Modelling the Impact of Asymptomatic Populations on the Effectiveness of Mass Testing on Lassa Fever Incidence in Edo State, Nigeria.

Simiat Titilola Adeogun
adeogunsimiat@gmail.com

Background

- Lassa Fever (LF) is a viral zoonotic disease of major public health concern in West Africa
- Endemic in Nigeria

As of September, 2024	
Nigeria	**Edo State**
8251 Suspected case	**2462** Suspected case
1005 Confirmed case	**230** Confirmed case
16.9% CFR	**11.7%** CFR

- Diagnosis is challenging
- LF symptoms are non-specific
- About 80% of cases are asymptomatic, resulting in large numbers of undetected infections.

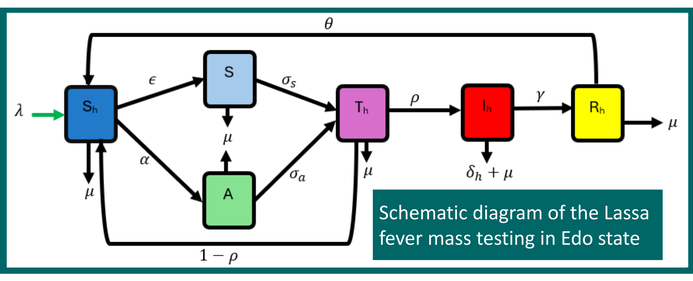
The silent role of asymptomatic carriers poses a critical barrier to control, raising questions about the true effectiveness of mass testing strategies.

This study therefore models the impact of asymptomatic populations on the effectiveness of mass testing in reducing LF incidence in Edo State, Nigeria.

Methods

- **Study design:** Cross-sectional analytical study
- **Model parameters:** Derived via an exhaustive literature review on LF transmission and testing dynamics

Data analysis
- Microsoft Excel 365 for descriptive statistics.
- Python and R (v4.4.2)
- Sensitivity analysis



Schematic diagram of the Lassa fever mass testing in Edo state

Model framework
- Modified SEIR deterministic compartmental model.
- Symptomatic and asymptomatic groups.
- Testing compartment

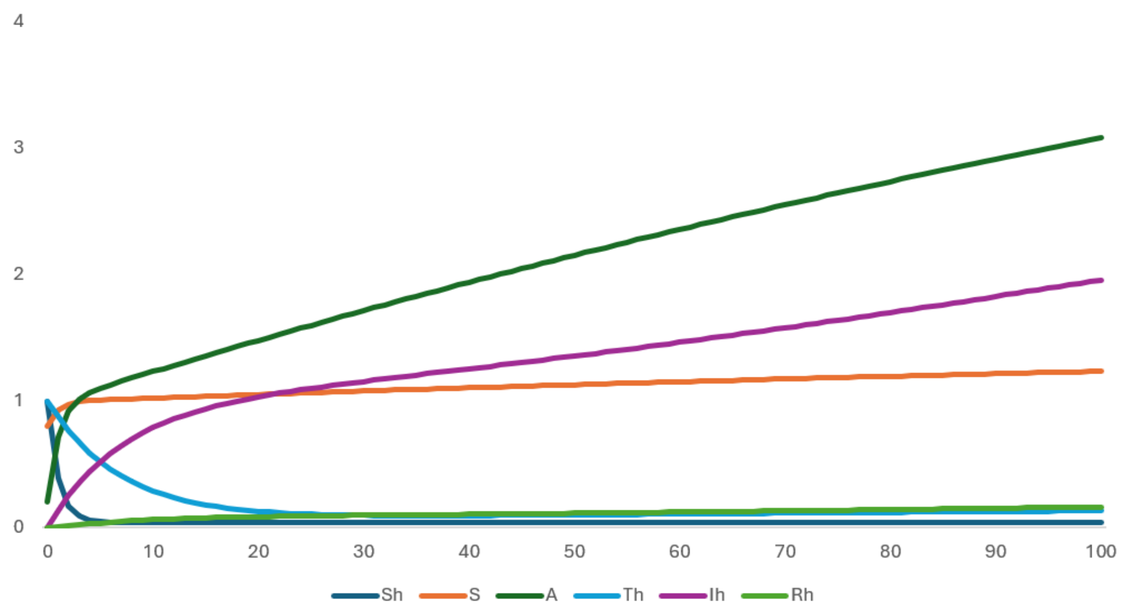
Data source: LF incidence data for Edo State (2018–2024) obtained from NCDC

