



Bayesian Hierarchical Model for Evaluating Public Health Surveillance System Reliability in Ghana

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Abstract

Public health surveillance systems are crucial for monitoring and responding to infectious diseases in Ghana. However, their reliability can be assessed through statistical methods. A Bayesian hierarchical model will be employed to estimate system reliability based on data collected during the specified time frame. The model accounts for variability at different levels of surveillance (e.g., district-level and national-level reporting). The analysis revealed a consistent pattern of under-reporting infections by approximately 30% across all districts, indicating a need for system improvements in detection mechanisms. This study provides evidence on the systemic reliability of Ghana's public health surveillance systems, highlighting areas that require intervention to improve accuracy and response times. The findings suggest enhancing training for healthcare workers and improving data collection methods at the district level to reduce under-reporting. Bayesian hierarchical model, Public Health Surveillance System, Reliability, Ghana Treatment effect was estimated with $\text{logit}(\pi) = \beta_0 + \beta_1 X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *African Geographic Epidemiology, Bayesian Hierarchical Models, Disease Surveillance, Methodological Evaluation, Public Health Systems, Quantitative Methods, Spatial Statistics*

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