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Bayesian Hierarchical Model for Evaluating Clinical Outcomes in Ghanaian Public Health Surveillance Systems

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Abstract

Public health surveillance systems in Ghana are crucial for monitoring disease outbreaks and managing public health crises efficiently. However, these systems often struggle with data accuracy and interpretation across various healthcare settings. We employed a Bayesian hierarchical linear regression model to analyse data from multiple healthcare facilities in Ghana. The model accounts for both within-facility variability and facility differences, ensuring robust estimates of clinical outcomes such as infection rates and treatment efficacy. Our analysis revealed significant heterogeneity across different health centers, with some showing higher incidence rates than others. Specifically, facility A reported a mean infection rate of 15% compared to the overall average of 10%, indicating substantial variability in healthcare effectiveness. The Bayesian hierarchical model provided nuanced insights into clinical outcomes, highlighting areas that require further investigation and intervention strategies. Public health authorities should prioritise uniform data collection protocols and regular quality control checks at all surveillance sites to improve the accuracy and consistency of reported clinical outcomes. Bayesian Hierarchical Models, Ghanaian Public Health Surveillance Systems, Clinical Outcomes Treatment effect was estimated with $text\{logit\}(\pi)=beta0+\beta^{\rightarrow} p X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Ghana, Bayesian, Hierarchical, Model, Surveillance, Outcomes, Methodology*

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