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Sex of household head and trends in uptake of sulfadoxine-pyrimethamine intermittent preventive treatment for malaria during pregnancy: insights from secondary data in sub-Saharan Africa

Benjamin Kobina Kwansa[1,2] · Deborah Atobrah[1,2] · Emmanuel Anongeba Anaba[2,3] · Abena Kyere[2] · Irene Akwo Kretchy[2,4]

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Abstract

Background Malaria in pregnancy remains a serious public health concern in sub-Saharan Africa. The household head as a primary decision-maker plays a major role in women's utilization of maternal health services. This study aimed to examine the trends, and the association between the sex of household head and the uptake of intermittent preventive treatment of malaria in pregnancy using sulfadoxine-pyrimethamine (IPTp-SP) in six sub-Saharan African countries. The findings provide insight into the progress, status and gender-specific barriers to IPTp-SP uptake.

Methods Secondary data from the most recent Malaria Indicator Surveys for the six countries were analysed. A total of 15,452 (weighted) women aged 15–49 years from the six countries were included in this study. Both descriptive and inferential statistics were computed, including a chi-square test and binary logistic regression.

Results The pooled data showed that 77% of the participants took at least one dose of IPTp-SP and 37% took ≥ 3 doses. The trend analysis showed that the uptake of IPTp-SP has increased over time. Women with a female household head (AOR = 1.21, 95% CI 1.08–1.38) had higher odds of taking ≥ 3 doses of IPTp-SP compared to those with a male household head.

Conclusion The findings suggest that promoting women's participation in decision-making and leadership at the household level may help increase the uptake of IPTp-SP in sub-Saharan Africa.

Keywords Malaria in pregnancy · Intermittent preventive treatment · Sulfadoxine-pyrimethamine · Sex of household head · Sub-Saharan Africa

Abbreviations

IPTp-SP	Intermittent preventive treatment for malaria in pregnancy using Sulfadoxine-Pyrimethamine
MIS	Malaria indicator survey

✉ Deborah Atobrah, datobrah@ug.edu.gh | [1]Institute of African Studies, University of Ghana, Accra, Ghana. [2]Centre for Gender Studies and Advocacy, University of Ghana, Accra, Ghana. [3]School of Public Health, University of Ghana, Accra, Ghana. [4]School of Pharmacy, University of Ghana, Accra, Ghana.

1 Introduction

Malaria remains a serious health threat in several parts of the world, but its burden is disproportionately high in Africa [1]. Globally, about 250 million malaria cases and 608,000 related deaths were reported in 2022 [2], with over 90% of the malaria cases occurring in sub-Saharan Africa. Nigeria, Uganda, Mozambique and DR Congo contributed to more than 50% of the malaria cases in 2022 [3]. Almost all malaria infections in Africa are caused by the Plasmodium falciparum parasite [4]. Pregnant women and children under five years of age bear the brunt of malaria in sub-Saharan Africa [1]. In 2021, more than 13 million malaria cases were reported among pregnant women in sub-Saharan Africa [5]. In the same year, malaria in pregnancy accounted for 11% and 20% of neonatal deaths and stillbirths, respectively [5]. Malaria in pregnancy is a risk factor for low birthweight and anaemia [6]. Newborns of mothers infected with malaria are at a higher risk of complications of placental malaria and death [3].

Intermittent preventive treatment for malaria in pregnancy using Sulfadoxine-Pyrimethamine (IPTp-SP) has been recommended by the World Health Organization (WHO) for the prevention of malaria in pregnancy in malaria-endemic regions. Sulfadoxine-pyrimethamine is an antimalarial drug administered to women at sixteen weeks of pregnancy, irrespective of their malaria infection status [2]. It is administered through directly observed therapy during antenatal care visits [7]. WHO recommends that women take three or more doses during pregnancy for optimal protection against malaria infection [8]. There is evidence to show that IPTp-SP is effective in preventing malaria during pregnancy and in newborns [9]. It is effective in reducing fetal anaemia, low birth weight and neonatal deaths [10, 11]. Optimal uptake of IPTp-SP (three or more doses) is beneficial to both the mother and her child [12]. For instance, cross-sectional data from 32 African countries revealed that children born to mothers who took optimal doses of SP during pregnancy were 18% protected against neonatal death and less likely to be underweight compared to their counterparts [13].

Generally, the uptake of optimal doses of IPTp-SP among women in most sub-Saharan African countries has increased over the past two decades. For instance, in Ghana, the coverage was 39% in 2014, which increased to 60.2% in 2022 [14, 15]. Countries with historically low uptake of IPTp-SP have seen a considerable increase over the past decade. For example, between 2010 and 2021, the coverage increased more than two times in Nigeria, from 13 to 31% respectively [16, 17]. In addition, Cameroon reported a significant increase between 2011 and 2022, thus from 12 to 46% respectively [18]. Similar trends have been reported in other sub-Saharan African countries. Despite the enormous benefits associated with IPTp-SP, uptake among women in sub-Saharan Africa is below expectations [19]. Earlier studies using pooled data from sub-Saharan Africa found that the coverage of IPTp-SP ranged between 29.5% in 2018 and 30.7% in 2021 [20, 21]. Optimal use of SP during pregnancy is associated with higher educational and wealth status of the woman, exposure to malaria messages on mass media, and low parity [22, 23]. Additionally, optimal IPTp-SP uptake is influenced by factors at various levels, including social-cultural factors at the household level. For instance, women who get support from their social networks, such as partners and household heads, are more likely to take optimal doses of SP [24].

Moreover, the sex of the household head is a major determinant of the utilization of maternal health services, including antenatal care [25, 26]. The household head is "the person in the household who is primarily responsible for household affairs and is acknowledged as the head by the other members" [15]. For example, Ghatak and Dutta [25] found that women with a female household head had reduced odds of using antenatal care, skilled delivery and postnatal care compared to their counterparts. In the quest to achieve the Sustainable Development Goals, especially goal five (achieve gender equality and empower all women and girls) [27], several countries are investing in women's empowerment and participation in decision-making at all levels, including the household [28]. The literature on the sex of household heads and IPTp-SP uptake is inconsistent. For instance, Darteh et al. [20] found no significant relationship between the sex of household head and IPTp-SP among women in twelve sub-Saharan African countries. However, a study in Guinea revealed that women with a male household head were less likely to use malaria preventive measures, including optimal uptake of IPTp-SP [29]. Male and female household heads may understand the importance of IPTp-SP differently, which could affect uptake. Therefore, the inconsistent evidence regarding the sex of household head and IPTp-SP uptake warrants further investigation. This will provide insight into gender-specific barriers to IPTp-SP uptake.

Additionally, a few studies have compared IPTp-SP uptake in multiple countries in sub-Saharan Africa using relatively old data, ranging from 2014 to 2019 [20, 21, 23]. These studies may not represent current trends and emerging patterns, making the findings less actionable and applicable to the present context. Again, prior studies gave

limited attention to the trends in IPTp-SP uptake (changes in uptake over time). Investigating the trends in IPTp-SP uptake is essential for evaluating the effectiveness of malaria prevention programs and identifying challenges in their implementation as well as tracking progress towards WHO recommendations. This study focused on six sub-Saharan African countries including Cameroon, Ghana, Mali, Niger, Nigeria and Uganda. Seventy percent of the global malaria burden in 2022 was concentrated in these and other countries [5]. Additionally, these countries have conducted recent Malaria Indicator Surveys. This study focused on trends and influences of the sex of household head on IPTp-SP uptake using recent data from 2019 to 2022 Malaria Indicator Surveys, which makes it different from existing studies. With the up-to-date data, we are thus able to assess changes in IPTp uptake over time, which is essential for evaluating the effectiveness of malaria prevention programmes and identifying challenges in their implementation as well as tracking progress towards malaria-related targets.

This study aimed to examine the trends, and association between the sex of household head and optimal uptake of IPTp-SP in six sub-Saharan African countries using recent nationally representative data. The significance of the study includes providing empirical evidence on the progress and status of IPTp-SP uptake in sub-Saharan Africa. The findings will enhance stakeholders understanding of household leadership dynamics and uptake of malaria prevention interventions. Above all, the findings will inform the design of malaria prevention interventions, strategies, policies and future research.

2 Methods

2.1 Data source

This study analysed the recent Malaria Indicator Survey (MIS) data from six malaria-endemic countries in sub-Saharan Africa, including Uganda (2018/19 MIS), Ghana (2019 MIS), Niger (2021 MIS), Nigeria (2021 MIS), Mali (2021 MIS) and Cameroon (2022 MIS) (Fig. 3). The MIS is conducted in several countries across the globe with technical and financial support from the USAID and ICF International. MIS seeks to provide quality data for the implementation and monitoring of malaria control programs. The survey measures key malaria-related indicators, such as mosquito net ownership and use, anaemia, malaria, knowledge about malaria prevention and treatment, exposure to malaria information, and IPTp-SP use during pregnancy, among others. Additionally, the MIS collects data on key sociodemographic factors, including age, educational status, wealth index, parity, place of residence and sex of household head. The target population for MIS include women of reproductive age (15–49 years). The MIS employs a stratified two-stage cluster sampling procedure. Before sampling the respondents, the administrative regions in the country are stratified into rural and urban areas. The first stage of the sampling procedure involves selecting enumeration areas or clusters based on probability-proportional to size. The second stage of the sampling comprises systematically listing and sampling households from each cluster and eligible women from the households. Data collection was done by trained field enumerators using a structured questionnaire. Details about the MIS are provided elsewhere (https://dhsprogram.com/).

