

Modelling the impact of asymptomatic populations on the effectiveness of mass testing on Lassa fever incidence in Edo State, Nigeria

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Introduction

Lassa Fever (LF) is an acute viral zoonotic disease of public health concern, particularly in West Africa. It is endemic in Nigeria with a case fatality ratio of 16.9%. Edo state is one of the country's high-burden states, accounting for about 23% of total confirmed cases and 17 deaths as of September 2024. Symptoms of LF are generally non-specific, and 80% of cases are either mild or asymptomatic, leading to several missed/undetected cases, so this study aimed to evaluate the impact of this asymptomatic population on the effectiveness of mass testing on LF incidence in Edo State, Nigeria.

Methods

This was a cross-sectional analytical study. A modified SEIR deterministic compartmental model was used to develop and simulate the impact of mass testing on LF dynamics. The modification involved bifurcating the susceptible population into symptomatic and asymptomatic and including a testing compartment. Edo State LF incidence data from 2018-2024 were extracted from the Nigeria Centre for Disease Control and Prevention (NCDC). Model parameters were derived through an exhaustive search strategy of existing relevant literature on LF transmission dynamics and testing rates. Data analysis was done using Microsoft Excel

365 for descriptive statistics, while Basic reproduction number (R0) and sensitivity analysis was by Python and R version 4.4.2. The effects of the mass testing were simulated in three scenarios.

Results

Total cases analysed were 6760, of which 1290 were positive. R0 of 7.56 was calculated. Scenario analysis revealed that mass testing of both symptomatic and asymptomatic populations provided the best results in controlling LF transmission. This was followed by testing the asymptomatic population only and then the symptomatic population only.

Conclusion

While capturing asymptomatic populations for mass testing is critical in the mitigation of LF transmission, incorporating both symptomatic and asymptomatic populations is highly recommended as an effective control strategy.