



A Methodological Evaluation of Community Health Centres in Uganda

A Time-Series Forecasting Model for Adoption Rate Measurement, 2000–2026

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ABSTRACT

The evaluation of public health interventions in sub-Saharan Africa is often constrained by a lack of robust, longitudinal methods to measure systemic adoption. This methodological gap impedes the accurate assessment of community health centre (CHC) integration and its long-term sustainability. This case study aimed to develop and validate a time-series forecasting model to measure the adoption rate of CHC systems, providing a methodological framework for evaluating their integration within national health systems. A case study design was employed, utilising longitudinal administrative data. The core methodology was an autoregressive integrated moving average (ARIMA) model, specified as $Y_t = \mu + \phi_1 Y_{t-1} + \theta_1 \varepsilon_{t-1} + \varepsilon_t$, where Y_t is the adoption rate at time t . Model diagnostics included checks for stationarity and residual autocorrelation, with forecast uncertainty quantified using 95% prediction intervals. The model forecasts indicate a decelerating trend in the rate of new CHC adoption, with the annual growth rate projected to fall below 2% within the forecast horizon. This deceleration is robust to different model specifications, as indicated by narrow prediction intervals in the near-term forecasts. The developed forecasting model provides a replicable, quantitative tool for tracking health system integration, revealing a significant transition from rapid

expansion to a phase of consolidation within the CHC system. Health policymakers should employ such forecasting models for strategic resource allocation. Future research should integrate socioeconomic covariates to improve model specificity and policy relevance. health systems research, time-series analysis, forecasting, adoption rate, public health evaluation, ARIMA modelling This paper provides a novel application of ARIMA modelling to measure the longitudinal adoption of community health infrastructure, offering a methodological advance for health systems evaluation in resource-constrained settings.

Keywords: *Community health centres, Sub-Saharan Africa, Time-series forecasting, Adoption rate, Public health evaluation, Uganda, Methodological evaluation*

<p>Article Highlights</p> <ul style="list-style-type: none"> • Develops a replicable ARIMA model to quantify community health centre adoption rates. • Forecasts reveal a significant deceleration in the rate of new CHC integration. • Provides a methodological framework for longitudinal health systems evaluation. • Highlights the utility of forecasting for strategic resource allocation in public health. 	<p>Core Methodology</p> <p>Autoregressive Integrated Moving Average (ARIMA) model applied to longitudinal administrative data from Uganda (2000–2026), with diagnostics for stationarity and residual autocorrelation.</p> <p><i>This paper offers a quantitative tool for tracking health system integration in resource-constrained settings.</i></p>
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