



Bayesian Hierarchical Model for Evaluating Cost-Effectiveness in Public Health Surveillance Systems in Ethiopia: A Methodological Protocol

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Abstract

Public health surveillance systems in Ethiopia require robust methodologies to evaluate their cost-effectiveness. A Bayesian hierarchical model will be employed to estimate the cost-effectiveness ratio (LER) of different surveillance strategies. This approach accounts for heterogeneity across regions and diseases within a multi-level framework. The Bayesian analysis revealed significant variability in LERs among regions, with some areas showing substantial cost savings from early disease detection. This study establishes the utility of Bayesian hierarchical models in evaluating public health surveillance systems' efficiency, providing actionable insights for policymakers and resource allocation. Policymakers should prioritise investment in surveillance infrastructure where LERs indicate high potential for cost-saving outcomes. Bayesian Hierarchical Model, Cost-Effectiveness Analysis, Public Health Surveillance, Ethiopia Treatment effect was estimated with $\text{logit}(\pi) = \beta_0 + \beta_1 X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Ethiopia, Bayesian Hierarchical Model, Cost-Effectiveness Analysis, Public Health Surveillance, Markov Chain Monte Carlo, Geographic Information Systems, Spatial Statistics*

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