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A Bayesian Hierarchical Model for Evaluating the Adoption of Community Health Centre Systems in Tanzania

A Methodological Case Study

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ABSTRACT

Background: Evaluating the adoption of community health centre (CHC) systems in sub-Saharan Africa is critical for improving healthcare delivery, yet existing methods often fail to account for complex, nested data structures and inherent uncertainty in measurement.

Purpose and objectives: This methodological case study presents a novel Bayesian hierarchical model to measure and analyse the adoption rates of CHC systems, demonstrating its application to a real-world evaluation in Tanzania.

Keywords: *Bayesian hierarchical modelling, Community health centres, Sub-Saharan Africa, Health systems evaluation, Adoption rates, Tanzania*

Article Highlights

- Novel three-level hierarchical logistic model for nested health system data
- Quantifies district-level heterogeneity in adoption with probabilistic estimates
- Reveals significant uncertainty in national adoption rates (95% CI: 0.42-0.51)
- Provides interpretable framework directly informing policy decisions

Methodological Contribution

Demonstrates how Bayesian hierarchical modelling formally incorporates multi-level variability and quantifies uncertainty in health system adoption evaluations.

This methodological framework is applicable to other complex intervention evaluations in resource-limited settings.