malaria consortium
disease control, better health

Malaria Consortium's seasonal malaria chemoprevention programme:

Philanthropy report 2022

April 2023

Report compiled by: Christian Rassi

Contributors and reviewers: Junior Achia, Dickson Awah, Kevin Baker, Craig Bonnington, Liberty Bunce, Cheick Compaore, Louise Cook, Simon Cordery, Michelle Davis, Monica Anna de Cola, Ashley Giles, Sam Gudoi, Tom Heslop, Maxwell Kolawole, Maurice Kwizera, Chuks Nnaji, Nkoli Nnamonu, Anthony Nuwa, Musa Odongo, Chibuzo Oguoma, Joshua Okafor, Samantha Rothbart, David Salandini Odong, Clotaire Tapsoba, James Tibenderana, Yakouba Zoungrana, Albertino Zunza

Established in 2003, Malaria Consortium is one of the world's leading non-profit organisations specialising in the prevention, control and treatment of malaria and other communicable diseases among vulnerable populations. Our mission is to save lives and improve health in Asia and Africa through evidence-based programs that combat targeted diseases and promote universal health coverage.

Malaria Consortium
The Green House, 244–254 Cambridge Heath Road, London E2 9DA

www.malariaconsortium.org
info@malariaconsortium.org

UK Registered Charity No: 1099776
US EIN: 98-0627052

Executive summary

This report summarises how Malaria Consortium used philanthropic funding for seasonal malaria chemoprevention (SMC), either exclusively or in combination with other funding sources, in 2022.

SMC is a highly effective community-based intervention to prevent malaria infections in areas where malaria morbidity and mortality are high and malaria transmission is seasonal. In those areas, malaria cases peak over a period of a few months every year, typically coinciding with the rainy season. SMC involves the intermittent administration of antimalarial medicines to populations at risk from malaria during this peak transmission season. The objective is to maintain therapeutic antimalarial drug concentrations in the blood throughout the period of greatest risk.

2022 marked 10 years since the initial recommendation to scale up its use by the World Health Organization in 2012. The intervention has since been scaled up successfully, reaching around 48 million children in 2022. New global guidelines for malaria emphasise the importance of local evidence and determining the optimal mix of interventions at the subnational level. For SMC, the guidelines no longer define geographic restrictions and provide greater flexibility in recognising age-based risk. Malaria Consortium believes that, for the foreseeable future, SMC is likely to remain a cornerstone of malaria prevention and control in areas where malaria transmission is seasonal. However, we are likely to see fundamental changes to how and where SMC is implemented. Key questions that will need to be addressed to ensure its longer-term effectiveness and shape the future of SMC relate to seasonality and age range; SMC in new geographies; parasite resistance and alternative drug regimens; integration; and innovation.

Malaria Consortium is a leading implementer of SMC. In 2022, we supported SMC delivery to almost 24 million children in seven countries: Burkina Faso, Chad, Mozambique, Nigeria, South Sudan, Togo and Uganda. This means around half of all children reached with SMC that year were supported by Malaria Consortium. The majority of Malaria Consortium's funding for SMC comes from philanthropic sources. In 2022, philanthropic funding or co-funding enabled us to deliver SMC to 16.08 million children in the seven countries we supported. This compares with 12.19 million reached with philanthropic support in 2021 and 7.14 million in 2020. The increased number of children reached in 2022 was primarily due to the expansion of SMC to new areas in Nigeria and Mozambique. We used philanthropic funding to procure around 77.5 million blister packs of SMC medicines and to support more than 150,000 SMC implementers involved in the delivery of SMC.

SMC campaigns are implemented under the leadership of national malaria programmes and through countries' existing health system structures. Consequently, Malaria Consortium's role in supporting SMC varies from country to country. However, we generally provide technical and operational support on all the components that together make up SMC as a public health intervention: administration of SMC medicines; planning and enumeration; procurement and supply management; community engagement; training; case management and pharmacovigilance; supervision; and monitoring and evaluation. Quality of SMC delivery, campaign digitalisation and mitigating risk are themes that cut across intervention components.

As both a leading implementer of SMC and a research organisation, Malaria Consortium is uniquely placed to develop and evaluate solutions to operational problems that can improve the quality of SMC delivery; assess the extent to which SMC impacts estimates of the burden of malaria; and test innovations that will shape the future of SMC. The scope and scale of Malaria Consortium's SMC research has grown substantially over the last few years. In 2022, Malaria Consortium's SMC research was published in seven peer-reviewed articles. We also presented our findings at

prestigious academic conferences. Research studies we conducted in 2022 included testing different community engagement strategies to increase the effectiveness of SMC by strengthening caregivers' adherence to SMC protocol in Burkina Faso, Chad, Nigeria and Togo; and an ecological analysis drawing on a range of data sets from Burkina Faso and Nigeria to estimate the impact of SMC in terms of preventing malaria cases among children during the high transmission season. Some of our most exciting and groundbreaking research in 2022 explored the feasibility, acceptability and impact of SMC in East and southern Africa, where SMC had not previously been tested due to concerns over widespread parasite resistance to the SMC medicines in this region. Those studies involved assessments of the feasibility and acceptability of SMC in those new settings; assessments of the chemoprevention efficacy of SMC medicines and the effectiveness of SMC in terms of preventing malaria cases during the high transmission season; as well as monitoring of common resistance markers associated with parasite resistance to the SMC medicines. We generally found SMC in the new locations to be feasible and highly acceptable. Effectiveness results so far have been promising, but we do not yet have results from the chemoprevention efficacy and resistance markers studies, which will become available over the course of 2023. We will only be able to draw robust conclusions on the suitability of SMC in the locations where we have tested the intervention once we have the full results from all study elements.

As a global leader on SMC, Malaria Consortium wants to contribute to relevant debates about SMC policy and practice. We also want to ensure sustainable financing for SMC from three core channels: governments, institutional donors and philanthropists. Our external relations outputs in 2022 included a technical brief describing our monitoring and evaluation framework; a summary of our insights from implementing the first SMC campaign in Mozambique; and an advocacy brief that lobbies for the inclusion of policy guidance on the co-implementation of SMC and vitamin A supplementation in Nigeria.

Photo 1: A caregiver and children holding their SMC record cards, where SMC doses are recorded, Mozambique

We regularly engage with national, regional and global malaria stakeholders and are active members of the SMC Alliance, a workstream under the RBM Partnership to End Malaria's Country/Regional Support Partner Committee. In 2022, we served as the secretariat of the SMC Alliance subgroups on research and communications and advocacy. This has included leading on the compilation of a report that celebrates 10 years of SMC on behalf of the SMC Alliance.

The total philanthropic expenditure in 2022 was 62.26 million United States dollars.

Contents

Acronyms and abbreviations

ACCESS-SMC	Achieving Catalytic Expansion of Seasonal Malaria Chemoprevention in the Sahel
AL	artemether-lumefantrine
AQ	amodiaquine
ASAQ	artesunate-amodiaquine
ASTMH	American Society of Tropical Medicine and Hygiene
CHIPS	Community Health Influencers, Promoters and Services
CHW	community health worker
CI	confidence interval
COVID-19	coronavirus disease
cRCT	cluster-randomised controlled trial
DOT	directly observed treatment
DP	dihydroartemisinin-piperaquine
EPI	Essential Programme on Immunization
FGD	focus group discussion
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
HR	hazard ratio
iCCM	integrated community case management
IDPs	internally displaced people
IPTi	intermittent preventive treatment of malaria in infants
IPTp	intermittent preventive treatment of malaria in pregnancy
IPTsc	intermittent preventive treatment of malaria in school-aged children
KII	key informant interview
KOICA	Korea International Cooperation Agency
LGA	local government area
LQAS	lot quality assurance sampling
M&E	monitoring and evaluation
MDA	mass drug administration
MSF	Médecins Sans Frontières
NMCD	National Malaria Control Division
NMEP	National Malaria Elimination Programme
nRCT	non-randomised controlled trial
OR	odds ratio
PDMC	post-discharge malaria chemoprevention
PhD	Doctor of Philosophy
PMC	perennial malaria chemoprevention
PMI	U.S. President's Malaria Initiative

PNCM	Programa Nacional de Controlo da Malária
PNLP	Programme National de Lutte contre le Paludisme
PReS	Project Results System
RDT	rapid diagnostic test
SMC	seasonal malaria chemoprevention
SP	sulfadoxine-pyrimethamine
SPAQ	sulfadoxine-pyrimethamine plus amodiaquine
UK	United Kingdom
UNICEF	United Nations Children's Fund
US	United States
USD	United States dollar
VHT	village health team
WHO	World Health Organization

1. Introduction

Malaria Consortium is a leading implementer of seasonal malaria chemoprevention (SMC), a highly effective community-based intervention to prevent malaria infections in areas where malaria morbidity and mortality are high and malaria transmission is seasonal. In those areas, malaria cases peak over a period of a few months every year, typically coinciding with the rainy season. SMC involves the intermittent administration of antimalarial medicines to populations at risk from malaria during this peak transmission season. The objective is to maintain therapeutic antimalarial drug concentrations in the blood throughout the period of greatest risk.

The majority of Malaria Consortium's funding for SMC comes from philanthropic sources. This includes grants and donations to Malaria Consortium's entities in the United Kingdom (UK) and the United States (US), primarily as a result of being awarded Top Charity status by GiveWell,[1,2] a non-profit dedicated to finding outstanding giving opportunities and publishing the full details of its analysis to help donors decide where to give.

In this report, we summarise how Malaria Consortium used philanthropic funding for SMC, either exclusively or in combination with other funding sources, in 2022. Section 2 presents an overview of the scale and scope of Malaria Consortium's current SMC portfolio. In section 3, we trace the scale-up of SMC over the past ten years and outline the adaptations and innovations that we believe will shape its future. Section 4 discusses Malaria Consortium's role as an SMC implementing partner, describing how we work in close partnership with national malaria programmes to implement SMC campaigns. Achievements and challenges in each of the countries where philanthropic funding was used to support SMC in 2022 are summarised in section 5. Section 6 discusses Malaria Consortium's role as a research organisation and summarises philanthropically funded SMC research activities conducted in 2022. In section 7, we describe our approach to external relations and how philanthropic SMC funding was used to engage with external stakeholders and audiences. Finally, section 8 presents an overview of philanthropic SMC expenditure in 2022.

Photo 2: A community health worker in Uganda provides SMC to eligible children alongside other services including malaria testing

2. Malaria Consortium's SMC portfolio 2022

In 2022, Malaria Consortium supported SMC delivery to almost 24 million children in seven countries: Burkina Faso, Chad, Mozambique, Nigeria, South Sudan, Togo and Uganda (**Figure 1**).

Figure 1: Countries where Malaria Consortium supported SMC delivery, 2022

Out of a total of 23.78 million children targeted with Malaria Consortium's support in 2022, 15.10 million were reached exclusively with philanthropic funding. An additional 970,000 children were supported through co-funding arrangements with the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund), the United Nations Children's Fund (UNICEF) and the Korea International Cooperation Agency (KOICA). Global Fund funding exclusively was used to support SMC delivery to the remaining 7.71 million children (**Table 1**).

Table 1: SMC target population supported by Malaria Consortium by funding source, 2022

Funding source	Number of children targeted	Countries
Philanthropic	15,100,000	Burkina Faso, Chad, Mozambique, Nigeria, South Sudan, Uganda
Philanthropic and Global Fund	390,000	Togo, Uganda
Philanthropic and UNICEF	300,000	Burkina Faso, Togo
Philanthropic and KOICA	280,000	Nigeria
Global Fund	7,710,000	Nigeria
TOTAL	**23,780,000**	

3. Seasonal malaria chemoprevention: Past, present and future

2022 marked 10 years since the initial recommendation to scale up the use of SMC by the World Health Organization (WHO) in 2012. In this section, we recount the journey of SMC from concept to scale; discuss the current WHO guidelines for the deployment of SMC; and outline key considerations that will shape the future of the intervention.

3.1 From concept to scale: Ten years of SMC

Photo 3: Boxes containing blister packs of the two antimalarials for use in SMC: sulfadoxine-pyrimethamine and amodiaquine

In 2012, the WHO recommended the scale-up of SMC as a strategy for the prevention of malaria caused by *Plasmodium falciparum* in children 3–59 months.[3] Children under five were targeted because young children are most at risk from severe malaria disease and death. Based on a meta-analysis of trials conducted over the previous decade,[4] the WHO expected that SMC could prevent 75 percent of uncomplicated and severe malaria cases in children under five. The policy recommended a combination of two antimalarials for use in SMC: sulfadoxine-pyrimethamine (SP) and amodiaquine (AQ). A full therapeutic course of SP plus AQ (SPAQ) confers a high degree of protection for approximately 28 days.[5] Annual SMC rounds comprising four monthly SMC cycles — beginning at the start of the transmission season and comprising a full therapeutic course of SPAQ each cycle — were recommended in areas where more than 60 percent of clinical malaria cases occur during a maximum of four months, and where the clinical attack rate of malaria is greater than 0.1 attack per transmission season among children under five. SMC was not recommended in areas where the therapeutic efficacy of SPAQ is below 90 percent due to parasite resistance, which is widespread across East and southern Africa.[6] Consequently, the Sahel region of West and Central Africa was prioritised for the scale-up of SMC. To support national malaria programmes in rolling out the intervention, the WHO published a field guide in 2013, which provided technical information and operational tools to inform decision-making on how and where SMC should be implemented.[7] The

recommendation to deploy SMC in suitable areas was reinforced in the WHO's Global Technical Strategy for Malaria 2016 – 2030.[8]

By 2014, eight Sahelian countries were implementing SMC, reaching about 2.5 million children. Between 2015 and 2017, the Achieving Catalytic Expansion of SMC in the Sahel (ACCESS-SMC) project, funded by Unitaid and led by Malaria Consortium, accelerated the scale-up of SMC across the region. At its peak, ACCESS-SMC reached close to seven million children in Burkina Faso, Chad, The Gambia, Guinea, Mali, Niger and Nigeria. The project also contributed towards building the evidence base of SMC as a safe and effective intervention when implemented at scale.[9] Case-control studies in the seven ACCESS-SMC countries showed that SMC under programmatic conditions provides high levels of protection comparable to those found in trial settings, with an average protective effectiveness of 88 percent against clinical malaria over a 28-day period.[10] A study in Mali found that SMC reduced hospital admissions among children under five by 39 percent.[11] The weighted average economic cost of administering four monthly SMC cycles was estimated at 3.63 United States dollars (USD) per child, with economic cost savings to ACCESS-SMC countries' health systems totalling 66 million US dollars by reducing the cost of malaria diagnosis, treatment and hospital admissions.[12]

SMC has since been embraced and further scaled up by governments, with support from donors such as the Global Fund, the U.S. President's Malaria Initiative (PMI), UNICEF, UK aid from the UK government, Médecins Sans Frontières (MSF), KOICA and philanthropic funding for Malaria Consortium's SMC programme. In 2021, SMC was implemented in 15 countries, targeting around 45 million children,[13] up from 33.5 million children in 13 countries the year before.[14] The increase in targeted children was primarily due to the expansion of SMC to new states in Nigeria, while the increased number of countries implementing SMC was a result of SMC pilot projects in Mozambique and Uganda — the first countries outside of the Sahel to test the use of SMC as a malaria prevention strategy. According to unpublished data compiled by the SMC Alliance, a workstream under the RBM Partnership to End Malaria's Country/Regional Support Partner Committee, the number of children targeted globally was just under 48 million in 2022. This means around half of all children reached with SMC that year were supported by Malaria Consortium.

3.2 SMC and malaria chemoprevention in the WHO's updated Guidelines for Malaria

The successful scale-up of SMC in the Sahel over the last decade has invigorated the global malaria community's interest in chemoprevention strategies for at-risk populations. This is reflected in the WHO's revised Guidelines for Malaria,[15] published in 2022, which encourage national malaria programmes to expand access to chemoprevention, including a range of different strategies (**Spotlight 1**). The consolidated guidelines provide greater flexibility to malaria-endemic countries to adapt malaria strategies to their specific context and epidemiology, emphasising the importance of local evidence and determining the optimal mix of interventions at the subnational level. Some countries have conducted systematic, evidence-based stratification exercises to determine the optimal mix of malaria interventions in different locations, taking into account epidemiological characteristics such as malaria prevalence, incidence and all-cause mortality among children under five, as well as measures of seasonality, urbanisation and access to health care.

Spotlight 1: Chemoprevention strategies recommended in the 2022 WHO Guidelines for Malaria

The WHO defines chemoprevention as the use of medicines, either alone or in combination, to prevent malaria infection and its consequences. The consolidated WHO Guidelines for Malaria recommend the following chemoprevention strategies:

- **Intermittent preventive treatment of malaria in pregnancy (IPTp)** involves giving pregnant women monthly courses of SP beginning in the second trimester of pregnancy. Doses should be given at least one month apart, with the objective of ensuring that at least three doses are received over the course of the pregnancy. IPTp is typically delivered through countries' antenatal care platforms. The WHO strongly recommends the use of IPTp in all malaria-endemic areas.
- **Perennial malaria chemoprevention (PMC)**, formerly known as intermittent preventive treatment of malaria in infants (IPTi), involves the regular administration of antimalarials in areas where malaria transmission is high throughout the year. No parameters have been defined for the age range of PMC, but the WHO advises that eligibility should be informed by the age pattern of severe malaria admissions. Where PMC has been deployed to date, typically children under 24 months have been targeted. Similarly, no specific drug regimen is recommended but, in practice, SP is commonly used. Delivery is typically integrated into countries' Essential Programme on Immunization (EPI) programmes. The WHO have issued a conditional recommendation for the scale-up of PMC.
- **Seasonal malaria chemoprevention (SMC)** involves the administration of antimalarial medicines (typically SPAQ) during peak malaria transmission seasons to reduce disease burden. Commonly, children 3–59 months are targeted through community-based door-to-door campaigns. The WHO strongly recommends the use of SMC in suitable areas.
- **Intermittent preventive treatment of malaria in school-aged children (IPTsc)** involves the administration of antimalarials to children 5–15 years at predetermined intervals. The intervention can be implemented both in areas of perennial and seasonal malaria transmission. IPTsc should only be introduced if it does not compromise chemoprevention interventions for younger children. Delivery is typically school based. No specific drug regimen has been defined. The WHO conditionally recommends IPTsc in malaria-endemic settings with moderate to high transmission.
- **Post-discharge malaria chemoprevention (PDMC)** involves the repeated administration of antimalarials to children with severe anaemia caused by malaria following their discharge from hospital. This is a new intervention that has not yet been clearly defined or operationalised. The WHO has issued a conditional recommendation for the use of PDMC in in settings with moderate to high malaria transmission.
- IPTp, PMC, SMC, IPTsc and PDMC all target specific at-risk groups and are intended to be implemented over several years. Those approaches are distinguished from **mass drug administration (MDA)**, which has a broader target population and is often implemented as a one-off, stand-alone campaign. The WHO guidelines conditionally recommend MDA for burden reduction; MDA for burden reduction in emergency settings; and MDA to reduce transmission in low-transmission settings. MDA to reduce transmission in moderate and high transmission settings is not recommended.

For SMC, the consolidated WHO guidelines no longer define geographic restrictions and they provide greater flexibility in recognising age-based risk.[16] Malaria Consortium welcomed these new guidelines, acknowledging that in the face of limited resources and cross-border challenges such as parasite resistance and the global climate crisis, a coordinated approach will be needed to guide the future deployment of SMC.[17] An updated SMC field manual will provide further guidance on where and how SMC should be implemented. Malaria Consortium was invited by the WHO to participate in a technical consultation to inform the revisions to the manual, which will be published in 2023.

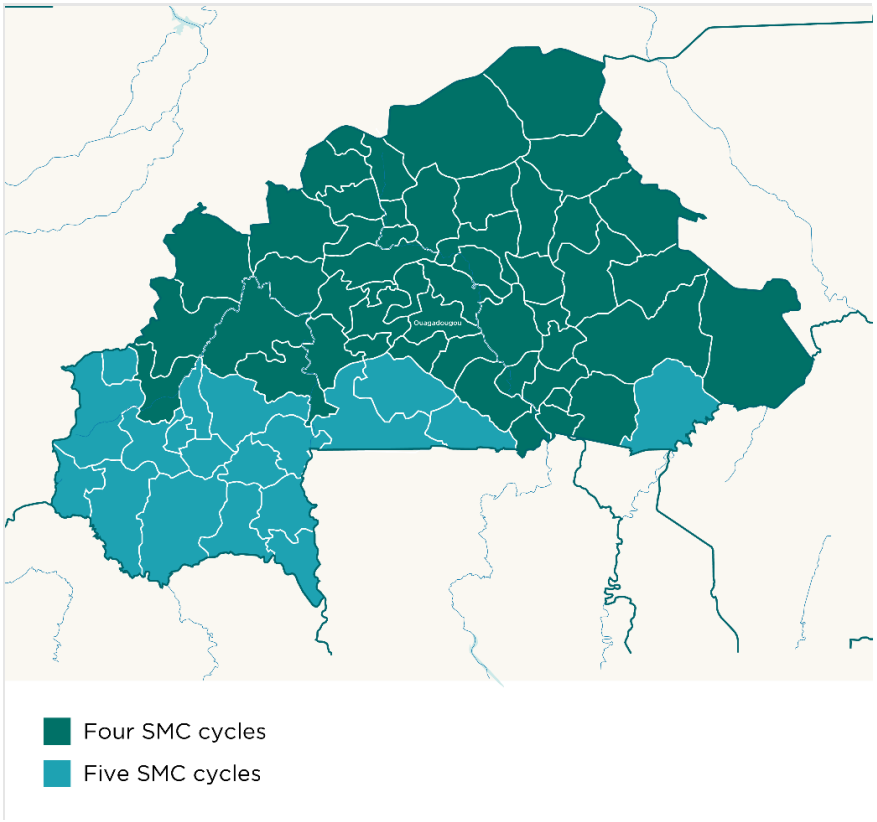
3.3 The future of SMC

For the foreseeable future, SMC is likely to remain a cornerstone of malaria prevention and control in areas where malaria transmission is seasonal, but we are likely to see several fundamental changes to how and where SMC is implemented. Key questions the global malaria community will need to address to maintain the longer-term effectiveness of SMC relate to seasonality and age range; SMC in new geographies; parasite resistance and alternative drug regimens; integration; and innovation.

i. Seasonality and age range

In recent years, we have seen countries varying the number of monthly SMC cycles to better reflect the duration of the peak malaria transmission season. A study conducted by Malaria Consortium in Burkina Faso showed that adding a fifth cycle is feasible and acceptable, with similar SMC coverage achieved across all cycles.[18] Following a recommendation from a systematic stratification exercise, Burkina Faso's National Malaria Control Programme — *Programme National de Lutte contre le Paludisme* (PNLP) — adopted the implementation of five SMC cycles in 19 of the country's 70 health districts, starting in 2019 (**Figure 2**). Of the countries supported by Malaria Consortium, some states in Nigeria and all SMC-implementing areas in South Sudan and Uganda also implement five cycles. It is likely that varying the number of SMC cycles between three and five per year will become the norm over the coming years. It is also possible that seasonality patterns will change as a result of the global climate crisis. There is a need to collaborate more closely with climate scientists to evaluate when and where SMC can be used to maximum effect, including determining the optimal start and end points of SMC campaigns based on local malaria transmission patterns.

Figure 2: Number of SMC cycles implemented by health district, Burkina Faso

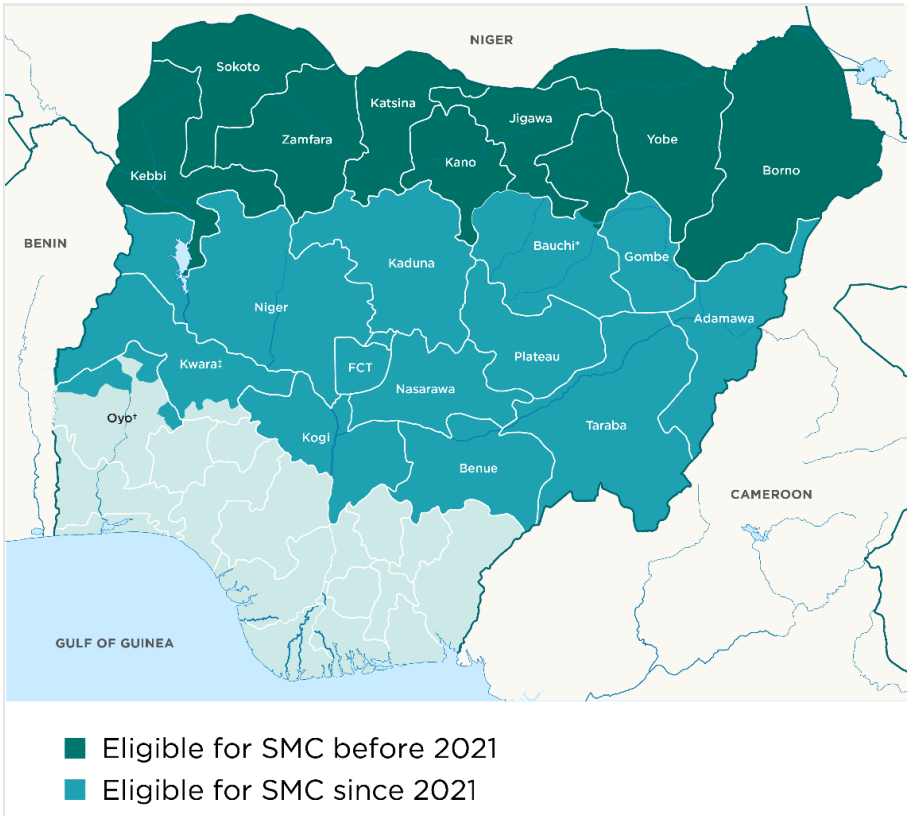


Another parameter some countries have experimented with is the age range that is targeted for SMC. For example, a study conducted in Senegal found that SMC in children up to 10 years is well tolerated and effective.[19] The WHO's consolidated malaria guidelines stipulate that the age group targeted for SMC should be informed by the local age pattern of severe malaria admissions, but also point out that cost-effectiveness of SMC will become less favourable as the intervention is extended to older age groups at lower risk of severe disease.[15] A study conducted by Malaria Consortium in Chad found that extending the age range of SMC to older children is generally acceptable to both policy makers and caregivers. However, there was also a strong preference for prioritising younger children.[20]

ii. SMC in new geographies

Greater flexibility and subnational tailoring will result in SMC being expanded to new geographies, thus reaching children that have not so far benefited from SMC. In Nigeria, for example, nine Sahelian states were targeted for the initial scale-up of SMC. In 2021, a systematic stratification exercise resulted in the National Malaria Elimination Programme (NMEP) considering an additional 11 states plus the Federal Capital Territory (FCT) eligible for SMC (**Figure 3**). Similar stratification exercises in other countries may result in the identification of additional locations that could benefit from SMC. Those exercises may, however, also conclude that SMC is not needed in some areas that currently receive the intervention. In line with the general paradigm shift away from one-size-fits-all approaches and towards subnational tailoring, there is a need for closer coordination between SMC and other malaria interventions, including net distribution and the other chemoprevention strategies recommended in the revised WHO malaria guidelines.

Figure 3: Areas considered eligible for SMC before 2021 and since 2021, Nigeria



*Only 10 local government areas (LGAs) in Bauchi were considered eligible for SMC pre-2021. The remaining 10 LGAs have been considered eligible since 2021.
‡Only 11 out of 16 LGAs in Kwara are considered eligible for SMC.
†Only six out of 33 LGAs in Oyo are considered eligible for SMC.

