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Bayesian Hierarchical Model for Assessing System Reliability in South African Community Health Centres Systems

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Abstract

Community health centres (CHCs) in South Africa play a crucial role in delivering healthcare services to underserved populations. However, there is limited evidence on their overall system reliability. A mixed-methods approach combining quantitative data from surveys and qualitative insights through interviews was employed. A Bayesian hierarchical model for assessing system reliability is applied, incorporating uncertainty in estimates through credible intervals. The analysis revealed that the proportion of CHCs meeting quality standards varied significantly across different regions (e.g., 60% in rural areas versus 85% in urban settings). Bayesian hierarchical models provided nuanced insights into system reliability, highlighting regional disparities and offering a robust framework for future evaluations. Future research should consider integrating additional data sources to enhance the model's applicability and accuracy. Treatment effect was estimated with $text\{logit\}(\pi)=beta\,0+\vec{\beta}\,p\,X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *African geography, Bayesian statistics, Hierarchical models, Mixed methods, System reliability, Quantitative analysis, Qualitative inquiry*

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