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Adherence to sulfadoxine-pyrimethamine five-dose policy among pregnant women in an urban slum in Ghana: a mixed-methods study

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Abstract

Background Malaria in pregnancy (MiP) is a public health concern especially for pregnant women living in slums. The World Health Organization recommends at least three doses of Sulfadoxine-Pyrimethamine (SP) to prevent MiP. In Ghana, it is recommended that pregnant women receive a minimum of five doses of the medication. This study sought to determine the level of adherence to IPT5 policy and factors associated with adherence among pregnant women in a slum community in Ghana.

Methods This was a cross-sectional study involving 232 nursing mothers and four healthcare workers at the St. Martin's Memorial Hospital, Sukura, Ghana. Sociodemographic characteristics of nursing mothers were obtained using an interview-administered questionnaire. Data on the number of SP doses and other obstetrics characteristics were collected by reviewing the antenatal record books. To obtain information about healthcare and health system factors associated with adherence to the five-dose policy, four healthcare providers were interviewed. A data extraction form was used to obtain information about the availability of SP at the facility.

Results The level of adherence to IPT5 was 8.6% (20/232) (95% CI 5.0–12.3) among the participants. Only 8.4% of the participants received their first dose at 16 weeks. Respondents who began ANC in the second trimester were 81% less likely to adhere to IPT5 than those who began in the first trimester (aOR = 0.19, 95% CI 90.01–0.65, $p < 0.008$). Healthcare provider and health system factors that influence IPT5 uptake include healthcare providers' knowledge of IPTp-SP guidelines, the practice of Directly Observed Therapy, education of pregnant women, training of healthcare providers, and availability of water. SP was available at the facility during the period of review.

Conclusion Adherence to the IPTp-SP five-dose policy was suboptimal. Pregnant women who started ANC early were more likely to adhere to the policy. Provider knowledge, DOT practice, training, education of pregnant women and water availability were also found to influence adherence. Encouraging early ANC visits and providing healthcare workers with necessary training can substantially improve adherence in slum areas.

Keywords Adherence, IPTp-SP, Malaria, Pregnancy, Healthcare providers, Sukura, Ghana

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Background

Malaria remains a significant public health concern despite the actions taken to control and eliminate the disease [1]. In 2021, it was estimated that 247 million malaria cases were recorded worldwide (increased from 245 million in 2020), and there were 619,000 recorded deaths [2]. Most malaria cases (95%) and deaths (96%) were recorded in the World Health Organization (WHO) African Region [2]. Malaria continues to have a disproportionately negative impact on sub-Saharan African (SSA) nations, with pregnant women and children being especially at risk of infection with malaria parasites [3, 4]. Estimates show that 32% of the 40 million estimated pregnancies in 2021 were at risk of malaria during pregnancy [2].

Malaria is an endemic disease in Ghana, and it accounts for about 38% of all outpatient attendance [5]. Annually, about 370,514 pregnancies in Ghana have been estimated to be exposed to malaria parasites [6]. According to reports, malaria in pregnancy (MiP) is responsible for about 14%, 11% and 9% of outpatient cases, hospital admissions and deaths, respectively [7].

MiP can harm both the mother and her fetus resulting in maternal anaemia, low birth weight (LBW), miscarriage and stillbirth [8]. Several strategies have been implemented to reduce the burden and effects of MiP, especially in SSA. In the 1990s, chloroquine was administered to pregnant women weekly during antenatal care (ANC) visits, however, *Plasmodium falciparum* was found to be resistant to it resulting in the inefficiency of the strategy [9, 10]. The WHO introduced a multipronged approach which included promoting the use of insecticide-treated bed nets (ITN), the administration of intermittent preventive treatment in pregnancy with sulfadoxine-pyrimethamine (IPTp-SP) and finally the effective treatment of pregnant women diagnosed with malaria [11].

IPTp-SP is one of WHO's recommended malaria preventive methods for pregnant women in SSA [11]. Pregnant women who reside in malaria-endemic areas are assumed to have malaria parasites in their placenta or blood [12] and, therefore, need to receive treatment. Initially, the WHO recommended at least two doses of SP which was later increased to three or more in 2012 [8, 13], based on the compelling evidence of a meta-analysis, that demonstrated that three or more SP doses were associated with an increase in mean birth weight [11].

