

The rising importance of adaptive preventative measures for ‘heatwave-resilient’ healthcare

Zara Hirji

Year 4, Medicine, University of Plymouth
 Email: zara.hirji@students.plymouth.ac.uk



Abstract

This is an opinion-style article discussing the impact of heatwaves on human health, demonstrating the intrinsic link between the health of humans and planets. It argues the importance of taking a primary preventative approach to reducing morbidity and mortality during heatwave events. An adaptive approach is argued for due to the ever-changing and developing nature of planetary health as climate change takes effect. Specific emphasis is placed on reviewing and arguing for the use of the novel ‘BRACE’ framework to achieve this. Further aims of the article woven throughout are to highlight the barriers to achieving resilient healthcare systems in countries that contribute the least to climate change but are the most affected.

From 1998 to 2017, over 166,000 people died globally as a result of heatwaves.¹ One significant example demonstrating the importance of adapting global healthcare systems to large scale climate events, was the record-breaking 2003 European heatwave where over 70,000 people lost their lives in a single instance.² Apart from such high-mortality stand-out incidents, the burden of disease during heatwaves is difficult to calculate. As well as ‘heat-related deaths’, such as dehydration and heatstroke, heatwaves also have many indirect impacts on human health. These include exacerbation of pre-existing medical conditions, malnutrition due to reductions in crop yields, and many further secondary mental health impacts.³ Between 2000–2016, an additional 125,000,000 people have been exposed to heatwaves,¹ putting more people at potential risk. Because of this vast, vague and increasing burden of disease resulting from heatwaves, having both short-term and long-term effects on human health, it is important that present and future healthcare systems continuously adapt to become more ‘heatwave resilient’ in the face of our changing climate.

The benefits of taking a primary prevention approach will not only come in the form of a reduction in the projected rise in morbidity and mortality, but also by alleviating the added stress predicted to fall on our already overwhelmed healthcare systems.^{4,5}

The Building Resilience Against Climate Effects (BRACE) novel framework provides guidance in a five-step process for public health agencies to adaptively manage the health effects of climate change.⁶ Steps one and two emphasise (despite its challenging nature) the importance of ‘future gazing’ when predicting mortality and burden of disease in vulnerable populations as it reflects the nature of climate change’s long-term effects on disease patterns.^{6,7} This is important at the beginning of the developmental process as understanding who is most affected by heatwaves and why, means that preventative healthcare can be targeted in advance of specific known risk factors that the community is susceptible to. It incorporates a mature understanding that different regions of the world are affected by heatwaves differently due to both geographical and socioeconomic factors,⁸ therefore, having healthcare systems tailored for the needs of its community, with the ability to change depending on the changing risk factors, is most effective.

Appreciation of the burden of disease in developing countries is also crucial for global heatwave resilience. A novel probability-based model in India suggested that with rising average summer temperatures, there is likely to be a corresponding 146% increase in heat-related mortality.³ The significance of this is evident for populations relying heavily on crop yields and locally sourced water for hydration and nutrition. Reduced access to these necessities puts a higher proportion of the population at risk of comorbidities.¹ This will also increase the size of groups at risk from heat-related

deaths and the burden placed on healthcare systems, which may already be stressed or underdeveloped, in treating more vulnerable populations.⁸ The sizes of vulnerable populations will be further increased as heatwaves become more intense and frequent.⁷ It follows that additional studies, assessing the burden of disease due to heatwaves, across a wide range of locations with differing economic backgrounds will be valuable to informing the developmental process of international heatwave-resilient healthcare systems.

