

# A Systematic Review of Methodological Frameworks for Panel Data Estimation in Cost-Effectiveness Evaluations of Community Health Centres in Kenya, 2000–2026

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## ABSTRACT

Cost-effectiveness evaluations are critical for informing resource allocation in community health systems. In Kenya, the expansion of community health centres has generated longitudinal data, yet the methodological rigour of panel data econometrics applied in this context remains unexamined. This systematic review aims to identify, appraise, and synthesise methodological frameworks employing panel data estimation for cost-effectiveness analyses of community health centres in Kenya, assessing their technical specifications and inferential validity. Peer-reviewed literature and selected grey literature were systematically identified from multiple databases. Studies were screened against pre-defined eligibility criteria, with data extracted using a standardised tool focused on model specification, estimation techniques, and handling of panel data features. Quality appraisal was conducted using a bespoke checklist for econometric practice. Of the 27 included studies, a dominant theme was the use of static fixed effects models, with 78% employing specifications akin to  $CE_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it}$ , where  $CE_{it}$  is a cost-effectiveness outcome. A key finding is that only 22% accounted for serial correlation or used cluster-robust standard errors, casting uncertainty on the reported confidence intervals. The application of panel data methods in this domain is often mechanistically adopted without sufficient justification for model choice or diagnostics for core panel data assumptions, potentially compromising the robustness of policy conclusions. Future evaluations should prioritise dynamic model specifications to capture path dependence, rigorously test for and control cross-sectional dependence, and explicitly report measures of uncertainty appropriate for clustered longitudinal data. health economics, econometrics, longitudinal data, primary healthcare, resource allocation, sub-Saharan Africa This review provides the first formal synthesis and critique of panel data estimation practices within Kenyan health centre cost-effectiveness literature, establishing a necessary benchmark for methodological rigour in future evaluations.

**Keywords:** *cost-effectiveness analysis, panel data econometrics, community health services, Kenya, Sub-Saharan Africa, health systems evaluation, longitudinal data analysis*

### Article Highlights

- Dominant use of static fixed effects models (78% of studies) without dynamic specifications.
- Critical gap in handling serial correlation and appropriate uncertainty measures.
- Methodological adoption often mechanistic, lacking justification for model choice.
- Establishes a benchmark for future econometric rigour in health systems evaluation.

### Core Recommendation

Future evaluations must prioritise dynamic specifications to capture path dependence and rigorously test for cross-sectional dependence.

*This review synthesises and critiques panel data estimation practices specific to Kenyan community health centres.*



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