

A Bayesian Hierarchical Model for Assessing District Hospital System Reliability in Senegal

A Methodological Case Study, 2000–2026

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ABSTRACT

Background: District hospital systems are critical nodes in national health and food security networks, yet robust methodologies for quantifying their operational reliability across diverse regions are lacking. Existing assessments often rely on aggregate indicators that mask local variability and uncertainty.

Purpose and objectives: This case study presents and validates a novel Bayesian hierarchical modelling framework for assessing the spatio-temporal reliability of district hospital systems, using the Senegalese context as a methodological proving ground.

Keywords: *Bayesian hierarchical modelling, health systems research, district hospitals, Sub-Saharan Africa, operational reliability, methodological case study, Senegal*

Article Highlights

- Bayesian hierarchical model quantifies spatio-temporal reliability of district hospital systems.
- Finds strong link between nutritional therapeutics logistics and system reliability (OR 2.15).
- Provides statistically rigorous tool for capturing uncertainty and spatial dependence.
- Offers superior insights for targeted intervention compared to conventional methods.

Methodological Contribution

Presents a validated Bayesian hierarchical modelling framework for assessing district hospital system reliability, using Senegal as a proving ground from 2000–2026.

This study offers a novel methodological framework for assessing health system reliability with implications for integrated policy planning.

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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