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Methodological Evaluation of Community Health Centre Systems in Rwanda Using Bayesian Hierarchical Models for Reliability Assessment

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Abstract

Community health centers (CHCs) in Rwanda play a critical role in providing accessible healthcare services to underserved populations. However, there is a need for rigorous methodological evaluation to ensure the reliability and efficiency of these systems. This study will employ Bayesian hierarchical models to analyse data from multiple CHC sites across Rwanda. The models will incorporate uncertainty quantification and allow for the estimation of site-specific reliability metrics while accounting for variability between different centers. Bayesian hierarchical models have demonstrated the ability to accurately capture both within-site and site variations in system performance, providing a nuanced understanding of reliability across diverse settings. The use of Bayesian hierarchical models offers a robust framework for evaluating CHC systems in Rwanda, offering insights into areas requiring improvement and informing policy decisions aimed at enhancing service delivery. Future research should consider expanding the scope to include additional variables that may affect system reliability, such as socioeconomic factors or technological infrastructure. Treatment effect was estimated with $text\{logit\}(\pi)=beta0+\vec{\beta} p X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *African geography, Bayesian inference, hierarchical modelling, system reliability, quantile regression, spatial analysis, randomized experiments*

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