



# Methodological Evaluation of Public Health Surveillance Systems in Ghana Using Multilevel Regression Analysis

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## Abstract

Public health surveillance systems are crucial for monitoring infectious diseases in Ghana, but their effectiveness varies widely across regions and over time. Multilevel regression analysis will be employed to assess the impact of various factors on surveillance system performance, including geographical location, socio-economic status, and historical data availability. The study will use a mixed-effects model with robust standard errors to account for intracluster correlation within regions. The multilevel analysis revealed significant variation in surveillance efficiency across different regions (e.g., urban vs rural) and over time, indicating the need for targeted interventions to enhance performance. This study provides a methodological framework for evaluating public health surveillance systems in Ghana using advanced statistical techniques. The findings suggest that targeted support in underserved areas could lead to substantial efficiency improvements. Investment should be directed towards regions with the lowest efficiency scores, and regular monitoring of system performance is recommended to ensure sustained improvement. Treatment effect was estimated with  $\text{text}\{ \text{logit} \}(\pi) = \beta_0 + \beta^T p X_i$ , and uncertainty reported using confidence-interval based inference.

**Keywords:** Ghana, Geographic Information Systems (GIS), Spatial Analysis, Multilevel Modelling, Cluster Randomized Trials, Process Evaluation, Outcome Assessment

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