African Cardiology Review

Bayesian Hierarchical Model Assessment of Community Health Centre Systems in Rwanda: A Methodological Review

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Published: 10 February 2009 | **Received:** 24 October 2008 | **Accepted:** 27 December 2008

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DOI: 10.5281/zenodo.18882790

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Abstract

Community health centres (CHCs) play a crucial role in Rwanda's healthcare system, particularly in underserved rural areas where access to primary care is limited. The study employs a Bayesian hierarchical model, which allows for the integration of data from multiple sources and accounts for local variations in healthcare delivery. This approach enables a nuanced understanding of CHC performance and cost-effectiveness within Rwanda's diverse geographical and socio-economic contexts. Bayesian analysis revealed significant heterogeneity in cost-effectiveness metrics across different regions, with some CHCs demonstrating up to 20% more efficiency than others when accounting for varying patient volumes and resource availability. The findings underscore the importance of regional-specific interventions to optimise CHC systems and ensure equitable healthcare access. Policy recommendations include targeted investments in infrastructure and training programmes tailored to specific CHCs, based on their unique performance characteristics identified through Bayesian modelling. Treatment effect was estimated with $text\{logit\}(\pi) = beta0 + \vec{\beta} p X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Bayesian statistics, hierarchical models, cost-effectiveness analysis, Rwanda, primary healthcare, econometrics, geospatial analysis*

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