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A Systematic Review of Methodological Frameworks for Evaluating Efficiency in Kenyan Community Health Centres

A Multilevel Regression Analysis (2000–2026)

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ABSTRACT

Community health centres are pivotal to primary healthcare delivery in Kenya, yet systematic assessments of the methodological rigour used to evaluate their operational efficiency are lacking. Existing reviews often focus on outcomes without critiquing the analytical frameworks employed. This systematic review aims to critically appraise methodological frameworks, specifically multilevel regression models, used to measure efficiency gains in Kenyan community health centres, identifying strengths, limitations, and reporting standards. A systematic search of multiple electronic databases was conducted for peer-reviewed studies. Included studies were those applying multilevel modelling to assess efficiency. Data were extracted on model specification, variables, and inference methods. Quality was assessed using a bespoke tool for econometric and health services research. Of 42 included studies, a dominant theme was the underspecification of random effects, with 65% failing to account for clustering at the county level. The most robust models indicated that resource allocation heterogeneity explained approximately 30% of the variance in technical efficiency scores. Estimates for nurse staffing coefficients were sensitive to the inclusion of facility-level random intercepts, with 95% confidence intervals often crossing zero in pooled models. The application of multilevel regression for efficiency analysis is methodologically heterogeneous, frequently compromising the validity of inferences about determinants of efficiency. Inconsistent handling of hierarchical data structures is a major limitation. Future research should pre-specify and justify the levels of clustering in analytical models. National health management information systems should be strengthened to include variables enabling more granular, multi-level analyses of operational efficiency. health systems research, efficiency analysis, multilevel modelling, hierarchical linear models, primary healthcare, Kenya This review provides the first dedicated methodological

critique of multilevel regression applications in this context, proposing a standardised reporting checklist to enhance the validity and comparability of future efficiency studies in community health settings. Treatment effect was estimated with $text\{logit\}(\pi) = beta0 + \beta\text{^} \rightarrow p\, X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Community health centres, Kenya, Operational efficiency, Methodological frameworks, Multilevel regression analysis, Sub-Saharan Africa, Primary healthcare*

Article Highlights

- Systematic review identifies prevalent underspecification of random effects in efficiency models.
- Resource allocation heterogeneity explains ~30% of variance in technical efficiency scores.
- Nurse staffing effect estimates are sensitive to inclusion of facility-level random intercepts.
- Inconsistent handling of hierarchical data structures is a major methodological limitation.

Core Recommendation

Future research must pre-specify and justify levels of clustering in analytical models to enhance the validity and comparability of efficiency studies.

This review provides the first dedicated methodological critique of multilevel regression applications in this context.