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Methodological Evaluation of Public Health Surveillance Systems in Rwanda

A Systematic Review of Multilevel Regression Analyses for Risk Reduction, 2000–2026

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ABSTRACT

Background: Public health surveillance systems are critical for monitoring disease burden and guiding interventions in sub-Saharan Africa. In Rwanda, the evolution of these systems has necessitated rigorous methodological evaluation to assess their effectiveness in measuring risk reduction for priority health conditions.

Purpose and objectives: This systematic review aims to methodologically evaluate the application of multilevel regression analyses within Rwanda's public health surveillance frameworks. It seeks to appraise model specifications, data integration techniques, and the inferential robustness of risk reduction estimates derived from these systems.

Keywords: *public health surveillance, Rwanda, sub-Saharan Africa, multilevel regression, risk reduction, methodological evaluation, disease burden*

Article Highlights

- Systematic review of multilevel regression in Rwanda's surveillance systems from 2000–2026.
- Identifies methodological gaps in error estimation for spatially clustered outbreak data.
- Finds inconsistent reporting of confidence intervals across reviewed studies.
- Recommends longitudinal models and better covariate integration for stronger causal inference.

Methodological Focus

This review critically appraises the application of multilevel models (e.g., $y_{ij} = \beta_{0} + \beta_{1}X_{ij} + u_{j} + e_{ij}$) within Rwanda's public health surveillance frameworks, evaluating model specification and inferential robustness.

A dedicated methodological critique of statistical practice in surveillance research.