Research and impact progress report

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1. Research

Malaria Consortium is committed to developing the seasonal malaria chemoprevention (SMC) evidence base to ensure that the program, Ministries of Health and other partners make informed decisions that support SMC programming. One way in which we do this is through conducting high-quality research that addresses knowledge gaps relating to SMC delivery, quality and impact.

In 2019, Malaria Consortium assessed the national SMC research agendas in Nigeria, Chad and Burkina Faso, as well as international research needs to generate a list of key research priorities. Priorities were considered at a five-day research workshop in Abuja, in March 2019, and three research studies were selected for 2019/20. This section of the report provides an update on the progress of these research studies.

Tailoring SMC to different malaria transmission contexts: a pilot implementation study in Burkina Faso

Malaria is endemic in Burkina Faso and transmission is highly seasonal, coinciding with the rainy season. Since 2015, Malaria Consortium has been implementing SMC from July to October every year in Burkina Faso, following the World Health Organization (WHO) recommended schedule of four monthly treatment cycles. However, in parts of the country, the rainy season now starts as early as June, with malaria incidence in children under five already increasing before the start of the SMC campaign in July.

In June 2019, Malaria Consortium implemented an additional SMC treatment cycle to eligible children in Mangodara health district in southern Burkina Faso, where the early start of the rainy season has been observed. A mixed-methods pilot implementation research study assessed whether this extension is feasible and acceptable, and its impact on malaria incidence in children 3 to 59 months, compared to 2018. Key informant interviews and focus group discussions were held with key stakeholders at the community, district and national level. Routine incidence data were also collected through the Health Management Information System (HMIS) at health facility level, but owing to a national health worker strike, these data are not currently available.

Results from an end-of-round household survey show that 87.7% (95% CI 85.6-89.5) of day 1 treatments were administered by community distributors to eligible children in Mangodara in June 2019 (additional cycle), compared to 87.2% (95% CI 83.4-90.3) for the other 23 health districts in July 2019 (cycle 1). These results suggest that if the campaign starts earlier, we can expect to see similar coverage in the first cycle compared to health districts starting the campaign in July.

Qualitative data collection was completed in February 2020, and analysis of these findings is under way. Preliminary findings suggest that caregivers, community distributors and supervisors believed that a reduction in malaria cases was associated with the earlier campaign. However, a number of concerns were identified, including the earlier cycle coinciding with agricultural work, which affects both caregivers and community distributors; difficulty accessing certain areas owing to flooding in June; remuneration issues; and lack of understanding among caregivers about why SMC started earlier. Key informants at the national and regional level suggested that there is a need for more evidence to demonstrate that distributing five treatment cycles has additional benefits over the current international recommendation of four cycles. In particular, they would like to see evidence that five treatment cycles have a bigger impact on reducing under-five mortality.

These preliminary findings suggest that while health benefits of tailoring were recognized, more evidence is needed on its impact to gain support from national and regional stakeholders.

Understanding barriers to delivery and feasibility and acceptability of extending SMC to children under ten in Chad

In line with WHO recommendations, delivering SMC to children aged 3 to 59 months is the current protocol for SMC administration in Chad. However, administrative data and coverage survey results suggest that SMC is frequently administered to children older than five. There is also a global discussion about extending the age eligibility range of SMC to ten years. A qualitative study was conducted in Massaguet district, to understand the current barriers to community distributors and caregivers delivering the intervention to children 3 to 59 months as recommended in the national SMC guidelines, as well as exploring the reasons why older children are also receiving SMC. Key informant interviews at the national and regional level, and focus group discussions with caregivers and community distributors, were held.

At the time of writing this report, a data quality assessment at 16 health centers in Massaguet is also being conducted using HMIS data. Malaria Consortium and other stakeholders use these data to routinely monitor and evaluate SMC and inform health policy decisions in Chad. Data are being assessed on the dimensions of integrity, completeness and accuracy. A clinic questionnaire is being used to allow us to identify contextual variables which predict data quality (clinic infrastructure, availability of clinical commodities, human resources), and which may identify barriers impeding effective gathering of health facility-level data. The assessment will provide evidence to inform decisions on whether future recommendations to extend SMC to older age groups should be based on HMIS data, and to identify areas for data quality improvement. Qualitative data collection was completed in March 2020 and the data quality assessment is ongoing.

