Bayesian Hierarchical Model for Measuring Yield Improvement in Public Health Surveillance Systems Across South Africa: A Longitudinal Study

Nokuthula Ngwenyama[1,2], **Sipho Mthethwa**[3]

[1] Department of Internal Medicine, Wits Business School

[2] Department of Pediatrics, Rhodes University

[3] Wits Business School

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Correspondence: nngwenyama@hotmail.com

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Author notes

Nokuthula Ngwenyama is affiliated with Department of Internal Medicine, Wits Business School and focuses on Medicine research in Africa.

Sipho Mthethwa is affiliated with Wits Business School and focuses on Medicine research in Africa.

Abstract

Public health surveillance systems in South Africa are crucial for monitoring disease prevalence and guiding public health interventions. However, their efficiency can vary over time and across different regions. We employed a Bayesian hierarchical model to analyse longitudinal data from multiple public health surveillance sites. This approach allows for capturing regional differences while accounting for temporal trends and individual site-specific effects. Our analysis revealed significant regional disparities in the accuracy of reported surveillance data, with some areas showing yield improvements over time that could be attributed to enhanced reporting mechanisms or training programmes. The Bayesian hierarchical model provided a nuanced understanding of how public health surveillance systems operate across South Africa, highlighting key areas for system optimization and resource allocation. Adopting the identified best practices in underperforming regions can lead to more consistent data quality and improved public health outcomes. Bayesian hierarchical model, public health surveillance, yield improvement, longitudinal study, South Africa Treatment effect was estimated with $text{ logit } (\pi) = beta 0 + \beta^{\rightarrow} p X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Sub-Saharan, Bayesian, Hierarchical, Model, Evaluation, Public, Health*

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