Simulation: Impact of mass testing evaluated under three different scenarios

System of differential equation

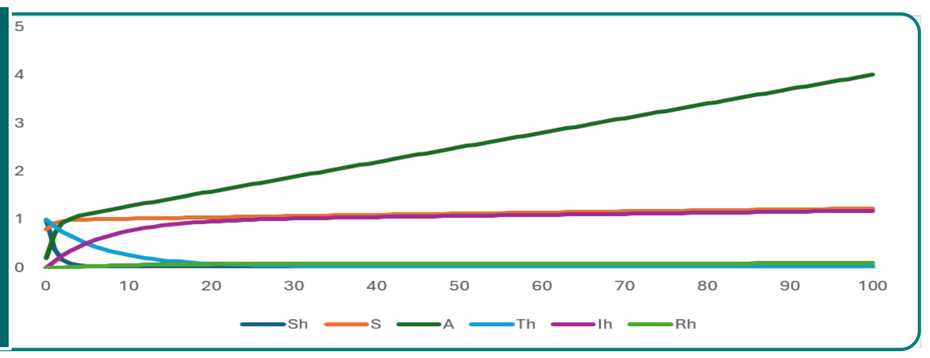
$$\frac{dS_h}{dt} = \lambda - \alpha S_h - \epsilon S_h - \mu S_h \quad (1)$$
$$\frac{dS}{dt} = \epsilon S_h - \sigma_s S - \mu S \quad (2)$$
$$\frac{dA}{dt} = \alpha S_h - \sigma_a A - \mu A \quad (3)$$
$$\frac{dT_h}{dt} = \sigma_s S + \sigma_a A - \rho T_h - \mu T_h \quad (4)$$
$$\frac{dI_h}{dt} = \rho T_h - (\delta_h + \mu) I_h \quad (5)$$
$$\frac{dR_h}{dt} = \gamma I_h - (\theta + \mu) R_h \quad (6)$$

Results

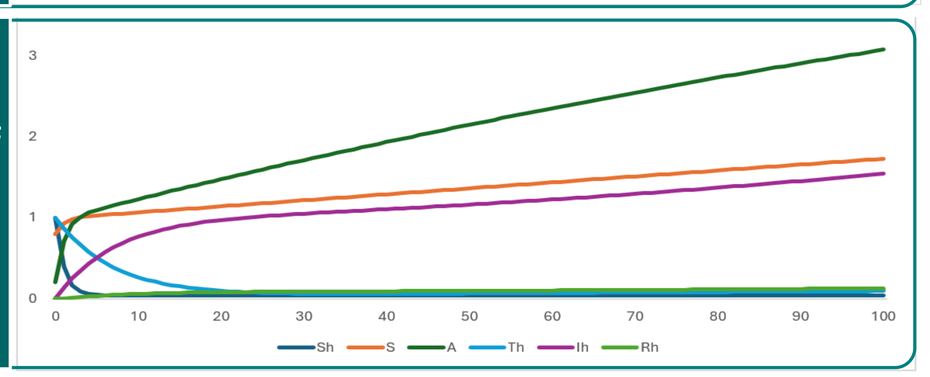


Population dynamics of Lassa fever testing the symptomatic and asymptomatic population at the same rate

Population dynamics of Lassa fever testing only the symptomatic population



Population dynamics of LF mass testing on only the asymptomatic population



Conclusions and Recommendations

- Asymptomatic carriers drive silent LF transmission in Edo State
- Excluding asymptomatic cases in testing leads to continuous rise in incidence despite rodent decline
- Mass testing is essential to uncover hidden infections
- **Scale up mass testing & integrate LF screening** into routine healthcare to detect hidden cases early
- Strengthen diagnostic capacity & surveillance
- Promote vigilance & IPC compliance among healthcare workers and communities regardless of symptoms

Contact: adeogunsimiat@gmail.com, email- +2348057727516 LinkedIn:https://www.linkedin.com/in/simiat-adeogun-219743286?