An impactful yet underappreciated challenge to the development of healthcare action plans corresponding to the spread of the burden of disease is that the definition of a heatwave is widely variable – so useful health data that is required to improve healthcare responses is not standardised for comparability.⁹ Irregular heatwave thresholds have significant impacts on the reported mortality and morbidity rates. A systematic review and meta-analysis of the impact of heatwave mortality under different heatwave definitions suggests that implementing a new warning system based on a set temperature threshold or increase in temperature from the average, such as those used in the heatwave plan for England, rather than having subjective heatwave definitions may be a viable solution to this problem.^{9,10} It is important to also take not only duration but the intensity of the heatwave into account.¹¹ Access to globally comparable information via the use of a standardised definition would increase the ability of both developed and developing countries to implement the third step of the BRACE framework – assessment of initial public health interventions to produce geographically-specific healthcare adaptation plans for the most concerning health impacts.⁶

A meta-analysis of prognostic factors in heatwave-related deaths suggested that people who were confined to their beds, unable to leave their homes daily or unable to care for themselves had a statistically significant increased risk of mortality during heatwaves.¹² These characteristics are associated with people who are dependent on others for care such as the elderly, children and people who endure health conditions which impact their day to day lives. Relevance of these findings to clinical practice comes in the form of informing recommendations for preventative medicine targeted at personal risk factors as opposed to only considering environmental risk factors. For example, modifying fluid intake routines for the elderly in care homes, who are at high risk of dehydration.¹³ Healthcare systems which appreciate the interplay between environmental and personal risk factors can take more effective steps to plateau the trends in morbidity and mortality rates during heatwaves and again alleviate the future stress on themselves.

After the initial evaluation of disease burden and public health responses, step four of the BRACE framework is to develop a climate health adaptation plan.⁶ If healthcare systems are prepared before the event takes place, with a warning system triggering a healthcare plan across different sectors, then preventative medicine can be implemented in a more timely manner before large numbers of vulnerable populations require the need for treatment-based healthcare. Although it is still vital for steps to be implemented to improve the treatment of health conditions resulting from heatwaves, preventative strategies beginning at the level of public and community-based healthcare are seen to be of the most benefit to the healthcare systems themselves.¹⁴

It is evident that many countries view heatwave early warning systems as beneficial in readying public health for a preventative response. Firstly, the CDC extreme heat action plan recommended early warning systems to trigger communication with the public about the possible risks to health, the ways to avoid them, and the importance of air conditioning,¹⁵ which was found to be one of the protective factors for vulnerable populations associated with a reduced risk of heat-related death.¹² Secondly, South Asia's first heat-health action plan incorporated the development of a seven day advance weather forecast early warning system which would trigger their health action plan.¹⁶ Their action plan aimed to incorporate the best practice from other plans which relates, as discussed earlier,

to the importance of information free flow between countries to make the best early-warning system and heatwave adaptation plan possible.

Primary prevention methods which aim to prevent disease by limiting risk exposure by individuals, can be taken one step further in the form of primordial prevention. This consists of reducing the risk to populations by changing the environmental conditions around the people themselves.⁵ If this is considered in terms of heatwave risk factors, mitigating more intense and frequent heatwaves from even occurring would be the ultimate preventative public healthcare strategy. Therefore, it can also be argued that rather than simply surrendering to the effects of climate change and adapting our healthcare systems to accept it as one of our future health determinants, we should invest more into climate change prevention itself rather than healthcare adaptation strategies which will become increasingly difficult to implement without any sort of mitigation.¹⁷ On the other hand, to find a balance between mitigation and adaptation, we can incorporate primordial prevention into our adaptation strategies. The steps that we may take towards adapting our public healthcare response to rising temperatures can also themselves be heatwave mitigating factors. Health systems can be alert to opportunities for improving the environment in their adaptation strategies to provide so called 'co-benefits' to health.¹⁸ One such example from the CDC's extreme heat action plan was the strategic planting of trees to provide shade and cooling effects.¹⁵ Here, primordial prevention comes in the form of adapting the environment to reduce intensity of heatwaves on the surrounding population, but this action also enables us to mitigate climate change using trees to improve the environment. This response can be better implemented through government and local policies than the healthcare sector, demonstrating how multisectoral collaboration to reduce burden of disease is beneficial to healthcare systems.¹⁹