In Ghana, the Reproductive Health Division (RHD) of the Ghana Health Service (GHS) and the National Malaria Elimination Programme (NMEP) have implemented the IPTp-SP strategy in all public health institutions [7]. Ghana adopted the new malaria treatment policy in 2003 and updated it in 2007 and 2012, based on the WHO 2000 recommendation for the use of IPTp-SP [7]. The NMEP now recommends that pregnant women who attend ANC should be given at least five doses of SP (IPT5) during pregnancy [14]. It also has an objective of protecting at least 80% of pregnant women by providing SP in all facilities for Directly Observed Therapy (DOT) by 2025 [15].

Despite the proven effectiveness and safety of taking three or more SP doses during pregnancy, adherence to the NMEP IPT5 policy is still a challenge. Studies have reported low adherence rates to the five-dose policy [3, 13], knowledge of pregnant women about malaria and the use of IPTp-SP as a prophylaxis, poor supervisory role of healthcare workers and unavailability of drinking water to take the medication are factors known to contribute to the low adherence [7, 13, 16]. Some studies have been conducted to assess IPT 3 adherence [7, 17, 18], and IPT 5 adherence in several regions of Ghana [3, 13]. However, most of these studies were conducted in rural/urbanized areas in Ghana [13, 19–21]. Studies targeting slums, where pregnant women have an increased risk of developing MiP are scarce [22]. Dako-Gyeke and Kofie observed a malaria prevalence of 57.4% and 42.6% among 120 pregnant women living in Chorkor and Korle Gonno, respectively in Greater Accra Region, higher than the national prevalence of 8.6% [23]. The study did not investigate the factors influencing IPT uptake in these two Ghanaian slums [22], little is known about adherence to the five-dose policy in urban slums. Therefore, this study aims to determine the level of adherence to IPT5 policy and factors associated with adherence among pregnant women in a slum community.

Methods

Study design and setting

A cross-sectional study involving nursing mothers and healthcare providers, specifically midwives, was carried out at the St. Martin's Memorial Hospital in the Sukura community. Sukura is a community in the Ablekuma Central Municipality that has been classified as an urban slum in the Greater Accra Region of Ghana [24, 25]. St. Martin's Memorial Hospital is a primary healthcare facility in Sukura. It was selected for the study because of its unique location in a visibly populated community. The hospital serves a community purpose and is notable for the wide range of services it offers, the affordability of the services and its high clientele traffic. Some of the health care services the hospital offers include out-patient, in-patient, laboratory, dental and eye services, ultrasound, pharmacy services, adolescent reproductive health, delivery, and antenatal and postnatal services. Data was collected from September to October 2023.

Sample size calculation and sampling procedures

The Cochran formula (1977) was used to determine the sample size. A prevalence of 5.2% of uptake of IPT5 in the Ablekuma Central Municipality was used for the calculation [26]. Using a 95% confidence interval and 0.03 precision, the sample size for the study was 211. This was increased to 232 to cater for a 10% non-response rate considering the vulnerability of the study population. A consecutive sampling method was used in selecting the nursing mothers until the sample size was achieved. The Head of the ANC unit and other healthcare workers involved in the administration of IPTp-SP were invited to participate in an in-depth interview. Those who agreed to participate were contacted to participate in the interview at a predefined time that was convenient for them.

Eligibility criteria

Nursing mothers who had given birth in the past 12 weeks during the study period and gave consent were included in the study. Mothers who were not feeling well after delivery were excluded from the study.

Data collection and analysis

Quantitative data collection

To begin with, data were collected from nursing mothers using an interview-administered questionnaire to solicit information on socio-demographic characteristics, knowledge on malaria, MiP and IPTp-SP and socio-cultural related factors. Knowledge was measured using 11 question items adapted from Vandy et al. [13] and Orish et al. [27] Secondly, data on ANC attendance and obstetrics characteristics were retrieved from ANC record books. Subsequently, data were collected on the availability of SP at the pharmacy using a data extraction form. The primary outcome, adherence to IPT5 was defined as taking five doses of SP during the nursing mother's most recent pregnancy. Two Higher National Diploma (HND) graduates were recruited as research assistants to collect data using the KoboCollect Android app after training and pretesting data collection tools at the Royal MMR Hospital in Dansoman.

