malaria consortium
disease control, better health

2018 seasonal malaria chemoprevention coverage report

Burkina Faso, Chad and Nigeria

Final report

July 2019

Report compiled by: Christian Rassi, Program Director - SMC
Maddy Marasciulo, US Representative, Global Case Management Specialist

Acknowledgements: Louise Maranda, Epidemiologist
Benoît Sawadogo, Monitoring and Evaluation Coordinator
Azoukalne Moukenet, Data Analyst
Abraham Ahmadu, Monitoring & Evaluation Specialist
Diego Moroso, Program Director - SMC

Table of Contents

Acronyms and Abbreviations

ACCESS-SMC	Achieving Catalytic Expansion of Seasonal Malaria Chemoprevention in the Sahel
AQ	Amodiaquine
CI	Confidence Interval
CHW	Community Health Worker
CHEW	Community Health Extension Worker
COSSOCIM	Conseil en Sciences Sociales Communication Interculturelle et Marketing
DOT	Directly Observed Therapy
EoC	End-of-cycle
EoR	End-of-round
INSTech	Institut de Sciences & Techniques
LGA	Local Government Area
LQAS	Lot Quality Assurance Sampling
M&E	Monitoring & evaluation
OPM	Oxford Policy Management
Recos	Relais Communautaires
SA	Supervision area
SP	Sulfadoxine-pyrimethamine
SPAQ	Sulfadoxine-pyrimethamine and amodiaquine
SMC	Seasonal malaria chemoprevention
WHO	World Health Organization

EXECUTIVE SUMMARY

Across Africa's Sahel sub-region most malaria illness and deaths occur during the rainy season. To prevent malaria in those most vulnerable where malaria transmission is seasonal, the World Health Organization recommends a single dose of sulfadoxine-pyrimethamine (SP) in combination with three daily doses amodiaquine (AQ) once a month for four months to children between 3 and 59 months for the chemoprevention of malaria during the rainy season.

The objective of seasonal malaria chemoprevention (SMC) is to maintain therapeutic antimalarial drug concentrations in the blood throughout the period of greatest risk. Randomized control trials and implementation of SMC at scale has shown it to be safe, feasible, effective and cost-effective in children under five. However, for SMC to be fully effective and provide maximum protection, children should receive the full three-day course of SP+AQ during each of the four monthly cycles.

SMC is delivered household-to-household over a period of three to four days by trained drug distributors each month for four monthly cycles. Drug distributors are instructed to administer the first dose of SP and AQ by directly observed therapy (DOT) and give the remaining two tablets of AQ in the blister pack to the child's caregiver to administer daily over the following two days.

Demonstrating the proportion of children who received a full course of SP+AQ each cycle is essential to having a level of certainty that SMC guidelines were followed and to determine the relative impact, effectiveness and future quantification of SMC each cycle and each round.

In 2018, Malaria Consortium implemented SMC in three countries, aiming to reach approximately 3,936,723 children. This included Burkina Faso (892,245 children in 18 districts); Chad (742,015 children in 15 health districts); and Northern Nigeria (2,302,463 in the States of Jigawa, Katsina, Sokoto and Zamfara).

Administrative coverage (the total number of treatments provided in a given cycle divided by the target population of children between 3 and 59 months), was consistently high across all countries where Malaria Consortium implemented SMC in 2018. The average number of treatments provided by drug distributors was 4,119,440 per cycle across all four cycles, corresponding to administrative coverage of 104.6%. Average coverage was above 100% in all three countries. There was also a noticeable trend showing increased coverage cycle-by-cycle.

In addition to determining administrative coverage, Malaria Consortium implemented two different types of coverage surveys in 2018 in each of the three implementation countries:

1) End-of-cycle (EoC) surveys were conducted following cycles 1 to 3 to enable implementing teams to quickly identify trends and draw conclusions so adjustments could be made in subsequent cycles.

2) More comprehensive cross-sectional end-of-round (EoR) surveys were conducted following cycle 4 to assess coverage of the last cycle and overall SMC performance across all four cycles.

Coverage surveys indicated consistently high coverage of over 90% across all cycles and countries, both in terms of eligible children receiving SP+AQ from a drug distributor, as well as the proportion of those receiving Day 2 and Day 3 of AQ from their caregivers. There were, however, indications that coverage declined over the course of the 2018 round. Administration of SMC to ineligible children

over 5 years of age remained common in all three countries. Coverage survey results by country are summarized below.

Burkina Faso

- During each of the four SMC cycles, between 93% and 96% of eligible children received Day 1 treatment from a drug distributor.
- District-level coverage in terms of administration of Day 2 and 3 AW was almost over 90% in all EoC surveys.
- Drug distributors observed DOT in around 95% of all treatments provided.
- According to the EoR survey, 20% of ineligible children over 5 received SMC treatment at least once.
- 83% of eligible children received SMC treatment during each of the four cycles. Only 6% of children did not receive any treatment.

Summary of coverage surveys in Chad

- Coverage in terms of administration of Day 1 treatment by a drug distributor ranged from 93% to 98% in the four SMC cycles.
- Coverage of Day 2 and Day 3 AQ was between 91% in cycle 1 to 95% in cycle 2
- Data with regard to adherence to DOT is only available from cycle 3, when it was observed in 79% of all treatments provided by drug distributors.
- The EoR survey revealed that 60% of ineligible children over age 5 received SMC treatment at least once.

Summary of coverage surveys in Nigeria

- Coverage across all states significantly improved as compared to 2017. Between 91% and 100% of eligible children received Day 1 treatment from a drug distributor per SMC cycle.
- Unlike the EoC surveys, the EoR survey conducted in Nigeria showed a marked decline in terms of coverage cycle-by-cycle in most states.
- With thee xception of Day 3 AQ in Sokoto in cycle 4, coverage of Day 2 and Day 3 AQ was generally above 90%.
- In cycles 1 to 3, adherence to DOT among drug distributors was generally high, with over consistently over 90%. However, there was a noticeable drop in cycle 4, when adherence ranged between 32% in Katsina and 51% in Zamfara.
- The proportion of ineligible children over 5 years of age receiving SMC treatment at least once ranged from 16% in Jigawa to 27% in Sokoto and Zamfara.
- Between 24% (Sokoto) and 53% (Katsina) of eligible children received treatment during all four SMC cycles. The proportion of children who did not receive any treatment was highest in Zamfara with 10%.

Operational challenges

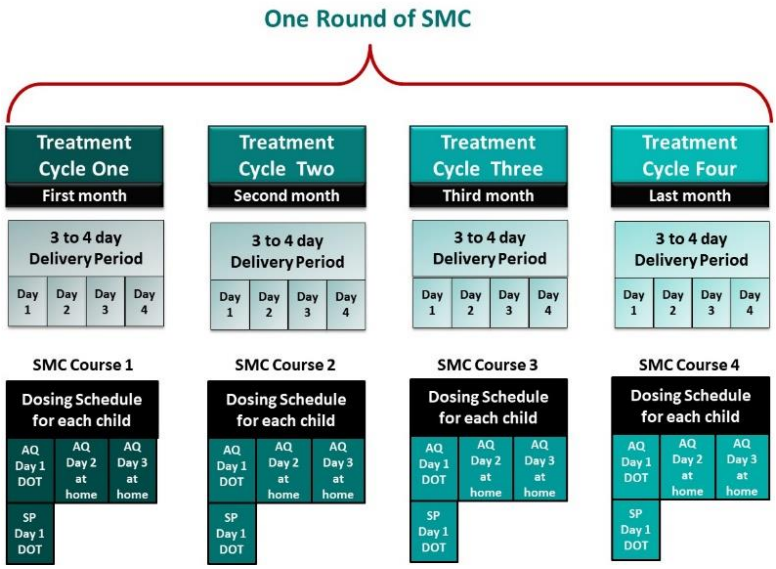
- The experience of the survey methodology, in terms of results and operational approaches, as applied in the different countries, was mixed. This was probably due to the novelty of the methods themselves, the fact that many members of the Malaria Consortium's M&E staff within the SMC teams joined only in mid-2018, but also to the different implementation choices in the various countries.
- There is a need to refine sampling, data collection tools, data analysis and reporting for the different types of coverage surveys, as well as building capacity to implement and supervise coverage surveys.

