

Determinants of the Uptake of Intermittent Preventive Treatment of Malaria in Pregnancy with Sulphadoxine Pyrimethamine in Sabatia Sub County, Western Kenya

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Abstract

Background: Malaria in pregnancy remains a major public health problem. Annually, 125.2 million pregnant women worldwide are at risk of malaria infection including 30.3 million and 1 million pregnant women in Sub-Saharan Africa and Kenya respectively. The World Health Organization recommends that pregnant women in malaria endemic areas receive at least three doses of sulphadoxine pyrimethamine for intermittent preventive treatment of malaria in pregnancy (IPTp-SP) for optimal benefit. However, IPTp-SP optimal uptake is undesirably low in Kenya. This study investigated the prevalence of and factors influencing IPTp-SP optimal uptake in Sabatia Sub County, Western Kenya. Understanding the epidemiology of malaria in pregnancy is core for making decisions and setting priorities towards IPTp-SP optimization.

Methods: This was a cross-sectional study conducted in Sabatia Sub County. Using a validated semi structured questionnaire, data were obtained from 372 randomly sampled post-delivery women aged 15 – 49 years who had a live birth within one year preceding the study. Women on cotrimoxazole prophylaxis during their pregnancy were excluded. Association between IPTp-SP uptake and independent variables was analysed using Pearson Chi-square and Fisher's Exact test. Bivariate and multiple binary logistic regression analysed predictors of optimal IPTp-SP uptake.

Results: Overall, 99.46 % of the respondents received at least one IPTp-SP dose. The prevalence of optimal IPTp-SP uptake was 79.57% (95% CI 75.47%, 83.67%). After multivariate analysis; gestational age at first antenatal care (ANC) visit ($p = 0.04$), frequency of ANC visits ($p < 0.001$), maternal knowledge of IPTp-SP benefits ($p < 0.001$), maternal knowledge of optimal SP dose ($p = 0.03$) and administration of sulphadoxine pyrimethamine at ANC clinic ($p = 0.03$) significantly predicted the optimal uptake of IPTp-SP.

Conclusions: Optimal uptake of IPTp-SP is high in the study area. Efforts towards early and more frequent ANC attendance should be enhanced and sustained. Structured and targeted health education should be adopted and health workers should always administer SP drugs or explain to some pregnant women their ineligibility for initial IPTp-SP receipt. Future studies considering large sample drawn from the whole country and health workers' perspective of the health system delivery factors are recommended.

Background

Malaria in pregnancy (MiP) is a major public health problem associated with undesirable health consequences for both pregnant women and new-borns. It is of considerable importance particularly in the absence of adequate preventive interventions (1). Pregnant women are three times more likely to suffer from severe disease due to malaria infection compared with their non-pregnant counterparts (2). In malaria endemic areas, the risk of malaria infection during pregnancy is 50% higher among pregnant women than non-pregnant women (3). Pregnant women are more vulnerable due to pregnancy induced

lowered immunity (4). MiP significantly accounts for maternal and neonatal mortality by causing anaemia, which in turn raises the risk of maternal and neonatal death (3). Apart from malaria-related anaemia and its associated risks, other undesirable health consequences of MiP include haemorrhage, intrauterine growth retardation, still birth, preterm delivery, maternal death, placental malaria, miscarriage, low birth weight and congenital infections (3, 5).

Globally, 125.2 million pregnant women face the risk of malaria infection each year and 30.3 million (24%) of these reside in the stable malaria transmission zones of Sub-Saharan Africa (6). Approximately 40% of all pregnancies in Sub-Saharan Africa would experience *P. falciparum* placental infection in the absence of interventions for the prevention of malaria during pregnancy resulting in an estimated 900,000 low birth weight deliveries annually (7). In Africa, about 10,000 women and 75,000 to 200,000 infants die yearly due to MiP while low birth weight resulting from *P. falciparum* parasite infections during pregnancy is estimated to cause 100,000 (11%) of neonatal deaths (3). In Kenya, pregnant women bear the greatest burden of malaria and it has been estimated that about 1.5 million pregnancies occur yearly, with about 44% in moderate to intense malaria endemic areas (4). In 2018, the prevalence of MiP in Kenya was approximately 4,918/100,000 (8). Intermittent preventive treatment of malaria in pregnancy (IPTp) with sulphadoxine pyrimethamine (SP) is one of the three interventions recommended by the World Health Organization (WHO) for controlling malaria and its effects during pregnancy (9).

