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A Systematic Review of Methodological Frameworks for Panel-Data Efficiency Estimation in Ethiopian District Hospitals, 2000–2026

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ABSTRACT

Background: District hospitals are critical nodes in Ethiopia's healthcare system, yet persistent resource constraints necessitate rigorous efficiency measurement. Panel-data econometric methods offer a robust approach for analysing efficiency dynamics over time, but the methodological frameworks applied in this specific context have not been systematically evaluated.

Purpose and objectives: This systematic review aims to identify, critically appraise, and synthesise methodological frameworks used for panel-data efficiency estimation in Ethiopian district hospitals, assessing their applicability, limitations, and evolution.

Keywords: *Health services research, Sub-Saharan Africa, Panel data, Hospital efficiency, Econometric modelling, Resource allocation, District hospitals*

Article Highlights

- Identifies predominant reliance on output-oriented stochastic frontier analysis for panel-data efficiency estimation.
- Finds frequent omission of statistical inference on inefficiency determinants in reviewed studies.
- Notes consistent evidence of substantial, unquantified heterogeneity in efficiency scores across Ethiopian regions.
- Advocates for system GMM estimators to address endogeneity and improve methodological transparency.

Primary Estimation Model

The synthesis centers on a true fixed-effects stochastic frontier model: $\ln y_{it} = \alpha_i + \beta' x_{it} + v_{it} - u_{it}$, where $u_{it} \sim N^{+}(\mu, \sigma_u^2)$.

This review critically appraises the methodological rigor of efficiency estimation frameworks applied to Ethiopian district hospitals.