



Bayesian Hierarchical Model for Measuring Reliability in Public Health Surveillance Systems in Ethiopia: A Longitudinal Study

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Abstract

Public health surveillance systems in Ethiopia rely on timely and accurate data to inform policy decisions and resource allocation. A longitudinal study using a Bayesian hierarchical model was conducted with data from the Ethiopian Public Health Surveillance System (EPHSS) spanning two years. The model accounts for temporal dependencies and heterogeneity across different regions and subsystems of EPHSS. The analysis revealed that regional variations in system reliability were significant, with some areas showing a 20% improvement over time compared to others. The Bayesian hierarchical model provided insights into the variability and stability of public health surveillance systems, highlighting regions needing targeted interventions for better performance. Public health authorities should focus on enhancing data collection in underperforming regions through training and infrastructure support. Bayesian Hierarchical Model, Public Health Surveillance Systems, System Reliability, Ethiopia Treatment effect was estimated with $\text{text}\{logit\}(\pi) = \beta_0 + \beta^{-1} p X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Ethiopia, Geographic Mapping, Spatial Analysis, Hierarchical Modelling, Bayesian Statistics, Reliability Measurement, Public Health Surveillance*

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