Quantitative data management and analysis

Data were cross-checked and cleaned on the KoboToolbox web browser, downloaded in Microsoft Excel format and subsequently exported to Stata version 15.0 for analysis. Statistical analysis was carried out using Stata version 15.0. All categorical variables were analysed using frequencies and proportions. Numerical variables were summarized using means and SD. The client's knowledge of malaria, MiP, and IPTp-SP was assessed through 11 question items, with one point awarded for accurate responses and zero for incorrect ones. The overall knowledge scores were categorized into low knowledge (1–4), moderate knowledge (5–8), and high knowledge (9–11) [13, 27]. A Chi-square test/Fisher's Exact test of association and logistic regression analysis was performed to assess the strength of association between client factors, sociocultural factors and adherence to IPT5. Analysis was performed at 95% CI and an alpha level of 0.05.

Qualitative data collection

An interview guide was used to elicit information from healthcare providers to identify healthcare providers and health system factors that influenced adherence to IPT5. The interview guide elicited information on; (i) professional profile; (ii) malaria and IPTp-SP; (iii) practice of Directly Observed Therapy (DOT); (iv) and participation in any IPTp-SP training program. Interviews were done one-on-one at a predetermined time and place that was convenient for the staff. After interviewing four ANC staff members, saturation was reached and data collection was brought to a halt [28]. All IDIs were recorded with an audio recorder with the permission of participants and were later transcribed. On average, each IDI lasted for about 30 minutes.

Qualitative data management and analysis

All IDIs obtained were transcribed and exported to NVivo Version 11 for thematic analysis. Sections that were identified to be potentially relevant were given shorthand labels (codes) and themes were generated using these codes. The themes were further classified as either a provider-related or health system-related factor. Thematic findings from the analysis served as the basis for developing a narrative and writing the study findings.

Results

Quantitative findings

Characteristics of study respondents

A total of 232 nursing mothers, aged 15–48 years (mean: 28.8; SD: 5.5) participated in the study. Most of the respondents were between the ages of 20–29 years (112/232, 48.3%) with a majority (153/232, 66%) of them married. The highest level of education for most of the respondents (85/232, 36.6%) was Junior High School with most of them (155/232, 66.8%) being self-employed. The mean number of children was 2.3 (range: 1–8; SD: 1.27) (Table 1).

ANC attendance and obstetrics characteristics of respondents

The number of visits to the antenatal centre ranged from 1 to 13 visits with a mean of 7.4 (SD ± 2.2). Out of the 232 respondents, 51.3% (119/232) made eight or more visits. The mean gestational age at the first ANC visit was

Table 1 Sociodemographic characteristics of respondents, Sukura, 2023

Characteristics	Frequency (N)	Percentage (%)
Age		
15–19	10	4.3
20–29	112	48.3
30–39	104	44.8
40–49	6	2.6
Marital Status		
Single	43	18.5
Married	153	66.0
Cohabiting	36	15.5
Level of Education		
No formal education	33	14.2
Primary	20	8.6
Junior High School	85	36.6
Senior High School	72	31.1
Tertiary	22	9.5
Employment status		
Unemployed	44	19.0
Self-employed	155	66.8
Government/Private worker	33	14.2
Number of children		
1–2	145	62.5
3–4	75	32.3
5–8	12	5.2

Table 2 ANC attendance and obstetrics characteristics of respondents, Sukura, 2023

Characteristics	Frequency (N)	Percentage (%)
Number of ANC visits		
< 8 visits	113	48.7
≥ 8 visits	119	51.3
Subtotal	232	100.0
Gestational age at first ANC visit		
First trimester	88	38.0
Second trimester	130	56.0
Third trimester	14	6.0
Subtotal	232	100.0
Number of SP doses received		
None	17	7.3
One dose	36	15.5
Two doses	49	21.1
Three doses	66	28.5
Four doses	44	19.0
Five doses	20	8.6
Subtotal	232	100.0
Gestational age at first SP dose		
16 weeks	18	8.4
17–27	118	54.9
28–40	79	36.7
Subtotal	215	100.0
Took SP under DOT		
Not directly observed	9	4.2
Directly	206	95.8
Subtotal	215	100.0
Received education on malaria and IPTp		
No	120	51.7
Yes	112	48.3
Subtotal	232	100.0

