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Measuring the impact of SMC on malaria prevalence and case distribution compared to predicted estimates from a transmission model in Burkina Faso

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Introduction

Clinical trials of seasonal malaria chemoprevention (SMC) show high impact, with around 80–85 percent of cases averted in children under five.[1] Now that SMC is routinely provided, it is important to monitor ongoing impact to assess whether effectiveness remains high, and to provide early indications of problems with coverage, adherence or drug efficacy. We are developing a model-based analysis framework that draws information from routine case data from the national health management information system (HMIS) and cross-sectional prevalence surveys (District Health Surveys/Malaria Indicator Surveys, DHS/MIS) to estimate ongoing impact of SMC.

Methods

- We calibrated a malaria transmission model,[2] to survey prevalence over time for selected health districts in Burkina Faso (DHS/MIS, 2010–2018). The model has previously been shown to replicate SMC efficacy in trials.[3] We simulated the introduction of SMC in under-fives in each district at the time of implementation, including rainfall, net use (Malaria Atlas Project) and treatment seeking (DHS/MIS).
- We fit to microscopy-confirmed malaria prevalence using maximum likelihood by varying mosquito density.
- Over 2013–2018, we compared model outputs of the proportion of clinical malaria cases in under-fives out of all children below 15 years, and impact of SMC upon this proportion, to district-level case data confirmed by rapid diagnostic tests (RDTs).
- We conducted mixed-effects logistic regression models with random intercepts for district to test for the impact of SMC on the proportion of clinical cases in under-fives, adjusting for the removal of user fees for children under five.

Results

- Preliminary analyses show that drops in prevalence for children 6–59 months following SMC implementation match model-predicted impact, assuming 70 percent coverage and full adherence (Figure 1).
- The proportion of cases in under-fives aligns well with model simulations prior to SMC; however, the change in the model predictions following SMC is more extreme than in case data (Figure 2).
- After covariate adjustment, there is a significant reduction of 25–35 percent in RDT-positive malaria cases in under-fives during implementation of SMC (July – October). This impact is seen after adjusting for the effect of the removal of user fees, which was most likely masking impact of SMC (OR=1.47 [95% CI: 1.46–1.48, p<0.001]) (Figure 3).

Conclusion

Initial results suggest that SMC is having the expected impact upon prevalence, but impact in routine data was obscured by the implementation of the removal of user fees for under-fives. Further analysis will attempt to account for this effect in order for this metric to remain useful for impact analyses.

References

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Analysing prevalence trends and age distribution of cases is a useful method for estimating the impact of SMC in Burkina Faso

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Supplementary visuals

Figure 1: Drops in population-based survey prevalence following SMC implementation match model predictions in Burkina Faso (2010, 2014, 2018)

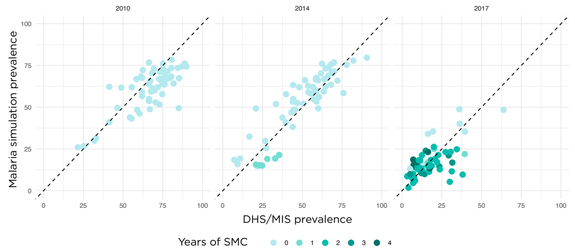


Figure 2: Ratio of clinical cases in children over five to children under five predicted by model match routine data before SMC implementation, but overestimate impact of SMC after scale-up in Burkina Faso (2013–2018)

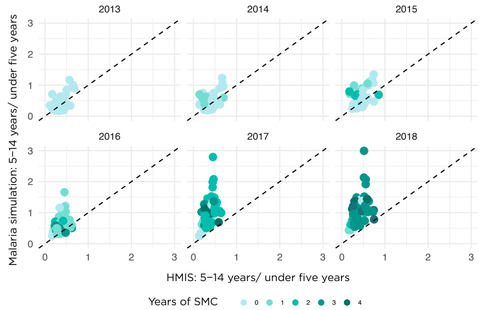
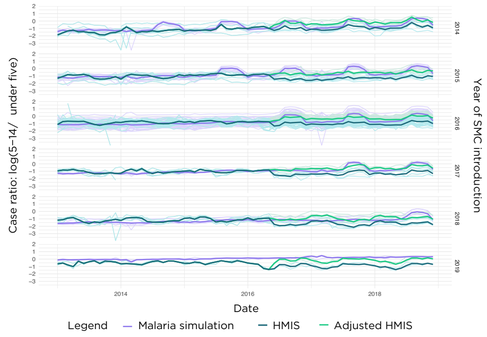


Figure 3: Crude estimates of the ratio of clinical cases in over-fives versus under-fives do not match model predictions without adjusting for the effect of changing healthcare-seeking behaviour due to removal of healthcare user fees in under-fives in 2016



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