The 2022 WHO malaria guidelines recommend SMC in all areas of seasonal malaria transmission and no longer specify a therapeutic efficacy threshold for SPAQ.[15] This recognises that SMC with SPAQ may still work for malaria prevention even in areas where the medicines are no longer efficacious in terms of curing clinical malaria cases due to parasite resistance. Malaria Consortium has supported the national malaria programmes in Mozambique, South Sudan and Uganda in conducting implementation research to test the use of SMC in areas where malaria transmission is highly seasonal, but parasite resistance to the SMC medicines is assumed to be high. Early results are promising, with one study in Uganda finding a 92 percent reduced risk of developing clinical malaria during the high transmission season among children in a district where SMC was implemented, compared with children in a control district with no SMC.[21] In 2022, Malaria Consortium hosted a webinar to share emerging results from those studies,[22,23] chaired a session on this topic at the annual meeting of the SMC Alliance and co-chaired a symposium at the annual meeting of the American Society of Tropical Medicine and Hygiene (ASTMH). Study designs and results to date are presented in section 6 of this report.
Compared with West and Central Africa, there is much greater heterogeneity across East and southern Africa in terms of parasite resistance profiles, malaria transmission and prevalence, population immunity and human genetic polymorphisms. All of those factors are likely to affect how, where and when SMC can be deployed safely and effectively in this region. Moreover, SMC intersects with other malaria prevention and control interventions and strategies, which will also be affected by greater heterogeneity in East and southern Africa. It is, therefore,

important to carefully assess how introducing SMC would affect malaria prevention and control more generally. Further research is needed to assess the chemoprevention efficacy of the medicines — their ability to clear existing infections and prevent new ones — in the context of high parasite resistance. This will tell us how long the medicines are likely to remain efficacious, and if there is a risk of negatively affecting other chemoprevention strategies such as IPTp and PCM, which use the same medicines. In 2022, the WHO published a standard protocol for the assessment of the chemoprevention efficacy for monitoring and evaluating the efficacy of medicines used for malaria chemoprevention.[24] Malaria Consortium is working with the WHO to field test and validate the protocol (**Spotlight 2**).

Spotlight 2: Chemoprevention efficacy studies

So far, Malaria Consortium has conducted chemoprevention efficacy studies in Burkina Faso, Mozambique, South Sudan and Uganda. Those studies involve taking blood samples from children who have received a full course of SMC medicines under the supervision of a trained distributor at different time points during the 28-day period during which SPAQ is assumed to confer protection from malaria. Typically, samples are taken on the day when the first doses of SP and AQ are administered (day 0) and then again on days 7, 14 and 28. The presence of malaria parasites in the blood is determined through microscopy and quantitative polymerase chain reaction. This method allows us to detect the presence of genetic markers commonly associated with parasite resistance to the SMC medicines. In addition, pharmacometric analyses are performed on samples taken on days 7 and 28 to determine drug concentrations, which allows us to understand how well the medicines are metabolised and eliminated over time. Taken together, the results enable us to assess not only if the medicines in the dosage provided are efficacious in clearing existing infections and preventing new ones, but also, where parasites survive and breakthrough infections occur, whether this is a result of parasite resistance or suboptimal dosing. This is an important distinction when considering the deployment of SMC, especially in areas where parasite resistance is high. Without measuring drug levels, breakthrough infections could be erroneously ascribed to parasite resistance and the deployment of SMC might not be recommended; when, in reality, the parasites survived due to suboptimal drug exposure, which could be addressed by increasing drug dosage.

Results from Malaria Consortium's chemoprevention efficacy studies will be available in 2023. Similar studies are planned in a range of locations. Increasing our understanding of the interplay between resistance and chemoprevention efficacy will allow us to make predictions about the longer-term effectiveness of SMC, which will provide context for global efforts to find alternative or complementary drug regimens for SMC.

iii. Resistance and alternative drug regimens

While the available evidence suggests that SPAQ remains efficacious for use in SMC, there is a need to develop sustainable methods to monitor parasite resistance and the chemoprevention efficacy of SMC medicines over time. This is because the large-scale administration of medicines over a long period of time is likely to result in reduced efficacy of those medicines at some point in the future. It is possible that the chemoprevention efficacy of SPAQ might decline faster in East and southern Africa due to parasite resistance than what has been observed in the Sahel. It is, therefore, imperative to develop and test alternative drug regimens that could replace or complement SPAQ. To be suitable for the use in SMC, alternative medicines will need to be safe,

efficacious and inexpensive. In addition to clinical research, it is likely that developing commercially viable medicines in the dosage and formulation required for SMC will involve working closely with pharmaceutical companies.

iv. Integration

SMC is a community-based platform that consistently reaches a large number of children. This platform could potentially be used for the delivery of other interventions. For example, Burkina Faso has successfully integrated malnutrition screening into SMC delivery. In Nigeria, a study conducted by Malaria Consortium showed that integrating vitamin A supplementation (VAS) with SMC substantially increased vitamin A coverage.[25] In some cases, interventions may not be delivered through the same mechanisms as SMC, but a partially integrated or synchronised approach can maximise the combined public health impact. For example, SMC campaigns could be used to check on household use of mosquito nets and promote uptake of services for malaria in pregnancy. Utilising the successful SMC platform for other community-based interventions and coordinating across health programmes has the potential to unlock efficiencies at the health system level, maximising coverage and reducing overall cost.

Another approach to minimising cost and ensuring the sustainability of the intervention could involve embedding SMC within routine community health service delivery. This would mean SMC would no longer be delivered through a dedicated campaign, but through routine activities such as household visits by community health workers (CHWs), community-based primary healthcare workers who typically receive a small stipend from the government and who provide basic health services in their communities. However, this raises questions in terms of workload, task shifting and respecting the 28-day rhythm between SMC cycles.

v. Innovation

Innovations such as malaria vaccines or monoclonal antibodies are likely to affect how and where SMC is deployed in the future. Malaria vaccines in particular have received considerable attention recently, following the WHO's recommendation to scale up the use of the RTS,S/AS01 vaccine among children in sub-Saharan Africa.[26] This vaccine should be provided in a schedule of four doses in children from five months of age. After administration of a series of three primer doses, the vaccine has been found to reduce clinical malaria cases in children 5–17 months by 51 percent over a 12-month period following the first three doses. Following administration of a fourth 'booster' dose 18 months after the first dose, it reduces clinical malaria cases by 39 percent over a median of 46 months' follow-up after the third dose.[27] Other promising malaria vaccine candidates that are designed to prevent disease are likely to receive WHO approval in the near future. They offer similar levels of protection for a comparable period of time. Malaria Consortium believes that vaccines have the potential to make a substantial contribution to the reduction of malaria, but need to be used in combination with other effective control measures.[28] In areas where malaria transmission is seasonal, maximum benefit can be achieved by combining seasonal vaccination with SMC (**Spotlight 3**). A study conducted in Burkina Faso and Mali showed that seasonal vaccination using RTS,S/AS01 was as effective as SMC in preventing malaria among young children. The study also showed that a combination of seasonal vaccination plus SMC provided a higher level of protection than either of those interventions alone, indicating an additive effect.[29]

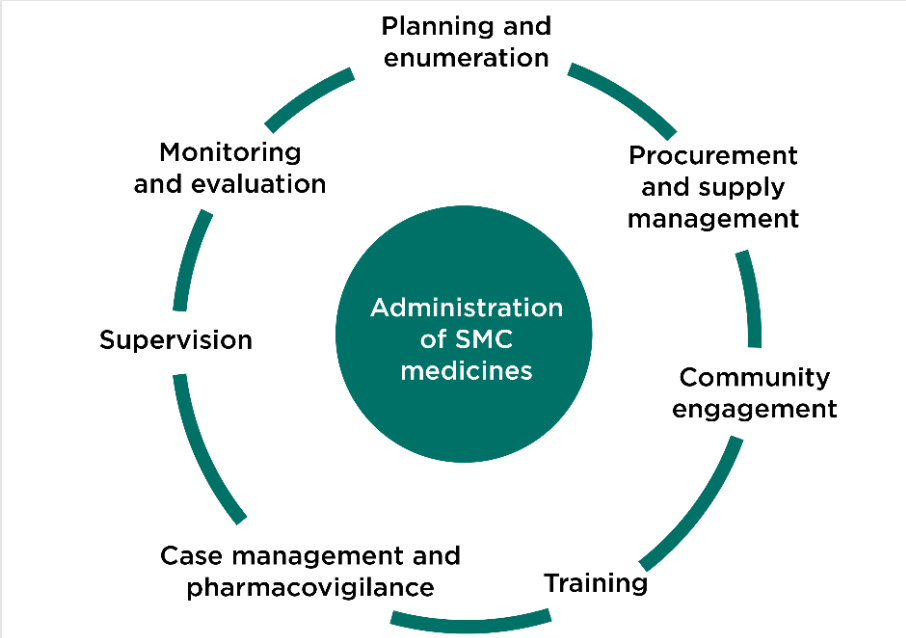
Spotlight 3: Seasonal vaccination and SMC

'Seasonal vaccination' refers to the administration of a malaria vaccine as an annual booster dose, given just prior to the peak malaria season to children who have received vaccine priming doses in the first year of their life. Childhood vaccines, such as those for measles, diphtheria or hepatitis B, are typically provided through EPI programmes and it is likely that EPI programmes will be the primary delivery platform for malaria vaccines, especially for the primer doses. The optimal delivery mechanism for the booster dose has not yet been determined. Either eligible children will need to attend a routine EPI vaccination centre in the month prior to the onset of the malaria season, or the booster dose could be given though an annual community-based campaign. The latter option is likely to achieve higher coverage. However, community-based vaccination campaigns will be more expensive and complex than SMC. For example, while SMC involves the administration of dispersible tablets that can be overseen by implementers with minimal training, the vaccine is administered through an injection and, therefore, requires medical expertise. Likewise, the medicines used in SMC are relatively stable and do not have complex storage requirements, while a cold chain needs to be maintained during the deployment of the RTS,S/AS01 vaccine. It may be possible to leverage efficiencies by integrating vaccination campaign activities into the SMC platform, for example planning, community engagement, training, supervision, monitoring and evaluation (M&E). This will require close coordination across several Ministry of Health departments — most importantly the EPI and national malaria control programmes — which comes with a range of operational challenges. More research is needed on how seasonal vaccination can best be operationalised, as well as on its cost-effectiveness and safety under programmatic conditions. This need is particularly urgent, since global manufacturing capacity is likely to remain a bottleneck for the large-scale deployment of malaria vaccines for the next two years, at least. Implementation research should be conducted on how to optimise the delivery of the malaria vaccine while supply remains an issue. This will ensure that programmes are adequately informed to maximise reach and effectiveness once sufficient quantities of vaccine are prequalified and available for large-scale deployment.

4. Malaria Consortium as an implementing partner for SMC

SMC campaigns are implemented under the leadership of national malaria programmes and through countries' existing health system structures. Consequently, Malaria Consortium's role in supporting SMC varies from country to country. However, we generally provide technical and operational support on all the components that together make up SMC as a complex public health intervention: administration of SMC medicines; planning and enumeration; procurement and supply management; community engagement; training; case management and pharmacovigilance; supervision; and M&E (**Figure 4**). We refer to all of those activities in a given location as annual SMC 'campaigns'. In this section, we describe how we work with our partners on delivering SMC campaigns. We also describe our efforts to strengthen quality of SMC delivery, support the digitalisation of health campaigns and mitigate risk for everyone involved in SMC, which cut across intervention components.

Figure 4: SMC intervention components



4.1 SMC intervention components

i. Administration of SMC medicines

The community-based distribution of SMC medicines is at the heart of SMC. Some community distributors are CHWs who are trained to provide basic health services at the community level. In most countries, however, most community distributors are volunteers recruited and trained specifically for the SMC campaign. Community distributors typically work in pairs, going door-to-door in the communities with whom they work to identify eligible children and administer SMC medicines.

There are two age-based SPAQ dosing regimens: a lower-strength regimen for infants 3–<12 months and a higher-strength regimen for children 12–59 months. A full course of SPAQ is given over three consecutive days. On the day of the community distributor's visit to a household, one tablet of SP and one tablet of AQ are dispersed in water and administered under the supervision of a community distributor. This is called directly observed treatment (DOT). The remaining two doses of AQ are given to the caregiver to administer once daily over the next two

days. Children who spit out or vomit the medicines within 30 minutes of SPAQ administration should be re-dosed once. All healthy children 3–59 months are eligible for SMC, except those who are allergic to SP, AQ or any other sulfa-containing medicines. Children who received SP or AQ within the past month should also not receive SMC. Those who have a fever or are unable to take oral medication should not receive SPAQ from community distributors but will be referred to a qualified health worker for further assessment and testing for malaria infection using a rapid diagnostic test (RDT). Children who test negative for malaria should receive SPAQ if deemed safe by a health worker.

In a given area, SMC medicines are typically distributed over a period of four or five days. This is called the 'distribution period'. SMC distribution is repeated in four or five monthly cycles over the course of the high transmission season. All SMC cycles in a given year are referred to as a 'round' of SMC.

ii. Planning and enumeration

Planning for SMC campaigns typically begins around five months before the start of the annual SMC round. This involves agreeing campaign dates and modalities at the central level, as well as reflecting on lessons learnt in previous years to inform adaptations to the SMC intervention tools and protocols. Micro-planning at the subnational level is conducted about four months before the start of the SMC round, including budgeting based on detailed enumeration of the target population (**Spotlight 4**), required personnel and commodities.

Photo 4: Community distributor uses a bicycle to travel between communities to distribute SMC medicines, Burkina Faso

Spotlight 4: Estimating the SMC target population in Burkina Faso

Burkina Faso is divided into 13 regions. For administrative purposes, each region is further subdivided into provinces and communities (*communes*). Official census-based population data make reference to those administrative units. The most recent census was conducted in 2019. Within the health system, health districts play an important role in coordinating health service delivery, including overseeing health centres and the implementation of mass campaigns like SMC. Health districts are generally smaller than, or equal to, provinces and larger than communities in terms of population size. As census data are not disaggregated at the health district level, the Ministry of Health and Public Hygiene, with support from the National Institute of Statistics and Demography, created a reference document with population figures at the health district level. The figures in this reference document are projections for the years 2011 to 2020, based on a census conducted in 2006. They guide the allocation of resources within the health system and are also used as the basis for estimating the SMC target population in Burkina Faso. The reference document contains projected population figures for children under one and children between one and five. The SMC target population of children 3–<12 months, that is, children who should receive the lower-strength SPAQ regimen, is estimated at 2.75 percent of the total population in the district as advised by the National Institute of Statistics and Demography. Since the reference document does not provide projections beyond 2020, an annual population growth factor is applied for each subsequent year. This factor is determined by calculating the average annual population growth per health district for the years 2015 to 2020 according to the reference document. Target population estimates are then reviewed during SMC micro-planning meetings that are held in each health district, about four months before the scheduled start of the annual SMC round. The meetings are led by the National Malaria Control Programme, with involvement from regional and district health authorities and implementing partners like Malaria Consortium. In some cases, population estimates are adjusted to reflect the local context. For example, in districts that have experienced an influx of internally displaced people (IDPs) in recent years, data obtained from the National Council for Emergency Relief and Rehabilitation are reviewed to determine by how much SMC target population estimates should be increased. For some districts that have seen substantial population changes in the recent past, projections based on the 2006 census are considered inadequate. This is the case in Ouagadougou and Bobo Dioulasso, urban centres that have been subject to rapid urbanisation, and certain districts in the south of the country, where the population has increased substantially due to migration from agricultural labourers caused by climate change in other parts of the country. For those areas, data from a household enumeration exercise conducted in preparation for a mosquito net distribution campaign in 2019 are used as the basis for estimating the SMC target population. To calculate the SMC target population by age band, the share of children 12–59 months among the total population is assumed to be 14 percent and the proportion of children 3–<12 months is estimated at 2.75 percent.

iii. Procurement and supply management

The medicines are packaged in co-formulated blister packs containing one full course of SPAQ. Currently, there are three manufacturers with the capacity to produce quality-assured SPAQ in the required formulation, dosing and packaging — one in China and two in India. While

manufacturers' production capacity has increased over the years, so has the global demand for SPAQ. The manufacturing lead time can be up to 10 months and, consequently, orders should ideally be placed around one year before the start of the annual SMC round. To determine the required quantities of SPAQ, approximate target population estimates need to be used. This is because, when more granular local figures are compiled, micro-planning will only take place later. Assumptions about wastage — for example, when a blister pack is damaged during SMC distribution — and an appropriate buffer to mitigate the risk of stock-outs due to, for example, population movement, are also considered.

Once the medicines have been produced, they need to be transported to Africa, preferably by sea owing to the lower freight cost, or by air at a higher cost if the consignment is more urgent. The process of procuring the medicines and coordinating the transport to central-level warehouses in the countries we support is led by Malaria Consortium's global operations team (**Spotlight 5**). As a UK-based organisation, our drug and medical supply chain management is subject to Good Distribution Practice regulations and standards set out by the UK Medicines and Healthcare Products Regulatory Agency. Once the medicines have passed customs and quality assurance procedures, they are distributed further using country-level supply chain mechanisms, typically to the district level, the lowest administrative level where suitable storage facilities exist.

Spotlight 5: A reefer's journey from India to Chad

From engaging manufacturers of quality-assured medicines several months before delivery, to ensuring Good Distribution Practice, Malaria Consortium's global operations team coordinates several moving parts towards achieving the success of SMC. Malaria Consortium uses refrigerated containers (also referred to as 'reefers') to transport medicines from manufacturers' sites in China and India to various locations across Africa. These reefers, usually 40 feet long, must be powered by generator sets to maintain an active cold chain throughout the trip. This is necessary as the SMC medicines must be stored within a temperature range of 15–25 degrees Celsius. Our team monitors the transport of the medicines using data loggers, some of which provide real-time information on light, relative humidity and geolocation, in addition to temperature.

The journey of a reefer containing SMC medicines from the Indian manufacturers' production plant to the central warehouse in Chad takes about two months, on average. After customs export clearance, a 'stuffed and loaded' reefer (one containing medicines, onboard a vessel) setting out from Nhava Sheva Port, India, will take between 28 and 45 days to get to the port of Douala in Cameroon by sea. This is the preferred sea route to get to Chad, a landlocked country. On arrival at the port, the reefer is offloaded from the ship and customs clearance commences. Upon completion, the reefer is loaded onto a delivery truck and travels from Douala to N'Djamena, the capital of Chad, by road. This journey spans seven to 10 days. At the Cameroon-Chad border, export and import customs clearance is carried out again, confirming all the shipment information provided prior to commencement of the journey. Once customs clearance has been obtained, the remaining journey by road to the central warehouse in N'Djamena will take just one more day. At the central warehouse, the medicines will be received and checked by the government-approved national supply chain service provider for medicines – *Centrale d'Achats des Médicaments Essentiels Génériques et des Consommables Médicaux* – and Malaria Consortium staff.

These processes and timelines are affected by several factors — weather, sea level, port congestion, availability of equipment such as generator sets or reefers, and country-specific customs requirements. Effective and proactive communication between programme managers, commodity managers, global and country-level operations teams, third-party logistics providers, government agencies, drug regulatory bodies, customs duty officials and consignees also contributes to timely delivery of SMC medicines.

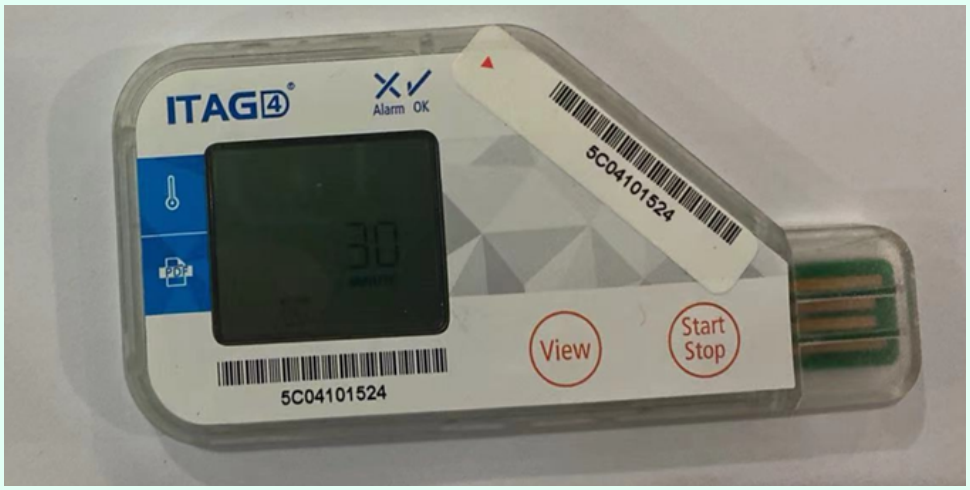


Photo 5: Data loggers are placed in reefers and provide real-time information including temperature

In 2021–22, SPAQ manufacturers experienced production delays, in part due to shortages of some of the pharmaceutical ingredients. In addition, global supply chains were constrained due to the coronavirus disease 2019 (COVID-19) and other global crises. While we generally managed to ship the required quantities of SPAQ on time to the countries we support, we sometimes had to split orders into several consignments. On a few occasions, we also had to transport the medicines by air to ensure their timely availability for SMC campaigns.

In addition to antimalarial medicines, SMC commodities include, for example, branded T-shirts, hijabs, bags and pens, as well as items required to minimise the risk of COVID-19 among SMC implementers and communities, such as face masks and hand sanitiser. Last-mile distribution — the transport of commodities to the health facilities that serve as functional units for the SMC campaign — usually happens just before the start of SMC distribution. This can be challenging due to poor infrastructure (especially during the rainy season) and limited storage facilities.

Supply management also involves reverse logistics, which is the process of transporting SMC commodities back to a central warehouse at the end of the cycle or annual round.

iv. Community engagement

Community engagement refers to the active participation of people and communities in health campaigns. The aim is to ensure that their voices are heard and their active contribution to decision-making is safe, equitable and effective. Community engagement is an important component of SMC campaigns to ensure high acceptability of the intervention among communities, as well as to encourage adherence to the three-day SPAQ administration protocol by caregivers. Activities typically include sensitisation meetings with local leaders, radio spots, and town announcers disseminating relevant information before and during the campaign. The

process of selecting community distributors is led by the community and distributors typically serve the communities in which they live.

v. Training

SMC implementers are trained through a cascade model beginning at the central level about two months before the start of the annual SMC round, with each cadre of trainers subsequently training the next lower level of trainers and learners. Community distributors, field supervisors and town announcers are typically trained at the health facility level just before the start of the round. SMC training includes modules on identifying eligible children, referring sick children to a health facility, administering SPAQ safely, recording SPAQ administration, interpersonal communication and safeguarding. In some countries, separate trainings are conducted on supply chain management and health education. Community representatives are also often included in the training cascade.

vi. Case management and pharmacovigilance

Children who are referred to a qualified health worker by community distributors and who test positive for malaria infection should not receive SPAQ. They should, however, be treated with effective antimalarial medicines according to country guidelines for the case management of malaria in children. Often, the health workers performing the RDT and deciding on appropriate case management of children who test positive are based at the health facilities that serve as functional units for SMC. In some countries, this function is provided by CHWs. While severe adverse events following administration of SPAQ are rare, they do occur. Affected children need to be seen and assessed by a health worker. Mild side effects such as vomiting are more common. All adverse events should be reported via countries' pharmacovigilance systems and followed up according to country guidelines.

vii. Supervision

During SMC distribution, community distributors are assisted by field supervisors who receive more in-depth training on supervision and mentoring skills. Supervision is coordinated by health workers at the health facilities that serve as functional units for SMC distribution, sometimes with support from CHWs. Malaria Consortium staff and local, regional and central health authorities also support the supervision of community distributors.

viii. Monitoring and evaluation

We undertake M&E activities to track the performance of our SMC portfolio and to inform decision-making and priority-setting. Our M&E approach is guided by a comprehensive M&E framework for SMC, which facilitates the assessment of the outcomes of our work and the effectiveness of our processes.[30] The framework assesses the relationship between different aspects of SMC implementation (inputs, processes and outputs) and the expected results (outcomes and impacts), while also accounting for external factors that can affect SMC or our ability to measure impact.

M&E data are collected through a variety of methods, including administrative programme data, household surveys and routine national health system databases. Administrative programme data — including on households visited, SPAQ administered to eligible children, and children referred to health facilities — are collected by community distributors on tally sheets, which are compiled at health facilities at the end of each cycle and reported upwards to the local, regional and central health authorities. Stock reconciliation data — including physical counts — are collected through the national supply management systems. To identify areas that do not meet certain coverage or quality targets, Malaria Consortium routinely conducts rapid end-of-cycle household surveys using the lot quality assurance sampling (LQAS) methodology, following all but the final SMC cycle. The objective of those surveys is to identify issues in SMC

delivery and provide a starting point to engage with local and national stakeholders to take corrective actions to improve SMC delivery in subsequent cycles. Following the end of the annual SMC round, we commission more comprehensive and nationally representative independent end-of-round household surveys to estimate SMC coverage and measure aspects of the quality of SMC implementation across all cycles. Note that detailed 2022 SMC coverage data in areas supported by Malaria Consortium have been compiled in a separate report.[31] M&E framework indicators for SMC have been set up in Malaria Consortium's online Project Results System (PReS), which was launched in 2021 to collect and compile data from all the organisation's programmes and projects and to facilitate data-driven decision-making (**Spotlight 6**).

Spotlight 6: Using PReS to operationalise the SMC M&E framework

In 2019, colleagues with relevant expertise from across Malaria Consortium's SMC programme formed a task force to develop an SMC M&E framework. The task force has since been transformed into an M&E working group that meets regularly to guide the collection of SMC framework indicator data from all the countries Malaria Consortium supports. Those data are collated into the PReS database, a cloud-based M&E platform developed by LogAlto. Within PReS, we have created custom forms based on four main routine data collection tools that contain the variables needed to calculate the indicators defined within our log frame. The forms are linked to a PowerBI file with pre-populated indicators formatted into dashboards for data visualisation.

The introduction of PReS required some change management, which came with its own unique challenges. First, data from routine household surveys are collected using a different platform, SurveyCTO. Those data need to be formatted to fit the custom forms within PReS, which can be a lengthy process given the volume of data that needs to be processed. We are exploring the introduction of Application Programming Interface endpoints, which allows a 'bridge' software to download, aggregate, clean and process data from SurveyCTO and translate those data into the format needed for PReS. Additionally, PReS does not yet have the functionality to automatically calculate the required indicators from the input variables. For this reason, we use PowerBI for this step, then download the populated indicators and then reupload them to PReS. Another challenge is staff turnover. New M&E colleagues need to be trained quickly on PReS, so they can participate effectively in the M&E working group. We are working on a PReS user handbook and standard operating procedures, which will facilitate training and inductions, as well as serve as reference materials for all colleagues working on the SMC programme.

The vision is for PReS to become a widely used, one-stop shop for reliable, actionable, and evidence-based results tracking and data-driven decision-making within Malaria Consortium. Having easy access to a wide range of programme data will also facilitate communication with stakeholders and external relations.

