Optimizing Rapid Diagnostic Test Allocation for Lassa Fever in Ebonyi State, Nigeria
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Background

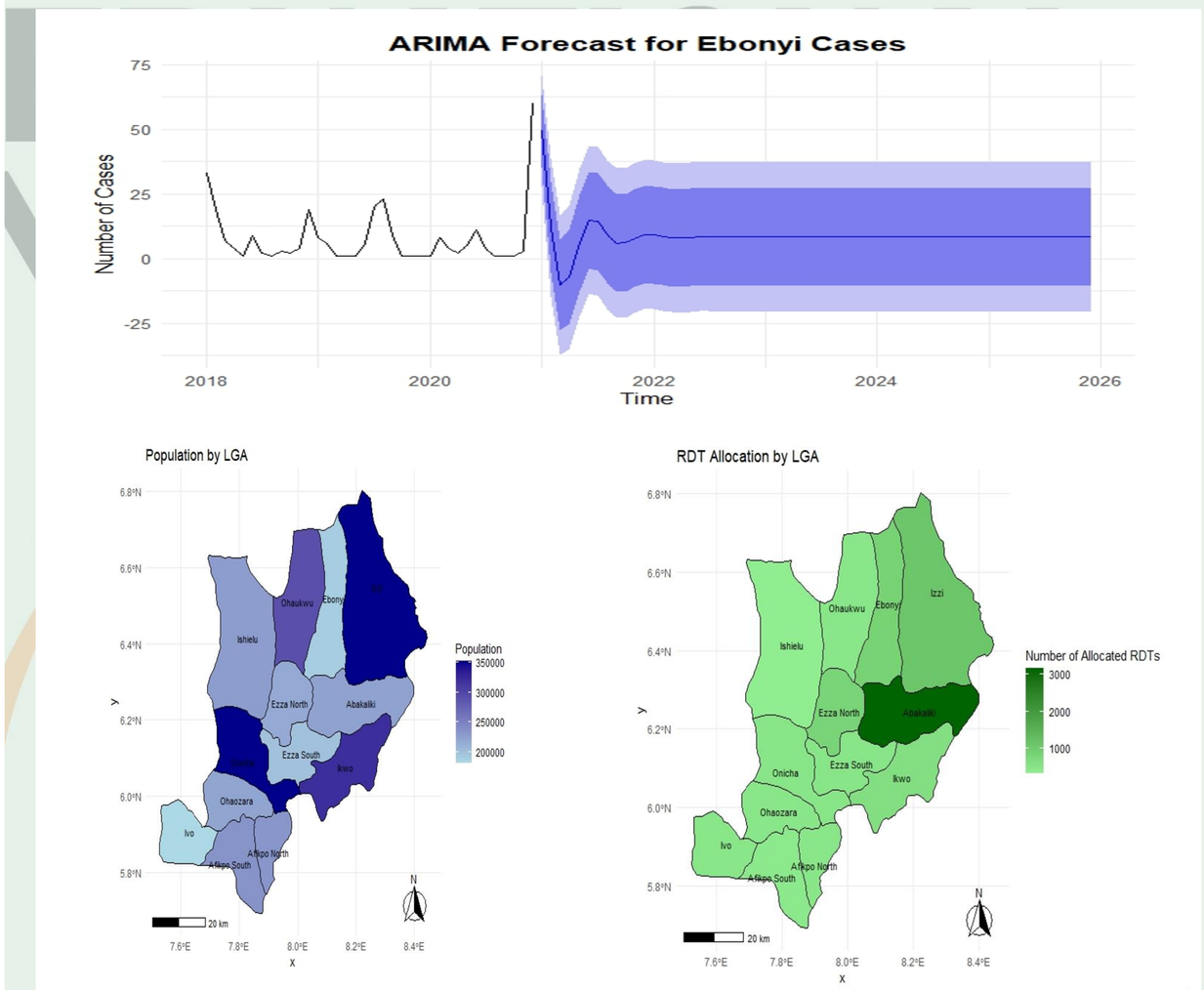
Lassa fever (LF) remains a public health threat in Nigeria, with Ebonyi State experiencing recurrent outbreaks. Rapid diagnostic tests (RDTs) are crucial for early detection and outbreak control. Additionally, RDT allocations are uneven especially in resource-limited settings. This scarcity necessitates data-driven allocation strategies, and to the best of our knowledge, no study has assessed this. This study therefore addresses the challenge of equitable RDT distribution by integrating temporal trends and geographic burden to optimize diagnostic coverage.

Methods

We analyzed a five-year (2018–2022) dataset of LF cases from Ebonyi State and assessed temporal trends, seasonality and outbreak patterns using time-series decomposition. Using LF cases per LGA and incorporating LGA population densities, we developed a weighted resource-allocation model which prioritized high-burden LGAs while ensuring baseline coverage for lower-incidence regions. LF case distribution and RDT allocation were visualized using geospatial mapping.

Results

Temporal analysis revealed peak incidence during dry seasons (January–April), correlating with increased human-rodent interactions. The ARIMA model forecasted recurrent outbreaks with 85% accuracy. The model allocated 18.5% of available RDTs to Abakaliki (with the highest burden) and 1.5% to Ivo (with the lowest burden). Two LGAs (Abakaliki and Izzi) which accounted for 25% of the state's population, contributed 40% of LF cases. Geospatial analysis highlighted mismatches between population density and disease burden, informing a need for targeted RDT distribution



Conclusions and Recommendations

This study demonstrates the utility of temporal-geospatial modeling to guide effective RDT allocation, ensuring equitable access while maximizing outbreak detection. Our recommendations to the Ebonyi State Government include: integrated surveillance that combines epidemiological and ecological data, preemptive RDT deployment during seasonal peaks, and adoption of weighted allocation frameworks. These strategies strengthen laboratory networks by aligning diagnostics with real-time demand, a critical step toward achieving Nigeria's Lassa fever control goals.

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