

Urban Climate-Health Strategies: New Opportunities to Promote Health Equity

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Kumar N. Urban climate-health strategies: new opportunities to promote health equity. *Harvard Public Health Review*. Fall 2018;17.

Across North America, cities are bracing for the health impacts of a changing climate, including more intense heat, severe storms, and frequent flooding events.^{1,2,3,4} Public health, urban planning, and emergency preparedness departments are developing new strategies, programs, and policies to respond to the health impacts of a changing

climate. It's increasingly clear that socially and economically marginalized groups will be particularly vulnerable to these hazards.^{5,6,7} Policy responses to climate change often acknowledge these differences between groups, and some cities have articulated *health equity* as a guiding

¹ Marinucci, G. D., Luber, G., Uejio, C. K., Saha, S., & Hess, J. J. (2014). Building resilience against climate effects—A novel framework to facilitate climate readiness in public health

agencies. *International Journal of Environmental Research and Public Health*, 11(6), 6433-6458

² American Public Health Association (2018). *Adaptation in Action Part 2: Updated Grantee Success Stories from CDC's Climate & Health Program*. Washington, DC: American Public Health Association & Center for Disease Control

³ Araos, M., Berrang-Ford, L., Ford, J. D., Austin, S. E., Biesbroek, R., & Lesnikowski, A. (2016). Climate change adaptation planning in large cities: A systematic global assessment. *Environmental Science & Policy*, 66, 375-382.

⁴ Sheehan, M. C., Fox, M. A., Kaye, C., & Resnick, B. (2017). Integrating health into local climate response: lessons from the US CDC Climate-Ready

States and Cities Initiative. *Environ Health Perspectives*, 125(9), 094501

⁵ Gamble, J. L., Balbus, J., Berger, M., Bouye, K., Campbell, V., Chief, K., ... & Hallisey, E. (2016). *Ch. 9: Populations of concern* (pp. 247-286). In Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska (eds). *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Washington, DC: United States Global Change Research Program

⁶ Haines, A., Kovats, R. S., Campbell-Lendrum, D., & Corvalán, C. (2006). Climate change and human health: impacts, vulnerability, and public health. *Public Health*, 120(7), 585-596

⁷ Public Health Institute (2015). *Climate Change, Health & Equity: Opportunities for Action*. Oakland, CA: Public Health Institute.

principle of their actions.^{8,9} However it's not always clear what this commitment to health equity really means, and how the concept may be operationalized with respect to climate-health strategies.

There is some consensus among public health institutions that the principle of *health equity* is about ensuring that all groups have the resources and opportunities they need to live healthy lives.^{10,11,12,13} Health equity is therefore not only concerned with unequal health outcomes. It is also concerned with the unfair distribution of social, environmental, and economic determinants of health that drive those outcomes. Promoting health equity requires responding to the health needs of the most vulnerable groups while also tackling the underlying conditions — low incomes, unhealthy neighborhoods, unsafe housing — that make these groups vulnerable in the first place. How are these

concepts reflected in cities' responses to climate change?

Using the example of extreme heat, this discussion briefly explores how the concept of *health equity* has been applied to climate-health strategies in North American cities. The discussion draws a distinction between 'downstream' interventions that respond to health needs as they arise and 'upstream' interventions that reduce peoples' overall vulnerability to the health impacts of a changing climate,¹⁴ and suggests that a *health equity* approach requires further upstream action.

Heat is one of the most serious health threats of climate change,¹⁵ and is a particular health risk in urban settings.¹⁶ Currently, within the United States, there are an estimated 65,000 emergency room visits¹⁷ and 670 deaths¹⁸ related to heat exposure annually. These figures are likely an underestimate. Mortality data rarely cite heat as a cause of

⁸ San Francisco Department of Public Health Climate & Health Program. (2017). *San Francisco's Climate & Health Adaptation Framework*. San Francisco, CA: San Francisco Department of Health

⁹ Toronto Public Health (2015). *Climate of Concern: Climate Change & Health Strategy for Toronto*. Toronto, ON: Toronto Public Health.

¹⁰ Braveman, P. (2014). What are health disparities and health equity?: we need to be clear. *Public Health Reports*, 129(Suppl 2), 5–8.

¹¹ National Partnership for Action to End Health Disparities. (2010 February). *The National Plan for Action Draft*. Washington, DC: U.S. Department of Health and Human Services, Office of Minority Health

¹² Public Health Agency of Canada (2010). *Towards Health Equity: Canadian Approaches to the Health Care Sector Role*. Ottawa, ON: Public Health Agency of Canada.