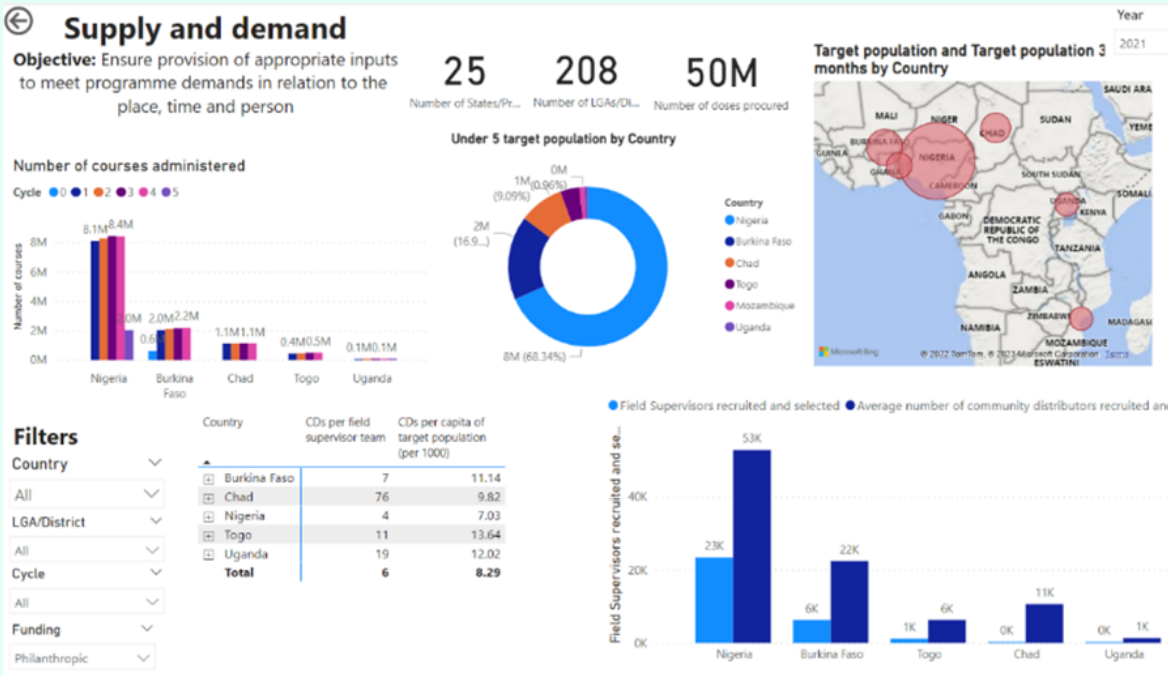


Photo 6: Screenshot of an SMC dashboard from Malaria Consortium's PReS database

Malaria Consortium actively participates in the SMC Alliance M&E subgroup. The subgroup comprises representatives from national malaria programmes, implementing partners and researchers. It serves as a platform where the SMC community can share challenges and best practices in measuring and tracking SMC indicators. The subgroup has published an M&E toolkit for SMC as a resource for national malaria programmes in SMC-implementing countries.[32] Malaria Consortium's M&E framework informed the content of the toolkit, which will be incorporated into the revised WHO field manual that will be published in 2023.

Photo 7: Caregivers, like the woman pictured here, are tasked with providing subsequent SMC doses after the child receives the first doses under supervision from community distributors

4.2 Quality of SMC delivery

Malaria Consortium conceptualises the quality of SMC delivery as the extent to which it is safe, efficacious, timely, efficient, equitable and people centred.[33] We think of quality as a theme that cuts across all SMC intervention components and have developed an SMC quality framework that defines 10 quality standards (**Figure 5**). While the standards are operationalised differently in different countries, they serve as benchmarks that, if followed well and consistently, ensure high-quality delivery of SMC.

Figure 5: Malaria Consortium's SMC quality standards

Continuous quality improvement requires that quality be measured, and lessons learnt be documented and shared. At the country level, this includes regular review meetings that bring together SMC stakeholders to review available M&E data and determine actions required to improve quality of SMC delivery. Malaria Consortium has developed tools for annual end-of-round quality assessment workshops, which are attended by national malaria programme staff, representatives from subnational health authorities and implementing partners. Participants are invited to reach group consensus on scores for a range of quality indicators and to determine top priorities for quality improvements in subsequent SMC rounds. Malaria Consortium SMC country teams are encouraged to establish and monitor quality improvement plans.

In 2022, we commissioned a consultancy to develop tools and methods of an external SMC quality audit as an additional method for assessing quality of SMC delivery. The audit was piloted in eight local government areas (LGAs) in four Nigerian states and involved both a retrospective review of documents, as well as direct observations by independent auditors. In 2023, we will review the quality audit methods and processes to determine if, and how, we will take this approach forward.

4.3 Digitalising SMC

Digital tools have the potential to transform the way health campaigns like SMC are delivered, by strengthening campaign quality, efficiency, accountability, equity and cost-effectiveness. There are multiple use cases for digital tools in SMC (**Table 2**), cutting across most intervention components

and supporting overall campaign management and oversight. However, despite a broad consensus on the potential benefits of campaign digitalisation, the adoption of digital tools in SMC has so far been slow. A key bottleneck is the need to better define scalable and sustainable implementation and financing models, ideally enabling multi-use, integrated approaches across different health campaigns, case management and routine surveillance. Other challenges include a lack of coordination between partners, a tendency to develop digital tools in silos rather than through a coordinated multi-partner effort, concerns over data protection and ownership, as well as challenges in ensuring interoperability with routine health system data platforms, such as the widely used District Health Information Software. Many of those challenges are not specific to SMC — they are typical across the public health community. As a result, we have seen many small pilots, but few digital solutions that have been successfully deployed at scale.

Table 2: Potential benefits of digitalising SMC

SMC intervention component	Potential benefits of digitalisation
Administration of SMC medicines	More reliable collection of administrative data; track administration of SMC medicines to individual children over time; increase coverage and equity by identifying areas with low coverage during SMC delivery; improved campaign management through dashboards and real-time reports
Planning and enumeration	More accurate target population estimates; ensure plan completeness and relevance; minimise duplication across health campaigns
Procurement and supply management	More precise stock inventory; prevent stock-outs or overstocking
Community engagement	Reach larger audience
Training	Measure and track knowledge improvements; remote access of training materials
Case management and pharmacovigilance	Tracking of patient referral and treatment
Supervision	Better quality control
M&E	Real-time availability of data for decision-making
Payments	Build a database of trained SMC implementers; cashless payment solutions; with the help of biometric verifiers, ensure that payments are made only to individuals who participated in SMC activities and only for days when they were actively involved in the SMC campaign

The best-established use of digital tools in SMC at Malaria Consortium is the electronic collection of survey data for M&E and research using software such as SurveyCTO. As described above, we also use platforms such as PReS to operationalise and visualise our SMC M&E framework.

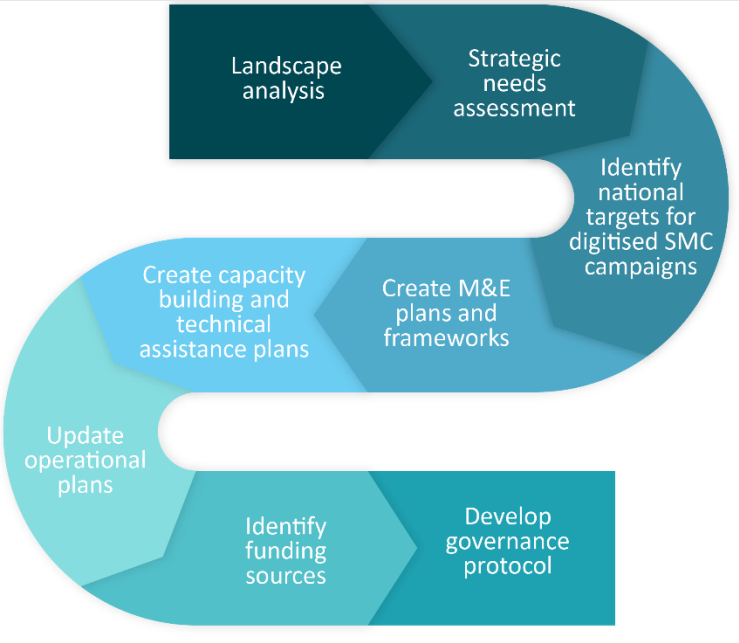
In 2020 and 2021, Malaria Consortium piloted Reveal, a geospatial platform developed by Akros, for use in SMC in Nigeria. The tool uses spatial intelligence and satellite imagery to enumerate residential structures and guide field staff during SMC delivery. It has three main components: i) the web user interface supports planning and enumeration and is used by higher-level implementers; ii) the mobile client allows community distributors to navigate in their catchment area and record administration of SMC medicines; iii) web-based dashboards are used by higher-level implementers to monitor field activities and collect reports. Scaling up the use of Reveal would require the development of a refined data model for the core platform, which would substantially improve the process of identifying residential structures on satellite images, making it less dependent on human input. As the refined data model was not ready for the 2022 campaign, we decided to pause our work on Reveal. Nevertheless, Malaria Consortium remains particularly interested in the geospatial functionality of the platform, which could transform SMC campaign planning and coordination. We are also excited about the role a geospatial tool could play in ensuring that hard-to-reach and vulnerable populations can benefit from SMC. In addition to Reveal, we have also supported the national malaria programmes in Burkina Faso, Chad and Nigeria in digitalising SMC activities, in particular the collection of administrative data, building databases of SMC implementers and supporting supervision of community distributors.

Another important area where efforts have been made to introduce the use of digital tools is payments to SMC implementers. Most of our SMC countries use mobile payment systems, typically working with mobile service providers to register SMC implementers and paying implementers for SMC activities through their mobile phones. While we have made progress over the last few years in terms of embedding mobile payments in SMC, the process remains challenging. Common issues are that implementers do not have an account with the service provider, that their accounts are not registered in their own name, or that the phone numbers provided for the payments are incorrect. There are also challenges relating to the exchange of information between health authorities, mobile service providers and Malaria Consortium. Roles and responsibilities are not always clearly defined, understood or accepted by all parties involved. In the absence of biometric verification, the verification of an implementer's identity, checking of mobile account details and validation of documents justifying payment — such as meeting attendance lists — for tens of thousands of implementers is cumbersome and requires substantial effort from Malaria Consortium programme, operations and finance staff. As a result, payment delays are not uncommon, which can affect SMC implementers' morale and willingness to participate in the campaign. Developing robust standard operating procedures that are accepted among all parties involved and reducing payment delays remain operational priorities in many of the countries where Malaria Consortium supports SMC delivery.

To help Malaria Consortium adopt a more comprehensive and systematic approach to SMC digitalisation, we formulated a digital road map for SMC in 2022. An important insight from the internal and external consultations we conducted to inform the roadmap is that there is currently no single tool that offers all the functionalities that could potentially strengthen SMC delivery. The roadmap recommends that campaign digitalisation should be rolled out through a structured and systematic process (**Figure 6**) and calls for action in three areas: build integrated tools and digital capacity; design with scalability in mind; and establish strong governance mechanisms. Operational research will be needed to define implementation models that work at scale and that blend in seamlessly with the established SMC delivery model. In 2023, we will continue to support national malaria programmes in exploring how SMC delivery can be strengthened through the use of digital

tools and to engage with global stakeholders on the development of coordinated approaches to sustainable health campaign digitalisation.

Figure 6: Process for digitalising SMC set out in Malaria Consortium's digital roadmap for SMC



4.4 Mitigating risk

Minimising risk to everyone involved in SMC campaigns, including communities, SMC implementers and Malaria Consortium staff is an important part of our work. We tend to look at the safety and safeguarding of communities through the SMC quality lens as described above. In this section, we focus on the safety of SMC implementers and Malaria Consortium staff, especially with regard to three types of risk: insecurity, natural disasters and COVID-19.

i. Insecurity

Over the last few years, security threats in many of the areas where Malaria Consortium supports SMC implementation have increased substantially, including from armed groups and criminals, as well as from intercommunal violence. It is generally accepted that insecurity is likely to increase further over the coming years. To manage the risk, Malaria Consortium's teams have put in place safety and security plans, staff movement protocols and standard operating procedures. We have invested in enabling team communication, security awareness and security training. We also enhanced our capacity to manage security risks by recruiting staff with a security focus in many of our SMC countries. With support from the global operations team, country teams continuously assess the security situation in the areas where we operate. This involves security mapping and assigning areas to different levels of risk: low, medium and high.

Malaria Consortium has developed security adaptation principles, which outline how SMC needs to be adapted in medium- and high-risk areas to minimise risk to communities, SMC implementers and Malaria Consortium staff, while ensuring maximum accountability, coverage and quality of SMC implementation. Recognising that security risks can never be mitigated against completely and that some residual risk will always remain, the principles outline

adaptations for each SMC intervention component. The principles draw on learning from all SMC countries with the aim of defining a comprehensive and harmonised approach that can inform our work across Malaria Consortium's SMC portfolio. A core principle is that Malaria Consortium staff can operate in medium-risk areas if approved by senior country management. However, Malaria Consortium staff cannot enter high-risk areas. In those areas, we work with our partners to identify how we can continue to deliver SMC within acceptable risk thresholds; for example, by making use of government structures, with support and oversight provided by Malaria Consortium remotely. In some of the most severely affected areas, that may involve transporting SMC commodities with the support of countries' security forces, sometimes by helicopter.

ii. Natural disasters

Other security risks that have gained prominence over the last few years are heavy rains, tropical storms and severe flooding. While SMC is, by its very nature, an intervention that is implemented during the rainy season, flooding seems to have become more common, possibly as a result of the global climate crisis. In 2022, floods and storms affected SMC delivery in Chad, Mozambique, Nigeria and South Sudan. Mitigating measures to minimise risk to SMC implementers and Malaria Consortium staff include the provision of life vests and suspending SMC activities, where necessary. This was the case in March 2022, when a tropical cyclone hit northern Mozambique and humanitarian efforts to assist those affected took priority over health campaigns like SMC.

iii. COVID-19

Since 2020, the COVID-19 pandemic has presented novel challenges to implementing community-based malaria control interventions. The pandemic has posed a significant risk of transmission to SMC implementers and communities. Minimising this risk has required adaptations to the SMC delivery model. For example, more training events have been scheduled to limit the number of participants per event. Physical distancing has also been facilitated by encouraging caregivers to administer the medicines to their children, with community distributors supervising from a safe distance. In addition, large quantities of COVID-19-related commodities, such as face masks and hand sanitiser, have been made available to SMC implementers. At the same time, it has been found that SMC can be a useful platform to share public health information among communities. A study conducted by Malaria Consortium in Nigeria found that community distributors can be an important source of knowledge of COVID-19 infection prevention and control behaviours among caregivers.[34] Malaria Consortium's insights from implementing SMC during the first year of the pandemic, based on comprehensive consultations with colleagues from across Malaria Consortium's SMC portfolio and external partners, were published in a learning paper.[35]

In preparation for the 2022 SMC campaigns, we reviewed and updated our internal COVID-19 guidance in light of lessons learnt during the previous two years, as well as the emergence of the Omicron variant at the time. We also took into account the findings of a study conducted by Malaria Consortium in Burkina Faso, Chad, Nigeria and Togo in 2021, which found that adherence to COVID-19 infection prevention and control measures was low among SMC implementers,[36] highlighting the need to promote adherence though training and supervision. Changes to the guidance included a requirement to use three-ply medical face masks (previously, fabric masks were considered sufficient), dropping the requirement to clean surfaces with bleach at meeting venues and health facilities, and asking SMC implementers to confirm that they do not have symptoms of COVID-19 before participating in SMC activities. Although there are positive signs and the global community has made significant strides in the

fight against COVID-19, Malaria Consortium believes that the pandemic will still pose a threat to SMC in 2023, especially since vaccination rates have remained low across Africa. We therefore expect that infection prevention and control measures will remain necessary. However, we are planning to move to a risk-based approach, where minimal measures will be in place in settings where the disease is considered endemic and more stringent measures will be in place in epidemic settings.

Photo 8: A child receives SMC medicines, Mozambique

5. Philanthropically supported SMC delivery in 2022

In 2022, philanthropic funding or co-funding enabled Malaria Consortium to deliver SMC to 16.08 million children in Burkina Faso, Chad, Mozambique, Nigeria, South Sudan, Togo and Uganda (**Table 3**). This compares with 12.19 million reached with philanthropic support in 2021[37] and 7.14 million in 2020.[38] Out of all children supported with philanthropic funding in 2022, 21 percent lived in areas that received SMC for the first time that year, primarily in Nigeria and Mozambique. Just under two-thirds of the philanthropically supported target population (62 percent) lived in areas where four SMC cycles were implemented. The remaining 38 percent received five cycles.

Table 3: SMC target population supported with philanthropic funding or co-funding, 2020–2022

Country	2020	2021	2022
Burkina Faso	1,620,000	2,020,000	2,110,000
Chad	960,000	1,080,000	1,200,000
Mozambique[a]	70,000	110,000	1,300,000
Nigeria	4,310,000	8,400,000	10,720,000
South Sudan	0	0	20,000
Togo	180,000	490,000	500,000
Uganda	0	90,000	230,000
TOTAL	**7,140,000**	**12,190,000**	**16,080,000**

[a]As the peak malaria transmission season cuts across calendar years in Mozambique, target population figures are reported for the calendar year in which the transmission season started. This does not necessarily coincide with the calendar year when the SMC round started. Both in the 2021/22 and the 2022/23 season, the start of the round was delayed until January.

Malaria Consortium used philanthropic funding to procure around 77.5 million blister packs of SPAQ in 2022. Philanthropic funding or co-funding supported more than 150,000 SMC implementers involved in the delivery of SMC campaigns. Below, we provide a detailed summary of achievements and challenges in each of the countries where philanthropic funding was used to support SMC in 2022, as well as an overview of support Malaria Consortium expects to provide with philanthropic funding in 2023.

5.1 Burkina Faso

i. Setting

Burkina Faso's total population was estimated at 22.10 million in 2021.[39] Malaria is endemic throughout the country, with a seasonal upsurge from June to October.[40] There were 8.33 million cases and 19,000 deaths from malaria in 2021, accounting for 3.3 percent of global cases and 3.4 percent of global deaths.[13] Security deteriorated further in 2022, with frequent attacks by armed groups against civilians and intense counterterrorism operations. Large parts of the country were affected and there are an estimated two million IDPs. Political instability deepened as a result of two military coups, one of which resulted in the overthrow of the President.[41]

ii. Scale-up of SMC and funding support

SMC implementation in Burkina Faso started in 2014 in seven health districts. Funding support for SMC gradually increased over the following years. In 2019, Burkina Faso achieved 100 percent geographical SMC coverage, with all of the country's 70 health districts reached. Full geographical coverage has been maintained in subsequent years. The total SMC target population in 2022 was 4.39 million children (**Table 4**). The slight target population increase compared with 2021 was due to population growth. As in previous years, funding for SMC was provided by Malaria Consortium's philanthropic funding, the Global Fund, PMI and UNICEF.

Table 4: SMC target population by funding source, Burkina Faso, 2021–2022

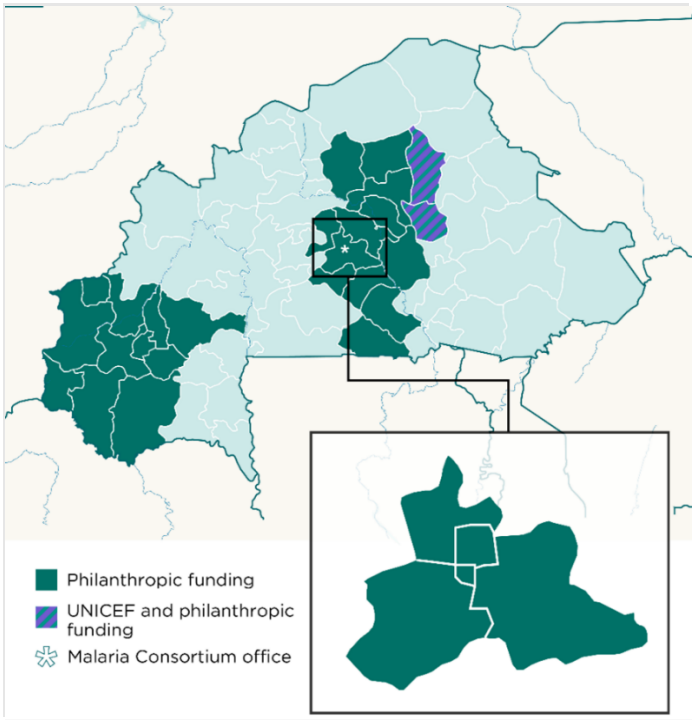
Funding source	Number of health districts (2021)	Target population (2021)	Number of health districts (2022)	Target population (2022)
Philanthropic	27	1,920,000	27	2,000,000
Global Fund	22	1,400,000	22	1,450,000
PMI	19	810,000	19	830,000
UNICEF and philanthropic	2	100,000	2	110,000
TOTAL	**70**	**4,230,000**	**70**	**4,390,000**

In Burkina Faso, SMC community distributors screen children for signs of malnutrition during SMC distribution. In 2022, Malaria Consortium received funding from UNICEF to coordinate malnutrition screening during SMC delivery in all 70 health districts.

iii. Philanthropically supported SMC delivery in 2022

The health districts supported by Malaria Consortium in 2022 (**Figure 7**) remained unchanged compared with the previous year. A total of 2.00 million children in 27 health districts were supported exclusively with philanthropic funding. As in the previous year, Malaria Consortium also used philanthropic funding to procure SPAQ for 110,000 children in two additional health districts, where all other SMC-related costs were covered by UNICEF.

Figure 7. Health districts supported with Malaria Consortium's philanthropic funding for SMC, Burkina Faso, 2022



A total of 10,560,000 blister packs of SPAQ was procured with philanthropic funding and shipped to Burkina Faso by sea. The medicines arrived at the central warehouse in March. Transport of SMC commodities from the central to the district level was provided free of charge by *Atlas Logistique*, an operational arm of Humanity & Inclusion. All commodities arrived before the scheduled start of the round and no stock-outs were experienced.

In preparation for the 2022 SMC campaign, Malaria Consortium supported the PNLP in updating social and behaviour change communication materials for SMC. We also successfully advocated for the adoption of new content embedding safeguarding principles in the SMC training cascade. Over 32,000 SMC implementers were trained with philanthropic support between May and June, including almost 23,000 volunteers who served as community distributors (**Table 5**).

Table 5: SMC implementers trained with philanthropic support, Burkina Faso, 2022

Cadre	Number of SMC implementers	Number of days per training	Number of training events
National-level trainers	125	2	4
Supply chain managers	40	3	1
Regional-level trainers and supervisors	129	1	6
District health staff	229	1	27
Health workers	3,127	1	95
Community distributors	22,822	1	1,110
Town announcers	6,041	1	926
TOTAL	**32,513**		**2,169**

In the 11 health districts supported by Malaria Consortium where five SMC cycles were implemented, the annual round commenced on 10 June. The remaining 18 health districts implemented four SMC cycles and started the annual round on 10 July. All subsequent cycles were implemented as scheduled. The final distribution day in all health districts was 7 October. One case of a serious adverse event was reported. A child who had experienced convulsions following the administration of SPAQ was treated at a health facility the same day and fully recovered.

iv. Plans for 2023

In 2023, Burkina Faso's National Malaria Control Programme was upgraded to permanent secretary status and is now called the *Secrétariat Permanent pour l'Élimination du Paludisme*. Malaria Consortium will continue to work with the permanent secretary to support the same health districts as in 2022, including procuring SPAQ for two districts that are otherwise supported by UNICEF. The total target population supported with philanthropic funding in Burkina Faso in 2023 will be approximately 2.18 million children. Operational priorities will include applying lessons from previous years to further improve the payment process for SMC implementers, developing tools to strengthen SMC-related advocacy at all levels, and ensuring timely availability of SMC commodities at the district level.

5.2 Chad

i. Setting

Chad's total population stood at 17.18 million in 2021.[42] About two-thirds of Chad's population live in areas of high malaria transmission, principally in the southern half of the country,[43] with a seasonal peak between July and October in many of those areas. In 2021, there were 3.51 million cases of malaria and 11,700 deaths. Chad accounted for 1.4 percent of global malaria cases and 2.0 percent of deaths.[13] Following the death of the President in 2021 and the declaration of his son as head of a Transitional Military Council, there were violent protests and demonstrations in urban centres throughout 2022. Protests were particularly noticeable around the anniversary of the transition in April, the opening of a 'national dialogue' — a series of talks involving all segments of Chadian society to define a timeline and rules for presidential elections — in August, and the decision to extend the transition by 24 months in October. Armed groups continue to carry out attacks against civilians and security forces in the Lake Chad area.[41]

ii. SMC scale-up and funding support

Starting with four health districts in 2013, SMC was gradually scaled up, reaching 68 health districts in 2022, with a total SMC target population of 2.60 million children. As in the previous year, funding for SMC was provided by Malaria Consortium's philanthropic funding, the Global Fund, UNICEF, and MSF (**Table 6**). In addition to population growth, the increased target population compared with 2021 was primarily due to the expansion of Global Fund and MSF support to previously unreached areas.

Table 6: Table 6: SMC target population by funding source, Chad, 2021–2022

Funding source	Number of health districts (2021)	Target population (2021)	Number of health districts (2022)	Target population (2022)
Philanthropic[a]	26	1,080,000	27	1,200,000
Global Fund	32	940,000	35	1,180,000
UNICEF[a]	4	120,000	5	120,000
MSF[b]	1	40,000	1	100,000
TOTAL	**63**	**2,180,000**	**68**	**2,600,000**

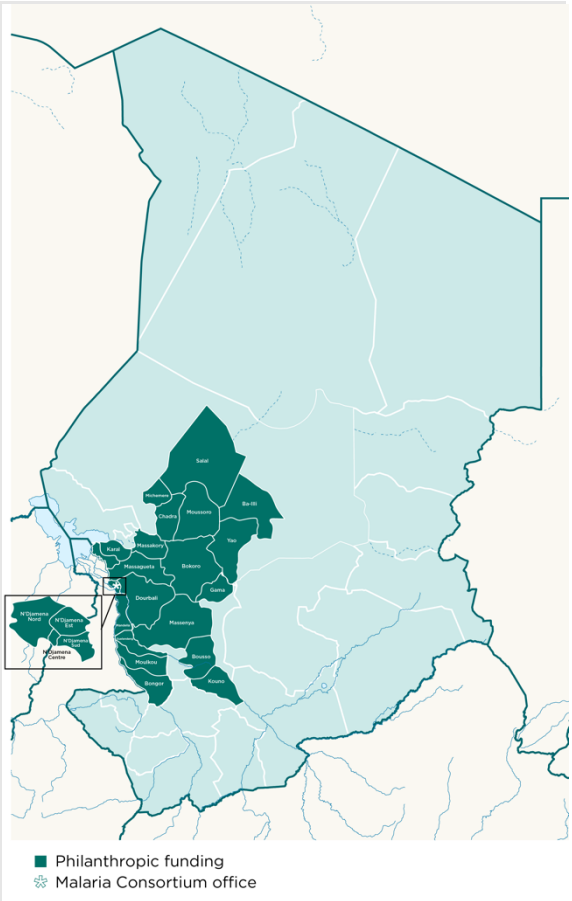
[a]The increase in the number of districts covered by Malaria Consortium's philanthropic funding and UNICEF compared with 2021 was a result of the creation of new health districts within areas previously reached by SMC. The geographical reach therefore remained unchanged.

[b]The increased target population supported by MSF in 2022 compared with 2021 was due to the expansion to areas in the same health district not previously reached by SMC.

iii. Philanthropically supported SMC delivery in 2022

Malaria Consortium used philanthropic funding to deliver SMC to 1.20 million children in 27 health districts (**Figure 8**). The geographical reach of Malaria Consortium's support for SMC in Chad in 2022 was the same as in the previous year. The additional health district covered is a result of one of the health districts in the area supported by Malaria Consortium being divided into two in 2022.

Figure 8: Regions supported with Malaria Consortium's philanthropic funding for SMC, Chad 2022



A total of 5,280,000 blister packs of SPAQ was shipped to Chad by sea. The shipment arrived at the central warehouse in May. Training was conducted in June and July, including for more than 12,000 volunteer community distributors (**Table 7**).

