Bayesian Hierarchical Model for Evaluating Public Health Surveillance System Efficiency in Rwanda: A Methodological Assessment

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Abstract

Public health surveillance systems are crucial for monitoring diseases in real-time, particularly in resource-limited settings like Rwanda. However, their efficiency and effectiveness can vary significantly. We employ a Bayesian hierarchical model to analyse data from various regions within Rwanda. This approach allows for the integration of local and national surveillance data while accounting for regional variability. Our analysis revealed significant efficiency gains across different regions, with some areas showing improvements as high as 20% in detection rates of infectious diseases. The Bayesian hierarchical model effectively highlights disparities in surveillance system performance and provides a robust framework for continuous improvement. Based on our findings, we recommend targeted interventions to enhance surveillance systems in underperforming regions and the development of standardised reporting protocols. Bayesian Hierarchical Model, Public Health Surveillance, Rwanda, Efficiency Gains, Real-Time Monitoring Treatment effect was estimated with $text\{logit\}(\pi)=beta\,0+\beta^{\top}\,p\,X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Geographic, Sub-Saharan, Surveillance, Bayesian, Hierarchical, Evaluation, Methodology*

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