



Methodological Evaluation of Community Health Centre Systems in Nigeria Using Bayesian Hierarchical Models for System Reliability Assessment

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Abstract

Community health centers (CHCs) play a crucial role in Nigeria's healthcare system, yet their operational efficiency and reliability vary significantly across different regions. Bayesian hierarchical models were employed to analyse data from various CHCs, allowing for the assessment of system reliability across multiple sites while accounting for site-specific variability. Data sources included peer-reviewed articles, grey literature, and existing reports on CHC operations in Nigeria. The analysis revealed that approximately 70% of CHCs had moderate to high levels of operational efficiency, with significant variations observed between urban and rural settings. Bayesian hierarchical models provide a robust framework for evaluating the reliability of CHCs in Nigeria. The identified variability underscores the need for tailored interventions aimed at improving service delivery in underserved areas. Policy-makers should consider implementing evidence-based strategies to enhance the performance and sustainability of CHCs, particularly focusing on resource allocation and capacity building initiatives. Community Health Centers, Bayesian Hierarchical Models, System Reliability Assessment, Nigeria Treatment effect was estimated with $\text{text}\{\text{logit}\}(\pi) = \beta_0 + \beta^T p X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: African geography, Bayesian hierarchical models, community health centers, Methodological evaluation, Nigeria, System reliability assessment, Spatial statistics

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