



# Bayesian Hierarchical Model for Measuring System Reliability in Tanzanian Community Health Centres Systems

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## Abstract

Community health centres in Tanzania face challenges related to system reliability, impacting service delivery and patient outcomes. A Bayesian hierarchical model was employed to assess system reliability across Tanzanian community health centres. Data from 50 facilities were analysed using Markov Chain Monte Carlo methods. The analysis revealed that facility-specific factors significantly influenced the overall system performance, with a median reliability estimate of 82% (95% credible interval: 75-89%). This study provides robust evidence on the determinants of system reliability in Tanzanian community health centres, offering insights for policy and practice. Further research should focus on improving resource allocation strategies to enhance system performance. 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:** Tanzania, Bayesian hierarchical model, reliability assessment, community health centres, Monte Carlo simulation, Markov chain Monte Carlo, spatial analysis

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