BACKGROUND

Across the Sahel sub-region, most malaria illness and deaths occur during the rainy season. To prevent malaria in those most vulnerable to the disease's effects in areas where malaria transmission is seasonal, the World Health Organization (WHO) recommends seasonal malaria chemoprevention (SMC). SMC is the administration of four monthly courses of sulfadoxine-pyrimethamine (SP) and amodiaquine (AQ), or SPAQ, to children between 3 and 59 months during the rainy season. The objective of SMC is to maintain therapeutic antimalarial drug concentrations in the blood throughout the period of greatest risk. SMC has been shown to be safe, feasible, effective and cost-effective for the prevention of malaria among children under five. WHO estimates that SMC prevents 75% of severe malaria cases in the target population (1). According to the 2018 World Malaria Report (2), 15.7 million children in 12 countries in Africa's Sahel sub-region were protected through SMC programs in 2017. However, about 13.6 million eligible children were not covered, mainly due to a lack of funding either from insufficient resources or delayed funding disbursement. This implies that just over half of eligible children were reached that year.

SMC activities take place in yearly rounds of four months during the peak of the rainy season, approximately July to October, with distribution cycles approximately 28 days apart from each other. Drugs are typically distributed through door-to-door campaigns by Community Health Workers (CHWs) during a period of three to four days per cycle. Each monthly course consists of one dispersible tablet of SP and three daily dispersible tablets of AQ. A dose of SP and the first dose of AQ are administered by or under the supervision of drug distributors to ensure that the tables are correctly dissolved and that the child fully ingests the drugs without spitting them out or vomiting. This is referred to as directly observed treatment (DOT). Children who vomit or spit out the drugs within 30 minutes should be given a second dose by the drug distributors. The remaining two doses of AQ are administered by the caregiver – one each over the following two days. Drug distributors leave a blister with the two remaining tablets with caregivers and provide instructions on how to administer and record on the dose on the *SMC Child Record Card*. If a child vomits or spits out the second or third dose of AQ, caregivers are encouraged to go to the nearest health facility to receive a replacement dose (**Figure 1**).

Figure 1. Illustration of schedule for an annual round of SMC.



Children under 3 months or over 5 years, as well as children who are severely ill, who are taking certain medications, and those with known allergies to SPAQ should not receive SMC. Drug distributors mark each house they have visited, indicating whether treatment was completed. They are instructed to refer children with fever to the nearest health facility, where they should be tested for malaria using a rapid diagnostic test. If the test result is negative, children should be given SP and the first dose of AQ by the health facility worker, giving the remaining two doses of AQ to the caregiver for administration over the following two days.

There are two formulations of SPAQ: a lower dose for children between 3 and <12 months, and a higher dose for children between 12 and 59 months. However, caregivers do not always know the exact age of their children, widespread malnutrition leads to stunting, and childbirth registration systems are weak. Consequently, while drug distributors are taught to estimate age by observing children's physical development stage[1], they often struggle with determining age and treatment of children outside the age eligibility range is common. There may also be pressure from caregivers to provide treatment to older children as they may be unaware that the dosage will not be sufficient to protect older children from malaria. Giving sub-therapeutic doses to older children contributes to the development of drug resistance and it also affects the accuracy of drug quantification and procurement, reducing the number of drugs available for eligible children. **Table 1** summarizes the procedural guidelines for each component of the SMC intervention.

Table 1. Procedural guidelines for administering SMC.

SMC component	SMC procedures
Eligibility	Only children aged 3 to 59 months should receive SMC. Children aged 3 to 59 months who have malaria, are too sick to swallow the drugs, have received SP or AQ during in the last 28 days, are taking certain types of medication containing sulfa, or have known allergies to SPAQ should not receive SMC.
Referral	Children who have a fever should be referred to a health facility where they should be tested for malaria using a rapid diagnostic test.
Administration	Day 1 SP and AQ should be administered by the drug distributor as DOT. If the child vomits or spits out the drugs within 30 minutes, a second dose should be given. Children who have a fever but test negative for malaria should receive Day 1 SP and AQ from a health worker. Day 2 and Day 3 AQ should be administered by the caregiver. If the child vomits or spits out the drug, the caregiver should visit the nearest health facility to receive a replacement dose.

[1] For example, children who cannot reach their arm over their head to touch the opposite ear are assumed to be under 5 years of age and therefore eligible for SMC. Infants who are not able to sit up on their own are considered to be under 3 months.

SMC component	SMC procedures
	The correct formulation should be administered according to the child's age (3 to <12 months and 12 to 59 months).
Communication	Drug distributors should explain the purpose and benefit of SMC to the caregiver. Drug distributors should demonstrate correct administration of AQ. Caregivers should be instructed to administer one dose of AQ on each of the following two days Caregivers should be instructed to complete and retain the *SMC Child Record Card* after each dose of AQ is given. Caregivers should be instructed to retain the empty blister as proof of administration of Day 2 and 3 AQ. Caregivers should be instructed to visit a health facility for a second dose if the child vomits or spits out Day 2 or Day 3 AQ. Caregivers should be instructed to visit a health facility if the child experiences severe adverse reactions after swallowing the drugs. Caregivers should be reminded of the importance to sleep under a mosquito net and seek prompt treatment when a child falls sick.
Recording	Administration of Day 1 SP and AQ should be recorded on a *Tally Sheet.* Administration of all doses of SPAQ should be recorded on an *SMC Child Record Card*, which should be kept by the caregiver. Each compound or household visited should be marked. Severe adverse reactions should be recorded by health workers in the *End-of-Cycle Report* and on the *National Pharmacovigilance Form*.

Malaria Consortium has been implementing SMC in Sahelian countries since 2013, with a major scale-up from 2015 through the Unitaid-funded "Achieving Catalytic Expansion of Seasonal Malaria Chemoprevention in the Sahel" (ACCESS-SMC) project. Since 2018, Malaria Consortium has been implementing SMC mainly with philanthropic funding from GiveWell-directed funds and individual donors from the United States, Europe and Australia. In 2018, the SMC program covered three countries and aimed to reach just under 4 million children (**Table 2**).

Table 2. Malaria Consortium's SMC program in 2018.

Country	Scale	Number of children targeted in 2018
Burkina Faso	18 health districts spread out across the country	892,245
Chad	15 health districts in 4 regions: Chari Baguirmi, Hadjer Lamis, Mayo Kebbi Est, N'Djamena	742,015

Country	Scale	Number of children targeted in 2018
Nigeria	46 LGAs in 4 states: 5 LGAs in Jigawa, 4 LGAs in Katsina, 23 LGAs in Sokoto, 14 LGAs in Zamfara	2,302,463
	TOTAL	**3,936,723**

This report summarizes coverage data from Malaria Consortium's 2018 SMC campaign from three data sources: administrative data, end-of-cycle (EoC) surveys and end-of-round (EoR) surveys.

COVERAGE

For maximum protection, children should receive a full three-day course of SPAQ during all four cycles in a seasonal round of SMC. Achieving high coverage in each cycle is therefore essential. It should be noted, however, that in a given population, SMC coverage can be defined in different ways:

A. Proportion of households with eligible children visited by a drug distributor as part of an SMC campaign in a given cycle;

B. Proportion of eligible children that received a dose of SP and the first dose of AQ from a drug distributor (Day 1 treatment) as part of an SMC campaign in a given cycle;

C. Proportion of eligible children that received a full course of SPAQ (i.e. including two daily doses of AQ administered by the caregiver) as part of the SMC campaign in a given cycle;

D. Proportion of child-months over which eligible children were protected out of all eligible child-months[2];

E. Proportion of eligible children that received four full courses of SPAQ as part of an SMC campaign.

SMC programs typically use the following data sources to assess coverage: administrative program data, *SMC Child Record Cards* kept by caregivers and independent coverage surveys.

Administrative data

Administrative data is obtained from routine monitoring forms used by drug distributors, often referred to as *Tally Sheets*, on which treatments administered are recorded. An example of an SMC *Tally Sheet* can be found in **Appendix 1**. Coverage is calculated by dividing the total number of treatments provided in a given cycle by the target population of children between 3 and 59 months in a given implementation area (i.e. corresponding to definition B above). The accuracy of coverage figures obtained using administrative data is compromised both by the accuracy of the numerator and the denominator.

While most drug distributors can read and write, their levels of education and literacy are often low and they struggle with filling in forms correctly. The accuracy of data recording further depends on the drug distributors' ability to correctly determine eligibility, mainly with regard to the age range. It is possible that drug distributors administer drugs to ineligible children but record these as treatment

[2] Coverage according to this definition is assessed by measuring the number of cycles of full courses of SPAQ received by child per round.

provided to eligible children. While supervisors are tasked with supporting drug distributors and correcting mistakes, it is not possible to supervise all instances of drug administration. Supervisors are also tasked with critically reviewing all *Tally Sheets* submitted by drug distributors. However, while their education levels are higher than drug distributors', many instances of mistakes going unnoticed are often observed. Moreover, data recording and reporting may not be seen as a priority by drug distributors or their supervisors, especially as they are busy delivering the SMC program in often resource-limited environments.

