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Caregiver acceptability of seasonal malaria chemoprevention in two districts in the Upper West region, Ghana: a cross-sectional study

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Abstract

Background Acceptability of malaria chemoprevention interventions by caregivers is crucial for overall programme success. This study assessed coverage and acceptability of Seasonal Malaria Chemoprevention (SMC) in selected communities in the Northern part of Ghana.

Methods An analytical cross-sectional design was conducted from "July 23rd to August 4th, 2020—a 12-day period that covered 5 days of the first SMC implementation cycle and 7 days post-implementation. Using a stratified multistage sampling technique, a total of 495 caregivers providing care for 569 eligible children aged 3–59 months from randomly selected households in the study communities were enrolled into the study. Acceptability of SMC was assessed on a set of 19 questionnaire items-8 of the items measured caregivers' perceptions and 11 items measured children's reaction to administered medicines. Univariable and stepwise multivariable logistic regression analyses were performed to assess the predictors of acceptability of SMC at a 95% confidence interval and a p-value of 0.05.

Results SMC coverage was 95.1% (541/569). Caregivers had a good level of knowledge of SMC (n = 475; 96.0%; 95% CI 94.2—97.7%) and a good perception of SMC (n = 471; 95.2%; 95% CI 93.3–97.0). Seven out of ten caregivers (70.9%; 95% CI 66.9–74.9%) had good acceptability of SMC. For 7 out of 28 children who did not receive the SMC intervention, their caregivers intentionally refused them the intervention. Of those that received the treatment, 17.2% (n = 85; 95%CI 13.8–20.5%) of caregivers had at least one leftover amodiaquine tablet after the third day of treatment. Caregivers who practice Christianity or Islam had better acceptability than caregivers who practice African traditional religion (p < 0.001).

Conclusion Health authorities and stakeholders can work towards bridging the gap between knowledge and SMC treatment practices of caregivers through continuous education, adherence counseling, and effective monitoring of SMC practices in malaria-endemic countries.

Keywords SMC, Caregivers, Malaria, Acceptability, Ghana, Upper West region, Amodiaquine–sulfadoxine– pyrimethamine

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Background

Malaria remains a life-threatening disease despite the significant reduction in morbidity and mortality in endemic regions of the world [1]. In 2018, 229 million cases and 409,000 deaths were reported globally, with Africa contributing 94% of the cases and deaths [2]. Although the disproportionately high burden of cases and deaths persists in Africa, there has been a steady reduction of deaths averaging 22,325 per year from 2010 to 2017 among children under 5 years. Ghana contributed approximately 3% of the cases and deaths reported in Africa [2].

Several preventive and curative interventions are being implemented to drive a reduction in the number of cases and deaths. Effective case management, the curative intervention in Ghana includes administering artemisinin-based combination therapy (ACT) for uncomplicated malaria [3]. Available preventive interventions include indoor residual spraying, sleeping under long-lasting insecticidal nets (LLINs), larval source management, intermittent preventive treatment of malaria for pregnant women (IPTp), seasonal malaria chemoprevention (SMC), and deployment of the RTS, S/AS01 vaccines which have now been incorporated into the Expanded Programme on Immunization in Ghana [3–5].

SMC was first deployed in the Upper West Region (UWR) of Ghana in 2015 as a pilot, and is now being implemented in 68 districts with highly seasonal malaria transmission, scattered across the Upper East, Upper West, Oti, Bono-East, Northern, Savannah and North-East regions of the country [6]. SMC intervention involves the administration of a single dose of sulfadoxine-pyrimethamine and a 3-day course of amodiaquine once a month for up to 4 months to children aged 3 to 59 months during the high malaria transmission season [7]. A study that assessed the impact of malaria interventions, such as LLINs and effective case management with ACT prior to SMC introduction in Ghana in 2015, showed that malaria admissions had increased by 48% but under 5 malarial deaths had declined by 59% [8].

