Gac Sanit. 2026;40(S4):343

Gaceta Sanitaria

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471 - HEAT INEQUITIES AND ELDERLY HOSPITAL ADMISSIONS IN PORTUGAL: A MACHINE LEARNING STUDY

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Resumen

Background/Objectives: Climate change exacerbates health inequalities, disproportionately affecting older adults. Traditional regression models often fail to capture complex, non-linear relationships between extreme heat and health outcomes across diverse geographies. This study quantifies the impact of extreme heat on hospital admissions among the elderly (≥ 65 years) across mainland Portugal, applying advanced machine-learning methods to identify geographic disparities in heat-health risk.

Methods: We conducted a nationwide retrospective ecological study across 278 Portuguese counties over 19 summer seasons (2000-2018). Daily hospital admissions were linked with high-resolution meteorological data. Heat exposure was assessed using the GATO IV index from the E-OBS dataset, a dynamic indicator that accounts for local acclimatisation and uses a 1950-1999 climatological baseline, serving as the basis for the Portuguese national heat-health warning system. We applied GPBoost, combining gradient-boosted decision trees with mixed-effects models, enabling non-linear effect estimation while explicitly modelling spatial dependencies. The model was trained using 80% stratified random split and validated on the remaining 20%.

Results: The GPBoost model demonstrated strong predictive performance (R^2 = 0.69, RMSE = 7.89, MAE = 3.90). Extreme heat was associated with a substantial healthcare burden, with a national average increase of 24.6% in elderly hospital admissions. Spatial clustering was identified, with several municipalities -predominantly in western and northwestern Portugal- experiencing surges exceeding 60%, while other areas

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showed moderate increases. These patterns indicate heterogeneous vulnerability, likely reflecting local demographic, environmental, and contextual factors captured by the model's spatial component.

Conclusions/Recommendations: Climate vulnerability is unevenly distributed, and uniform national heat alerts are insufficient. Heat action plans should incorporate spatially targeted resource allocation and strengthen hospital surge capacity in high-risk counties, ensuring protection of vulnerable populations regardless of geographic location.

Funding: AI4HeatHealth (FCT 2024.07710.IACDC).

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