

A N ASSESSMENT OF SEASONAL MALARIA CHEMOPREVENTION (SMC) AMONG CHILDREN OF UNDER 5 YEARS IN SOKOTO METROPOLIS, NIGERIA.

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ABSTRACT

The study was assessment of seasonal malaria chemoprevention (SMC) among children of under 5 years in Sokoto metropolis, Nigeria. Three research questions were used to the study in line the purpose. A descriptive survey design was adopted for the study. Population of the study stands at was 5,451,337 children between 3-59 months eligible for SMC, A total sample size of 1380 respondents were selected using stratified random sampling. Which was drawn from the various LGA's. a structured questionnaire was used as the instrument for data collection. The instrument was validated by three experts. Percentage, frequency and mean statistics was used to analysed the data. The finding and some recommendations were made, which included: Health facility workers should provide with intensive health

Introduction:

Seasonal malaria chemoprevention (SMC) is defined as “the intermittent administration of full treatment courses of an antimalarial medicine during the malaria season to prevent malarial illness with the objective of maintaining therapeutic antimalarial drug concentrations in the blood throughout the period of greatest malarial risk (*Assob et al., 2017; Scholar, 2007*).” SMC is recommended in areas of highly seasonal malaria transmission throughout the Sahel sub-region. A complete treatment course of

education to the caregivers on the positive impact of seasonal malaria chemoprevention. SMC is implemented and provision for strengthening national pharmacovigilance systems should be included in plans for SMC implementation, to monitor ADR and possible cases of gene mutation against any of the drugs (SP, AQ or both) for effective management of resistance and modification of the SMC drug.

Keywords: assessment, seasonal, malaria, chemoprevention.

Sulphadoxine-pyrimethamine (SP) plus amodiaquine (AQ) should be given to children aged 3-59 months at monthly intervals, beginning at the start of the transmission season, up to a maximum of four doses during the malaria transmission season (provided both drugs retain sufficient antimalarial efficacy) (*Abossie et al., 2020*).

The considerations for the deployment of SMC with SP+AQ should not be implemented in areas with high levels of resistance to SP or AQ. While there are several potential approaches to implementing SMC, there is presently insufficient evidence to recommend a standard strategy, and individual approaches best suited to the local conditions should be used. If possible, SMC should be integrated into existing programs, such as community case management and other community health worker schemes. The results of clinical trials indicate that a high level of protection against uncomplicated clinical malaria is likely to be maintained for only 4 weeks after administration of each treatment course of SP+AQ; thereafter, protection appears to decay rapidly. For maximum protection, and to minimize selection of drug resistance, children should receive SMC each month during the transmission period and should take the complete 3-day course each month (*White et al., 2014*). In areas where SMC is deployed: pharmacovigilance should be strengthened where it exists and should be instituted where it does not. Drug resistance monitoring and system evaluation should be supported or instituted, including systems to assess the number of breakthrough infections and their intervals after the last dose of SMC (*Laxminarayan, et al., 2006*). Health workers must record and monitor the doses of SP+AQ administered in order to evaluate the impact of the intervention. Existing systems for

documenting severe malaria, malaria deaths and confirmed cases of malaria should be strengthened. Treatment of breakthrough *P. falciparum* infections during SMC should not include either AQ or SP or combinations containing either of these drugs, such as artesunate + amodiaquine. Where SMC is implemented, alternative antimalarial combinations must be made available for the treatment of clinical malaria in the target age group ([Thuilliez et al., 2017](#)).

Existing systems for recording and reporting confirmed cases of malaria and malaria deaths should be strengthened for evaluation of the impact of SMC. SMC complements existing malaria control interventions and should therefore be deployed concurrently. Intermittent preventive treatment in infancy and SMC should not be given concomitantly to the same population. Therefore, in target areas for SMC, intermittent preventive treatment of malaria in infancy should not be used. Expected benefits of SMC the WHO policy recommendation for SMC is based on the results of seven studies conducted in areas of highly seasonal malaria transmission in the Sahel and sub-Sahel regions of sub-Saharan Africa ([Adeoti et al., 2020](#)).