Co-implementing SMC and vitamin A distribution: a pilot study in Nigeria

Vitamin A deficiency is a major public health problem in children under five in low- and middle-income countries **[1, 2]**. It is a risk factor for under-five mortality from measles and diarrhea and an important cause of preventable childhood blindness in low income countries **[3]**. Vitamin A deficiency in particular is a major risk factor contributing to child mortality in Nigeria. Administering high-dose vitamin A supplementation (VAS) twice per year to pre-school children has been shown to reduce morbidity and all-cause child mortality **[1]**. While VAS campaigns are held biannually at health facilities through the national immunization program, coverage remains low. The WHO recommends integrating VAS into other public health programs aimed at improving child survival **[4]**. To address the low VAS coverage in Nigeria, Malaria Consortium piloted its integration with door-to-door delivery during the fourth SMC treatment cycle in one local government area (LGA) in Sokoto state, where community distributors administered VAS together with SMC in October 2019 to eligible children between six months and five years. The study aimed to assess the feasibility and acceptability of co-implementing SMC and VAS; estimate the coverage of SMC and VAS; and estimate the impact of integration on the quality of SMC implementation. Integrated training and monitoring tools were developed for the purpose of this study.

We conducted key informant interviews with stakeholders at the state and LGA level, and focus group discussions with caregivers and community distributors. We also conducted baseline and endline household surveys to collect data about SMC and VAS coverage, adherence to SMC directly-observed-treatment protocol and adverse drug reactions to SMC.

Results of the study indicate that coverage of VAS in eligible children for the six months preceding the survey was 1.6% (95% CI 0.4-7.0) at baseline and 59.4% (95% CI 47.0-70.7) at endline. The integration of SMC and VAS did not affect coverage of SMC or the adherence to the directly-observed-treatment protocol.

Among those interviewed, there was general acceptance of co-implementation owing to the perceived increased health protection offered from the combination of SMC and VAS, the increased acceptance of SMC reported among caregivers following the co-implementation, and the perceived benefits of using the existing SMC delivery platform to administer VAS. Several concerns were raised, including lack of additional remuneration and increased workload for community distributors, logistical difficulties in sourcing commodities, and the need for accurate VAS administration data that is standardised and collected across existing programs. Suggested factors facilitating program sustainability included state ownership and funding, employing community distributors from the communities they serve, and continued awareness-raising, mobilization and advice at community level.

The study adds to the limited evidence base for co-implementation of SMC with nutritional supplements in Nigeria and suggests key areas for improvement for future campaigns.

Research uptake

Malaria Consortium has been committed to engaging stakeholders throughout the research cycle for the aforementioned studies through national meetings and community sensitization. National dissemination meetings will take place for all three research studies in spring and summer 2020.

An abstract for oral presentation of the results of the data quality assessment in Chad has been submitted to the Sixth Global Symposium on Health Systems Research in November 2020. Three abstracts for oral presentation of results from each research study are planned for the 2020 American Society of Tropical Medicine and Hygiene (ASTMH) Conference. Publications will be prepared and submitted to peer-reviewed journals for each research study by the end of 2020.

Malaria Consortium's research team and external relations team will work together to disseminate these findings by preparing a research brief for each study and disseminating findings on social media and other online channels.

2. Impact

Large-scale implementation of SMC programs can be expected to prevent up to 75% of uncomplicated and severe malaria episodes in targeted populations **[5]**. However, several factors can limit the potential impact of SMC when implemented at scale, including programmatic conditions such as level of coverage achieved, number of treatment cycles administered, quality and timeliness of drug delivery, as well as factors affecting the transmission and epidemiology of malaria. In addition, differences in impact estimates in controlled settings versus programs implemented at scale may be due to issues of measurement, such as access to quality data that is timely, accurate, complete and appropriate for its intended use.

To assess impact of SMC, Malaria Consortium collects data and reports on process and outcome indicators through a variety of methods including training and supervision checklists, health worker tally sheets, inventory control cards, end-of-cycle surveys using Lot Quality Assurance Sampling, and more comprehensive end-of-round coverage surveys. By demonstrating that the program has reached the expected targets, we can expect a certain level of impact. Impact indicators are then analyzed to determine whether the level of protection achieved through routine delivery is comparable to that found in controlled settings, with the understanding of the limitations in controlling for confounding factors.

To-date, efforts to validate impact estimates have focused on exploring impact indicators through external data sources, primarily data extracted from national HMIS databases. Previous analyses conducted by

Malaria Consortium assessed the strengths and limitations of using HMIS data as a source for measuring the impact of SMC. The purpose was to define factors which could be addressed to improve and strengthen HMIS in the longer term as well as identify potential complementary and alternative data sources. Based on the findings of these analyses, Malaria Consortium identified four 'next steps' to address those issues. Below is a brief description of those steps and update on progress so far.

