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A Methodological Evaluation and Time-Series Forecasting Model for Yield Improvement in Rwanda's Public Health Surveillance Systems (2000–2026)

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ABSTRACT

Background: Public health surveillance systems in Rwanda have undergone significant development, yet methodological frameworks for quantitatively evaluating their yield—defined as the actionable information generated per unit resource—are lacking. This gap impedes the optimisation of system performance and resource allocation for future health threats.

Purpose and objectives: This protocol details a study to methodologically evaluate the yield of Rwanda's integrated disease surveillance system and to develop a robust time-series forecasting model for yield improvement. The primary objective is to generate a validated predictive tool for public health planning.

Keywords: *Public health surveillance, Sub-Saharan Africa, Time-series analysis, Yield improvement, Methodological evaluation, Rwanda*

Article Highlights

- Proposes a quantitative framework to evaluate surveillance yield—actionable information per resource.
- Details a SARIMA model for forecasting system performance in Rwanda (2000–2026).
- Aims to generate a validated predictive tool for public health planning and resource allocation.
- Recommends integration into national health information systems for routine monitoring.

Core Forecasting Model

Seasonal ARIMA (SARIMA) formulation: $Y_t = \mu + \varphi_1 Y_{t-1} + \Theta_{12} Y_{t-12} + \varepsilon_t$, with parameters estimated via maximum likelihood and 95% prediction intervals for uncertainty.

This article presents a study protocol; empirical findings from model calibration are forthcoming.