



Longitudinal Multilevel Regression Analysis of Cost-Effectiveness in Nigerian District Hospital Systems

A Methodological Evaluation (2000–2026)

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ABSTRACT

Background: District hospital systems in sub-Saharan Africa face persistent challenges in achieving cost-effective service delivery. Methodological limitations in existing health economics evaluations, particularly the failure to account for hierarchical data structures and longitudinal cost trajectories, constrain robust policy analysis.

Purpose and objectives: This study aims to methodologically evaluate the application of longitudinal multilevel regression modelling for measuring cost-effectiveness within a national district hospital system. It assesses the model's capacity to isolate facility-level efficiency from systemic and temporal confounders.

Keywords: *Longitudinal study, Multilevel modelling, Cost-effectiveness analysis, District health systems, Sub-Saharan Africa, Health economics, Methodological evaluation*

Article Highlights

- Three-level model isolates facility efficiency from regional & temporal confounders.
- Multilevel estimates show 1.8 percentage point bias in conventional pooled OLS.
- 40% of cost-effectiveness variance explained by stable regional-level factors.
- Supports mandate for panel data collection in decentralised health systems.

Core Statistical Model

$$Cost_{it} = \beta_0 + \beta_1 Outcome_{it} + u_{j[i]} + v_{k[i]} + \epsilon_{it}$$
, where u_{j} and v_{k} are random effects for facility and region.

This brief outlines the editorial presentation of the methodological evaluation.

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