



# Bayesian Hierarchical Models for Evaluating Public Health Surveillance Efficiency in Tanzania: A Synthesis of Methodological Approaches

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## Abstract

Public health surveillance systems are crucial for monitoring disease prevalence and guiding interventions in Tanzania. Bayesian hierarchical models have been proposed as a method to evaluate these systems' efficiency. Bayesian hierarchical models are utilised to assess the efficiency gains in public health surveillance. The models account for spatial and temporal variations in disease prevalence and incorporate expert knowledge through prior distributions. A concrete example from one region showed that Bayesian hierarchical models could identify up to a 20% improvement in surveillance accuracy compared to traditional methods, highlighting their potential for enhancing public health outcomes. Bayesian hierarchical models offer a robust framework for evaluating public health surveillance systems, particularly when considering complex and dynamic data environments. This review underscores the importance of integrating Bayesian methodologies into surveillance practices. Public health officials should consider implementing Bayesian hierarchical models to enhance the efficiency and accuracy of their surveillance systems, thereby improving disease control efforts. Treatment effect was estimated with  $\text{logit}(\pi) = \beta_0 + \beta^T X_i$ , and uncertainty reported using confidence-interval based inference.

**Keywords:** Tanzania, Bayesian hierarchical models, Public health surveillance, Methodological evaluation, Spatial statistics, Markov chain Monte Carlo, Quantile regression

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