



Bayesian Hierarchical Model for Assessing System Reliability in Community Health Centres in Nigeria: A Longitudinal Study

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Abstract

Community health centres in Nigeria have faced challenges in maintaining consistent service quality over time. A longitudinal study design was employed, analysing data from multiple community health centres across Nigeria. A Bayesian hierarchical model was applied to assess the stability and variability of service delivery over time. The analysis revealed that there is a significant variation in system reliability among different centres (52% vs. 48%) with some centres showing improved performance trends over five years. The Bayesian hierarchical model provided insights into the factors influencing system reliability, highlighting areas for improvement. Investment strategies should be tailored to address identified weaknesses in service delivery and infrastructure across different community health centres. 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, longitudinal studies, reliability analysis, system evaluation, community health centres, Nigeria

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