



# Methodological Evaluation of Community Health Centre Systems in Rwanda Using Bayesian Hierarchical Models to Assess System Reliability

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## Abstract

Rwanda's community health centres (CHCs) play a crucial role in primary healthcare delivery. Despite their importance, there is limited systematic evaluation of CHC systems' reliability and efficiency. Bayesian hierarchical models will be employed to assess system reliability. This approach allows for the integration of data from multiple levels (e.g., individual patient records, clinic-level metrics) within a coherent framework. Initial findings suggest that there is substantial variability in CHC performance across different regions and types of services offered. The use of Bayesian hierarchical models offers a robust method for evaluating system reliability, highlighting the need for targeted interventions to enhance service delivery and patient outcomes. Strategic planning should focus on strengthening infrastructure, training healthcare providers, and implementing data-driven quality improvement initiatives. 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:** Rwanda, Community Health Centre, Bayesian Hierarchical Model, Reliability Assessment, Spatial Analysis, Quantitative Methods, Geographic Information Systems

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