15.8 weeks (SD ± 6.3). Most of the respondents (130/232, 56.0%) made their first visit to the antenatal clinic in their second trimester. The mean gestational age at which the first SP dose was taken was 25.0 weeks (SD ± 6.5). Of the 215 respondents who received SP during pregnancy, only 8.4% (18/215) received their first SP dose at 16 weeks as recommended by the IPTp-SP guidelines. However, the majority of the respondents (118/215, 54.9%) received their first SP dose from 17 to 27 weeks. Most of the respondents (206/215, 95.8%) took the SP under DOT. More than half of the respondents (120/232, 51.7%) did not receive any education on malaria and IPTp during their most recent pregnancy (Table 2).

Adherence to IPTp-SP five-dose policy

Out of 232 respondents, 7.3% (17/232) did not receive SP during their most recent pregnancy. Of the 17 respondents who did not receive SP during their most recent pregnancy, eight (47.1%) were G6PD deficient while nine (52.9%) refused to take SP due to the side effects they had experienced from previous pregnancies. The level of IPTp-SP uptake was: one dose 15.5% (36/232), two doses 21.1% (49/232), three doses 28.5% (66/232), four doses 19% (44/232) and five doses 8.6% (20/232). Majority of the respondents (212/232, 91.4%) received less than five doses (Fig. 1).

Knowledge level of malaria, MiP and IPTp-SP among participants

Over half of the respondents (161/232, 69.4%) had moderate knowledge about malaria, MiP and IPTp-SP, 22.4% had high knowledge and only 8.2% had low knowledge about malaria, MiP and IPTp-SP.

Sociocultural factors

Almost all the respondents (225/232, 97%) did not need to seek permission from anyone before starting ANC. Only 3% (7/232) had to seek permission from their partners/husbands before they could start attending ANC. Approximately 10.8% (25/232) received some form of encouragement to attend ANC. A single respondent

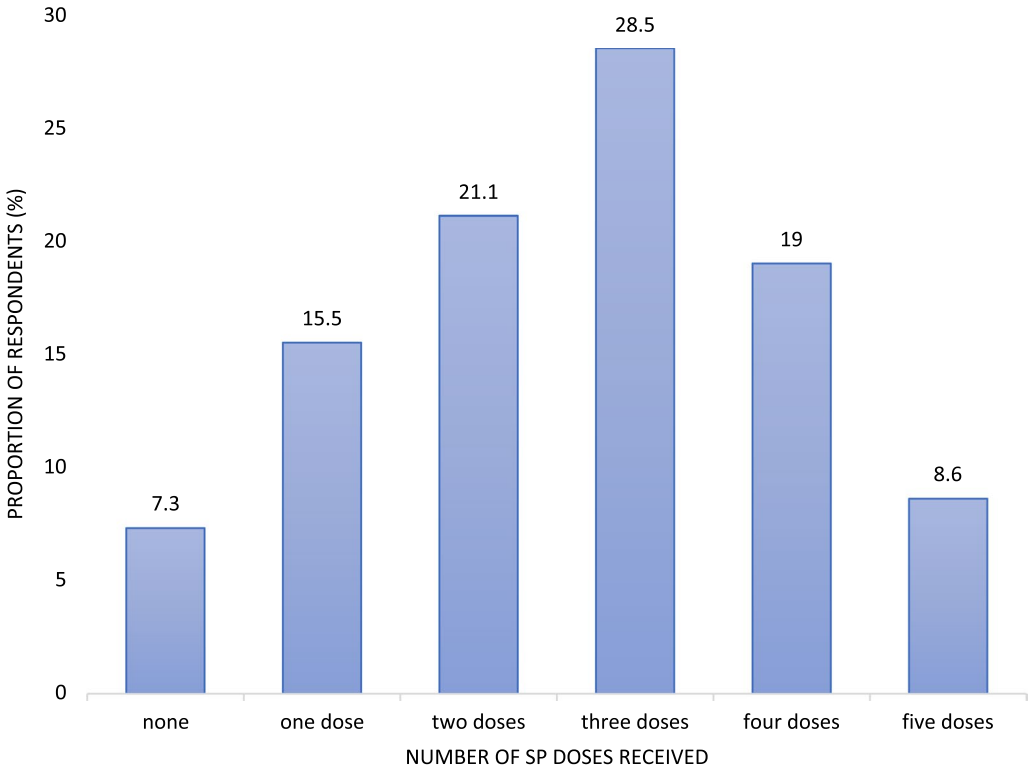

Fig. 1 Number of SP doses received by respondents before delivery, Sukura, 2023

sought permission from her husband before taking SP. All the respondents (100%) who took SP during pregnancy did not think SP could harm them during pregnancy.