2.2 Study variables

The outcome variable of interest in this study was the optimal uptake of IPTp-SP (≥ 3 doses) during pregnancy. The MIS measured this variable using two related research questions. First of all, the participants were asked if they took SP during pregnancy to prevent malaria. A follow-up question was asked about the number of SP doses they took during pregnancy. In this study, we recoded the responses into a binary outcome for the logistic regression (1–2 doses = 0; ≥ 3 doses = 1). The outcome was categorised based on WHO's recommendation.

The independent variable in this study was the sex of the household head coded as (Male = 1 and Female = 2). The covariates included age of the respondent categorised as 15–19, 20–24, 25–29, 30–34, 35–39, 40–44 and 45–49 years. Additionally, the educational status (no education = 1, primary = 2, secondary = 3, and higher = 5) of the respondent and household wealth index (poorest = 1, poor = 2, middle = 3, richer = 4 and richest = 5) were included in this analysis. Place of residence (urban = 1 and rural = 2) and number of children ever born (1–3 children = 1, 4–6 children = 2 and ≥ 7 children = 3) were included in the models. Other covariates include the respondent sleeping under a mosquito net, awareness of malaria preventive medication, exposure to malaria information and the source of the information (radio, television and community health workers), all coded as No = 1 and Yes = 2. The predictors were selected based on the literature,

availability in all the datasets of the six countries and had no missing data. The country of the survey was included in the pooled analysis, coded as Ghana = 1, Uganda = 2, Niger = 3, Nigeria = 4, Cameroon = 5 and Mali = 6.

2.3 Statistical analysis

The statistical analysis was done using Stata/SE version 17. The data were analysed in three levels, including univariable, bivariable and multivariable. At the univariable level, descriptive statistics, including frequencies and percentages were used to analyse participant characteristics and prevalence of IPTp-SP uptake. The chi-square test was used at the bivariable level to assess the association between IPTp-SP uptake and the sex of the household head. Two models, including crude odd ratios (COR) and adjusted odd ratios (AOR), binary logistic regression, were computed at the multivariable level to identify significant predictors of taking ≥ 3 doses of IPTp-SP during pregnancy. Variables that were statistically significant (p value < 0.05) at the crude level were included in the adjusted regression model. Trends in SP uptake were estimated using data from three recent surveys (either DHS or MIS) in each of the six countries with the aid of STATcompiler (https://www.statcompiler.com/en/). The results were presented in tables and graphs at both the country level and pooled data. We employed the variance inflation factor (VIF) to test for multicollinearity and the results showed that the maximum VIF was less than 5. Based on this result, there was no evidence of collinearity among the independent variables. Clustering, stratification and sample weight were adjusted by applying the inherent sampling weight (v005/1000000) and the survey ('SVY') command in STATA, version 17 [20]. To avoid misclassification, the clusters and strata were assigned unique identifiers in the pooled data. The regression model was adjusted to account for covariates and sample weight. The odd ratios were reported at a 95% confidence interval and 0.05 significance level. The goodness of fit of the models was tested using the Hosmer–Lemeshow test (p value > 0.05).

2.4 Ethical considerations

The de-identifiable data analysed in this study was obtained from the DHS program through a formal request. We received authorization before the datasets were downloaded, cleaned and analysed. Therefore, Institutional Review Board (IRB) approval was not required.

3 Results

3.1 Participant characteristics

The results showed that Ghana (30%) had the highest proportion of female household heads, followed by Uganda (24.9%), while Mali (4.2%) had the lowest. A considerable proportion of the participants were in their twenties: Mali (49.5%), Niger (51.3%), Cameroon (53.9%), Nigeria (48.5), Ghana (50.3%) and Uganda (53.1%). More than half of the participants in Mali (67%) and Niger (72.3%) had no formal education, while 53.2% and 54.6% of those in Ghana and Uganda had secondary and primary education, respectively. The pooled analysis showed that 12.3% of the household heads were females, 50.7% of the participants were in their twenties, 45% had no formal education and 43.5% were in the poor wealth index. In addition, seven in ten participants resided in rural areas, 52.9% had given birth to less than four children and 70% slept under mosquito nets. It was found that only 10% knew about malaria preventive medication, and 44% had heard or seen malaria messages in the last six months. Regarding the source of malaria messages, 16.3%, 10.9%, and 11.5% of the participants heard on radio, television and from a community health worker, respectively (Table 1).

3.2 Uptake of IPTp-SP among women in six sub-Saharan African countries

The pooled analysis showed that 77%, 59.3% and 36.8% of the participants took one, two and three doses of SP, respectively. More than half of the participants in all the countries took at least one dose of SP. Except in Nigeria, over 50% of the participants took two doses of SP during pregnancy. Regarding optimal uptake of SP (≥ 3 doses), Ghana had the highest prevalence of 61%, while Niger (25%) had the lowest prevalence (Fig. 1).

Table 1 Characteristics of participants from six sub-Saharan African countries

Characteristic	Mali (n = 3665) n (%)	Niger (n = 2066) n (%)	Cameroon (n = 1746) n (%)	Nigeria (n = 4086) n (%)	Ghana (n = 1151) n (%)	Uganda (n = 2739) n (%)	Total (n = 15,453) n (%)
Sex of household head							
Male	3512 (95.8)	1946 (94.2)	1389 (79.6)	3849 (94.2)	805 (70.0)	2056 (75.1)	13,557 (87.7)
Female	153 (4.2)	120 (5.8)	357 (20.4)	238 (5.8)	346 (30.0)	683 (24.9)	1896 (12.3)
Age of respondent							
15–19	452 (12.3)	237 (11.5)	185 (10.6)	312 (7.6)	88 (7.7)	276 (10.1)	1550 (10.0)
20–24	893 (24.4)	547 (26.5)	463 (26.5)	907 (22.2)	245 (21.3)	792 (28.9)	3848 (24.9)
25–29	918 (25.1)	513 (24.8)	478 (27.4)	1076 (26.3)	334 (29.0)	667 (24.2)	3985 (25.8)
30–34	737 (20.1)	403 (19.5)	347 (19.9)	954 (23.4)	244 (21.2)	541 (19.8)	3226 (20.9)
35–39	447 (12.2)	232 (11.2)	199 (11.4)	546 (13.4)	173 (15.0)	338 (12.3)	1935 (12.5)
40–44	173 (4.7)	103 (5.0)	62 (3.5)	224 (5.5)	55 (4.8)	109 (4.0)	726 (4.7)
45–49	45 (1.2)	31 (1.5)	12 (0.7)	67 (1.6)	12 (1.0)	16 (0.6)	183 (1.2)
Educational status							
None	2457 (67.0)	1493 (72.3)	414 (23.7)	1825 (44.6)	224 (19.5)	478 (17.5)	6890 (44.6)
Primary	559 (15.3)	327 (15.8)	452 (25.9)	624 (15.3)	248 (21.6)	1497 (54.6)	3708 (24.0)
Secondary	599 (16.3)	231 (11.2)	712 (40.8)	1229 (30.1)	612 (53.2)	630 (23.0)	4013 (26.0)
Higher	50 (1.4)	15 (0.7)	168 (9.6)	408 (10.0)	67 (5.8)	134 (4.9)	842 (5.4)
Wealth index							
Poorest	733 (20.0)	442 (21.4)	386 (22.1)	840 (20.6)	242 (21.0)	780 (28.5)	3422 (22.1)
Poorer	739 (20.2)	402 (19.4)	390 (22.4)	906 (22.2)	266 (23.1)	611 (22.3)	3314 (21.4)
Middle	781 (21.3)	434 (21.0)	347 (19.9)	836 (20.5)	232 (20.2)	477 (17.4)	3106 (20.1)
Richer	762 (20.8)	388 (18.8)	319 (18.3)	734 (18.0)	222 (19.3)	428 (15.6)	2855 (18.5)
Richest	650 (17.7)	400 (19.4)	304 (17.4)	770 (18.8)	189 (16.5)	443 (16.2)	2756 (17.8)
Place of residence							
Urban	746 (20.3)	349 (16.9)	804 (46.1)	1162 (28.4)	500 (43.4)	835 (30.5)	4396 (28.4)
Rural	2919 (79.7)	1717 (83.1)	942 (53.9)	2924 (71.6)	651 (56.6)	1904 (69.5)	11,057 (71.6)
Number of children							
01-Mar	1796 (49.0)	936 (45.3)	985 (56.4)	2198 (53.8)	766 (66.5)	1499 (54.7)	8179 (52.9)
04-Jun	1232 (33.6)	705 (34.1)	507 (29.1)	1284 (31.4)	318 (27.7)	810 (29.6)	4858 (31.4)
≥ 7	637 (17.4)	425 (20.6)	254 (14.5)	604 (14.8)	67 (5.8)	430 (15.7)	2416 (15.6)
Slept under a mosquito net							
No	684 (18.7)	200 (9.7)	580 (33.2)	2097 (51.3)	458 (39.8)	693 (25.3)	4712 (30.5)
Yes	2981 (81.3)	1866 (90.3)	1166 (66.8)	1989 (48.7)	693 (60.2)	2046 (74.7)	10,741 (69.5)
Know about preventive malaria medication							
No	3117 (85.0)	1645 (79.6)	1570 (89.9)	3778 (92.5)	1110 (96.4)	2610 (95.3)	13,830 (89.5)
Yes	548 (15.0)	421 (20.4)	176 (10.1)	308 (7.5)	41 (3.6)	129 (4.7)	1623 (10.5)
Seen/heard malaria message							
No	2006 (54.7)	1219 (59.0)	745 (42.6)	2374 (58.1)	434 (37.7)	1778 (64.9)	8556 (55.4)
Yes	1659 (45.3)	847 (41.0)	1001 (57.4)	1712 (41.9)	717 (62.3)	961 (35.1)	6897 (44.6)
Heard MM on radio							
No	2903 (79.2)	1884 (91.2)	1673 (95.8)	3457 (84.6)	885 (76.9)	2135 (77.9)	12,938 (83.7)
Yes	762 (20.8)	182 (8.8)	73 (4.2)	629 (15.4)	266 (23.1)	604 (22.1)	2515 (16.3)
Seen MM on television							
No	3181 (86.8)	2006 (97.1)	1563 (89.5)	3782 (92.5)	699 (60.7)	2535 (92.6)	13,765 (89.1)
Yes	484 (13.2)	60 (2.9)	183 (10.5)	304 (7.5)	452 (39.3)	204 (7.4)	1688 (10.9)
Heard MM from a CHW							
No	3332 (90.9)	1907 (92.3)	1406 (80.5)	3603 (88.2)	1070 (93.0)	2364 (86.3)	13,682 (88.5)
Yes	333 (9.1)	159 (7.7)	340 (19.5)	483 (11.8)	81 (7.0)	375 (13.7)	1771 (11.5)