Children younger than the age of 5 years are highly susceptible to recurrent febrile illness. In sub-Saharan Africa (SSA), malaria makes a significant contribution to the burden of febrile illness among these children. Reportedly, it is the fourth leading cause of under-5 mortality in sub-Saharan Africa ([Druetz, 2018](#)). Seasonal malaria chemoprevention (SMC) has been introduced widely in the Sahel since its recommendation by WHO in 2012 for children under 5 years of age. It is a highly effective intervention to prevent malaria in those most vulnerable to the disease's effects ([Jacques et al., 2020](#)). SMC involves monthly antimalarial treatment for up to four months to prevent malaria and is recommended by the World Health Organization (WHO) for children who live in areas with intense and highly seasonal malaria transmission in the Sahel sub-region¹. In 2017, twelve countries had SMC programs reaching about 15million children (Burkina Faso, Cameroon, Chad, Gambia, Ghana, Guinea, Guinea Bissau, Mali, Niger, Nigeria, Senegal and Togo) ([Jacques et al., 2020](#); [Scholar, 2007](#)). Seasonal Malaria Chemoprevention (SMC) is defined by World Health Organization (WHO),([Somé et al., 2014](#)), as the intermittent administration of full treatment courses of an anti-malarial

medicine during the malaria season to prevent malarial illness with the objective of maintaining therapeutic anti-malarial medicine concentration in the blood throughout the period of greatest malarial risk ([Noor *et al.*, 2015](#); [Ward *et al.*, 2019](#)).

Since its recommendation by the World Health Organization in 2012, Seasonal malaria chemoprevention (SMC) has been introduced in 12 countries ([Kana *et al.*, 2017](#)). SMC targets children aged 3-59 months in the Sahel during the short, but intense, malaria transmission season. SMC is recommended in areas of high seasonal malarial transmission throughout the Sahel sub-region, as in some parts of Northern Nigeria ([El-Houderi *et al.*, 2019](#)). A complete treatment course of Sulphadoxine-Pyrimethamine (SP) plus amodiaquine (AQ) should be given to children aged 3-59 months at 28 days cycle intervals, ([York, 2017](#)). Beginning at the start of the transmission season (rainy season), up to a maximum of four doses during the malarial transmission season ([Tagbor *et al.*, 2016](#)). Malaria remains a leading cause of illness and causing an estimated 100 million cases of clinical malaria and 300,000 deaths. Nigeria contributes 25% of malaria cases worldwide and most deaths occur in children under five years of age ([Druetz, 2018](#); [Malaria Consortium, 2015b](#)).

Across the Sahel sub-region, most childhood malaria mortality and morbidity occur during the rainy season which is generally short. Providing effective malaria treatment at intervals during this period has been shown to prevent illness and death from malaria in children ([Greenwood, 2017](#)). With the introduction of various interventions and the widespread insecticide-treated bed nets (ITNs) distribution campaigns that have been conducted since 2009, the epidemiology of malaria is changing. There is a need to shift from the 'one size fits all' approach and target specific interventions to specific populations and /or locations for maximal effectiveness ([Afoakwah *et al.*, 2018](#)). In keeping with this, WHO has recommended, and the National Malaria Elimination Program adopted Seasonal Malaria Chemoprevention (SMC) for children less than five years of age in areas with *Plasmodium falciparum* and highly seasonal malaria transmission ([Adeoti *et al.*, 2020](#); [York, 2017](#)). The duration of the transmission is longer in the south and reduces as one moves north being perennial in duration in most of the south but lasting 3 months or

less in the North. In Nigeria, 9 states are eligible for SMC namely, Kebbi, Sokoto, Zamfara, Katsina, Kano, Jigawa, Bauchi, Yobe, Borno because they are within the Sahelian belt and have been recommended by National Malaria Elimination Program (NMEP) for scale-up implementation. (Afoakwah et al., 2018; Scholar, 2007; S. Singh et al., 2014).