Table 7: SMC implementers trained with philanthropic support, Chad, 2022

Cadre	Number of SMC implementers	Number of days per training	Number of training events
National- and province-level trainers and supervisors	74	2	4
District-level trainers/supervisors and health workers	633	2	27
Field supervisors and community distributors	13,564	1	435
Town announcers	2,175	1	435
TOTAL	**16,446**		**901**

Four SMC cycles were implemented, starting on 15 July, in the majority of the health districts supported by Malaria Consortium. Nine health districts started cycle one distribution with a delay of one day and one health district started two days later, primarily due to conflicting COVID-19 vaccination activities in those areas. All health districts completed the annual SMC round by 15 October. While this did not significantly delay SMC delivery, the annual SMC round in 2022 was affected by the challenging security situation as well as severe flooding.

The PNLP in Chad aims to digitalise the collection of administrative SMC data over the coming years. In 2022, a digital tool was piloted in several districts, including one supported by Malaria Consortium with philanthropic funding. The pilot in this district involved around 300 community distributors. In general, the pilot went well, but issues were reported with faulty mobile devices and synchronisation issues due to poor connectivity.

iv. Plans for 2023

In 2023, we will continue to support SMC in the same health districts as in 2022, with a target population of around 1.24 million children. Programmatic priorities include developing contingency strategies to better respond to severe flooding during SMC delivery, strengthening the mobile payment process, and identifying further cost efficiencies to reduce the cost per child. Following GiveWell's decision to phase out philanthropic SMC funding for Chad because, following the revision of its 2022 funding projections,[44] it is below its current cost-effectiveness threshold,[45] we will also discuss an appropriate transition strategy for the period 2024–25 with the PNLP.

Photo 9: A community distributor records the number of SMC treatments delivered on a tally sheet, Mozambique

5.3 Mozambique

i. Setting

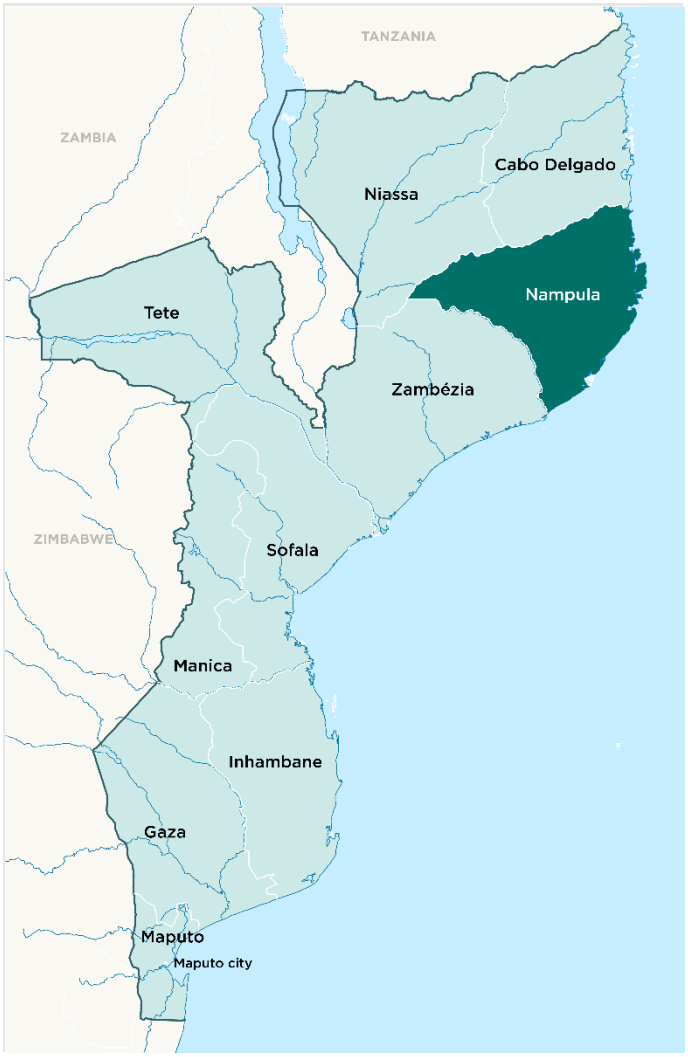
Mozambique had a total population of 32.08 million in 2021.[46] Malaria is highly endemic in the entire country, with the highest prevalence in the north and along the coast.[47] While

transmission is perennial in the south, there is a seasonal peak between December or January and March or April in many areas in the northern half of the country. Mozambique ranks fourth in terms of global malaria cases (4.1 percent) and accounts for 3.8 percent of global malaria deaths. In 2021, there were 10.28 million malaria cases and 22,300 deaths.[13] The humanitarian situation in Mozambique worsened in 2022, with attacks by armed groups, primarily in Cabo Delgado province, and increased presence of Mozambican security forces in the area. The violence has led to about 950,000 IDPs seeking refuge in other provinces of northern Mozambique. In September, attacks on civilians occurred in two villages in Nampula province.[41]

ii. Scale-up of SMC and funding support

A mid-term review of Mozambique's Malaria Strategic Plan 2017–2022[48] recommended SMC as a strategy to accelerate impact in the highest-burden locations. In 2020, the National Malaria Control Programme — *Programa Nacional de Controlo da Malária* (PNCM) — approached Malaria Consortium about the possibility of exploring the use of SMC in Nampula province (**Figure 9**), where under-five mortality is high and malaria transmission is seasonal. Since 2020, Malaria Consortium and the PNCM have been conducting a two-phase implementation study to test if SMC can be a viable malaria prevention strategy in northern Mozambique despite high resistance to SP.[49] The study is described in more detail in section 6. An insight brief summarising lessons learnt from the first phase of the project during the 2020/21 season, when SMC was implemented in two districts of Nampula, targeting 70,000 children, was published on Malaria Consortium's website.[50] A key learning was that the benefits of employing more SMC implementers to strengthen community engagement need to be weighed up against budget implications. The second phase of the project involved SMC delivery to 110,000 children during the 2021/22 season. With support from GiveWell,[51] SMC was further scaled up to all 23 districts in Nampula during the 2022/23 season, with a total target population of 1.30 million children.

Figure 9: Location of Nampula province within Mozambique

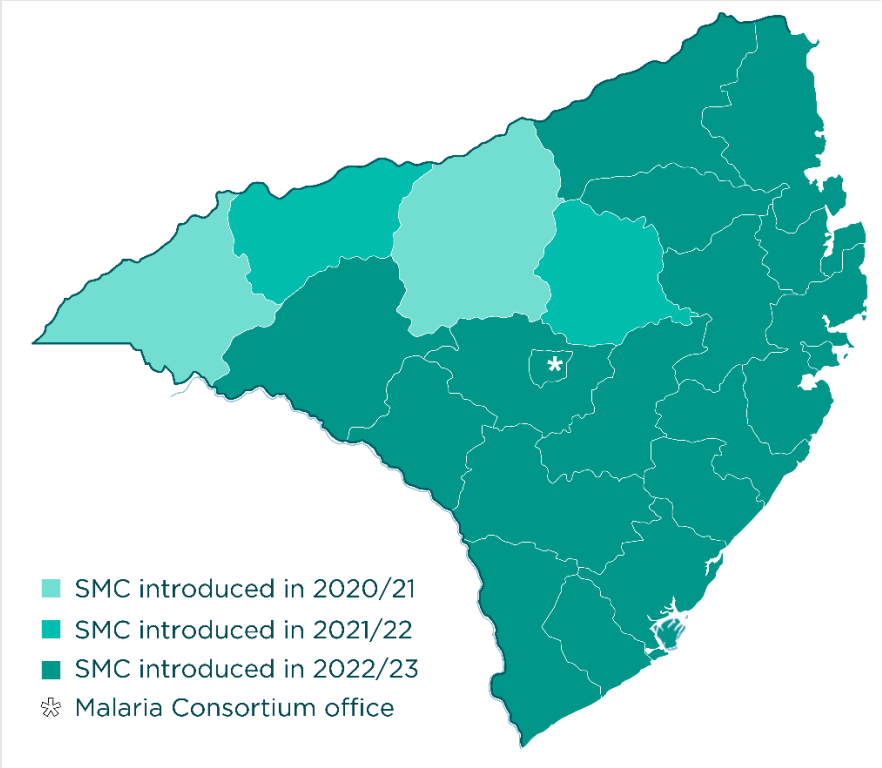


Based on the promising early results from the SMC implementation study in Nampula (see section 6), Malaria Consortium believes that the scale-up of SMC to the entire province is justified while the research is ongoing. However, decisions on the longer-term deployment of SMC in Nampula or other provinces of northern Mozambique will only be possible once the full results from the study are available in 2023. To date, all SMC implementation activities in Mozambique have been supported by Malaria Consortium's philanthropic funding for SMC.

iii. Philanthropically supported SMC delivery in 2022

Unlike in all other countries supported by Malaria Consortium, the SMC season in Mozambique cuts across calendar years. Activities conducted in the calendar year 2021 in preparation for the 2021/22 SMC campaign were described in last year's SMC philanthropy report, including the quantity of SPAQ procured and number of SMC implementers trained.[38] Due to delays in obtaining ethical approval for phase two of the SMC implementation study, the 2021/22 round, which was scheduled to start in November 2021, did not commence until 18 January 2022 in all four of the districts covered (**Figure 10**). Cycle 3 was delayed by about one week due to the impact of tropical cyclone Gombe, which made landfall in Nampula on 11 March and affected more than 700,000 people.[52] The annual SMC round concluded after four cycles on 21 April.

Figure 10: Districts supported with Malaria Consortium's philanthropic funding for SMC by high transmission season when SMC was introduced, Nampula province, Mozambique



In preparation for the 2022/23 SMC round and the scale-up to all 23 districts in Nampula province, a health economist worked with Malaria Consortium's Mozambique team to identify opportunities for reducing the unit cost of SMC as the project transitioned from a tightly controlled research project to at-scale implementation. Examples included leveraging economies of scale in the procurement of larger quantities of SMC commodities and using health system mechanisms for the transport of commodities to the district level. In August, a delegation comprising representatives from the PNCM, the provincial health authority and Malaria Consortium's Mozambique team visited Nigeria to learn about the successes and challenges of the Nigeria SMC programme, especially in terms of embedding large-scale SMC delivery in the national health system (**Spotlight 7**).

Spotlight 7: Learning from Nigeria about implementing SMC at scale

In August 2022, a four-strong delegation from Mozambique visited Nigeria to learn from Nigeria's experience of implementing SMC at a large scale. The delegation included the Head of Social and Behaviour Change at the PNCM, the head of the Public Health Department at the provincial health authority in Nampula, the project manager of Malaria Consortium's Mozambique SMC project and Malaria Consortium's Mozambique Country Technical Coordinator. The agenda of the learning visit included observing SMC distribution in Nasarawa state, meetings with health authorities at the LGA and state level, discussions with the NMEP and an exchange of learning with Malaria Consortium's Nigeria team.

On their return to Mozambique, the delegation reflected on a number of important insights that will inform the potential scale-up of SMC in Mozambique. For example, the need to start

internal planning as early as possible — up to eight months before the scheduled start of the annual round — was noted as a major difference between a small-scale research project and an at-scale implementation project. The Mozambique delegation also learned about the integration of last-mile distribution into national supply chain mechanisms in Nigeria — a process that had been coordinated by Malaria Consortium in Mozambique in previous years. At small scale, formal review meetings had only been conducted after each cycle in previous years in Mozambique — the Malaria Consortium team were aware of developments because they were closely involved in all activities. However, it was recognised that this would not be feasible at scale; hence, daily review meetings would be needed, with Malaria Consortium and senior health authority staff focusing on managing from a distance. A pragmatic suggestion that will be adopted in Mozambique going forward was to distribute SMC over the weekend, if possible, as that is when caregivers are most likely to be at home with their children. The NMEP emphasised the need to embed SMC in the national health system and to have dedicated SMC focal persons at the central and state level. The PNCM plans to emulate this structure in Mozambique, if the research conducted by Malaria Consortium and the PNCM confirms that SMC is a viable malaria prevention strategy in the country.

The delegation that visited Nigeria shared their observations and learnings with a broader group of SMC stakeholders in Mozambique. Several adaptations to the SMC delivery model for the 2022/23 campaign were made. We plan to publish our reflections on how those adaptations have strengthened SMC in Mozambique in 2023.

A total of 5,598,000 blister packs of SPAQ was procured with philanthropic funding for the 2022/23 SMC round in Mozambique and shipped to the country by sea. The medicines arrived in Nampula in November, in time for the scheduled start of the round in December. However, at the request of the Ministry of Health, the campaign was postponed to January 2023 due to conflicting health campaigns in December. While community-level trainings were conducted in January and will be reported in next year's philanthropy report, almost 700 national, province- and district-level trainers and supervisors were trained in November and December 2022 (**Table 8**).

Table 8: SMC implementers trained for the 2022/23 SMC round with philanthropic support, Mozambique, 2022

Cadre	Number of SMC implementers	Number of days per training	Number of training events
National-level master trainers	30	2	2
District-level trainers and supervisors	97	2	5
District-level trainers and supervisors	563	2	35
TOTAL	**690**		**42**

iv. Plans for 2023

The 2022/23 SMC round will conclude in April 2023. We expect to use philanthropic funding to support SMC delivery in the same 23 districts of Nampula province during the 2023/24 transmission season. The 2023/24 round is scheduled to start in December, targeting 1.57 million children. We will work closely with the PNCM and other stakeholders to ensure the timely start of the SMC round.

5.4 Nigeria

i. Setting

Nigeria is Africa's most populous country, with an estimated 213.40 million inhabitants in 2021.[53] Malaria is endemic in the majority of the country and 97 percent of the population are considered to be at risk. In the south, malaria transmission is perennial, whereas in the north, there are seasonal peaks of four to five months between June and November.[54] Nigeria has the highest malaria burden globally. In 2021, there were 65.40 million malaria cases and 193,500 deaths, accounting for 26.6 percent of global cases and 31.3 percent of global deaths.[13] Insecurity has worsened with threats and frequent attacks from multiple armed groups. In the northeast, the main threat comes from armed groups attacking government facilities, including health centres. Areas not previously affected by insecurity were the target of attacks in 2022. In the northwest, armed groups, known previously as bandits but now categorised by the government as terrorists, are responsible for frequent killings and kidnappings for ransom. The Nigerian military responded with airstrikes. Political tensions also increased as Nigeria prepared for the 2023 general elections.[41] The number of IDPs is increasing and is currently estimated to be around three million.[55]

ii. Scale-up of SMC and funding support

Nigeria started implementing SMC in five LGAs in Katsina state in 2013. The first scale-up phase targeted nine Sahelian states in the north of the country. In 2020, all LGAs in those nine states were reached for the first time. As of 2021, the NMEP considers 20 states plus the FCT eligible for SMC. Out of these, 18 were reached in 2021, with a total target population of 21.70 million children and funding support from the Global Fund, Malaria Consortium's philanthropic funding, PMI and KOICA. (**Table 9**). Thanks to increased support from philanthropic funding and PMI, all 20 eligible states and the FCT were covered in 2022. The total SMC target population grew to 26.97 million.

Table 9: SMC target population by funding source, Nigeria, 2021–2022

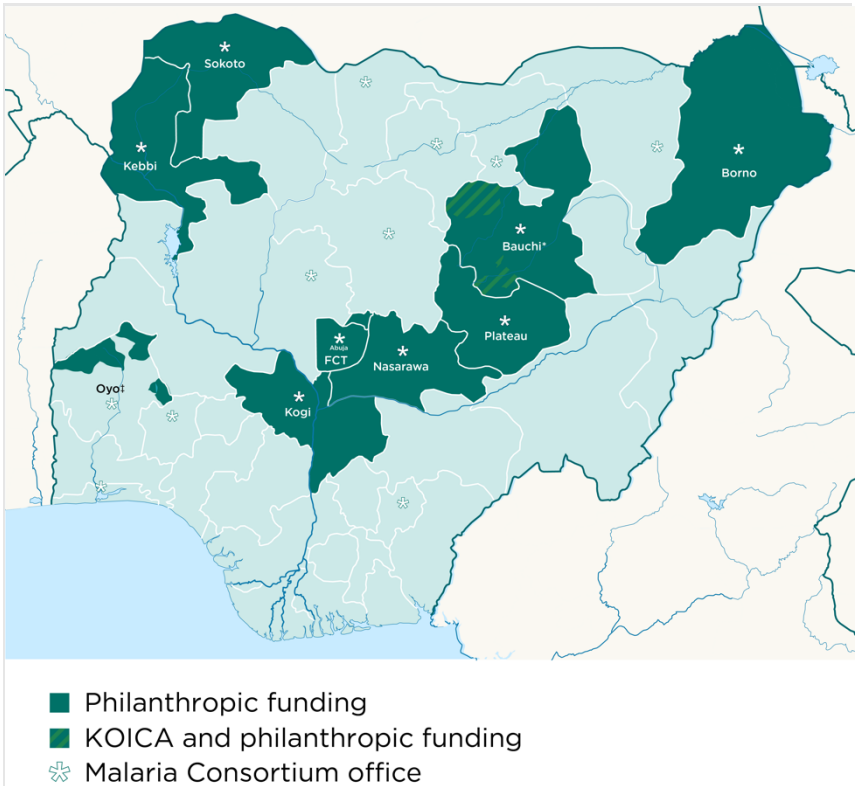
Funding source	Number of LGAs (2021)	Target population (2021)	Number of LGAs (2022)	Target population (2022)
Global Fund	225	12,320,000	220[a]	13,590,000
Philanthropic	127	8,130,000	152	10,440,000
PMI	14	990,000	37	2,650,000
KOICA and philanthropic	2	260,000	2	280,000
TOTAL	**368**	**21,700,000**	**411**	**26,969,000**

[a]The reduction in the number of LGAs covered by the Global Fund in 2022 is due to several LGAs in Kwara state no longer being considered eligible. Malaria Consortium has been unable to ascertain why the total target population supported with Global Fund funding still increased considerably compared with 2021.

iii. Philanthropically supported SMC delivery in 2022

The target population supported with philanthropic funding exclusively increased from 8.13 million in seven states (127 LGAs) in 2021 to 10.44 million children in eight states and the FCT (152 LGAs) in 2022 (**Figure 11**). The increased target population was due to the expansion of Malaria Consortium's support to eligible LGAs in Oyo state, the FCT and 12 additional LGAs in Kogi. This expansion was supported by GiveWell.[56] While our support for SMC in Borno was intended as a one-year stopgap to cover a funding gap that emerged only a few months before the planned start of the 2021 round,[57] Malaria Consortium continued to support SMC in the state with philanthropic funding in 2022, as the expected World Bank loan had not been finalised in time for the 2022 round. One LGA in Borno, which had previously been considered inaccessible, was included in the SMC campaign for the first time in 2022. As in the previous year, an additional 280,000 children in two LGAs were supported by Malaria Consortium in Bauchi state in 2022, where the KOICA-funded SMC IMPACT project[58] covered the majority of costs. However, philanthropic funding was used to cover SPAQ for one cycle, as well as around 40 percent of the cost of allowances paid to SMC implementers during the annual round. The SMC IMPACT project budget was fixed in 2020, before the decision was made to implement five rather than four SMC cycles in Bauchi. Philanthropic co-funding ensures that the two SMC IMPACT LGAs receive the same number of SMC cycles as the remaining, fully philanthropically supported, LGAs in the state.

Figure 11: States supported with Malaria Consortium's philanthropic funding for SMC, Nigeria, 2022



*Two LGAs in Bauchi are co-funded by KOICA and philanthropic funding; the remaining 18 LGAs are fully funded philanthropically.
‡Only six LGAs in Oyo are considered eligible for SMC.

Early in 2022, Malaria Consortium's Nigeria team held engagement meetings with stakeholders, including the state malaria elimination programmes and public health departments, in Oyo and FCT, the two areas where we had not previously supported SMC delivery. Warehousing, health facility and in-depth security assessments were also conducted, and a new local office was opened in Oyo. A Malaria Consortium SMC project management handbook facilitated the orientation of staff supporting SMC in Nigeria.

A total of 54,843,000 blister packs of SPAQ was procured for the philanthropically supported states in Nigeria. This includes 1,593,000 blister packs initially intended for Borno in 2021, when Malaria Consortium agreed to provide support to this state at short notice and an order was placed based on a rough population estimate. Once a more accurate population estimate was available, only the required quantity of SPAQ was air freighted for use in the 2021 SMC campaign in Borno and the surplus quantity was shipped to Nigeria by sea for use in 2022. The total also includes SPAQ for the two SMC IMPACT LGAs in Bauchi, as philanthropic funding was used to cover the cost of SPAQ for one cycle in those LGAs. As a result of the large quantity of SPAQ procured with philanthropic funding for use in Nigeria in 2022, as well as global production constraints, orders had to be split into seven consignments, which arrived at the destined state-level warehouses between March and July (**Table 10**). Most consignments were shipped by sea, but one consignment had to be air freighted to ensure availability of sufficient quantities of SPAQ for the scheduled start of the annual SMC round in Kogi state. In September, Malaria Consortium agreed to loan 1,522,200 blister packs of SPAQ to PMI to help avoid stock-outs in the two states supported by this funder. At that point, we were confident that we had

enough SPAQ in stock for the remaining cycles in philanthropically supported states. The loaned quantity of SPAQ will be returned to Malaria Consortium before the 2023 SMC round.

Table 10: SPAQ consignments for philanthropically supported states in Nigeria, 2022

Consignment	Number of SPAQ blister packs	Mode of transport	Arrival at warehouse	Notes
1	1,593,000	Sea	March	Surplus quantity originally intended for Borno
2	2,403,400	Air	May	Air freighted to ensure availability of sufficient SPAQ in Kogi for scheduled start of the annual round
3	15,834,000	Sea	June	Includes SPAQ for SMC IMPACT LGAs in Bauchi
4	13,206,000	Sea	June	-
5	7,650,000	Sea	June	-
6	10,560,000	Sea	June	-
7	3,596,600	Sea	July	-
TOTAL	**54,843,000**			

As Nigeria is the only country supported by Malaria Consortium where SMC medicines from different manufacturers of quality-assured SPAQ are used, training materials were updated to reflect the slightly different packaging and labelling of the products. Malaria Consortium also supported the inclusion of content on safeguarding in national SMC training materials. More than 110,000 SMC implementers were trained with philanthropic support for the 2022 annual round between May and July (**Table 11**), including over 73,000 volunteers who served as community distributors. At the central and state level, the trainings included participation from the National Primary Health Care Development Agency and the National Agency for Food and Drug Administration and Control to strengthen coordination between Ministry of Health departments and avoid clashes with conflicting health activities, which had frequently resulted in delays to SMC campaigns in the past. Other cadres involved in SMC delivery in Nigeria include health educators, who coordinate SMC-related community engagement activities at the LGA level, and lead mothers. This cadre of female volunteers is tasked with sharing information about SMC within their communities and visiting households over the two days following community distributors' visits, to encourage adherence to the three-day SPAQ regimen. Because of the challenging security situation in Borno, the SMC training cascade in this state differed somewhat from that in other states. For example, many health facilities in Borno are not functional. To make up for the lack of health workers who typically coordinate SMC delivery, additional implementers were drawn from the state level and focal persons representing each ward, the administrative level below the LGA, were appointed. Instead of community leaders — a cadre of traditional leaders who are formally recognised by the

government and typically support community sensitisation for health activities in most states — this function was adopted by a government-recognised cadre of LGA employees in Borno. Lead mothers were not used in Borno.

Table 11: SMC implementers trained with philanthropic support,[a] Nigeria, 2022

Cadre	Number of SMC implementers	Number of days per training	Number of training events
National-level master trainers	54	2	1
State-level master trainers	27	2	9
State-level supply chain specialists	9	2	9
State-level health educators	9	2	9
LGA-level trainers and supervisors	464	2	16
LGA-level supply chain specialists	156	2	10
LGA-level health educators	127	2	9
Health workers	13,038	2	402
Ward focal persons and additional state-level supervisors[b]	291	2	10
Community distributors	73,047	2	2,467
Community leaders	7,395	1	247
LGA representatives[b]	135	1	5
Town announcers	9,319	1	313
Lead mothers	7,846	1	261
TOTAL	**111,917**		**3,768**

[a]As KOICA funding was used for training in the two SMC IMPACT LGAs in Bauchi, SMC implementers trained in those LGAs have not been included in the figures presented here.
[b]Borno only

Borno, Kebbi, Sokoto and 10 LGAs in the north of Bauchi continued to implement four SMC cycles as in previous years. Ten LGAs in the south of Bauchi changed to implementing five cycles for the first time in 2022, in line with a recommendation from the above-mentioned stratification exercise. Five cycles were implemented in all other philanthropically supported states. The Nigerian Meteorological Agency predicted that the rainy season would start unusually early in 2022. Starting SMC delivery as early as May was considered. However, given the supply chain constraints, this was not possible, with actual implementation dates varying between states (**Table 12)**. The first states to start cycle 1 distribution, on 25 June, were Bauchi, Kogi, Nasarawa and Oyo. Abuja Municipal Council in the FCT was the last area to complete the

SMC round, on 30 October. Bauchi, Borno, Kebbi, Kogi, Nasarawa and Sokoto were all affected by severe flooding in 2022.[60] In some cases, the distribution period of SMC cycles had to be extended in the worst-affected areas to ensure all communities were reached. SMC delivery in hard-to-reach areas of Borno was further affected by fuel shortages, which resulted in fewer WHO-supported airlifts of SMC commodities into those areas. A learning brief summarising our insights from implementing SMC in conflict-affected areas of Borno has been published on Malaria Consortium's website.[61] A key learning was that strong collaborations with partners that have an established presence and expertise on the ground were crucial for the accurate assessment of operations in this volatile setting. Despite the challenges, SMC was safely delivered to hard-to-reach populations, including many IDPs, at a cost comparable to that in areas that are less affected by insecurity.

