COMMENTARY

Preventative strategies and interventions to improve outcomes during heatwaves

MICHELLE BRENNAN¹, PAULA M. O’SHEA², EAMON C. MULKERRIN¹

¹Department of Geriatric Medicine, Saolta University Health Care Group (SUHCG), University Hospital Galway, Co. Galway, Ireland
²Department of Clinical Biochemistry, Saolta University Health Care Group (SUHCG), Galway University Hospitals, Galway, Ireland

Address correspondence to: Dr Michelle Brennan, Specialist Registrar in Geriatric and General Internal Medicine, Department of Geriatric Medicine, Saolta University Healthcare Group, University Hospital Galway, Newcastle Road, Galway H91 YR71, Ireland. Fax: 00353 91 524222; Email: mich.brennan90@gmail.com

Abstract

Extreme weather events including recently experienced prolonged heatwaves are predicted to increase in frequency and intensity as a result of climate change. Vulnerable groups, and particularly older persons, are at increased risk of heat-related illness and mortality. Multimodal interventions that incorporate community, primary and secondary care programmes are required. Social programmes such as early warning systems, regional heat plans and community-led initiatives that specifically target the isolated, dependent older person are protective. Establishing clear and effective communication on health promotion and preventative measures is the key. Energy-efficient building design and eco-city planning are vital to reduce the impact of heatwaves at both a population and individual level. Anticipatory strategies should be adopted to ensure ample access to fluids, target barriers to increase oral intake and allow early identification of intercurrent illness, along with regular medication reviews. Prompt management of risk factors for the development of heat-related illness and treatment of complications such as heat stroke and cardiovascular events are keys to reducing the negative health impact of extreme heat in at-risk populations. Morbidity and mortality in heatwaves should be preventable. Evidence-based interventions are available to mitigate and prevent the negative health impact of extreme heat and should be implemented in all residential settings.

Keywords: heatwave, dehydration, older people, preventative strategies, interventions

Key points

• Heatwaves will increase in frequency, severity and duration as a result of climate change.
• Vulnerable populations such as older people have a higher risk of harm during heat waves.
• Preventative strategies include warning systems, social programmes, environmentally sound urban and housing design.
• Multimodal interventions to increase oral intake, recognise complications and treat heat-related illness are effective.
• Anticipatory measures instigated in primary and secondary care should reduce morbidity and mortality.

Background

Background global warming has resulted in a rise in global mean temperature of more than 1°C above pre-industrial levels [1]. Heatwaves have increased in frequency, intensity and duration as a result of climate change. At-risk groups for heat-related mortality include extremes of age, those living with chronic conditions e.g. cardiovascular and renal disease, prescribed medications, which blunt protective thermoregulation mechanisms. Extreme heat can have a devastating impact on the older person due to presence of multimorbidity, frailty, polypharmacy and social factors.

Negative health outcomes during heatwaves include: heat exhaustion, syncope, heat stroke, renal failure, electrolyte...
imbalances, exacerbations of chronic disease, medication-related thermoregulation disturbance and death. Excessive mortality is well described; in Europe, the 2003 heatwaves resulted in up to 70,000 deaths [2]. However, the true mortality is often under-reported as deaths may be attributed to 'natural causes' such as cardiovascular events.

Physiological age-related changes in renin–angiotensin–aldosterone system predispose older persons to natriuresis, diuresis and salt depletion and thus inadequate compensatory mechanisms during prolonged excessive heat. Glomerular filtration rate declines with normal aging and is accelerated in those with underlying risk factors for chronic kidney disease (CKD). Diagnosis of dehydration is challenging as currently available clinical and bedside measures lack sensitivity and specificity. There is an emergent need for non-invasive and cost-effective tools to improve diagnostic accuracy [3].

Interventions are available to prevent and manage complications of heatwaves, particularly in vulnerable subgroups. Regional heat plans, social programmes along with effective anticipatory and clinical management have been proven to reduce this impact.

**Preventative Strategies and Interventions**

**Social programmes**

Social factors associated with an increased risk of heat-related illness include extremes of age, lower socioeconomic status, dependency on others, isolation and housing factors. Older people are more likely to demonstrate more than one of these [4]. Heatwave early warning systems (HEWS), which use meteorological indicators such as maximum temperatures or heat-index ratings to trigger a warning signal and initiate an action plan, have been developed and implemented in several countries [5].

Communication of heatwave notifications must be clear and effective using mass media and word of mouth, with particular efforts to reach socially isolated and marginalised populations. General advice should focus on maintaining adequate hydration, wearing light clothing, avoiding unnecessary exertion, and keeping the environment cool [6]. The role of primary care response teams include education around the recognition of signs and symptoms of heat-related illness, administering medical care in the community and arranging prompt referral to secondary care if required [7].

