

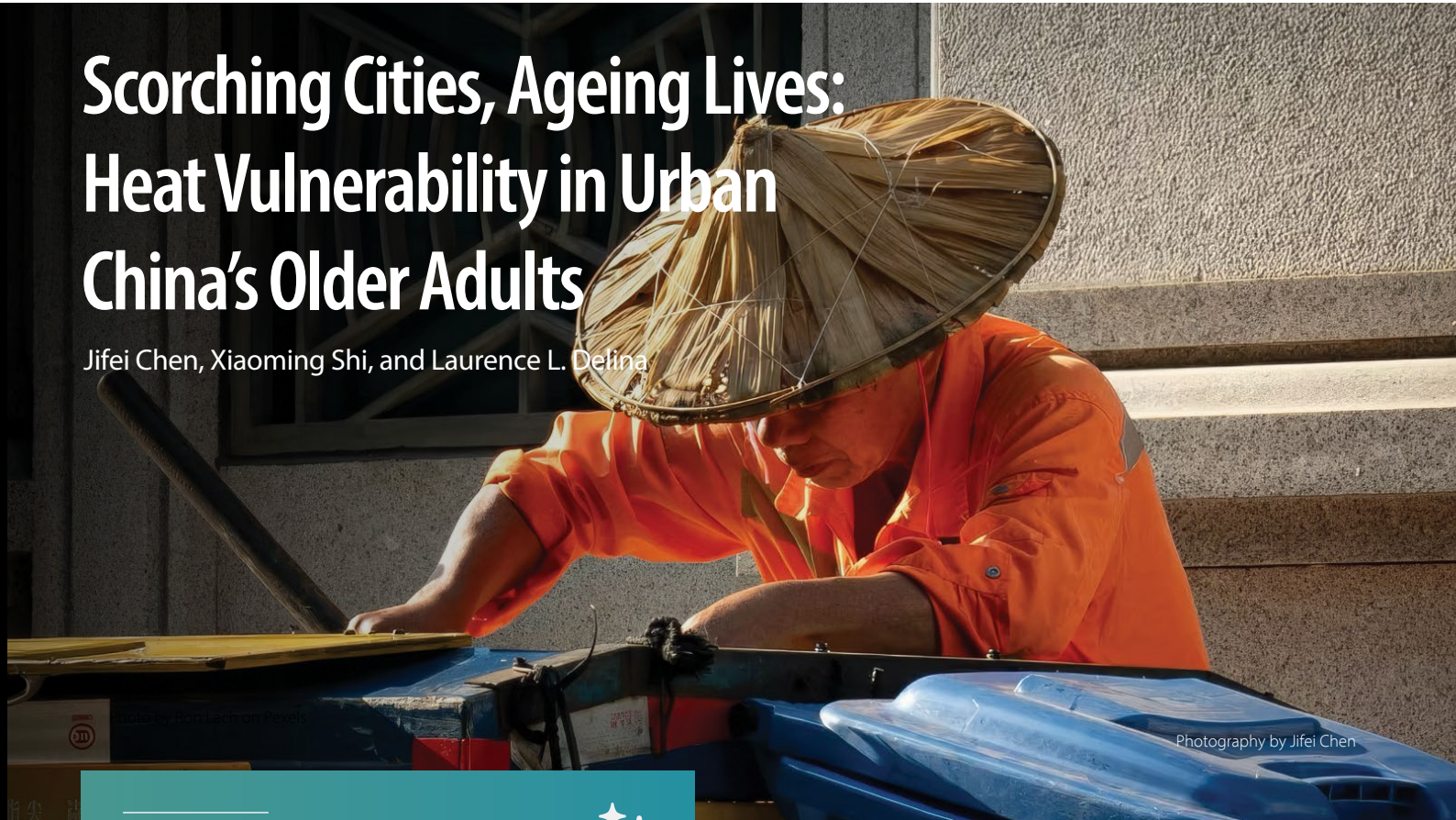


SUSTAINABILITY & CLIMATE RISKS

THOUGHT LEADERSHIP BRIEF SERIES

Scorching Cities, Ageing Lives: Heat Vulnerability in Urban China's Older Adults

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Photography by Jifei Chen

KEY POINTS



- ▶ Older adults exhibit heightened vulnerability to the ramifications of climate change, mainly the increasing frequency and severity of extreme heat events, which can significantly impair their mental well-being.
- ▶ Two cities in China, Jinan and Guangzhou, exhibit varying levels of heat vulnerability due to differences in socioeconomic conditions, infrastructure, and environmental factors.
- ▶ An "Exposure-Sensitivity-Adaptation" framework effectively assesses heat vulnerability risk, revealing significant disparities in how different communities experience and respond to heat.
- ▶ Adaptation strategies include enhancing green spaces, improving public transport, and tailoring heat action plans to local demographics.

ISSUE

Climate change is fundamentally altering the human living environment. The World Health Organization (WHO) estimates that health problems associated with high temperatures result in more than 250,000 annual deaths, highlighting the severity of this climate-related health emergency. Older adults often possess inadequate heat adaptation abilities and face significant hardships, rendering them more susceptible to extreme heat and associated public health risks. During periods of extreme heat, older adults frequently find themselves confined indoors, a limitation that seriously affects their autonomy, mobility, and mental well-being.

Mental well-being remains an underexplored dimension of heat vulnerability in Chinese cities. We addressed this gap through mixed-methods research, combining spatial analysis to map community-level vulnerability with a thematic analysis of lived experiences data.



ASSESSMENT

Our approach links spatial patterns with social perspectives, offering nuanced insights into the impacts of urban heat and adaptation. Our study utilises the “Exposure-Sensitivity-Adaptation” framework (Fig. 1) from the IPCC Sixth Assessment Report, integrating spatial analysis with qualitative insights to evaluate heat vulnerability.

Figure 1: Exposure–Sensitivity–Adaptation framework



