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A Methodological Framework for Evaluating the Association between Informal Settlement Upgrading and Typhoid Fever Incidence: A Case Study of Kibera, Nairobi

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Abstract

Typhoid fever remains a significant public health burden in informal settlements, driven by inadequate water, sanitation, and hygiene infrastructure. While settlement upgrading programmes aim to improve these conditions, robust methodologies to evaluate their specific impact on enteric disease incidence are lacking. This article presents a methodological framework to evaluate the association between informal settlement upgrading and typhoid fever incidence. Its primary objective is to detail a replicable approach for linking spatial and temporal data on infrastructure improvements with health outcome data in a complex urban environment. Developed for a case study in Kibera, Nairobi, the framework employs a mixed-methods, quasi-experimental design. It integrates spatial mapping of upgrading interventions with longitudinal, laboratory-confirmed typhoid surveillance data. Temporal analysis uses interrupted time-series and difference-in-differences models to compare incidence trends in upgraded and non-upgraded areas, while controlling for confounders such as population density and rainfall. As a methodology article, this paper presents no empirical results. The framework is described in detail, illustrating how key variables are operationalised. A core component is the spatial buffering analysis used to define populations ‘exposed’ to an upgraded water point within a specified radius. The proposed framework provides a structured, transparent approach for assessing the health impacts of complex urban upgrading projects. It addresses common methodological challenges in informal settlement research, including dynamic populations and non-random intervention placement. Researchers applying this framework should prioritise community engagement for data validation and invest in high-resolution spatial and temporal data collection. Public health authorities should integrate such evaluation methodologies into the planning stages of future upgrading programmes. methodology, informal settlements, slum upgrading, typhoid fever, evaluation framework, urban health This article contributes a detailed methodological framework to the field of public health evaluation, offering a structured approach to assess the association between infrastructure improvements and disease incidence in informal settlements.

Keywords: *Typhoid fever, informal settlements, sub-Saharan Africa, quasi-experimental design, water, sanitation and hygiene (WASH), public health intervention, longitudinal study*

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