¹³ Braveman P, Arkin, E., Orleans, T., Proctor, D., and Plough, A. (2017). *What Is Health Equity? And What Difference Does a Definition Make?* Princeton, NJ: Robert Wood Johnson Foundation.

¹⁴ National Collaborating Centre for the Determinants of Health. (2014). *Moving Upstream*. Antigonish, NS: St. Francis Xavier University.

¹⁵ Hunt, A., & Watkiss, P. (2011). Climate change impacts and adaptation in cities: a review of the literature. *Climatic Change*, 104(1), 13-49

¹⁶ Clarke, J. F. (1972). Some effects of the urban structure on heat mortality. *Environmental Research*, 5(1), 93-104.

¹⁷ Sarofim, M. C., Saha, S., Hawkins, M. D., Mills, D. M., Hess, J., Horton, R., ... & Juliana, A. S. (2016). *Ch. 2: Temperature-related death and illness* (pp. 43-68). In Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska (eds). *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Washington, DC: United States Global Change Research Program

¹⁸ Berko, J., Ingram, D. D., Saha, S., & Parker, J. D. (2014). Deaths attributed to heat, cold, and other weather events in the United States, 2006-2010. *National Health Statistics Reports*, (76)

death, although it is known to exacerbate other common causes including cardiac events and stroke.¹⁹ Climate projections indicate that heat-related mortality could increase in the next three decades, with estimates ranging from several hundred to several thousand additional deaths every year.²⁰ While heat waves are a particular concern, even small increases in daily temperatures can be harmful to health.²¹

Like other climate hazards, heat has serious health equity implications: many groups face heightened vulnerability solely because of the conditions in which they live.²² People without air conditioning at home, or those who cannot afford to run their air conditioners, are far more likely to die during heat waves;²³ one analysis of Chicago's 1995 heat wave has suggested that 50% of mortality was attributable to a lack of air conditioning.²⁴ Residents in multi-story apartment buildings, particularly those living

on higher floors, also face greater health risk because their buildings tend to retain heat.^{25, 26} Similarly, people living in neighborhoods that are susceptible to 'heat island effect' because of a lack of tree cover or expansive pavement are at greater risk.^{27, 28} The conditions that make people most vulnerable to heat are closely correlated with social and economic marginalization: these risk factors are far more common in low-income communities and communities of color.^{29, 30}

The projected rise in temperature throughout North America has prompted many jurisdictions to develop new programs and policies to protect public health. As of 2011, approximately 40% of US counties had implemented heat action plans,³¹ and this figure has likely grown in recent years. These plans most commonly include the implementation of an alert system to inform the public about impending heat waves and

¹⁹ Basu, R., & Samet, J. (2002). Relation between elevated ambient temperature and mortality: A review of the epidemiologic evidence. *Epidemiologic Reviews* 24, 190-20

²⁰ Sarofim et. al. (2016).

²¹ Basu & Samet (2002).

²² Gamble et. al. (2016).

²³ O'Neill, M. S., Zanobetti, A., & Schwartz, J. (2005). Disparities by race in heat-related mortality in four US cities: the role of air conditioning prevalence. *Journal of Urban Health*, 82(2), 191-197.

²⁴ Semenza, J. C., Rubin, C. H., Falter, K. H., Selanikio, J. D., Flanders, W. D., Howe, H. L., & Wilhelm, J. L. (1996). Heat-related deaths during the July 1995 heat wave in Chicago. *New England Journal of Medicine*, 335(2), 84-90.

²⁵ Semenza et. al. (1996).

²⁶ Vandentorren, S., Bretin, P., Zeghnoun, A., Mandereau-Bruno, L., Croisier, A., Cochet, C., ... & Ledrans, M. (2006). August 2003 heat wave in France: risk factors for death of elderly people living at home. *The European Journal of Public Health*, 16(6), 583-591

²⁷ Harlan SL, Brazel A, Prashad L, Stefanov WL, Larsen L (2006) Neighborhood microclimates and vulnerability to heat stress. *Social Science & Medicine* 63:2847–2863.

²⁸ Climate Protection Partnership Division, Office of Atmospheric Programs. (2008) *Reducing urban heat islands: Compendium of strategies*. Washington, DC: United States Environmental Protection Agency

²⁹ Mitchell, B. C., & Chakraborty, J. (2015). Landscapes of thermal inequity: disproportionate exposure to urban heat in the three largest US cities. *Environmental Research Letters*, 10(11), 115005.

