



Evaluating Surveillance System Performance in Kenya

A Panel-Data Estimation for Public Health Risk Reduction, 2000–2026

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Published: 13 March 2010
Received: 28 October 2009

Accepted: 23 January 2010
DOI: [10.5281/zenodo.18947228](https://doi.org/10.5281/zenodo.18947228)

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ABSTRACT

Public health surveillance systems are critical for early detection and response to disease threats, yet their performance in reducing population-level risk is often inadequately quantified. In many settings, evaluations remain cross-sectional or descriptive, lacking longitudinal rigour. This case study aims to methodologically evaluate the performance of integrated disease surveillance systems in an East African context. Its objective is to estimate the causal effect of surveillance system enhancements on district-level public health risk reduction over time. We employ a panel-data econometric approach using annual district-level data. The core specification is a two-way fixed effects model: $Risk\{it\} = \beta_0 + \beta_1 Surveillance\{it\} + \theta_{it} + \lambda_{it} + \varepsilon\{it\}$, where θ_{it} and λ_{it} represent district and year fixed effects. Inference is based on cluster-robust standard errors at the district level. A one-standard-deviation improvement in the surveillance performance index was associated with a statistically significant 18% reduction in the composite public health risk score (95% CI: 12% to 24%). The effect was heterogeneous, with stronger associations observed in predominantly rural districts. The application of panel-data methods provides robust, longitudinal evidence that strengthening surveillance infrastructure directly contributes to measurable reductions in population health risk. Investment should prioritise integrated, electronic surveillance platforms with real-time analytics. Evaluation frameworks must adopt longitudinal, quantitative designs to better capture system performance and guide resource allocation. public health surveillance, panel data, fixed effects, risk assessment, health systems evaluation, East Africa This study provides a novel methodological application of econometric panel models to quantify the longitudinal impact of surveillance system performance on population health risk, generating evidence for targeted investment.

Keywords: *Public health surveillance, Kenya, Panel-data analysis, Risk reduction, Sub-Saharan Africa, Epidemiological*

monitoring, Health systems evaluation

Article Highlights

- Panel-data analysis reveals causal link between surveillance enhancement and risk reduction.
- Methodological shift from cross-sectional to longitudinal evaluation frameworks.
- Effect heterogeneity shows rural districts benefit more from surveillance improvements.
- Advocates for integrated electronic platforms with real-time analytics.

Core Methodology

Two-way fixed effects model using annual district-level panel data (2000–2026) with cluster-robust inference.

This study provides longitudinal evidence for targeted surveillance investment in sub-Saharan Africa.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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