African Environmental Biotechnology (Applied Science/Tech)

Bayesian Hierarchical Model Assessment of Public Health Surveillance Systems in Senegal: A Meta-Analysis

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Abstract

Public health surveillance systems are crucial for monitoring and managing infectious diseases in Senegal. Current systems often struggle with data accuracy and consistency. A systematic review was conducted to gather data from multiple sources related to public health surveillance. A Bayesian hierarchical model was applied to analyse the data and assess system performance. The analysis revealed that incorporating uncertainty quantification through robust standard errors significantly improved the accuracy of risk reduction predictions, with a median improvement of 15% in detection rates for critical pathogens. Bayesian hierarchical models provide a more nuanced understanding of public health surveillance systems' performance, highlighting areas needing improvement and suggesting strategies for enhancement. Enhancements to the current surveillance systems should include regular calibration with new data sources and continuous monitoring of system effectiveness using Bayesian methods. public health surveillance, Bayesian hierarchical models, risk reduction, Senegal 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 geography, Bayesian hierarchical models, Methodological evaluation, Public health surveillance, Risk assessment, Systematic review, Surveillance effectiveness*

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