Factors associated with adherence to IPT5

In the univariate logistic regression model, making the first ANC visit during the second trimester (cOR = 0.11, 95% CI 0.03–0.37, $p < 0.001$) and gestational age at first SP were significantly associated with adherence to IPT5 (cOR = 0.04, 95% CI 0.0–0.6, $p < 0.021$).

After adjusting for other characteristics, completing Junior High School (aOR = 0.11, 95% CI 0.02–0.70, $p < 0.020$) was found to be associated with adherence to IPT5, compared to participants who had no formal education. However, post-estimation analysis showed that the overall, level of education had no association with the outcome ($p < 0.1491$). Additionally, making the first ANC visit in the second trimester (aOR = 0.19, 95% CI 90.01–0.65, $p < 0.008$) was significantly associated with adherence to IPT5 (Table 3).

SP availability

Stock levels of SP at the medical stores unit were adequate from March to May as the quantity of SP at the beginning and end of the months was not less than the minimum stock level of SP (300 tablets). However, at the end of June and the beginning of July, the stock was depleted entirely (Fig. 2). The inventory control card also showed that SP was issued to the ANC unit frequently resulting in the availability of SP at the ANC unit all the time.

Qualitative data

Four midwives at the antenatal clinic were interviewed. Their professional qualifications ranged from a professional diploma staff midwife (3) to a certificate midwife (1). The number of years worked at the antenatal clinic ranged from 3 to 7 years. Only one midwife had worked for less than a year.

Provider factors

The responses from four IDIs were categorized according to themes as shown in Table 4. Healthcare providers demonstrated high knowledge about malaria, its transmission and its effects during pregnancy. However, they demonstrated moderate knowledge of Ghana's IPTp-SP policy. Healthcare providers strictly administered SP under DOT and educated pregnant women about malaria during ANC visits. It was also revealed that healthcare workers did not receive training on IPTp-SP regularly.

Table 3 Association between client-related factors, sociocultural factors and adherence to IPT5, Sukura, 2023

Variable	Unadjusted			Adjusted		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Level of education 0.149**						
No formal education	1.00					
Primary	0.50	0.07–3.49	0.488	0.15	0.01–1.69	0.126
Junior High School	0.27	0.06–1.20	0.086	0.11	0.02–0.70	0.020*
Senior High School	0.75	0.22–2.61	0.652	0.27	0.05–1.49	0.133
Tertiary	2.06	0.52–8.18	0.304	0.47	0.07–3.18	0.441
Gestational age at first ANC 0.030**						
First trimester	1.00					
Second trimester	0.11	0.03–0.37	< 0.001	0.19	0.05–0.65	0.008*
Third trimester	0.14	0.52–8.18	0.180	0.93	0.01–64.4	0.972
Gestational age at first SP						
Second trimester	1.00					
Third trimester	0.04	0.0–0.23	0.021	0.08	0.00–1.55	0.094
Knowledge level						
Low	1.00					
Moderate	2.16	0.12–38.89	0.602	4.51	0.16–129.58	0.379
High	12.04	0.68 -213.97	0.090	16.32	0.57–465.60	0.102
Encouragement to attend ANC						
Did not receive encouragement	1.00					
Received encouragement	3.31	1.13–9.70	0.029	3.80	0.98–14.77	0.054

*Statistically significant

**Results of the post-estimation analysis

Health system factors

The interviews with the respondents revealed that drinking water was not made available to the pregnant women at the facility. Pregnant women were responsible for getting their water whenever they had to take SP. Even though it is not a problem for most pregnant women, one of the respondents said making water available to pregnant women will encourage them to take the medicine and also prevent them from going home when they are asked to go and get water.