Table 1 (continued)

CHW community health worker, *MM* malaria message

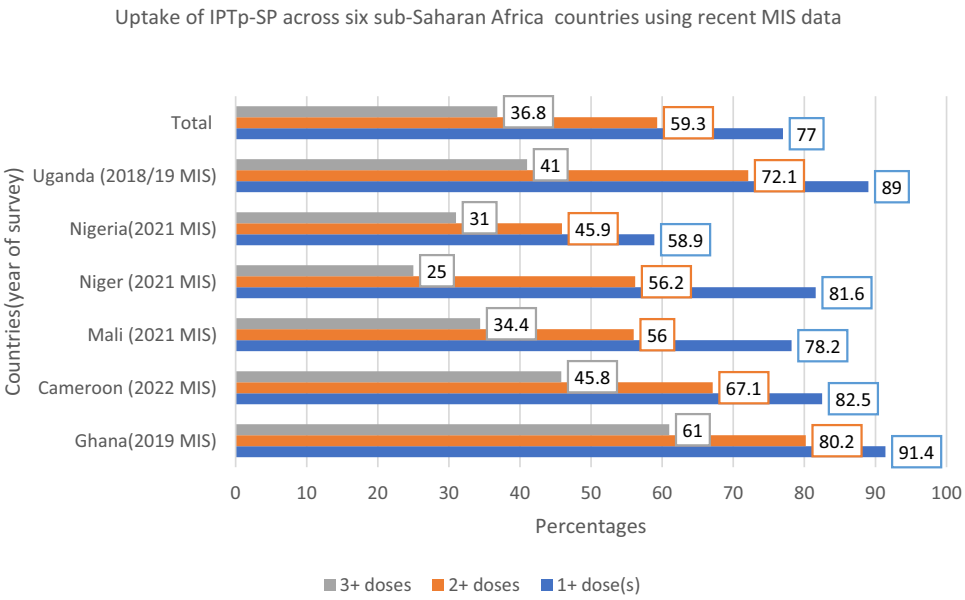

Fig. 1 Bar chart showing uptake of IPTp-SP across the six sub-Saharan Africa countries using recent MIS

3.3 Trend in IPTp-SP uptake among women in six sub-Saharan African countries

Data from the last three surveys showed an inconsistent trend in optimal uptake of IPTp-SP across the six countries. There was a consistent increase in IPTp-SP uptake in Cameroon, Niger and Mali. For instance, in Cameroon, it increased from 12% in 2011 to 31.9% in 2018 and 45.8% in 2022. However, the margin between 2011 and 2018 (19.9%) was higher than the margin between 2018 and 2022 (13.9%). Similarly, there was a consistent increase in IPTp-SP uptake in Niger, increasing from 0.4% in 2006 to 9.1% in 2012 and 25% in 2021. Between 2006 and 2012, it increased by 8.7% and 15.9% between 2012 and 2021. In Mali, IPTp-SP uptake increased from 12% in 2015 to 28.3% in 2018 and 34.4% in 2021. On the contrary, an inconsistent trend was observed in Ghana, Uganda and Nigeria. For instance, IPTp-SP uptake increased from 59.6% in 2016 to 61% in 2019 but declined slightly in 2022 (60.2%) in Ghana. In Uganda, the uptake of IPTp-SP declined from 27.5% to 17.2% (a difference of −10.3%) over a period of two years, from 2014 to 2016. However, between 2016 and 2018, IPTp-SP uptake increased considerably, from 17.2% to 41% (a difference of 23.8%). In Nigeria, IPT-p-SP uptake declined by 4.8% between 2015 (21.4%) and 2018 (16.6%) but increased to 31% in 2021(Fig. 2).

3.4 Association between sex of household head and uptake of IPTp-SP

The pooled analysis showed that there was a statistically significant association between the sex of the household head and the uptake of IPTp-SP. For instance, a higher proportion of participants with a female household head (85%) took at least one dose of IPT-p-SP compared to those with a male household head (75.8%). Similarly, most of the participants with a female household head (68.9%) took at least two doses of SP compared to their counterparts (58%). Regarding optimal uptake of IPTp-SP, the prevalence was higher among participants with a female household head (44%) than those with a male household head (35.8%) (Table 2).

3.5 Crude analysis of factors associated with optimal uptake of IPTp-SP among participants

The pooled analysis showed that participants with a female household head (COR = 1.4, 95% CI 1.24–1.58) were more likely to take ≥ 3 doses of IPTp-SP compared to their counterparts in male-headed households. Additionally, the odds

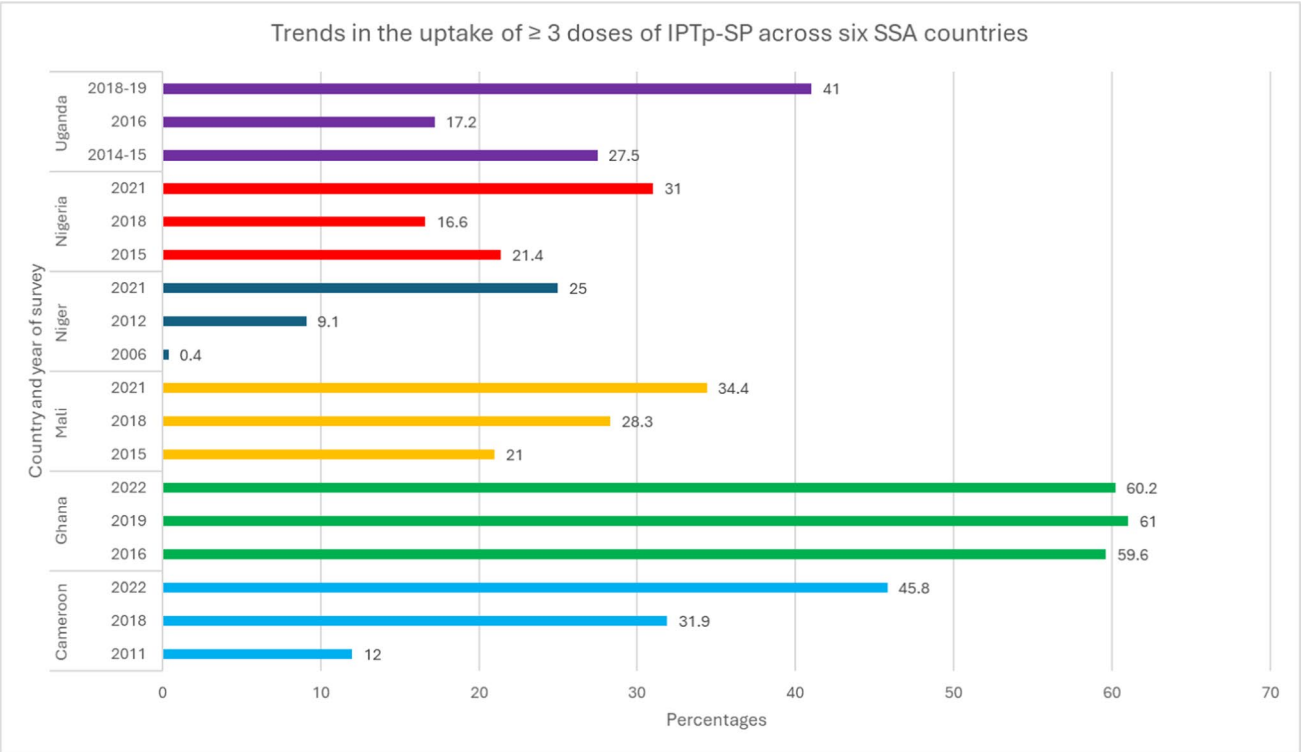

Fig. 2 A graph showing the trends in the uptake of ≥ 3 doses of IPTp-SP across six sub-Saharan Africa countries over time (2006–2022)

