



# Methodological Evaluation of Public Health Surveillance Systems in Rwanda: Multilevel Regression Analysis for Risk Reduction Assessment

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## Abstract

Public health surveillance systems are crucial for monitoring disease outbreaks in Rwanda. However, their effectiveness varies across different regions and sectors. A multilevel regression model was applied to assess the impact of various factors on disease detection rates. The model includes district-level and sector-specific variables. The multilevel regression analysis revealed that increasing funding per capita in healthcare significantly reduced the lag time between symptom onset and reporting by 15% (95% CI: -20% to -10%). This study provides robust evidence on how resource allocation can enhance disease surveillance efficiency. Investment strategies should focus on increasing healthcare funding per capita in underserved districts, thereby improving early detection and response times. Treatment effect was estimated with  $\text{text}\{logit\}(\pi) = \beta_0 + \beta^T p X_i$ , and uncertainty reported using confidence-interval based inference.

**Keywords:** *Rwanda, Geographic Information Systems (GIS), Public Health Surveillance, Multilevel Models, Regression Analysis, Spatial Statistics, Data Quality Assessment*

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