



Spatiotemporal Analysis and Time Series Forecasting of Malaria Death Rates in African Countries: Progress Towards SDG 3.3 by 2030 Using Advanced Time Series Models

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Malaria remains a major public health threat in Africa. Progress since 2000 is threatened by persistent transmission and resistance, jeopardizing the 2030 elimination goal (SDG 3.3). This study analyzes historical trends and forecasts future malaria death rates to evaluate Africa's trajectory. Annual malaria death rate data (2000–2021) for 54 African nations were analyzed spatiotemporally. Eight time-series models, including ARIMA and Exponential Smoothing (ETS), forecasted death rates through 2030. Performance was assessed using the Symmetric Mean Absolute Percentage Error (sMAPE).

The mean death rate was 50.32 per 100,000, with the highest burdens concentrated in West and Central Africa. The ETS model yielded the most accurate forecasts (e.g., Ghana sMAPE=1.40%). Projections to 2030 show divergent trends: while countries like Eswatini approach elimination (0.34/100,000), high-burden nations like Niger (131.96) and Sierra Leone (100.82) will maintain elevated mortality, missing the SDG 3.3 target.

While Africa has reduced malaria mortality, gains are uneven. Forecasts suggest that without intensified, targeted interventions, many high-burden countries will not achieve the 2030 goal. Precision public health strategies are critical to address these persistent hotspots.

