

A Methodological Evaluation and Cost-Effectiveness Analysis of Public Health Surveillance Systems in Kenya

A Difference-in-Differences Model

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ABSTRACT

Public health surveillance is critical for food security and disease control, yet robust methodological frameworks for evaluating its cost-effectiveness in resource-limited settings are lacking. This case study aimed to develop and apply a novel quasi-experimental methodology to evaluate the cost-effectiveness of enhanced surveillance systems, comparing their impact on outbreak detection timeliness and resource utilisation. A difference-in-differences model was employed, using panel data from surveillance units. The core specification was
$$Y_{it} = \beta_0 + \beta_1 \text{text}\{Treated\}\{i\} + \beta_2 \text{text}\{Post\}\{t\} + \delta (\text{text}\{Treated\}\{i\} \times \text{text}\{Post\}\{t\}) + \varepsilon_{it}$$
, where Y_{it} is the detection time. Inference was based on cluster-robust standard errors. Cost data were integrated for incremental cost-effectiveness ratios. The intervention was associated with a statistically significant reduction in mean detection time of 4.2 days (95% CI: 2.1, 6.3). The incremental cost-effectiveness ratio was estimated at *unicode{x00A3}1,850* per outbreak detected one week earlier, with sensitivity analyses confirming robustness. The applied econometric model provides a rigorous framework for attributing changes in surveillance outcomes, demonstrating that the enhanced system was cost-effective under local conditions. Programme planners should adopt quasi-experimental designs for surveillance evaluation. Investment should prioritise integrated data platforms that reduce reporting delays, as modelled here. health surveillance, cost-effectiveness analysis, difference-in-differences, quasi-experimental design, programme evaluation This study provides a novel application of a difference-in-differences framework to attribute changes in surveillance performance and calculate cost-effectiveness, generating a replicable model for similar settings.

Keywords: *Public health surveillance, Cost-effectiveness analysis, Difference-in-differences, Sub-Saharan Africa, Health systems evaluation, Kenya*

Article Highlights

- Enhanced surveillance reduced mean outbreak detection time by 4.2 days.
- Incremental cost-effectiveness was £1,850 per outbreak detected one week earlier.
- The study provides a replicable quasi-experimental model for similar settings.
- Findings support investment in integrated data platforms to reduce reporting delays.

Core Methodology

A difference-in-differences model with cluster-robust standard errors was used to evaluate the impact of enhanced surveillance systems on detection timeliness, integrated with cost data for ICER calculation.

This study offers a replicable framework for evaluating public health surveillance in resource-limited settings.

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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