> *"They bring their own water. After the palpation we tell them that today you'll be taking your malaria drug then they just go and buy it from the store and bring it." (IDI, Midwife, 04)*
> *"…in a way providing water can help, source of motivation." (IDI, Midwife, 01)*

Discussion

This study clearly demonstrates that the level of adherence to the SP five-dose policy is suboptimal. This may be because more than half of the participants did not receive any education about malaria and IPTp-SP during their most recent pregnancy. Therefore, they were not aware of Ghana's five-dose policy. This level of adherence is higher than earlier reports of 6.65% in Sekondi-Takoradi [16], but much lower than that of studies conducted in the Volta region of Ghana [13] and Osu, Accra [3].

In this study, gestational age at the first ANC visit was found to be significantly associated with adherence to the SP five-dose policy. One plausible explanation for this could be that women who start ANC early in their pregnancies are more likely to be involved and proactive in their overall prenatal care, which may extend to adhering to the IPTp-SP five-dose policy. The findings are consistent with the findings of another study conducted in Gushegu in the Northern Region of Ghana. One of the key determinants for inadequate adherence to IPTp-SP was the late first ANC visit. Women who made their first ANC visit early were more likely to take two or more SP doses [19]. Similarly Dun-Dery and colleagues [20] revealed a significant association between gestational age at first ANC contact and IPTp-SP uptake. These findings underscore the importance of starting ANC early in shaping subsequent adherence patterns. There is a need to address barriers to early ANC initiation as this can be pivotal in maximizing adherence rates to the intervention.

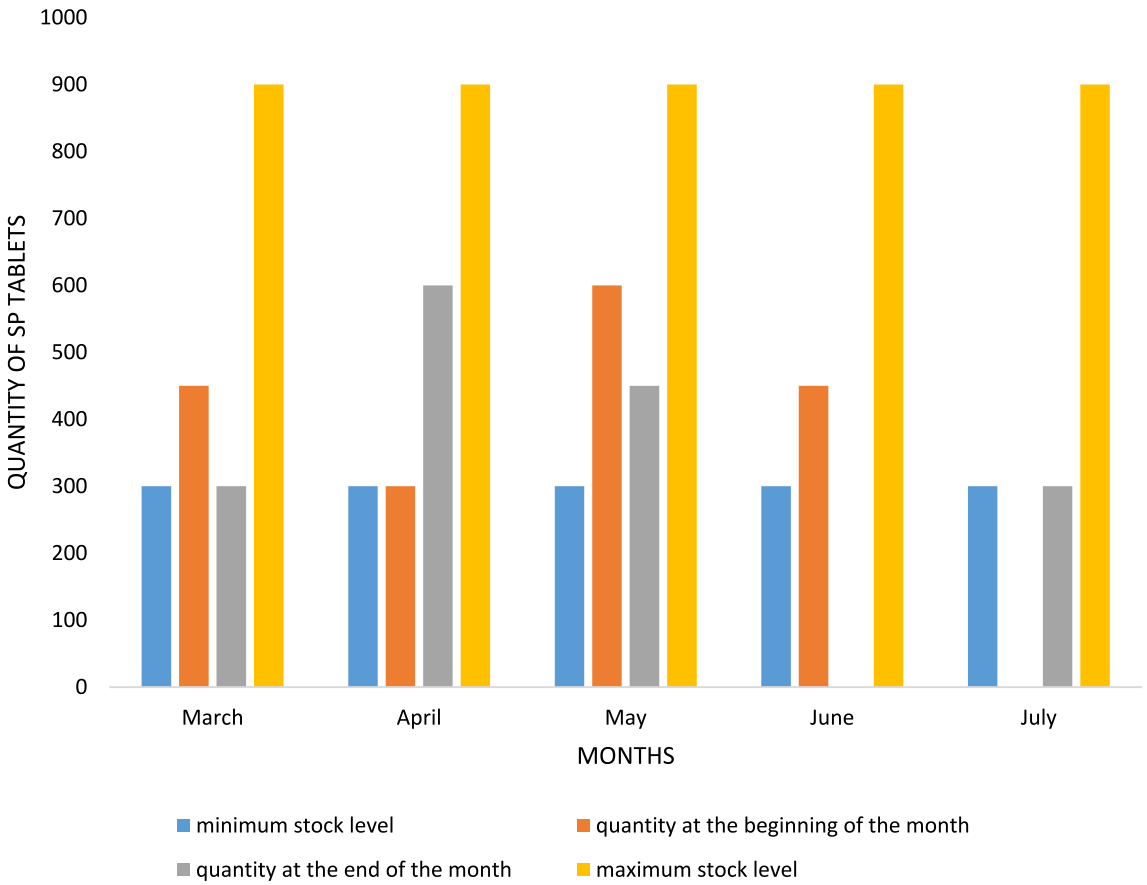

Fig. 2 Stock levels of SP at the facility for 5 months period (March–July, 2023)

