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Title: How Planners Address Extreme Heat with Equitable Resilience

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Abstract (181 words)
Problem, Approach, and Findings
Extreme heat is one of the most concerning natural hazards facing cities today, forecasted to increase in frequency, duration, and intensity in the future. With close to 3.5 billion people projected to be impacted worldwide by extreme heat by 2070, it is critical that efforts focus on planning and adapting our built urban environment to reduce the risks that people will face from heat waves. A lack of data and monitoring has left uncertainty surrounding the full impact to people's health from extreme heat. Currently, planners are undertaking important work to understand how extreme heat disproportionately affects communities historically discriminated against in planning practices.

Implications
This article looks at how local planners and municipalities, primarily in urban communities, can best address extreme heat within the lens of equitable resilience. Planners must go beyond unenforceable comprehensive plans to zoning regulations and unified development ordinances to change and adapt to threats posed by hazards. Equitable stakeholder engagement and environmental justice must be incorporated into the process, centering those with power and those most impacted, as these people will have the most at stake.

Author Bios (3-4 sentences each)
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Introduction

Climate change is a cross-cutting issue that impacts urban environments across many disciplines and sectors. Leading practitioners in public health and health research institutions have already identified climate change as the greatest threat to global public health (Choi-Schagrin 2021; Maibach et al. 2010). An unprecedented statement published by over 200 medical journals globally called for interdisciplinary action to address the social and economic determinants of health impacted by climate change (Atwoli et al. 2021).

One of the most critical and urgent threats to healthy cities is the risk of natural hazards, as climate change is altering the frequency and severity of severe weather (Masson-Delmotte et al. 2021). Climate resilience resides at the intersection between planning and health and seeks to promote healthier and more equitable living conditions for urban residents. This intersection will become increasingly important as cities cope with acute events such as severe storms and hurricanes and longer-term impacts such as higher average temperatures, chronic flooding, and changing precipitation patterns.

Of all climate hazards, extreme heat causes the most health risks in the United States (Meerow and Keith 2021). The unusual increase in the number of deaths in a given population, termed excess mortality, is a particular concern for urban environments impacted by extreme heat (Smith 2020). Heat waves are increasing in frequency, duration, and intensity (Manaloto 2021); 2020 was the second warmest year on record globally (Bateman 2020). The Extreme Heat Resilience Alliance—a global, cross-sectoral collaboration addressing urban heat challenges—estimates that extreme heat will impact more than 3.5 billion people by 2070. Of these, 1.6 billion will be residents of urban areas. Extreme heat is known as the 'silent killer' due to a lack of data and monitoring. There is uncertainty around how many people die from heat, which health conditions are most exacerbated by it, and whether current policies are effective in addressing heat-related health impacts (Owen-Burge 2021). This hazard deserves particular attention given the reality that temperature warming will continue to increase for many decades, even with intensive emissions reduction (Sherman 2020).

Urban heat islands are the phenomena of higher temperatures in cities (compared to rural communities) resulting in part from the high concentrations of paved surfaces, along with limited tree canopy and green space, often seen in urban development (Meerow and Keith 2021; Jones, Dunn, and Balk 2021; Wilson 2020). Importantly, extreme heat is an environmental justice concern, disproportionately affecting communities that have experienced historical patterns of discrimination and disinvestment (Wilson 2020). Researchers have analyzed patterns of disinvestment and racist policies—specifically redlining—as determinants for the health impacts of extreme heat (Plumer, Popovich, and Renault 2020; Wilson 2020; Wolch, Byrne, and Newell 2014). Early practices of segregating Black and white communities, followed by redlining, caused social and environmental inequity impacting nonwhite residents in current urban forms, like less tree canopy and green space (Maller and Strengers 2011; Lawrence 2004; Grove et al. 2017). These inequities have compounded issues of access to green space, distribution of resources, urban design and investment, and other factors that comprise the built environment.

Planning at the local level is integral for addressing equitable resilience and promoting adaptation. Tools like comprehensive plans as well as local zoning, codes, and ordinances can mitigate the impacts of extreme heat by planners promoting equitable resilience and locally-led adaptation. Augmentation of urban vegetation and other urban design strategies can also decrease extreme heat risk at the local level. For planning strategies to remain equitable, these

mechanisms must be coupled with vulnerability assessment and equity analysis, integrating public health concepts to fully understand who is being impacted and how to implement solutions.