³⁰ Rosenthal, J. K., Kinney, P. L., & Metzger, K. B. (2014). Intra-urban vulnerability to heat-related mortality in New York City, 1997–2006. *Health & Place*, 30, 45-60

³¹ White-Newsome, J. L., Ekwurzel, B., Baer-Schultz, M., Ebi, K. L., O'Neill, M. S., & Anderson, G. B. (2014). Survey of county-level heat preparedness and response to the 2011 summer heat in 30 US states. *Environmental health perspectives*, 122(6), 573.

associated health risks, and education campaigns to encourage healthy behaviors like drinking more water and spending time in air-conditioned spaces. When temperatures exceed a given threshold, some cities open cooling centers, public spaces with air conditioning where people can go to escape the heat and seek medical attention if needed.³² Many cities have also developed detailed heat vulnerability assessments that identify neighborhoods where residents face heightened risk because of the physical and built environment, population demographics, or social and economic factors.³³

Guided by assessments, cities employ multiple strategies to ensure that health interventions reach those who most need them. This might include specific communications strategies to ensure that heat alerts and health education materials are effectively disseminated to the most vulnerable communities, for example, by working with local community-based organizations or health care providers to deliver information.³⁴ Recognizing that a lack of transportation can be a major barrier for many low-income people, a small number of jurisdictions offer free transportation to cooling centers.³⁵ Although rigorous

evaluations are challenging to complete, there is some evidence that these interventions can successfully reduce heat-related illness and mortality.^{36, 37} However, there is little evidence to suggest that these services and supports can counteract the disproportionate harm that climate change poses to socially and economically marginalized groups.^{38, 39}

There is no question that it is important and necessary to protect the health of the most vulnerable people during an emergency. Implementing interventions like alerts, education campaigns, and cooling centers, and targeting these interventions towards the highest-risk populations, are important steps in achieving that goal. However, these interventions primarily address downstream risk factors like an individuals' health behaviors or their access to emergency services. They are designed to respond to the health needs of the most vulnerable groups once they are already experiencing the threat.

A meaningful health equity approach to climate change requires us to take a step further by asking: why are these people vulnerable in the first place? A commitment to health equity means engaging with the

³² Hiltz, A. S. (2017). *Use of cooling centers to prevent heat-related illness: summary of evidence and strategies for implementation*. Washington, DC: Climate & Health Program, Centers for Disease Control and Prevention.

³³ Widerynski et. al. (2017).

³⁴ White-Newsome, et. al. (2014).

³⁵ White-Newsome et. al. (2014).

³⁶ Boeckmann, M., & Rohn, I. (2014). Is planned adaptation to heat reducing heat-related mortality and illness? A systematic review. *BMC Public Health*, 14(1), 1112.

³⁷ BRACE Midwest and Southeast Community of Practice. (2017). *Climate and Health Intervention Assessment: Evidence on Public Health Interventions to Prevent the Negative Health Effects of Climate*

Change. Climate and Health Technical Report Series. Washington, DC: Climate and Health Program, Centers for Disease Control and Prevention.

³⁸ Bassil, K. L., & Cole, D. C. (2010). Effectiveness of public health interventions in reducing morbidity and mortality during heat episodes: a structured review. *International journal of environmental research and public health*, 7(3), 991-1001.

³⁹ Benmarhnia, T., Bailey, Z., Kaiser, D., Auger, N., King, N., & Kaufman, J. S. (2016). A difference-in-differences approach to assess the effect of a heat action plan on heat-related mortality, and differences in effectiveness according to sex, age, and socioeconomic status (Montreal, Quebec). *Environmental health perspectives*, 124(11), 1694.

upstream factors, like income, housing conditions, and neighborhood environments that make people vulnerable to the health impacts of a changing climate. Some jurisdictions are embracing upstream interventions, moving beyond the traditional public health response to build communities that are better able to cope with climate change. Yet despite their importance, such interventions remain a relatively uncommon component of climate-health strategies.⁴⁰

For example, although access to home cooling is known to reduce heat-related mortality for low-income people, relatively few jurisdictions have made it a priority. As of 2011, only 3% of US counties provide temporary assistance for utility costs as part of their heat action plans,⁴¹ and energy initiatives make up only 3% of local climate change adaptation actions.⁴² Boston is one of several cities exploring the feasibility of local energy production to lower the cost of household energy and improve efficiency.⁴³ Importantly, this initiative would make home air-conditioning more accessible, reliable, and affordable. The proposed program would be first implemented in subsidized housing sites,

where many households currently do not have air-conditioners or cannot afford the costs of running them.