Table 12: SMC distribution dates in philanthropically supported states, Nigeria, 2022

State	Implementation dates	Delays and challenges
Bauchi (five-cycle LGAs)	Cycle 1: 25 June Cycle 2: 23 July Cycle 3: 20 August Cycle 4: 17 September Cycle 5: 15 October	Parts of Bauchi were affected by severe flooding between the end of July and September. In some affected areas, the distribution period was extended, especially in cycle 3, in order to reach the target population, including those who were displaced because of the floods.
Bauchi (four-cycle LGAs)	Cycle 1: 2 July Cycle 2: 4 August Cycle 3: 1 September Cycle 4: 29 September	Cycle 2 was delayed by five days due to conflicting Maternal, Newborn and Child Health Week activities. Parts of Bauchi were affected by severe flooding between the end of July and September. In some affected areas, the distribution period was extended by a few days, especially in cycle 3, in order to reach the target population, including those who were displaced because of the floods.
Borno	Cycle 1: 15 July Cycle 2: 13 August Cycle 3: 10 September Cycle 4: 8 October	The SMC round started about two weeks later than planned due to delays in agreeing a memorandum of understanding with the state malaria elimination programme. Cycle 2 was delayed by one day due to a lack of fuel to enable helicopter transport of commodities into hard-to-reach areas.
FCT (Abuja Municipal Council)	Cycle 1: 1 July Cycle 2: 29 July Cycle 3: 30 August	In the urban areas of Abuja, delays were experienced throughout the round due to challenges in collaborating with health

	Cycle 4: 29 September Cycle 5: 27 October	workers, for example because of disputes over payments.
FTC (other area councils)	Cycle 1: 30 June Cycle 2: 28 July Cycle 3: 26 August Cycle 4: 23 September Cycle 5: 21 October	-
Kebbi	Cycle 1: 1 July Cycle 2: 30 July Cycle 3: 27 August Cycle 4: 24 September	-
Kogi, Nasarawa and Oyo	Cycle 1: 25 June Cycle 2: 23 July Cycle 3: 20 August Cycle 4: 17 September Cycle 5: 15 October	Parts of Kogi were affected by severe flooding between June and September. In some affected areas, the distribution period was extended by a few days, especially in cycles 3 and 4, in order to reach the target population, including those who were displaced because of the floods.
Plateau	Cycle 1: 26 June Cycle 2: 24 July Cycle 3: 21 August Cycle 4: 18 September Cycle 5: 16 October	-
Sokoto	Cycle 1: 1 July Cycle 2: 29 July Cycle 3: 26 August Cycle 4: 23 September	-

Several SMC processes, including for administrative data collection and supportive supervision, have been digitalised in Nigeria. Digitalisation has been facilitated by the existence of Emergency Operation Centers, government-led initiatives in seven northern Nigerian states that are managed by the National Primary Health Care Development Agency. The centres aim to improve public health emergency management by strengthening information sharing and joint programming, including the collection, storage, and visualisation of relevant public health and demographic information. In 2022, Malaria Consortium worked with the state malaria elimination programmes of Bauchi, Borno and Sokoto to utilise the centres for daily reporting

during SMC distribution, which informed frequent review meetings and supportive supervision of SMC implementers in those states. In all states, Malaria Consortium introduced an electronic attendance registration process for SMC meetings, trainings and SMC distribution days. Due to a lack of suitable providers, mobile payments are not used in Nigeria. Instead, payments are processed via bank transfer.

iv. Plans for 2023

In 2023, we expect to continue to use philanthropic funding to support the same states and LGAs as in 2022. At the request of the NMEP, this includes Borno, where funding arrangements through the World Bank loan had not been finalised at the end of 2022. We also expect to continue to use philanthropic funding to co-fund SMC in the two KOICA-funded SMC IMPACT LGAs in Bauchi. The total target population supported with philanthropic funding in Nigeria in 2023 will be approximately 11.28 million children. Programmatic priorities include improving SMC coverage in the highly urbanised areas of FCT, further embedding digital tools in SMC delivery, and increasing timeliness of cashless payments.

5.5 South Sudan

i. Setting

South Sudan has a total population of 10.75 million.[62] Malaria is endemic throughout the country, with transmission peaking during the rainy season between May and October.[63] In 2021, South Sudan reported 2.95 million cases of malaria and 7,300 deaths, which accounted for 1.2 percent of both global cases and deaths. Malaria incidence is thought to have doubled since 2015 due to conflict, poverty, malnutrition and climate change.[64] In 2022, the government declared malaria a national emergency and launched a Zero Malaria campaign. Violence between armed groups affects many parts of the country. The United Nations Office for the Coordination of Humanitarian Affairs estimates that more than half of the population insecure due to conflict, chronic underdevelopment and severe weather conditions.[65] There are over two million IDPs in South Sudan.[66]

ii. Scale-up of SMC and funding support

The country's Malaria Strategic Plan 2021–2025 recommends SMC as a prevention strategy in areas where the malaria burden is high and malaria transmission is seasonal.[67] To test if SMC can be a feasible, acceptable and impactful intervention in South Sudan, Malaria Consortium and the National Malaria Control Programme conducted an implementation study in 2022, which is described in more detail in section 6. As part of the study, SMC was implemented targeting just under 20,000 children in one county of Northern Bahr el Ghazal state (**Figure 12**) in 2022, supported with Malaria Consortium's philanthropic funding. The location for the study was selected based on the seasonal malaria transmission pattern in the region, high malaria incidence according to routine health system data and the state's relative stability compared with other potentially suitable states where the security risk is greater. In addition, Malaria Consortium had well-established working relationships with the state and county-level health authorities through previous non-SMC-related projects. While MSF had experimented with intermittent malaria chemoprevention for children in the area in the past, the pilot project was the first time SMC was implemented using the standard door-to-door distribution model. A news article announcing the expansion of Malaria Consortium's SMC portfolio to South Sudan was published on Malaria Consortium's website.[68]

Figure 12: Location of Northern Bahr el Ghazal state within South Sudan

iii. Philanthropically supported SMC delivery in 2022

The pilot project was implemented in Aweil South county (**Figure 13**). A total of 105,000 blister packs of SPAQ were procured with philanthropic funding for the SMC pilot. At the time the project received ethical approval in-country, shipment by sea was no longer possible and the consignment was, therefore, air freighted to South Sudan. It arrived in Aweil in June. South Sudan uses artesunate-amodiaquine (ASAQ) as the first-line treatment of breakthrough malaria cases. There is a risk of overdosing on AQ if children who receive SPAQ for SMC subsequently receive ASAQ for the treatment of malaria. For this reason, the first-line treatment in the study area had to be changed to artemether-lumefantrine (AL). As this was not routinely available at health centres, 78,300 AL tablets were procured with philanthropic funding, air freighted to South Sudan and distributed to health facilities in the study area in July. More than 300 SMC implementers were trained in June and July, including around 290 *Boma* Health Workers, a salaried cadre of community health workers who serve as community distributors in South Sudan (**Table 13**). Given the small scale of the project, only one training was conducted for trainers and supervisors at the national, state and county-level, as well as for health workers.

Figure 13: Counties supported with Malaria Consortium's philanthropic funding for SMC, Northern Bahr el Ghazal, South Sudan, 2022

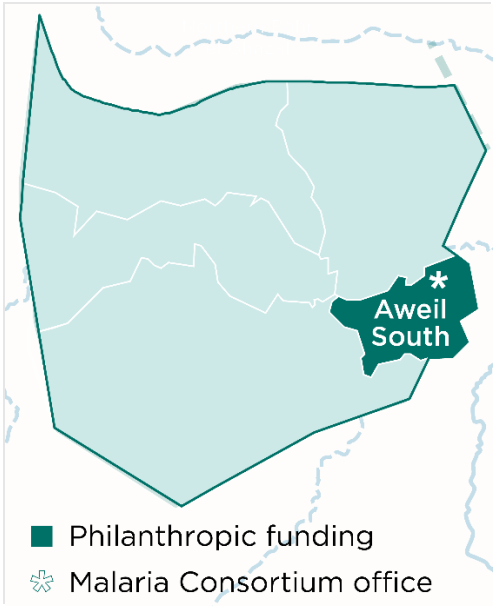


Table 13: SMC implementers trained with philanthropic support, South Sudan, 2022

Cadre	Number of SMC implementers	Number of days per training	Number of training events
National, state and county-level trainer/supervisors and health workers	23	3	1
Supervisors	18	3	1
Boma Health Workers	288	3	4
TOTAL	**329**		**6**

Five monthly SMC cycles were implemented, starting on 22 July. This was about one month later than planned due to delays in obtaining ethical approval for the study. Subsequent cycles were implemented as scheduled and SMC distribution ended on 20 November. Throughout the campaign, there was strong support and involvement from central, state and county health authorities. Communities in the study area also expressed strong support for the intervention.

iv. Plans for 2023

We will use philanthropic funding to continue the SMC project to further build the evidence base for SMC in the complex environment of South Sudan. In 2023, we plan to implement SMC in two counties of Northern Bahr el Ghazal state, targeting around 60,000 children.

5.6 Togo

i. Setting

In 2021, Togo had a total population of 8.64 million.[69] Malaria is highly endemic in the entire country.[70] In the north, there is a seasonal transmission peak between June and September. There were an estimated 2.05 million malaria cases and 3,700 deaths in 2021, accounting for 0.8 percent of global cases and 0.6 percent of global deaths.[13] Though Togo has not been affected by the same levels of violence and insecurity as many of its Sahelian neighbours, 2022 saw a deterioration of the security situation in the north of the country. The government declared a state of security emergency in Savanes region in June, following an attack by armed militants.[71]

ii. Scale-up of SMC and funding support

SMC has been implemented in Togo since 2013. The three northernmost regions of Centrale, Kara and Savanes are considered eligible for SMC. Geographical coverage increased from five districts initially to all districts in the eligible regions from 2016 onwards. Full geographic coverage was maintained in 2022 with funding from the Global Fund, Malaria Consortium's philanthropic funding and UNICEF, with a total target population of 510,000 (**Table 14**). The slight increase in the SMC target population compared with the previous year was due to population growth.

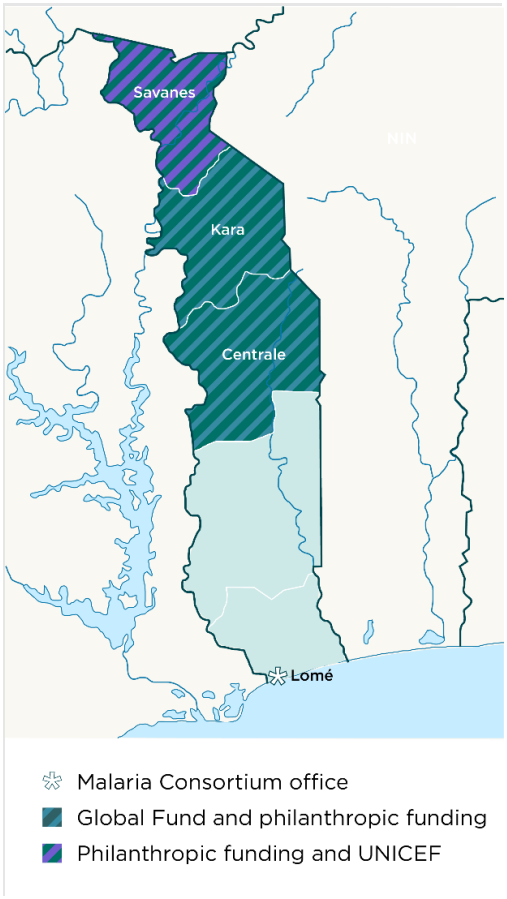
Table 14: SMC target population by funding source, Togo, 2021–2022

Funding source	Number of districts (2021)	Target population (2021)	Number of districts (2022)	Target population (2022)
Global Fund and philanthropic	12	300,000	12	310,000
Philanthropic and UNICEF	7	190,000	7	200,000
TOTAL	**19**	**490,000**	**19**	**510,000**

iii. Philanthropically supported SMC delivery in 2022

SMC in the three eligible regions is supported by Malaria Consortium's philanthropic funding through co-funding arrangements with the Global Fund and UNICEF (**Figure 14**). In the 12 districts of Centrale and Kara regions, the Global Fund covers SPAQ and the majority of SMC implementation costs. Some activities, including training and household surveys, were supported with philanthropic funding, as insufficient funds were available from the Global Fund to cover those activities. In the seven districts of Savanes region, UNICEF covered SPAQ, while philanthropic funding was used for all SMC implementation costs. Those arrangements have been in place since 2021. Because of the co-funding arrangements with the Global Fund and UNICEF, Malaria Consortium does not procure SPAQ for Togo.

Figure 14: Regions supported with Malaria Consortium's philanthropic funding for SMC, Togo, 2021



The training flipbook Malaria Consortium had introduced in 2021 was further refined based on lessons from the previous year. All the national- and regional-level trainers involved in the 2022 SMC campaign had been involved in previous years and hence no trainings were conducted at those levels in preparation for the 2022 round. Consequently, trainings were only conducted at the district and community level, including for almost 6,000 volunteers serving as community distributors (**Table 15**).

Table 15: SMC implementers trained with philanthropic support,[a] Togo, 2022

Cadre	Number of SMC implementers	Number of days per training	Number of training events
Supervisors	624	2	19
Community distributors	5,996	2	258
TOTAL	**6,620**		**277**

[a]In the districts where co-funding arrangements are in place with the Global Fund, Global Fund funding was used to co-finance training activities.

All districts implemented four SMC cycles. While SMC distribution was initially scheduled to start in June, micro-planning was delayed due to conflicting priorities affecting the capacity of the PNLP. Cycle 1 distribution started on 1 July in all districts. Cycles 2 and 3 were implemented as scheduled, but cycle 4 was delayed because a SPAQ consignment did not arrive on time. The

PNLP arranged to borrow SPAQ from neighbouring Benin, resulting in a relatively short delay of three days. SMC distribution ended on 6 October in all districts. One severe adverse event was reported during the 2022 SMC campaign in Togo. A child had developed a rash, lesions and swellings following the administration of SPAQ and had to be treated in a local hospital. The incident was followed up through the national pharmacovigilance system and the child recovered.

Malaria Consortium's key role as an implementing partner in Togo is to advise on quality implementation of SMC. In 2022, we rolled out the end-of-cycle surveys that had been piloted in three districts in the previous year to all SMC-implementing districts. Processes were established to ensure survey data are reviewed and used to inform improvements in subsequent cycles. Feedback on the approach from stakeholders at the different levels of the health system has been positive.

iv. Plans for 2023

In 2023, Malaria Consortium expects to support SMC in all provinces through the same co-funding arrangements as in 2022. Priorities for the year include agreeing the timescale for the 2022 SMC campaign with all stakeholders well in advance of campaign activities, ensuring timely availability of SMC medicines, and improving the timeliness of mobile payments.

5.7 Uganda

i. Setting

Uganda's population was estimated at 45.85 million in 2021.[72] Malaria is highly endemic in the entire country.[73] Transmission is perennial in much of the country, but there are areas with a seasonal transmission peak between May and September in the northeastern parts of the country. In 2021, there were 13.02 million cases and 19,700 deaths. Uganda ranks third in terms of malaria cases globally, accounting for 5.1 percent of global cases. The country also accounts for 3.2 percent of global malaria deaths.[13] Uganda is relatively stable and not affected by the same level of violence as other countries where Malaria Consortium supports SMC. However, there is an ongoing military operation in the Karamoja subregion against intercommunal violence.[74]

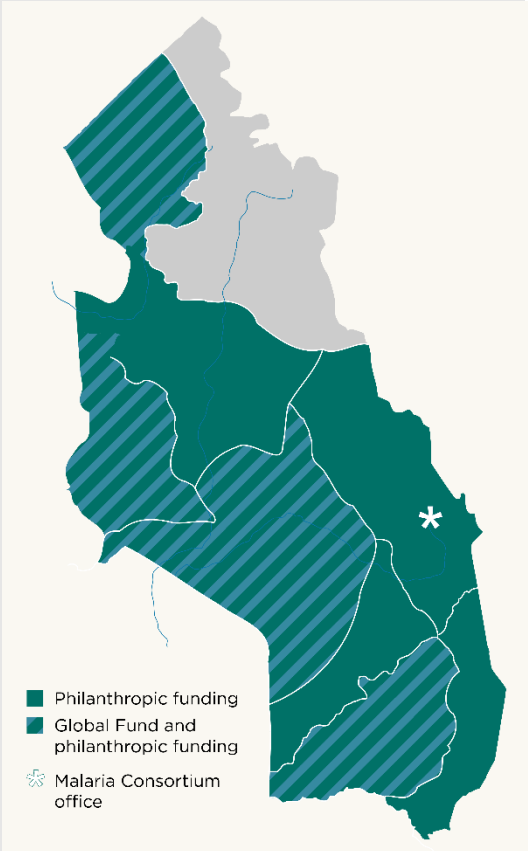
ii. Scale-up of SMC and funding support

The Uganda Malaria Reduction and Elimination Strategic Plan 2021–2025[75] aims to move the country into the malaria pre-elimination stage and proposes new, innovative chemoprevention approaches to combat malaria, especially in children. Modelling conducted by the Swiss Tropical and Public Health Institute suggested that SMC could be a viable malaria prevention strategy in the Karamoja subregion (**Figure 15**),[76] where malaria transmission is seasonal and the highest prevalence rates in the country are consistently reported. However, SP resistance is high in Uganda.[77] In 2020, the National Malaria Control Division (NMCD) approached Malaria Consortium with a request to support an SMC implementation study in Karamoja to investigate the feasibility, acceptability and impact of SMC. The study commenced in 2021 and employs a similar two-phase design as the study Malaria Consortium is conducting in Mozambique. It is described in more detail in section 6. An article discussing the use of modelling data to inform the rollout of SMC in Uganda was published on Malaria Consortium's website.[78]

Figure 15: Location of Karamoja subregion within Uganda

In 2021, the first year of SMC implementation in Uganda, philanthropic funding was used to deliver SMC to 90,000 children in two districts of Karamoja. In 2022, philanthropic funding supported SMC delivery in eight districts of Karamoja, with a total target population of 230,000 children (**Figure 16**). Philanthropic funding was used exclusively to implement SMC in four districts of Karamoja, targeting 150,000 children as part of phase two of the SMC implementation study. This figure excludes around 3,000 children who lived in control communities in Amudat, where a cluster-randomised controlled trial (cRCT) to assess the effectiveness of SMC was implemented. SMC was not delivered in control communities. In a fifth district, around 18,000 children were targeted, primarily with philanthropic funding. However, the initial plan had been to only cover about 1,500 children enrolled in a cohort study to determine the chemoprevention efficacy of SMC medicines in this district. It was later decided to extend SMC to children beyond the study population, except around 19,000 who lived in three subcounties that were kept as buffer zones to minimise contamination with communities where the study was implemented. Children who lived in communities where SMC was not delivered are not included in the target population figure. The additional quantity of SPAQ needed was provided from stock procured by the Global Fund. The majority of children in the five research districts received SMC with SPAQ, but around 15,000 children received SMC with dihydro-artemisinin-piperaquine (DP), an alternative drug regimen tested as part of the research. SMC was also implemented by Malaria Consortium with funding from the Global Fund in an additional three districts, where no research was conducted. The total target population in those three districts was 70,000 children. Philanthropic funding was used to support project management and Malaria Consortium operational costs in those districts, which is why top-level achievements have been included in this report. To date, SMC has not been implemented elsewhere in Uganda.

Figure 16: Districts supported with Malaria Consortium's philanthropic funding for SMC, Karamoja subregion, Uganda, 2022



iii. Philanthropically supported SMC delivery in 2022

In preparation for the 2023 campaign, the Malaria Consortium Uganda team carried out assessments of storage facilities and health facilities in the new districts where SMC had not previously been implemented. A total of 723,600 blister packs of SPAQ and 174,000 tablets of DP was procured with philanthropic funding. The SPAQ was shipped by sea and arrived in March. DP was more challenging to source. To minimise delays to the research, the consignment had to be air freighted. It arrived in Karamoja in late April. Between September 2022 and January 2023, Uganda experienced an outbreak of Ebola in the central part of the country.[79] While Karamoja was not affected, Malaria Consortium donated 93,125 tablets of left-over DP to the Ministry of Health for MDA in areas where the outbreak occurred in November.

The SMC training cascade for the 2023 round was conducted between April and June for the five districts that were primarily supported with philanthropic funding. This included more than 1,300 village health team (VHT) members, a recognised cadre of salaried community health workers, who serve as community distributors in Uganda (**Table 16**) (**Spotlight 8**). In areas where DP was used, the trainings had a strong focus on the protocol for administration of DP, which differs from that for SPAQ. For example, dosing is based on weight rather than age and all children had to be weighed prior to DP administration.

Table 16: SMC implementers trained with philanthropic support,[a] Uganda, 2022

Cadre	Number of SMC implementers	Number of days per training	Number of training events
National trainers and supervisors	7	4	1
Regional- and district-level trainers and supervisors	23	3	3
Health workers (SPAQ and DP)	28	2.5	1
Health workers (SPAQ only)	34	2	2
VHTs	1,322	2	43
TOTAL	**1,414**		**50**

[a]As Global Fund funding was used for training in the three districts primarily supported by the Global Fund, SMC implementers trained in those districts have not been included in the figures presented here.

Spotlight 8: The role of village health teams in SMC delivery in Uganda

Uganda's national CHW programme involves volunteer VHTs, who are selected by their communities to serve as the first point of contact for basic health services at the village level. They are supervised by facility-based health workers and have close ties with their communities. Their responsibilities include community health promotion and education, distribution of health commodities, follow-up of patients after their discharge from a health facility, mothers during pregnancy and after birth, and community-level health information management and surveillance. Each village has an average of four VHTs. In some districts, two of those VHTs have been trained to provide integrated community case management (iCCM) of malaria, pneumonia and diarrhoea in children under five. For malaria treatment, they are equipped with RDTs and antimalarial medicines.

At the recommendation of Uganda's Ministry of Health, VHTs trained on iCCM serve as SMC community distributors. Many people in Karamoja are nomadic pastoralists, but VHTs are aware of seasonal migration patterns and the population's health-seeking behaviours. They are familiar with the best times and locations to deliver services to the population, including market days, religious gatherings or community meetings. VHTs also command a high level of trust within their communities and, because of their role in iCCM, it is well known that they can hand out antimalarials. Moreover, when they identify a child with malaria symptoms during SMC distribution, they can perform a rapid diagnostic test (RDT) and administer malaria treatment on the spot. This eliminates the need to refer those children to a health facility and ensures that all sick children are indeed tested and treated as appropriate, including those outside of the SMC-eligible age range who live in households visited for SMC. In most other countries, SMC community distributors are volunteers who cannot perform RDTs or provide antimalarials for the treatment of malaria. They, therefore, have to refer children with symptoms of malaria to the nearest health facility; however, not all caregivers are able to follow this advice, often because of the time and cost involved in travelling to a health centre. The same health workers who supervise VHTs also serve as supervisors during SMC

distribution, which acts as a quality assurance mechanism for supportive supervision in SMC. Because VHTs are a recognised cadre of community health workers who receive a stipend for their work, payment mechanisms are well established, which minimises the risk of payment delays and low motivation.

Malaria Consortium believes that the use of VHTs in SMC has been a main contributor to the high acceptance of SMC among the population and the very good coverage results achieved in this challenging setting.

Photo 10: A VHT member performs a malaria rapid diagnostic test, Uganda

Five SMC cycles were implemented in all philanthropically supported districts. To facilitate the coordination of various research activities, SMC implementation dates were staggered and varied by district (**Table 17**). Some resentment was reported from communities in control areas who felt left out because they did not receive SMC. The Malaria Consortium team stepped up community engagement activities in the control areas in response. Global Fund support for the three districts was only confirmed in June; hence, the start of implementation was delayed until July and only four cycles were implemented. In Uganda, a mobile app is used to strengthen supportive supervision of VHTs.

Table 17: SMC distribution dates in philanthropically supported districts, Uganda, 2022

District	Implementation dates	Delays and challenges
Kotido and Moroto	Cycle 1: 17 May Cycle 2: June Cycle 3: 14 July Cycle 4: 12 August Cycle 5: 8 September	-
Nabilatuk	Cycle 1: 22 May Cycle 2: 18 June Cycle 3: 17 July Cycle 4: 17 August Cycle 5: 14 September	Cycle 1 was delayed by about one week due to a conflicting COVID-19 vaccination campaign.
Amudat	Cycle 1: 18 June Cycle 2: 19 July Cycle 3: 21 August Cycle 4: 26 September Cycle 5: 25 October	An effectiveness cRCT with a SPAQ, a DP and a control arm was implemented in this district. SMC distribution started about one month later than planned due to delays in the delivery of DP and because training (including on administration of DP) took longer than anticipated.
Nakapiripirit	Cycle 1: 20 June Cycle 2: 20 July Cycle 3: 21 August Cycle 4: 20 September Cycle 5: 18 October	A chemoprevention efficacy study with a SPAQ, a DP and a control arm was implemented in this district. SMC distribution started about one month later than planned as approval was needed from the NMCD for the use of SPAQ procured by the Global Fund to ensure SMC distribution across the entire district, rather than just for children enrolled in the study as initially planned. Approval was only received in June.

In October, towards the end of the 2023 round in Uganda, the NMCD and Malaria Consortium hosted an event to celebrate the successful rollout of SMC in Karamoja, with participation from the Minister of State for Health, the Permanent Secretary, and several Members of Parliament. A news article about the event was published on Malaria Consortium's website.[80]

iv. Plans for 2023

In 2023, Malaria Consortium expects to implement SMC with philanthropic support in the same five districts as in 2022, but including children who lived in control or buffer communities and thus did not receive SMC in 2022. The philanthropic SMC target population will be approximately 190,000. We expect that the remaining four districts of Karamoja, with a combined target population of 100,000 children will be reached with support from the Global Fund. Based on the good effectiveness measures found in the first study phase,[21] Malaria Consortium believes that the use of SMC in the entire subregion is justified while the research is ongoing. As in Mozambique, conclusions on the longer-term viability of SMC in Karamoja or elsewhere in Uganda can only be drawn once all study results are available.

6. Malaria Consortium's SMC research

Malaria Consortium is one of a small number of non-governmental organisations in the UK that has been awarded independent research organisation status by Research Councils UK.[81] We are committed to evidence-based interventions and to contributing towards building the evidence base for the interventions we implement. In this section, we describe Malaria Consortium's role as a research organisation and how philanthropic funding was used for SMC research in 2022. We also present emerging results from our studies.

6.1 Scope and scale of Malaria Consortium's SMC research

As a both a leading implementer of SMC and a research organisation, Malaria Consortium is uniquely placed to develop and evaluate solutions to operational problems that can improve the quality of SMC delivery; assess the extent to which SMC impacts estimates of the burden of malaria; and test innovations that will shape the future of SMC.

The scope and scale of Malaria Consortium's SMC research has grown substantially over the last few years. For example, in 2018, we had no peer-reviewed publications and no SMC-related presentations or posters at the annual meeting of the ASTMH, one of the most prestigious academic conferences for malaria researchers. In 2022, Malaria Consortium's SMC research was published in seven peer-reviewed articles (**Spotlight 9**).[18,20,25,36,76,82,83] We also co-hosted an SMC-themed symposium at ASTMH and shared our research findings in five oral presentations and 12 conference posters.[84-100] Academic publications with contributions from Malaria Consortium's SMC research are referenced throughout this report.

Spotlight 9: Malaria Consortium's SMC-themed peer-reviewed publications, ASTMH presentations and posters, 2022

Malaria Consortium staff authored or co-authored the following SMC-themed peer-reviewed articles that were published in 2022:

1. Co-implementing vitamin A supplementation with seasonal malaria chemoprevention in Sokoto State, Nigeria: A feasibility and acceptability study. BMC Health Services Research.
2. Delivery of seasonal malaria chemoprevention with enhanced infection prevention and control measures during the COVID-19 pandemic in Nigeria, Burkina Faso and Chad: A cross-sectional study. Malaria Journal.
3. Dynamical malaria modeling as a tool for bold policy-making. Nature Medicine.
4. Extending delivery of seasonal malaria chemoprevention to children aged 5–10 years in Chad: A mixed-methods study. Global Health: Science and Practice.
5. Extending seasonal malaria chemoprevention to five cycles: A pilot study of feasibility and acceptability in Mangodara district, Burkina Faso. BMC Public Health.
6. Feasibility, acceptability, and protective efficacy of seasonal malaria chemoprevention implementation in Nampula province, Mozambique: Protocol for a hybrid effectiveness-implementation study. JMIR Research Protocols.
7. Impact of seasonal malaria chemoprevention on prevalence of malaria infection in malaria indicator surveys in Burkina Faso and Nigeria. BMJ Global Health.

At the 71st annual meeting of the ASTMH in Seattle 2022, our research was shared in five oral presentations:

1. A cross-sectional survey to assess the feasibility and acceptability of seasonal malaria chemoprevention among nomadic pastoralist population: The case of Karamoja, region in Uganda.
2. A non-randomised controlled trial to assess the protective effect of seasonal malaria chemoprevention in the context of high parasite resistance in Uganda.
3. Results from an implementation study to assess the impact, feasibility and acceptability of implementing seasonal malaria chemoprevention in Karamoja region.
4. Seasonal malaria chemoprevention: Mozambique implementation study 2020–22.
5. Seasonal malaria chemoprevention (SMC): New geographies in Nigeria and quality of SMC delivery.