In Sokoto state, seasonal malaria chemoprevention is being put into play usually by a kick-off meeting between Malaria Consortium and Sokoto state malaria elimination agency, during the meeting deliberations are made on how best to implement the activity in each tear under review, the discussion will be made in line with the protocol of implementation as well as a memorandum of the agreement be reviewed and signed, that marks the beginning of SMC in that particular year (Singh et al., 2014; WHO, 2019). The objective of SMC which is intermittent administration of full treatment courses of an antimalarial medicine to children in areas of highly seasonal transmission during the malaria season is to prevent malarial illness by maintaining therapeutic antimalarial drug concentrations in the blood throughout the period of greatest malarial risk. WHO recommends SMC with Sulphadoxine-pyrimethamine (SP) + amodiaquine (AQ) in areas with highly seasonal malaria transmission across the Sahel sub-region, where most childhood malarial disease and deaths occur during the rainy season, children are given a single dose of Sulphadoxine/pyrimethamine combined with a 3-day course of amodiaquine, once a month for up to 4 months. Giving this effective antimalarial treatment at monthly intervals during this period has been shown to be 75% protective against uncomplicated and severe malaria in children under-5 years of age (Ajakaye and Ibukunoluwa, 2020).

Since 2012, the scale-up of SMC has been remarkable, with over 12 million children receiving the intervention, much of its growth has been driven by major donor agencies including, the UNITAID-funded consortium, Access-SMC, World Bank and UNICEF (Kana et al., 2017; WHO, 2013). National Malaria Elimination Program (NMEP) have readily adopted donor-funded SMC, and many non-governmental organizations are supporting its implementation. Since SMC has been recommended, research on innovative strategies has continued. In an area with the long seasonal transmission, children receiving 5 monthly distributions of SMC had approximately 50%

lower malaria incidence than children receiving no SMC (or children receiving 3 monthly distributions) (WHO, 2020). A trial of azithromycin in addition to SP+AQ has been carried out, and a trial of SMC and seasonal vaccination with the RTS, S/AS01 malaria vaccine is underway (Oladepo *et al.*, 2007).

Despite its impact, SMC remains unsatisfying for several reasons, including its logistical burden, the use of preventive medications that require a 3-day course of therapy, and incomplete coverage of zones that could benefit most from SMC. SMC distributions occur once per month, necessitating a large commitment of time and resources reaching millions of children every month, every rainy season, is a challenge in any setting, particularly so in the rural Sahel, where infrastructure is poor, and access is difficult especially during the rainy season (Coldiron *et al.*, 2017). As with many preventive interventions, children who stand to benefit the most from SMC (those living farthest from health centres and who have the worst access to care) are also the hardest to reach month after month. With implementing partners facing “SMC fatigue”, it is a challenge to continue reaching these most isolated regions. One way forward could be decentralization, perhaps making one delivery per season, storing enough SP+AQ to cover all four rounds in remote villages, and transferring the responsibility to distribute the anti-malarial to community health workers. Such a strategy would be logistically less challenging but requires close, continued supervision in these areas (Coldiron *et al.*, 2017).

Series of innovations were introduced in SMC -MDA from 2016 to 2020 aimed to enhance the exercise and improve coverage as well as to meet the desired goals, this include among others, at the beginning of SMC in 2015 at Sokoto State fixed post was adopted in the delivery of SMC services with the facility and ad-hoc staffs providing the needed services in the related communities, a lot of achievements were recorded particularly in areas or settlements at closer proximity with the health facilities and the designated sites, while the role model mothers (RMM) provides the referrals and enlightenment activities, it was later noted that the coverage was significantly far below the enumerated age populations of under five leading to the abolished of the fixed post in 2016, this brings about a boost in the SMC coverage as a much higher increase in the number of the eligible children was recorded and role model mothers (RMM) were also from the beginning co-opted in the SMC services