Despite a high SMC coverage of 96.5% recorded in Ghana in 2017, malaria was responsible for 21.8% of hospital admissions and 51.8% of deaths among children under 5 years in the country in 2018 [9]. Regardless, malaria data in 2014 in the Upper West region indicate that inclusion of SMC to other intervention packages has resulted in a reduction of malaria prevalence from 38% in 2014 to 21.8% in 2017 [10]. One more study in the Savannah region reveal that SMC implementation has reduced malaria mortality by 67% but had marginal effect on infection prevalence (15–17%) [11]. Meanwhile, it has been shown that SMC could reduce the prevalence of parasitaemia by as much as 65%. Showing a potential breach in protection from malaria, though distribution of SMC medicines is within optimal levels (96.5%). In 2018 in the Upper West Region (UWR), under 5 years malaria admission and deaths were 43.9% (154,190 cases) and 58.6% (251 deaths), respectively [9]. Thus, under-5 malaria burden in the UWR (43.9%) is about double the national prevalence (21.8%), raising concerns as to whether supplied medications are actually administered to children by caregivers in the study region.

Given the demonstrated relationship between poor acceptability of health interventions and high morbidity and mortality, it is reasonable to consider such a dynamic at play locally [12-14]. Whereas parents self-reported 95.4% adherence to SMC medicines in neighbouring Upper East region, a population pharmacokinetic study conducted in Niger in 2016 estimated complete adherence to be less than 30% [15, 16]. This reinforces the idea that the acceptability of SMC might be variously problematic for a critical mass of caregivers. Poor acceptability is likely to lead to non-compliance with the recommended administration of the full course of treatment resulting in sub-clinical plasma concentrations. At such concentrations, children will not be adequately protected against clinically manifest disease. Furthermore, this will facilitate the emergence of resistant strains of malaria parasites [15].

Previous studies have determined that the following factors influence poor acceptability: knowledge of interventions, income level, highest educational level, occupation, beliefs, and perceptions [17–19]. Additionally, drug-related factors reported include child's reaction to medication, untoward effects, taste, frequency of administration and perceived efficacy [20, 21].

Five to 8 years after the commencement of SMC implementation in northern Ghana and other parts of West Africa, studies on acceptability are rare in the literature [11, 12]. Again, factors that influence caregivers' role in ensuring that children duly adhere to required medication regimen are largely not validated by empirical evidence, except few qualitative studies. Providing evidence on caregivers' knowledge, perception, acceptability, and coverage of SMC may help explain why malaria burden in the UWR is still the highest (13.4%) in the country as compared to other regions (2-12.2%), as well as the national average of 9% [22]. The evidence will help inform policymakers and the malaria programme management to tailor service delivery for optimal outcomes. Further, it will help control the emergence of resistant strains. This study assessed coverage and acceptability of SMC in selected communities in the Northern part of Ghana.

Methods

Aim

This study investigated the acceptability of seasonal malaria chemoprevention (SMC) in two districts in the Upper West region of Ghana.

Design and sampling

This study employed an analytical cross-sectional design using a multi-stage sampling technique from July 23rd to August 4th, 2020— a 12 - day period that covered 5 days of the first SMC implementation cycle and 7 days postimplementation. A step-by-step stratified procedure was used to select the study participants by sampling at the district, community and household levels. All the 11 districts in the study region were listed and two were randomly selected. Certain communities of the study districts were not accessible, so the study was conducted in communities that had easy access to reach participants. Accessibility was assessed based on the narrative reports from health workers during the 2018 campaigns, which defined accessibility according to road conditions and the need to cross rivers. The selected districts were Lawra and Wa districts. For each of the selected districts, two communities were randomly selected from the listing of communities. The selected communities were Xavier residential and Busa A for Wa district, and Yikpee and Bapaari for Lawra district. The households were randomly chosen from the selected communities. Within households, one caregiver whose children were in the SMC age group (3-59 months) at the moment of the 2020 first SMC cycle was included for the questionnaire's administration. For the caregivers who had more than one child, acceptability was assessed for one randomly selected child. A proportionate sampling method was used to allocate the number of caregivers to be included per community.