Table 2 Cross-tabulation of sex of household head and uptake of IPTp-SP

Number IPTp-SP doses	Sex of household head		
	Male n (%)	Female n (%)	Chi-square test
At least one dose of IPTp-SP			
No	3275 (24.2)	285 (15.0)	41.00***
Yes	10,282 (75.8)	1611 (85.0)	
Total	13,557 (100)	1896 (100)	
At least two doses of IPTp-SP			
No	5698 (42.0)	589 (31.1)	
Yes	7859 (58.0)	1307 (68.9)	45.44***
Total	13,557 (100)	1896 (100)	
At least three doses of IPTp-SP			
No	8705 (64.2)	1062 (56.0)	31.11***
Yes	4852 (35.8)	834 (44.0)	
Total	13,557 (100)	1896 (100)	

***p value < 0.001

of IPTp-SP uptake increased with education, where participants with higher education (COR = 2.30, 95% CI 1.84–2.88) had increased odds of optimal uptake. Similarly, participants in the richest wealth index (COR = 1.73, 95% CI 1.48–2.01) were about two times more likely to take ≥ 3 doses compared to those in the poorest wealth index. Participants aged 35–39 years (COR = 1.25, 95% CI 1.05–1.48) were 25% times more likely to take ≥ 3 doses compared to those aged 15–19 years. The odds of IPTp-SP uptake increased among participants who had heard about malaria in the last six months (COR = 1.45, 95% CI 1.33–1.58). Regarding the source of information, the odds of IPTp-SP uptake were higher among those who heard about malaria on the radio (COR = 1.46, 95% CI 1.31–1.62), television (COR = 1.95, 95% CI 1.72–2.22) and from a community health worker (COR = 1.25, 95% CI 1.10–1.43). However, participants in rural areas and those with

seven or more children had decreased odds of IPTp-SP uptake. The odds of uptake were higher for participants in Ghana than those in the other countries.

The country-level analysis showed that optimal uptake of IPTp-SP was significantly associated with older age among participants in Ghana, Nigeria and Niger. There was a significant association between educational status and IPTp-SP uptake among participants in Ghana, Nigeria, Cameroon and Mali. The wealth index was a significant predictor of optimal uptake of SP among pregnant women in Nigeria, Cameroon, Niger and Mali. Additionally, participants residing in the rural parts of Mali and Nigeria were less likely to take ≥ 3 doses of SP during pregnancy. Parity significantly predicted optimal uptake of IPTp-SP in Nigeria and Niger, while sleeping under mosquito net was only significant in Uganda. Women in Uganda, Nigeria, and Cameroon who were aware of malaria preventive medication had increased odds of optimal uptake of SP during pregnancy. Moreover, exposure to malaria messages in the last six months of the survey was significantly associated with optimal uptake of SP during pregnancy among women in all the countries, except Uganda and Cameroon. Women who heard about malaria messages on the radio were more likely to take ≥ 3 doses of SP, except those in Cameroon and Niger. Exposure to malaria messages on television was a significant predictor of optimal uptake of SP among women in Nigeria, Niger and Mali. Finally, Nigerian women who heard about malaria messages from a community health worker had increased odds of taking optimal doses of SP during pregnancy (Table 3).

3.6 Adjusted analysis of factors associated with taking ≥ 3 doses of IPTp-SP among participants

We simultaneously adjusted for covariates that were significant at the crude analysis level. Adjusted analysis of the pooled data showed that optimal uptake of SP during pregnancy was influenced by the sex of household head, age, educational status, wealth index, and exposure to malaria messages on radio, television and from a community health worker. For example, women with a female household head (AOR = 1.21, 95% CI 1.08–1.38) had higher odds of receiving ≥ 3 doses of IPTp-SP during pregnancy compared to their counterparts. Women aged 40–44 years (AOR = 1.14, 95% CI 1.10–1.81) were more likely to take ≥ 3 doses compared to those aged 15–19 years. Also, women with higher education (AOR = 1.73, 95% CI 1.36–2.20) had increased odds of IPTp-SP uptake compared to those with no education. Women in the richer wealth index (AOR = 1.21, 95% CI 1.04–1.42) were more likely to take ≥ 3 doses of SP compared to those n the poorest wealth index (Table 4). The relationship between the sex of household head and uptake of IPTp-SP was no longer significant after adjusting for the country of the survey (Appendix 1).

At the country level, the adjusted analysis showed that the age of the participant was associated with optimal uptake of SP in Ghana and Niger. Ghanaian women aged 40–44 years (AOR = 2.68, 95% CI 1.09–6.59) and Nigerian women aged 45–49 years (AOR = 2.68, 95% CI 1.08–6.64) had increased odds of SP uptake compared to those aged 15–19 years. Educational status was significantly associated with SP uptake among participants in Ghana, Nigeria, Cameroon and Mali. Also, the wealth index influenced the optimal uptake of SP among women in Nigeria, Cameroon, Niger and Mali. Women in the rural parts (AOR = 0.79, 95% CI 0.64–0.98) of Nigeria were less likely to take ≥ 3 doses of SP compared to their counterparts. The odds of optimal uptake of SP were higher among women in Uganda (AOR = 1.91, 95% CI 1.28–2.83) Nigeria (AOR = 1.36, 95% CI 1.03–1.80) and Cameroon (AOR = 1.67, 95% CI 1.14–2.45), who knew about malaria preventive medication. Participants in Ghana (AOR = 1.56, 95% CI 1.09–2.23) and Mali (AOR = 1.39, 95% CI: 1.07–1.79) who heard about malaria messages on radio were more likely to take ≥ 3 doses of SP. Also, Malian women who heard about malaria messages from a community health worker (AOR = 1.66, 95% CI: 1.26–2.20) were 66% times more likely to take optimal doses of SP during pregnancy (Table 4).

4 Discussion

The results showed that the pooled prevalence of receiving ≥ 3 doses of IPTp-SP was 37 per cent. Earlier studies in sub-Saharan Africa also found suboptimal use of IPTp-SP among pregnant women [20, 21, 30]. For instance, a study among women in twelve sub-Saharan African countries found that three in ten women took ≥ 3 doses of IPTp-SP [20]. This disappointing finding suggests that it may be difficult for countries in sub-Saharan Africa to meet WHO's 2030 target of reducing the burden of malaria by at least 90% [2]. Going forward, governments and health agencies of the studied countries should enhance policy efforts such as leveraging community-based health workers (the majority of who are women), establishing a gender promotion unit within ANC clinics to promote gender-responsive ANC services or sending gender-sensitive messages to remind pregnant women about ANC visits and uptake of SP. In

Table 3 Crude logistic regression analysis of factors associated with taking ≥ 3 doses of IPTp-SP among participants