delivery in Sokoto State, their involvement is voluntary without any financial entitlement, 10 ladies were selected from each ward to serves as the RMM and were later trained highly in such areas of endeavour with the aim of the RMM to provide the required valuable services of information dissemination on SMC, a referral from the community to the health facilities, valuable information on adherence and the significance of SMC in the eligible age group, is it a voluntary service there was no commitment and full dedication toward achieving the required goal, this leads to the stoppage of the Role Model Mothers in 2016. Moreover, focus group discussion and key informant interview is a form of group interview or evaluation of the SMC activities to gather information through listening, interacting and observation, initially this was employed in 2015, used in the monitoring of SMC activities at the community level to bring all stakeholders on board and this includes the community leaders, service providers and core implementers of the SMC activities as well as obtaining valuable information on the acceptance of the services. Equally, gaps were noted during the interviewing and discussion and modalities were adopted to counteract the defects. This was later ceased in 2016 and replaced with a satisfaction survey in 2016 aimed at obtaining still the same valuable information on the SMC from the beneficiaries and community leaders on the level of coverage and satisfaction of the services renders. Key informant interview is also an in-depth interview on SMC with community leaders, professionals or residents who have first-hand knowledge about the community and the SMC, this was also halted in the same year (i.e.,2015), and the satisfaction survey also took effect in this perfective providing all relevant, necessary information and a reliable data to back-up all the findings. Still, in 2016 the evening review meeting was introduced by MC to replace focus group discussion and was adopted in all the 23 LGAs of the state. This involves meeting first with at facility level after each daily MDA by the CHWs to generate information that includes success stories, gaps and challenges. The meeting is to be headed by the facility IC who will, in turn, participate in the main evening review meeting at the LGA level to be chaired by the Roll Back Malaria Focal (RBM) of the LGA, in which all the ICs were mandated to attend and relent the information gathered from their respective facilities.

Statement of the Problem

Despite the significant investments to control malaria infection rates over the past years, infection rates remain significant in sub-Saharan Africa (Gallup and Sachs, 2001). An accurate diagnosis of malaria has become increasingly important as *Plasmodium falciparum* becomes resistant to commonly used antimalarial drugs, posing a major threat to the global effort to 'Roll Back Malaria', especially in rural areas where malaria is more severe and frequent (WHO, 2019). The diagnostic approaches most commonly used in Nigeria are the syndromic approach, followed by microscopy and rapid diagnostic tests (RDT) (Cox, 2002). Due to the poor or absence of laboratory facilities, malaria diagnosis in many health centres has continued to be based on fever or history of fever. Microscopy, considered the gold standard for malaria diagnosis, is generally unavailable at primary healthcare centres only available at the secondary and tertiary level hospitals. However, it is often not used and has an accuracy of only 70- 75% (Crutcher and Hoffman, 1996).

Microscopy depends on well-maintained equipment, an uninterrupted supply of quality reagents, trained staff, regular quality monitoring and supervision. Maintaining quality microscopy is a major challenge, and it is unsuitable for routine use at a community level (Yeung et al., 2004). RDTs based on detection of *Plasmodium*-specific proteins can be used if microscopy is unavailable, but cost, availability, false-positive tests, false-negative tests and lack of parasite density information are important limitations, particularly in high transmission areas. Deploying RDTs did not affect the overdiagnosis of malaria in febrile patients (Nkwenti, et al., 2019). Concerted efforts by governments, international organizations and nongovernmental organizations (NGOs) to combat the disease impacted morbidly caused by malaria over the past decades, there has been a significant increase in investment towards the fight against malaria. Hence, this study aimed at determining the impact of Seasonal Malaria Chemoprevention (SMC) among children under five years, a review from a five-year intervention in Sokoto state.

Aims and objectives of the study

1. To examine the knowledge level of SMC among parents/caregivers of children under 5 years in Sokoto metropolis.
2. To explore the perception of parents/caregivers on the SMC intervention in Sokoto state.

3. To assess the factors associated with malaria infection among children under 5 years who had SMC in Sokoto metropolis.

Research Questions

1. What is the knowledge of SMC among parent/caregivers of children under 5 years in Sokoto state, Nigeria?
2. What is the perception of parents/caregivers on the SMC intervention in Sokoto state?
3. What is the factors associated with malaria infection among children under 5 years who had SMC in Sokoto metropolis?

METHODOLOGY

Research Design: This study was a quantitative research that utilized descriptive survey design. According to Cohen, et al., (2011), surveys gather data at a particular point in time with the intention of describing the nature of existing conditions, or identifying standards against which existing conditions can be compared or determine the relationships that exist between specific events. In the context of this paper, to assess the seasonal malaria chemoprevention (SMC) among children of under -5 years in Sokoto metropolis, Nigeria.

Population: The target populations of this study consist of children of under 5 years who are either attending general hospital or primary health care facilities in Sokoto state. The target population for this study was 5,451,337 children between 3-59 months eligible for SMC were enrolled across the 23 local government areas of Sokoto state of Nigeria, covering a period of 2015 – 2019.

