



# Methodological Evaluation of Public Health Surveillance Systems in Ghana Using Multilevel Regression Analysis to Measure Risk Reduction

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## Abstract

Public health surveillance systems are critical for monitoring infectious diseases in Ghana, where they play a significant role in disease prevention and control. However, their effectiveness can vary across different regions and populations. We employed a mixed-effects logistic regression model to analyse data from multiple sources, including sentinel sites across different regions. Multilevel modelling was used to account for the hierarchical structure of surveillance data (e.g., individual cases nested within districts). Our analysis revealed that public health surveillance systems in Ghana underestimated risk reduction by approximately 15% when compared to actual disease incidence rates, indicating a need for system refinement. The findings suggest improvements are necessary to enhance the accuracy of surveillance data and better reflect real-world disease dynamics. Multilevel regression analysis provides robust insights into these issues. Public health officials should consider enhancing the sensitivity of their surveillance systems by incorporating more comprehensive data sources and refining reporting protocols. Treatment effect was estimated with  $\text{text}\{\text{logit}\}(\pi) = \beta_0 + \beta_1 X_i$ , and uncertainty reported using confidence-interval based inference.

**Keywords:** *Sub-Saharan, Geographic, Multilevel, Regression, Surveillance, Evaluation, Public Health*

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