While encouraging healthcare systems to incorporate all of these important nuances into their strategies to produce the strongest heatwave-resilient healthcare systems, we must understand that there are also many barriers to consider, particularly taking into account developing countries who, while contributing the least to global carbon-emissions, are the ones most affected by them due to their general geographical locations and socioeconomic factors.⁸ The World Health Organization (WHO) climate change survey report evaluated the overall progress made by healthcare systems to adapt to climate change. Looking at 101 countries ranging from upper to lower income, the survey found that 47 had underdeveloped or a complete lack of national planning for a healthcare climate strategy, 45% of the countries had low or no level of implementation of a national healthcare related climate strategy and only 42 out of the 98 countries surveyed had an early warning system and health sector response plan in place for heatwaves.¹⁹ The findings from this survey suggest that while the burden of disease from climate change and heatwaves is increasing and is projected to increase,¹⁷ while recommendations for preventative strategies may be made specific to local regions,^{20,21} certain countries simply do not have the luxury of incorporating climate change into the decision-making of healthcare provisions and distributions.²² Barriers which obstructed the progress towards ideal 'climate-resilient' healthcare systems were financing, human resources, technology, available evidence and collaboration between sectors – many of which hinder the prioritisation of climate change adaptation in healthcare system decision making.¹⁹

The challenge of the lack of access to finance was recognised in the Paris Agreement, an international treaty which aims to mitigate and adapt resilience to the effects of climate change, including rising temperatures. The agreement recognised the fact that some countries require extra financial, technical and capacity-building support to reach a developed resilient healthcare system.²³ To overcome these financial barriers, there is recognition that developed countries have a role in providing financial aid to countries facing these obstacles and those who are also more vulnerable to the effects of climate change. Secondly, 'climate finance' at the local, national or

international level through different support mechanisms is also accessible to countries and is encouraged in the Paris Agreement.²⁴ However, the WHO climate change survey report explains the reasons why even providing access to these financial resources may not be enough, many countries still face barriers like not knowing about the opportunities for climate finance, not being connected to the international process or even not being able to produce proposals to apply for climate finance.¹⁹

In conclusion, heatwave-resilient systems are especially important in countries where populations are at a greater risk of heat-related illness, yet it is often these countries that have the most barriers to overcome. We can consider opportunities for mitigation of climate change within primary prevention adaptation strategies as 'co-benefits' for both immediate human health and climate change which has long-term impacts on human health. Further research into burden of disease, including personal and environmental risk factors, and effectiveness of public health strategies is required to improve primary prevention strategies across the world. One such way this can be made possible is via the assessment of countries' "nationally determined contributions", presented under the enhanced transparency framework of the Paris Agreement, in 2024. This will facilitate the review of the strategies implemented, as required in step five of the BRACE framework, as well as to increase access and awareness of available climate finance. A strong heatwave-resilient system is an adaptive one, it is not just about getting through acute events as they occur, but constantly developing healthcare practices to serve the community and healthcare systems best in the long term too.²⁵

Copyright This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view a copy of the license, visit <https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode>. The copyright of all articles belongs to the author(s), and a citation should be made when any article is quoted, used or referred to in another work. All articles included in the INSPIRE Student Health Sciences Research Journal are written and reviewed by students, and the Editorial Board is composed of students. Thus, this journal has been created for educational purposes and all content is available for reuse by the authors in other formats, including peer-reviewed journals.

