Intra-city, spatio-temporal epidemic dispersion of arboviruses in Cienfuegos, Cuba

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Transmission of arboviruses is highly heterogeneous in space and time. Previous studies mainly focused on static risk maps, but less frequently explored how patterns change across years and within epidemic waves. Understanding of transmission processes may be enhanced by exploring recurring spatial distribution and underlying spread mechanisms. Using georeferenced confirmed arbovirus (mainly dengue) surveillance data from the Cienfuegos municipality (2012-2025), arbovirus waves were identified using a negative binomial endemicity threshold model and divided into relevant epidemic phases. Districts were classified into epidemiological typologies based on recurring incidence patterns across waves and subsequently grouped into mutually exclusive categories for interpretation and mapping. To assess spatial dispersion dynamics, houseblocks were labelled according to the epidemic phase in which arbovirus activity first occurred and visualized across waves. Spatial proximity analysis with permutation testing were used to evaluate dispersion patterns between epidemic phases. Preliminary results indicated distinct spatio-temporal patterns between waves with emerging and recurring serotypes, requiring separate characterization. Within these groups, dengue showed persistent spatial patterns over multiple years, allowing districts to be classified into distinct epidemiological typologies (e.g. early spread, peak-burden, lingering, persistent). Additionally, the emerging dengue typologies showed consistency with patterns of newly circulating arboviruses. Spatial dispersion often showed localized concentric spread compatible with vector-mediated transmission. Besides vector-mediated spread, discontinuous jump-like patterns were also observed, indicating a potential role of human mobility in dengue transmission. These findings can support more targeted and timely arbovirus control strategies by improving understanding of persistent transmission patterns and local spread dynamics.