With regard to the denominator used to calculate coverage from administrative data, accuracy is compromised due to the use of inaccurate target population estimates. These are based on census data that is frequently outdated, adjusted by estimated population growth factors. They also typically do not adequately reflect population movements, for example due to migration or internal displacement. As official population figures are used as the basis for funding allocation by governments and donors, there is some uncertainty with regard to their accuracy. As a result of the numerous limitations of using administrative data to measure coverage, it is possible (and not uncommon) to achieve coverage of well over 100%.

Some countries have started tracking how many courses of SMC treatment children receive. For example, individual children are given unique identifier numbers through the four SMC cycles. Ultimately, this information will allow calculation of coverage coming close to definitions E and D above, because the number of drug distributor-administered treatments received per child will be known. However, it will not be known if AQ doses 2 and 3 were administered by the caregiver, so full protection cannot be assumed. In most countries, attempts to introduce tracking of number of doses received per child are in their infancy and methods need to be refined further to provide sufficiently robust data. These data will therefore not be presented in this report.

SMC Child Record Card

Coverage can also be calculated on the basis of *SMC Child Record Cards*, which are given to caregivers by drug distributors the first time they administer SPAQ to a child. Caregivers are then asked to record administration of AQ doses 2 and 3 and to keep the card in a secure place. Caregivers should produce the card during subsequent cycle visits and information on the card is updated. In theory, *SMC Card* data could be used to calculate coverage according to definition E above. However, *SMC Cards* have shown to be an unreliable data source, as retention and accurate completion of the required information has proven to be challenging for caregivers, despite extensive behavior change communication. *SMC Card* data will not be presented in this report.

Coverage surveys

Coverage surveys can be helpful to monitor coverage while efforts to improve administrative data are ongoing. They aim to retrospectively determine coverage by surveying caregivers of eligible children and asking them if their children received SMC treatment during the previous cycle or over the course of that year's SMC round. Surveys can also be used to assess the quality of program delivery, for example adherence to DOT or administration of AQ doses 2 and 3 by caregivers. Two major limitations of coverage surveys are that they rely on accurate memory and self-reporting. They are thus subject to recall and social desirability bias. Caregivers might, for example, inaccurately remember when asked after the end of the SMC round during which cycles their children did or did not receive treatment, especially in a context of simultaneous mass drug administration and vaccination

campaigns (e.g. polio, immunizations, nutrition supplementation, neglected tropical diseases) are common. Caregivers might also be inclined to inaccurately state that treatment was given if they believe that this is the desirable social norm, particularly if they believe that the data collectors had a stake in program delivery. Naturally, coverage surveys are subject to the limitations of all types of surveys in terms of the robustness of the methods used and the scientific rigor of data collection and analysis. SMC coverage surveys need to be implemented soon after the cycle or round they are designed to assess, at sufficient scale and with sufficient robustness to allow for meaningful results. At the same time, they are conducted in a context where the focus of the majority of program stakeholders is necessarily on implementation of the intervention. A balance needs to be struck between committing time and resources to strengthening rigor on the one hand, and, on the other hand, the surveys' ability to produce insights quickly, so program implementers can respond to trends, taking corrective action where possible and necessary. Equally, it is necessary to strike a balance between independent evaluation of the program (ideally by third parties) and the need to involve program implementers' in the evaluation process, so they can use insights to make adaptations to the program.

METHODS

Administrative data

In all areas where Malaria Consortium implemented SMC in 2018, *Tally Sheets* were completed by drug distributors, recording doses administered and fully ingested by eligible children, disaggregated by age and sex. SMC treatments administered by health workers to children who were referred to a health facility with fever and tested negative for malaria were also recorded. Supervisors and facility in-charges then compiled information from the *Tally Sheets* into *Daily Summary Forms* and *SMC End-of-Cycle Reports*. Information from *End-of-Cycle Reports* were collected and compiled, typically by dedicated monitoring and evaluation (M&E) staff at district and/or Local Government Area (LGA) level. In Burkina Faso and Chad, district-level data were obtained by Malaria Consortium and compiled into a Microsoft Excel spreadsheet. In Nigeria, LGA-level data were compiled by Malaria Consortium staff at state level and entered into Magpi, an electronic data collection platform.[3] Treatments provided were divided by official target population figures provided by state authorities to calculate the proportion of eligible children in a given intervention area that received Day 1 treatment from a drug distributor or health worker as part of the 2018 SMC campaign for each cycle. The average number of treatments provided per cycle was also calculated.

Coverage Surveys

In previous years, only one coverage survey was conducted at the end of the annual SMC round to measure coverage achieved by Malaria Consortium's SMC program. This meant that administrative data had to be relied on to gauge coverage while the campaign was ongoing. As gathering and compiling administrative data is a time-consuming process, this limited the program's capacity to take evidence-based corrective action and make adaptations to the intervention during the campaign. For this reason, Malaria Consortium decided to implement coverage surveys following each of the four SMC cycles in each of the three implementation countries. The survey methods used following cycles 1 to 3 needed to be pragmatic, enabling the team to identify trends and draw conclusions quickly, so

[3] https://home.magpi.com/solutions/field-surveys/

adaptations could be made in subsequent cycles. To this end, it was decided to use methods adapted from surveys using lot quality assurance sampling (LQAS), a method for assessing programs by analyzing the data produced in a comparatively small sample. Throughout this report, those surveys will be referred to as end-of cycle or EoC surveys. Following cycle 4, a more comprehensive, cross-sectional survey was conducted in each country to assess program performance across all four cycles. These surveys are referred to as end-of-round of EoR surveys in this report. EoR surveys used a more comprehensive questionnaire and sampling methods designed to return results that were representative of the areas where Malaria Consortium implemented SMC in 2018 in Burkina Faso and Chad, and in the case of Nigeria, the LGAs covered by Malaria Consortium in each of the four states covered by Malaria Consortium. Generic questionnaires for both types of survey were initially developed in English and subsequently translated into French by bilingual Malaria Consortium staff. The generic questionnaires were further adapted by each country to suit the specific context, for example with regard to the terminology used to refer to administrative units or different program components[4]. Data were generally analyzed descriptively. Informed consent was sought from all survey participants and Malaria Consortium's policy on ethical research was observed. **Figure 2** Illustrates the sequence of coverage surveys conducted over the course of the 2018 SMC round.

Figure 2. Sequence of coverage surveys conducted over the course of the 2018 SMC round.

Cycle 1					**Cycle 2**					**Cycle 3**					**Cycle 4**				
1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4	
July				**LQAS 1**	August				**LQAS 2**	September				**LQAS 3**	October				**Coverage Survey**

End-of-cycle surveys

In Nigeria, EoC surveys were coordinated and supervised by Malaria Consortium, whereas in Burkina Faso and Chad, external consultants were contracted for this purpose. In all three countries, only households with at least one child up to the age of 10 were eligible for the purpose of survey. In each household, a caregiver was asked about all children in the compound or household. For the questions about adherence to SMC guidelines, questions were asked about the caregiver's second child if more than one child lived in the household.

Lot quality assurance sampling

The LQAS method was developed in the 1920s for industrial quality control and has been recommended by WHO as one of the more practical methods available for the assessment of health intervention coverage (3). LQAS works by subdividing a program implementation area into smaller functional areas (such as districts or health facility catchment areas), referred to as "Supervision Areas" (SAs). Data from SAs is aggregated into an estimate of coverage for the larger implementation area, with the aim of classifying whether SAs have or have not reached a predetermined coverage standard. The LQAS method results in the need for a relatively small sample per SA. The following concepts are taken into account:

- **Coverage target**

[4] For example, the drug distributors are referred to as Distributeurs Communautaires in Burkina Faso, Recos (Relais Communautaires) in Chad and CHEWs (Community Health Extension Workers) in Nigeria.

Typically, 80% coverage is used as the coverage standard for mass drug distribution campaigns such as SMC. SAs that have reached coverage of 80% or more are classified as having reached the coverage target. LQAS also assumes a lower threshold of 50% below which SAs are classified as having failed the coverage target. The lower threshold of 50% is the commonly accepted standard in health intervention assessments and derives from the original industrial framework for which LQAS was developed.

