



Bayesian Hierarchical Model in Public Health Surveillance: Methodological Evaluation and Clinical Outcomes Assessment in Nigeria

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Abstract

Public health surveillance systems in Nigeria have faced challenges in effectively monitoring clinical outcomes due to variability among healthcare facilities and regions. A Bayesian hierarchical regression analysis was employed, accounting for spatial variation using spatial random effects. Uncertainty quantification was provided through credible intervals. The model demonstrated significant heterogeneity in pneumonia incidence rates across different regions of Nigeria, with estimated mean rate at 45 infections per 1000 population (95% CI: 38-52). The Bayesian hierarchical model effectively captured regional variability and provided robust estimates for clinical outcomes. Further validation in diverse settings is recommended to ensure generalizability of the findings. Bayesian Hierarchical Model, Public Health Surveillance, Nigeria, Clinical Outcomes, Pneumonia 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: *Nigeria, Bayesian hierarchical model, Public health surveillance, Clinical outcomes, Methodological evaluation, Statistical inference, Geographic variability*

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