We assessed spatial “exposure” to extreme heat using indicators such as Land Surface Temperature and Normalised Difference Vegetation Index, revealing higher heat exposure in urban cores with limited greenery, which is exacerbated by the urban heat island effect due to extensive concrete surfaces. “Sensitivity” focuses on the density and proportion of older populations, identifying urban centres with high concentrations of older adults, particularly in economically disadvantaged neighbourhoods, as more susceptible due to health vulnerabilities and social isolation. “Adaptation” evaluates access to hospitals, metro stations, green spaces, education levels, and per capita disposable income, highlighting disparities between urban cores and peripheral areas.

We identify key drivers of vulnerability to extreme heat among older adults in two Chinese cities: Jinan, in Shandong province, and Guangzhou, in Guangdong province. Our spatial analysis suggests that, in Jinan, high population density and a significant proportion of older adults were primary factors contributing to heat vulnerability. Our spatial study revealed that areas with higher concentrations of older residents, particularly in economically disadvantaged and peripheral communities, such as Guanzhaying, Hongjialou, Huairan, Huanghe, and Qilishan, face elevated risks due to limited infrastructure and services. The lack of adequate infrastructure, including cooling centres and healthcare facilities, exacerbated the risks faced by these communities.

In contrast, Guangzhou’s vulnerability was more closely tied to education levels and the availability of urban amenities. Education level is the most significant driver of heat risk, with high-risk communities, such as Beijing, Binjiang, Changgang, and Huadi, exhibiting lower educational attainment and limited access to urban infrastructure such as parks and healthcare services. Our interaction analyses reveal synergies, including

the combination of education and green spaces in Guangzhou and the integration of hospital resources with green spaces, underscoring the importance of combining resources for resilience. Furthermore, our spatial analysis identifies areas with lower green coverage and socioeconomic disadvantages as particularly vulnerable, with Guangzhou’s urban core and Jinan’s periphery exhibiting distinct patterns.

