

A Methodological Evaluation and Panel-Data Estimation of System Reliability in Ethiopian Community Health Centres, 2000–2026

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ABSTRACT

Background: Community health centres are critical nodes in primary healthcare systems, yet their operational reliability is poorly quantified. Existing assessments often rely on cross-sectional data, failing to capture temporal dynamics and systemic performance under varying conditions.

Purpose and objectives: This intervention study aimed to develop and apply a novel panel-data methodology for estimating the system reliability of community health centres, and to evaluate the impact of a targeted maintenance and training intervention on this metric.

Keywords: *Health Systems Research, Sub-Saharan Africa, Panel Data Analysis, Primary Health Care, System Reliability, Community Health Centres, Ethiopia*

Article Highlights

- Introduces a panel-data framework for dynamic health system reliability assessment.
- Finds a significant 15-point reliability improvement from structured intervention.
- Identifies supply chain support as the strongest driver of sustained performance.
- Advocates for integrating longitudinal metrics into routine health system monitoring.

Core Methodology

Longitudinal difference-in-differences design with a two-way fixed effects model, estimating intervention impact on a composite reliability score.

This study offers a replicable framework for evaluating health system performance over time.

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