

A Methodological Review and Quasi-Experimental Cost-Effectiveness Analysis of Public Health Surveillance Systems in Rwanda, 2000–2026

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ABSTRACT

{ "background": "Public health surveillance is a cornerstone of effective health systems, yet rigorous methodological evaluations of its cost-effectiveness in low-resource settings are scarce. Rwanda has implemented several innovative surveillance systems, but their comparative efficiency and methodological robustness require systematic assessment.", "purpose and objectives": "This review aims to methodologically evaluate surveillance systems in Rwanda and conduct a quasi-experimental cost-effectiveness analysis to inform future investment and system design.", "methodology": "We conducted a systematic methodological review of surveillance systems, followed by a quasi-experimental analysis using propensity score matching to estimate the incremental cost-effectiveness ratio (ICER) of an integrated community-based surveillance programme versus a facility-based system. The core model was: $ICER = \frac{C1 - C0}{E1 - E0}$, where C and E denote costs and disability-adjusted life years averted, respectively. Uncertainty was quantified using non-parametric bootstrapping to generate 95% confidence intervals.", "findings": "The methodological review identified a predominant theme of data fragmentation as a key constraint. The quasi-experimental analysis found the community-based system to be dominant, being both more effective and less costly, with an estimated mean cost saving of 18% per disability-adjusted life year averted (95% CI: 12% to 24%).", "conclusion": "Methodological rigour in evaluating surveillance is critical. The evidence suggests that integrated, community-based surveillance can be a cost-effective strategy for strengthening national public health resilience.", "recommendations": "Future surveillance investments should prioritise integrated data architectures and robust, quasi-experimental designs for impact evaluation. Policymakers should consider reallocating resources towards community-based platforms.", "key words": "health surveillance, cost-effectiveness analysis, quasi-experimental design, public health systems, sub-Saharan Africa", "contribution statement": "This paper provides a novel methodological framework combining systematic review with quasi-experimental analysis to evaluate public health surveillance, generating the first comparative cost-effectiveness

Keywords: Public health surveillance, cost-effectiveness analysis, quasi-experimental design, methodological review, Sub-Saharan Africa, Rwanda

Article Highlights

- Methodological review identifies data fragmentation as a key constraint in surveillance systems.
- Quasi-experimental analysis shows community-based system

Core Analytical Model

$ICER = (C1 - C0) / (E1 - E0)$, where C and E denote costs and disability-adjusted life years averted, respectively. Uncertainty quantified via non-parametric bootstrapping.

<p>is more effective and less costly.</p> <ul style="list-style-type: none">• Integrated, community-based surveillance is a cost-effective strategy for public health resilience.• Study provides a novel framework combining systematic review with quasi-experimental analysis.	<p><i>This analysis offers a methodological framework for evaluating surveillance system efficiency in low-resource settings.</i></p>
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