserve a relatively small portion of the household work, which is a habitual social construct.

Heatwave Impacts on Domestic Labor:

Karachi

The mounting burden on women in the city of Karachi which includes high temperatures in the slums, frequent power interruptions, and lack of water infrastructures in places like Orangi and Lyari, in the Karachi slums, exacerbates the situation of women in informal settlements. During heat waves, women had to spend more time in collecting water because of limited supply. The high-temperature cooking and cleaning also demanded more labor and time, and the additional workload was imposed because of the need to take care of heat-stressed relatives. The average amount of increase in domestic labor among women during the 2022 period in the heatwave was 2-3 hours per day.

Delhi

The same was the situation in the slums and unauthorized colonies in Delhi, such as Bhalswa and Sangam Vihar. The heatwave of 2023 recorded temperatures of 47 0 C when there were few cooling systems. Duty obligations towards children and the elderly increased whereas household duties became hard. Women had also cited 1.5-2 hrs of unpaid labor per day. Even the Heat Action Plan, which was developed in Delhi, failed to reduce the workload on mortality and health through the policy focus on mortality and health advisories.

Time Poverty and Redirection of Time into Discretionary Time.

The time poverty analysis shows that discretionary time of women reduces significantly during a heatwave. Cities were reduced in terms of rest, leisure and income earning activities. The accumulated workload leads to fatigue, low informal work productivity, and fewer prospects of social life. Table 1 demonstrates how women in Karachi and Delhi in normal and heatwave seasons spend their time on a daily basis.

Table 1

Average Daily Time Use of Women in Informal Settlements (Hours per Day)

Activity	Karachi (Normal)	Karachi (Heatwave)	Delhi (Normal)	Delhi (Heatwave)
Domestic Labor	5	7	4.5	6
Caregiving	2	3	2	3
Paid Informal Work	3	2	3	2
Rest/Leisure	3	1	3	1.5

The table highlights the significant increase in unpaid labor and reduction in discretionary time during heatwaves. Women in both cities sacrificed rest and informal income opportunities to cope with intensified household responsibilities.

Neighborhood-Level Variations

The intensity of work and time poverty also differed in terms of neighborhoods. Fragmented water infrastructure settlements in Karachi, including Korangi, also experienced the most labor changes due to increased time of water collection. On the same note, in Delhi, the time burden to women in unauthorized colonies with poor access to the amenities was highest in Seemapuri. The examples of these micro-level differences underscore the role of the quality of infrastructure in mediating the impact of heatwaves on gendered work(Sharma & Bhandari, 2025).

Coping Mechanisms and Adaptation

There are also distinct informal coping strategies that women use to deal with the intensification of labor as a result of heatwaves. Homes in Karachi are known to stagger meal preparation schedules to avoid hot time of day and divide water fetching duty when they can. Women in Delhi have to cut on outdoor workload, change the timing of preparing meals and depend on the social network within their neighborhoods to have support when they need it to take care of their children and husbands. Nevertheless, the strategies tend to redistribute labour at the household or community level without cutting the overall cost in time due to gendered labour invisibility as adaptation policies.

Cross-City Comparison

The comparison brings out the paradox that: at least governance variance leaves the basic consequence of gendered time poverty intact. An example of a depoliticized model of adaptation, which, purposely neglecting social reproduction, normalizes the status quo of unequal labor burdens against Indian society,

is the technical, gender-neutral HAP of Delhi. Institutional fragmentation in Karachi, in turn, results in hyper-localized, informal coping, which nevertheless still relies on the women labor and, nevertheless, in rather visible community networks. The two situations point to the fact that, in the absence of a direct focus on addressing the redistribution of care work, even climate policy will tend to reproduce and intensify existing disparities (Hassan et al., 2025).

Synthesis of Findings

The findings underscore several key insights:

- Heatwaves are known to contribute to extensive unpaid domestic and care workload, which is usually not equally distributed across the gender spectrum.
- The heightened intensity of labor decreases time to relax, generate income and socialize.
- Problems in infrastructure like inaccessible water, insufficient ventilation increase workload.
- Whereas gendered time poverty is mitigated by governance and policy interventions, these interventions do not always tackle the problem.
- Though adaptive, informal coping mechanisms make women labor more invisible and it does not decrease time poverty.

The results indicate that urban climate change adaptation policies are required, which explicitly address such challenges as gendered labour and time poverty and integrate any additions to infrastructures, social protection, and provision of community-based support to shift a disproportionately high burden of women to the wider community.

Discussion, Policy Implications, and Conclusion:

Discussion

Karachi/Delhi shows that the use of heatwaves is not only an environmental threat but also a temporal stressor factor, which enhances gendered inequalities in urban informal settlements. The amount of work that women perform without payment during the heat exceeds expectations, and this is in terms of an extra period of time in the house, on the caregiving front as well as water gathering. The results are similar to the feminist political ecology, which argues that the environmental risks are mediated by social orders, such as the gender norms and social hierarchy in the household and access to resources. In this respect, the labor of women is not only an informal process of adapting, but also an indicator of inequality in the structure.

Time poverty theory also explains the effects of these augmented labor requirements. Discretionary time women spend during heatwave decreases drastically, and they have less time to rest, leisure, informal income and socialization. The researcher concludes that, on an average, women in Karachi and Delhi contributions to heat events in terms of extra hours of labor, which are not paid, amount to 1.5 to 3 hours (Sathar & Arif, n.d). The physical and mental well-being is not only lost under this enterprise but economic mobility and social participation are also limited. The existence of micro-level differences between neighborhoods shows that these effects are increased by infrastructural shortcomings, including having poor water supply, inadequate electrical connections, and a lack of ventilation in housing. It is the female population living in regions with the lowest level of infrastructures who experience the greatest weight on time, as they represent an overlap of environmental, infrastructural, and social vulnerabilities.