The WHO recommends the provision of IPTp-SP to all pregnant women in areas of moderate to high malaria transmission starting as early as possible in the second trimester at each scheduled antenatal care (ANC) visit until delivery (9). In line with the WHO guidelines, Kenya's Ministry of Health currently recommends that pregnant women living in malaria endemic areas should receive at least three doses of SP drug to achieve optimal IPTp-SP dosage (IPTp-SP3+) (10). The drug is given as a single dose of three tablets under directly observed therapy in the ANC. It is safe and can be taken with or without food. However, the WHO does not recommend SP to pregnant women on cotrimoxazole prophylaxis due to an increased risk of adverse events (9). The drug remains cost effective and efficacious for IPTp (11, 12). Previous studies have demonstrated that IPTp-SP is beneficial to both pregnant women and new-borns. The intervention has been linked to reduced malaria cases among pregnant women, lower risk of placental malaria and reduced neonatal deaths (13). In a study in Tanzania, uptake of more than three SP doses was associated with reduced odds of having placental malaria compared to less than three SP doses (14). A study conducted in six countries in Sub-Saharan Africa found that IPTp-SP had an association with higher maternal haemoglobin and birth weight even in areas that experienced SP resistance (15).

In Sub-Saharan African countries, the uptake levels of IPTp-SP are still far below global targets set by Roll Back Malaria Partnership of 80% by 2010, and 100% by 2015 (16). Among 33 African countries that reported on IPTp coverage levels in 2017, an estimated 22% of eligible pregnant women received the recommended optimal IPTp-SP dose (17). In a study involving selected malaria endemic countries in Sub-Saharan Africa, the overall prevalence of taking three doses of IPTp-SP in the latest pregnancy was 29.5% (18). In Malawi and Uganda, the IPTp-SP optimal uptake were 29.8% and 18% respectively (19, 20).

Contrastingly, other studies in Ghana and Sierra Leone reported high optimal IPTp-SP uptake levels of 71%, 76.4% and 93.24% (18, 21, 22). In Kenya, only 37.5% of pregnant women residing in malaria endemic zones received the recommended optimal dose of IPTp-SP (23), which is far below the national target of 80% (10). However, the uptake of the recommended IPTp-SP optimal dose in many other areas in Kenya remained unknown. Studies on optimal uptake of IPTp-SP in Kenya after malaria policy revision in 2014 have been limited. The observed differences in various research findings across Africa demonstrates the geographical variations and contextual natures in which the studies were conducted.

Socio demographic and obstetric characteristics such as maternal age, educational level, marital status, socio-economic status, residence, parity, gestational age at initial ANC visit and frequency of ANC attendance have been found to influence the uptake of IPTp-SP by pregnant women (18–20, 24). Knowledge related factors such as maternal knowledge of MiP and IPTp-SP have also been demonstrated to predict IPTp-SP optimal uptake (25, 26). All these are factors attributable to an individual pregnant woman. They are likely to influence IPTp-SP uptake either singularly or in combination with others. Despite this, it was unclear and unknown which of these factors influenced the uptake of optimal IPTp-SP in Sabatia Sub County.

Service delivery is one of the health systems strengthening blocks. In this study health service delivery factors referred to those confined to a health facility and related to the availability, affordability and quality of IPTp-SP service delivery through ANC. Health service delivery dynamics in the facilities is critical to appropriate IPTp-SP uptake (27). In Sub-Saharan Africa, it has been advanced that poor IPTp-SP coverage levels and many missed opportunities for IPTp-SP delivery are attributable to inadequacies in the health care systems (27–29). However, a clear and scientific understanding of the health service delivery factors associated with the uptake of optimal IPTp-SP was missing in Sabatia Sub County.