Social programmes are vital in reducing the negative health impact for the older person. There is a higher risk of adverse events in those who are housebound or dependent on others for basic care needs in comparison with those with strong social supports. Isolated or rural-based older people often rely on the vigilance and support of community neighbourhood groups and primary care teams during extreme weather events [8].

Community-led initiatives, such as ‘be-friending’ and volunteer outreach groups are protective. Simple but effective measures that can be implemented locally include ensuring access to fluids, establishing regular communication networks and having pre-determined arrangements to access private property safely if required in an emergency.

The use of air-conditioning is controversial; the benefits must be balanced with the negative ramifications for the environment, power outages and the costs involved. The use of fans in community and hospital settings is also debated. Designated, temperature-controlled areas for refuge may form part of some regional strategies.

**Environmental alterations**

Improved building design and eco-city development are important considerations for urban town planning.Judicious alterations to the structure and design of buildings protect from heat retention and promote cooling. Insulation, reflective surfaces and the use of bright colours and shaded areas can help keep houses cool [9]. Less heat is generated by utilising energy-efficient appliances and energy-conserving techniques. Construction material should be chosen wisely as concrete buildings tend to retain heat leading to the ‘heat island’ effects of older accommodation, where bedrooms retain heat especially when situated close to the roof [10].

Urban town planning should involve the creation and preservation of green spaces; green parks, planting tall vegetation and greening high-rise buildings with rooftop gardens or plants can help mitigate the effects of pollution. Public transport should be promoted, and traffic restructuring schemes introduced to reduce the congestion and emissions in large urban environments.

**Anticipatory clinical measures**

Following a heat warning, anticipatory measures should be promptly instituted. Ensuring ample access to fluids is essential to maintain hydration. A significant proportion of older people, up to 25% of those >85 years, drink less than 1 litre of fluid per day. This is likely secondary to a combination of reduced thirst mechanisms, reduced access to adequate fluids due to cognitive or physical factors and habitual patterns [11]. Swallowing problems are more likely to occur in older patients due to previous stroke disease, dementia or an intercurrent illness. Modified diets can also contribute to reduced oral intake and propensity to dehydration due to patient’s dislike, smaller volume of fluids or time required for preparation and feeding by carers.

A qualitative study of community-dwelling older people and their carers highlighted several important themes. Many perceived themselves as drinking little yet felt the expectation to drink more not easily achievable. Barriers to increasing oral intake included fears around urinary incontinence, over-reliance on thirst as a prompt, and cumulative cognitive and functional deficits. Habitual drinking habits at meals and medication times were noted. Individual factors influencing intake were taste preferences, having alternative beverages options and whether medical advice was provided [12]. Oral hydration interventions have shown a positive impact on
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Clinical management

Even with preventative and anticipatory strategies, adverse health events can still occur. Management of heat-related illness should be instigated in a timely and efficient manner. Intercurrent infection can result in further insensible losses through fever, volume depletion and, if severe, the development of sepsis, septic shock and multiorgan failure.

Hypernatremia is a surrogate for morbidity and mortality in dehydration, particularly in the older person. A recent study by the authors demonstrated a 250% increase in the prevalence of hypernatremia during heatwaves [16]. The choice and rate of fluids should be carefully considered to allow a steady decrease in sodium while avoiding over-rapid correction. Primary care response teams should be resourced to initiate first-line medical care. If patients’ fail to respond to initial measures or have evidence of actual or threatened organ dysfunction, timely transfer to acute care facilities for ongoing management should be arranged if appropriate.

One retrospective American study reported only a modest increase in the absolute risk of hospitalisations for heat-related maladies in older patients during heatwaves [17]. Disorders of fluid and electrolyte balance and acute renal failure accounted for the majority, and the highest risk of hospitalization was the day of onset of the heatwave. Given the major susceptibility of older patients to adverse health outcomes during heatwaves, this comparatively small increase in hospital admissions may reflect a suboptimal response. Prospective data are required to identifying thresholds at which escalation to hospital admission should be triggered for at-risk populations.

Conclusion

Older people are at an increased risk of illness and mortality during prolonged periods of extreme heat, the majority of which are avoidable. Table 1 summarizes interventions that have been shown to reduce the negative health impact and inform best-practice guidelines for future preventative and
management strategies. Heat-wave warning systems, dedicated social programmes to ensure community awareness and strategic eco-friendly urban planning are important preventative measures. Multimodal targeted interventions for at-risk groups in community, nursing home facilities and hospitals are effective in anticipating reduced intake or excessive fluid loss and facilitate prompt recognition and management of heat-related complications.

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References


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