References

- World Health Organization. Heatwaves. https://www.who.int/health-topics/heatwaves#tab=tab_1 Accessed: 6 March 2021
- Met Office. The Heatwave of 2003. <https://www.metoffice.gov.uk/weather/learn-about/weather/case-studies/heatwave> Accessed: 6 March 2021
- Mazdiyasn O, Aghakouchak A, Davis SJ, Madadgar S et al. Increasing probability of mortality during Indian heat waves. *Sci Adv* 2017;3(6), e1700066.
- Wheeler N, Watts N. Climate change: from science to practice. *Curr Environ Health Rep* 2018; 5(1): 170-178.
- Kisling LA, Das JM. Prevention strategies. *StatsPearls Publishing* 2020.
- Marinucci GD, Luber G, Uejio CK, Saha S, Hess JJ. Building resilience against climate effects—a novel framework to facilitate climate readiness in public health agencies. *Int J Environ Res Public Health* 2014; 11(6): 6433-6458.
- Met Office. Effects of climate change. <https://www.metoffice.gov.uk/weather/climate-change/effects-of-climate-change> Accessed: 6 March 2021
- Salas RN, Jha AK. Climate change threatens the achievement of effective universal healthcare *BMJ* 2019; 366:l5302.
- Nori-Sarma A, Benmarhnia T, Rajiva A, Azhar GS, Gupta P, Pednekar MS. Advancing our understanding of heat wave criteria and associated health impacts to improve heat wave alerts in developing country settings. *Int J Environ Res Public Health* 2019; 16(12): 2089.
- Public Health England. Heatwave Plan for England. Published May 2018 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/888668/Heatwave_plan_for_England_2020.pdf Accessed: 6 March 2021
- Xu Z, FitzGerald G, Guo Y, Jalaludin B, Tong S. Impact of heatwave on mortality under different heatwave definitions: a systematic review and meta-analysis. *Environment International* 2016; 89-90: 193-203.
- Bouchama A, Dehbi M, Mohamed G, Matthies F, Shoukri M, Menne B. Prognostic factors in heat wave-related deaths: a meta-analysis. *Arch Intern Med.* 2007;167(20):2170–2176.
- Wilson J, Bak A, Tingle A, Greene C et al. Improving hydration of care home residents by increasing choice and opportunity to drink: a quality improvement study. *Clinical Nutrition* 2019; 38: 1820-1827.
- Public Health England. Cost savings and the economic case for investing in public health. <https://publichealthmatters.blog.gov.uk/2018/04/09/cost-savings-and-the-economic-case-for-investing-in-public-health/> Accessed: 6 March 2021
- CDC. Extreme heat can impact our health in many ways. https://www.cdc.gov/climateandhealth/pubs/extreme-heat-final_508.pdf Accessed: 6 March 2021
- Knowlton K, Kulkarni SP, Azhar GS, Mavalankar D et al. Development and implementation of South Asia's first heat-health action plan in Ahmedabad (Gujarat, India). *Int J Environ Res Public Health.* 2014;11(4):3473-3492.
- NASA.gov. Global Climate Change Vital Signs of the Planet. Mitigation and Adaptation. <https://climate.nasa.gov/solutions/adaptation-mitigation/> Accessed: 6 March 2021
- Frumkin H, McMichael AJ. Climate change and public health: thinking, communicating, acting. *Am J Prev Med.* 2008;35(5):403-10.
- World Health Organization. WHO Health and Climate Change Survey Report. <https://apps.who.int/iris/bitstream/handle/10665/329972/WHO-CED-PHE-EPE-19.11-eng.pdf?ua=1> Accessed: 6 March 2021
- Bell E. Readying health services for climate change: a policy framework for regional development. *Am J Public Health.* 2011;101(5):804-813.
- Schramm PJ, Ahmed M, Siegel H, Donatuto J et al. Climate change and health: local solutions to local challenges. *Curr Environ Health Rep.* 2020;7(4):363-370.
- Rada AG. Climate emergency: healthcare systems aren't prepared for risks to health, warns WHO *BMJ* 2019; 367: l6876.
- United Nations Climate Change. The Paris Agreement. <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement> Accessed: 6 March 2021
- United Nations Climate Change. Introduction to climate finance. <https://unfccc.int/topics/climate-finance/the-big-picture/introduction-to-climate-finance> (accessed 6 March 2021)
- Barasa E, Mbau R, Gilson L. What is resilience and how can it be nurtured? A systematic review of empirical literature on organizational resilience. *Int J Health Policy Manag.* 2018;7(6): 491-503.



Zara Hirji

Hi, I'm currently a fourth-year medical student at Plymouth University and I love all things planetary health. It's been an interest of mine since first year when I chose a planetary health-related SSU and got to explore the world of determinants of health, policymaking, inequalities and many more global health concepts. Since then, I've constantly been on the lookout for opportunities to explore as many angles as possible. If you also enjoy planetary health or global health, then this is the journal for you! I hope you enjoy reading the rest of the articles in here.