Predictors of taking ≥ 3 doses of IPTp-SP	Ghana COR (95% CI)	Uganda COR (95% CI)	Nigeria COR (95% CI)	Cameroon COR (95% CI)	Niger COR (95% CI)	Mali COR (95% CI)	Pooled data COR (95%)
Sex of household head							
Male	1 (ref)	1 (ef)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Female	0.77 (0.56–1.05)	1.07 (0.87–1.32)	1.22 (0.88–1.70)	1.10 (0.82–1.48)	0.85 (0.48–1.48)	1.34 (0.88–2.03)	1.40 (1.24–1.58)***
Age of respondent							
15–19	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
20–24	1.09 (0.60–1.98)	1.07 (0.78–1.47)	1.37 (1.00–1.89)*	0.95 (0.60–1.50)	1.55 (1.04–2.33)*	0.92 (0.68–1.25)	1.12 (0.96–1.30)
25–29	1.63 (0.92–2.89)	0.89 (0.64–1.25)	1.37 (0.99–1.90)	1.24 (0.74–2.09)	1.64 (1.05–2.56)*	1.02 (0.78–1.35)	1.20 (1.03–1.40)*
30–34	1.58 (0.95–2.64)	0.89 (0.63–1.25)	1.23 (0.87–1.72)	1.07 (0.68–1.69)	1.87 (1.20–1.90)**	1.08 (0.80–1.48)	1.15 (0.99–1.35)
35–39	1.55 (0.81–2.99)	1.11 (0.79–1.55)	1.66 (1.17–2.37)**	1.06 (0.62–1.80)	1.71 (0.98–2.99)	0.86 (0.60–1.24)	1.25 (1.05–1.48)*
40–44	2.95 (1.18–7.38)*	1.11 (0.63–1.95)	1.26 (0.83–1.90)	1.99 (0.96–4.10)	2.16 (1.09–4.28)*	0.74 (0.49–1.10)	1.21 (0.97–1.52)
45–49	0.96 (0.24–3.76)	0.39 (0.13–1.12)	1.12 (0.56–2.24)	1.66 (0.29–9.50)	3.00 (1.30–6.91)*	0.94 (0.44–2.01)	1.01 (0.70–1.46)
Educational status							
None	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Primary	0.60 (0.33–0.94)*	1.10 (0.82–1.49)	1.69 (1.30–2.20)***	1.14 (0.79–1.64)	1.17 (0.86–1.59)	1.23 (0.93–1.63)	1.53 (1.35–1.73)***
Secondary	0.92 (0.57–1.48)	0.97 (0.73–1.29)	1.87 (1.51–2.33)***	1.44 (1.01–2.06)*	1.02 (0.69–1.51)	1.42 (1.13–1.79)**	1.74 (1.55–1.96)***
Higher	1.34 (0.68–2.63)	0.92 (0.56–0.83)	2.48 (1.83–3.36)***	2.64 (1.33–5.24)	0.80 (0.244–2.69)	5.26 (2.91–9.50)***	2.30 (1.84–2.88)***
Wealth index							
Poorest	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Poorer	1.08 (0.71–1.64)	0.96 (0.70–1.31)	1.42 (0.97–2.06)	1.39 (0.94–2.05)	1.49 (0.94–2.36)	1.52 (1.02–2.25)*	1.24 (1.06–1.44)**
Middle	1.05 (0.65–1.70)	0.91 (0.69–1.20)	2.15 (1.55–2.97)***	1.34 (0.90–2.00)	1.72 (1.12–2.64)*	2.17 (1.42–3.31)***	1.45 (1.25–1.69)***
Richer	1.16 (0.71–1.90)	0.92 (0.64–1.32)	2.55 (1.82–3.57)***	1.61 (1.06–2.44)*	1.72 (1.11–2.66)*	2.15 (1.45–3.17)***	1.57 (1.35–1.83)***
Richest	0.99 (0.57–1.71)	1.00 (0.77–1.30)	2.72 (1.94–3.82)***	2.17 (1.37–3.43)**	1.69 (1.06–2.69)*	2.75 (1.84–4.11)***	1.73 (1.48–2.01)***
Place of residence							
Urban	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Rural	1.12 (0.81–1.53)	1.01 (0.81–1.27)	0.61 (0.50–0.75)***	0.92 (0.67–1.25)	1.09 (0.79–1.40)	0.64 (0.50–0.83)**	0.70 (0.63–0.77)***
Number of children							
01-Mar	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
04-Jun	0.88 (0.65–1.21)	0.99 (0.76–1.29)	0.82 (0.70–0.98)*	0.81 (0.61–1.06)	1.33 (1.02–1.74)*	0.94 (0.78–1.14)	0.88 (0.80–0.97)*
≥ 7	1.24 (0.69–2.26)	0.79 (0.58–1.09)	0.84 (0.68–1.04)	0.94 (0.62–1.43)	1.32 (0.91–1.90)	0.79 (0.61–1.01)	0.80 (0.71–0.90)**
Slept under a mosquito net							
No	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Yes	1.06 (0.76–1.48)	1.51 (1.07–2.14)*	1.17 (0.96–1.41)	0.98 (0.73–1.32)	1.15 (0.71–1.87)	0.89 (0.69–1.14)	1.05 (0.94–1.18)
Aware of malaria preventive medication							
No	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)

Table 3 (continued)

Predictors of taking ≥ 3 doses of IPTp-SP	Ghana COR (95% CI)	Uganda COR (95% CI)	Nigeria COR (95% CI)	Cameroon COR (95% CI)	Niger COR (95% CI)	Mali COR (95% CI)	Pooled data COR (95%)
Yes	1.70 (0.84–3.45)	1.95 (1.33–2.88)**	1.66 (1.28–2.15)***	1.50 (1.02–2.20)*	1.37 (0.99–1.89)	0.95 (0.75–1.20)	1.12 (0.99–1.28)
Seen/ heard MM in 6 ms							
No	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Yes	1.38 (1.07–1.79)*	0.69 (0.62–1.26)	1.89 (1.60–2.24)***	1.30 (0.99–1.71)	1.37 (1.04–1.81)*	1.19 (0.99–1.42)*	1.45 (1.33–1.58)***
Heard MM on radio							
No	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Yes	1.54 (1.14–2.08)**	1.95 (1.47–2.58)***	1.59 (1.29–1.97)***	1.14 (0.71–1.80)	1.08 (0.68–1.73)	1.33 (1.08–1.64)**	1.46 (1.31–1.62)***
Seen MM on television							
No	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Yes	0.83 (0.55–1.26)	1.27 (0.85–1.89)	1.85 (1.37–2.51)***	1.42 (0.89–2.28)	1.84 (1.09–3.09)*	1.94 (1.53–2.45)***	1.95 (1.72–2.22)***
Heard MM from a CHW							
No	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Yes	1.28 (0.77–2.12)	1.00 (0.75–1.34)	1.64 (1.27–2.11)***	1.26 (0.93–1.71)	0.84 (0.49–1.42)	1.09 (0.79–1.50)	1.25 (1.10–1.43)***
Country							
Ghana	n/a	n/a	n/a	n/a	n/a	n/a	1 (ref)
Uganda							0.45 (0.37–0.54)***
Niger							0.21 (0.17–0.26)***
Nigeria							0.28 (0.23–0.34)***
Mali							0.33 (0.27–0.40)***
Cameroon							0.53 (0.43–0.67)***

n/a not applicable, *CHW* community health worker, *MM* malaria message, *ref* reference group

*p value < 0.05, **p value < 0.01; ***p value < 0.001

Table 4 Adjusted logistic regression analysis of factors associated with taking ≥ 3 doses of IPTp-SP among participants

Predictors of taking ≥ 3 doses of IPTp-SP	Ghana AOR (95% CI)	Uganda AOR (95% CI)	Nigeria AOR (95% CI)	Cameroon AOR (95% CI)	Niger AOR (95% CI)	Mali AOR (95% CI)	Pooled data AOR (95% CI)
Sex of household head							
Male	n/s	n/s	n/s	n/s	n/s	n/s	1 (ref)
Female							1.21 (1.08–1.38)**
Age of respondent							
15–19	1 (ref)	n/s	1 (ref)	n/s	1 (ref)	n/s	1 (ref)
20–24	1.02 (0.56–1.84)		1.16 (0.84–1.60)		1.43 (0.94–2.16)		1.10 (0.94–1.28)
25–29	1.50 (0.85–2.65)		1.05 (0.75–1.46)		1.45 (0.89–2.34)		1.19 (1.01–1.40)*
30–34	1.45 (0.84–2.50)		0.91 (0.63–1.30)		1.59 (0.94–2.70)		1.21 (1.02–1.45)*
35–39	1.38 (0.73–2.59)		1.22 (0.84–1.79)		1.55 (0.82–2.90)		1.36 (1.11–1.67)**
40–44	2.68 (1.09–6.59)*		1.03 (0.64–1.64)		1.93 (0.86–4.32)		1.14 (1.10–1.81)**
45–49	0.92 (0.23–3.63)		1.04 (0.51–2.14)		2.68 (1.08–6.64)*		1.33 (0.89–1.98)
Educational status							
None	1 (ref)	n/s	1 (ref)	1 (ref)	n/s	1 (ref)	1 (ref)
Primary	0.61 (0.39–0.96)*		1.29 (0.97–1.72)	1.07 (0.74–1.53)		1.12 (0.86–1.47)	1.43 (1.27–1.62)***
Secondary	0.95 (0.54–1.55)		1.34 (1.03–1.72)*	1.22 (0.83–1.78)		1.09 (0.84–1.42)	1.46 (1.29–1.67)***
Higher	1.21 (0.59–2.46)		1.60 (1.10–2.33)*	2.04 (0.99–4.17)*		3.42 (1.78–6.55)***	1.73 (1.36–2.20)***
Wealth index							
Poorest	n/s	n/s	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Poorer			1.28 (0.90–1.84)	1.33 (0.90–1.97)	1.50 (0.96–2.37)	1.48 (1.00–2.19)*	1.17 (1.01–1.36)*
Middle			1.74 (1.27–2.40)**	1.24 (0.84–1.84)	1.69 (0.10–2.59)*	2.05 (1.34–3.11)**	1.27 (1.10–1.48)**
Richer			1.73 (1.20–2.49)**	1.41 (0.91–2.19)	1.67 (1.09–2.58)*	1.94 (1.32–2.85)**	1.21 (1.04–1.42)*
Richest			1.52 (1.00–2.29)*	1.65 (1.06–2.57)*	1.61 (0.01–2.57)*	2.10 (1.24–3.56)**	1.02 (0.85–1.23)
Place of residence							
Urban	n/s	n/s	1 (ref)	n/s	n/s	1 (ref)	1 (ref)
Rural			0.79 (0.64–0.98)*			0.96 (0.65–1.42)	0.86 (0.75–0.98)*
Number of children							
01-Mar	n/s	n/s	1 (ref)	n/s	1 (ref)	n/s	1 (ref)
04-Jun			0.92 (0.77–1.11)		1.16 (0.84–1.61)		0.90 (0.81–1.01)
≥ 7			1.11 (0.85–1.44)		1.07 (0.65–1.75)		0.86 (0.73–1.01)
Slept under a mosquito bed net							
No	n/s	1 (ref)	n/s	n/s	n/s	n/s	n/s
Yes		1.49 (1.06–2.10)*					
Aware of malaria preventive medication							
No	n/s	1 (ref)	1 (ref)	1 (ref)	n/s	n/s	n/s
Yes		1.91 (1.28–2.83)**	1.36 (1.03–1.80)*	1.67 (1.14–2.45)**			