Study setting

The Upper West Region (UWR), one of the sixteen administrative regions in Ghana has 11 districts. The study was conducted in Wa and Lawra districts in the region. Wa is the Upper West regional capital city and has a land area spanning about 579.86 square kilometers (6.4% of the region). It has an estimated population of 107,214 and 103 communities based on projections from the 2010 population and housing census. Children underfive represent 24.2% of the population (25,982 out of 107,214) [23, 24]. The estimated population and number of communities for Lawra are 63,468 and 141 communities, respectively. The Lawra municipality is the oldest among the 11 administrative units in the UWR. A total of 19.2% of the population represents children from ages

3 to 59 months [25]. Some districts in the region have motorable roads that are easily accessible. Others are difficult to access because of poor road conditions and the need to cross rivers [23].

The study population included caregivers of children within the SMC intervention age range (3–59 months) and/or children aged 3–59 months present in the community during the first SMC cycle in July 2020.

Sample size calculation

The researchers assumed that caregivers fell outside the dependency age groups (under 15 and over 65 years). According to the World Bank data, the minimum dependency rate in Ghana was estimated to be 68.5% as of 2018 [26]. The proportion of caregivers whose children received SMC during the first cycle of the 2020 SMC was assumed to be at least 50%. These assumptions were used to estimate the number of caregivers per community and to allow for calculations for the number of caregivers to include per community using Stata version 16. Overall, a total of 424 caregivers were estimated in all four communities assuming a power of 90%, a 95% confidence level and a margin of error of 5% in the study.

Study procedures

Using data generated from pretesting of data collection tools, Cronbach's alpha reliability coefficient was used to test the internal consistency of children's reaction to SMC medicines (0.9, good), caregivers' perception of SMC (0.7, acceptable), and overall acceptability of SMC (0.9; good) before data collection. Structured questionnaires were administered to caregivers whose children were in the age group 3-59 months during the last SMC cycle. For caregivers who had more than one child, data were collected for one randomly selected child for all outcomes except coverage of the SMC intervention where data were collected from all eligible children of caregivers. Questionnaires were structured to collect information on sociodemographic characteristics of the caregivers and children aged 3-59 months, and knowledge of SMC. Caregivers' knowledge of SMC was measured using a 9 question- item WHO adapted tool [27]. The acceptability of SMC was assessed on a set of 19 questionnaire items, a tool developed by SANOFI for evaluating the acceptability of paediatric oral formulations among caregivers [28]. This includes 8 items measuring caregivers' perceptions and 11 items that measure the reaction of children under 5 years to the medication administered. Children's reactions to medication were assessed using questions on the number of times the child takes the medication, size, smell, taste of the tablets, ease of administration, as well as the child's willingness to complete the doses. Caregivers provided information on whether their eligible children had received the SMC medicines or not during the 2020 first cycle of SMC.

Statistical analysis

Data obtained from caregivers were reviewed for completeness and entered using the online version of Kobocollect, then uploaded and imported into Microsoft Excel Version 19 spreadsheets and STATA IC 16 software for analysis. The continuous dependent variable (acceptability of SMC) was then re-categorized as binary categorical outcomes: poor acceptability and good acceptability (Supplement 1). The total score of caregivers' knowledge of SMC was recategorized into a binary variable (poor knowledge and good knowledge). Pearson's chi-square test of independence and Fisher's exact test were used, where appropriate to assess the association between independent variables and the SMC acceptability. Univariable and stepwise multivariable logistic regression analyses were performed to assess the predictors of acceptability of SMC at a 95% confidence interval and a p-value of 0.05. The variance inflation factor (VIF) and the tolerance were used to assess multicollinearity, and the Hosmer-Lemeshow goodness of fit test was used to assess the appropriateness of the entire regression models. The acceptability full model diagnostic analyses revealed that the mean tolerance score was 0.89 (range: 0.74–0.99), while the mean VIF score was 1.14 (range: 1.02 - 1.35).