Improving HMIS data quality and analysis

Malaria Consortium promotes the use of HMIS data for monitoring trends in disease and assessing impact of its programs as it reinforces the institutionalization of interventions, avoids the establishment of parallel systems, and contributes to strengthening health systems overall. Therefore, in parallel to other methods of assessing impact of SMC, Malaria Consortium continues to support systems for improved data reporting and adjust methods of analysis of HMIS data to generate more accurate impact estimates.

A previous analysis of district-level HMIS data in Burkina Faso highlighted issues in data quality and reporting. We expect that analyzing HMIS data at the health facility level will provide better insight into factors and causes of poor data quality and reporting, for example by identifying similar characteristics among the health facilities that are not reporting consistently. This information can be used to make adjustments to the analysis such as removing health facilities with poor data quality or, if possible, replacing missing data using appropriate imputation methods. Additionally, overlaying health facility-level HMIS data with other data sources may allow for better adjustments by factors affecting malaria transmission, such as urban versus rural, seasonality, other interventions etc. Suitable health facility-level data have been received from the Burkina Faso Ministry of Health and the analysis is currently in the early phases of data processing.

In Chad, health facility-level data are not readily available; therefore, different methods of analysis and data cleaning are being tested for how to handle issues in data quality at the district level. To account for missing data (individual line listings as well as multiple months of data) the number of cases was scaled by reporting rates and adjusted by the proportion of health facilities reporting by district. Missing data methods such as interpolation or multiple imputation by chained equations could also be employed to handle non-reporting and partial reporting of cases. The analysis is ongoing, and we are currently waiting for data from additional sources to adjust for seasonality and other factors affecting malaria transmission.

In the longer term, and subject to obtaining a model with sufficient goodness-of-fit, a secondary analysis could be attempted using a robust synthetic control method to estimate what the incidence of cases would have been for individual districts over the period 2015 to 2018 had SMC not been implemented. This method would allow for impact to be quantified in terms of overall estimated numbers of cases prevented by district over time.

An abstract for an oral presentation is planned for the 2020 ASTMH conference to summarize the analyses of data from Burkina Faso and Chad.

Monitoring sites

To address issues of quality and reporting of HMIS data, health facilities in Nigeria that met requirements of minimum quality standards and contextual factors were selected as 'monitoring sites.' Routinely collected data between the years of 2017 to 2019 from health facility registers were abstracted by independent research assistants and are currently being analyzed with appropriate regression techniques as follows:

- Intervention versus control: In Sokoto and Zamfara states, where there is full SMC coverage and no pre-intervention data, one LGA was randomly selected per senatorial district. We used propensity

score matching (matched on rainfall, temperature and proportion of cases in the four-month SMC season) to match six LGAs in each of the states with six LGAs in Kebbi, where SMC has not yet been implemented. Propensity score matching is used to reduce bias in the analysis due to confounding and ensure that any mean differences in the outcomes are due to the effects of SMC. There were nine health facilities selected in Sokoto, nine health facilities selected in Zamfara, and 18 health facilities selected in Kebbi.

- Before and after: In Jigawa state, where there is full coverage of SMC and pre-intervention data, a before and after analysis will be conducted. Two LGAs were selected per senatorial zone. A total of 36 health facilities were selected.

The project is currently in the analysis phase and results are expected to be submitted as an abstract to ASTMH, as well as in a manuscript to a peer-reviewed journal.

Triangulation of data

An analysis using national-level household survey data is being conducted to triangulate with results coming from routinely collected data from health facility registers, as well as data reported through HMIS. Demographic and health surveys (DHS) are nationally representative household surveys that collect data for indicators on population, health and nutrition. As part of the DHS program, stand-alone surveys on special topics are also conducted, including malaria indicator surveys (MIS). Data from DHS and MIS were merged with SMC program data, rainfall data and temperature data to assess the impact of SMC in Burkina Faso.

The analysis will be conducted at both the district and individual level. At the district level, trends in malaria prevalence, rainfall, temperature and malaria intervention coverage will be analyzed to understand the context and provide insight into what adjustments need to be taken for the individual-level analysis. To assess impact at the individual level, a multilevel logistic regression will be conducted adjusting for factors affecting point prevalence of malaria in children.

The analysis is ongoing and planned to be replicated for the other SMC countries. Preliminary results are planned to be presented as an abstract at the ASTMH conference and in a manuscript in a peer-reviewed journal.

Research on impact

Malaria Consortium had considered conducting research studies using a cohort study design to evaluate the impact of SMC. However, currently efforts are focused on improving methods of analyzing routinely collected data and data already available from other sources to generate more accurate estimates of impact. Research studies may be being considered based on feasibility and context in the future.

In addition to the manuscripts outlined above, a research brief on Malaria Consortium's approach to measuring impact of SMC is planned for the last quarter of 2020, for publication on Malaria Consortium's website.

References

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