

# Emergency medical care overload during heatwaves: a neglected topic

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European Journal of Emergency Medicine 2023, 30:5–6

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Received 25 July 2022 Accepted 27 July 2022

Climate change represents one of the most complex challenges faced by humankind in recent history [1]. Due to its features – mainly the gradual onset and the wide range of effects across different regions – the awareness of populations and governments is low. Consequently, strategies to contain the rise in global average temperature are difficult to put into practice [2]. The most evident manifestations of climate change are extreme weather events – such as droughts, floods, or periods of extreme temperatures – whose trend in frequency and intensity is progressively increasing [3]. Although the mitigation of the impacts of such hazards should be among the priorities of governments, strategies to limit global warming and policies to improve preparedness toward extreme weather events are scarcely reported in the literature [4].

Among extreme weather events, heatwaves represent one of the most common extreme temperature events; however, no universally accepted definition has been currently established. These complex phenomena are complicated to study and compare with each other, due to differences in features and locations. Nevertheless, current literature suggests a relationship between heatwaves and mortality, morbidity, or the burden posed on healthcare systems and their components. However, the lack of high-quality evidence hampers the development of evidence-based mitigation strategies [4].

In the specific case of emergency medical care, increased presentations and usage rates have been consistently described during heatwaves in emergency departments (EDs) and emergency medical services (EMSs). Several retrospective analyses confirmed an overall increase in ED accesses during heatwaves in different countries, ranging from 2% [5,6] to 19% [7] for all-cause presentations. Calkins *et al.* [8] also identified an 8 and 14% rise in EMS dispatch during heatwaves for basic life support and advanced life support ambulances, respectively. These results are consistent with other studies that reported an overall increase in ambulance dispatch of 4% [5] and 14% [6].

However, it is still unclear if these heatwave-related increases in ED presentations and EMS usage rates could

affect ED system performances and result in hospital care dysfunction. Toloo *et al.* [9] detected an increased input due to heat-related illness in 11 EDs from the greater Brisbane area (Australia) during the period 2000–2012; among the secondary outcomes, a longer stay in the ED for these patients was detected. Higher in-ED [10] and in-hospital [7] mortality rates have also been measured during heatwaves. Even though the specific association with ED overload was not investigated, it is reasonable to think that higher volumes of patients, along with emergency medical care and hospital systems' maladaptation leading to bottlenecks in patient processing, might have contributed to these negatively measured outcomes.

Knowing the magnitude of emergency medical care overload due to heatwaves, a step toward better care should be achieved by investigating and then implementing interventions targeting its specific predisposing factors. The authors performed a scoping review to include any study dealing with emergency medical care (EDs and EMSs) and heatwaves and identify these vulnerability factors, but none of the records analyzed the possible causes of emergency medical care overload during heatwaves. In our opinion, this relevant gap in the literature is the epiphenomenon of a not-in-depth studied field.

Since the workflow in emergency medicine is not exclusively focused on a single patient, but also considers groups of patients, processes, and systems at the same time with a peculiar public health perspective [11], the constant monitoring of operational efficiency of the whole system – prehospital and in-hospital – is crucial. The above-described heatwave-related overload of emergency medical care presents several overlapping features with a phenomenon called 'ED overcrowding', a global health issue leading to a considerable worsening in patient outcomes and clinical risk [12]. As such, methods commonly used to evaluate the factors predisposing to ED overcrowding could be used to identify factors causing heatwave-related overload. Kelen *et al.* [12] recently conducted a root cause analysis of ED overcrowding, highlighting that the traditional input-throughput-output model used for

patient processing analysis can be helpful but not exhaustive and, therefore, addressed healthcare systems' economic aspects previously neglected. The authors present a granular analysis of prehospital-, ED-, and hospital-related factors causing ED overcrowding and recommend several possible solutions based on public health and disaster medicine principles [13]. In the same vein, during a heatwave, processes aiming to improve factors internal to EDs and EMSs but also targeting primary and in-hospital care could reduce the overload for emergency medical care. For example, a tailored information service available to the vulnerable populations, early warning systems triggering the recruitment of extra personnel, or a specifically activated hospital-based unit reducing boarding dysfunction could constitute effective interventions that can mitigate the impact of heatwaves on EDs. Surveys can be another valuable tool to investigate the factors underlying ED overcrowding [14]. For example, Bond *et al.* tried to increase knowledge about factors determining ED overcrowding by interviewing a sample of Canadian ED directors. Space constraints, boarding delays, and the increasing complexity of cases were identified as the leading causes of ED overcrowding [15]. By reproducing similar studies, researchers could find the targets of future interventions to mitigate emergency medical care overload during heatwaves. Also, the lessons learned during the COVID-19 pandemic could be investigated in light of heatwave-related surges. As EDs and EMSs implemented strategies to dynamically repurpose patient processing protocols, adapt spaces, relocate resources, and deploy personnel based on COVID-19 contagion curves, early warning systems and syndromic surveillance could guide changes in assets allocation before, during, and after heatwaves [16].