- **Alpha error**

  The term alpha error refers to the probability of classifying a SA as not having reached the coverage target when in fact, it did (i.e. false positives).

- **Beta error**

  The probability of classifying a SA as having achieved the coverage target, when in actual fact it didn't is referred to as beta error (i.e. false negatives).

- **Decision rule**

  The decision rule determines how many respondents must respond "yes" to the question whether treatment was received for the SA to be classified as having reached the coverage target. In the case of an 80% coverage target with a 50% lower threshold, and alpha and beta errors of 10%, the decision rule is "13" out of a required sample of n=19[5]. This is independent of the population size. While it is possible to adjust upper and lower thresholds, alpha and beta error, which would result in different decision rules and required sample sizes, a sample size of 19 per SA is the standard generally recommended for LQAS coverage surveys (4).

Aims, objectives and indicators

The aim of the EoC surveys was to determine whether SAs had reached acceptable coverage, defined as the proportion of compounds[6]/households with eligible children (0 to 10 years) visited by a drug distributor during the preceding cycle as part of the SMC (definition A). The surveys were designed to meet the following objectives:

- To assess coverage in terms of compounds/households visited, Day 1 SPAQ treatments administered and full course of SPAQ received (definitions A, B and C)
- To assess adherence to SMC guidelines
- Provide timely insights on implementation issues requiring adaptations in subsequent cycles

The key indicators assessed were:

1) Compounds/households with eligible children visited by a drug distributor
2) Day 1 treatments of SP and AQ administered by drug distributors to eligible children between 3 and 59 months

[5] See, for example, http://lqas.spectraanalytics.com/ for a tool that can be used to calculate sample size per SA based on the LQAS methodology.

[6] The majority of settlements in Nigeria and Chad consist of compounds which contain several households. This practice is often linked to the practice of polygamy. It is typically not possible for males to enter another man's compound.

3) Children who received a full three-day course of SPAQ

4) SPAQ treatments administered by drug distributors observing DOT

5) SPAQ treatments provided to ineligible children above age 5

Sampling

In Burkina Faso, for each cycle, 60 health facility catchment areas were selected as SAs in the 18 health districts where Malaria Consortium implemented SMC in 2018. This corresponded to approximately 10% of all health facilities in the implementation area. Health facilities were selected randomly using proportional-to-size methods, resulting in between two and six health facilities being selected per health district. In each health facility catchment area, villages were assigned to three categories according to their distance from the health facility. Households were then randomly selected from each of the three strata. Except in cycle 1, when the LQAS decision rule was fixed at 28, resulting in a required sample size of 45 per SA, 19 households were selected per cycle. More than the required number of households were surveyed in all three cycles. In total, 5,192 households were surveyed (**Table 3**).

Table 3. Sampling frame end-of-cycle surveys, Burkina Faso.

Health district	Cycle 1	Cycle 2	Cycle 3
Supervision areas	60	60	60
Decision rule	28	13	13
Required sample size per supervision area	45	19	19
Total required sample size	2,700	1,140	1,140
Number of households surveyed	**2,837**	**1,171**	**1,184**

In Chad, each health district was subdivided into SAs, typically combining catchment areas of three health facilities. This resulted in a total of 78 SAs. In each SA, eight villages were randomly selected and further sub-divided into two to five sections comprising about 30 compounds. Next, two or three compounds were randomly selected from within one of those sections and then one randomly selected household per compound was surveyed. This approach resulted in a total sample of 1,482 per cycle (**Table 4**).

Table 4. Sampling frame end-of-cycle surveys, Chad.

Region	Health district	Number of health facilities	Number of supervision areas	Number of households surveyed per cycle
Chari Baguirmi	Ba-Illi	9	3	**57**
	Bousso	11	4	**76**
	Dourbali	15	5	**95**
	Mandelia	19	6	**114**
	Massenya	16	5	**95**

Region	Health district	Number of health facilities	Number of supervision areas	Number of households surveyed per cycle
	Kouno	4	1	**19**
Hadjer Lamis	Karal	8	2	**38**
	Mani	11	4	**76**
	Massaguet	15	5	**95**
	Massakory	17	6	**114**
Mayo Kebbi Est	Bongor	30	10	**190**
N'Djamena	N'Djamena Est	19	6	**114**
	N'Djamena Centre	17	6	**114**
	N'Djamena Nord	15	5	**95**
	N'Djamena Sud	27	9	**171**
TOTAL		**233**	**78**	**1,482**

In Nigeria, each LGA was further subdivided into wards, which were chosen as the SA unit for the EoC surveys. Nineteen households were surveyed in each of the 488 wards in the 46 LGAs where Malaria Consortium implemented SMC in 2018. Within each ward, one health facility was randomly selected. Data collectors were instructed to spread the sampled households across the villages in the selected health facilities' catchment area, selecting no more than two or three compounds per village. One household was surveyed per compound. This approach resulted in a total sample of 9,272 across the four states per cycle (**Table 5**).

Table 5. Sampling frame end-of-cycle surveys, Nigeria.

State	Local Government Areas	Supervision areas	Households surveyed per cycle
Jigawa	5	54	**1,026**
Katsina	4	43	**817**
Sokoto	23	254	**4,826**
Zamfara	14	137	**2,603**
TOTAL	**46**	**488**	**9,272**

Data collection

Two questionnaires were developed:

- One questionnaire captured information about all children in the compound or household;
- A second questionnaire captured more specific information about adherence to the SMC guidelines for one child in the household only.

Electronic versions of the questionnaires were created using Magpi. The questionnaires were pre-tested as part of the data collector training. An example questionnaire can be found in **Appendix 2**.

Data collectors were recruited and trained by Malaria Consortium staff in Nigeria and by external consultants contracted for this purpose in Burkina Faso and Chad. All data collectors had completed at least a secondary education and were fluent in at least one local language. Interviews were conducted in local languages, with data collectors translating from the French or English questionnaire on the spot and assigning responses to pre-defined answer categories in MagPi. Where possible, responses regarding treatments received were verified by checking household markings left by drug distributors on the household wall or door, inspecting *SMC Child Record Cards* and asking to see empty SPAQ blisters.

Data analysis

In Nigeria, data were analyzed by Malaria Consortium staff using STATA 14. Where 95% confidence intervals (CIs) were calculated, this was done using the Wilson exact method (AusVet). In Burkina Faso and Chad, the consultants analyzed data and reported results independently.

End-of-round surveys

All EoR surveys were conducted by local research firms selected by Malaria Consortium through a competitive bidding process:

- Burkina Faso: Institut de Sciences & Techniques (INSTech)
- Chad: Conseil en Sciences Sociales Communication Interculturelle et Marketing (COSSOCIM)
- Nigeria: Oxford Policy Management (OPM)

Lead researchers from those firms were trained by Malaria Consortium staff. The research firms subsequently recruited and trained data collectors, oversaw data collection and analysis, and submitted a final report to Malaria Consortium. An example of an EoR questionnaire can be found in **Appendix 3.** Final reports with detailed description of the methods used can be found attached to this report (**Appendices 4-6**). Brief summaries are presented below.

Generally, interviews were conducted with caregivers of children aged 3 to 59 months. Some questions related to a specific child (typically the caregiver's second child), but some questions related to all children up to 10 years of age in the household.

Aims, objectives and indicators

The EoR surveys aimed to assess coverage defined as the proportion of eligible children that received SMC treatment during each of the four monthly cycles of the 2018 SMC campaign. The survey was designed to meet the following objectives:

- To assess coverage in terms of compounds/households visited, Day 1 SPAQ treatments administered and full course of SPAQ received during cycle 4 (definitions A, B and C)
- To assess coverage in terms of children who received Day 1 treatment during all four cycles[7]
- To asses coverage in terms of number of Day 1 treatments received per child[8]

[7] This comes close to assessing coverage according to definition e. However, dose 2 and 3 are not taken into account, so full protection cannot be presumed.
[8] This comes close to assessing coverage according to definition d. However, dose 2 and 3 are not taken into account, so full protection cannot be presumed.

- To assess adherence to SMC guidelines
- To assess program performance across the four SMC cycles

The key indicators assessed were:

1) Compounds/households with eligible children visited by a drug distributor
2) Day 1 treatments of SP and AQ administered by drug distributors to eligible children between 3 and 59 months
3) Children who received a full three-day course of SPAQ
4) SPAQ treatments administered by drug distributors observing DOT
5) SPAQ treatments provided to ineligible children above age 5
6) Day 1 treatments received per child over the course of the SMC round
7) Children who received Day 1 SPAQ treatment during all four SMC cycles

Several other indicators relating to the full ingestion of drugs, general malaria prevention, and caregivers' knowledge of SMC were also explored. Full results can be found in detailed EoR survey reports summarizing results from each country provided in **Appendices 4-6**. For the purpose of this report, only key indicators will be presented.