Participants: A total sample size of 1380 respondents were selected using stratified random sampling to select samples from the various LGA's in Sokoto state. According to Nworgu (2004), with purposive sampling, specific elements which satisfy some pre-determined criteria are selected. Although, these criteria to be used are usually a matter of the researcher's judgment, where he/she exercises this judgment in relation to what he thinks will constitute a representative sample with respect to the research purpose. Indeed, purposive sampling is relatively cheaper and easier and ensures that

only those elements that are relevant to the research is included or serve as representatives.

Instrument for data collections : A self-reporting structured interview questionnaire was designed and developed based on extensive review of literature related to seasonal malaria chemoprevention (SMC) among children of under 5 years and also using online national health data repository which is a District Health Information System (DHIS2)-based platform called ENDOS-BF. The instrument consisted of four sections. The first part elicited the demographic profile of the respondents such as gender, age bracket. Section B measured Respondent's knowledge on SMC. Section C contained Respondent's perception on SMC. Section D contained Respondents information on the factors associated with malaria infection among children under-5 years who had SMC.

Data Collection Method: Each participant responded to the interview questionnaire independently using the caregiver/ parent. The researcher utilizes researcher assistants to cover the respondents.

Data Analysis Method: The data collected were cleaned for errors. Preliminary analyses of normality, linearity, outliers and homogeneity of variance assumptions were checked to ensure no violations. The data were subjected to both descriptive and inferential statistics. This was facilitated with the assistance of computer software called SPSS version 23.

Result Presentation

Demographic Result

The socio-demographic characteristics of the respondents (n=1380) out of which 1208 (87.5%) consented for the interview and 172 (12.5%) rejected the interview as request, the respondents' willingness to participate in this study was voluntary without coercion, they have explained the benefit of the study and that their participation will be anonymous while the data obtained will be solely used for this study only. The distribution of the study respondents by their age category, 18-27 years old have the highest frequency of 54% and those above 48 years of age have the lowest participation of 14% in the present study. The study respondent's categorization by gender, 23%

of the study respondents were male while the female counterpart represents a total of 77%.

