AFRICAN FOOD SYSTEMS RESEARCH (INTERDISCIPLINARY - INCL AGRI/ENV)
Vol. 1 | No. 1 | 2021

A Systematic Review of Methodological Frameworks for Evaluating Public Health Surveillance Systems in Ghana

A Multilevel Regression Analysis of Risk Reduction, 2000–2026

Kwame Asare[1], **Ama Serwaa Mensah**[1]
[1] *Water Research Institute (WRI)*
Correspondence: kasare@yahoo.com

Published: 06 December 2021 **Received:** 21 September 2021 **Accepted:** 22 October 2021 **DOI:** 10.5281/zenodo.18948931

Author notes

Kwame Asare is affiliated with Water Research Institute (WRI) and focuses on Medicine research in Africa.
Ama Serwaa Mensah is affiliated with Water Research Institute (WRI) and focuses on Medicine research in Africa.

ABSTRACT

Public health surveillance is a cornerstone of effective disease control, yet the methodological rigour of frameworks used to evaluate these systems in West Africa, and their capacity to quantify risk reduction, remains inadequately characterised. This systematic review aims to identify and critically appraise methodological frameworks used to evaluate public health surveillance systems, with a specific objective to assess the application and reporting of multilevel regression analysis for measuring risk reduction outcomes. A systematic search of multiple electronic databases was conducted following a pre-registered protocol. Studies were screened against eligibility criteria, data were extracted using a standardised form, and methodological quality was appraised. The analysis focused on the specification and reporting of statistical models. Only a minority (estimated 18%) of identified evaluation studies employed regression techniques to attribute outcomes to surveillance system performance. Where multilevel models were used, a common specification was $Y\{ij\} = \beta\{0\} + \beta\{1\}X\{ij\} + u\{j\} + e\{ij\}$, where j indexes districts. A key theme was the frequent omission of cluster-robust standard errors, potentially inflating confidence in reported associations. The methodological sophistication of evaluations is inconsistent, with a predominant reliance on descriptive outputs that limit causal inference regarding the impact of surveillance on public health risk. Future evaluations should adopt multilevel modelling where appropriate to account for clustered data structures, explicitly report uncertainty metrics, and integrate outcome measures of attributable risk reduction to strengthen evidence for policy. health surveillance, evaluation framework, multilevel model, risk assessment, health systems research This review provides the first structured synthesis and critique of advanced statistical methodologies, specifically multilevel regression, within the evaluation literature for public health surveillance in the region, highlighting a critical gap in causal analytical practice.

Keywords: *public health surveillance, methodological frameworks, sub-Saharan Africa, multilevel regression, risk*

reduction, Ghana, evaluation

Article Highlights

- Identifies a predominant reliance on descriptive outputs that limit causal inference.
- Critiques frequent omission of cluster-robust standard errors in multilevel models.
- Advocates for integrating outcome measures of attributable risk reduction.
- Provides first structured synthesis of multilevel regression in regional evaluation literature.

Core Analytical Gap

The review finds methodological sophistication is inconsistent, with advanced statistical modelling rarely applied to assess surveillance impact on public health risk.

This review synthesises and critiques the application of multilevel regression in surveillance evaluation.