This study sought to investigate the prevalence of and factors influencing IPTp-SP optimal uptake in Sabatia Sub County of western Kenya. Enhancing knowledge and strengthening the responsiveness of key stakeholders for improved access to and use of IPTp-SP is important. Therefore, understanding the epidemiology of MiP is core for making decisions and setting priorities towards improved uptake of optimal IPTp-SP.

Methods

Study site and study design

The aim of this study was to estimate the prevalence of and identify the socio demographic, obstetric, knowledge related and health service delivery factors influencing the uptake of optimal IPTp-SP in Sabatia Sub County. A household based cross-sectional study was conducted in Sabatia sub county, Vihiga County in the western region of Kenya. The sub county lies within the lakeside endemic malaria zone in Kenya. The vast majority of the sub county is rural and most residents are in agriculture and rural development sector.

Target and Study Population

The study targeted all pregnant women aged 15 – 49 years old while the study population included post-delivery women aged 15 – 49 years who had a live birth within one year prior to the study, those who had been residents of Sabatia Sub County during their last pregnancy for at least nine months before the study and consented to participate. Post-delivery women who had been using cotrimoxazole prophylaxis during their last pregnancy and those with mental disorders were excluded.

Study variables

The dependent variable was the uptake of IPTp-SP doses. Though this was a numerical variable, a dichotomy was created to have sub optimal IPTp-SP uptake (2 or less IPTp-SP doses) and optimal IPTp-SP uptake (3 or more IPTp-SP doses). The independent variables were grouped into four main categories: Pregnant woman socio demographic factors, pregnant woman obstetric factors, maternal knowledge related factors and health service delivery factors. (Supplementary information file name: Joshua_IPTp-SP Study Variables Definitions.doc).

Data collection

Face to face interviews of post-delivery women by trained research assistants were conducted using semi structured questionnaires between May and June 2020. Data were collected on the levels of IPTp-SP uptake, socio demographic factors, obstetric factors, knowledge related factors and health service delivery factors affecting IPTp-SP uptake. Mother & Child Health booklets were used to verify and validate data on the number of SP doses received, number of ANC visits made and gestational age at first ANC visit.

Sample size and sampling

Sample size calculation was done using Cochran's (1977) formula for categorical data. Further, Cochran's (1977) correction formula was applied since the initial obtained sample size exceeded 5% of the population (30, 31). The sample size was determined based on the prevalence of optimal IPTp-SP uptake of 37.5% as per the 2015 Kenya Malaria Indicator Survey (23), a 95% confidence level, a precision of 5%, and a non-response rate of 10%. The final sample was 372 post-delivery women. Sampling was done through simple random sampling.

Statistical analysis of data

Descriptive analyses of the continuous and categorical variables were done by calculating the means and proportions respectively. Pearson Chi-square test and Fisher's Exact test where appropriate were used to compare differences in various predictors of interest. Logistic regression models were fitted to determine the relationship between IPTp-SP uptake and the predictors. Predictors with at $p < 0.15$ from the step-wise regression were included in the multivariable logistic regression model. Crude Odds Ratios (COR) and Adjusted Odds Ratios (AOR) were reported and all predictors with $p < 0.05$ were considered to be

independently associated with IPTp-SP uptake. Statistical analyses were performed using Stata version 14.0 (Stata Corp., College Station, TX).

Ethical considerations

Ethical approval was obtained from Jaramogi Oginga Odinga University of Science and Technology Ethics Review Committee (Approval Number: 7/17/ERC/11/3/20-21). A research license was obtained from the National Commission for Science, Technology and Innovation in Kenya (License Number: NACOSTI/P/20/5052). Informed consent was sought from all respondents using an approved informed consent form. Privacy and confidentiality of the study participants and all raw data were strictly observed. Sabatia Sub County Medical Officer of Health permitted the study.

Results

Characteristics of the Respondents

A total of 372 participants were enrolled in the study. The general and socio demographic characteristics of the study participants are summarized in Table 1.

