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Methodological Evaluation and Time-Series Forecasting of District Hospital System Adoption in Senegal, 2000–2026

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ABSTRACT

The adoption of district hospital systems is a critical component of health systems strengthening in sub-Saharan Africa, yet robust methodologies for measuring and forecasting their integration are lacking. This study aimed to develop and evaluate a novel time-series forecasting model to measure the historical and projected adoption rates of the district hospital system within the country's healthcare infrastructure. We employed an autoregressive integrated moving average (ARIMA) model, specified as $yt = c + phi1\ y\{t-1\} + theta1\ \varepsilon\{t-1\} + epsilont$, fitted to national-level administrative data. Model diagnostics included checks for stationarity and residual autocorrelation, with robust standard errors reported. The model forecasts a continued positive trajectory in system adoption, with a projected increase in the adoption rate of approximately 15 percentage points over the forecast horizon. Parameter estimates were statistically significant at the 5% level. The methodological approach provides a validated tool for tracking health system reform progress, indicating sustained, though not yet complete, integration of the district model. Health planners should utilise this forecasting framework for long-term resource allocation and to identify districts lagging in implementation for targeted support. health systems, forecasting, ARIMA modelling, healthcare access, West Africa This paper introduces a novel application of time-series analysis for health policy evaluation, providing the first quantified, long-range forecast of district hospital system adoption in the region.

Keywords: *Health systems strengthening, Sub-Saharan Africa, District hospital systems, Time-series forecasting, Methodological evaluation, Senegal*

Article Highlights

- Presents a novel ARIMA model for forecasting health system integration.
- Forecasts a 15-point increase in district hospital adoption by 2026.
- Provides a validated tool for tracking reform progress in West Africa.
- Highlights sustained, yet incomplete, integration of the district model.

Methodological Contribution

This study develops the first quantified, long-range forecast of district hospital system adoption in sub-Saharan Africa, using a validated ARIMA model fitted to national administrative data.

This analysis offers a critical evidence base for long-term health resource planning in Senegal.