



Longitudinal Panel-Data Estimation of Clinical Outcomes in Ethiopian Rural Clinic Systems

A Methodological Evaluation, 2000–2026

Yonas Tadesse^{1,2}, Meklit Gebremedhin³

¹ Department of Epidemiology, Hawassa University

² Addis Ababa Science and Technology University (AASTU)

³ Department of Pediatrics, Addis Ababa Science and Technology University (AASTU)

Correspondence: ytadesse@yahoo.com

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Author notes

Yonas Tadesse is affiliated with Department of Epidemiology, Hawassa University and focuses on Medicine research in Africa.

Meklit Gebremedhin is affiliated with Department of Pediatrics, Addis Ababa Science and Technology University (AASTU) and focuses on Medicine research in Africa.

ABSTRACT

Background: Longitudinal data from rural health clinics in low-resource settings are crucial for evaluating health system performance, yet methodological challenges in panel-data estimation for clinical outcomes persist. Existing approaches often fail to account for the complex, time-varying confounders and clinic-level heterogeneity characteristic of such systems.

Purpose and objectives: This study provides a methodological evaluation of panel-data estimators for measuring clinical outcomes within a rural clinic network. Its objective is to determine the most robust estimation strategy for deriving causal inferences from observational, clinic-level longitudinal data.

Keywords: Longitudinal study, Panel-data analysis, Health systems research, Sub-Saharan Africa, Clinical outcomes, Rural health services, Methodological evaluation

Article Highlights

- Dynamic panel estimators (System GMM) outperform static fixed-effects models.
- Nurse turnover shows significant negative association with antenatal care completion.
- Clinic-level heterogeneity requires robust estimation for causal inference.
- Methodological choice substantively influences key determinant significance.

Core Specification

Two-way fixed effects model: $Y_{it} = \alpha_i + \lambda_t + \beta X_{it} + \varepsilon_{it}$, with inference based on cluster-robust standard errors at clinic level.

This methodological evaluation underscores how estimator choice shapes inferences about health system performance.

ABSTRACT-ONLY PUBLICATION

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