In addition, Malaria Consortium colleagues presented 12 SMC-themed ASTMH conference posters:

1. Acceptability of seasonal malaria chemoprevention among children under five in Mozambique: A qualitative study.
2. Assessing the quality of SMC delivery by village health teams in Uganda.
3. Evaluating the adaptation of seasonal malaria chemoprevention implementation during COVID-19 in Karamoja, Uganda.
4. Exploring the role model approach to strengthen the administration of SMC medicines in Chad.
5. Facilitators of, and barriers to, fully integrating seasonal malaria chemoprevention with vitamin A supplementation: A qualitative enquiry.
6. Feasibility and acceptability of extending delivery of seasonal malaria chemoprevention to children aged 5–10 years in Chad.
7. Harnessing the seasonal malaria chemoprevention campaign in Nigeria: Safety, equity and cost of fully integrating vitamin A supplementation.
8. Impact assessment of seasonal malaria chemoprevention using routine health surveillance data in Kogi state, Nigeria.
9. Integrating gender into the process evaluation of seasonal malaria chemoprevention in Karamoja, Uganda: Results and future directions.
10. Measuring the impact of SMC on malaria prevalence and case distribution compared to predicted estimates from a transmission model in Burkina Faso.
11. Optimising the role of lead mothers in seasonal malaria chemoprevention campaigns: Insights from formative research in Kano state, northern Nigeria.
12. Using the role model approach to identify best practices and challenges during seasonal malaria chemoprevention drug administration in Burkina Faso.

Our commitment to SMC research is illustrated by our participation in the SMC Alliance research subgroup, which aims to provide a platform for national malaria programmes, implementing partners and researchers to present study protocols and research findings, discuss evidence gaps and research priorities, and promote the use of evidence to inform SMC implementation. Malaria Consortium serves as the subgroup's secretariat. On behalf of the subgroup, Malaria Consortium is currently coordinating a global SMC research priority-setting exercise using the eDelphi method. This involves asking a large group of different SMC stakeholders to define and rank SMC-related research priorities. Results and a peer-reviewed publication are expected in 2023.

6.2 Developing and evaluating solutions to operational challenges

In 2022, we worked on a number of studies that aimed to resolve operational challenges and improve the quality of service delivery. The studies we conducted focused on how SMC could be implemented more efficiently, effectively and equitably.

i. Increasing efficiency

We explored two different approaches to increasing the efficiency of service delivery by integrating SMC with other health services. A study in Nigeria looked at leveraging the SMC platform for the delivery of another health intervention, VAS. We demonstrated that leveraging the SMC campaign for VAS can substantially increase VAS coverage without negatively affecting SMC delivery. In Togo, our research is looking at the opposite approach, exploring if SMC can be integrated into routine community healthcare delivery; that is, moving away from SMC being delivered through a dedicated campaign.

a) Co-implementing VAS with SMC, Nigeria

Building on a study conducted by Malaria Consortium in 2019 to explore if delivering VAS to children 6–59 months via SMC is feasible and acceptable,[101] we carried out further research on this topic at a larger scale in 2021. The follow-up study targeted around 165,000 children during SMC cycle 4 in two LGAs of Bauchi state. A convergent mixed-methods design, including 12 key informant interviews (KIIs) and 12 focus group discussions (FGDs), as well as baseline and cross-sectional endline household surveys with 540 children 6–59 months, was used to explore the feasibility and acceptability of integrating VAS with SMC among caregivers, community distributors, health workers and policymakers, as well as to assess the effectiveness and safety of the approach. Baseline was defined as cycle 3 (SMC only) and endline as cycle 4 (SMC plus VAS). The study also included a cost analysis. The study was primarily funded through a grant from the Health Campaign Effectiveness programme at the Task Force for Global Health. Philanthropic funding was used to support dissemination and publication of research results in 2022. A project brief describing the study methods can be found on Malaria Consortium's website.[102]

At endline, the proportion of children who received at least one dose of VAS in the last six months increased significantly from two to 59 percent. There were no adverse effects on the coverage of SMC delivery, with 70 percent of eligible children reached at baseline, increasing to 76 percent at endline. VAS did not appear to negatively affect the quality of SMC delivery, measured by proportion of children receiving their first dose as DOT, with 54 percent at baseline compared to 68 percent at endline. Adverse drug reactions were consistent between baseline and endline. Intervention costs were determined at 0.94 USD per child and cycle for SMC only, and 1.18 USD per child for SMC and VAS. Caregivers liked the intervention because of the perceived health benefits to their children. Facilitating factors included knowledge of the benefits of VAS among caregivers and intensive community mobilisation. Political influence in the recruitment of community distributors, delayed payments to community distributors and their supervisors, and poor communication with communities were reported as barriers to the successful co-implementation of SMC and VAS. The study concluded that full integration of SMC and VAS is feasible, with minimal incremental cost, and is acceptable to implementers and communities. Study findings were published in BMC Health Services Research[25] and presented as posters at the 2022 annual ASTMH meeting.[93,95]

A key learning from the study was that co-design and collaborative planning of the integrated SMC and VAS campaign with stakeholders at all levels promoted active

participation and ownership by the National Malaria Elimination Programme. Utilising existing health system and programme delivery structures and mechanisms during design and planning facilitated stakeholder buy-in.[103] An advocacy brief was produced in support of efforts to lobby for the inclusion of policy guidance on VAS integration in the NMEP's SMC strategy.[104]

b) Integrating SMC into routine community health service delivery, Togo

The PNLP in Togo is interested in integrating SMC into routine health service delivery to ensure the intervention's long-term sustainability. Malaria Consortium worked with Togo's *Cabinet d'Expertise en Recherche-Action* to conduct formative qualitative research to explore the feasibility and acceptability of the closer integration of SMC with routine community health services such as iCCM. The research protocol involves KIIs and FGDs with key stakeholders to explore how the integration of SMC into routine community health services could be achieved. Results will be available in 2023 and will feed into a co-design workshop with stakeholders to develop processes and tools for the integrated delivery of SMC, which could then be evaluated through further research. A blog post describing how researchers were trained for this study was published on Malaria Consortium's website.[105] A peer-reviewed publication is in preparation.

ii. Increasing effectiveness

SMC relies on caregivers administering the full course of SMC medicines to their children over a three-day period each cycle. In 2022, our research explored two different strategies to strengthen caregivers' adherence to the three-day SPAQ regimen. In Burkina Faso, Chad and Togo, we tested the role model approach, a community-driven behaviour change strategy that identifies existing strengths and solutions among individuals in a community, which are then shared with other community members to bring about positive behaviour change. Malaria Consortium has previously used the approach successfully as a novel tool in malaria control and elimination in other projects.[106] In Nigeria, we conducted a study to optimise the role of lead mothers. Both studies confirmed that context-appropriate community engagement approaches can play an important role in strengthening caregiver adherence to the SMC protocol. While we have not yet demonstrated the cost-effectiveness of those approaches, Malaria Consortium believes that appropriate community engagement is preferable to providing all SPAQ doses as DOT, which would have significant implications in terms of the required resources and cost.

a) Using the role model approach to improve administration of SPAQ in Burkina Faso, Chad and Togo

In 2021, a formative study was conducted in Burkina Faso, Chad and Togo to identify positive caregiver behaviours around the administration of SMC medicines.[107] Those behaviours included incentivising children with treats; spouses, family members or neighbours reminding caregivers to administer day 2 and 3 AQ; and placing blister packs in a prominent place such as near utensils or ingredients used for cooking. Some negative behaviours that should be discouraged were also identified, including mixing SPAQ with food or drink, often with porridge or tea, when it should only be mixed with water; and using force to make the child take the medicines. Findings from the formative research stage were shared at the 2022 ASTMH meeting.[92,100]

In 2022, role models were trained to deliver interactive monthly sessions within their communities, with the goal of sharing behaviours and reinforcing key messages. Social and behaviour change tools, such as posters exhibited at health facilities, were also developed to reinforce positive behaviours. The impact of promoting the identified role model

behaviours on SMC outcomes was assessed at the end of the 2022 SMC campaign. Data analysis is ongoing, and results will be published in 2023.

b) Optimising the role of lead mothers in SMC, Nigeria

Although lead mothers have been involved in SMC for several years, their role and how it impacts on SMC delivery has so far not been evaluated. In 2021 and 2022, Malaria Consortium and the NMEP conducted a study in one LGA in Kano that aimed to develop, implement and evaluate an intervention to optimise the role of lead mothers in SMC. The study comprised three phases. During the formative stage, a literature review and KIIs with community leaders and national, state and local government health officials provided insights that were used during the development phase to define the role of lead mothers and enhance their capacity to strengthen high-quality SMC delivery. The development phase included a co-design workshop with key stakeholders. The evaluation phase involved baseline and endline household surveys to assess the impact of lead mothers on SMC outcomes, as well KIIs and FGDs with key stakeholders. The study methods are described in more detail in a synopsis that was published on Malaria Consortium's website.[108]

The formative research conducted for this study concluded that lead mothers influence caregivers to adopt healthy malaria prevention behaviours during SMC campaigns due to their close ties with the community. Attributes and skills of lead mothers that were reported to strengthen relationships with caregivers were shared customs and beliefs, being known by caregivers, and good communication skills. Areas for improvement identified included recruitment criteria, training, work planning and supervision, and timely payment of lead mothers. Concrete suggestions included increasing the number of lead mothers and giving a supportive or supervisory role to Community Health Influencers, Promoters and Services (CHIPS) agents, a cadre of community agents established by the National Primary Health Care Development Agency to bridge gaps in access to healthcare at the community level. It was also suggested that the selection criteria for lead mothers should be reviewed and that tailored training for lead mothers should be provided. There is a need to improve lead mothers' knowledge and skills and provide supporting materials, so they can better deliver targeted health messages to caregivers. Policymakers need to find a way of transitioning the role of lead mothers into the existing community health worker infrastructure, for example the CHIPS programme, to ensure the sustainability of the approach. Findings from the formative phase were published in the Malaria Journal[109] and at the 2022 ASTMH meeting.[99]

In 2022, the lead mothers approach was adapted based on the formative phase. In particular, this involved strengthening the key messages lead mothers share with community members, as well as developing targeted training materials for lead mothers. The improved lead mothers approach was assessed using a mixed-methods approach, including KIIs and FGDs, and before and after household surveys. Data analysis is ongoing. Results will be published in 2023.

iii. Promoting equity

While SMC campaigns generally achieve high coverage, it has been speculated that some populations may not be optimally served through door-to-door campaigns because of their mobility. Our research in 2022 addressed the needs of one such group: nomadic populations in Chad. This study aimed to assess the feasibility and acceptability of SMC among nomadic populations, determine factors affecting the administration of SPAQ in those populations, and develop strategies to strengthen access to SMC among eligible children in nomadic populations.

A study protocol was developed that involved a mixed-methods design, including KIIs, cross-sectional surveys and geospatial analysis. Malaria Consortium signed an agreement with the Ministry of Health department in charge of services for hard-to-reach populations with the aim of improving access to SMC services for nomadic populations. Results were intended to feed into a co-design workshop with key stakeholders and community members to develop strategies to increase access to SMC among nomadic populations. The planned study site was in a health district in Chari Baguirmi province, where a large number of nomads lives. However, due to several factors, including flooding and a decline in the security situation in this area, the study could not be implemented as planned and had to be stopped before data collection could take place. We will review the feasibility of resuming the study in 2023, if conditions allow.

6.3 Assessing impact

Evidence of the impact of SMC has been growing over recent years, including through the studies conducted as part of ACCESS-SMC.[9,10,12] Our research employs a variety of methods to monitor impact over time and at scale. In 2022, our work included assessments of the chemoprevention efficacy of SPAQ in different locations, as well as secondary analyses of a range of data sets to assess the effectiveness of SMC.

i. Assessing the chemoprevention efficacy of SMC medicines

SMC has now been deployed for several years in the Sahel. While the evidence generated through the ACCESS-SMC project suggests that parasite resistance to SPAQ remains low,[9] Malaria Consortium believes that there is a need to corroborate those findings now SMC has been fully scaled up in the region. There is also a need to assess the chemoprevention efficacy of the SMC medicines after a decade of their use. If the continued chemoprevention efficacy of the medicines can be confirmed, we can confidently predict that SMC will remain a viable malaria prevention strategy for the foreseeable future.

In 2022, we conducted a chemoprevention efficacy study in one health district of Burkina Faso, using Malaria Consortium's chemoprevention efficacy study protocol. A description of the study methods can be found in Spotlight 2 above. This was the first time this study protocol was implemented in West and Central Africa to assess the chemoprevention efficacy of SPAQ after several years of SMC implementation at scale. In total, 500 children were enrolled in the study and received a full course of SPAQ as DOT. The presence of malaria parasites, resistance markers and drug concentrations in the blood was determined through microscopy, quantitative polymerase chain reaction and pharmacometric analyses at different time points. Data have been collected and analysis of the samples is ongoing. Results will be available in 2023.

Chemoprevention efficacy studies were also conducted in Mozambique, Uganda and South Sudan as part of the SMC wider implementation studies in those countries and are described in more detail in the section below on shaping the future of SMC.

ii. Evaluating the effectiveness of SMC at scale

SMC aims to prevent malaria disease in eligible children during the peak malaria transmission season. The effectiveness of the intervention is well documented in research settings, but monitoring effectiveness under programmatic conditions at scale can be challenging, for example, due to varying quality of available routine data or changes in health-seeking behaviour. In addition to evaluating a range of impact measures, we are also interested in the use of malaria modelling and in contributing to the establishment of standardised methodologies, especially those using routine health system data or other readily available data

sets. Our work on measuring the impact of SMC in 2022 included an ecological impact analysis drawing on a range of data sets from Burkina Faso and Nigeria, as well as an analysis of routine health surveillance data to assess the impact of SMC in Kogi state, Nigeria.

a) Ecological impact analysis

This project explores how the impact of SMC could be measured by using multiple available data sources, which may be a more sustainable approach than conducting primary research, especially in areas where the effectiveness of SMC has been established in principle. Prevalence data from nationally representative household surveys, such as the Demographic and Health Surveys and Malaria Indicator Surveys, which are routinely and regularly conducted in many countries, provide reliable representative estimates of malaria prevalence at a specific time and place. They could potentially be used as an alternative, sustainable data source to assess the impact of SMC. To test this hypothesis, an ecological study based on analysis of survey, rainfall, geographical and SMC programme data from Burkina Faso (2010–2017) and Nigeria (2010–2018) was undertaken to assess the impact of SMC. Mixed-effects logistic regression was performed to predict presence of malaria infection in children 6–59 months. In Burkina Faso, there was a substantial decrease in the odds of RDT-positive malaria infection in children living in areas where SMC was implemented during the months when SMC is delivered (odds ratio [OR]: 0.28, 95 percent confidence interval [CI] 0.21–0.37, p<0.001). The same trend was found in Nigeria (OR: 0.40; 95 percent CI: 0.30–0.55, p<0.001). The odds of malaria were lower up to two months post-SMC in Burkina Faso (OR: 0.33; 95 percent CI: 0.17–0.64, p<0.001). In Nigeria, the odds of malaria were lower up to one month post-SMC, but this was not statistically significant (OR: 0.49; 95 percent CI: 0.23–1.05, p=0.07). The analysis showed that impact of SMC can be detected in reduced prevalence of malaria from data collected through household surveys if conducted during SMC administration or within months afterwards. These results were published in BMJ Global Health.[83]

Building on this work, we proceeded to calibrate a malaria transmission model[110] to survey prevalence over time for selected health districts in Burkina Faso. The model had previously been shown to replicate SMC efficacy in trials.[111] We simulated the introduction of SMC in children under five in each district at the time of SMC implementation, including data on rainfall, net use and treatment seeking, fitting to microscopy-confirmed malaria prevalence using maximum likelihood by varying mosquito density. Model outputs of the proportion of clinical malaria cases in under-fives out of all children below 15 years were compared for the years 2013–2018. We also assessed the impact of SMC upon this proportion, using district-level case data confirmed by RDT. Mixed-effects logistic regression models with random intercepts for district were conducted to test for the impact of SMC on the proportion of clinical cases in children under five, adjusting for the removal of user fees for children under five in Burkina Faso.

This work forms part of a Doctor of Philosophy (PhD) project at Imperial College London. Preliminary results were presented at the 2022 annual ASTMH meeting.[98] They show that drops in prevalence for children 6–59 months following SMC implementation match model-predicted impact, assuming 70 percent coverage and full adherence. 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. This suggests 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.

b) Impact assessment of seasonal malaria chemoprevention using routine health surveillance data in Kogi state, Nigeria

This analysis used propensity score matching to select three intervention and three control LGAs in Kogi state, Nigeria, with similar meteorological characteristics, population size and malaria epidemiology. Data for 2021 were extracted from outpatient daily registers at selected primary health facilities, and monthly incidence rates of confirmed malaria cases in the intervention and control LGAs were compared. SMC impact was estimated by fitting a negative binomial regression model to measure outcomes.

Data were extracted from a total of 4,067 outpatient records — 2,206 and 1,861 from intervention and control health facilities, respectively. After adjusting for rainfall, month and age, the rate of confirmed malaria cases was almost two times lower among children 3–59 months in the SMC implementing LGAs, compared to non-implementing LGAs (incidence rate ratio=0.508, 95 percent CI: 0.407–0.64, p<0.001). Incidence of confirmed malaria among under-fives in the intervention LGAs was significantly lower during months when SMC was implemented. We did not observe a similar reduction in control LGAs. The findings were presented at the 2022 annual meeting of the ASTMH.[96]

Photo 11: A child receives SMC medicines from a VHT member, to be administered by their caregiver, Uganda

6.4 Shaping the future of SMC

Due to the organisation's global reach, Malaria Consortium is particularly interested in informing policy and practice regarding SMC in new geographies that were not prioritised for the initial scale-up of SMC in both West and Central and East and southern Africa. Some of our most exciting and groundbreaking research in 2022 explored the feasibility, acceptability and impact of SMC in those new locations.

i. Expanding SMC to new geographies in West and Central Africa

Several countries in West and Central Africa, where SMC has been deployed for many years, recently expanded the geographical reach of SMC beyond the areas targeted for the initial scale-up of SMC, often based on recommendations from systematic stratification exercises. Frequently, the transmission season in those areas is slightly longer and five monthly SMC cycles are implemented. The expansion of SMC to those areas is now well established, but there is a need to monitor impact and assess if the SMC delivery model used in the areas where SMC was initially rolled out is applicable in those new areas.

In 2022, we examined results from the 2021 end-of-round household surveys conducted in four states that had implemented SMC in previous years (Bauchi, Borno, Kebbi, Sokoto) and three new states that implemented SMC for the first time that year (Kogi, Nasarawa, Plateau) to assess if there was a difference in the quality of SMC implementation in those two states. Four quality-related indicators were assessed: community distributor adherence to DOT; caregiver adherence to day 2 and day 3 administration of AQ; perception of the efficacy of SMC medicines by caregivers; and caregiver satisfaction with service delivery.

No difference between old and new states was observed on any of the indicators assessed, which suggests that the delivery model works equally well in both 'old' and 'new' SMC locations. In new states, community distributor adherence to DOT was 89.5 percent; caregiver adherence to day 2 and day 3 DOT was 98.3 percent; 98.2 percent of caregivers believed in the efficacy of SMC medicines; and 99.5 percent were happy with the service community distributors had provided. For old states, those figures were 89.3 percent, 99.0 percent, 96.8 percent and 99.3 percent respectively. Household coverage was also comparable across all states, ranging from 94.5 percent in Bauchi to 98.9 percent in Kebbi. Results were presented during a symposium on Taking SMC to New Geographies at the 2022 annual ASTMH meeting.[88]

ii. Assessing SMC in East and southern Africa

The 2012 WHO policy recommendation called for the scale-up of SMC in the Sahel region of West and Central Africa. SMC in East and southern Africa was not prioritised because of concerns over parasite resistance to SPAQ in this region. However, there are many areas in East and southern Africa where malaria transmission is seasonal, and the most recent WHO guidelines no longer place any geographic restrictions on the deployment of SMC. Assessing if SMC can be a viable malaria prevention strategy in this region despite parasite resistance is, therefore, of the highest priority. In 2022, Malaria Consortium continued the SMC implementation studies we started in previous years in Mozambique and Uganda. We also conducted an implementation study in South Sudan. All those studies included assessments of the feasibility and acceptability of SMC in this new setting; assessments of the chemoprevention efficacy of SMC medicines and the effectiveness of SMC in terms of preventing malaria cases during the high transmission season; as well as monitoring of common resistance markers associated with parasite resistance to the SMC medicines. We generally found SMC in the new locations to be feasible and highly acceptable. Effectiveness results so far have been promising, but we do not yet have results from the chemoprevention efficacy and resistance markers studies, which will become available over the course of 2023. We will only be able to draw robust conclusions on the suitability of SMC in the locations where we have tested the intervention once we have the full results from all study elements.

We also started a new research project in 2022, which we refer to as 'rapid assessments'. The aim of the project is to determine the extent to which the results from the implementation studies in Mozambique and Uganda are generalisable to other geographies in East and southern Africa.

a) Assessing the feasibility, acceptability and impact of SMC in Nampula, Mozambique

The SMC study in Mozambique was designed as a two-phase hybrid effectiveness-implementation study. The first phase focused on acceptability and feasibility, followed by more rigorous assessments of the effectiveness of the intervention and chemoprevention efficacy of SPAQ in phase 2. Detailed methods for both phases have been published in JMIR Research Protocols.[82,112]

Phase 1 of the study was implemented alongside SMC implementation during the 2020/21 season in two districts of Nampula: Malema and Mecubúri. A third district, Lalaua, served as a control for some of the study components. Phase 2 of the study was conducted during the 2021/22 season in four districts: the three districts involved in phase 1 plus a new district, Muecate.

Acceptability and feasibility of SMC were assessed through KIIs and FGDs, as well as end-of-round household surveys in both research phases. Both phases also involved resistance markers surveys before and after SMC delivery to determine the prevalence of *Plasmodium falciparum* parasites with common markers of resistance to SP and AQ, as well as any increase in resistance due to SMC implementation. To assess the effectiveness of SMC in terms of preventing clinical malaria cases, a non-randomised controlled trial (nRCT) was conducted in phase 1, while phase 2 involved a cRCT. In addition, a cohort study was conducted to determine the chemoprevention efficacy of SPAQ and whether drug concentrations or resistance influence the duration of protection.

The study was conducted in collaboration with the PNCM and the *Centro de Investigação em Saúde de Manhiça*. It was co-funded by the Bill & Melinda Gates Foundation. A scientific advisory committee comprising malaria experts, the donor community and national stakeholders guides the study to ensure scientific rigour and support research uptake. An article published in Science magazine about how research in Mozambique could get the fight against malaria back on track featured the study.[113] Phase 1 results were presented at the annual ASTMH meeting in 2021. Preliminary results from phase 2 were shared at a symposium on Taking SMC to New Geographies at the 2022 annual ASTMH meeting.[87] Final results from all study elements will be available in 2023 and will be published in a peer-reviewed journal.

- **Feasibility and acceptability**

  The intervention was successfully delivered with only minor delays and at the anticipated scale. No serious adverse events were reported. High coverage was achieved. In phase 1, 85.2 percent (95 percent CI: 82.1–88.9) of eligible children were reached. Caregivers' adherence to administration of AQ on days 2 and 3 was high at 98.3 percent (95 percent CI: 98.5–99.7).[114]

  Acceptability of the intervention among the population was high. Caregivers, community members and health officials all felt that introducing SMC had helped to reduce cases of malaria and improved caregivers' lives, as they did not have to look after sick children. Community engagement, the involvement of local and religious leaders, and coordination between local authorities and implementing partners were mentioned as success factors. A challenge reported was that some female caregivers could not allow their children to take the SMC medicines because they did not have their male partner's permission. Acceptability results were presented at the 2022 annual meeting of the ASTMH.[89]

- **Effectiveness**

  The nRCT conducted in phase 1 suggested that SMC was effective in preventing malaria cases in children under five during the high transmission season, with SMC conferring a

protective effect of 83 percent.[87] In phase 2, a two-arm cRCT was conducted to assess the effectiveness of SMC (on an intention-to-treat basis) for prevention of clinically significant cases of malaria among children 3–59 months. The primary outcome was the incidence of confirmed malaria using RDTs in SMC-eligible children who visited a clinic or contacted a community health worker for suspected malaria during the study period (January–May 2022) in the two districts where the study was conducted. The study was powered to have an 80 percent chance to detect a 40 percent effect size at the 95 percent confidence level.

Clusters were selected at the community level from a list of all communities, with probability for inclusion proportional to population size. A total of 76 communities was randomly selected for inclusion in the intervention arm. From the remaining communities, 114 were randomly selected for inclusion in the control arm. SMC was implemented as per the standard protocol in communities in the intervention arm. In communities in the control arm, community health workers visited households monthly to disseminate similar health messages as those provided to caregivers by SMC community distributors. In each selected community, 15 households were selected at random from a list of all households in the community. One eligible child was selected at random from among all eligible children in each selected household. In households where no eligible children were identified, additional households were randomly selected until 15 children had been recruited in each community.

Once children had been recruited into the study, a questionnaire was administered to caregivers to establish covariates, including sex, age, socioeconomic status, parental education, use of mosquito nets and indoor residual spraying. Children enrolled in the study were visited monthly by researchers to ascertain if, since the researchers' last visit, they had experienced a fever episode. For children who had experienced a fever episode, caregivers were asked if they had visited a clinic or contacted a community health worker, whether a malaria RDT had been performed and what the outcome of the RDT was. In the intervention arm, caregivers were also asked if the child had received SMC in the previous cycle and if the child had experienced any adverse reactions to SPAQ.

In the first instance, multiple logistic regression was performed to calculate odds ratios. This analysis did not account for the duration of follow-up. Covariates were tested using the likelihood ratio test to determine whether model fit was improved. The protective effect of SMC was estimated using multiple Cox proportional hazards regression models to account for duration of follow-up. Children in both arms were right-censored when they were lost to follow-up or experienced their first RDT-confirmed malaria event after the date of recruitment at baseline. The likelihood ratio tests showed that none of the covariates considered improved model fit. Results from the unadjusted model are presented here, expressed in terms of hazard ratio (HR).

Data from 1,338 children were included in the final analysis: 710 in the intervention arm and 628 in the control arm. In the intervention arm, 181 children experienced a malaria episode confirmed by an RDT, while in the control arm, 431 children had an RDT-confirmed malaria episode. Cox regression analysis revealed that children in the intervention arm had a 77 percent lower risk of having an RDT-confirmed malaria episode than children in the control arm (HR=0.2; 95 percent CI: 0.19–0.28)

This means that the study found approximately 80 percent effect size, which was highly statistically significant at the 95 percent confidence level ($p<0.001$). Although our sample was smaller than the original sample size calculation required, the larger effect size

meant that the smaller sample was sufficient to provide statistical power to detect a significant association. Additional data cleaning and analyses for the cRCT are ongoing, including efforts to reduce loss to follow-up, descriptive analyses of baseline data with survey weights and analysis for recurrent events within each cycle. Final results may differ from the preliminary results presented here.