Research Question One Respondents' Knowledge on SMC

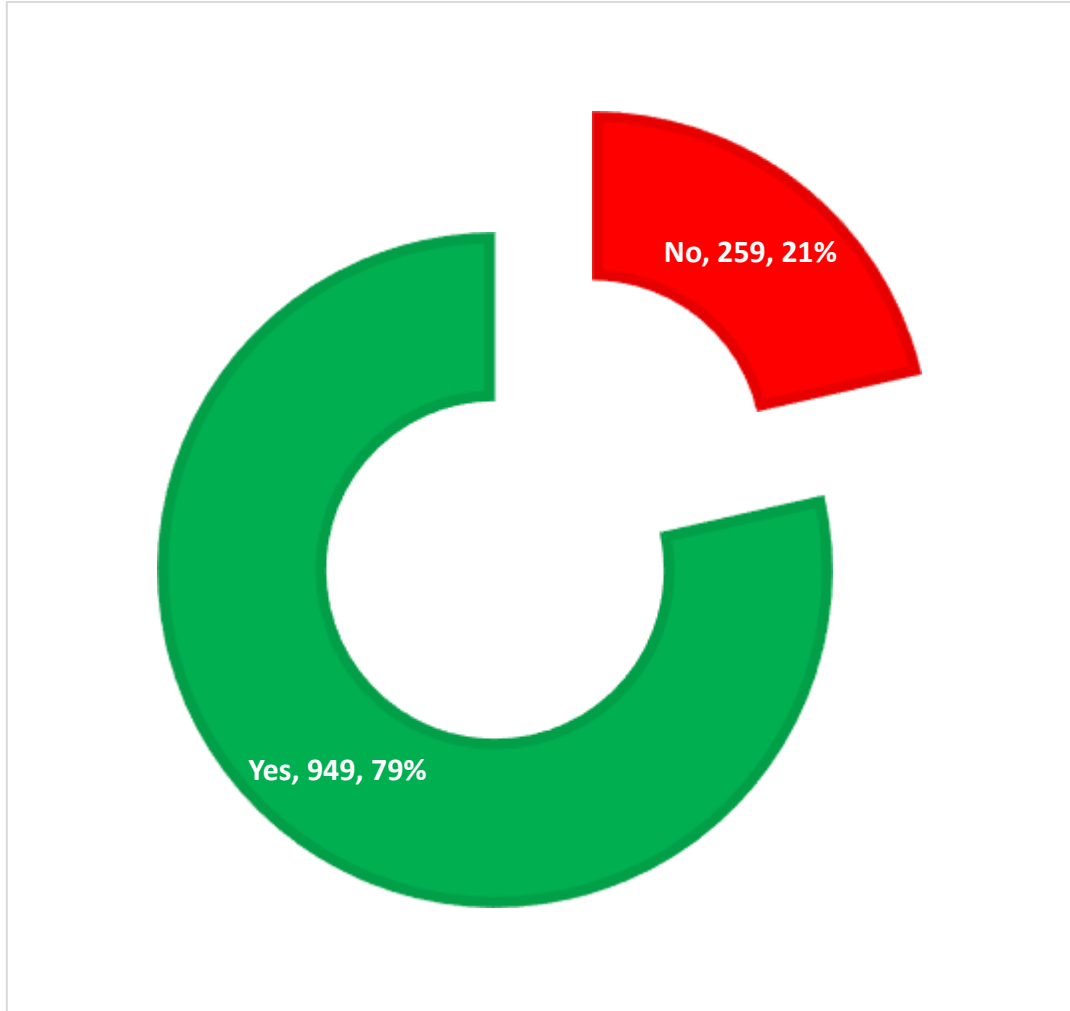


Figure 1: Population of the respondents that have been previously attacked by malaria

The data of the respondents' knowledge on malarial analysed is presented below. It represents the population of the respondents that have been previously attacked by malaria where 949 population of respondents were attacked by malaria are 79% and those that were not attacked are 259 representing 21%.

