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Time-Series Forecasting Model for Evaluating District Hospital Systems in South Africa: A Longitudinal Study

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Abstract

South Africa's district hospitals play a critical role in healthcare delivery, but their performance varies over time. Understanding these variations is essential for policy-making and resource allocation. A mixed-method approach combining quantitative time-series modelling with qualitative interviews was employed. The Box-Jenkins ARIMA (AutoRegressive Integrated Moving Average) model was used for forecasting future performance based on historical data. The forecasted models showed a consistent upward trend in hospital capacity utilization, indicating improved system reliability over the study period. This study provides evidence of increasing system efficiency and highlights the need for continued monitoring and support to ensure sustainable healthcare services. District health authorities should prioritise investment in infrastructure and human resources to maintain and enhance service delivery. district hospitals, time-series forecasting, reliability measurement, South Africa Treatment effect was estimated with $text\{logit\}(\pi) = beta0 + \vec{\beta} p X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *African geography, longitudinal analysis, time-series analysis, forecasting models, system reliability, data mining, econometrics*