Knowledge level of healthcare workers influenced adherence to IPTp-SP in this study. Healthcare providers who have a good understanding of malaria, its implications during pregnancy, and the rationale behind IPTp-SP are better equipped to communicate the importance of adherence to pregnant women. This finding is in line with a study conducted by Onoka and colleagues [29], which reported that healthcare providers' knowledge of the delivery directives of IPTp-SP influenced adherence to the intervention. Similarly, another study by Webster et al. [30], highlighted that confusion among healthcare providers over the dosing and timing of SP influenced adherence. The knowledge gap among healthcare providers may stem from various reasons including limited access to updated information and lack of involvement in any training programme among others.

While some studies carried out in other malaria-endemic African countries have documented non-adherence to the practice of DOT in the administration of IPTp-SP [29, 31] the results of this study were the opposite. The direct involvement of healthcare providers signals the significance of the medication, potentially emphasizing its role in preventing malaria during pregnancy. Findings from this study also demonstrated that healthcare workers educated pregnant women about malaria and IPTp-SP. This is important because education addresses any perceived risks or concerns the pregnant women may have about taking medications during pregnancy. Education of pregnant women being a factor that influenced adherence as found in this study is similar to a study by Kofour et al. [7], which stated that women who were exposed to information about malaria and IPTp-SP were more likely to take three or more doses of SP than those who were not.

Proper training reinforces adherence to established clinical guidelines and protocols. Healthcare providers who undergo comprehensive training are more likely to follow standardized practices. Despite the importance of training, it is sometimes overlooked, and this influences adherence to the five-dose policy. According to a study by Rassi and colleagues [32], healthcare providers expressed concern about the safety and effectiveness of SP as an IPT because they did not understand why they were asked to stop using SP to treat clinical malaria during pregnancy.

Table 4 Qualitative Findings from IDIs with Healthcare Providers

Themes	Verbatim quotes
Knowledge of malaria, MiP and IPTp-SP	"The bit I know about malaria is that malaria is a disease which is caused by mosquito specifically the female anopheles mosquito and usually pertaining to pregnant women it becomes very serious because now we are dealing with two lives. If malaria is not treated well it can cause preterm labour, it can also abort the baby and also put the mother's life in danger." (IDI, Midwife, 04)
	"I learnt that, it can cause preterm labour. Yes, when malaria sets in preterm labour can be caused, like the symptoms of malaria, the pregnant woman will have it but in relation to pregnancy it's a very risky something for pregnant women. It can cause premature labour." (IDI, Midwife, 02)
	"So the drug of choice is Sulfadoxine-Pyrimethamine. After 16 weeks of pregnancy or after quickening that's when we start to give the malaria drug. So it comes in three doses, you take it. Urm so I'll say the time interval is 1 month after the first dose, so it's just 1 month 1 month interval after the first dose" (IDI, Midwife, 01)
	"With the guidelines, I don't know whether they've revised it. The first thing that I know we do is we look at the G6PD status then afterwards we look at the gestational age. Depending on when they first feel the baby's movement that's when they can start…. But those who have already given birth feel the fetal movement earlier around 16 weeks and they start taking their SP and it's 4 weeks interval with each dosage." (IDI, Midwife, 04)
Practice of Directly Observed Therapy	"Oh it's oral, when we give it [SP] to them [pregnant women] they will not take it [SP] so we tell them to get their water we put it [SP] in their hand and they take it orally. We [midwives] observe them as they take it." (IDI, Midwife, 02)
	"We don't give it to them [pregnant women] to send it home. You bring the water and the midwife gives the tablet [SP] to you to take it in front of her." (IDI, Midwife, 03)
	"Some of them they'll [pregnant women] say they have reactions when they take it [SP], they feel dizzy, they have body pains so they don't want to take it." (IDI, Midwife, 01)
Education of pregnant women	"We've been telling them things that will happen if they do not take the drug. Even if it escapes us to give it to them they remind us to do so." (IDI, Midwife, 03)
	"…those who come early and the education is well gotten that helps us when we're giving the medication. And even some of the clients are even able to testify to aid our education and how the SP is able to help them, how they've seen someone who didn't take their SP well and the end results of it." (IDI, Midwife, 04)
Training of healthcare providers	"Like I said, I am just starting the work so I've not had the opportunity to attend any workshop and since I started working here too they haven't organized any workshop here. So maybe as time goes on" (IDI, Midwife, 02)
	"Yes, we did an in-service training here once and I joined." (IDI, Midwife, 04)

