



Bayesian Hierarchical Model for Evaluating Public Health Surveillance System Efficiency in Nigeria: A Methodological Assessment

Samson Obiakor^{1,2}, Chima Okezie^{1,2}

¹ University of Abuja

² Federal University of Technology, Akure

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Correspondence: sobiakor@hotmail.com

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Author notes

Samson Obiakor is affiliated with University of Abuja and focuses on Medicine research in Africa.

Chima Okezie is affiliated with University of Abuja and focuses on Medicine research in Africa.

Abstract

Public health surveillance systems (PHSSs) are crucial for monitoring disease outbreaks and managing public health risks efficiently. A Bayesian hierarchical model was employed to assess the efficiency gains from current surveillance practices. The model accounts for variations across different regions and integrates expert knowledge through prior distributions. The model revealed that certain regions showed substantial underreporting of disease cases, indicating a need for targeted interventions to enhance reporting accuracy. This study provides insights into the effectiveness of Nigeria's PHSSs and highlights specific areas where improvements are necessary. Integrating technology solutions and strengthening training programmes in surveillance regions with low efficiency could significantly boost overall system performance. Treatment effect was estimated with $\text{logit}(\pi) = \beta_0 + \beta_1 X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Bayesian statistics, hierarchical modelling, disease surveillance, public health, sub-Saharan Africa, spatial analysis, model validation*

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