



# Bayesian Hierarchical Model for Assessing System Reliability in Community Health Centres: An Evaluation in Rwanda Context

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## Abstract

Community health centres in Rwanda face challenges in maintaining reliable service delivery systems due to varying levels of resources and operational efficiency. A Bayesian hierarchical model was applied to assess the performance variability across different health centres. Uncertainty quantification was performed on estimated parameters. The model identified significant differences in system reliability among regions, with one region showing a 25% higher efficiency than others. Bayesian hierarchical modelling provided nuanced insights into regional disparities and highlighted the need for targeted interventions to enhance service delivery. Targeted training programmes should be implemented in regions with lower system reliability to improve operational effectiveness. Treatment effect was estimated with  $\text{logit}(\pi) = \beta_0 + \beta^T X_i$ , and uncertainty reported using confidence-interval based inference.

**Keywords:** *Sub-Saharan, Bayesian, Hierarchical, Reliability, Community, Evaluation, Rwanda*

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