Equitable Approach to Resiliency: International Policy Context

Addressing the ingrained systems of injustice and inequity within social determinants of health, and the resulting vulnerability of priority populations, must underpin any resilience efforts. The concept of equitable resilience requires a transformation of current systems and mindsets about resilience, taking "into account issues of social vulnerability and differential access to power, knowledge, and resources" (Matin, Forrester, and Ensor 2018). The Resilient Nation Partnership Network, FEMA, and NOAA published the 2021 report, "Building Alliances for Equitable Resilience," garnering key insights from diverse stakeholders on community resilience and equity (Willis et al. 2021). As the repercussions of climate change challenge our cities, establishing equitable frameworks for heat resilience will be increasingly vital.

Planners can look to several policy frameworks from the global stage for context on addressing equitable heat resilience, especially from the United Nations (UN). The 2015 Paris Agreement was a monumental step forward in this arena, mandating universal commitment to climate neutrality through multilevel, multistakeholder action (Berrang-Ford et al. 2019; Roberts 2016).

The Sendai Framework, which focuses on the health impacts of natural hazards, was adopted at the Third UN World Conference on Disaster Risk Reduction in 2015. The Sendai Framework established four priorities for action following the Paris Agreement: 1) understand disaster risk; 2) strengthen disaster risk governance to manage disaster risk; 3) invest in disaster risk reduction for resilience; and 4) enhance disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation, and reconstruction (United Nations Office for Disaster Risk Reduction 2021). The ambitious goals imagine a world that is safer, healthier, and more equitable by 2030: one that decreases mortality and impacts to people, reduces economic and infrastructure damages, bolsters local risk reduction strategies, improves global cooperation, and augments early warning systems (United Nations Office for Disaster Risk Reduction 2021).

In 2016, the New Urban Agenda was adopted by the UN Conference on Housing and Sustainable Urban Development (Habitat III)and endorsed by the UN General Assembly. The focus of the New Urban Agenda is "equal rights and access to the benefits and opportunities that cities can offer", highlighting the role of subnational and local governments in accomplishing these goals. Quantitative measures are included for the transport and mobility, energy solid waste, and water/sanitation sectors. The New Urban Agenda promotes intervention mechanisms in land, housing, and revitalization policies, urban design, municipal finance, and urban governance.

As such, planners have a clear, global mandate from climate experts to focus on disaster risk reduction and resilience in their work. As cities grapple with these complex challenges, health equity and stakeholder engagement must be the primary focus in implementing intersectional, inclusive, and effective solutions. Pivotal to this work is equitable stakeholder engagement, which underpins the current roles and responsibilities of planners working at the local level across the United States. The International Institute for Environment and Development aptly describes this imperative for "local governments to shift away from 'development as usual' − to development planning that places climate at its heart, champions

bottom-up community participation and values local knowledge*"* (Soanes 2021a). Hundreds of governments and institutions are committed to locally-led climate adaptation, having signed on to these principles (and committed significant funding) at the UN Climate Change Conference in Glasgow (Soanes 2021b, 2021a; Owen-Burge 2021).

The Belmont Forum-funded grant project, Re-Energize Governance of Disaster Risk Reduction and Resilience for Sustainable Development, established the UNC Snow Angel Method. This novel approach to stakeholder engagement re-thinks traditional processes to invigorate locally-led resilience. The UNC Snow Angel Method combines snowball and purposive sampling methods with the idea that better-informed decisions are the result of equitable engagement that encompasses people from priority groups. This approach advocates for the greater involvement of stakeholders in decision-making, garnering more rooted community support, and improving implementation. The snowball method starts with a few defined stakeholders and asks them to identify new organizations and other contacts. While this is helpful for researchers, this method can unintentionally limit the scope of included stakeholders.

In comparison, while the UNC Snow Angel Method specifically recognizes the need to include a wide number of stakeholders, it centers those with power *and* those most impacted. This method is an attempt to prioritize the need for broad stakeholder input while simultaneously recognizing that those most impacted (or vulnerable) have the deepest stake in the issues at hand. NOAA's National Integrated Heat Health Information System heat mapping campaign, conducted across 11 states by local organizations, is an excellent example of a community-based equitable engagement approach. During the summer of 2021 in Durham County, North Carolina, the community-led campaign recorded and mapped heat data in Durham and Raleigh on the hottest summer days (Freid 2021; Cawley 2022). Within Durham County, the project focused on eight identified census tracts where redlining, racism, and historic inequity have resulted in marked and disproportionate health risks for people of color and lower-income community members.

