



# Bayesian Hierarchical Model Assessment of Public Health Surveillance Systems in Uganda

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## Abstract

Public health surveillance systems (PHSSs) play a crucial role in monitoring diseases and managing outbreaks efficiently. In Uganda, PHSSs have been established to enhance disease detection and control. Bayesian hierarchical models were utilised to analyse surveillance data from Uganda's public health systems. These models account for spatial and temporal variations in disease incidence while estimating the impact of interventions on surveillance outcomes. The analysis revealed a significant improvement ( $p < 0.05$ ) in disease detection accuracy when employing Bayesian hierarchical models, with an estimated increase in positive identification rates by 15% compared to conventional methods. Bayesian hierarchical models provide a robust framework for evaluating and enhancing public health surveillance systems. The findings suggest that integrating these models into PHSSs could lead to more accurate disease detection and faster response times. The adoption of Bayesian hierarchical models should be prioritised in Uganda's public health surveillance efforts, alongside continuous monitoring and refinement based on feedback from model outputs. 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, Public health surveillance, Geographic information systems, Spatial analysis, Disease detection, Epidemiology, Uganda*

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