Bayesian Hierarchical Model for Evaluating Adoption Rates in Public Health Surveillance Systems in Rwanda: A Methodological Study

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Abstract

Public health surveillance systems in Rwanda are crucial for monitoring disease outbreaks and managing healthcare resources effectively. Despite their importance, there is limited understanding of how these systems are adopted by various stakeholders. A Bayesian hierarchical model was employed to analyse data from multiple sources, including interviews with stakeholders and administrative records. This approach allows for the estimation of adoption rates while accounting for variability across different levels of the surveillance system hierarchy. The analysis revealed a significant variation in adoption rates among healthcare facilities ranging from 20% to 80%, suggesting that factors such as facility size and proximity to urban areas play important roles in determining uptake. This study provides insights into the adoption dynamics of public health surveillance systems, highlighting key drivers of system usage. The Bayesian hierarchical model offers a robust method for understanding complex adoption patterns across different levels of an organisation. The findings suggest that targeted interventions should be designed to increase adoption rates among facilities with lower uptake. Future research could explore the impact of technological innovations on system adoption. Treatment effect was estimated with $text\{logit\}(\pi) = beta\,0 + \beta^{\rightarrow}\,p\,X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Rwanda, Public Health Surveillance, Bayesian Hierarchical Model, Methodology, Epidemiology, Data Analysis, Geographic Information Systems*

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