



Bayesian Hierarchical Model for Measuring Clinical Outcomes in Public Health Surveillance Systems in Uganda: A Methodological Evaluation

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Abstract

Public health surveillance systems in Uganda are essential for monitoring clinical outcomes to inform policy and improve healthcare delivery. However, challenges exist in accurately measuring these outcomes due to variability across different settings. A Bayesian hierarchical linear regression model was applied to analyse surveillance data. The model accounts for spatial heterogeneity by incorporating random effects at different levels of geographic aggregation (districts and provinces). Uncertainty quantification is provided through credible intervals based on posterior distributions. The analysis revealed significant spatial variation in clinical outcomes, with some districts showing improved recovery rates compared to others, indicating the need for targeted interventions. The Bayesian hierarchical model demonstrated its ability to accurately estimate and quantify uncertainty in local healthcare performance metrics across Uganda's diverse settings. Future surveillance systems should consider implementing similar models to enhance the accuracy and reliability of clinical outcome assessments. Bayesian Hierarchical Model, Clinical Outcomes, Public Health Surveillance, Uganda 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: African, Bayesian, Hierarchical, Methodology, Surveillance, Epidemiology, Quantitative

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