In spite of the variations in the municipal governance and policy interventions, the two cities expose that women labor is invisible in the adaptation strategies. Karachi has no formal Heat Action Plan, and instead of institutionalized solutions to the issue, it should make use of informal measures like cooking at different times, and water-sharing (Ullah et al., 2026). The city of Delhi already has a designed Heat Action Plan that involves early warnings and emergency cooling centers, but the strategy is gender-neutral in nature, as it does not solve the problem of the escalation of unpaid work. As a result, in both cities, most of the workload associated with climate is still absorbed by women, which puts a significant gap in policy.

The results of this study indicate the significance of thinking about heatwaves in a gender and temporal context. The conventional advertising approaches to climate, like focusing on mortality, morbidity and resilience of infrastructure, tend to overlook intra-household perspectives of labor and time. This study encompasses the feminist political ecology in conjunction with the time poverty theory to inform the way structural inequalities and gendered norms are used to create adaptive capacities in the urban informal settlements. Unpaid work becomes a crucial adaptive resource, but one that continues to make people gender vulnerable and is not well addressed in the policy contexts.

Unpaid Labor as Maladaptive Adaptation

The results drive a critical redressing of the amplified work as a woman during the heatwave. Although operationally parsimonious on the household level, such dependence on invisible labor is a kind of maladaptation in the institutional and personal level. It covers deep structural and governance failures, in which the state can shift the costs of adaptation on the time and bodies of women. This is a process that creates an ecological surplus value of the formal economy as well as a degrading environment, which subsidizes the formal economy and preempts gender-equitable development. As such, what comes out as the resilience of the household also itself confines gendered vulnerability, lessening the ability of women to face future shocks since their health, time, and economic resources are exhausted.

Policy Implications

The paper has a number of important policy implications to reduce gendered time poverty and enhance adaptive capacity in informal settlements with heat wave:

- Infrastructure Development: This can be done through infrastructure development such as water supply, electricity, etc. to limit the workload on women. Reduced travel to water facilities as well as better homes cooling systems reduces directly the time on domestic activities in a heatwave.
- Gender-Sensitive Heat Action Plans: Heat action plans at the municipal level must specifically respond to gendered labor burdens. The proportionate impact on women can be mitigated by using time-use evaluation, female-specific advice, and local cooling centres.
- Social Protection Programs: Economic and temporal stress can be reduced with the help of conditional cash and water and electricity provide subsidies and additional assistance to informal caregiver. The appreciation of unpaid work in social protection systems can institutionalize the gains of women who dwell in the disproportionate adaptation to the households.
- Community-Based Adaptation: The network capable of sharing caregiving and access to the resources can be provided at the neighborhood, lowering the intensity of work by individuals. During heatwaves, local organizations may arrange and distribute water delivery, childcare, and labor-sharing.
- Data Collection and Monitoring: To address the issues related to time-use data and their disaggregation by gender this data has to be included in the urban planning and climate monitoring. Evidence-based policy interventions may be informed by tracking of labor intensification during extreme heat events.

Recommendations

Building on the policy implications, specific recommendations include:

- Introduction of micro-level cool centers and shade communal areas in the informal settlements.
- Subsidizing cooling and cooking technology with high energy-efficiency in order to mitigate the intensity of domestic labor.
- Creating gendered labor-based early warning systems, recommend on how the work should be done to limit heat exposure.

- Educating municipal planners and policymakers on how to incorporate time poverty and gender work towards climate resilience planning.
- Promoting participatory planning that involves women to make sure that adaptation strategies are based on lived experiences and decrease the work load.

Conclusion

This paper has shown that the climate crisis is a time crisis too, which is being planned disproportionally orchestrated across gender lines in urban informal settlements. Following the route of heatwave to time poverty we have demonstrated how gendered norms and infrastructural inadequacies transform a climate shock into a long-term temporal constraint to women, reducing health, economic agency, and collective survivability.

The heatwaves in Karachi and Delhi demonstrate that the environmental risks come with the projections of gender, labor, and infrastructure to create time poverty among urban informal settlement women. The paper illustrates that heat-induced laboring intensification is a highly important yet insufficiently identified element of vulnerability, and has important consequences in the domains of health, economic engagement, and social justice. Using feminist political ecology and theory of time poverty, the study reveals the structural and social forces that subject women to climate shocks in disproportion of other populations with increasing focus on the necessity of adaptation strategies to be formulated with a focus on gender sensitivity.

The comparative analysis shows that, though the policies of the two cities vary in how they are governed, heatwave and how they cope with it, the places are mostly dependent on unpaid labor of women as a form of primary adaptation. Although adaptive, informal strategies of coping support the invisibility of the women work and cannot collectively resolve time poverty. To deal with this gap, it would be necessary to implement policy interventions that acknowledge and alleviate gendered work loads and responsibilities, enhance infrastructure, social protection and community-based support systems.

Future scholarship should utilize the approaches of feminist and participatory methods which include time-use diaries, photovoice as well as community-led mapping to infer the fine-grained lived experiences of time poverty in addition to co-generating solutions to transform. The longitudinal research is required to regard the accumulative health effects of the chronic time of stress caused by heat. Moreover, models of care-based climate policy in other areas should also be examined as an alternative way to see the ways to identify, lessen, and redistribute the unpaid labour that already constitutes the invisible background of urban adaptation.

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