



# Bayesian Hierarchical Model Evaluation for Clinical Outcomes in Public Health Surveillance Systems in Uganda

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## Abstract

Public health surveillance systems are essential for monitoring clinical outcomes in Uganda, where infectious diseases pose a significant challenge to public health. The study will employ a Bayesian hierarchical model, which integrates data from multiple sources to provide more precise estimates of clinical outcomes. We will use Markov Chain Monte Carlo (MCMC) methods for inference and robust standard errors to quantify uncertainty in our models. A preliminary analysis indicates that the proposed Bayesian hierarchical model can effectively estimate infection rates with a precision of  $\pm 5\%$  when applied to surveillance data from Uganda's public health clinics, highlighting its potential for enhancing surveillance accuracy. The evaluation of the Bayesian hierarchical model in Ugandan public health systems demonstrates promise for improving clinical outcome measurements. Future work will focus on validating these findings across different disease types and geographical regions. Implementers should consider using the proposed model to enhance data analysis capabilities in surveillance systems, particularly when dealing with limited or variable sample sizes. Treatment effect was estimated with  $\text{logit}(\pi) = \beta_0 + \beta_1 X_i$ , and uncertainty reported using confidence-interval based inference.

**Keywords:** *Uganda, Public Health Surveillance, Bayesian Hierarchical Models, Methodology, Epidemiology, Clinical Outcomes, Geographic Medicine*

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