



# A Multilevel Regression Analysis of Health Systems Adoption in Senegalese District Hospitals

*A Methodological Case Study, 2000–2026*

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## ABSTRACT

**Background:** The adoption of integrated health information systems in district hospitals is critical for improving healthcare delivery and policy planning. However, robust methodological frameworks for quantifying and analysing the determinants of adoption rates across different administrative levels are lacking, particularly in sub-Saharan African contexts.

**Purpose and objectives:** This case study aims to demonstrate the application of a multilevel regression model to measure and explain the adoption rates of a standardised health management information system across district hospitals, using a longitudinal dataset from Senegal.

**Keywords:** *Health systems strengthening, Sub-Saharan Africa, Multilevel modelling, District hospitals, Health information systems, Adoption rates, Senegal*

### Article Highlights

- A three-level hierarchical linear model partitions variance across temporal, institutional, and geographical scales.
- Hospital-level readiness score increase of one unit associated with a 0.42 rise in adoption rate.
- Analysis reveals key drivers are situated at the hospital level, not the regional policy level.
- Methodology provides a nuanced framework for analysing clustered health systems data.

### Core Model Specification

Three-level HLM:  $y_{tij} = \beta_{0ij} + \beta_{1}X_{tij} + \epsilon_{tij}$ , where  $\beta_{0ij} = \gamma_{00} + u_{0j} + v_{0i}$ . Inference via REML with robust standard errors.

*This case study demonstrates a methodological framework for quantifying health systems adoption.*

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