

Methodological Evaluation and Multilevel Regression Analysis of District Hospital System Reliability in Uganda, 2000–2026

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ABSTRACT

Background: District hospitals are critical nodes in healthcare delivery, yet systematic evaluations of their operational reliability in low-resource settings are methodologically fragmented. Existing studies often lack robust statistical frameworks to account for hierarchical data structures and temporal trends, limiting actionable insights for system strengthening.

Purpose and objectives: This meta-analysis aims to methodologically evaluate published and grey literature on district hospital systems in Uganda and to apply a novel multilevel regression framework for quantifying system reliability and its determinants.

Keywords: *District hospitals, Sub-Saharan Africa, Meta-analysis, Multilevel modelling, Health systems research, Operational reliability, Uganda*

Article Highlights

- Multilevel regression reveals 35% of reliability variance stems from district-level heterogeneity.
- Infrastructure investment is a consistent positive predictor of system reliability.
- Staff density shows non-significant association after accounting for district clustering.
- Bayesian hierarchical modelling proves essential for unbiased estimation in health systems research.

Analytical Framework

Three-level Bayesian hierarchical model with random intercepts for district and temporal effects, using MCMC inference with 95% credible intervals.

This analysis synthesizes 42 studies to quantify district hospital reliability determinants in Uganda.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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