This was a result of a lack of training on IPTp-SP. In this study, the lack of receiving any form of training on the administration of IPTp-SP was reflected in the knowledge level of the healthcare providers that were interviewed. Mohammed et al. [33] observed that healthcare providers who had participated in an IPTp-SP training programme had an increased odds of adherence as compared to those who had not.

The availability of SP is a vital component for IPTp and ensuring its availability is fundamental to implementing this preventive measure effectively. One challenge in the acquisition of SP for the facility was the unavailability of SP at the Health Directorate, this may have contributed to the observed fluctuations in stock levels. Fluctuations in stock levels at the facility may have led to missed opportunities for IPTp administration during ANC visits and this likely played a role in the observed suboptimal adherence to IPT5 policy. In this study, pregnant women were asked to purchase their water since the facility was not providing drinking water for pregnant women. This finding is consistent with the results of Doku and colleagues [34] they reported that pregnant women were asked to buy their water to take SP and this could have contributed to some of them refusing to take the medicine and also dropping out. The availability of drinking water will not only facilitate the practice of DOT but also encourage pregnant women to take the medicine since they would not have to spend money on buying water.

A few limitations were identified in this study. Although only mothers who had delivered in the past 12 weeks were included in the study, there is still a possibility of recall bias as some might not have remembered the events during their ANC visits. The findings of this study might be generalizable to only urban slum settings similar to the Sukura community.

Conclusion

Adherence to Ghana's SP five-dose policy was sub-optimal. Gestational age at the first ANC visit was associated with adherence. Provider and health system factors influencing adherence to IPT5 include the knowledge level of providers, DOT practice, education of pregnant women by providers, training of providers and availability of drinking water. Encouraging pregnant women to start

ANC early during pregnancy, alongside providing the healthcare workers with the necessary training required in the administration of IPTp-SP will ultimately lead to substantial improvement in adherence to the SP five-dose policy in slum areas.

Availability or data and materials

The dataset analysed for this study is available from the corresponding author (habonful@ug.edu.gh) on reasonable request.

Abbreviations

ANC	Antenatal Care
DHIMS	District Health Information Management System
DOT	Directly Observed Therapy
FANC	Focused Antenatal Care
GHS	Ghana Health Service
IPT	Intermittent Preventive Treatment
IPTp-SP	Intermittent Preventive Treatment in pregnancy with Sulfadoxine-Pyrimethamine
ITN	Insecticide Treated Net
LBW	Low Birth Weight
MiP	Malaria in Pregnancy
NMEP	National Malaria Elimination Program
RHD	Reproductive Health Division
SP	Sulfadoxine-Pyrimethamine
SSA	Sub-Saharan Africa
WHO	World Health Organization

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Author contributions

H.I. and H.A.B. conceptualized and designed the study. H.I. collected the data from the field. H.I. and H.A.B. analyzed and interpreted the data. H.I. drafted the initial manuscript. H.A.B. and E.A.T. reviewed and edited the manuscript. All authors reviewed and approved the submitted version of the manuscript.

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Data Availability

The dataset analysed for this study is available from the corresponding authour (habonful@ug.edu.gh) on reasonable request.

Declarations

Ethics approval and consent to participants

The study was approved by the Ghana Health Service Ethical Review Committee before commencement of the study (Ethical Approval ID NO: GHS-ERC: 093/07/23). We also sought permission from the administration of St. Martin's Memorial Hospital. A written informed consent was obtained from all study participants before data were collected. Participation in the study was voluntary as participants had the right to withdraw from the study at any time. A detailed explanation of the study and its purpose was given to any potential participant in the study. Participants were assured of privacy and anonymity.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interest.

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