Sampling

In Burkina Faso, villages were selected randomly in each health district using proportional-to-size methods, which determined the number of households to be surveyed in each village. As lists of households in selected villages were not commonly available, field teams used the roadmap technique to randomly select households. Using this approach, a total of 951 households were surveyed.

In Chad, each district was classified as either urban or rural and sampling was carried out independently within those two strata. Initially, 72 health facility catchment areas were randomly selected from a total of 233 in the implementation area, using equal probability techniques. In a second step, villages and compounds were randomly selected from comprehensive village lists. Where lists were incomplete or outdated, field teams conducted mapping exercises. The team aimed to survey ten compounds per village in N'Djamena and three in selected villages outside the capital. A total of 1,920 households were surveyed (**Table 6**).

Table 6. Sampling frame end-of-round survey, Chad.

Region	Health district	Number of respondents interviewed		
		Rural	Urban	TOTAL
Chari Baguirmi	Ba-Illi	16	32	**48**
	Bousso	16	32	**48**
	Dourbali	32	48	**80**
	Mandelia	80	16	**96**
	Massenya	32	48	**80**
	Kouno	16	16	**32**
Hadjer Lamis	Karal	16	16	**32**

Region	Health district	Number of respondents interviewed		
		Rural	Urban	TOTAL
	Mani	0	48	**48**
	Massaguet	64	16	**80**
	Massakory	32	48	**80**
Mayo Kebbi Est	Bongor	64	80	**144**
N'Djamena	N'Djamena Est	144	144	**288**
	N'Djamena Centre	0	240	**240**
	N'Djamena Nord	0	240	**240**
	N'Djamena Sud	0	384	**384**
TOTAL		**512**	**1,408**	**1,920**

In Nigeria, health facility catchment areas were selected from all 1,799 health facilities in the LGAs where Malaria Consortium implemented SMC in 2018, proportionate to the respective number of health facilities in the four states. In Jigawa and Katsina, health facilities were selected from all the LGAs covered by the SMC program, while in Sokoto and Zamfara, LGAs were stratified, respectively, into eight and six homogenous groups according to the relative density of health facilities by population size, before selecting health facilities from the different strata. 40 compounds in 5 villages were then randomly selected from each health facility catchment area. This approach resulted in a total sample of 4,120 households (**Table 7**).

Table 7. Sampling frame end-of-round survey, Nigeria.

State	LGAs covered	Total number of health facilities	Health facility catchment areas selected	Respondents interviewed per cycle
Jigawa	5	104	15	**600**
Katsina	4	199	20	**800**
Sokoto	23	757	40	**1,600**
Zamfara	14	739	28	**1,120**
TOTAL	**46**	**1,799**	**103**	**4,120**

Data collection

In Burkina Faso, INSTech collected data using an Android app. Anonymized data were shared with Malaria Consortium. COSSOCIM in Chad and OPM in Nigeria collected and shared data with Malaria Consortium using MagPi.

Limitations

In addition to the general limitations outlined above, several additional limitations relating to the two types of coverage surveys conducted to assess Malaria Consortium's 2018 SMC campaign should be noted. First, the questionnaires did not attempt to conclusively determine children's eligibility for SMC. For example, they did not ask about severe illness at the time of the campaign, other medication

taken or history of allergic reaction to SPAQ. They also did not attempt to measure provision of SMC through health workers for children who were referred with fever to a health facility and tested negative for malaria. In general, the questionnaires could be further improved by refining the questions and answer options and by building common-sense checks into the electronic data collection platform, such that impossible combinations of responses are automatically rejected[9]. Language and translation present further opportunities for introducing bias, especially as questionnaires were only provided in English and French and each data collector would have translated questions into the local language slightly differently. Finally, data collectors were subject to the same challenge drug distributors face during SMC administration with regard to determining children's age (and hence eligibility for SMC).

Experience with using the two types of surveys was generally mixed, reflecting the novelty of the approach and the fact that many members of Malaria Consortium's SMC M&E team joined only in mid-2018 due to recruitment challenges. Despite training and quality assurance mechanisms, it is not uncommon for data collectors to struggle with following sampling instructions, correctly completing data collection forms or entering data into electronic systems. Generally, the quality of reports submitted by external research firms and consultants was poor, sometimes omitting crucial information about sampling and data analysis methods. Results were often poorly presented and important findings were missing from reports. Implementing surveys under close supervision by Malaria Consortium staff, on the other hand, risks introducing a bias due to the closeness of implementers and evaluators.

Other challenges were country-specific. For example, in Chad, after negative experiences with the consultants contracted for the EoC surveys, finding an external firm to coordinate the EoR survey took much longer than expected, resulting in the survey only being conducted in January 2019, several months after the end of the 2018 SMC round. This is much later than recommended for coverage surveys and increases the risk of recall bias. In Nigeria, EoC surveys were carried out by data collectors recruited through state- or LGA-level health authorities, which raises concerns about the impartiality of data collectors, as their employers would have a stake in implementing a successful SMC campaign. There were also concerns that the data collectors, being familiar with the SMC campaign, may have selected villages they knew had been covered by drug distributors. Finally, it should be noted that despite efforts to verify treatment status reported by caregivers, by checking *SMC cards*, empty blisters and compound/household markings, this was often not conclusive.

Improvements are also needed in terms of harmonized analysis and presentation of data. In 2018, each Malaria Consortium country team and each external research firm analyzed and reported results independently. This means it is not always possible to present data consistently across the SMC program for easy comparison in this summary report. Also note that in this report, EoC and EoR survey results are often presented side-by-side. Readers should bear in mind, however, that the two types of surveys served different purposes, used different methods and operationalized coverage differently.

[9] For example, it was found in Nigeria that a large proportion of caregivers who stated that they had not been given a blister for administration of AQ Doses 2 and 3, yet also stated that they had administered those doses.

RESULTS & DISCUSSION

Administrative data

Malaria Consortium's 2018 SMC campaign aimed to reach 3,936,753 children per cycle across the three implementation countries. The number of treatments provided by drug distributors was 4,119,440 per cycle on average across all four cycles, corresponding to administrative coverage of 104.6%. Average coverage was above 100% in all three countries. There was a noticeable trend showing increased coverage cycle-by-cycle (**Table 8**).

Table 8. 2018 administrative program coverage per cycle by country.

Country	Target per cycle	Cycle 1		Cycle 2		Cycle 3		Cycle 4		Total	
		Children treated	Coverage	Children treated	Coverage	Children treated	Coverage	Children treated	Coverage	Average number children treated per cycle	Average coverage per year
Burkina Faso	892,245	923,603	103.5%	941,018	105.5%	959,272	107.5%	976,648	109.5%	**950,135**	**106.5%**
Chad	742,015	790,698	106.6%	802,177	108.1%	816,830	110.1%	809,050	109.0%	**804,689**	**108.4%**
Nigeria	2,302,493	2,215,452	96.2%	2,298,289	99.8%	2,345,967	101.9%	2,598,755	112.9%	**2,364,616**	**102.7%**
Total	**3,936,753**	**3,929,753**	**99.8%**	**4,041,484**	**102.7%**	**4,122,069**	**104.7%**	**4,384,453**	**111.4%**	**4,119,440**	**104.6%**

Coverage surveys

Compounds/households with eligible children visited by a drug distributor

According to EoC survey results, the percentage of compounds or households visited by drug distributors during the first three cycles was over 90% in all countries and states (**Table 9**). The EoR result was slightly lower in Nigeria, but the differences are not very large in the case of Jigawa and Katsina. The lower coverage figures found by the EoR survey in Sokoto and Zamfara may reflect the geographical challenges in those two states, with larger distances between villages and compounds, as well as poor accessibility of remote areas especially during the rainy season, because unpassable unpaved roads and rivers without bridges. In general, EoC surveys showed a steady increase cycle-by-cycle, while EoR results are lower, which may be due recall bias or data collectors' bias. Anecdotal evidence from Malaria Consortium field staff suggests that caregivers do not necessarily clearly distinguish between different public health interventions and mass campaigns. To increase the likelihood of respondents referring to SMC, EoR data collectors were equipped with SPAQ blisters and an *SMC card*, which served to remind respondents of the SMC campaign. The differences between the EoC and EoR results may also have been a result of questionnaire design. The EoC survey asked about drug distributors visiting the compound/household in the previous week, whereas the EoR survey asked if a drug distributor had "ever visited" the compound/household to administer SMC during the 2018 campaign.

