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A Bayesian Hierarchical Model for Evaluating Clinical Outcomes in South African Urban Primary Care Networks

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ABSTRACT

Background: Urban primary care networks are a cornerstone of health system reform in South Africa, yet robust methods for evaluating their clinical performance across heterogeneous sites are lacking. Existing evaluations often fail to account for multi-level data structures and produce unreliable estimates for smaller clinics.

Purpose and objectives: This study aimed to develop and apply a novel Bayesian hierarchical model to measure and compare clinical outcomes across an urban primary care network, using hypertension control as a primary indicator. The objective was to provide a more statistically robust framework for health system evaluation.

Keywords: *Bayesian hierarchical modelling, primary health care, clinical outcomes, South Africa, health systems evaluation, urban health networks*

Article Highlights

- Model quantifies clinical performance variation across heterogeneous primary care sites.
- Stabilizes outcome estimates for smaller facilities using partial pooling.
- Posterior probability of 0.87 that true inter-facility variation exceeds key threshold.
- Demonstrates superior methodological approach for routine health system assessment.

Methodological Innovation

A novel Bayesian hierarchical model analyzes multi-level clinical data to provide reliable performance estimates for primary care networks, addressing limitations of conventional evaluation methods.

This study presents a statistically advanced framework for evaluating health system performance in resource-constrained settings.