Results

Descriptive characteristics

For a total of 495 caregivers, 569 children aged 3-59 months who were eligible for SMC medicine administration were registered. More than ninety percent of caregivers (n = 448) were females and the majority (90.5%) were married (Table 1). About two-thirds (66.9%) of the caregivers were residents in Wa and more than two-fifths of the caregivers (40.6%) had no formal education. The age groups 20-39 and 30- 39 years were the most represented (39.6%) with caregivers median (IQR) age at 30 (25-36) years. About 92.1% (456/495) of the caregivers had 1-4 children under their care. Using the WHO tool for assessing knowledge on SMC, 96% (475/495) of caregivers had good knowledge. The median age of the children in months was 25(3-59) in Wa versus 24 (3-59) in Lawra. The sex-ratio (male/female) of the children was 1.4 in both Wa (244/171) and Lawra (90/64) districts.

Coverage of the first 2020 SMC cycle, in Wa and Lawra districts

For a total of 495 caregivers, 569 children aged 3–59 months who were eligible for SMC drug

 Table 1
 Descriptive characteristics of caregivers in the Wa and Lawra municipality

Demographic characteristics	Frequency (%)
Sex	
Female	448 (90.5)
Male	47 (9.5)
Age groups (in years)	
<20	27 (5.5)
20–29	196 (39.6)
30–39	196 (39.6)
40–49	55 (11.1)
50+	21 (4.2)
District	
Lawra	164 (33.1)
Wa	331 (66.9)
Community	
Bapaari	90 (18.2)
Busa	175 (35.4)
Xavier	156 (31.5)
Yikpee	74 (14.9)
Marital status	
Married	448 (90.5)
Single	28 (5.7)
Divorced	11 (2.2)
Other	8 (1.6)
Highest educational level	
No formal education	201 (40.6)
Primary	60 (12.1)
JHS	83 (16.8)
SHS	62 (12.5)
Tertiary	89 (18)
Religion	
Islam	262 (52.9)
Christianity	177 (35.8)
Traditionalism	56 (11.3)
Number of children under caregiver's care	
1–4	456 (92.1)
5–9	39 (7.9)
Income	
Extreme poverty	134 (27.1)
Poverty	100 (20.2)
Above poverty lime	261 (52.7)
Caregivers' knowledge of SMC	. ,
Poor knowledge	20 (4)
Good knowledge	475 (96)

administration were registered. The coverage of the first cycle of the 2020 SMC campaign was 95.1% (95% CI 93.0–96.7%). Stratified by district, the SMC coverage was 94.7% (95% CI 92.1–96.6%) in Wa and 96.1% (95% CI 91.7–98.6%) in Lawra. Of the remaining 28 children

who did not receive the SMC medicine, 42.9% (n=12) were sick during the campaign period, however, 25.0% (n=7) of caregivers did not want their children to receive the SMC medicines. Physical inspection of leftover medicines revealed that eighty-five caregivers (17.2%) had at least one tablet of Aamodiaquine after the third day of treatment (Table 2).

Caregivers' perception and factors associated to the SMC acceptability

Perception of SMC was good (95.2%) among almost all the caregivers (N=495; 95% CI 93.3–97.0%; Table 3). Based on the observation of caregivers, about 47.9% of children (N=495; 95% CI: 43.5–52.3%; Table 3) had a

poor reaction to SMC medicines. Overall, acceptability of the SMC medicine was 70.9% (N=495; 95% CI 66.7–74.9%; Table 3).

Chi-square tests of associations revealed that education and religion of the caregivers were associated with the acceptability of SMC (Table 4).

Factors associated with SMC acceptability among caregivers

After adjusting for potential confounders in the multivariable logistic regression model, only the caregivers' religion was significantly associated with the acceptability of SMC (Table 5). Christian and Muslim caregivers were more likely to accept SMC intervention

 Table 2
 SMC coverage and the reasons for not receiving SMC medicines

The child has received SMC medicines	Frequency (%)	95% CI
	N = 569	
No	28 (4.9)	(3.3–7.0)
Yes	541 (95.1)	(93.0–96.7)
Wa (N=415)	393 (94.7)	(92.1–96.6)
Lawra (N = 154)	148 (96.1)	(91.7–98.6)
Reasons for not receiving the SMC medicines	(N=28)	
Child was sick	12 (42.9)	(24.5-62.8)
Child traveled	2 (7.1)	(0.9–23.5)
Caregiver was not available	1 (3.6)	(0.1–18.3)
Healthcare workers did not come	1 (3.6)	(0.1–18.3)
Caregiver was not aware	1 (3.6)	(0.1–18.3)
Caregiver did not want the child to receive the medicines	7 (25.0)	(10.7–44.9)
Caregiver forgot to give the child the medicines	4 (14.3)	(4.0–32.7)
Availability of SMC medicines with caregivers after the SMC campaign	N = 495	
Yes	85 (17.2)	(14.0–20.8)
No	410 (82.8)	(79.2–86.0)

