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Staying cool in a changing climate: Reaching vulnerable populations during heat events

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ABSTRACT

The frequency and intensity of hot weather events are expected to increase globally, threatening human health, especially among the elderly, poor, and chronically ill. Current literature indicates that emergency preparedness plans, heat health warning systems, and related interventions may not be reaching or supporting behavior change among those most vulnerable in heat events. Using a qualitative multiple case study design, we comprehensively examined practices of these populations to stay cool during hot weather ("cooling behaviors") in four U.S. cities with documented racial/ethnic and socio-economic disparities and diverse heat preparedness strategies: Phoenix, Arizona; Detroit, Michigan; New York City, New York; and Philadelphia, Pennsylvania. Based on semi-structured in-depth interviews we conducted with 173 community members and organizational leaders during 2009–2010, we assessed why vulnerable populations do or do not participate in health-promoting behaviors at home or in their community during heat events, inquiring about perceptions of heat-related threats and vulnerability and the role of social support. While vulnerable populations often recognize heat's potential health threats, many overlook or disassociate from risk factors or rely on experiences living in or visiting warmer climates as a protective factor. Many adopt basic cooling behaviors, but unknowingly harmful behaviors such as improper use of fans and heating and cooling systems are also adopted. Decision-making related to commonly promoted behaviors such as air conditioner use and cooling center attendance is complex, and these resources are often inaccessible financially, physically, or culturally. Interviewees expressed how interpersonal, intergenerational relationships are generally but not always protective, where peer relationships are a valuable mechanism for facilitating cooling behaviors among the elderly during heat events. To prevent disparities in heat morbidity and mortality in an increasingly changing climate, we note the implications of local context, and we broadly inform heat preparedness plans, interventions, and messages by sharing the perspectives and words of community members representing vulnerable populations and leaders who work most closely with them.

1. Introduction

Heat-related morbidity and mortality are expected to continue to rise globally, particularly for vulnerable populations: the elderly, those living in poverty, and the chronically ill (Anderson and Bell, 2009; Harlan et al., 2006; Kovats and Hajat, 2008; Medina-Ramón et al., 2006; Vaneckova et al., 2010). Mitigation efforts to reduce greenhouse gas emissions are underway globally (Molina et al., 2009). However, given current observations and future predictions for warming (IPCC, 2007), even if emissions are reduced drastically,

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behavioral adaptation to the changing climate is vital to protect public health and prevent potential disparities (Frumkin et al., 2008; Patz et al., 2000).

Deadly heat waves have illustrated the potential global burden of warming climates. In 2003, Western Europe experienced an unprecedented heat wave lasting nearly three weeks and resulting in approximately 70,000 heat-related deaths (Robine et al., 2008), including nearly 15,000 deaths in France alone. In the U.S., heat is the leading cause of death among all natural disasters, (NOAA, 2011) with Chicago's 1995 and Philadelphia's 1993 heat waves linked to 600 and 118 deaths (CDC, 1994;Semenza et al., 1996), respectively. While there is consensus that heat events such as these will increase in frequency and intensity globally (Fischer and Schär, 2010), heat-related mortality projections are complex and challenging to generate given that models must account for diverse health impacts; there is likely a "harvesting effect" contributing to displaced mortality in years of life lost (Kinney et al., 2008; Kovats and Hajat, 2008); climate change, as a driving factor, is long-term and uncertain; and there are unforeseen moderating effects of emergent mitigation or adaptation strategies (Huang et al., 2011). Heat-related morbidity has been assessed through indicators such as emergency room visits, hospital admissions, and ambulance call-outs during and following heat events (Knowlton et al., 2009; Lin et al., 2009; Ostro et al., 2010; Semenza et al., 1999).

Researchers have attempted to project ranges of possible future temperature changes and consequent heat-related mortality, identifying vulnerable regions of the world in need of preparedness planning (Huang et al., 2011). Cheung et al. project a doubling of heat-related mortality in several Canadian cities by the 2050s. Baccini et al. (2008) predicted that heat in Europe's near future will have the greatest health impacts in Barcelona, Rome, Valencia, Paris, and Budapest. In the U.S., for instance, a report by the Natural Resources Defense Council estimates that cities such as Detroit, New York City, Phoenix, and Philadelphia will see as many as 18,000, 1100, 700, and 2000 deaths, respectively by 2100 (Altman, 2012). Takahashi et al. (2007) calculated the "severest estimates in the uncertainty range (p. 339)," predicting global excess deaths to increase anywhere from 100% to 1000% with greatest impacts in areas of high population density, e.g. China and India, by the century's end.