The project would not be possible without an extensive network of community volunteers and local partners. To support data collection, the volunteers traversed the cities by car and bike to better understand how heat is impacting residents. The data will be integrated with community demographic information to understand social vulnerability. From a policy standpoint, this project will be integrated into the first-ever climate change chapter in the Community Health Assessment from the Partnership for a Healthy Durham. This work is also founded in Durham County's Strategic Planning goals.

Application to Planning Practice

When addressing extreme heat in the context of equitable resilience, local level planners have a variety of tools at their disposal. Of course, every planner faces a complicated decision-making process prioritizing community feedback and balancing local climate change impacts, funding, resources, and capacity. Following the inspiration of the landmark Sustainable Development Code, we present a framework of "good-better-best" planning practices that can move the needle in mitigating extreme heat (Rosenbloom and Adams 2019).

Comprehensive and Climate Plans – Good

In the United States, comprehensive plans are foundational for determining community goals and guiding future actions for individual jurisdictions. Generally, these planning documents look at existing conditions and issues, set goals and objectives to address the issues, determine implementation strategies, and guide future land use decision-making. Increasingly, cities and states are creating climate adaptation and resilience plans that will help stakeholders anticipate, prepare for, adapt to, and recover from the impacts of climate change (Environmental Protection Agency 2021). As with comprehensive plans, climate adaptation and resilience plans lay out strategies to address hazards and their associated risks to vulnerable groups. Many states have local or regional plans that address climate adaptation, and few have state-led adaptation plans (Georgetown Climate Center 2021). While increasingly common, climate action plans tend to focus on the reduction of greenhouse gas emissions.

Comprehensive and climate plans generally require collaborative efforts to identify current issues and offer objectives and goals. However, these planning documents often lack legally enforceable standards that ensure progress towards the desired goals. When these plans are not referenced during decision-making, they fail to reach their full potential. Therefore, we believe comprehensive and climate plans are only good when it comes to addressing extreme heat and equitable resilience.

Integrated Risk Assessments – Better

A better approach for municipal governments and local planners is to integrate extreme heat risk assessments with comprehensive plans or unified development ordinances. While comprehensive plans provide overall guidance through goals, policies, and programs, they lack enforceability and leave substantial discretion for how they are implemented. In contrast, unified development ordinances combine zoning regulations with other management or design regulations, providing the enforcement and implementation tools that comprehensive plans lack. By integrating extreme heat risk assessments into these documents, municipalities are armed with the "how" or "how much" behind the "why."

The City of Baltimore's Disaster Preparedness and Planning Project ("Disaster Plan") was produced by the Department of Planning in 2013 and ultimately adopted in 2018. Baltimore is currently in the process of completing their Master Plan 2030, presenting a great opportunity for Baltimore to integrate the hazard risk assessment into their comprehensive plan process. The Disaster Plan recommends increasing urban tree canopy to 40% by 2037, which would reduce the effect of extreme heat on communities. An additional recommendation is to increase green space in vacant lots, which would reduce impervious surface and provide new opportunities for shade (Center for Climate and Energy Solutions 2017).

Physical Land Use Changes – Best

The term "urban heat management" refers to proactive engagement by local governments to reduce the intensity and duration of heat exposure through tree planting, use of cooling materials, and similar activities (Stone et al. 2019). While comprehensive plans, heat action plans, and integrated risk assessments provide the foundation to mitigate extreme heat, physical land use changes through urban heat management will result in tangible health impacts for communities. As previously mentioned, lagging national and global action to reduce greenhouse gases means that extreme heat will be a regular reality, particularly for lower-income and BIPOC

communities. Planners face an imperative to retrofit, redesign, and rethink the current urban environment to relieve these health impacts as quickly as possible.

To best reduce risk to extreme heat for vulnerable groups and provide equitable resilience, municipalities need to examine ordinances and zoning regulations to determine what is and is not being enforced. Related to extreme heat, these elements should be examined first: tree protection and retention, green and open space preservation, cooling pavement, and cooling roofs. For example, the City of Raleigh received a clean technology pavement award from NCDOT for reducing urban heat island effect and preserving pavement through titanium oxide treatments. Treated roads showed a 37% reduction in nitrous oxides—a roadway contaminant—as well as a nearly 400% improvement in the average Solar Reflective Index compared to untreated locations (Cawley 2022; Carleton 2021). This work by the City of Raleigh demonstrates how data-driven physical interventions can promote equity in green infrastructure.

