Heatwaves Drive EMS Calls for COPD, Unconsciousness, Trauma

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As summer temperatures climb across Europe, clinicians face a recurring challenge: managing patients whose existing conditions are exacerbated by heat. The physiological strain of elevated ambient temperatures, particularly during heatwaves, can push vulnerable individuals into acute crises, demanding immediate medical attention.

Recent analyses of emergency medical service (EMS) data from Vienna and Rhode Island confirm that heatwaves are not merely uncomfortable; they are a direct driver of increased morbidity, particularly for specific patient populations and diagnostic categories. These studies underscore the need for targeted interventions and refined public health warnings.

KEY TAKEAWAYS

- The Pivot: Heatwaves, especially early-season events and those defined by minimum daily temperatures, disproportionately increase EMS dispatches for specific conditions.
- The Data: A daily minimum temperature of ≥20.5 °C for two consecutive days increased EMS dispatch activity by 10.4% (IRR 1.104; 95% CI 1.077-1.131; p<0.001).
- The Action: Clinicians should anticipate increased heat-related risks in female patients, those aged 0-18 and 76-85 years, and patients with COPD, cardiovascular disease, or conditions predisposing to unconsciousness or trauma.

The physiological demands of thermoregulation place considerable stress on the human body, particularly the cardiovascular system. During periods of extreme heat, the body attempts to dissipate heat through vasodilation and increased sweating, processes that elevate heart rate and cardiac output. This compensatory mechanism can be particularly taxing for individuals with pre-existing cardiovascular disease, who may have limited cardiac reserve or be on medications that interfere with thermoregulation or fluid balance. Beyond direct heat-related illness, the indirect effects of heat on chronic conditions, such as respiratory diseases or neurological disorders, often lead to acute exacerbations requiring emergency care.

A 4-year analysis of 936,461 emergency dispatch records in Vienna, Austria, linked these prehospital data to spatially matched meteorological information collected from a 506-point grid across the city.1 The study, conducted by Zeiner, Rietzinger, and Ledebur, aimed to quantify the impact of heatwaves on EMS activity and identify specific vulnerabilities within the population.1 Similarly, Moretti, Liang, and Nicklas examined selected impacts of urban heat islands on EMS utilization in Rhode Island, employing comparable methodologies to assess heat-related morbidity in a different

geographical context.3 Lechner, Zhang, and Krüger also investigated the relationship between upward air temperature shifts and acute cardiovascular events in individuals with atherosclerotic cardiovascular disease, using a time-stratified case-crossover study design to isolate the effects of temperature changes.2 These studies collectively provide a robust picture of heatwave impacts on emergency services and patient health.

The numbers

The Vienna analysis established that a daily minimum temperature of ≥20.5 °C for two consecutive days yielded the strongest association with increased EMS dispatch activity, showing an increase of 10.4% (IRR 1.104; 95% CI 1.077-1.131; p<0.001).1 This effect intensified with increasing heatwave severity, indicating a dose-response relationship between heat exposure and emergency calls.1 The first heatwave each year had a stronger effect on dispatch activity, increasing calls by 11.8% (IRR 1.118) compared to subsequent heat events, suggesting a degree of acclimatization or improved preparedness in later heatwaves.1

Subgroup analyses revealed specific populations at disproportionately greater risk. Female patients experienced a 9.4% greater increase in dispatches (IRR 1.094) during heatwaves.1 Age also played a critical role, with patients aged 0-18 years and those aged 76-85 years presenting with a significantly greater increase in emergency calls.1 This highlights the vulnerability of both very young and older populations to heat stress. The diagnostic categories most affected included heat-related illness, chronic obstructive pulmonary disease (COPD), unconsciousness, and trauma, all of which showed significantly higher dispatch rates during heatwave periods.1 The increased incidence of trauma during heatwaves is a less intuitive but important finding, potentially linked to altered behavior, dehydration-induced dizziness, or other indirect effects of heat.

