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Thermoregulatory Stress and the Ageing Mind: Investigating Environmental High Heat Exposure as a Risk Factor for Dementia

As populations age globally, the health impacts of high heat exposure are a growing public health concern. This study explored the association between high heat exposure and the prevalence of Alzheimer's Disease and Related Dementias (ADRD) and Mild Cognitive Impairment (MCI) among U.S. adults in the All of Us Research Program (n=286,767). Heat data from the CDC's National Environmental Public Health Tracking Network was mapped to 3-digit ZIP codes. High heat exposure was defined as number of days within a multi-day heat event (≥ 2 consecutive days with a maximum heat index above the 90th percentile for May–September). ADRD/MCI diagnosis and medical comorbidities (CVD, cerebrovascular disease, type 2 diabetes, COPD, hearing impairment, depression) were identified in EHR data based on ICD codes. Demographics, smoking, alcoholism, and social isolation were measured via survey. Community-level SES was quantified using the Area Deprivation Index (ADI). Logistic regression evaluated associations between high heat days and ADRD/MCI. Mediation analysis by SES and social isolation was also examined. In multivariable-adjusted models, each additional high heat day was associated with a 0.39% increase in ADRD/MCI odds (95% CI: 1.0026–1.0051). Every 10 days of exposure to a high heat event corresponded to ~4% higher odds of ADRD/MCI, reinforcing concerns about prolonged environmental stressors. Mediation analysis found that the ADI partially mediated this relationship, explaining 8.6% of the association ($p < 0.001$). However, neither education nor social isolation significantly mediated or moderated effects. Findings highlight the need for climate adaptation policies to protect ageing populations, especially in disadvantaged communities. The urban heat island effect may also exacerbate health risks for this group. Addressing these disparities requires strengthened public health policies and targeted adaptation strategies to reduce vulnerability and safeguard cognitive health.