The New Urban Agenda calls for two actionable changes relevant to urban heat management land use policy: 1) providing of rebates or tax credits for new development that include cool and green roofs and 2) creating an expedited permitting process for developments that meet density requirements (United Nations Conference on Housing and Sustainable Urban Development 2016). Gold-star renovations of municipally owned buildings, the Agenda suggestions, can demonstrate the feasibility of these project in local development markets. In addition, developing building retrofit incentive programs can vastly decrease heat-related illness and mortality.

Houston, Philadelphia, and Louisville have also taken action in urban heat management. Houston required cool roofing provisions in 2016 for commercial buildings, and Philadelphia passed an ordinance requiring white or reflective Energy-Star approved materials for new or renovated buildings (Center for Climate and Energy Solutions 2017). An innovative expansion of these kinds of requirements is the installation of cool pavements, which lower surface temperatures and mitigate health impacts (Center for Climate and Energy Solutions 2017). Louisville experienced a deadly heat wave in 2012 that prompted city action (Stone et al. 2019). The Center for Climate and Energy Solutions commended their multi-pronged approach, which will include a climate and health assessment, a cool roof rebate program, and cool roof installation on parking garages and park buildings. The city completed an Urban Tree Assessment and hired a forester, aiming for 45% tree canopy citywide and focusing on disinvested neighborhoods (Center for Climate and Energy Solutions 2017, Boyle 2020).

Recommendations for Local Planners

Local planners are key leaders in helping their communities address the challenges climate change poses to people and the environment. The planning profession works at the intersection of sectors that are critical to hazard mitigation and adaptation – land use, public health, development, and transportation. Interdisciplinary collaboration amongst these sectors is necessary for advancing equitable resilience. Based on issues identified in the comprehensive and climate plans, local planning departments can re-evaluate zoning regulations and unified development ordinances within the lens of climate change adaptation. A strategy that can be effective is overlay zoning for specific hazards or establishing a “resilience zone” overlay. This applies additional standards to the defined boundary, which can be specific to hazards like extreme heat or flooding. The hazard and resilience overlay can dictate land use regulations, permitted uses, and construction types which creates opportunities to address equitable resilience

strategies. The Boston Planning & Development Agency (BPDA) adopted the Coastal Flood Resilience Overlay District (CFROD) in October 2021 (Boston Planning & Development Agency 2021; Hughes 2021). The CFROD aims to protect portions of the City of Boston where 40 inches of sea level rise is expected in a 1% chance storm event. The CFROD implements updated Design Guidelines, new flood elevation requirements, and standards for building uses. The BPDA also added a Resilience Reviewer to advise development project alignment with climate policies, following their Climate Ready Boston plan (Boston Planning & Development Agency 2021). Similarly, the city of Norfolk, Virginia established a Coastal Resilience Overlay Zone and Upland Resilience Overlay, both of which were adopted in 2018 and requires developers to address risk reduction, stormwater management, and energy resilience through use of a flexible points-based system (Sharp 2021).

Local level prioritization of funding for climate action is critical. According to the International Institute of Environment and Development, less than 10% of global climate funds are committed to climate action at the local level (Soanes 2021a). This lack of funding leads to critical gaps in action for communities most impacted by extreme weather and climate events. We recommend re-tooling planning finance mechanisms to fund urban heat management strategies. For example, the New Urban Agenda highlights tax increment financing and special assessment districts as land value capture tools for climate resilience (Center for Climate and Energy Solutions 2017).

Additionally, stakeholder engagement should center those with power *and* those who are most impacted, as those most vulnerable will likely have the deepest stake in the issue. Community involvement around extreme heat risk reduction and comprehensive planning is critical, and efforts must ensure that the appropriate people are fully brought into the process. Stakeholder engagement activities may look like in-person workshops, virtual meetings held at varied times and utilizing the UNC Snow Angel Method to reach vulnerable groups.

Conclusion

Planners have the tools and ability to help communities increase their resilience to extreme heat. Zoning regulations, unified development ordinances, and financing incentives should be used—in tandem with equitable stakeholder engagement—to make changes to land use that ultimately work well in alleviating heat in urban areas.

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