

Longitudinal Multilevel Regression Analysis of Clinical Outcomes in Rural South African Primary Care Systems, 2000–2026

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ABSTRACT

Background: Rural primary care systems in sub-Saharan Africa face persistent challenges in delivering consistent clinical quality. Robust longitudinal methods are required to evaluate systemic performance and identify modifiable factors influencing patient outcomes.

Purpose and objectives: This study aims to methodologically evaluate the performance of rural clinic systems by applying a longitudinal multilevel regression framework to measure clinical outcomes over an extended period. The objective is to quantify the variance in outcomes attributable to clinic-level versus patient-level factors.

Keywords: *Longitudinal study, Multilevel modelling, Primary health care, Rural health services, Sub-Saharan Africa, Clinical outcomes, Health systems evaluation*

Article Highlights

- Applies a three-level linear mixed model to partition variance in clinical outcomes.
- Finds clinic-level operational systems significantly influence patient results.
- Demonstrates the feasibility of longitudinal multilevel analysis using routine data.
- Provides a framework for targeted quality improvement in primary care.

Methodological Core

The analysis fits a model where patients (i) are nested within clinics (j) and measurement occasions (t): $y_{ijt} = \beta_0 + \beta X_{ijt} + u_{ij} + v_t + \varepsilon_{ijt}$.

This brief outlines the editorial presentation for a methodological health systems study.

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