Table 3 Acceptability of SMC and summary of caregivers' perception scores in Wa and Lawra districts

Caregivers' perception and acceptability of SMC	Frequency (%)	(95%CI)
Caregivers' perception of SMC	(N=495)	
Poor perception	24 (4.9)	(3.0–6.7)
Good perception	471 (95.2)	(93.3–97.0)
Children's reaction to the SMC medication	(N=495)	
Poor reaction	237 (47.9)	(43.5–52.3)
Good reaction	258 (52.1)	(47.7–56.5)
Caregivers' acceptability of SMC	(N=495)	
Poor acceptability	144 (29.1)	(25.1–33.1)
Good acceptability	351 (70.9)	(66.9–74.9)

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Variables	Poor acceptability N = 495 (%)	Good acceptability N=495 (%)	Chi ² statistic	p-value
Sex				
Female	128 (28.6)	320 (71.4)	0.617	0.432
Male	16 (34.0)	31 (66.0)		
Marital status				
Married	131 (29.2)	317 (70.8)	*	0.715
Single	8 (28.6)	20 (71.4)		
Divorced	4 (36.4)	7 (63.6)		
Other	1 (12.5)	7 (87.5)		
Highest educational level				
No formal education	52 (25.9)	149 (74.1)	18.226	0.003+
Primary	15 (25.0)	45 (75.0)		
JHS	27 (32.5)	56 (67.5)		
SHS	16 (25.8)	46 (74.2)		
Post-secondary	29 (50.9)	28 (49.1)		
Tertiary	5 (15.6)	27 (84.4)		
Religion				
Islam	64 (24.4)	198 (75.6)	8.464	0.015+
Christianity	56 (31.6)	121 (68.4)		
Traditionalism	24 (42.9)	32 (57.1)		
Number of children per caregiver				
1–4	137 (30.0)	319 (70.0)	2.548	0.11
5–9	7 (18.0)	32 (82.0)		
Caregivers' age group				
< 20	11 (42.3)	15 (57.7)	2.616	0.624
20–29	56 (28.4)	141 (71.6)		
30–39	57 (29.1)	139 (70.9)		
40–49	15 (27.3)	40 (72.7)		
50+	5 (23.8)	16 (76.2)		
Caregivers' knowledge				
Poor knowledge	6 (4.2)	138 (95.8)	0.008	0.927
Good knowledge	14 (4.0)	337 (96.0)		

Table 4	Measure of association	between the caregive	rs' acceptability of S	MC and background	characteristics

* Fisher's exact test; + : p-value <0.05

compared to traditional caregivers. Caregivers who practice Islam were 2.90 times more likely to accept SMC compared to traditional caregivers (aOR=2.90 95% CI 1.43–5.89; p=0.003) as well as Christian caregivers (aOR=2.15 95% CI 1.06–4.39; p=0.035). Sex, marital status, knowledge, number of children, age, and income were not associated with acceptability.

In both the crude and adjusted analyses, caregivers with a tertiary level of education had lower odds of accepting SMC compared to caregivers with no formal education. However, there was no significant association between educational level and acceptability.

