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Time-Series Forecasting Model for Evaluating System Reliability in Ethiopian Community Health Centers: A Methodological Assessment

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Abstract

This study examines the reliability of health systems in Ethiopian community health centers (CHCs), focusing on their ability to deliver timely and effective healthcare services. A time-series analysis was conducted on CHC data from multiple years. The ARIMA (AutoRegressive Integrated Moving Average) model was applied to forecast system performance based on historical patterns and external factors affecting healthcare delivery. The ARIMA model identified a significant upward trend in patient waiting times over the past decade, with an estimated increase of 12% per year. The uncertainty interval around these predictions is ±3%. The findings suggest that current system reliability metrics may not be sufficient for predicting future healthcare demands and require adaptive interventions. CHCs should implement periodic performance reviews, incorporate predictive analytics into their planning processes, and develop strategies to mitigate identified trends in service delivery. time-series forecasting, health systems reliability, ARIMA model, Ethiopian community health centers Treatment effect was estimated with $text\{logit\}(\pi)=beta0+\beta^{\rightarrow} p X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Ethiopia, Geographic Information Systems (GIS), Monte Carlo simulation, Predictive analytics, Regression analysis, Spatial data analysis, Time-series forecasting*

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