Table 4 (continued)

Predictors of taking ≥ 3 doses of IPTp-SP	Ghana AOR (95% CI)	Uganda AOR (95% CI)	Nigeria AOR (95% CI)	Cameroon AOR (95% CI)	Niger AOR (95% CI)	Mali AOR (95% CI)	Pooled data AOR (95% CI)
Seen/ heard MM in 6 ms							
No	1 (ref)	1 (ref)	1 (ref)	n/s	1 (ref)	1 (ref)	1 (ref)
Yes	1.12 (0.82–1.52)	1.35 (1.12–1.63)**	1.49 (1.19–1.88)**		1.30 (0.98–1.72)	0.79 (0.62–1.02)	1.12 (1.00–1.34)
Heard MM on radio							
No	1 (ref)	n/s	1 (ref)	n/s	n/s	1 (ref)	1 (ref)
Yes	1.56 (1.09–2.23)*		1.12 (0.85–1.48)			1.39 (1.07–1.79)*	1.20 (1.06–1.35)**
Seen MM on television							
No	n/s	n/s	1 (ref)	n/s	n/s	1 (ref)	1 (ref)
Yes			1.03 (0.73–1.45)			1.66 (1.26–2.20)***	1.43 (1.23–1.66)***
Heard MM from a CHW							
No	n/s	n/s	1 (ref)	n/s	n/s	n/s	1 (ref)
Yes			1.14 (0.85–1.52)				1.16 (1.00–1.34)*

CHW community health worker, *MM* malaria message, *ref* reference group, *n/a* not applicable, *n/s* not significant

*p value < 0.05, **p value < 0.01; ***p value < 0.001

the quest to increase IPTp uptake, it would be necessary for future studies to explore gender-based barriers to IPTp uptake among women in sub-Saharan Africa.

The trend analysis also showed that IPTp-SP uptake in the selected countries had assumed an upward trend. The observed increase in IPTp-SP uptake could be attributed to several factors. For instance, countries in sub-Saharan Africa have implemented strategies to increase coverage of IPTp-SP, including educating pregnant women about the benefits of taking antimalarial drugs [22]. Additionally, recent community-based initiatives might have contributed to the increase in IPTp-SP uptake. These initiatives include the training of community health workers to deliver crucial malaria information directly to households, raise awareness among community members through mass media and administer SP in communities [31, 32]. The findings could also be due to the increase in antenatal care visits across sub-Saharan African countries [33, 34]. There is a positive relationship between the frequency of antenatal care visits and the uptake of SP during pregnancy [35]. This is expected since IPTp-SP is administered through directly observed therapy during antenatal care visits. This reassuring finding implies that the burden of malaria in pregnancy may be reduced by 2030 if the uptrend in IPTp-SP uptake is not interrupted. This finding suggests that the upward trend in SP uptake could be sustained or improved if health agencies in the selected countries invest more in gender-sensitive awareness campaigns (i.e. educating men about the importance of male involvement in ANC) and ensure the availability of SP in health facilities. Future studies may need to explore whether the increase in SP uptake translates into improved maternal and neonatal health outcomes.

Consistent with previous studies [20, 21], this study found that the uptake of IPTp-SP was higher in Ghana. This finding is not surprising because Ghana is one of the countries in sub-Saharan Africa that has high ANC coverage, leading to an increase in SP utilization [36]. This finding could also be explained by factors such as health system initiatives. For instance, Ghana has implemented a Community-based Health Planning Services (CHPS), that brings maternal health services, including IPTp-SP, closer to people in rural communities [37]. Again, Ghana's National Health Insurance Scheme (NHIS) provides free maternal healthcare services [38], removing financial barriers to accessing ANC and IPTp-SP. There is a need for further research on the specific factors contributing to Ghana's higher IPTp uptake. With this understanding, stakeholders from other malaria-endemic countries may adopt Ghana's model of IPTp-SP delivery to help reduce the burden of malaria among pregnant women.

The analysis showed that pregnant women who had a female as a household head were more likely to take three or more doses of IPTp-SP compared to their counterparts. The findings of this study reflect those of Barry et al. [29] who also revealed that women with a female household head had increased odds of using malaria preventive measures, including optimal uptake of IPTp-SP. On the contrary, the finding of the current study contradicts earlier studies that found no significant relationship between the sex of the household head and uptake of IPTp-SP [20, 39]. A plausible explanation is that female household heads may have better health-seeking behaviours. Additionally, this finding could be explained by changes in gender norms in Africa, where more females are now taking part in decision-making at the household level [40]. This finding is expected because female household heads may know more about the benefits of IPTp-SP and pregnancy-related issues compared to male household heads, hence they (the former) are more likely to influence uptake. This suggests that empowering women to participate in decision-making at the household level may be helpful in the fight against malaria infections in pregnancy. For instance, economic empowerment programs such as microfinance schemes and conditional cash transfers might help increase women's participation in decision-making at the household level [41]. In addition, female household heads could be engaged to lead women's advocacy groups to provide peer education on the importance of IPTp-SP uptake during pregnancy.

In accordance with previous studies, the current study showed that optimal uptake of IPTp-SP was influenced by older age, higher educational status, higher wealth index [30], and exposure to malaria information on radio, television or from a community health worker [20–22]. These insightful findings may be explained by several factors. For instance, older women might have more experience in childbearing and more information about pregnancy-related issues and antenatal care compared to younger women. Additionally, women with higher education may have good health literacy and be more conscious about their health. Antenatal care visits may be associated with cost (i.e. transportation cost and service fee), especially in settings where maternal healthcare is not free or covered by health insurance. Hence, women in the poorest wealth index might not be able to make adequate antenatal care visits, leading to suboptimal uptake of IPTp-SP. Furthermore, women who are exposed to malaria messages may have more information about antimalarial drugs and the effects of malaria infection on maternal and child health outcomes, which may inform their health-seeking behaviours. Going forward, stakeholders should focus on promoting girl child education and financial empowerment of women to help increase IPTp uptake in Africa.

It was surprising to find that awareness of malaria preventive medication was not a significant predictor of IPTp-SP uptake across all the countries. The influence of awareness on IPTp-SP uptake may depend on several factors, including the availability of SP and proximity to health facilities. These factors may vary across countries. Additionally, differences in cultural factors such as preference for traditional medicine over orthodox medicine and gender-based barriers to accessing ANC might have reduced the impact of awareness on the uptake of IPTp-SP.

Several important actions need to be taken to help reduce the burden of malaria in pregnancy in sub-Saharan Africa. For instance, greater efforts are required to help increase IPTp-SP coverage in the selected countries. Stakeholders should leverage the mass media and community health workers to intensify gender-sensitive malaria prevention education, especially the benefits associated with receiving optimal doses of IPTP-SP during pregnancy. Going forward, interventions focusing on increasing IPTp-SP uptake should prioritize women of poor socioeconomic status, the less educated, and adolescent mothers, as well as establish male engagement programs where men are encouraged to support women in accessing malaria preventive health services.

5 Conclusion

This study has demonstrated that the uptake of optimal doses of IPTp-SP is increasing across sub-Saharan Africa. However, the current prevalence rate still requires improvement. The sex of the household head was significantly associated with IPTp-SP uptake. Receiving three or more doses of IPTp-SP was influenced by older age, exposure to malaria messages, and higher educational and wealth status. The findings suggest that the burden of malaria infection in pregnancy may be reduced through educational empowerment and increasing women's participation in decision-making at the household level. In the quest to increase IPTp uptake in sub-Saharan Africa, the ministries in charge of gender and women empowerment should implement gender equity campaigns in communities to promote shared decision-making at the household level. In addition, the Ministry of Health should collaborate with the National Malaria Control Programme to implement mass media malaria awareness campaigns via mass media targeting younger women and those with low socio-economic status. This is one of the few studies in sub-Saharan Africa that has examined trends and gender dynamics in the uptake of IPTp-SP. The use of recent national-level data from multiple countries enhances the external validity of the findings. However, this study is not devoid of limitations. Self-reporting of IPTp-SP uptake may be subject to recall bias, since the women may not remember the exact doses of IPTp-SP they received during pregnancy. We also acknowledge that unmeasured confounders such as cultural differences and underlying health conditions could have influenced the observed relationships. It is also possible that some participants may provide socially desirable responses regarding the uptake of IPTp-SP. Additionally, the findings cannot be generalized to women who were outside the sampling frame, including the homeless and institutional populations. Notwithstanding, the findings provide relevant insights into the trends, coverage and determinants of IPTp-SP uptake in sub-Saharan Africa.