Similarly, despite the clear links between neighborhood environment and heat, in 2012 only 25% of the most populous US cities were developing strategies to combat the urban heat island effect.⁴⁴ New York City has implemented a \$106 million “Cool Neighborhoods” initiative to reduce temperatures in the most heat-vulnerable neighborhoods.⁴⁵ The initiative aims to improve the built environment, for example, by planting more trees and introducing pavement materials that absorb less heat. The Cool Neighborhoods initiative also addresses housing challenges, for example by improving ventilation in apartment buildings to keep residents safer and more comfortable during heat waves. Similar initiatives are underway in cities throughout North America and around the world.⁴⁶ It is too early to evaluate these strategies specifically, but modeling studies consistently find that neighborhood-built environment interventions can lead to significant reductions in heat and heat-related illness.^{47, 48}

⁴⁰ Bowen, K. J., & Ebi, K. L. (2015). Governing the health risks of climate change: towards multi-sector responses. *Current Opinion in Environmental Sustainability*, 12, 80-85.

⁴¹ White-Newsome et. al. (2014).

⁴² Stults, M., & Woodruff, S. C. (2017). Looking under the hood of local adaptation plans: shedding light on the actions prioritized to build local resilience to climate change. *Mitigation and Adaptation Strategies for Global Change*, 22(8), 1249-1279

⁴³ Boston Redevelopment Authority. (2016). *Boston Community Energy Study: Exploring the Potential for Local Energy Generation, Microgrids, and District Energy*. Boston, MA: Planning Division, Boston Redevelopment Authority

⁴⁴ Stone, B., Vargo, J., & Habeeb, D. (2012). Managing climate change in cities: will climate action plans work?. *Landscape and Urban Planning*, 107(3), 263-271.

⁴⁵ City of New York (2017). *Cool Neighborhoods NYC: A Comprehensive Approach to Keep Communities Safe in Extreme Heat*. New York, NY: Mayor’s Office of Recovery & Resiliency.

⁴⁶ C40 Cities (2016 February). *Cool Cities Good Practice Guide*. London, UK, New York, NY, & Rio de Janeiro, Brazil: C40 Cities Climate Leadership Group.

⁴⁷ BRACE Midwest and Southeast Community of Practice (2017)

⁴⁸ O’Neill, M. S., Carter, R., Kish, J. K., Gronlund, C. J., White-Newsome, J. L., Manarolla, X., ... &

Rather than solely responding to the health impacts of climate change, these initiatives are getting at the root causes of vulnerability. This approach is also valuable for other climate change threats, such as flooding and severe storms, which similarly cause disproportionate harm to the socially and economically marginalized.⁴⁹ A key strength of upstream interventions is that they offer long-term health protection, preparing communities for the chronic pressures of climate change. Moreover, these interventions improve residents' day-to-day quality of life while also minimizing the health risks associated with climate change.^{50, 51} This approach aligns with the growing body of evidence demonstrating how investments in healthier social, economic, and environmental conditions can improve overall population health and promote health equity.^{52, 53}

There is little doubt that climate change will permanently shape population health in cities across North America. To support health equity in the coming decades, climate-health action will need to move beyond addressing the acute health impacts among vulnerable populations. There will need to be an investment towards policies and programs that address the conditions that make people

vulnerable in the first place. By moving upstream to address the underlying social, economic, and environmental determinants of health, cities can better deliver on the goal of promoting health equity in a changing climate.

Schwartz, J. D. (2009). Preventing heat-related morbidity and mortality: new approaches in a changing climate. *Maturitas*, 64(2), 98-103.

⁴⁹ Gamble et. al. (2016)

⁵⁰ Heltberg, R., Siegel, P. B., & Jorgensen, S. L. (2009). Addressing human vulnerability to climate change: toward a 'no-regrets' approach. *Global Environmental Change*, 19(1), 89-99.

⁵¹ Luber, G., K. Knowlton, J. Balbus, H. Frumkin, M. Hayden, J. Hess, M. McGeehin, N. Sheats, L. Backer, C. B. Beard, K. L. Ebi, E. Maibach, R. S. Ostfeld, C. Wiedinmyer, E. Zielinski-Gutiérrez, and L. Ziska, 2014: Ch. 9: Human Health. Climate Change Impacts in the United States: The Third National Climate

Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 220-256.

⁵² Thornton, R. L., Glover, C. M., Cené, C. W., Glik, D. C., Henderson, J. A., & Williams, D. R. (2016). Evaluating strategies for reducing health disparities by addressing the social determinants of health. *Health Affairs*, 35(8), 1416-1423.

⁵³ Bradley, E. H., Canavan, M., Rogan, E., Talbert-Slagle, K., Ndumele, C., Taylor, L., & Curry, L. A. (2016). Variation in health outcomes: the role of spending on social services, public health, and health care, 2000–09. *Health Affairs*, 35(5), 760-768.