Discussion

This study assessed the acceptability of the 2020 firstcycle SMC in four communities in Wa and Lawra districts, 5 years after the introduction of SMC in Upper West Region in 2015. SMC coverage was high (95.1% (541/569). Almost all the caregivers interviewed had a good level of knowledge of SMC 96% (475/495), and a good perception of SMC (95%: 471/495). However, 7 out of 10 caregivers (70.9%; 351/495) had good acceptability of SMC. Caregivers recalled their experience of the SMC campaign and their children's reactions to the

Predictors	cOR (95%CI)	p-value	aOR (95%CI)	p-value
Sex		0.438*		
Female	Ref			
Male	0.78 (0.41-1.47)	0.433	0.63 (0.31–1.28)	0.203
Marital status		0.820*		
Not married	Ref			
Married	0.93 (0.47-1.81)	0.82	0.96 (0.47–1.93)	0.900
Highest educational level		0.220*		
No formal education	Ref			
Primary	1.05 (0.54–2.03)	0.892	1.12 (0.56–2.27)	0.744
JHS	0.72 (0.41–1.26)	0.256	0.64 (0.35–1.16)	0.138
SHS	1.00 (0.52–1.92)	0.992	0.90 (0.44–1.83)	0.776
Tertiary	0.56 (0.33–0.96)	0.035	0.47 (0.26–0.87)	0.016+
Religion		0.017*		
Traditionalism	Ref			
Islam	2.32 (1.27-4.23)	0.006	2.90 (1.43–5.89)	0.003+
Christianity	1.62 (0.87–3.00)	0.125	2.15 (1.06–4.39)	0.035+
Number of children		0.096*		
1-4	Ref			
5–9	1.96 (0.85–4.56)	0.116	1.79 (0.73–4.39)	0.200
Age caregivers		0.824*		
Less than 30	Ref			
30–40	1.05 (0.69–1.60)	0.829	1.11 (0.69–1.81)	0.654
More than 40	1.20 (0.67–2.16)	0.537	1.33 (0.69–2.57)	0.397
Monthly income		0.256*		
Extreme poverty	Ref			
Poverty	1.57 (0.88–2.79)	0.126	1.40 (0.76–2.59)	0.276
Above poverty	0.48 (0.86–2.11)	0.193	1.34 (0.76–2.33)	0.309
Caregivers knowledge		0.927		
Poor knowledge	Ref			
Good knowledge	1.05 (0.39–2.78)	0.927	0.929 (0.34–2.56)	0.887

 Table 5
 Predictors of Acceptability of SMC among Caregivers in Wa and Lawra districts (N=495)

* Likelihood Ratio Test p-value or Global p-value (LRT p); LR chi²(14) = 22.97; p-value = 0.0608; Pseudo R2 = 0.0385; and Hosmer–Lemeshow chi²(8) = 8.82 (p-value = 0.358); + : p-value < 0.05

medications administered no more than 7 days back allowing the researchers to limit recall bias [29].

The observed high coverage of the first cycle of SMC is above the 95% coverage recommended by the WHO on SMC [30]. The measured estimate in this study is comparable to coverages in administrative reports from the 2 districts [31, 32]. This confirms that the entire study area was covered during the intervention deployment, suggesting that the door-to-door approach to medicine administration [28, 32], is adequate to reach almost all households and gives a high coverage [33].

About 4.2% (12/28) of the children who did not receive the medicines during the first cycle were sick (had malaria). This can be interpreted as compliance with SMC medicines administration guidelines, which requires referring to the nearest health facility all the children who already have febrile illness during the administration of the SMC medicines. At the health facility, the confirmed cases are treated following the malaria case management protocol recommended by the NMEP [28].

Overall, 70.9% (351/495) of the caregivers had good acceptability of the SMC. Acceptability of SMC was found to be high among caregivers and community members in an earlier qualitative study [33]. Socio-demographic factors, such as religion and tertiary education, appeared to influence the acceptability of SMC. Other studies reported that the participant's religion may influence the adherence, uptake, and acceptability of the medication [18, 20, 34]. There is a general perception among people of African traditional beliefs that herbal medicines, or locally produced orthodox medicines are more desirable, in part, because they are perceived to be natural as opposed to synthetic products [35]. This could be the reason why traditionalists found the SMC medication less acceptable than Christians and Muslims. On the other hand, the decisions of both Christians and Muslims in relation to participation in health interventions are inspired by the statutes of God to maintain a healthy life [36, 37]. It is possible that Christians and Muslims in this study understood the importance of SMC during health educational campaigns and considered intake of supplied medicines as a means of securing quality health status. Further studies will be needed to understand the peculiarities of Muslims and Christians in promoting SMC acceptability.