Table 9. Compounds/households with eligible children visited by a drug distributor.

Data source	Number of compounds/ households visited	Number of compounds/ households surveyed	Coverage [95% CI]
Burkina Faso			
EoC: Cycle 1	2,748	2,837	96.9% [96.2 to 97.4]
EoC: Cycle 2	1,146	1,171	97.9% [97.0 to 98.6]
EoC: Cycle 3	1,174	1,184	99.2% [98.7 to 99.6]
EoR: At least 1 visit	n/a	n/a	**n/a**
Chad			
EoC: Cycle 1	n/a	n/a	**92%**
EoC: Cycle 2	1,396	1,482	**94.2%**
EoC: Cycle 3	n/a	n/a	**96.4%**
EoR: At least 1 visit	2,642	2,740	**96.4%**
Jigawa			
EoC: Cycle 1	1,004	1,028	**97.7% [96.7 to 98.6]**
EoC: Cycle 2	996	1,020	**97.6% [96.7 to 98.5]**
EoC: Cycle 3	1,019	1,028	**99.1% [98.5 to 99.6]**
EoR: At least 1 visit	568	600	**94.7% [92.8 to 96.5]**
Katsina			
EoC: Cycle 1	798	809	**98.6% [97.8 to 99.4]**
EoC: Cycle 2	816	827	**98.7% [97.8 to 99.4]**
EoC: Cycle 3	821	821	**100.0%**
EoR: At least 1 visit	747	800	**93.4% [91.6 to 95.0]**
Sokoto			
EoC: Cycle 1	2,693	2,836	**95.0% [94.2 to 95.7]**
EoC: Cycle 2	4,364	4,494	**97.1% [96.6 to 97.6]**
EoC: Cycle 3	4,388	4,772	**98.1% [97.7 to 98.5]**
EoR: At least 1 visit	1,338	1,608	**83.2% [81.4 to 85.1]**
Zamfara			
EoC: Cycle 1	2,312	2,385	**96.9% [96.2 to 97.5]**
EoC: Cycle 2	2,304	2,338	**98.6% [98.1 to 99.0]**
EoC: Cycle 3	2,390	2,418	**98.8% [98.4 to 99.3]**
EoR: At least 1 visit	1,041	1,175	**88.6% [86.7 to 90.4]**

Day 1 treatments of SP and AQ administered by drug distributors to eligible children between 3 and 59 months

EoC surveys showed high coverage in terms of Day 1 treatment administered by CHW drug distributors in cycles 1 to 3, with coverage rates consistently above 90%. Again, the EoR survey found slightly lower coverage in Nigeria (**Table 10**). This difference could be a result of recall bias, data collectors' bias or

it could be due to questionnaire design, with the EoR survey measuring administration of at least one Day 1 treatment during the campaign. 2018 coverage figures showed a marked improvement over 2017, when coverage ranged from 26% in Sokoto to 75% in Zamfara.

Table 10. Day 1 treatments of SP and AQ administered by drug distributors to eligible children between 3 and 59 months.

Data source	Number of children treated	Number of children surveyed	Coverage [95% CI]
Burkina Faso			
EoC: Cycle 1	8,394	8,909	**94.2 [93.1 to 95.3]**
EoC: Cycle 2	3,842	4,002	**96.0 [94.8 to 97.2]**
EoC: Cycle 3	3,923	4,196	**93.5 [92.2 to 94.8]**
EoR: At least 1 treatment	n/a	n/a	**n/a**
Chad			
EoC: Cycle 1	n/a	n/a	**93%**
EoC: Cycle 2	n/a	n/a	**98.2%**
EoC: Cycle 3	n/a	n/a	**96.4%**
EoR: At least 1 treatment	4544	4726	**96.1 [95.6 to 96.7]**
Jigawa			
EoC: Cycle 1	3,111	3,174	**98.0% [93.6 to 100.0]**
EoC: Cycle 2	3,268	3,291	**99.3% [98.7 to 100.0]**
EoC: Cycle 3	3,437	3,429	**100.0% [99.8 to 100.0]**
EoR: At least 1 treatment	1,074	1,137	**94.5% [93.2 to 95.8]**
Katsina			
EoC: Cycle 1	2,536	2,584	**98.1% [96.1 to 100.0]**
EoC: Cycle 2	2,890	2,967	**90.4% [93.4 to 100.0]**
EoC: Cycle 3	3,303	3,364	**98.2% [93.2 to 100.0]**
EoR: At least 1 treatment	1,615	1,763	**91.6% [91.8 to 93.8]**
Sokoto			
EoC: Cycle 1	9,878	10,308	**95.8% [93.6 to 98.0]**
EoC: Cycle 2	19,432	20,225	**96.1% [93.2 to 99.0]**
EoC: Cycle 3	20,673	21,424	**96.5% [93.2 to 99.8]**
EoR: At least 1 treatment	2,453	2,643	**92.8% [91.8 to 93.8]**
Zamfara			
EoC: Cycle 1	7,818	8,140	**96.0% [93.8 to 98.3]**
EoC: Cycle 2	9,585	9,774	**98.1% [96.1 to 99.3]**
EoC: Cycle 3	9,990	10,233	**97.6% [95.5 to 99.8]**
EoR: At least 1 treatment	2,624	2,819	**93.1% [92.1 to 93.9]**

Because of the substantial likelihood of recall bias skewing results, EoR findings with regard to cycles 1 to 3 are not normally presented in this report. However, in the case of treatments administered by

drug distributors to eligible children, the EoR survey in Nigeria shows a noticeable declining trend cycle-to-cycle, with worryingly low coverage in cycle 4, the cycle preceding the survey (**Table 11**). Though not reflected in administrative coverage data, which measures coverage according to the same definition as this question in the EoR survey, the low coverage in cycle 4 may be explained by poor morale due delays to payments to drug distributors and supervisors who did not have bank accounts.

Table 11. Day 1 treatments administered by drug distributors to eligible children between 3 and 59 months per cycle, end-of-round survey, Nigeria.

State	Coverage cycle 1 [95% CI]	Coverage cycle 2 [95% CI]	Coverage cycle 3 [95% CI]	Coverage cycle 4 [95% CI]
Jigawa	77.1% [74.6 to 79.4]	84.5% [82.4 to 86.6]	74.9% [72.3 to 77.4]	54.9% [52.0 to 57.5]
Katsina	81.9% [80.0 to 83.6]	66.7% [64.5 to 69.0]	52.9% [50.6 to 55.4]	55.4% [53.1 to 57.9]
Sokoto	79.7% [78.2 to 81.3]	67.3% [65.6 to 69.1]	58.0% [55.9 to 60.0]	45.8% [43.8 to 47.8]
Zamfara	82.9% [81.5 to 84.3]	84.3% [82.9 to 85.6]	79.0% [77.5 to 80.5]	68.1% [66.2 to 69.9]

Children who received a full three-day course of SPAQ

Both types of surveys found that very few children did not receive the AQ doses on Day 2 and 3 from their caregivers, with little difference between Day 2 (**Table 12**) and Day 3 (**Table 13**). Burkina Faso only reported coverage per health district from the EoC surveys, with numerators and denominators not provided. It is therefore not possible to calculate coverage at country level from this information. District-level coverage in Burkina Faso in all EoC surveys was almost universally over 90%. Chad reported on the percentage of children who received both doses, without distinguishing between doses. Coverage ranged from 91.1% in cycle 1 to 94.9% in cycle 2. As caregivers are likely to feel that they would have been expected to administer those doses, it cannot be ruled out that social desirability bias may have led to inflated coverage figures.

Table 12. Children who received a second dose of AQ from their caregiver.

