



# Bayesian Hierarchical Model for Measuring Clinical Outcomes in Public Health Surveillance Systems in Ethiopia: An Evaluation Study

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## Abstract

Public health surveillance systems in Ethiopia are crucial for monitoring clinical outcomes to guide policy and resource allocation. However, these systems often face challenges in accurately measuring and reporting such outcomes. A Bayesian hierarchical model was employed, incorporating multiple layers of uncertainty to account for variability across different healthcare settings in Ethiopia. Data from the national public health surveillance database were analysed using Markov Chain Monte Carlo methods with robust standard errors estimated. The model demonstrated a significant improvement ( $p < 0.05$ ) in estimating disease prevalence rates compared to traditional approaches, particularly when accounting for local healthcare facility-specific variations and temporal trends. Bayesian hierarchical models provide valuable insights into the accuracy of clinical outcome measurements within Ethiopia's public health surveillance systems. The results suggest that ongoing model refinement and validation are necessary to maintain the reliability of these systems, especially in addressing regional disparities and ensuring equitable resource distribution. Bayesian Hierarchical Model, Clinical Outcomes, Public Health Surveillance Systems, Ethiopia Treatment effect was estimated with  $\text{text}\{\text{logit}\}(\pi) = \beta_0 + \beta^{-1} p X_i$ , and uncertainty reported using confidence-interval based inference.

**Keywords:** *African, Bayesian, Hierarchical, Surveillance, Epidemiology, Quantitative, Methodology*

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