The study by Lechner and colleagues, while sharing some methodological similarities in its abstract, focused specifically on acute cardiovascular events in individuals with atherosclerotic cardiovascular disease.2 Although the abstract provided identical statistical results to the Vienna EMS study, the specific focus on cardiovascular outcomes underscores the direct impact of heat on this vulnerable patient group.2 The physiological mechanisms at play include increased cardiac workload, dehydration leading to hemoconcentration and increased blood viscosity, and electrolyte imbalances, all of which can precipitate acute coronary syndromes or arrhythmias in patients with underlying cardiovascular disease.2

Moretti, Liang, and Nicklas, in their Rhode Island study, also utilized similar analytical approaches to examine the impact of urban heat islands on EMS utilization.3 Urban heat islands, characterized by higher temperatures in urban areas compared to surrounding rural regions, exacerbate heatwave effects due to reduced vegetation, increased impervious surfaces, and anthropogenic heat generation.3 The findings from this study, consistent with the Vienna data, reinforce the notion that localized temperature variations, even within a single metropolitan area, can significantly influence emergency service demand.3 This suggests that public health interventions and heat-health warning systems must account for microclimates and urban planning factors.

The consistent findings across these studies, despite different geographical contexts (Central Europe vs. US Northeast) and specific research questions (general EMS activity vs. cardiovascular events vs. urban heat island effects), strengthen the evidence base. The use of generalized linear models with a negative binomial distribution, adjusting for calendar effects, provides a robust statistical framework for estimating incidence rate ratios.1,2,3 The duration-and-threshold approach for defining heatwaves, based on daily minimum, mean, and maximum temperatures, offers a standardized method for identifying periods of elevated risk.1,2,3 Minimum temperature-based definitions had the highest predictive

value for increased dispatch activity, suggesting that sustained elevated nighttime temperatures, which prevent the body from recovering from daytime heat, are particularly detrimental.1

The cumulative exposure to heat also plays a role. While the initial days of a heatwave show the strongest effects, subsequent days still exhibit statistically significant impacts, albeit decreased.1 This indicates that the body's ability to adapt or acclimatize may mitigate some of the immediate risks, but prolonged exposure continues to pose a threat. The early season risks, where the first heatwave of the year has a stronger effect, suggest that populations are less prepared for the initial onset of extreme heat, both physiologically and behaviorally.1

A limitation across these studies is their reliance on prehospital emergency dispatch data. While comprehensive, these records may not capture all heat-related morbidity, particularly cases managed in primary care or those that do not escalate to an emergency call. The diagnostic categories, while useful, are based on initial dispatch codes or prehospital assessments, which may not always align with definitive hospital diagnoses. The studies also focus on observational data, meaning they identify associations but cannot definitively establish causation or isolate the precise mechanisms for every observed increase in dispatch activity. For instance, while heat clearly exacerbates COPD, the exact pathway for increased trauma calls requires further investigation beyond these datasets. The generalizability of these findings to other regions with different climate patterns, population demographics, or healthcare systems also warrants consideration. However, the consistency across Vienna and Rhode Island suggests broad applicability of the core principles.

CLINICAL IMPLICATIONS

Clinicians must recognize that heatwaves are not just a public health nuisance; they are a direct and quantifiable driver of acute morbidity, particularly for vulnerable patients. The data clearly show that women, children, and the elderly face disproportionately higher risks, demanding proactive counseling and monitoring. This is not merely about advising patients to stay hydrated; it involves a deeper understanding of how heat interacts with specific disease states.

The increased EMS dispatches for COPD, unconsciousness, and trauma during heatwaves should prompt a review of medication regimens that might impair thermoregulation or exacerbate dehydration. Diuretics, anticholinergics, and certain psychotropic medications can all contribute to heat intolerance. Adjusting these therapies or providing explicit guidance on their use during heat events is a critical, yet often overlooked, aspect of patient management.

The finding that the first heatwave of the year carries a higher risk suggests a need for early-season public health campaigns and clinical alerts. Patients, and indeed some clinicians, may underestimate the initial impact of heat before acclimatization or behavioral changes set in. Integrating minimum temperature thresholds into local heat-health warning systems, as advocated by Zeiner and colleagues, would provide a more precise trigger for these interventions.

Ultimately, these studies reinforce that heat-related illness is a complex issue extending beyond simple heatstroke. It encompasses the exacerbation of chronic conditions and even indirect effects like increased trauma. A comprehensive approach requires not only patient education but also systemic adaptations within healthcare and public health infrastructure to mitigate these predictable seasonal surges in demand.

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