

Evaluation of the co-influence of heat index, social vulnerability index, and neighborhood factors on crime rate - a case study of Baltimore City

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This study investigates the relationship between heat index (HI), built environment, socioeconomic status, social vulnerability index (SVI), and violent crimes in Baltimore in the summer from 2016 to 2022 through a univariate analysis using zero-inflated Poisson (ZIP) regression and spatiotemporal analysis using a spatiotemporal Bayesian hierarchical model. First, we found in univariate ZIP analysis that a negative correlation between green space (GS) coverage and the crime rate (relative risk (RR) = 0.544, 95% confidence interval (CI) 0.527-0.562 per 1 percentage increase) and a subtle positive correlation between HI and crime rate (RR = 1.007, 95% CI 1.004-1.008 per unit increase). SVI strongly affected crime outcomes (RR = 6.749, 95% CI 5.887-7.737 per 0.01 increase). Given HI is positively associated with crime rates in univariate analyses, the spatiotemporal analysis also shows the same result (posterior mean = 1.006 (95% CI, 1.004-1.008) in 2016), its impact is largely masked by the SVI of the city (posterior mean = 6.591 (95% CI, 5.749-7.557) in 2016). During the 2020-2022 COVID pandemic, the impact of HI showed the opposite correlation (posterior mean = 0.995 (95% CI, 0.989-1.002) in 2020). Even so, the study assumes that, as a public health intervention, reducing HI to the lowest observed level on each day within the city, the estimated number of avoidable crime incidents in 2016-2019 (before the pandemic is approximately 368.48, less than 5% of the total accumulated crimes events). However, even small numbers of preventable violent crimes highlight the significant value of such interventions.

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