Data source	Number of second doses given	Number of children surveyed	Coverage [95% CI]
Burkina Faso			
EoR: Cycle 4	946	951	**99.5%**
Jigawa			
EoC: Cycle 1	985	1,004	**98.1% [97.2 to 98.9]**
EoC: Cycle 2	992	996	**99.6% [99.1 to 99.9]**
EoC: Cycle 3	1,019	1,019	**100.0%**
EoR: Cycle 4	546	568	**96.1% [94.6 to 97.5]**
Katsina			
EoC: Cycle 1	786	798	**98.5% [97.6 to 99.4]**

Data source	Number of second doses given	Number of children surveyed	Coverage [95% CI]
EoC: Cycle 2	802	816	**98.3% [97.4 to 99.1]**
EoC: Cycle 3	814	821	**99.1% [98.4 to 99.8]**
EoR: Cycle 4	729	747	**97.6% [96.5 to 98.5]**
Sokoto			
EoC: Cycle 1	2,547	2,693	**94.6% [93.8 to 95.4]**
EoC: Cycle 2	4,270	4,364	**97.8% [97.4 to 98.3]**
EoC: Cycle 3	4,302	4,388	**98.0% [97.6 to 98.4]**
EoR: Cycle 4	1,247	1,338	**93.2% [92.0 to 94.5]**
Zamfara			
EoC: Cycle 1	2,283	2,312	**98.7% [98.3 to 99.2]**
EoC: Cycle 2	2,286	2,304	**99.2% [98.8 to 99.6]**
EoC: Cycle 3	2,371	2,390	**99.2% [98.8 to 99.5]**
EoR: Cycle 4	990	1,041	**95.1% [93.7 to 96.3]**

Table 13. Children who received a third dose of AQ from their caregiver.

Data source	Number of third doses given	Number of children surveyed	Coverage [95% CI]
Burkina Faso			
EoR: Cycle 4	943	951	**99.2%**
Jigawa			
EoC: Cycle 1	979	1,004	**97.5% [96.5 to 98.4]**
EoC: Cycle 2	990	996	**99.4% [98.8 to 99.8]**
EoC: Cycle 3	1,019	1,019	**100.0%**
EoR: Cycle 4	525	568	**92.4% [90.1 to 94.6]**
Katsina			
EoC: Cycle 1	786	798	**98.5% [97.6 to 99.3]**
EoC: Cycle 2	795	816	**97.4% [96.3 to 98.4]**
EoC: Cycle 3	806	821	**98.2% [97.3 to 99.0]**
EoR: Cycle 4	704	747	**94.2% [92.5 to 95.9]**
Sokoto			
EoC: Cycle 1	2,477	2,693	**92.0% [91.0 to 93.0]**
EoC: Cycle 2	4,170	4,364	**95.6% [94.9 to 96.1]**
EoC: Cycle 3	4,175	4,388	**95.1% [94.5 to 95.8]**
EoR: Cycle 4	1,174	1,338	**87.7% [86.0 to 89.5]**
Zamfara			
EoC: Cycle 1	2,268	2,312	**98.1% [97.5 to 98.6]**
EoC: Cycle 2	2,277	2,304	**98.8% [98.4 to 99.2]**

Data source	Number of third doses given	Number of children surveyed	Coverage [95% CI]
EoC: Cycle 3	2,358	2,390	**98.7% [98.2 to 99.1]**
EoR: Cycle 4	953	1,041	**91.6% [90.0 to 93.3]**

According to the EoR survey conducted in Nigeria, the main reasons given for not administering the second or third dose of AQ were:

a) The child vomited the first dose and refused to take the same drug again;

b) The child got better or got sick following administration of Day 1;

c) The caregiver forgot about giving the Day 2 and 3 doses;

d) The caregiver did not know or think it was necessary to administer AQ on Day 2 and 3.

While these responses were given by relatively few caregivers, they suggest that communication around adherence to AQ on Day 2 and 3 needs to be improved.

SPAQ treatments administered by drug distributors observing DOT

The EoC survey consistently showed high levels of adherence to DOT. However, the EoR survey found significantly lower adherence rates. This was particularly noticeable in Sokoto, where only about a third of treatments were administered as DOT (**Table 14**). This may reflect better training and guidance provided to EoR survey data collectors compared with their EoC survey counterparts. Data collectors would thus have been more likely to distinguish between caregivers reporting that a blister was left by the drug distributor and caregivers stating that drug distributors administered the drug themselves.

Table 14. SPAQ treatments administered by drug distributors observing DOT.

Data source	Number of DOTs	Number children surveyed	Adherence [95% CI]
Burkina Faso			
EoC: Cycle 1	n/a	n/a	**95.6%**
EoC: Cycle 2	n/a	n/a	**94.7%**
EoC: Cycle 3	n/a	n/a	**96.1%**
EoR: Cycle 4	n/a	n/a	**n/a**
Chad			
EoR: Cycle 4	2,159	2,740	**78.8% (77.9 to 79.7)**
Jigawa			
EoC: Cycle 1	924	1,004	**92.0% [90.4 to 93.6]**
EoC: Cycle 2	974	996	**97.8% [97.0 to 98.7]**
EoC: Cycle 3	1,017	1,019	**99.8% [99.5 to 100.0]**
EoR: Cycle 4	183	568	**32.2% [28.2 to 36.1]**
Katsina			
EoC: Cycle 1	774	798	**97.0% [95.8 to 98.1]**
EoC: Cycle 2	773	816	**94.7% [93.2 to 96.2]**

Data source	Number of DOTs	Number children surveyed	Adherence [95% CI]
EoC: Cycle 3	766	821	**93.3% [91.8 to 94.8]**
EoR: Cycle 4	307	747	**41.1% [37.5 to 44.6]**
Sokoto			
EoC: Cycle 1	2,440	2,693	**90.6% [89.6 to 91.8]**
EoC: Cycle 2	4,158	4,364	**95.3% [94.7 to 95.9]**
EoC: Cycle 3	4,162	4,388	**94.8% [94.2 to 95.5]**
EoR: Cycle 4	634	1,338	**47.4% [45.0 to 49.8]**
Zamfara			
EoC: Cycle 1	2,070	2,312	**89.5% [88.5 to 90.6]**
EoC: Cycle 2	2,177	2,304	**94.5% [93.7 to 95.2]**
EoC: Cycle 3	2,335	2,390	**97.7% [97.1 to 98.3]**
EoR: Cycle 4	527	1,041	**50.6% [47.9 to 53.6]**

There may be several reasons for non-adherence to DOT. Most obviously, drug distributors may have felt they could save time by simply handing the blisters to caregivers without overseeing the administration of the drugs. It is equally possible that cultural norms about who is allowed to enter a compound may have played a role. While the Malaria Consortium recommends that at least 50% of drug distributors be female, recruiting female candidates with sufficient literacy skills was challenging. It is therefore likely that all-male teams of drug distributors may not have been allowed to enter compounds, leaving them with no option but to leave the drugs with a caregiver. It is also possible that the issues relating to delayed payments may have affected morale and willingness to follow the SMC guidelines as outlined above.

SPAQ treatments provided to ineligible children aged 5 and above

While the EoC survey found comparatively low coverage among children aged 5 and above in Burkina Faso and Nigeria, the EoC survey suggests that up to a quarter of children who were too old to be eligible for SMC were in fact treated. Coverage of children over 5 was even more common in Chad, where the EoR survey found that 60% of children in this age group had received treatment at least once (**Table 15**).

Table 15. SPAQ treatments provided to ineligible children aged 5 and above.

Data source	Number of treatments	Number of children surveyed	Coverage
Burkina Faso			
EoC: Cycle 1	1,043	8,410	**12.4%**
EoC: Cycle 2	209	3,646	**5.7%**
EoC: Cycle 3	172	3,540	**4.9%**
EoR: treated at least once	234	1,192	**19.6%**
Chad			

Data source	Number of treatments	Number of children surveyed	Coverage
EoC: Cycle 1	n/a	n/a	**35%**
EoC: Cycle 2			
EoC: Cycle 3			
EoR: treated at least once	304	503	**60.4%**
Jigawa			
EoC: Cycle 1	3,111	205	**6.2%**
EoC: Cycle 2	3,268	40	**1.2%**
EoC: Cycle 3	3,437	32	**0.9%**
EoR: treated at least once	1,074	215	**16.6%**
Katsina			
EoC: Cycle 1	2,536	61	**2.3%**
EoC: Cycle 2	2,890	41	**1.4%**
EoC: Cycle 3	3,303	82	**2.4%**
EoR: treated at least once	1,615	547	**25.3%**
Sokoto			
EoC: Cycle 1	9,878	1,699	**14.7%**
EoC: Cycle 2	19,432	2,592	**11.8%**
EoC: Cycle 3	20,673	2,035	**9.0%**
EoR: treated at least once	2,453	920	**27.3%**
Zamfara			
EoC: Cycle 1	7,818	554	**6.6%**
EoC: Cycle 2	9,585	414	**4.1%**
EoC: Cycle 3	9,990	980	**8.6%**
EoR: treated at least once	2,623	948	**26.5%**

The issue of determining age eligibility was highlighted as a focus during the supervisor training. As a result of the trends found in EoC surveys, supervisors were also asked to emphasize the importance of adhering to the SMC guidelines in monthly interactions with drug distributors. The diminishing trend of coverage of children over five in Jigawa and Sokoto may indicate that the constant reminders were effective. However, the EoR survey is likely to paint a more accurate picture as determining age was taught in detail during the training of EoR data collectors. Note, however, that the question asked in the two types of survey differs, with the EoC survey inquiring about the preceding cycle, whereas the EoR questionnaire asks about children over 5 who were ever treated during the campaign. In addition to the general challenges in determining age outlined above, the inability for all-male teams of drug distributors to enter compounds may have also contributed to children over 5 being treated, as they may have been unable to determine age themselves.

