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Bayesian Hierarchical Model for Evaluating Risk Reduction in Public Health Surveillance Systems in Nigeria: A Meta-Analysis

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Abstract

Public health surveillance systems in Nigeria aim to monitor disease outbreaks and implement timely interventions. However, their effectiveness varies across different regions. This study focuses on evaluating these systems by analysing data from various regions. A Bayesian hierarchical model was applied to aggregate and analyse data from multiple studies conducted across different regions of Nigeria. The model accounts for heterogeneity among studies and aims at estimating the overall effect size while accounting for uncertainty in estimates. The analysis revealed significant variability in risk reduction effectiveness, with some regions showing substantial reductions (up to 40%) compared to others where only minor improvements were observed. This study provides insights into the performance of public health surveillance systems in Nigeria and highlights the importance of tailored interventions based on regional-specific challenges. The Bayesian hierarchical model offers a robust framework for future evaluations. Public health authorities should prioritise resource allocation to regions with lower effectiveness, focusing on capacity building and innovative strategies such as digital health solutions to enhance surveillance capabilities. Treatment effect was estimated with $text\{logit\}(\pi) = beta0 + \beta^{\rightarrow} p X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Geographic, Sub-Saharan, Surveillance, Bayesian, Hierarchical, Meta-analysis, Quantitative*

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