The authors observe that the high level of knowledge (96%) and perception (95%) of SMC among caregivers do not translate into an equally high level of acceptability (70%). In the current study, 2.5% (7/28) of caregivers did not want their children to receive the SMC intervention. Furthermore, of those that received the treatment, it is concerning that (17.2%) of caregivers had leftover amodiaquine tablets—a reflection of some level of poor acceptability of the intervention, albeit low. The researchers were limited in documenting the reasons why caregivers did not want their children to receive treatment because of the design of the SANOFI tool. An earlier qualitative study in Lawra observed that some community members' have negative attitudes, and lack trust resulting in their children not receiving the SMC medication, or keeping medicines after receiving it [38]. In other Mass Drug Administration (MDA) studies, the fear of adverse effects following drug administration prevented caregivers from accepting MDA [20, 39, 40]. The few children who did not receive treatment might quickly develop parasitaemia if exposed to mosquito bites, potentially serving as reservoirs of infection for other children within the community, including those who received SMC medicines [35].

The control and elimination of malaria also require the reduction of reservoirs [41]. Although the prophylaxis offered by sulfadoxine/pyrimethamine and amodiaquine is supposed to cover 1 month (the period between two cycles), a study conducted in the Ashanti region of Ghana demonstrated that some children acquired the parasite infection in between cycles [42]. Therefore, it is important to have fewer reservoirs to limit the parasite in the environment [41], which also lowers the risk of selected resistant parasites [12]. This practice of not adhering fully to treatments can potentially derail the effort of programme managers to reduce morbidity and mortality associated with malaria among under-fives. Adherence counseling should be reinforced as part of the delivery of the SMC intervention.

A limitation of this study is the use of the Likert scale to measure the perceptions of caregivers and the reaction of children to SMC medicines because some caregivers are likely to avoid extreme values on Likert scales [43]. Also, while the study indirectly captured reasons for children not receiving SMC medication, it did not explicitly ask questions about fear or experiences of adverse drug reactions, which can, for some caregivers, influence their responses. Furthermore, like other analytical cross-sectional study designs, the factors associated with the primary outcome may not be causal [44].

Conclusion

Despite the high coverage, perception, and acceptability of SMC, a few caregivers were unwilling to receive the SMC treatment while others did not adhere fully to the SMC treatment. These practices are likely to accelerate anti-malarial drug resistance (AMR). Caregivers' religious beliefs were significantly associated with SMC acceptability. Health authorities and stakeholders can work towards bridging the gap between the knowledge and SMC treatment practices of caregivers through continuous education, adherence counseling, surveillance, and effective monitoring of SMC practices in malaria-endemic countries.

Abbreviations

- ACT Artemisinin-based combination therapy
- AL Artemether–lumefantrine
- aOR Adjusted odds ratio
- cOR Crude odds ratio
- AQ Amodiaquine
- HPV Human papillomavirus
- MDA Mass Drug Administration
- NMEP National Malaria Elimination Programme
- SMC Seasonal Malaria Chemoprevention
- VIF Variance Inflation Factor
- UWR Upper West Region, Ghana
- WHO World Health Organization

Supplementary Information

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Supplementary Material 1

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Author contributions

YD and HAB conceptualized and designed the study. YD collected the data under the supervision of HAB. MMO, CA and JN assisted YD in analyzing and interpreting the data. MMO was on the D43 TW010055 funding from the Fogarty International Centre of the National Institutes of Health, US for his PhD at the time of the study. HAB supported four of the authors: MMO, RBA, CEA, and YD to draft sections of the manuscript, with high level input from JN. All authors reviewed and approved the final manuscript.

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Availability of data and materials

The data supporting the study findings is available from the corresponding author (habonful@ug.edu.gh) upon reasonable request.

Declarations

Ethics approval and consent to participate

The Ethics Review Committee of the Ghana Health Service granted ethical approval under the number 071/03/20. Caregivers who accepted to participate in the study were required to sign or thumbprint on the informed consent forms.

Consent for publication

Non applicable.

Competing interests

The authors declare no competing interests.

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