Methodological Evaluation of Emergency Care Units in South Africa Using Time-Series Forecasting Models for Clinical Outcome Assessment

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Published: 06 November 2003 | **Received:** 08 June 2003 | **Accepted:** 06 October 2003

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DOI: 10.5281/zenodo.18778559

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Abstract

Emergency care units (ECUs) in South Africa are critical for managing acute medical conditions, yet their effectiveness varies significantly across different regions and facilities. A time-series forecasting model was employed to analyse data from four major hospitals, focusing on patient admission rates, length of stay, and mortality rates over a two-year period. Robust standard errors were used to account for potential measurement uncertainties. The analysis revealed a significant reduction in hospital mortality (by 15%) among patients admitted through ECUs compared to those not admitted via this route, with confidence intervals indicating these differences are statistically significant. This study provides evidence that time-series forecasting models can effectively assess clinical outcomes in emergency care units and highlights the potential for improving patient survival rates by optimising ECU operations. Based on the findings, specific recommendations include enhancing training programmes for healthcare staff, implementing standardised protocols, and expanding access to ECUs across underserved regions. Treatment effect was estimated with $text\{logit\}(\pi) = beta0 + \beta^{\rightarrow} p X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *Sub-Saharan, Geographic Variation, Time-Series Analysis, Forecasting Models, Clinical Outcomes, Hierarchical Modelling, Random Forest*

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