Day 1 treatments received per child over the course of the SMC round and children who received Day 1 SPAQ treatment during all four SMC cycles

Day 1 treatments received per child and number of children who received Day 1 treatment during all four cycles could only be assessed through the EoR survey. As mentioned above, this does not take into account the two daily doses of AQ, so full protection cannot be presumed. The proportion of children who received all four Day 1 treatments over the course of the SMC round ranged from 24% in Sokoto to 83% in Burkina Faso. It was encouraging to see that very few children received no treatment at all (**Table 16**)[10].

Table 16. Number of Day 1 treatments received per child.

Number of treatments received	Number of children surveyed	Coverage [95% CI]
Burkina Faso (n=1,828)		
None	111	**6.1%**
One	1,717	**93.9%**
Two	1,658	**90.7%**
Three	1,610	**88.1%**
Four	1,513	**82.8%**
Jigawa (n=1,074)		
None	32	**3.0% [2.0 to 4.1]**
One	82	**7.6% [6.0 to 9.4]**
Two	248	**23.1% [20.6 to 25.9]**
Three	297	**27.7% [25.2 to 30.4]**
Four	415	**38.6% [35.5 to 41.7]**
Katsina (n=1,615)		
None	31	**1.9% [1.3 to 2.7]**
One	305	**18.9% [17.0 to 20.9]**
Two	447	**27.7% [25.6 to 29.9]**
Three	378	**23.4% [21.3 to 25.4]**
Four	454	**28.1% [26.0 to 30.3]**
Sokoto (2,453)		
None	75	**3.1% [2.4 to 3.8]**
One	432	**17.6% [16.1 to 19.1]**
Two	704	**28.7% [26.9 to 30.6]**
Three	653	**26.6% [24.9 to 28.4]**
Four	589	**24.0% [22.4 to 25.6]**
Zamfara (n=2,624)		
None	20	**0.8% [0.4 to 1.1]**

[10] Chad did not report on number of cycles received per child.

Number of treatments received	Number of children surveyed	Coverage [95% CI]
One	255	**9.7% [8.6 to 10.8]**
Two	430	**16.4% [14.9 to 17.8]**
Three	542	**20.7% [19.1 to 22.3]**
Four	1377	**52.5% [50.5 to 54.4]**

CONCLUSIONS & RECOMMENDATIONS

Administrative program data shows very high coverage of SMC across all areas where Malaria Consortium implemented SMC in 2018. Coverage surveys confirmed generally high coverage, with the proportion of eligible children receiving a dose of SP and the first dose of AQ from a drug distributor, as well as the proportion of those receiving Day 2 and Day 3 of AQ from their caregivers consistently over 90% across all cycles and countries. There were, however, indications that coverage declined over the course of the 2018 round, possibly due to issues relating to paying drug distributors and supervisors who did not have a bank account.

In Burkina Faso, a very encouraging 82% of children received Day 1 SPAQ during each SMC cycle. This figure ranged from 24 to 52% in Nigeria. At the same time, there were very few eligible children (between 1% and 6%) who never received SPAQ.

One of the key indicators of quality implementation, observing DOT for the administration of Day 1 SP and AQ, showed mixed results, ranging from nearly universal adherence in some areas and some cycles, to less than a third of treatments administered by DOT in Sokoto in cycle 4. Administration of SMC to children above the eligible age range remains common, especially in Chad. EoR surveys revealed that the issue persists across all areas where Malaria Consortium implements SMC.

In addition to pointing to a need to address a range of programmatic shortcomings, there are also numerous lessons with regard to the methods used to assess coverage. Principally, these concern the need to refine sampling, data collection tools, data analysis and reporting, as well as building capacity to implement and supervise coverage surveys. **Table 17** summarizes recommendations resulting from the 2018 campaign that will be considered for subsequent campaigns.

Table 17. Recommendations resulting from 2018 SMC coverage report.

Program component	Recommendation
Administrative data	Efforts to track doses received by children over the course of a round of SMC, such as the cohort tracking trialed in Nigeria and the unique identifiers used in Chad, should be intensified. While *SMC Child Record Cards* are not themselves a reliable source of coverage data due to poor retention and completion, their use should be continued as they can support the tracking of number of doses received per child. *Tally Sheets* should be simplified and re-designed with the aim of improving user-friendliness.

Program component	Recommendation
	Although practicing the use of *Tally Sheets* is a key component of drug distributors' and supervisors' training curriculum, it is likely that this is not always followed; there is therefore a need to reinforce the monitoring and evaluation of training quality. Guidance and support on the completion of *Tally Sheets* should be a key component of supervision provided to drug distributors. The importance of collecting administrative data should be emphasized to everyone involved in delivering the program. The use and cost of electronic or mobile tools for collection of administrative data should be explored.
Coverage surveys	Sampling methods for EoC and EoR surveys should be refined and standardized. Robustness and rigor of survey methods should be improved, for example with regard to the recruitment and training of data collectors, quality assurance mechanisms and observance of good practice with regard to ethical research. Survey aims and objectives should be refined and questionnaires should be designed accordingly, collecting only information that relates directly to the stated aims and objectives. Improve the reliability of data by building in automatic common sense-checks into electronic data collection tools. Translate questionnaires into local languages and ensure they are administered identically by all data collectors. Build a pool of reliable and experienced local research firms and consultants. Ensure data collectors are not linked to or attached to SMC program stakeholders. Increase the capacity of Malaria Consortium staff to supervise and quality assure data collection, analysis and presentation. Strengthen training of data collectors in general and with regard to determining children's age in particular. Provide guidance to data collectors with regard to ensuring respondents refer to SMC rather than other mass drug administration campaigns. Harmonize the terminology used across Malaria Consortium's SMC program with regard to coverage and quality indicators, program components etc.

Program component	Recommendation
	Harmonize data analysis and presentation of coverage data across Malaria Consortium's SMC program, for example by developing a common M&E framework and set of standard indicators, as well as providing report templates. Explore the use of more complex data analysis methods to triangulate data from different data sources and identify factors affecting coverage. Explore the possibility of triangulating and correlating programme coverage with data on quality and impact.
Program	Strengthen communication provided to caregivers regarding the administration of Day 2 and Day 3 AQ. Strengthen communication provided to caregivers regarding the need to retain the *SMC Child Record Card*. Increase the number of female drug distributors, ensuring that each team has at least one female distributor. Emphasize the importance of DOT to drug distributors during training and supervision. Emphasize the importance of adhering to age eligibility criteria to drug distributors during training and supervision. Resolve the issue of making payments to drug distributors and supervisors who do not have bank accounts, for example by exploring mobile payment options.
Research	Conduct operational research on the reasons why administration of SMC to ineligible children over 5 remains a common challenge.

REFERENCES

1. World Health Organization. WHO policy recommendation: seasonal malaria chemoprevention (SMC) for Plasmodium falciparum malaria control in highly seasonal transmission areas of the Sahel sub-region in Africa. Geneva, Switzerland; 2012.
2. World Health Organization. World malaria report 2018. Geneva, Switzerland; 2018.
3. MEASURE Evaluation, Macro International Inc., John Snow Research and Training Institute, Tulane University. Report of a technical meeting on the use of Lot Quality Assurance Sampling (LQAS) in polio eradication programs. Chapel Hill, NC; 1998.
4. UNICEF, Liverpool School of Tropical Medicine. LQAS detailed implementation plan v1.0 Jun 2012. Liverpool, UK: LSTM; 2012.

APPENDICES

Appendix 1: SMC Tally Sheet

Appendix 2: End-of-cycle survey questionnaire

Appendix 3: End-of-round survey questionnaire

Appendix 4: End-of-round survey report, Burkina Faso

Appendix 5: End-of-round survey report, Chad

Appendix 6 End-of-round survey report, Nigeria