African Hydrology Research (Earth Science focus)

Bayesian Hierarchical Model for Assessing System Reliability in Community Health Centres, Kenya

Wycliffe Koechinyũ[1]

[1] International Centre of Insect Physiology and Ecology (ICIPE), Nairobi

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Correspondence: wkoechiny@gmail.com

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Author notes

Wycliffe Koechinyũ is affiliated with International Centre of Insect Physiology and Ecology (ICIPE), Nairobi and focuses on Medicine research in Africa.

Abstract

Bayesian hierarchical models have been increasingly applied in various fields to assess system reliability, including healthcare systems. This study focuses on community health centres (CHCs) in Kenya, aiming to enhance understanding of their operational performance. A Bayesian hierarchical model was employed, incorporating data from multiple CHCs across Kenya. The model accounts for both fixed effects (e.g., geographical location) and random effects (e.g., variability within regions). Uncertainty in the model predictions is quantified using robust standard errors. The analysis revealed significant variation in system reliability among different regions of Kenya, with a notable proportion (35%) of CHCs failing to meet established service standards. This suggests substantial room for improvement in infrastructure and operational practices. The Bayesian hierarchical model provides valuable insights into the performance of CHC systems in Kenya, highlighting regional disparities that can inform targeted interventions aimed at improving system reliability. Based on the findings, a multi-faceted approach is recommended, including investment in infrastructure upgrades and training for staff to ensure better service delivery across all regions. Treatment effect was estimated with $text\{logit\}(\pi)=beta\,0+\beta^{\rightarrow}\,p\,X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *African geography, Bayesian inference, Hierarchical modelling, Reliability analysis, Community health centres, System assessment, Methodology*

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