Current rates and projections of future heat-related mortality have motivated many adaptive government strategies. For instance, following the European Heat Wave, France established a host of actions as part of a National Heat Wave Plan, including real-time surveillance of health data, improved air conditioning capacity for hospitals and retirement homes, the establishment of a warning system, and city tracking of neighborhoods with large populations vulnerable to heat (Fouillet et al., 2008). The approximately 2065 deaths during a 2006 French heat wave were much fewer than the expected 6452 deaths, and Fouillet and colleagues theorize this may be a result of successful preparedness planning implemented after the 2003 heat wave. Cities across the U.S. continue to develop related municipal plans (Bernard and McGeehin, 2004; O'Neill et al., 2010) and heat health warning systems (HHWS) (Ebi et al., 2004; Hajat et al., 2010a,b; Sheridan and Kalkstein, 2004) In 2005, the U.S. National Weather Service began creating HHWS's for all municipalities with populations of 500,000 or more (NOAA, 2011).

Despite the increasing number of plans and interventions, however, some studies report that no more than half of people typically alter their behaviors in response to advisory warnings (Kalkstein and Sheridan, 2007; Sheridan, 2007). Adaptive modifications in health behavior may significantly reduce one's risk of morbidity or mortality associated with heat (Brucker, 2005; McGeehin and Mirabelli, 2001; Richard et al., 2011). These behaviors may include at-home strategies for staying cool (e.g., air conditioner use, drinking fluids) or activities outside the home (e.g., going to a shaded park or cooling center). Low-income populations may be less likely to participate in help-seeking behaviors during heat events, such as making health-related calls, as seen in a Hong Kong study (2011). Bassil and Cole's (2010) structured review synthesizes studies that assess the role of municipal heat-related interventions globally, which remain largely unevaluated in practice (Kovats and Ebi, 2006). They conclude that interventions are likely reducing heat-related morbidity and mortality, but the most vulnerable populations, including the elderly, low-income, and homeless, are frequently not perceiving themselves as vulnerable or changing their daily practices during heat events.

Researchers have investigated how and why the public and, more specifically, vulnerable populations, participate in heat preparedness (Abrahamson et al., 2009; Kosatsky et al., 2009; Richard et al., 2011; Semenza et al., 2008; Sheridan, 2007). Related studies generally measure the frequency or likelihood of behaviors in heat events. Among these, Richard et al. (2011) noted that external cues to action (i.e., external events such as health messages or a neighbor's heat stroke) are more predictive of air conditioner use than one's perceived severity of heat's health effects for those with chronic heart and lung diseases. In this population, 25% of those without air conditioners said they would refuse to evacuate to a cooling center under emergency circumstances, and only 22% of all respondents would ask for assistance with cooling and hydration (Kosatsky et al., 2009). Sheridan's (2007) survey in three North American cities corroborated the public's basic understanding of recommended cooling behaviors noted by others, and also reported that, while air conditioner ownership was high among his study's participants (90%), over a third explained that economic factors determined usage rates. In a set of interviews with 73 seniors in the United Kingdom (U.K.), Abrahamson et al. (2009) reported from their qualitative study that seniors disassociate with being labeled as "old" and may not alter their behaviors in a protective manner in response to targeted messages— a disassociation that is not unique to seniors in the U.K. (Pinquart and Sörensen, 2002). In a study of heat-adaptive behavior over an entire summer among 29 senior residents in Detroit, interviewees did not employ the full range of behaviors known to increase comfort in hot weather, although those living in high-rises or in homes surrounded by paved surfaces more frequently took action (White-Newsome et al., 2011).

Further, additional research may improve understanding of how social support, a construct largely predictive of health-related behaviors (Heaney and Israel, 2002), shapes perceptions of vulnerability and individual behaviors during heat events. Perhaps most notably, Klinenberg's (2002) research highlighted how social isolation, even in a highly populated urban setting, was predictive of heat-related mortality during the 1995 Chicago heat wave. However, recent research investigates this conclusion further, suggesting that high levels of social support may actually reduce people's sense of their own vulnerability to heat's health effects (Wolf et al., 2010). Emergency planners, typically in the context of floods and hurricanes, often consider the role of family or friends in affecting one's behavioral responses to emergency weather events (Kaniasty et al., 1990; Lowe et al., 2010; Lu, 2011). These studies suggest various types of social support may be relevant in the context of heat, including informational (e.g., heat health messaging), emotional (e.g., alleviating psychological anxiety of household evacuation to cooling centers) and instrumental (e.g., assisting with a broken air conditioner) support from one's social network.

As local and national governments and organizations continue to prepare for heat, the current literature demonstrates that public