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Review Article

Heatwaves and Urban Health: Assessing Preparedness and Adaptive Strategies in Low- and Middle-Income Countries

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Abstract

Heatwaves are increasingly viewed as a significant public health issue in low- and middle-income countries (LMICs). Urban populations in these regions are particularly vulnerable due to their limited ability to adapt. This review examines the health effects of heatwaves in urban areas, assesses preparedness and adaptive strategies, and connects these efforts to Sustainable Development Goals (SDGs). The article specifically emphasizes the importance of SDG3 (Good Health and Well-Being), SDG11 (Sustainable Cities and Communities), and SDG13 (Climate Action) in shaping integrated responses. Evidence shows that while some progress has been made in establishing heat-health action plans, there are still major gaps in expanding these initiatives across LMICs. Improving collaboration among sectors, urban planning, and community-based adaptation is crucial for reducing health risks related to heat.

Keywords: Public health, Climate Action, Adaptive strategies, SDGs

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Introduction

Climate change is increasing the frequency, severity, and duration of heatwaves worldwide. Urban populations in LMICs experience greater exposure due to the urban heat island effect, poor housing, and overstretched healthcare systems. Tackling these issues is essential for advancing SDG3 (Good Health and Well-Being), which aims to lower preventable deaths and improve resilience to environmental risks. At the same time, SDG11 (Sustainable Cities and Communities) highlights the need for inclusive, safe, and resilient cities, and SDG13 (Climate Action) stresses the urgent requirement for adaptation and mitigation efforts.

Health Impacts of Heatwaves in Urban Settings

Heatwaves lead to increased deaths from cardiovascular, respiratory, and kidney diseases. In LMIC cities, where access to cooling and healthcare is limited, vulnerable groups like older adults, outdoor workers, and children face higher risks. Strengthening healthcare systems to tackle these risks supports SDG3. Heat stress can also lead to psychological distress, sleep issues, and mental health disorders. Urban populations in informal settlements without reliable cooling are especially affected, emphasizing the need for integrated health responses aligned with SDG3. Heatwaves worsen air pollution, reduce work productivity, and put pressure on urban infrastructure. These indirect health and economic consequences illustrate the connection between urban sustainability (SDG11) and climate resilience (SDG13).

Vulnerability Factors in LMIC Urban Populations

Socioeconomic disparities, closely linked to SDG 11 (Sustainable Cities and Communities), play a major role in amplifying the health impacts of extreme heat. Many people living in informal or low-income urban settlements is exposed to higher risks because these areas often lack access to green spaces, proper ventilation, and a steady electricity supply needed for cooling. Poor housing conditions further trap heat, making indoor environments unsafe during heatwaves.

In terms of healthcare limitations (SDG 3 – Good Health and Well-being), only a limited number of cities in low- and middle-income countries (LMICs) have developed dedicated emergency plans to respond to heatwaves. The absence of trained personnel, early warning systems, and resources for heat-related illness management leads to preventable health crises during extreme weather events.

Urban planning challenges (SDG 11 and SDG 13 – Climate Action) also exacerbate heat vulnerability. Rapid, unplanned urbanization and the use of heat-retaining construction materials, such as concrete and asphalt, increase local temperatures—a phenomenon known as the urban heat island effect. These issues are further intensified by insufficient tree cover and the lack of climate-adaptive infrastructure.

Lastly, occupational risks (SDG 3) are particularly high among outdoor workers in sectors such as agriculture, construction, and transportation. Prolonged exposure to high temperatures without proper rest, shade, or hydration facilities leads to severe heat stress, dehydration, and even long-term health complications. Addressing these interconnected challenges requires an integrated approach combining urban planning, healthcare preparedness, and labor protection to build truly heat-resilient and equitable cities.

Preparedness and Adaptive Strategies

Heat-related health challenges demand integrated and evidence-based interventions that align with multiple Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).

Heat-Health Action Plans (HHAPs) serve as a cornerstone of climate–health resilience. These plans encompass early warning systems, public awareness initiatives, and medical preparedness protocols designed to reduce mortality and morbidity during heatwaves. A notable example is the city of Ahmedabad, India, which implemented South Asia's first HHAP. This initiative significantly decreased heat-related deaths through coordinated efforts between meteorological services, health departments, and community organizations. Despite such success, many low- and middle-income country (LMIC) cities still lack comprehensive and well-resourced HHAPs, leaving populations vulnerable to extreme heat events.

Early Warning and Communication Systems, integral to SDG 13, play a crucial role in minimizing heat-related risks. The use of mobile alerts and localized community messaging has proven effective in several LMICs by enabling timely behavioral responses and targeted interventions. Expanding these digital and community-based systems not only strengthens climate adaptation capacity but also contributes directly to public health protection.

Urban Design and Green Infrastructure interventions, aligned with SDG 11 and SDG 13, provide long-term, sustainable solutions to mitigate urban heat. The integration of nature-based strategies—such as increasing tree cover, creating urban green spaces, using reflective and permeable materials, and promoting sustainable housing—reduces surface temperatures and enhances thermal comfort for urban residents.

Strengthening Healthcare Systems under SDG 3 is equally vital. Hospitals and primary health centers must be equipped with reliable cooling systems, uninterrupted power supplies, and adequate emergency resources. Moreover, training healthcare workers to recognize and manage heat-related illnesses ensures timely and effective responses during extreme weather events.

Finally, Community-Based Adaptation (SDG 11) emphasizes local empowerment and participatory planning. Engaging communities through awareness campaigns, neighborhood preparedness initiatives, and promotion of low-cost cooling technologies fosters ownership and resilience at the grassroots level. Collectively, these strategies represent a holistic approach to heat adaptation—bridging health, environment, and governance to safeguard populations in a warming world.

Challenges and Barriers

LMICs encounter various challenges in implementing adaptive strategies, such as financial constraints, governance issues, weak data systems, and competing public health priorities. These obstacles impede progress toward SDG3, SDG11, and SDG13.

Policy Implications and SDG Alignment

SDG3: Strengthen healthcare systems to lower heat-related deaths and illnesses.

SDG11: Encourage urban design that includes green spaces and resilient infrastructure.

SDG13: Improve climate action with early warning systems and adaptive planning.

Cross-cutting: Promote intersectoral governance, ensure fair access to resources, and mobilize international funding for climate-health adaptation.

Conclusions

Heatwaves present an urgent challenge for public health and urban resilience in LMICs. Effective adaptation requires a merger of health protection (SDG3), sustainable urban planning (SDG11), and climate action (SDG13). Building resilient cities that protect vulnerable populations needs coordinated efforts across various sectors, levels of governance, and international partnerships.

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