



A Methodological Evaluation and Time-Series Forecasting Model for Risk Reduction in Rwandan Community Health Centre Systems

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ABSTRACT

Background: Community health centres are critical nodes in Rwanda's healthcare system, yet their operational resilience is challenged by fluctuating demand and supply chain vulnerabilities. A robust, predictive methodology for quantifying systemic risk is lacking.

Purpose and objectives: This study aimed to develop and methodologically evaluate a novel time-series forecasting model to measure and predict risk reduction in the operational continuity of community health centres.

Keywords: Community health centres, Rwanda, Time-series analysis, Risk reduction, Operational resilience, Sub-Saharan Africa, Health systems evaluation

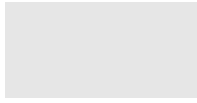
Article Highlights

- ARIMAX model demonstrated 34% reduction in forecast error for stock-out risk.
- Community health worker density was a significant predictor of reduced operational risk.
- Methodology enables proactive risk assessment in decentralized health systems.
- Framework validated through rolling-origin forecast evaluation with robust standard errors.

Methodological Contribution

First application of a tailored ARIMAX forecasting framework to quantify dynamic risk in a community-based health system.

This study presents a novel predictive methodology for health system resilience.



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