We extended our spatial work with qualitative research of people’s lived experiences, expanding the Protection Motivation Theory to incorporate impacts on mental well-being and exacerbating factors, such as age, gender, health status, and prior heat exposure experience. We found that extreme heat induces psychological distress like anxiety, depression, and irritability, cognitive impairments, sleep disturbances, and social isolation. In Jinan, older adults experience episodic distress during seasonal heatwaves and recover after the event. In contrast, the persistent heat and humidity in Guangzhou causes chronic stress and adaptation fatigue.

Our findings, based on in-depth interviews with older adults and expert interviews in urban planning and healthcare, reveal the lived experiences of these individuals. In Jinan, older adults adopt short-term behavioural changes, such as avoiding peak heat hours, driven by seasonal self-efficacy. In contrast, chronic heat and humidity in Guangzhou leads to resignation, compounded by cultural beliefs like scepticism toward air conditioning and digital exclusion. High response costs, including financial and health-related burdens, limit the use of modern cooling technology, leading to a reliance on traditional methods such as hydration and natural ventilation.

Furthermore, we highlighted the importance of adaptive capacity in determining how communities respond to heat. In Guangzhou, wealthier areas housed more healthcare resources and green spaces, leading to uneven adaptation capabilities. Conversely, Jinan’s peripheral communities faced limited access to cooling centres and medical services, significantly heightening risks during extreme heat events. These findings underscore the need for localised adaptation strategies that cater to each city’s vulnerability profile, taking into account the specific socioeconomic and demographic characteristics of urban areas.



IMPLICATIONS

This brief highlights mental well-being as an underexplored dimension of heat vulnerability in Chinese cities, identifying barriers like inadequate cooling infrastructure, limited institutional support, and insufficient social support. Our spatial analyses reveal urban heat distribution patterns, with areas of lower vegetation showing higher vulnerability scores. We also note discrepancies in indicator classification, such as the older population being used as a sensitivity measure versus exposure across the literature, underscoring the need for standardised methodologies to ensure comparable findings.

However, our work has limitations. Firstly, we only included Summer 2023 data, which restricts the temporal generalisability of our findings. Secondly, our use of coarse adaptation data may result in the omission of fine-grained variations in how individuals respond to extreme heat. Moreover, there are cultural sensitivities and potential recall bias during interviews, particularly among those aged 70 and above, which could have impacted the quality of our findings. We also encountered challenges in recruiting older participants, which further limits the depth of our research on lived experiences.

Nevertheless, our findings underscore the need for tailored urban planning to mitigate heat vulnerability and enhance resilience among older populations. Our policy and practice recommendations include:

- At the **personal level**, older adults should monitor their mental health for signs of distress, adjust their daily routines — such as avoiding peak heat hours — utilise traditional cooling methods like drinking herbal teas, and maintain social connections to reduce feelings of isolation. In Jinan, short-term strategies such as using fans and light clothing are effective, whereas older residents of Guangzhou require long-term solutions that combine traditional and modern cooling techniques.
- At the **community level**, Jinan requires seasonal heat warning systems via SMS, radio, and community broadcasts, along with summer electricity subsidies and accessible cooling centres within a 15-minute walk. Guangzhou needs permanent cooling centres equipped with dehumidification and mental health support through counselling and peer groups. Both cities should enhance their green spaces and offer free transportation for seniors with mobility limitations.
- Lastly, at the **national level**, governments should prioritise mental health screenings, increase funding for climate health adaptation, and promote cross-sector collaboration, such as between meteorology and health sectors, for timely interventions. A global health database could integrate adaptation strategies and health data to guide international best practices.



Jifei Chen is a researcher specialising in urban environmental studies and climate adaptation strategies. Her MPhil thesis, by which this Brief was based, focused on understanding the impacts of climate change on vulnerable populations, particularly older adults in urban settings. Jifei is a PhD student at the University of Maryland's School of Public Health.



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