

# Heat waves and wildfires: A global public health concern

The third article in a series examining urban response to Major Adverse Climate Events (MACEs) – looks at how emergency response organisations, public health bodies and city authorities should plan to protect people and infrastructure

**T**HE NATIONAL WEATHER SERVICE IN the United States predicted this summer to be slightly cooler than previous years.

But, at the time of writing, the summer of 2013 had been characterised by widespread areas of high temperatures, droughts and periods of below average temperatures.

Many urban centres in the United States and Europe have first hand experience of dealing with rising temperatures. The highly developed and congested infrastructures of such areas create a ‘heat island’ effect, making these environments particularly vulnerable to extreme temperatures. This, combined with dense populations, makes cities such as New York, London and Paris distinctively susceptible to the devastating effects associated with prolonged severe temperatures and heat waves.

In the summer of 1995, Chicago experienced an unprecedented heat wave, exposing residents to temperatures over 37.7°C (100 degrees Fahrenheit). In 2003, Europe was subjected to one of the hottest summers on record, which caused powerful heat waves throughout the continent (see *CRJ* 1:4, or visit [www.crisis-response.com](http://www.crisis-response.com) for full analysis). Extensive forest fires engulfed Portugal, burning an estimated five per cent of the mainland and claiming 21 lives. Crop yields declined virtually throughout Europe, generating an estimated loss of €13.1 (US\$17.57; £11.2) billion, with France witnessing soaring mortality rates reflecting those of a mass disaster.

In New York City, seven out of the last ten summers have been the hottest experienced over the last 60 years, prompting the New York City Office of Emergency Management (OEM) to issue an Extreme Heat Health Advisory Alert instructing residents how to protect themselves from adverse heat-related health effects.

High mortality rates associated with heat waves are the main concern, as extreme heat is known to increase morbidity and mortality through numerous direct and indirect pathways.

Physiologically, high temperatures could result in muscle cramps, fatigue, heat exhaustion, sunstroke and heat strokes, while exacerbating pre-existing health conditions, such as chronic respiratory and cardiovascular conditions.

The 1995 Chicago heat wave claimed the lives of over 500 individuals in just five days. The 2003 summer heat waves in Europe caused more than 35,000 deaths, with over 15,000 in France alone. Yet, heat waves can give rise to a variety of health-related issues that are not directly fatal, but which can overload emergency health care facilities and thereby complicate patient care.

Currently, Chicago data shows that the sheer number of 911 emergency calls and heat-related dispatches correlate with rising temperatures: the higher the temperature, the higher volume of calls and dispatches issued. All of this contributes to miscommunication, misinformation and constant strain on a system that is already stressed. Ambulance response times (and first response) have deteriorated when temperatures and emergency calls are high. Thus, heat waves present a unique challenge for emergency health care providers.

## Rising temperatures

Unfortunately, the United Nations Intergovernmental Panel on Climate Change anticipates unequivocal, ongoing warming. The rising temperatures will increase morbidity and mortality. In the Mediterranean, heat wave days are anticipated to increase seven-fold between 2012 – 2050. If the mortality rates from the 2003 heat waves in this region are any indication, heat-related deaths could increase exponentially when combined with an ageing population and increasing urbanisation; the number of heat-related respiratory hospital admissions in Europe is predicted to triple between the years 2021–2050.

The issues heat waves present to emergency health care responders (and the public

at large) are not only currently pressing, but are growing at an exponential rate.

Many cities have already taken preventive steps to protect residents from adverse heat-related health effects. The elderly pose the highest vulnerability, followed by children under five, diabetics, individuals with comorbid neurological or psychiatric disorders, and individuals with chronic medical conditions.

Moreover, socioeconomic factors are significant indicators of surviving heat waves: poorer households are less likely to have access to air conditioning and informational resources warning against impending heat waves and other MACEs.

The onus to identify high-risk populations lies with each municipality, as heat-related illness is entirely preventable, provided appropriate public health interventions are instituted. After vulnerable areas and populations have been located and quantified, emergency and disaster management authorities can address risk reduction.

Vulnerability can be mitigated by increasing messaging and active response (ie cooling centres, home visits and altered schedules), which means pre-hospital triage can be managed more effectively and resources allocated more efficiently.

Large cities, thanks to their high pollutant gas emission rates and their large carbon footprint leading to a higher heat island index, along with increasing urbanisation, are undoubtedly the focus of climate adaptation strategies. By 2025, it is estimated that a majority of the world’s population will live in urban areas.

Currently, in New York City, the OEM recognises ‘Extreme Heat’ as a main hazard to the city, requiring appropriate preparation, planning and response strategies. Every year, the OEM establishes cooling centres, providing air-conditioned facilities in community and senior centres, as well as in public libraries.

Regarding wildfires, on June 30, 2013,

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Yarnell, Arizona experienced atmospheric conditions conducive to wildland blazes: triple digit temperatures, low humidity and high winds. Lightning ignited a fire, which burned for days across the dry land. One hundred homes were engulfed in flames and 19 elite firefighters from the Granite Mountain Hotshots died during wildland firefighting operations.

Unfortunately, wildfires of this calibre are no longer a rarity. Accustomed to fighting forest fires every year, the state of Colorado is currently in the midst of battling flames. Earlier this summer, the Black Forest Fire in Colorado Springs burned for days, destroying 511 homes and severely damaging 28 others. The destruction exceeds the damage caused by last year's Waldo Canyon Fire, making it the most disastrous fire in state history.

Escalation in the scope and size of wildfire activity has increasingly complicated the work of emergency responders. Fires are unpredictable and containment presents unique challenges for emergency responders to combat disasters caused by MACEs. Persistent heat presents an additional risk to the responders themselves, affecting work rate duration and recovery.

