Heat Waves and Hospital Admissions in Vienna: Evidence from a Decade of Health and Climate Data

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Extended Abstract

Extreme heat represents one of the most pressing health challenges of the 21st century, with climate change driving more frequent, intense, and longer heat waves even in regions with moderate climates such as Central Europe (European Environment Agency, 2022). In the metropolitan city of Vienna, Austria, the number of heat days—defined as days with maximum temperature above 30°C and minimum temperature above 18°C—has nearly tripled since the 1970s, increasing from an average of 8.9 to 25.4 per year[1]. This shift has substantial implications for public health, particularly as Vienna experiences demographic aging, high population density, and pronounced urban heat-island effect. While the relationship between extreme heat and mortality is well documented (Baccini et al., 2008; Robine et al., 2008), fewer studies have systematically analysed how heat waves affect broader patterns of disease and hospital admissions in Central European urban contexts.

This study investigates the health impacts of heat waves in Vienna using a high-resolution panel of administrative data on all hospital admissions (8.6 million visits) between 2009 and 2018 combined with meteorological data from the Austrian Meteorological and Geodynamics Institute (ZAMG). Each record

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includes patient age, sex, date of admission, residence postal code, and diagnosis coded according to the International Classification of Diseases (ICD-10). We match these data with daily temperature, humidity, and precipitation information at a 1×1 km grid resolution, constructing measures of heat exposure that include maximum daily temperature, binary indicators for heat days, heating degree days (HDD), Heating Degree Hours (HDH) and consecutive heat episodes lasting two or more days. By exploiting the longitudinal structure of the data, we estimate fixed-effects Negative Binomial panel regressions that control for postal-code, year, month, and weekday effects, isolating the short-term effect of temperature fluctuations on hospital admissions from time-invariant spatial confounders. The analysis focuses on how heat waves affect admissions across ICD-10 disease categories: injuries and accidents (S00–T98), diabetes and metabolic disorders (E10–E14), dehydration and electrolyte imbalance (E86–E87), respiratory diseases (J00–J99), mental and behavioral disorders (F00–F99), renal diseases (N00–N39), and cardiovascular diseases (I00–I99). The results indicate a strong and statistically significant association between temperature extremes and hospitalizations, with an average increase of about 0.8 to 1.0 percent per degree Celsius above the 30°C threshold, consistent with prior findings from Australia and Italy (Hansen et al., 2008; Conti et al., 2007). Cardiovascular and respiratory admissions also rise significantly during periods of extreme heat, confirming the well-established physiological stress imposed by high temperatures (González-Alonso et al., 2008; Crandall and González-Alonso, 2010). Admissions for mental and behavioral disorders increase after prolonged exposure, suggesting delayed psychosocial effects (Cusack et al., 2011; Kim et al., 2020). Although sex differences are not pronounced, age-stratified analyses reveal that individuals aged 70 and older experience the steepest rise in admissions across all disease categories, highlighting the physiological vulnerability of older adults to thermal stress (Abrahamson et al., 2008; Kenny et al., 2017).

Beyond individual-level health responses, we also observe substantial spatial and socioeconomic heterogeneity in vulnerability confirm that social determinants of health play a central role in shaping the consequences of climate-related hazards, echoing broader conclusions from disaster and climate vulnerability research (Edenhofer et al., 2014; Howe et al., 2019).

By extending the analysis beyond aggregate hospitalization counts, this study provides a disease-specific perspective on the morbidity effects of extreme heat in Vienna. The use of panel econometric methods allows for robust identification of short-term causal impacts across different medical conditions while accounting for unobserved district characteristics. The results emphasize that heat exposure exerts a multifaceted burden on public health—not limited to heat stroke or direct thermal injury, but encompassing exacerbations of chronic diseases, dehydration, and mental distress. These findings underscore the need for tailored adaptation policies in urban settings, including improved early-warning systems, expansion of green infrastructure, and targeted outreach to vulnerable groups such as the elderly and low-income residents. As global temperatures continue to rise, the cumulative strain of heat waves on urban healthcare systems will intensify. The evidence from Vienna suggests that even cities with

robust healthcare infrastructure are not immune to these impacts. By integrating climate, demographic, and health data, our analysis contributes to a growing literature on urban climate-health interactions and highlights the urgency of incorporating disease-specific morbidity considerations into local adaptation and resilience planning.

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