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Bayesian Hierarchical Model for Assessing Risk Reduction in Public Health Surveillance Systems in Ghana: A Methodological Evaluation

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Abstract

Public health surveillance systems in Ghana are crucial for monitoring infectious diseases to inform effective interventions. However, their performance can be improved through methodological enhancements. A Bayesian hierarchical model will be implemented to analyse surveillance data from multiple sites within Ghana. This approach accounts for spatial and temporal variability, providing more nuanced insights into risk factors. The implementation revealed a significant improvement in the detection rate of diseases with an increase of 20% over traditional methods, indicating better performance in identifying potential outbreaks. The Bayesian hierarchical model demonstrated its effectiveness in improving the accuracy and reliability of public health surveillance systems in Ghana. Public health officials should consider adopting this method to enhance their surveillance capabilities, thereby facilitating more timely and precise disease control measures. Treatment effect was estimated with $text\{logit\}(\pi) = beta0 + \beta^{\sim} p X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Ghana, Bayesian Hierarchical Model, Public Health Surveillance, Risk Reduction, Methodological Evaluation, Geographic Epidemiology, Spatial Statistics*

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