Bayesian Hierarchical Model for Assessing System Reliability in Public Health Surveillance Systems, South Africa

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Abstract

Public health surveillance systems are critical for monitoring infectious diseases in South Africa. However, their reliability can be assessed through statistical models to optimise resource allocation and policy decisions. A Bayesian hierarchical model was employed to analyse surveillance data from to . The model incorporated spatial and temporal dependencies to estimate the reliability of reporting systems across different regions in South Africa. The analysis revealed that the average detection accuracy varied by region, with some areas showing a detection rate as high as 95% for certain diseases, indicating significant regional disparities in surveillance effectiveness. This study provides valuable insights into the reliability of public health surveillance systems in South Africa and highlights the need for targeted interventions to improve system performance in underserved regions. Public health authorities should prioritise investment in surveillance infrastructure in areas with lower detection rates, aiming to reduce disparities and enhance overall disease control effectiveness. Treatment effect was estimated with $text\{logit\}(\pi) = beta\,0 + \vec{\beta}\,p\,X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *African epidemiology, Bayesian statistics, hierarchical modelling, reliability analysis, surveillance systems, uncertainty quantification, validation studies*

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This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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