Research Question Two

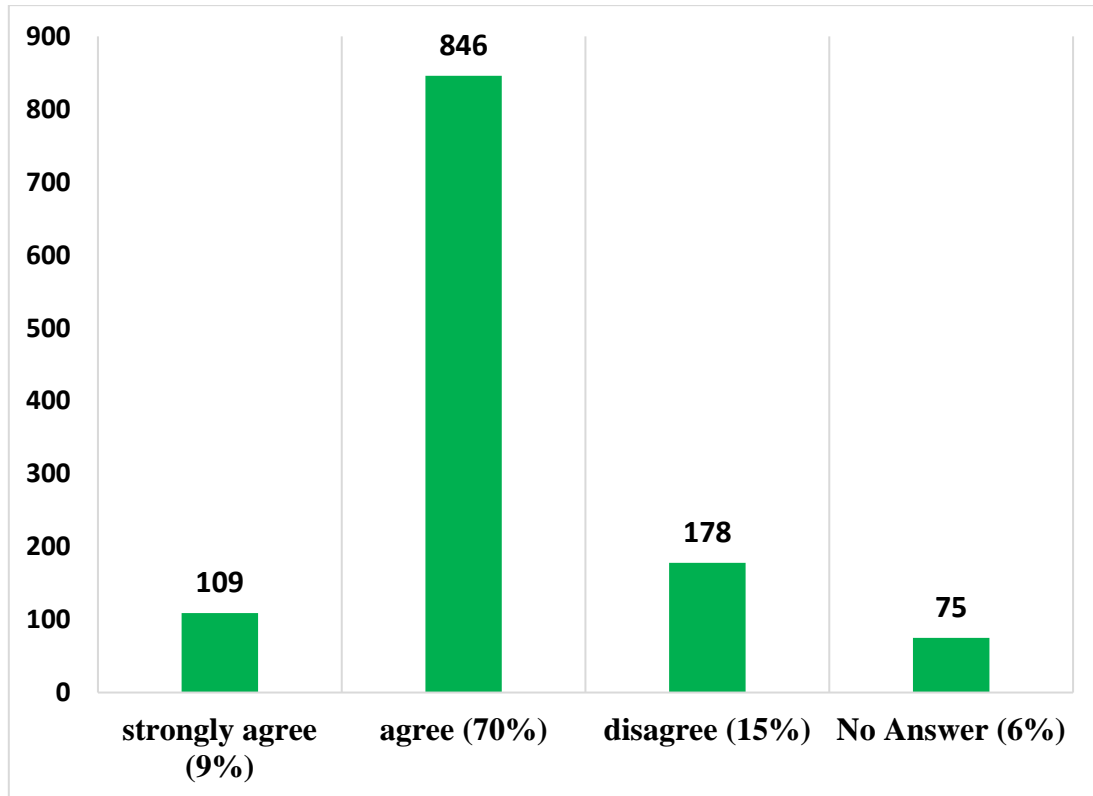


Figure 2: People in this community would like to receive more information on the medicine that prevents malaria during the rainy season

The respondents' perception on SMC recorded in this survey is presented in this section. The respondents were interviewed whether the medicine that prevents malaria during the rainy season medicines are easy to administer to young children. This information shows that 160 (13%) of the respondent strongly agreed that SP+AQ is easy to administer, at the same time 893(74%) of the respondent agreed on the above and 155(13%) disagree that SP+AQ is easy to administer to young children. The pictorial presentation in Figure 2 represents the response of the respondents where people in this community would like to receive more information on the medicine that prevents malaria during the rainy season. From the total number of respondents in the community 109 (9%) strongly agreed on the need for more information related to SMC to gain acceptance, 846 (70%) agreed on the same, 178

(15%) disagreed while 75 (6%) of the respondents did not comment on the need to intensify information dissemination.

Research Question Three

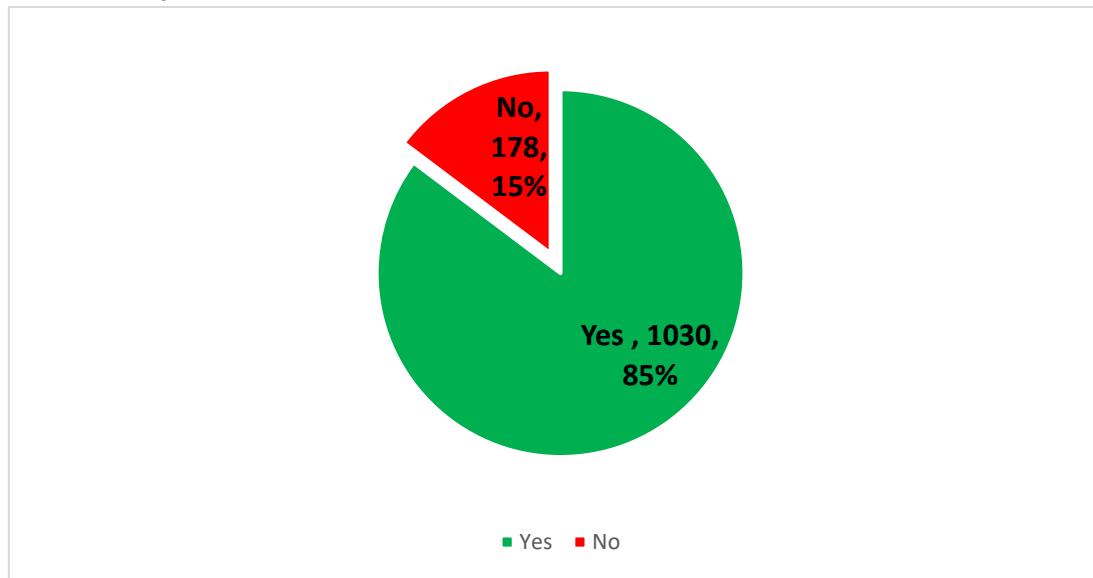


Figure 3: Is there at least one child from 3 months to 5 years old in the compound

Responses on the SMC intervention recorded from the data gathered by the information provided by the respondents is analysed below. The response of the respondents if there is at least one child from 3 months to 5 years old in their compound, it indicates that 1030 respondents selected yes representing (85%) while 178 respondents selected no represented (15%).

