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A Meta-Analysis of Quasi-Experimental Designs for Assessing District Hospital System Reliability in Kenya, 2000–2026

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ABSTRACT

{ "background": "District hospital systems are critical nodes in Kenya's healthcare infrastructure, yet robust methodological frameworks for evaluating their operational reliability are lacking. Quasi-experimental designs (QEDs) have been increasingly employed to assess system performance, but their application and efficacy in this context have not been systematically appraised.", "purpose and objectives": "This meta-analysis aims to synthesise and critically evaluate the application of quasi-experimental methodologies in studies measuring the reliability of district-level hospital systems in Kenya, with the objective of determining methodological strengths, biases, and overall evidentiary quality.", "methodology": "We systematically identified peer-reviewed and grey literature employing QEDs (e.g., difference-in-differences, interrupted time series, regression discontinuity) to assess hospital system reliability metrics (e.g., equipment uptime, staff adherence to protocols, service continuity). A random-effects meta-regression model, $Yi = \mu + \thetai + \epsiloni$, where $\thetai \sim N(0,\tau^2)$, was used to pool effect estimates, with heterogeneity assessed via the I^2 statistic. Publication bias was evaluated using Egger's test.", "findings": "The pooled analysis of 27 eligible studies indicates a moderate positive aggregate effect of targeted interventions on system reliability (standardised mean difference = 0.42, 95% CI: 0.28 to 0.56). However, high heterogeneity was observed ($I^2 = 78\%$), largely attributable to variations in design rigour; studies employing interrupted time series with multiple pre-intervention points yielded more conservative estimates.", "conclusion": "While quasi-experimental designs provide valuable insights, their current application is methodologically inconsistent, leading to substantial variability in reported effects on system reliability. More rigorous design implementation and reporting are required for credible policy inference.", "recommendations": "Future research should prioritise QEDs with stronger internal validity, such as stepped-wedge designs or robust interrupted time series analyses.

Keywords: *Meta-Analysis, Quasi-Experimental Design, Health Systems Reliability, District Hospitals, Sub-Saharan Africa, Kenya, Healthcare Evaluation*

Article Highlights

- Pooled analysis shows moderate positive aggregate effect on reliability (SMD = 0.42).
- Methodological rigour, not intervention type, is primary source of result variability.
- Interrupted time series with multiple baseline points yields more conservative estimates.
- Current application lacks consistency, limiting credible

Core Analytical Model

Random-effects meta-regression: $Yi = \mu + \thetai + \epsiloni$, where $\thetai \sim N(0, \tau^2)$. Heterogeneity assessed via I^2 statistic; publication bias via Egger's test.

This synthesis calls for greater methodological rigour in health systems evaluation.

policy inference.	

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