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A Methodological Framework for Analysing Heatwave-Mortality Associations in an African Urban Context: A Case Study of Khartoum's Elderly, 2004

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Abstract

Heatwaves are a growing public health threat in African cities. Methodologies for analysing their health impacts, often developed in temperate regions, are frequently unsuitable for the unique climatic, demographic, and data infrastructure conditions of African urban settings. This article presents a methodological framework for analysing heatwave-mortality associations, designed specifically for an African urban context. Its primary objective is to detail a replicable process for defining heatwaves, acquiring and processing health and meteorological data, and conducting time-series regression analyses where routine mortality data are limited. The framework is illustrated with a case study of elderly residents in Khartoum. It outlines steps for: defining location-specific heatwave thresholds using percentile-based methods; sourcing and validating mortality data from civil registration and health facilities; obtaining and processing gridded meteorological data; and applying a distributed lag non-linear model within a time-series design to quantify associations, while controlling for temporal confounders. As a methodology article, it presents no primary empirical results. The illustrative case study demonstrated the framework's feasibility, indicating a preliminary positive association between heatwave exposure and elevated mortality risk in the target population. The proposed framework provides a structured, context-appropriate approach for quantifying the mortality burden of heatwaves in African cities. It addresses key challenges in data sourcing and climate-health modelling specific to the region. Public health researchers in similar settings should adopt and adapt this framework, prioritising collaboration with national meteorological and statistical agencies to improve data access. Future applications should incorporate vulnerability factors like socio-economic status and comorbidities. heatwave, mortality, elderly, methodology, time-series analysis, Africa, urban health, climate change This work provides a practical, context-sensitive methodological framework to support the quantification of heatwave-related health risks in African urban areas, where such analytical capacity is often limited.

Keywords: *Heatwave-mortality association, Elderly population, Sub-Saharan Africa, Time-series analysis, Case-crossover design, Urban health, Environmental epidemiology*

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