

Measuring the impact of seasonal malaria chemoprevention in Nigeria using propensity score matching for counterfactuals (2017–2019)

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Introduction

Malaria morbidity and mortality among children under five remain high in Nigeria, where transmission is highly seasonal. In 2019, we implemented seasonal malaria chemoprevention (SMC) in six states, reaching over four million eligible children.

Often, the most feasible method of assessing the impact of large-scale public health programmes is through routine data collection. However, SMC impact estimates using this approach showed lower effect sizes than the expected 75 percent reduction in cases measured from clinical trials.^[1] This could be due to differences in programme implementation, methods of measurement, data quality or contextual factors. This study, therefore, explores propensity score matching as a means of determining SMC impact when routine data are insufficient.

Methods

- We selected two intervention states in Nigeria where SMC had been implemented (Sokoto and Zamfara) in 2017–2019 and one control state (Kebbi).
- We randomly selected six local government areas (LGAs) from each intervention state and matched these 1:1 with control state LGAs according to mean annual temperature, rainfall and elevation.
- Having abstracted data from outpatient daily registers for 2017–2019 from 133 public health facilities across all LGAs, we descriptively analysed the difference in monthly rates of confirmed malaria cases between intervention and control areas.
- To estimate SMC impact, we fitted a negative binomial regression model to measure outcome. Results were expressed as incidence rate ratios (IRR) with 95 percent confidence intervals (95% CI).

Results

- We matched six pairs of intervention and control LGAs within a caliper width of 0.8.
- After adjusting for rainfall, month, year and age group, SMC sites in Zamfara showed a lower monthly rate of confirmed malaria cases than Kebbi state; however, this was not statistically significant (IRR=0.887, 95% CI=0.74–1.06, p=0.176).
- We observed similar results in Sokoto. After adjusting for co-variables, we found no evidence of an association between SMC implementation and confirmed malaria cases (IRR=0.960, 95% CI=0.804–1.147, p=0.657).

Conclusion

This analysis did not find evidence of SMC impact via routinely collected data, potentially due to confounding factors. Propensity score matching could be a suitable method to adjust for such influences if additional factors can be accounted for — such as transmission intensity and other malaria prevention interventions — to improve the quality of matching.

Reference

1. Meremikwu MM, Donegan S, Sinclair D, Esu E, Oringanje C. Intermittent preventive treatment for malaria in children living in areas with seasonal transmission. Cochrane Database of Systematic Reviews. 2012(2).

Propensity score matching could be a suitable method of determining the impact of seasonal malaria chemoprevention when routine data analysis is inadequate

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Supplementary visuals

Figure 1: Zamfara incidence rate ratios, 2017–2019

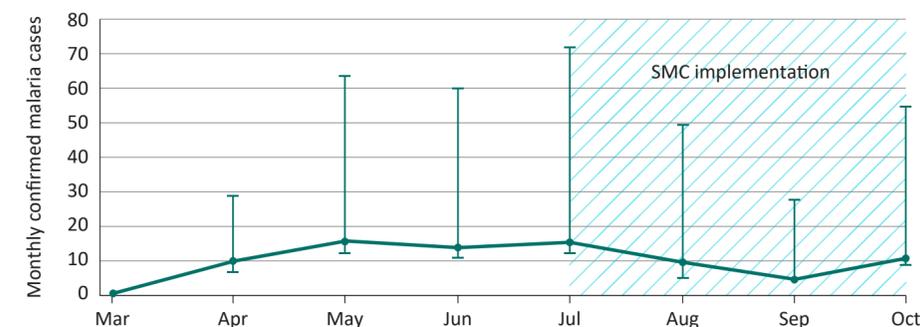
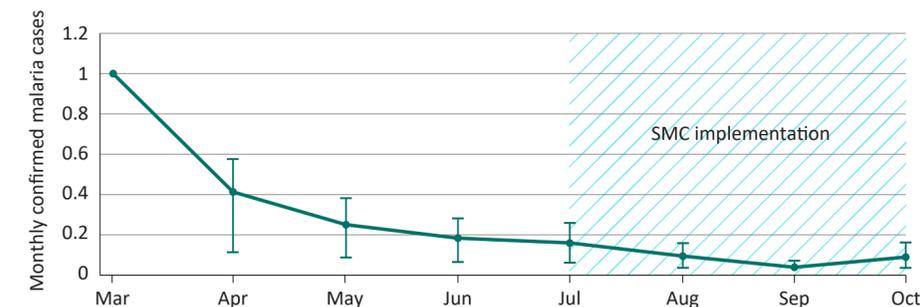


Figure 2: Sokoto incidence rate ratios, 2017–2019



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