Bayesian Hierarchical Model Assessment of Clinical Outcomes in Rural Clinics Systems, Rwanda

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Abstract

Clinical outcomes in rural clinics systems have significant implications for healthcare delivery in Rwanda. Existing models often struggle to account for variability across different clinics and regional disparities. A Bayesian hierarchical regression model was employed to estimate the effect of various clinic characteristics on patient health outcomes. Model parameters were estimated using Markov Chain Monte Carlo methods with uncertainty quantified through credible intervals. The analysis revealed a strong correlation between clinic infrastructure (e.g., availability of essential medical equipment) and clinical performance, suggesting that improvements in these areas could lead to better patient outcomes by up to 20% in some clinics. This study provides insights into how Bayesian hierarchical models can enhance the understanding of healthcare delivery systems in rural settings and inform targeted policy interventions. Public health officials should prioritise investments in infrastructure improvements, particularly in underserved rural areas where outcomes are notably lower than in urban centers. Treatment effect was estimated with $text\{logit\}(\pi) = beta\,0 + \vec{\beta}\,p\,X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Rwanda, Hierarchical Modelling, Bayesian Methods, Spatial Statistics, Clinical Trials, Random Effects, Multilevel Analysis*

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