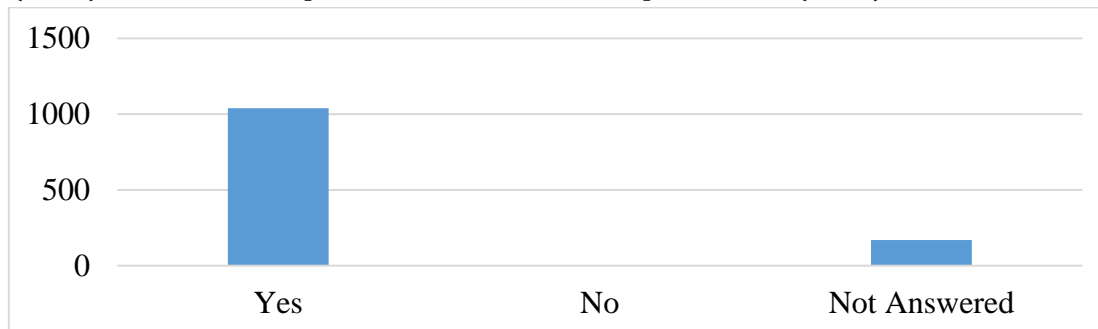


Figure 4: Was the compound ever visited by a CHWs/distributor this year for SMC

The respondents were interviewed if their compound was ever visited by a CHWs/distributor for SMC, the information shows 1039 respondents responded yes while 0 respondents responded no and 169 respondents showed not answered.

Conclusion

Knowledge of the caregivers on seasonal malaria chemoprevention within Sokoto state was considerably high. Results obtained show that most of the messages surrounding SMC were delivered using several routes with the highest coming from the health personnel. This highlights the need to leverage resources on the use of community caregivers and religious leaders to disseminate information about SMC activities in addition to other sources.

The perception of caregivers was generally high on the effectiveness of SMC, also the acceptability of the program was noted to be very highly appreciated by parents and other stakeholders. Parents and caregivers placed a high priority on the health of their children and have pledged to support the SMC intervention and any other program in the community aimed at improving the health of their children. However, negative attitudes and lack of trust by few parents have proven the little interest they have in the intervention. Therefore, intensive health education on the SMC intervention with a focus on the importance of the drug, the likely side effects and the need for parents to allow their children to receive the drug could further improve acceptability and the smooth implementation of the program by changing the mindset of some caregivers in other areas who are relatively low.

Few children were noted to come up with malaria fever despite taken the SMC medication which might be due to poor adherence to day 2 and day 3 medication (AQ), not combining SMC programme with other preventive measures against malaria such as the use of LLIN, fumigation and good environmental management. The most alarming was that some of the children coming up with malaria have been participating in the SMC programme for 2 or 3 years, and this might likely be due to the pfmdr1 86Y mutation which is associated with the AQ resistance which is very rare.

Seasonal Malaria Chemoprevention is an intervention with great potential in Sokoto state, and along with other interventions, it could contribute greatly to

approaching the threshold where elimination strategies will be envisioned, the intervention has significantly reduced hospital visit, admission and malaria indicators in children during the mass drug administration in all the 23 LGAs, comprising of 244 wards and 8269 settlements.

Recommendation

The concept of Lead-mothers should be improved to include having a checklist containing all the children captured during the pre-implementation assessment and a map of their catchment area with a movement chart to ascertain whether all houses and children are being reviewed for the second- and third-day medication.

Accordingly, as part of the integration of services, a pamphlet containing awareness creation on the use of LLIN in the houses, proper environmental sanitation and early reporting of all fever cases to health facilities instead of visiting medicine stores for the avoidance of any treatment as many health facilities have free malaria drugs at their disposal and some parent may probably not be aware of it, this is because maximizing the effectiveness of SMC may be associated to the aforementioned.

Health facility workers are to provide intensive health education to the caregivers on the positive impact of seasonal malaria chemoprevention, they should also intensify effort to change the mindset of the very few caregivers that have a negative perception of the free SMC medication, the project is a high capital intensive one with a source of funding from the international donor agencies, USAID and other philanthropic funds, even though it might be free in Nigeria yet somebody somewhere is paying the expenses of procurement to distribution which is a long chain of activities.

Moreover, pharmacovigilance should be maintained where SMC is implemented and provision for strengthening national pharmacovigilance systems should be included in plans for SMC implementation, to monitor ADR and possible cases of gene mutation against any of the drugs (SP, AQ or both) for effective management of resistance and modification of the SMC drug.

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