



# Bayesian Hierarchical Model Evaluation of Public Health Surveillance Systems in South Africa,

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## Abstract

Public health surveillance systems in South Africa have been implemented to monitor infectious diseases such as HIV/AIDS. However, their effectiveness and reliability require rigorous evaluation. A comprehensive search of peer-reviewed journals identified studies on public health surveillance metrics from 2000 to 2015. Data were analysed using a Bayesian hierarchical model with credible intervals as uncertainty measures. In the evaluated systems, there was an observed reduction in HIV/AIDS incidence by approximately 15% across provinces, indicating consistent risk management effectiveness. The Bayesian hierarchical model provided nuanced insights into surveillance system performance and highlighted areas for improvement. Future studies should focus on integrating additional health indicators to enhance the accuracy of public health surveillance in South Africa. Treatment effect was estimated with  $\text{logit}(\pi) = \beta_0 + \beta_1 X_i$ , and uncertainty reported using confidence-interval based inference.

**Keywords:** *African geography, Bayesian hierarchical models, epidemiology, infectious diseases, public health surveillance, risk assessment, statistical methods*

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