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Author contributions BKK, DA and IAK conceptualized the paper. Data acquisition and analysis were performed by BKK, DA, EAA, AK and IAK. All five authors (BKK, DA, EAA, AK, and IAK) interpreted the data, while BKK, DA, EAA, and IAK drafted the paper. All five authors (BKK, DA, EAA, AK, and IAK) approved the paper for submission.

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Data availability The datasets used for the study can be found at: https://dhsprogram.com/data/available-datasets.cfm.

Code availability Not applicable.

Declarations

Ethics approval and consent to participate Not applicable.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

Welfare of animals Not applicable.

Appendix 1

Predictors of taking ≥ 3 doses of IPTp-SP	Ghana AOR (95% CI)	Uganda AOR (95% CI)	Nigeria AOR (95% CI)	Cameroon AOR (95% CI)	Niger AOR (95% CI)	Mali AOR (95% CI)	Pooled data AOR (95% CI)
Sex of household head							
Male	n/s	n/s	n/s	n/s	n/s	n/s	1 (ref)
Female							1.01 (0.89–1.15)
Age of respondent							
15–19	1 (ref)	n/s	1 (ref)	n/s	1 (ref)	n/s	1 (ref)
20–24	1.02 (0.56–1.84)		1.16 (0.84–1.60)		1.43 (0.94–2.16)		1.07 (0.92–1.25)
25–29	1.50 (0.85–2.65)		1.05 (0.75–1.46)		1.45 (0.89–2.34)		1.14 (0.97–1.35)
30–34	1.45 (0.84–2.50)		0.91 (0.63–1.30)		1.59 (0.94–2.70)		1.15 (0.96–1.37)
35–39	1.38 (0.73–2.59)		1.22 (0.84–1.79)		1.55 (0.82–2.90)		1.25 (1.02–1.53)*
40–44	2.68 (1.09–6.59)*		1.03 (0.64–1.64)		1.93 (0.86–4.32)		1.32 (1.02–1.53)*
45–49	0.92 (0.23–3.63)		1.04 (0.51–2.14)		2.68 (1.08–6.64)*		1.26 (0.84–1.89)
Educational status							
None	1 (ref)	n/s	1 (ref)	1 (ref)	n/s	1 (ref)	1 (ref)
Primary	0.61 (0.39–0.96)*		1.29 (0.97–1.72)	1.07 (0.74–1.53)		1.12 (0.86–1.47)	1.17 (1.02–1.33)*
Secondary	0.95 (0.54–1.55)		1.34 (1.03–1.72)*	1.22 (0.83–1.78)		1.09 (0.84–1.42)	1.15 (1.01–1.32)*
Higher	1.21 (0.59–2.46)		1.60 (1.10–2.33)*	2.04 (0.99–4.17)*		3.42 (1.78–6.55)***	1.48 (1.16–1.89)**
Wealth index							
Poorest	n/s	n/s	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Poorer			1.28 (0.90–1.84)	1.33 (0.90–1.97)	1.50 (0.96–2.37)	1.48 (1.00–2.19)*	1.22 (1.05–1.42)*
Middle			1.74 (1.27–2.40)**	1.24 (0.84–1.84)	1.69 (0.10–2.59)*	2.05 (1.34–3.11)**	1.43 (1.23–1.66)***
Richer			1.73 (1.20–2.49)**	1.41 (0.91–2.19)	1.67 (1.09–2.58)*	1.94 (1.32–2.85)**	1.46 (1.24–1.71)***
Richest			1.52 (1.00–2.29)*	1.65 (1.06–2.57)*	1.61 (0.01–2.57)*	2.10 (1.24–3.56)**	1.44 (1.18–1.76)***
Place of residence							
Urban	n/s	n/s	1 (ref)	n/s	n/s	1 (ref)	1 (ref)
Rural			0.79 (0.64–0.98)*			0.96 (0.65–1.42)	0.98 (0.85–1.12)
Number of children							
01-Mar	n/s	n/s	1 (ref)	n/s	1 (ref)	n/s	1 (ref)

Predictors of taking ≥ 3 doses of IPTp-SP	Ghana AOR (95% CI)	Uganda AOR (95% CI)	Nigeria AOR (95% CI)	Cameroon AOR (95% CI)	Niger AOR (95% CI)	Mali AOR (95% CI)	Pooled data AOR (95% CI)
04-Jun			0.92 (0.77–1.11)		1.16 (0.84–1.61)		0.93 (0.83–1.04)
≥ 7			1.11 (0.85–1.44)		1.07 (0.65–1.75)		0.91 (0.77–1.08)
Slept under mosquito bed net							
No	n/s	1 (ref)	n/s	n/s	n/s	n/s	n/s
Yes		1.49 (1.06–2.10)*					
Aware of malaria preventive medication							
No							
Yes	n/s	1 (ref)	1 (ref)	1 (ref)	n/s	n/s	n/s
		1.91 (1.28–2.83)**	1.36 (1.03–1.80)*	1.67 (1.14–2.45)**			
Seen/ heard MM in 6 ms							
No	1 (ref)	1 (ref)	1 (ref)	n/s	1 (ref)	1 (ref)	1 (ref)
Yes	1.12 (0.82–1.52)	1.35 (1.12–1.63)**	1.49 (1.19–1.88)**		1.30 (0.98–1.72)	0.79 (0.62–1.02)	1.12 (1.00–1.26)*
Heard MM on radio							
No	1 (ref)	n/s	1 (ref)	n/s	n/s	1 (ref)	1 (ref)
Yes	1.56 (1.09–2.23)*		1.12 (0.85–1.48)			1.39 (1.07–1.79)*	1.19 (1.05–1.35)**
Seen MM on television							
No	n/s	n/s	1 (ref)	n/s	n/s	1 (ref)	1 (ref)
Yes			1.03 (0.73–1.45)			1.66 (1.26–2.20)***	1.13 (0.96–1.32)
Heard MM from a CHW							
No	n/s	n/s	1 (ref)	n/s	n/s	n/s	1 (ref)
Yes			1.14 (0.85–1.52)				1.15 (1.00–1.33)*
Country							
Ghana	n/a	n/a	n/a	n/a	n/a	n/a	1 (ref)
Uganda							0.50 (0.40–0.61)***
Niger							0.25 (0.20–0.33)***
Nigeria							0.31 (0.25–0.38)***
Mali							0.38 (0.30–0.47)***

Predictors of taking ≥ 3 doses of IPTp-SP	Ghana AOR (95% CI)	Uganda AOR (95% CI)	Nigeria AOR (95% CI)	Cameroon AOR (95% CI)	Niger AOR (95% CI)	Mali AOR (95% CI)	Pooled data AOR (95% CI)
Cameroon							0.57 (0.45–0.72)***

CHW community health worker, *MM* malaria message, *ref* reference group, *n/s* not significant, *n/a* not applicable
*p value < 0.05, **p value < 0.01; ***p value < 0.001

Appendix 2

See Fig. 3.