- **SPAQ resistance**
  While there was high prevalence of SP resistance, one annual round of SMC did not appear to have had a negative impact on the resistance profile.[115] Analysis of resistance data from phase 2 is ongoing.
- **Chemoprevention efficacy of SPAQ**
  A chemoprevention efficacy study as described in Spotlight 2 above was conducted in 2022. Data analysis is ongoing.

b) Assessing the feasibility, acceptability and impact of SMC in Karamoja, Uganda

A two-phase hybrid implementation effectiveness study was conducted in the Karamoja subregion in 2021 and 2022, in collaboration with the NMCD and the Infectious Diseases Research Collaboration. Phase 1 of the study was conducted in two districts, with a third district serving as a control. Phase 2 involved research activities in five districts. The study closely mirrored the design of the Mozambique study described above. In addition to exploring the effectiveness of SMC using SPAQ and the chemoprevention efficacy of SPAQ, phase 2 in Uganda also explored the use of DP as an alternative drug regimen for SMC, including a safety study of the use of DP in children under six months. Phase 2 of the study was co-funded by a grant from the Bill & Melinda Gates Foundation. The phase 2 study protocol was published in Gates Open Research.[116] A summary of available results from both study phases was presented at a symposium on Taking SMC to New Geographies at the 2022 annual ASTMH meeting.[86] Final results will be available in 2023 and will be published in a peer-reviewed journal.

- **Feasibility and acceptability**
  SMC in Karamoja was found to be feasible and safe. The end-of-round household survey at the end of phase 1 showed that a minimum of 87.2 percent of eligible children received SMC per cycle, with the highest coverage (99.6 percent) achieved in cycle 5. A household survey conducted in phase 2 found that 93.1 percent of eligible children had received SMC. Few adverse events were reported. Structured observations by district supervisors and health workers of over 2,000 instances of VHTs administering SMC medicines found that SMC delivery by VHTs was of high quality. The active engagement of stakeholders through training, supervision and political buy-in were critical success factors.

  Acceptability was high, including among nomadic pastoralists. All stakeholders perceived SMC as a highly relevant intervention in Karamoja. Female caregivers reported that they needed to visit the health facilities less often, which gave them more time for housework. While male caregivers felt that they have joint responsibility for the health of their children, most respondents reported that female caregivers primarily care for children. It was also reported that many mothers delegate the administration of SMC medicines to older children, extended family or neighbours, suggesting that community networks play an important role in supporting primary caregivers with SMC. Phase 2 feasibility and acceptability results were presented at the 2022 annual ASTMH meeting.[84,86,90,91,97]

- **Effectiveness**

  The nRCT conducted in phase 1 found that the malaria incidence rate was 3.0 and 38.8 per 100 person-months in the intervention and control groups, respectively. In the intervention areas 90.0 percent of children did not experience any malaria episodes during the study period, compared to 15 percent in the control area. The incidence rate ratio was 0.078 (95 percent CI: 0.063–0.096), which corresponds to a protective effectiveness of 92 percent (95 percent CI: 90.0–94.0) among children in the intervention area. Results from the phase 1 nRCT have been published in the Malaria Journal[21] and were presented at the 2022 annual ASTMH meeting.[85]

  The cRCT in phase 2 was conducted in one district. There are 427 village clusters in this district, of which 190 were randomised for each SMC intervention arm (SPAQ and DP), leaving 47 as control villages. The study had 80 percent power to detect this difference using a two-sided test at the five percent significance level. In each selected village, 10 households were selected at random from a list of all households in the community. One eligible child was selected at random from among all eligible children in each selected household.

  Upon enrolment into the study, a questionnaire was administered to caregivers to establish child- caregiver- and household-level covariates, including sex, age, socioeconomic status, parental education, use of mosquito nets and indoor residual spraying. Children enrolled in the study were visited monthly by research assistants and VHTs to ascertain if, since the researchers' last visit, they had experienced a fever episode. At enrolment and at each follow-up visit, caretakers were encouraged to take their children to the VHTs or nearest health facility whenever the children were sick or unwell. All the health facilities and VHTs were provided with lists of the children enrolled in the study for easy identification when they visited. Children who presented with a history of fever had an RDT for malaria. If this was positive, they were treated as per national guidelines or referred to the nearest health facility. Additionally, the research assistants collected data pertaining to the health of the children, previous clinic visits, mosquito net usage, any medication taken and if they took the right SMC regimen in the right dose for those in the intervention arm. In addition, research assistants shared messages designed to ensure adherence to the study protocol and avoid contamination between study arms.

  Data were initially analysed using mixed-effects logistic regression models adjusted for covariates, with ORs to assess the association between study arm allocations and the primary outcome of interest (RDT-confirmed malaria cases) at any point during the study period, converted to a percentage estimate of protective effect. The likelihood ratio test was used to determine models' goodness of fit. The protective effect of SMC was estimated using random-effects Cox proportional hazards regression models to account for duration of follow-up, in an intention-to-treat analysis. This analysis was based on recurrent events, with a new period of follow-up defined after a child has developed a confirmed case of malaria (under the assumption that the child recovers from malaria on the date of case confirmation and is subsequently at risk of developing a recurrent case) or when a child is lost to follow-up but subsequently re-joins the study.

  Data from 3,749 children (1,698 in the SPAQ arm, 1,667 in the DP arm and 384 in the control arm) were included in the analysis, contributing a total of 554,155 person-days (251,414 in the SPAQ arm, 249,069 in the DP arm and 53,672 in the control arm) to the analysis. There were 464 events of clinical malaria (76 in the SPAQ arm, 66 in the DP arm

and 322 in the control arm). Compared with children in the control arm, those in the SPAQ arm had a 94 percent lower risk of having an RDT-confirmed malaria episode (HR: 0.06; 95 percent CI: 0.04–0.08, p<0.001), while those in the DP arm had a 96 percent lower risk (HR: 0.04; 95 percent CI: 0.03–0.06, p<0.001). The HR for the protective effectiveness of SPAQ was non-inferior to that of DP.

The cRCT results suggest that both SPAQ and DP are highly effective in reducing the incidence of clinically significant malaria. Further data cleaning and analyses are ongoing, including more detailed descriptive analyses across cycles and analyses of secondary outcomes. Final results may differ from the preliminary data presented here.

- **Resistance**

  The resistance markers surveys that were carried out before and after the phase 1 SMC round involved analysis of 300 blood samples, taken as dry blood spots, from symptomatic children 3–59 months who had a positive malaria test in the two study districts and the control district. Five mutations of concern associated with SP resistance (PfDHPS437G, 540E and DHFR 51I, 59R 108N) were prevalent, but remained unchanged between baseline and endline. DHFR 164L and DHPS 581G mutations, which mediate high-level SP resistance, were rare at both baseline and endline. Mutations associated with AQ resistance (PfCRTand PfMDR1 including copy number) were also rare. The results, presented at the Conference on Public Health in Africa, which was held in Kigali in December 2022,[117] indicate that one round of SMC with SPAQ did not appear to select for an observable change in resistance markers for SP and AQ. Data analysis of resistance markers samples collected before and after SMC delivery in phase 2 is ongoing.

- **Chemoprevention efficacy of SPAQ and DP and safety of DP in children under six months**

  All data were collected in 2022. Data analysis is ongoing.

c) Exploring the use of SMC in South Sudan

Like the implementation studies conducted in Mozambique and Uganda, this study aims to test the feasibility, acceptability and impact of SMC in South Sudan. Because of the complexity of conducting research in a region affected by years of conflict, we opted for a less rigorous one-year design in South Sudan, compared with the complex two-year studies in Mozambique and Uganda. Research was conducted alongside SMC distribution in one county of Northern Bahr el Ghazal state. Control communities in the county did not receive SMC. Research activities included two cross-sectional surveys (before and after the SMC round) to establish confirmed malaria cases in the intervention and control areas; a chemoprevention efficacy cohort study to determine if SPAQ provides 28 days of protection from infection; baseline and endline resistance markers prevalence surveys; an end-of-round household survey to determine coverage and quality of SMC implementation; as well as KIIs and FGDs to assess acceptability. A synopsis of the study design was published on Malaria Consortium's website.[118] Oversight was provided by a scientific advisory committee comprising members from the WHO, the Ministry of Health and implementing partners. All data were collected in 2022. Results will be published in 2023.

d) Rapid assessments

Malaria Consortium plans to conduct rapid assessments of SMC in a series of locations in East and southern Africa over the next two years. The rapid assessments are intended to inform decisions about the potential scale-up of SMC in those locations. In addition, and together with results from the implementation studies in Mozambique and Uganda, the rapid assessments will inform a calibrated malaria model that can predict the impact of SMC in

those geographies, thus eliminating the need to conduct elaborate primary research in each new location. To develop the model, Malaria Consortium is partnering with Imperial College London. Study design and planning started in 2022. The first assessments will be carried out in 2023.

Locations for the rapid assessments will be selected based on seasonality of malaria transmission, malaria incidence among children under five, potential size of the target population, inclusion of SMC in national malaria plans or strategies, buy-in from the national malaria programme, and operational considerations such as the security situation and the feasibility of importing SPAQ to those new locations. Likely locations for rapid assessments include Niassa province in Mozambique — which differs from Nampula in terms of the parasite resistance profile and the intensity of malaria transmission — the Democratic Republic of the Congo and Malawi.

The mix of research methods used in the rapid assessments will differ between different locations, for example, depending on what data are already available in a given location. In principle, each rapid assessment will include intervention and control areas. Each intervention area will involve distribution of one cycle of SMC using SPAQ to a sample of children under five during the high transmission season. There will be no SMC implementation in the control area. The specific number of children for the intervention and control areas will be determined for each location using age-specific incidence data. **Table 18** shows the mix of research components that may be included in a rapid assessment.

Table 18: Potential rapid assessment study components

Objective	Method	Outcomes	Approximate sample size
Effectiveness	cRCT (one cycle) with follow-up extended to 42 days	Primary outcome: incidence of clinical malaria in the target population	500 children per arm (intervention and control)
Chemoprevention efficacy	Cohort Study with follow-up extended to 42 days	Chemoprevention efficacy of SPAQ	500 children per arm (intervention and control)
Resistance to SPAQ	Cross-sectional descriptive before and after genetic resistance markers surveys	Parasite resistance markers prevalence and profile	300 RDT-positive children
Feasibility and acceptability	KIIs and process evaluation	Feasibility and acceptability	2 FGDs, 10 KIIs and record of programme adaptations

We expect that each rapid assessment will take about six months and result in a set of recommendations regarding the potential scale-up of SMC in the location where the assessment was conducted. Recommendations will be discussed with local stakeholders, especially the respective national malaria programmes, as well as the global SMC community.

7. External relations

Malaria Consortium's external relations strategy for SMC underlines two core objectives: i) to maintain Malaria Consortium's position as a global leader on SMC by contributing to relevant debates about SMC policy and practice; ii) to contribute to ensuring sustainable financing for SMC from three core channels: governments, institutional donors and philanthropists.

Over the course of 2022, we produced various communications and publications outputs, including blogs, news pieces and non-peer-reviewed publications to highlight Malaria Consortium's work on SMC and its impact. These outputs are referenced throughout this report and are also available on Malaria Consortium's website,[119] including pages specifically about our SMC portfolio.[120] Many of these resources were translated into French and Portuguese to increase their reach and impact. Two photography assignments were also arranged in which a photographer visited our SMC projects in Karamoja, Uganda, and Nampula, Mozambique. Two special newsletters marking World Malaria Day and the end-of-year festive period were sent to our SMC newsletter audience of around 1,600 subscribers. We introduced a new format for the newsletters, which are now introduced by different Malaria Consortium colleagues working on SMC with reflections on their role and their work. Malaria Consortium's SMC work was also featured in the organisational impact report,[121] underlining its contribution to Malaria Consortium's mission of saving lives and improving health through evidence-based programmes that combat targeted diseases and promote universal health coverage. We also regularly engage with the effective altruism community, including foundations in Europe, Australia and the US. For example, the SMC Programme Director presented Malaria Consortium's SMC portfolio at an event organised by effective altruism university groups based at the University of London. SMC was also discussed by Malaria Consortium Technical Director on the 80,000 Hours podcast as part of a wider conversation on malaria control and elimination.[122] Through these relationships and networks, we can communicate the impact of SMC to large communities of individuals worldwide. They, in turn, continue to advocate for, and invest in, SMC.

Our external relations team amplified SMC research findings, especially the early results that emerged from our implementation studies in Uganda and Mozambique. To advocate for SMC and influence SMC policy and practice, we held meetings with global stakeholders, including the WHO Global Malaria Programme, the Global Fund and Unitaid, in which those results were presented and discussed (**Spotlight 10**). We supported SMC colleagues who attended the annual ASTMH meeting in designing posters and preparing presentations. The conference was also an important platform for meetings with representatives from US-based SMC stakeholders such as the Bill & Melinda Gates Foundation, the US Agency for International Development, PMI and the Centers for Disease Control and Prevention. A blog post that discusses how we used our presence at ASTMH to advance the conversation on SMC was published on Malaria Consortium's website.[123]

Spotlight 10: Advocating for SMC though our external relations

Our external relations activities for SMC have focused on advancing the conversation on the future of SMC following the publication of the WHO's new Guidelines for Malaria. The debate around SMC — how and where it is deployed, which drugs are used and what its ongoing scale-up means for drug resistance — is not settled. Malaria Consortium's role as a leading implementer of the intervention across seven countries puts us in a unique position to share our learning and contribute to SMC policy and practice.

The ASTMH Annual Meeting 2022 was a key outlet for these activities. We used the meeting to advance the conversation with the wider SMC and tropical medicine community. Here are some of the highlights from the meeting:

- Through the SMC Alliance, we co-chaired a symposium on Implementing SMC in New Geographies' including the presentation of findings from implementation studies in Mozambique and Uganda from representatives of the national malaria programmes from both countries.
- The new WHO Guidelines for Malaria no longer specify strict criteria on seasonality, number and timing of cycles, age range or drug choice. The SMC symposium was a forum for discussion on these issues and underlined the importance of collaboration between health authorities, SMC implementers and researchers as the pathway for future implementation is agreed.
- Malaria Consortium's Senior Country Technical Coordinator in Nigeria presented observations from Nigeria where we have worked with partners to expand the reach of SMC from the Sahelian states in the north of the country to states further south, which also experience a rainy season. This work contrasts with the studies in Mozambique, South Sudan and Uganda, as it expands on how new geographies within Nigeria can benefit from SMC.
- The Annual Meeting's scientific programme also reflected other exciting malaria innovations on the horizon, including malaria vaccines, post-discharge malaria chemoprevention and next-generation monoclonal antibody treatments. Malaria Consortium will look to contribute its learning on SMC to upcoming policy and practice debates around these novel interventions, including how they may be implemented alongside SMC.

Our SMC research was also an important part of Malaria Consortium's wider external relations activities around the ASTMH conference, which focused on three core themes: innovation, equity and partnerships. Through the insights from our SMC implementation and research presented during the Annual Meeting, we showcased our experience across these themes, for example, in our studies assessing the feasibility of SMC in new geographies, research to integrate gender into evaluation processes and underlining the role of lead mothers in SMC implementation. At the meeting, Malaria Consortium also engaged in a workshop to define an advocacy agenda for the Global Gender and Malaria Community of Practice.

The malaria community also came together in 2022 at the Kigali Summit on Malaria and Neglected Tropical Diseases, held on the side of the Commonwealth Heads of Government Meeting (CHOGM). Malaria Consortium was represented at the meeting by the Regional Director for East and Southern Africa and the SMC External Relations Manager. The summit ended with new spending commitments worth USD 4 billion and served as a valuable platform for conversations with other malaria stakeholders.

Through these activities, we have looked to share our experiences as a leading SMC implementing organisation to inform SMC policy and practice worldwide, and ultimately help to improve the intervention for the benefit of the children who receive it. Malaria Consortium will continue to use our external relations to make a positive contribution to the global SMC community.

Malaria Consortium is an active member of the SMC Alliance, which holds monthly calls to discuss

emerging issues. In 2022, this has included discussions about harmonising the labelling and branding of SPAQ from different manufacturers, as well as preparations for the Global Fund replenishment conference. The annual meeting of the SMC Alliance was held as a virtual event and included presentations from the national malaria programmes of all SMC-implementing countries on their achievements in 2021 and plans for 2023. Malaria Consortium hosted a session on Taking SMC to New Geographies, where the directors of the malaria programmes in Mozambique and Uganda presented results from the SMC implementation studies in those countries. Other topics discussed included strategies to monitor parasite resistance and ensuring sustainable financing for SMC.

Within the SMC Alliance, we initiated the formation of a subgroup focusing on communications and advocacy. The subgroup currently has about 15 members representing nine organisations. Malaria Consortium serves as the subgroup's secretariat. The subgroup supported several outputs in 2022, including infographics and social media content and a placement of an article in Health Policy Watch to mark the Day of the African Child.[124] To mark the tenth anniversary of the rollout of SMC following the WHO's initial policy recommendation in 2012, the subgroup compiled a report that recounts how SMC progressed from concept to scale, and recognises the contributions from national malaria programmes, bilateral agencies, donors, implementing partners and researchers.[125]

In 2023, we will continue to engage with global SMC stakeholders and proactively support the SMC Alliance and its subgroups. We will also prioritise the dissemination of results from the implementation studies in Mozambique and Uganda, along with a learning output charting the story of the expansion of SMC in Mozambique.

8. Philanthropic SMC expenditure 2022

The total expenditure of philanthropic funding used for SMC in 2022 was approximately 62.26 million USD, around 17 percent less than the forecast submitted to GiveWell in June 2022 (**Table 19**).

Table 19: Philanthropic expenditure for SMC, 2022

Budget line	Forecast (USD)	Expenditure (USD)	Variance (USD)	Variance (percent)
Burkina Faso	8,795,149	7,655,837	-1,139,312	-13
Chad	5,331,304	4,660,553	-670,751	-13
Mozambique	6,807,913	4,374,633	-2,433,280	-36
Nigeria	46,040,079	39,181,345	-6,858,734	-15
South Sudan	1,153,479	847,919	-305,560	-26
Togo	1,407,601	1,248,922	-158,679	-11
Uganda	1,583,832	1,682,710	98,878	6
New country	100,000	0	-100,000	-100
Rapid assessments[a]	0	51,139	51,139	n/a
Above-country	886,791	839,929	-46,862	-5
Research	2,448,640	1,560,037	-888,603	-36
External relations	243,329	157,341	-85,988	-35
TOTAL	**74,798,117**	**62,260,365**	**-12,537,752**	**-17**

[a]Operational costs associated with the rapid assessments had been included in the research forecast. Those costs are shown on a separate budget line in the actual expenditure. Only the costs of rapid assessment research activities are included on the research line.

Compared with the forecast, substantial cost savings were made in several countries. For example, in Nigeria, training materials produced in previous years were reused, and specifications for printouts were adapted to reduce costs. Further savings were made by combining procurement for areas where Malaria Consortium uses philanthropic funding and those where Global Fund funding is used, resulting in lower unit costs overall. In addition, some of the budgeted stock management and community engagement costs were covered by state governments. In Chad, South Sudan and Togo, adaptations made over the course of the SMC round resulted in lower costs compared with the forecast, for example by reducing the number of SMC implementers, training events, vehicle hire and quantity of SMC commodities. We also spent less than budgeted on international freight for SMC medicines by largely avoiding air freight. Another reason for the underspend compared with the forecast was that some costs that had been included in the forecast have shifted to 2023, especially in Mozambique, where the start of the 2022/23 round had to be postponed to January 2023, and in Burkina Faso, where many payments for 2022 SMC delivery were only made in January 2023 because of the delayed submission of supporting documents. The forecast also included costs of potentially expanding Malaria Consortium's support on SMC to a new country, which did not happen in 2022. Research costs were overestimated primarily because payments for the analysis of

chemoprevention efficacy samples had been forecast for 2022. However, as sample analysis is ongoing, those costs will now only be incurred in 2023. Research costs were also lower than budgeted because a study exploring access to SMC among nomadic populations in Chad had to be cancelled due to security concerns. Finally, there is an underspend on the external relations budget line because the forecast included the cost of an SMC policy project; this was discussed at the time with other global SMC stakeholders but, in the end, did not materialise. The only country where costs were underestimated in the forecast was Uganda. At the request of the local health authorities, SMC was extended to all children in the district where the chemoprevention efficacy study was conducted, rather than only delivering SMC to children enrolled in the study as originally planned.

In addition to philanthropic funding for SMC, Malaria Consortium received co-funding for SMC from the Bill & Melinda Gates Foundation, the Global Fund, KOICA and the Task Force for Global Health to implement the activities described in this report (**Table 20**). Co-funding provided by the Global Fund or UNICEF in Burkina Faso and Togo is not reported here, as those contributions are provided directly to the respective national malaria programmes.

Table 20: Malaria Consortium's SMC expenditure using third-party co-funding, 2022

Funding source	Expenditure (USD)	Notes
Bill & Melinda Gates Foundation	771,627	Grant for an end-of-round household survey, chemoprevention efficacy cohort study and resistance markers study as part of phase 2 of the SMC implementation study in Mozambique (INV-033337). This grant ends in 2023.
Bill & Melinda Gates Foundation	496,009	Grant for an end-of-round household survey, chemoprevention efficacy cohort study, resistance markers study and qualitative research as part of phase 2 of the SMC implementation study in Uganda (INV- 039889). This grant ends in 2023.
Global Fund	547,434	Funding received from Global Fund to implement SMC in three districts of Karamoja subregion. This does not include the cost of SPAQ, which was procured directly by the Global Fund.
KOICA	618,256	SMC IMPACT project. This funding covered SPAQ for four out of five cycles implemented in two LGAs in Bauchi, targeting 280,000 children, as well the majority of SMC implementation costs in those LGAs. The SMC IMPACT project will end in 2024.
Task Force for Global Health	44,653	Grant for implementation of an operational research study exploring the co-implementation of SMC and VAS in Nigeria. This grant ended in 2022. Some philanthropic funding was used to support the publication of results in a peer-reviewed journal and at academic conferences.

Malaria Consortium also received funding from the Global Fund to implement SMC in four states in Nigeria in 2022 and from UNICEF to coordinate malnutrition screening during SMC delivery in all 70 health districts of Burkina Faso. As no philanthropic funding was used to co-finance those activities, the costs are not included in this report.

9. Concluding remarks

2022 was a record year for SMC at Malaria Consortium. In total, 24 million children have been reached across seven countries with Malaria Consortium support, representing around half of all children reached with the intervention globally. Around 16 million of this total were reached thanks to philanthropic support. Implementing SMC differs from country to country, but thanks to the leadership of national malaria control programmes and strong collaboration with other national, regional and local partners, Malaria Consortium continues to successfully support SMC deployment in a range of geographies and against the backdrop of various operational challenges.

Malaria Consortium has also used this extensive reach to continue research activities designed to improve the quality of SMC delivery, assess its impact on malaria cases and produce evidence that will shape the future of SMC, including its potential use in new geographies. Malaria Consortium's position as a large-scale implementer and research organisation has underlined its unique position to contribute to global debates on SMC policy and practice and advocacy efforts to ensure the intervention's sustainability.

As we move through 2023, Malaria Consortium aims to maintain the scale of its SMC activities despite challenging economic circumstances and a difficult security landscape. Ten years on from the WHO's initial recommendation to scale up SMC in the Sahel, the intervention continues to prove itself to be an important part of the malaria prevention toolkit. Thanks to philanthropic support, Malaria Consortium can continue its efforts to reach as many eligible children as possible with life-saving SMC medicines.

References

1. GiveWell. Our top charities; last updated: 2022 Dec [cited 2023 Feb 17]. Available from: https://www.givewell.org/charities/top-charities.
2. Kaplan, Miranda. Our recommendations for giving in 2022; 2022 Nov 23 [cited 2023 Feb 17]. Available from: https://blog.givewell.org/2022/11/23/giving-recommendations-2022.
3. 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: WHO; 2012.
4. Meremikwu MM, Donegan S, Sinclair D, Esu E, Oringanje C. Intermittent preventive treatment for malaria in children living in areas with seasonal transmission. Cochrane Database of Systematic Reviews, 2012; (2): CD003756.
5. Cairns M, Carneiro I, Milligan P, Owusu-Agyei S, Awine T, Gosling R, et al. Duration of protection against malaria and anaemia provided by intermittent preventive treatment in infants in Navrongo, Ghana. PLoS One, 2008; 3(5): e2227.
6. Amimo F, Lambert B, Magit A, Sacarlal J, Hashizume M, Shibuya K. *Plasmodium falciparum* resistance to sulfadoxine-pyrimethamine in Africa: A systematic analysis of national trends. BMJ Global Health, 2020; 5(11): e003217.
7. World Health Organization. Seasonal malaria chemoprevention with sulfadoxine-pyrimethamine plus amodiaquine in children: A field guide. Geneva: WHO; 2013.
8. World Health Organization. Global technical strategy for malaria 2016–2030: 2021 update. Geneva: WHO; 2021.
9. ACCESS-SMC Partnership. Effectiveness of seasonal malaria chemoprevention at scale in west and central Africa: An observational study. The Lancet, 2020; 396(10265): 1829–40.
10. Cairns M, Ceesay SJ, Sagara I, Zongo I, Kessely H, Gamougam K, et al. Effectiveness of seasonal malaria chemoprevention (SMC) treatments when SMC is implemented at scale: Case-control studies in 5 countries. PLoS Medicine, 2021; 18(9): e1003727.
11. Issiaka D, Barry A, Traore T, Diarra B, Cook D, Keita M, et al. Impact of seasonal malaria chemoprevention on hospital admissions and mortality in children under 5 years of age in Ouelessebougou, Mali. Malaria Journal, 2020; 19(1): 103.
12. Gilmartin C, Nonvignon J, Cairns M, Milligan P, Bocoum F, Winskill P, et al. Seasonal malaria chemoprevention in the Sahel subregion of Africa: A cost-effectiveness and cost-savings analysis. Lancet Global Health, 2021; 9(2): e199-e208.
13. World Health Organization. World malaria report 2022. Geneva: WHO; 2022.
14. World Health Organization. World malaria report 2021. Geneva: WHO; 2021.
15. World Health Organization. WHO guidelines for malaria. Geneva: WHO; 2022.
16. World Health Organization. Updated WHO recommendations for malaria chemoprevention among children and pregnant women. 2022 Jun 03 [cited 2023 Feb 17]. Available from: https://www.who.int/news/item/03-06-2022-Updated-WHO-recommendations-for-malaria-chemoprevention-among-children-and-pregnant-women.
17. Malaria Consortium. WHO issue new guidelines on seasonal malaria chemoprevention implementation — our response. 2022 June 08 [cited 2023 Feb 17]. Available from: https://www.malariaconsortium.org/news-centre/who-issue-new-guidelines-on-seasonal-malaria-chemoprevention-implementation-andndash-our-response.htm.
18. Traore A, Donovan L, Sawadogo B, Ward C, Smith H, Rassi C, et al. Extending seasonal malaria chemoprevention to five cycles: A pilot study of feasibility and acceptability in Mangodara district, Burkina Faso. BMC Public Health, 2022; 22(1): 442.

