



Bayesian Hierarchical Model for Measuring System Reliability in South African District Hospitals Systems,

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Abstract

This study focuses on evaluating the reliability of district hospitals in South Africa, a critical aspect for healthcare system performance and patient outcomes. A Bayesian hierarchical model was employed to analyse the data collected from South African district hospitals over two years. The model accounts for variability within and between districts through a multi-level structure. The analysis revealed that the reliability scores varied significantly across different regions, with certain areas showing higher system performance than others. This study provides insights into how Bayesian hierarchical models can be effectively utilised to enhance the evaluation of district hospital systems in South Africa, offering a robust framework for future research and policy development. Based on this analysis, it is recommended that targeted interventions are developed to improve system reliability in regions with lower performance scores identified. Treatment effect was estimated with $\text{logit}(\pi) = \beta_0 + \beta_1 X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *African geography, Bayesian inference, Hierarchical modelling, Reliability analysis, System evaluation, District health systems, Epidemiology*

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