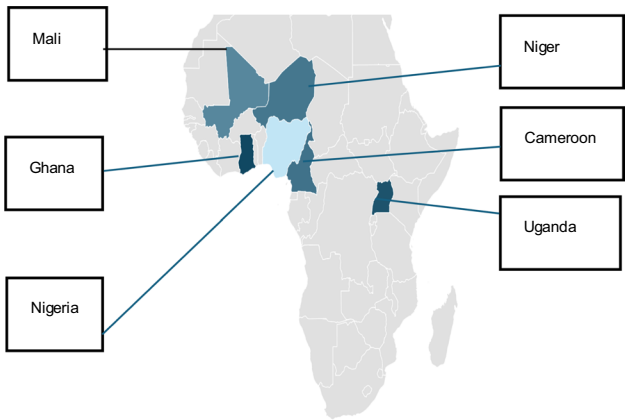

Fig. 3 Location of selected countries

References

1. Center for Disease Control, "Malaria's Impact Worldwide." [Online]. Available: https://www.cdc.gov/malaria/php/impact/index.html#:~:text=Malaria's%20Impact%20Worldwide%20*%20Globally%2C%20an%20estimated,it%20is%20the%20leading%20cause%20of%20death.
2. World Health Organization, "Malaria Fact Sheet." [Online]. Available: https://www.who.int/en/news-room/fact-sheets/detail/malaria
3. World Health Organization, "World malaria report 2023," WHO, Geneva, 2023. [Online]. Available: https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2023
4. Loy DE, et al. Out of Africa: origins and evolution of the human malaria parasites *Plasmodium falciparum* and *Plasmodium vivax*. Int J Parasitol. 2017;47(2–3):87–97.
5. World Health Organization, "World Malaria Report 2022," Geneva, 2022. [Online]. Available: https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022.
6. Kakuru A, Staedke SG, Dorsey G, Rogerson S, Chandramohan D. Impact of *Plasmodium falciparum* malaria and intermittent preventive treatment of malaria in pregnancy on the risk of malaria in infants: a systematic review. Malar J. 2019;18:1–13.
7. Mikomangwa WP, et al. Effect of sulfadoxine-pyrimethamine doses for prevention of malaria during pregnancy in hypoendemic area in Tanzania. Malar J. 2020;19(1):160. https://doi.org/10.1186/s12936-020-03234-4.
8. World Health Organization. Intermittent preventive treatment of malaria in pregnancy using sulfadoxine-pyrimethamine (IPTp-SP): updated WHO policy recommendation. In: Intermittent preventive treatment of malaria in pregnancy using sulfadoxine-pyrimethamine (IPTp-SP): updated WHO policy recommendation, 2012.
9. Eboumbou-Moukoko CE, et al. Effectiveness of intermittent preventive treatment with sulfadoxine-pyrimethamine in pregnancy: low coverage and high prevalence of *Plasmodium falciparum* dhfr-dhps quintuple mutants as major challenges in Douala, an urban setting in Cameroon. Pathogens. 2023;12(6):844.
10. Bakken L, Iversen PO. The impact of malaria during pregnancy on low birth weight in East-Africa: a topical review. Malaria J. 2021. https://doi.org/10.1186/s12936-021-03883-z.
11. van Eijk AM, et al. Effect of *Plasmodium falciparum* sulfadoxine-pyrimethamine resistance on the effectiveness of intermittent preventive therapy for malaria in pregnancy in Africa: a systematic review and meta-analysis. Lancet Infect Dis. 2019;19(5):546–56.
12. Bauserman M, Conroy AL, North K, Patterson J, Bose C, Meshnick S. An overview of malaria in pregnancy. Semin Perinatol. 2019;43:282–90.
13. Eisele TP, et al. Malaria prevention in pregnancy, birthweight, and neonatal mortality: a meta-analysis of 32 national cross-sectional datasets in Africa. Lancet Infect Dis. 2012;12(12):942–9.
14. GSS, GHS, and ICF International, Ghana Demographic and Health Survey 2014, GSS, GHS, and ICF International, Rockville, Maryland, USA, 2015.
15. Ghana Statistical Service and ICF, Ghana Demographic and Health Survey 2022. Accra, Ghana, and Rockville, Maryland, USA: GSS and ICF, Accra, Ghana and Rockville, Maryland, USA, 2024.
16. NPC, NMCP, and ICF International, Nigeria Malaria Indicator Survey 2010, NPC, NMCP, and ICF International, Abuja, Nigeria, 2012.
17. NMEP, NPC, and ICF International, Nigeria Malaria Indicator Survey 2021 Final Report, NPC, NMEP, and ICF International., Abuja , Nigeria, and Rockville, Maryland, USA, 2022.
18. NIS, NMCP, and ICF International, Cameroon Malaria Indicator Survey 2022, NIS, NMCP, and ICF, Yaoundé, Cameroon, and Rockville, Maryland, USA, 2023.
19. Nana RRD, et al. Intermittent preventive treatment with Sulfadoxine pyrimethamine for malaria: a global overview and challenges affecting optimal drug uptake in pregnant women. Pathog Glob Health. 2023;117(5):462–75.
20. Darteh EKM, et al. Factors influencing the uptake of intermittent preventive treatment among pregnant women in sub-Saharan Africa: a multilevel analysis. Arch Public Health. 2021;79:1–9.
21. Yaya S, Uthman OA, Amouzou A, Bishwajit G. Use of intermittent preventive treatment among pregnant women in sub-Saharan Africa: evidence from malaria indicator surveys. Trop Med Infect Dis. 2018;3(1):18.
22. Masoi TJ, Moshi FV, Tungaraza MB. Factors associated with uptake of intermittent preventive treatment for malaria during pregnancy analysis of data from the Tanzania 2015–2016 demographic health survey and malaria indicator survey. East Afr Health Res J. 2022;6(2):134.
23. Okethwangu D, et al. Factors associated with uptake of optimal doses of intermittent preventive treatment for malaria among pregnant women in Uganda: analysis of data from the Uganda demographic and health survey, 2016. Malar J. 2019;18:1–8.
24. Aberese-Ako M, Magnussen P, Ampofo GD, Gyapong M, Ansah E, Tagbor H. An ethnographic study of how health system, socio-cultural and individual factors influence uptake of intermittent preventive treatment of malaria in pregnancy with sulfadoxine-pyrimethamine in a Ghanaian context. PLoS ONE. 2021;16(10): e0257666.
25. Ghatak S, Dutta M. Utilizing maternal healthcare services: are female-headed households faring poorly? BMC Pregnancy Childbirth. 2024;24(1):299.
26. Yaya S, Bishwajit G, Ekholuenetale M, Shah V, Kadio B, Udenigwe O. Factors associated with maternal utilization of health facilities for delivery in Ethiopia. Int Health. 2018;10(4):310–7.
27. Bennett S, et al. Understanding the implications of the sustainable development goals for health policy and systems research: results of a research priority setting exercise. Glob Health. 2020. https://doi.org/10.1186/s12992-019-0534-2.
28. Kabir A, Rashid MM, Hossain K, Khan A, Sikder SS, Gidding HF. Women's empowerment is associated with maternal nutrition and low birth weight: evidence from Bangladesh demographic health survey. BMC Women's Health. 2020;20:1–12.
29. Barry I, et al. Variations in the use of malaria preventive measures among pregnant women in Guinea: a secondary analysis of the 2012 and 2018 demographic and health surveys. Malar J. 2022;21(1):309.
30. Ameyaw EK. Uptake of intermittent preventive treatment of malaria in pregnancy using sulfadoxine-pyrimethamine (IPTp-SP) in Uganda: a national survey. Malar J. 2022;21(1):285.
31. Population Council, Revive IPTp-SP: Revitalization of Intermittent Preventive Treatment of Malaria in Pregnancy. [Online]. Available: https://popcouncil.org/project/revive-iptp-sp-revitalization-of-intermittent-preventive-treatment-of-malaria-in-pregnancy-in-kenya/.

32. Koita K, Kayentao K, Worrall E, Van Eijk AM, Hill J. Community-based strategies to increase coverage of intermittent preventive treatment of malaria in pregnancy with sulfadoxine–pyrimethamine in sub-Saharan Africa: a systematic review, meta-analysis, meta-ethnography, and economic assessment. Lancet Glob Health. 2024;12(9):e1456–69.
33. Duodu PA, et al. Trends in antenatal care visits and associated factors in Ghana from 2006 to 2018. BMC Pregnancy Childbirth. 2022;22(1):59.
34. Birhan TY, Seretew WS. Trends and determinants of an acceptable antenatal care coverage in Ethiopia, evidence from 2005–2016 Ethiopian demographic and health survey; multivariate decomposition analysis. Arch Public Health. 2020;78:1–12.
35. Yaya S, Kota K, Buh A, Bishwajit G. Antenatal visits are positively associated with uptake of tetanus toxoid and intermittent preventive treatment in pregnancy in Ivory Coast. BMC Public Health. 2019;19:1–12.
36. Andegiorgish AK, Elhoumed M, Qi Q, Zhu Z, Zeng L. Determinants of antenatal care use in nine sub-Saharan African countries: a statistical analysis of cross-sectional data from demographic and health surveys. BMJ Open. 2022;12(2): e051675.
37. Ghana Health Service, Community-Based Health Planning and Services (CHPS) National Implementation Guidelines, Ghana Health Service n, Ghana, 2016. [Online]. Available: https://ghs.gov.gh/wp-content/uploads/2022/10/National-CHPS-Implementation-Guidelines-Final-Version-ZNS-13022017.pdf.
38. Anafi P, et al. Implementation of fee-free maternal health-care policy in Ghana: perspectives of users of antenatal and delivery care services from public health-care facilities in Accra. Int Q Community Health Educ. 2018;38(4):259–67.
39. Pons-Duran C, et al. Coverage of intermittent preventive treatment of malaria in pregnancy in four sub-Saharan countries: findings from household surveys. Int J Epidemiol. 2021;50(2):550–9.
40. Annan J, Donald A, Goldstein M, Martinez PG, Koolwal G. Taking power: women's empowerment and household well-being in Sub-Saharan Africa. World Dev. 2021;140: 105292.
41. Abbakary H, Kilamlya J. Role of microfinance service as an approach to women economic empowerment in Tanzania: experience from women food vendors in Shinyanga municipal. Am J Youth Women Empower. 2024;3(1):8–13.