In conclusion, the lack of scientific literature addressing the factors predisposing emergency medical care to overload during heatwaves currently hampers any effective planning strategy. Therefore, the authors encourage the empowerment of research in this field. Taking inspiration from the existing ED overcrowding literature and consulting the opinions of relevant experts in this field, scholars will then be able to design and implement effective interventions to mitigate emergency medical care overload during heatwaves.

## Acknowledgements

The present manuscript is the result of a study conducted in the framework of the International Ph.D. in Global Health, Humanitarian Aid, and Disaster Medicine jointly

organized by Università del Piemonte Orientale (UPO) and Vrije Universiteit Brussel (VUB).

This study was partially funded by the AGING Project-Department of Excellence-Department of Translational Medicine, Università del Piemonte Orientale.

## Conflicts of interest

There are no conflicts of interest.

## References

- Climate Change 'Biggest Threat Modern Humans Have Ever Faced', World-Renowned Naturalist Tells Security Council, Calls for Greater Global Cooperation | Meetings Coverage and Press Releases. <https://www.un.org/press/en/2021/sc14445.doc.htm>. Accessed 25 May 2022
- Psychology and Global Climate Change: Addressing a Multi-faceted Phenomenon and Set of Challenges. <https://www.apa.org/science/about/publications/climate-change>. Accessed 25 May 2022
- Pachauri RK, Mayer L, Intergovernmental panel on climate change, editors. *Climate change 2014: synthesis report*. Intergovernmental Panel on Climate Change 2015.
- Conti A, Valente M, Paganini M, Farsoni M, Ragazzoni L, Barone-Adesi F. Knowledge gaps and research priorities on the health effects of heatwaves: a systematic review of reviews. *Int J Environ Res Public Health* 2022;**19**:5887.
- Sun X, Sun Q, Yang M, Zhou X, Li X, Yu A, *et al.* Effects of temperature and heat waves on emergency department visits and emergency ambulance dispatches in Pudong new area, China: a time series analysis. *Environ Health* 2014;**13**:76.
- Schaffer A, Muscatello D, Broome R, Corbett S, Smith W. Emergency department visits, ambulance calls, and mortality associated with an exceptional heat wave in Sydney, Australia, 2011: a time-series analysis. *Environ Health* 2012;**11**:3.
- Oray NC, Oray D, Aksay E, Atilla R, Bayram B. The impact of a heat wave on mortality in the emergency department. *Medicine (Baltimore)* 2018;**97**:e13815.
- Calkins MM, Isaksen TB, Stubbs BA, Yost MG, Fenske RA. Impacts of extreme heat on emergency medical service calls in King County, Washington, 2007-2012: relative risk and time series analyses of basic and advanced life support. *Environ Health* 2016;**15**:13.
- Toloo GS, Yu W, Aitken P, FitzGerald G, Tong S. The impact of heatwaves on emergency department visits in Brisbane, Australia: a time series study. *Crit Care* 2014;**18**:R69.
- Hess JJ, Saha S, Lubner G. Summertime acute heat illness in U.S. emergency departments from 2006 through 2010: analysis of a nationally representative sample. *Environ Health Perspect* 2014;**122**:1209-1215.
- Pollock DA, Lowery DW, O'Brien PM. Emergency medicine and public health: new steps in old directions. *Ann Emerg Med* 2001;**38**:675-683.
- Morley C, Unwin M, Peterson GM, Stankovich J, Kinsman L. Emergency department crowding: a systematic review of causes, consequences and solutions. *PLoS One* 2018;**13**:e0203316.
- Kelen GD, Wolfe R, D'Onofrio G, Mills AM, Diercks D, Stern SA, *et al.* Emergency Department Crowding: the Canary in the Health Care System. *NEJM Catal Innov Care Deliv*. 2021. <https://catalyst.nejm.org/doi/full/10.1056/CAT.21.0217>. Accessed 25 May 2022
- Keeney S, Hasson F, McKenna HP. *The Delphi technique in nursing and health research*. Wiley-Blackwell 2011.
- Bond K, Ospina MB, Blitz S, Afilalo M, Campbell SG, Bullard M, *et al.* Frequency, determinants and impact of overcrowding in emergency departments in Canada: a national survey. *Healthc Q* 2007;**10**:32-40.
- Freund Y. The challenge of emergency medicine facing the COVID-19 outbreak. *Eur J Emerg Med* 2020;**27**:155.