Firefighters depend on local water reserves to combat forest fires. Rising temperatures deplete these reserves, as well as heightening the incidence of fires. Water transport to fires increases in complexity and expense. A longer fire season puts further strains on water resources, as well as potentially diminishing resource replenishment time. Diminished humidity makes the forest fuel load and biomass dry out more rapidly.

As warming increases, epidemic insect infestations intensify. The mountain pine beetle outbreaks in Colorado best illustrate the cause and effect of tree deaths providing ample timber to fuel further blazes. Increasing requirements for water allocation, or active use for fire suppression and control, may compromise municipal distribution systems, putting pressure on the availability of water for drinking or agricultural purposes.

Exposure to smoke or contaminated land and water can provoke acute or chronic health problems. Increases in cardiovascular disease, asthma, and other respiratory ailments are anticipated. Vulnerable populations such as children, pregnant women, and the elderly, those with cardiorespiratory diseases and the chronically sick are particularly at risk from the combined effects of smoke inhalation and heat waves.

Increasingly, houses are being built on land designated as Wildland-Urban Interface (WUI), areas at high risk from wildland blazes, meaning



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► that firefighters are now forced to protect more homes over greater distances, escalating the cost of protection. The US Forest Service average annual cost alone has risen from US\$580 (€432; £370) million in 1991–2000 to US\$1.2 (€.89; £.77) billion in 2001–2010.

Thus, early communication is essential to public safety. A study conducted in 2009 revealed that 78 per cent of the 327 civilian wildfire fatalities over the past years were as a direct result of people failing to vacate their homes promptly. Evacuation to a refuge centre or area outside the fire risk zone has become essential for people living in the WUI. Without proper and timely evacuation plans, routes and reception facilities, residents are at greater risk of becoming wildfire victims.

In the light of the above, public health adaptive planning will assume ever greater importance in efforts to mitigate the effects of increased temperatures and extreme climate-related events, especially in urban areas.

## Dangerous surges

To increase public awareness, the OEM's 'Ready New York: Beat The Heat' campaign provides the public with tips for staying cool and promotes awareness of the symptoms of heat-related illnesses. With forest fires, the OEM has identified state-wide 'outer-borough grasslands' in New York as being prone to brush fires during the summer months, issuing tips to residents in these areas on ways to make their homes less prone to fires.

One of the most important aspects of the OEM campaign is the use of a Heat Health Warning System (HHWS), which has been implemented recently in numerous American and European cities. Worldwide, after the heat wave of 2003, the HHWS led to significant mortality reduction in following years.

Surges in emergency room visits in the wake of a wildfire or heat wave can pose dangerous problems for hospitals.

To combat the surge in patients and to ensure hospital operations are not disrupted, they need to have contingency policies in place prior to MACEs. These plans should allow for adequate emergency hospital personnel and resources to be available during such natural disasters. Hospital officials must determine the probability of the type of disasters they are likely to experience and, accordingly, prioritise vulnerable areas that are essential to a hospital's daily operations. Moreover, along with having contingency plans in place, it is recommended that hospitals and local disaster response teams co-ordinate with one another to ensure the state, local, and federal response

teams are working together. Coalitions among hospitals within a particular range need to be built and the lines of communication between local hospital officials should be open.

Hospitals must adapt to the changing community, plan resources and staff accordingly and modify their own hazard vulnerability analyses in the face of drought and fire risk.

An adequate response to climate change is not solely dependent on the health care sector. In a heat wave, steps taken by individual members of the public to save energy and reduce their exposure to heat can be extremely important in influencing health outcomes. Simply installing a thermometer to measure temperatures, or adopting digital or mobile temperature alerts for vulnerable populations, can help warn individuals to take action in extreme heat.

Other preventive steps include increasing the external shading of windows to reduce solar heat. The use of mobile evaporative coolers, and local air conditioners can reduce heat exposure and, ultimately, adverse health effects.

Along with these immediate short-term measures, long-term steps can be taken to depreciate the urban heat island (UHI) effect and heat exposure. Reducing

debate has shifted to the scope of damages and the mitigation measures required.

While preparing this series of articles, New York City has experienced the burden of MACEs. The well-documented destruction of Hurricane Sandy aside, New York City has experienced higher than normal temperatures, has been surprised by brush fires in areas with little to no history of such events, and the city's electrical grid has been severely tested, causing several black and brown outs. New York City is not alone in experiencing abnormal climate related events: the city represents a microcosm of events evolving worldwide.

The final article in this series will shift the focus to the legal and policy aspects of MACEs. The devastation caused by these events is increasingly costly (and deadly) for urban planners – with extensive legal implications and demanding greater understanding of legal actions and causalities. The increase of urbanisation will add a heavy toll to already stressed infrastructures.

At this critical juncture, it is vital that considerations be made to ensure urban settings are well equipped to withstand MACEs. It is the only responsible way forward. CRJ

## The discourse surrounding climate change and its adverse effects is no longer a question of 'if' or 'when': the debate has shifted to the scope of damage and the preventive measures needed to curb its destruction

pavement, dark coloured roofs and ground surfaces, and increasing biomass can help balance the UHI effect.

Development of climate sensitive buildings and more efficient air conditioners may also be beneficial in reducing the risk of an urban community.

There are many barriers to achieving climate change adaptive strategies. A lack of resources, both financial and in human capital, limits advancement. A perceived lack of urgency across numerous disciplines, drags the implementation of climate change strategies.

Awareness, preparation and response are necessary by all entities to ensure public health and access to healthcare as needed.

To conclude, the discourse surrounding climate change and its adverse effects is no longer a question of 'if' or 'when'. The

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