19. Cissé B, Ba EH, Sokhna C, NDiaye JL, Gomis JF, Dial Y, et al. Effectiveness of seasonal malaria chemoprevention in children under ten years of age in Senegal: A stepped-wedge cluster-randomised trial. PLoS Medicie. 2016; 13(11): e1002175.
20. Moukénet A, Donovan L, Honoré B, Baker K, Smith H, Richardson S, et al. Extending delivery of seasonal malaria chemoprevention to children aged 5–10 years in Chad: A mixed-methods study. Global Health: Science and Practice, 2022; 10(1): e2100161.
21. Nuwa A, Baker K, Bonnington C, Odongo M, Kyagulanyi T, Bwanika JB, et al. A non-randomized controlled trial to assess the protective effect of SMC in the context of high parasite resistance in Uganda. Malaria Journal; 2023: 63.
22. Malaria Consortium. The future of SMC: Taking seasonal malaria chemoprevention to new geographies [video]; 2021 Dec 6 [cited 2023 Mar 05]. Available from: https://www.youtube.com/watch?v=44M4uJhwxuM&t=14s.
23. Malaria Consortium. Webinar: Taking seasonal malaria chemoprevention to new geographies. Infographic. London: Malaria Consortium; 2021. Available from: https://www.malariaconsortium.org/resources/publications/1521/webinar-taking-seasonal-malaria-chemoprevention-to-new-geographies.
24. World Health Organization. Malaria chemoprevention efficacy study protocol. Geneva: WHO; 2022.
25. Oresanya O, Phillips A, Okereke E, Ahmadu A, Ibinaiye T, Marasciulo M, et al. Co-implementing vitamin A supplementation with seasonal malaria chemoprevention in Sokoto State, Nigeria: A feasibility and acceptability study. BMC Health Services Research, 2022; 22(1): 871.
26. World Health Organization. WHO recommends groundbreaking malaria vaccine for children at risk; 2021 Oct 06 [cited 2023 Mar 04]. Available from: https://www.who.int/news/item/06-10-2021-who-recommends-groundbreaking-malaria-vaccine-for-children-at-risk.
27. World Health Organization. Malaria vaccine: WHO position paper – March 2022. Weekly Epidemiological Record, 2022; 97(09): 60–78.
28. Malaria Consortium. Vaccines: The cornerstone of disease burden reduction. Position statement. London: Malaria Consortium; 2022. Available from: https://www.malariaconsortium.org/resources/publications/1333/vaccines-the-cornerstone-of-disease-burden-reduction.
29. Chandramohan D, Zongo I, Sagara I, Cairns M, Yerbanga RS, Diarra M, et al. Seasonal malaria vaccination with or without seasonal malaria chemoprevention. New England Journal of Medicine, 2021; 385(11): 1005–1017.
30. Malaria Consortium. Monitoring and evaluating seasonal malaria chemoprevention using a logical framework approach. Technical brief. London: Malaria Consortium; 2022. Available from: https://www.malariaconsortium.org/resources/publications/1538/monitoring-and-evaluating-seasonal-malaria-chemoprevention-using-a-logical-framework-approach.
31. Malaria Consortium. Coverage and quality of seasonal malaria chemoprevention supported by Malaria Consortium in 2022: Results from Burkina Faso, Chad, Mozambique, Nigeria, South Sudan, Togo and Uganda. London: Malaria Consortium; 2023. Available from: https://www.malariaconsortium.org/resources/publications/1679/Coverage-and-quality-of-seasonal-malaria-chemoprevention-supported-by-Malaria-Consortium-in-2022.
32. SMC Alliance. Seasonal malaria chemoprevention monitoring & evaluation toolkit; 2021 Nov 09 [cited 2023 Mar 05]. Available from: https://www.smc-alliance.org/resources/seasonal-malaria-chemoprevention-monitoring-evaluation-toolkit.
33. World Health Organization. Quality of care; no date [cited 2023 Mar 04]. Available from: https://www.who.int/health-topics/quality-of-care#tab=tab_1.

34. Richardson S, Ibinaiye T, Nikau J, Oresanya O, Marasciulo M, Roca-Feltrer A, et al. COVID-19 knowledge, beliefs, prevention behaviours and misinformation in the context of an adapted seasonal malaria chemoprevention campaign in six northern Nigerian states. Tropical Medicine and Health, 2020; 48(1): 101.
35. Malaria Consortium. Implementing mass campaigns during a pandemic: What we learnt from supporting seasonal malaria chemoprevention during COVID-19. Learning paper. London: Malaria Consortium; 2021. Available from: https://www.malariaconsortium.org/resources/publications/1432/implementing-mass-campaigns-during-a-pandemic-what-we-learnt-from-supporting-seasonal-malaria-chemoprevention-during-covid-19.
36. Ward C, Phillips A, Oresanya O, Olisenekwu G, Arogunade E, Moukénet A, et al. Delivery of seasonal malaria chemoprevention with enhanced infection prevention and control measures during the COVID-19 pandemic in Nigeria, Burkina Faso and Chad: A cross-sectional study. Malaria Journal, 2022; 21(1): 103.
37. Malaria Consortium. Malaria Consortium's seasonal malaria chemoprevention program: Philanthropy report 2021. London: Malaria Consortium; 2022.
38. Malaria Consortium. Malaria Consortium's seasonal malaria chemoprevention program: Philanthropy report 2020. London: Malaria Consortium; 2021.
39. World Bank. World Bank open data: Population, total — Burkina Faso; no date [cited 2023 Mar 04]. Available from: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=BF.
40. Severe Malaria Observatory. Burkina Faso: Malaria facts; no date [cited 2023 Mar 05]. Available from: https://www.severemalaria.org/countries/burkina-faso.
41. Human Rights Watch. World report 2023: Events of 2022. New York: Human Rights Watch; 2023.
42. World Bank. World Bank open data: Population, total — Chad; no date [cited 2023 Mar 04]. Available from: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=TD.
43. Malaria Consortium. Where we work: Chad; no date [cited 2023 Mar 05]. Available from: https://www.malariaconsortium.org/where-we-work/chad.htm.
44. GiveWell. An update on GiveWell's funding projections; 2022 Jul 05 [cited 2023 mar 05]. Available from: https://blog.givewell.org/2022/07/05/update-on-givewells-funding-projections/.
45. GiveWell. Malaria Consortium — SMC Renewal in Nigeria, Burkina Faso, Chad, and Togo (January 2023); 2023 Apr [cited 2023 Apr 04]. Available from: https://www.givewell.org/research/grants/Malaria-Consortium-SMC-renewal-Nigeria-Burkina-Chad-Togo-January-2023.
46. World Bank. World Bank open data: Population, total — Mozambique; no date [cited 2023 Mar 04]. Available from: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=MZ.
47. Malaria Consortium. Where we work: Mozambique; no date [cited 2023 Mar 05]. Available from: https://www.malariaconsortium.org/where-we-work/mozambique.htm.
48. Programa Nacional de Controlo da Malária [Republic of Mozambique]. Plano estratégico da malária 2017–2022. Maputo: PNCM; 2017.
49. Gupta H, Macete E, Bulo H, Salvador C, Warsame M, Carvalho E, et al. Drug-resistant polymorphisms and copy numbers in *Plasmodium falciparum*, Mozambique, 2015. Emerging Infectious Diseases, 2018; 24(1): 40–48.
50. Malaria Consortium. Insights from implementing the first seasonal malaria chemoprevention campaign in Mozambique. Insight brief. London: Malaria Consortium; 2022. Available from: https://www.malariaconsortium.org/resources/publications/1565/insights-from-implementing-the-first-seasonal-malaria-chemoprevention-campaign-in-mozambique.

51. GiveWell. Malaria Consortium — Seasonal Malaria Chemoprevention, Nampula, Mozambique. 2022 February [cited 2023 March 02]. Available from: https://www.givewell.org/research/grants/Malaria-Consortium-SMC-Mozambique-February-2022.
52. ReliefWeb. Tropical Cyclone Gombe — Mar 2022; no date [cited 2023 Mar 05]. Available from: https://reliefweb.int/disaster/tc-2022-000184-moz.
53. World Bank. World Bank open data: Population, total — Nigeria; no date [cited 2023 Mar 04]. Available from: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=NG.
54. Severe Malaria Observatory. Nigeria: Malaria facts; no date [cited 2023 mar 05]. Available from: https://www.severemalaria.org/countries/nigeria.
55. United Nations High Commissioner for Refugees, Nigeria. Internally displaced people; no date [cited 2023 March 05]. Available from: https://www.unhcr.org/ng/idps.
56. GiveWell. Malaria Consortium — Support for SMC in FCT and Oyo States, Nigeria (Oct 2021); 2021 Dec [cited 2023 Mar 05]. Available from: https://www.givewell.org/research/incubation-grants/Malaria-Consortium-SMC-FCT-Oyo-states-October-2021.
57. Malaria Consortium. Malaria Consortium responds to urgent call to deliver SMC to two million children in Borno state; 2021 July 30 [cited 2023 Mar 05]. Available from: https://www.malariaconsortium.org/news-centre/malaria-consortium-responds-to-urgent-call-to-deliver-smc-to-two-million-children-in-borno-state.htm.
58. Malaria Consortium. SMC extended to more countries thanks to SMC-IMPACT project; 2021 Feb 19 [cited 2023 Mar 05]. Available from: https://www.malariaconsortium.org/news-centre/smc-extended-to-more-countries-thanks-to-smc-impact-project.htm.
59. Malaria Consortium. Implementing seasonal malaria chemoprevention in conflict-affected areas in Borno state. Learning brief. London: Malaria Consortium; 2023. Available from: https://www.malariaconsortium.org/resources/publications/1677/implementing-seasonal-malaria-chemoprevention-in-conflict-affected-areas-in-borno-state.
60. ReliefWeb. Nigeria: Floods — Jun 2022; no date [cited 2023 Mar 05]. Available from: https://reliefweb.int/disaster/fl-2022-000271-nga.
61. Malaria Consortium. Implementing seasonal malaria chemoprevention in conflict-affected areas in Borno state: Lessons learnt from Nigeria. London: Malaria Consortium; 2022. Available from: https://www.malariaconsortium.org/resources/publications/1677/implementing-seasonal-malaria-chemoprevention-in-conflict-affected-areas-in-borno-state.
62. World Bank. World Bank open data: Population, total — South Sudan; no date [cited 2023 Mar 04]. Available from: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=SS.
63. Severe Malaria Observatory. South Sudan: Malaria facts; no date [cited 2023 mar 05]. Available from: https://www.severemalaria.org/countries/south-sudan-0.
64. Pasquale HA. Malaria prevention strategies in South Sudan. South Sudan Medical Journal, 2020; 13(5): 187– 90.
65. United Nations Office for the Coordination of Humanitarian Affairs. 2022 humanitarian response in review: South Sudan. New York: OCHA; 2023.
66. ReliefWeb. South Sudan: Overview of the IDPs population per county (April 2022); 2022 May 13 [cited 2023 Mar 05]. Available from: https://reliefweb.int/report/south-sudan/south-sudan-overview-idps-population-county-april-2022#:~:text=The%20conflict%20and%20violence%20which,people%20as%20of%20March%202022.
67. National Malaria Control Programme [Republic of South Sudan]. Malaria Strategic Plan 2021–2025. Juba: Ministry of Health; 2020.

68. Malaria Consortium. Malaria Consortium announces expansion of seasonal malaria chemoprevention to South Sudan; 2022 Apr 25 [cited 2023 Mar 05]. Available from: https://www.malariaconsortium.org/news-centre/malaria-consortium-announces-expansion-of-seasonal-malaria-chemoprevention-to-south-sudan.htm.
69. World Bank. World Bank open data: Population, total — Togo; no date [cited 2023 Mar 04]. Available from: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=TG.
70. Malaria Consortium. Where we work: Togo; no date [cited 2023 Mar 05]. Available from: https://www.malariaconsortium.org/pages/togo.htm.
71. ReliefWeb. Togo — State of emergency (DG ECHO, Government, Le Monde, The Guardian) (ECHO Daily Flash of 15 June 2022); 2022 Jun 15 [cited 2023 Mar 05]. Available from: https://reliefweb.int/report/togo/togo-state-emergency-dg-echo-government-le-monde-guardian-echo-daily-flash-15-june-2022.
72. World Bank. World Bank open data: Population, total — Uganda; no date [cited 2023 Mar 04]. Available from: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=UG.
73. Severe Malaria Observatory. Uganda: Malaria facts; no date [cited 2023 mar 05]. Available from: https://www.severemalaria.org/countries/uganda.
74. UK Government. Foreign travel advice Uganda: Safety and security; no date [cited 2023 Mar 05]. Available from: https://www.gov.uk/foreign-travel-advice/uganda/safety-and-security.
75. Ministry of Health [Republic of Uganda]. The Uganda malaria reduction and elimination strategic plan 2021–2025. Kampala: Ministry of Health; 2020.
76. Owen BN, Winkel M, Bonnington C, Nuwa A, Achan J, Opigo J, et al. Dynamical malaria modeling as a tool for bold policy-making. Nature Medicine, 2022.
77. Mbonye AK, Birungi J, Yanow SK, Shokoples S, Malamba S, Alifrangis M, et al. Prevalence of *Plasmodium falciparum* resistance markers to sulfadoxine-pyrimethamine among pregnant women receiving intermittent preventive treatment for Malaria in Uganda. Antimicrobial Agents and Chemotherapy, 2015; 59(9): 5475–82.
78. Malaria Consortium. Scientific modelling for malaria policymaking; 2022 Apr 20 [cited 2023 Mar 05]. Available from: https://www.malariaconsortium.org/news-centre/scientific-modelling-for-malaria-policymaking.htm.
79. World Health Organization. Ebola outbreak 2022 — Uganda: Overview; no date [cited 2023 Mar 05]. Available from: https://www.who.int/emergencies/situations/ebola-uganda-2022.
80. Malaria Consortium. Uganda celebrates launch of SMC as part of roadmap to achieve zero malaria status by 2030; 2022 Oct 26 {cited 2023 Mar 05]. Available from: https://www.malariaconsortium.org/news-centre/uganda-celebrates-launch-of-smc-as-part-of-roadmap-to-achieve-zero-malaria-status-by-2030.htm.
81. Malaria Consortium. Malaria Consortium awarded prestigious independent research organisation status; 2021 Feb 12 [cited 2023 Mar 05]. Available from: https://www.malariaconsortium.org/news-centre/malaria-consortium-awarded-prestigious-independent-research-organisation-status.htm.
82. Baker K, Aide P, Bonnington CA, Rassi C, Richardson S, Roca-Feltrer A at al. Feasibility, acceptability, and protective efficacy of seasonal malaria chemoprevention implementation in Nampula province, Mozambique: Protocol for a hybrid effectiveness-implementation study. JMIR Research Protocols, 2022; 11(9): e36403.
83. de Cola MA, Sawadogo B, Richardson S, Ibinaiye T, Traoré A, Compaoré CS et al. Impact of seasonal malaria chemoprevention on prevalence of malaria infection in malaria indicator surveys in Burkina Faso and Nigeria. BMJ Global Health, 2022; 7(5): e008021.

84. Nuwa A. A cross-sectional survey to assess the feasibility and acceptability of seasonal malaria chemoprevention among nomadic pastoralist population: The case of Karamoja, region in Uganda [presentation]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1628/a-cross-sectional-survey-to-assess-the-feasibility-and-acceptability-of-seasonal-malaria-chemoprevention-among-nomadic-pastoralist-population-the-case-of-karamoja-region-in-uganda.
85. Nuwa A. A non-randomised controlled trial to assess the protective effect of seasonal malaria chemoprevention in the context of high parasite resistance in Uganda [presentation]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1627/a-non-randomised-controlled-trial-to-assess-the-protective-effect-of-seasonal-malaria-chemoprevention-in-the-context-of-high-parasite-resistance-in-uganda.
86. Nabakooza J. Results from an implementation study to assess the impact, feasibility and acceptability of implementing seasonal malaria chemoprevention in Karamoja region [presentation]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/gallery-file/12010535-21/drjanenabakoozasmcalliancesymposiumastmh2022slides.pdf.
87. Candrinho B. Seasonal malaria chemoprevention: Mozambique implementation study 2020-22 [presentation]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/gallery-file/12010557-90/astmh2022drbcandrinho2.pdf.
88. Oresanya O, Aidenagbon A. Seasonal malaria chemoprevention (SMC): New geographies in Nigeria and quality of SMC delivery [presentation]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1649/seasonal-malaria-chemoprevention-smc--new-geographies-in-nigeria-and-quality-of-smc-delivery.
89. Sitoe M, Zunza A, Tarquino I, Rodrigues M, Enosse S, Richardson S, et al. Acceptability of seasonal malaria chemoprevention among children under five in Mozambique: A qualitative study [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1632/acceptability-of-seasonal-malaria-chemoprevention-among-children-under-five-in-mozambique-a-qualitative-study.
90. Odongo M, Nuwa A, Marasciulo M, Salandini Odong D, Achuma T, Dilla A. Assessing the quality of SMC delivery by village health teams in Uganda [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1617/assessing-the-quality-of-smc-delivery-by-village-health-teams-in-uganda.
91. Salandini Odong D, Nuwa A, Odongo M, Tibenderana J, Baker K, Rassi C, et al. Evaluating the adaptation of seasonal malaria chemoprevention implementation during COVID-19 in Karamoja, Uganda [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1623/evaluating-the-adaptation-of-seasonal-malaria-chemoprevention-implementation-during-covid-19-in-karamoja-uganda.
92. Tounaikok N, Donovan L, Diar MSI, Baker K, Viganò E, Honore B, et al. Exploring the role model approach to strengthen the administration of SMC medicines in Chad [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available

from: https://www.malariaconsortium.org/resources/publications/1631/exploring-the-role-model-approach-to-strengthen-the-administration-of-smc-medicines-in-chad.
93. Fadipe JJ, Olusola O, Okechukwu E, Ibinaiye T, Ogunmola O, Achan J, et al. Facilitators of, and barriers to, fully integrating seasonal malaria chemoprevention with vitamin A supplementation: A qualitative enquiry [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1629/facilitators-of-and-barriers-to-fully-integrating-seasonal-malaria-chemoprevention-with-vitamin-a-supplementation-a-qualitative-enquiry.
94. Tounaikok N, Moukénet A, Diar MSI, Donovan L, Awah D, Dingamtel N, et al. Feasibility and acceptability of extending delivery of seasonal malaria chemoprevention to children aged 5–10 years in Chad [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1636/feasibility-and-acceptability-of-extending-delivery-of-smc-to-children-aged-5--10-years-in-chad.
95. Oresanya O, Phillips A, Ihechukwu E, Ogunmola O, Ibinaiye T, Muhammad K, et al. Harnessing the seasonal malaria chemoprevention campaign in Nigeria: Safety, equity and cost of fully integrating vitamin A supplementation [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1621/harnessing-the-seasonal-malaria-chemoprevention-campaign-in-nigeria-safety-equity-and-cost-of-fully-integrating-vitamin-a-supplementation.
96. Ibinaiye T, Ogunmola O, Salifu E, Okwulu A, Maduka K, Oguoma C. Impact assessment of seasonal malaria chemoprevention using routine health surveillance data in Kogi state, Nigeria [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1637/impact-assessment-of-seasonal-malaria-chemoprevention-using-routine-health-surveillance-data-in-kogi-state-nigeria.
97. Viganò E, Nakirunda M, Richardson S, Nuwa A, Bonnington C, Baker K. Integrating gender into the process evaluation of seasonal malaria chemoprevention in Karamoja, Uganda: Results and future directions [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1638/integrating-gender-into-the-process-evaluation-of-seasonal-malaria-chemoprevention-in-karamoja-uganda-results-and-future-directions.
98. de Cola MA, Sawadogo B, Compaore C, Tougri G, Richardson S, Roca-Feltrer A, et al. Measuring the impact of SMC on malaria prevalence and case distribution compared to predicted estimates from a transmission model in Burkina Faso [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1635/measuring-the-impact-of-smc-on-malaria-prevalence-and-case-distribution-compared-to-predicted-estimates-from-a-transmission-model-in-burkina-faso.
99. Okereke E, Smith H, Oguoma C, Oresanya O, Kolawole M, Rajab A, et al. Optimising the role of lead mothers in seasonal malaria chemoprevention campaigns: Insights from formative research in Kano state, northern Nigeria [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1633/optimising-the-role-of-lead-

mothers-in-seasonal-malaria-chemoprevention-campaigns-insights-from-formative-research-in-kano-state-northern-nigeria.
100. Compaore C, Traore A, Sawadogo B, Tapsoba C, Donovan L, Baker K, et al. Using the role model approach to identify best practices and challenges during seasonal malaria chemoprevention drug administration in Burkina Faso [poster]. 71st American Society of Tropical Medicine and Hygiene Annual Meeting. 30 October – 03 Nov 2022. Available from: https://www.malariaconsortium.org/resources/publications/1630/using-the-role-model-approach-to-identify-best-practices-and-challenges-during-seasonal-malaria-chemoprevention-drug-administration-in-burkina-faso.
101. Malaria Consortium. Co-implementing vitamin A supplementation with seasonal malaria chemoprevention: A pilot implementation study in Sokoto state, Nigeria. Research brief. London: Malaria Consortium; 2020. Available from: https://www.malariaconsortium.org/resources/publications/1365/co-implementing-vitamin-a-supplementation-with-seasonal-malaria-chemoprevention-a-pilot-implementation-study-in-sokoto-state-nigeria.
102. Malaria Consortium. Improving vitamin A coverage through co-implementation with seasonal malaria chemoprevention: Applying an effective, integrated health campaign in Nigeria. Project brief. London: Malaria Consortium; 2021. Available from: https://www.malariaconsortium.org/resources/publications/1529/improving-vitamin-a-coverage-through-co-implementation-with-seasonal-malaria-chemoprevention-applying-an-effective-integrated-health-campaign-in-nigeria.
103. Malaria Consortium. Integrating seasonal malaria chemoprevention and vitamin A supplementation: Lessons learnt from Nigeria. Learning brief. London: Malaria Consortium; 2022. Available from: https://www.malariaconsortium.org/resources/publications/1579/integrating-seasonal-malaria-chemoprevention-and-vitamin-a-supplementation-lessons-learnt-from-nigeria.
104. Malaria Consortium. Maximising resources for healthcare: Integrating vitamin A supplementation with seasonal malaria chemoprevention. Advocacy brief. Malaria Consortium; 2022. Available from: https://www.malariaconsortium.org/resources/publications/1580/maximising-resources-for-healthcare-integrating-vitamin-a-supplementation-with-seasonal-malaria-chemoprevention.
105. Pfurtscheller T, Ainsworth J. Defining the future of SMC in Togo: exploring new delivery strategies; 2022 Dec 19 [cited 2023 Mar 05]. Available from: https://www.malariaconsortium.org/blog/defining-the-future-of-smc-in-togo-exploring-new-delivery-strategies.
106. Shafique M, Edwards HM, de Beyl CZ, Thavrin BK, Min M, Roca-Feltrer A. Positive deviance as a novel tool in malaria control and elimination: Methodology, qualitative assessment and future potential. Malaria Journal, 2016; 15: 91.
107. Malaria Consortium. Using the role model approach to improve administration of seasonal malaria chemoprevention drugs in Burkina Faso, Chad and Togo. Synopsis. London: Malaria Consortium; 2021. Available from: https://www.malariaconsortium.org/resources/publications/1484/using-the-role-model-approach-to-improve-administration-of-seasonal-malaria-chemoprevention-drugs-in-burkina-faso-chad-and-togo.
108. Malaria Consortium. Optimising the role of lead mothers during the seasonal malaria chemoprevention campaign in Kano state, Nigeria: A mixed-methods study. Synopsis. London: Malaria Consortium; 2021. Available from: https://www.malariaconsortium.org/resources/publications/1525/optimising-the-role-of-lead-

mothers-during-the-seasonal-malaria-chemoprevention-campaign-in-kano-state-nigeria-a-mixed-methods-study.
109. Okereke E, Smith H, Oguoma C, Oresanya O, Maxwell K, Anikwe C, et al. Optimizing the role of 'lead mothers' in seasonal malaria chemoprevention (SMC) campaigns: Formative research in Kano State, northern Nigeria. Malaria Journal, 2023; 22(1): 13.
110. Griffin JT, Ferguson NM, Ghani AC. Estimates of the changing age-burden of *Plasmodium falciparum* malaria disease in sub-Saharan Africa. Nature Communications, 2014; 5(3136).
111. Thompson H. Modelling the public health impact of second-generation malaria vaccines; 2022. PhD thesis, Imperial College London, UK.
112. Wharton-Smith A, Baker K, Roca-Feltrer A, Rodrigues M, Richardson S, Bonnington CA, et al. Assessment of the feasibility, acceptability, and impact of implementing seasonal malaria chemoprevention in Nampula province, Mozambique: Protocol for a hybrid effectiveness-implementation study. JMIR Research Protocols, 2021; 10(9): e27855.
113. Roberts L. Lingering fever: The battle against malaria in Africa has stalled. Can research in Mozambique explain why — and how to get it back on track? Science; 09 September 2022: 1139–1143.
114. Malaria Consortium. Exploring the implementation of seasonal malaria chemoprevention in Mozambique: Results from an end-of-round coverage survey in Nampula province, 2020–2021. Research brief. London: Malaria Consortium; 2021. Available from: https://www.malariaconsortium.org/resources/publications/1483/exploring-the-implementation-of-seasonal-malaria-chemoprevention-in-mozambique.
115. Candrinho B. Seasonal malaria chemoprevention: Results from Mozambique implementation study 2020–2021 [presentation]. 70th American Society of Tropical Medicine and Hygiene Annual Meeting. 17–21 Nov 2021. Available from: https://www.malariaconsortium.org/resources/publications/1514/seasonal-malaria-chemoprevention-results-from-mozambique-implementation-study-2020--2021.
116. Kajubi R, Ainsworth J, Baker K, Richardson S, Bonnington C, Rassi C, et al. A hybrid effectiveness-implementation study protocol to assess the effectiveness and chemoprevention efficacy of implementing seasonal malaria chemoprevention in five districts in Karamoja region, Uganda [version 1; peer review: awaiting peer review]. Gates Open Research, 2023; 7: 14.
117. Nuwa A, Bonnington C, Baker K, Odongo M, Kyagulanyi T, Nabakooza J. Evaluation of the impact of one round of seasonal malaria chemoprevention on resistance markers associated with sulfadoxine-pyrimethamine and amodiaquine in Karamoja, Uganda, March 2022 [poster]. 2nd Conference on Public Health in Africa. 13–15 December 2022. Available from: https://www.malariaconsortium.org/resources/publications/1658/evaluation-of-the-impact-of-one-round-of-seasonal-malaria-chemoprevention-on-resistance-markers-associated-with-sulfadoxine-pyrimethamine-and-amodiaquine-in-karamoja-uganda-march-2022.
118. Malaria Consortium. Exploring the use of seasonal malaria chemoprevention in South Sudan. Synopsis. London: Malaria Consortium; 2022. Available from: https://www.malariaconsortium.org/resources/publications/1604/exploring-the-use-of-seasonal-malaria-chemoprevention-in-south-sudan.
119. Malaria Consortium. SMC Publications; no date [cited 2023 Mar 9]. Available from: https://www.malariaconsortium.org/resources/publications/search/SMC
120. Malaria Consortium. Seasonal malaria chemoprevention; no date [cited 2023 Mar 9]. Available from: https://www.malariaconsortium.org/pages/preventive_treatments/seasonal-malariachemoprevention.htm.

121. Malaria Consortium. Unlocking universal health coverage — Impact report 2022. London: Malaria Consortium; 2022. Available from: https://www.malariaconsortium.org/pages/unlocking-universal-health-coverage.htm
122. Wiblin R, Harris K. Dr James Tibenderana on the state of the art in malaria control and elimination. 80,000 Hours podcast. 2022 May 09. Available from: https://80000hours.org/podcast/episodes/james-tibenderana-malaria-control-and-elimination/?msclkid=02ed36d1d03411eca8cbdd5671e07b57.
123. Giles A. Advancing the conversation on SMC at ASTMH 2022; 2022 Nov 25 [cited 2023 Mar 05]. Available from: https://www.malariaconsortium.org/blog/advancing-the-conversation-on-smc-at-astmh-2022.
124. Tchouatieu AM, Poku-Awuku A. Protecting Children: 10 Years of seasonal malaria chemoprevention. Geneva: Health Policy Watch; 2022. Available from: https://healthpolicy-watch.news/97669-2/.
125. SMC Alliance. From concept to scale: Celebrating 10 years of seasonal malaria chemoprevention. London: Malaria Consortium; 2023. Available from: https://www.smc-alliance.org/resources/from-concept-to-scale-celebrating-10-years-of-seasonal-malaria-chemoprevention.

UK Registered Charity No: 1099776
Contact: info@malariaconsortium.org

malaria consortium
disease control, better health