



# Bayesian Hierarchical Model for Assessing System Reliability in Community Health Centres, Nigeria

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## Abstract

Bayesian hierarchical models are increasingly used in reliability analysis to assess system performance across diverse settings. A Bayesian hierarchical model was employed to analyse data from CHCs in Nigeria. The model accounts for variability across different regions and integrates expert knowledge through prior distributions. The analysis revealed that the reliability of CHCs varied significantly by region, with some areas showing a 20% higher system availability compared to others. The Bayesian hierarchical approach provided nuanced insights into CHC systems' performance, offering tailored recommendations for improvement. Based on findings, specific interventions should be prioritised in regions with lower reliability scores, focusing on infrastructure and staff training. Treatment effect was estimated with  $\text{text}\{\text{logit}\}(\pi) = \beta_0 + \beta^T X_i$ , and uncertainty reported using confidence-interval based inference.

**Keywords:** *Sub-Saharan, Bayesian, Hierarchical, Reliability, Modelling, Quantitative, Evaluation*

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