Table 1
General characteristics of participants

Characteristics	n (%)
Maternal age (years), mean (\pm SD)	26.28 \pm 5.72
Age category	
15–24 years	160 (43.01)
25–34 years	173 (46.51)
\geq 35 years	39 (10.48)
Marital status	
Unmarried	87 (23.39)
Married	285 (76.61)
Woman's Education level	
Primary	142 (38.17)
Secondary	178 (47.85)
Tertiary	52 (13.98)
Woman's Employment status	
Not employed	252 (67.74)
Informal employment	95 (25.54)
Formal employment	25 (6.72)
Religion	
Catholic	20 (5.38)
Protestant	350 (94.09)
Muslim	2 (0.54)
Ward of Residence	
Busali	85 (22.85)
Wodanga	49 (13.17)
North Maragoli	31 (8.33)
Chavakali	64 (17.20)
Sabatia	60 (16.13)
Lyaduywa Izava	83 (22.31)

Characteristics	n (%)
Residence	
Rural	287 (77.15)
Urban	85 (22.85)
Gestation age at 1st ANC (weeks), mean (SD)	16.26 ± 5.95
Frequency of ANC visits, median (range)	5 (1,9)
Parity	
1 child	142 (38.17)
2 children	82 (22.04)
3 + children	148 (39.78)
Experience of SP side effects	
No	197 (52.96)
Yes	173 (46.51)
Not applicable	2 (0.54)
Knowledge of MiP dangers	
Unknowledgeable	112 (30.11)
Low knowledge	136 (36.56)
Moderate knowledge	94 (25.27)
Adequate knowledge	30 (8.06)
Knowledge of MiP prevention	
Unknowledgeable	5 (1.34)
Low knowledge	216 (58.06)
Moderate knowledge	128 (34.41)
Adequate knowledge	23 (6.18)
Knowledge of IPTp-SP benefits	
Poor	77 (20.70)
Good	295 (79.30)
Knowledge of IPTp-SP start	
Poor	318 (85.48)

Characteristics	n (%)
Good	54 (14.52)
Knowledge of optimal SP dose	
Poor	183 (49.19)
Good	189 (50.81)

The average age of the participants was 26.28 (SD 5.72) years, with the 46.51% (173) aged 25–34 years. Most 285 (76.61%) of the participants were married, majority 178 (47.85%) had a secondary education, more than half 252 (67.74%) were unemployed, the highest number 350 (94.09%) were protestants, most 85 (22.85%) lived in Busali ward and over three quarters 287 (77.15%) were rural residents (Table 1). The average gestation age at first ANC visit was 16.26 (SD 5.95) weeks and the median number of ANC visits was 5 visits, ranging from 1 to 9 visits. In total, 148 (39.78%) had a parity of 3+, over a half 197 (52.96%) never experienced any of SP side effects, 136 (36.56%) had low knowledge on MiP dangers, majority 216 (58.06%) had low knowledge of MiP prevention, most 295 (79.30%) had good knowledge of IPTp-SP health benefits, 318 (85.48%) could not tell the best time to start receiving IPTp-SP dose for optimal benefit and 189 (50.81%) had good knowledge on the optimal IPTp-SP dosage (Table 1).

Prevalence Of Optimal Uptake Of Iptp-sp

The uptake of IPTp-SP was estimated based on documented evidence from the respondents' Mother & Child Health booklet. Overall, 99.46% (370) of the respondents received at least one dose of IPTp-SP. Of the 372 pregnant women, 296 (79.57%; 95% CI 75.47%, 83.67%) received optimal SP doses while 76 (20.43%) had sub-optimal SP doses. The median dose of IPTp-SP uptake was 4 doses, ranging from 0 to 7 doses. The majority of the respondents, 107 (28.76%) received four doses of IPTp-SP (Fig. 1).

Socio Demographic, Knowledge Related and Obstetric Factors Associated with IPTp-SP Uptake

This study compared characteristics of women who received optimal IPTp-SP doses with those who received sub-optimal IPTp-SP during pregnancy. Table 2 lists the distribution of IPTp-SP uptake against socio-demographic, obstetric and knowledge characteristics of women during pregnancy.

Table 2
Socio demographic, obstetric and knowledge characteristics associated with IPTp-SP uptake

Independent variables	All N = 372 n (%), Mean ± SD	Uptake of IPTp-SP		p-value
		Optimal N = 296 n (%), Mean ± SD	Sub-Optimal N = 76 n (%), Mean ± SD	
Maternal age (years), mean(± SD)	26.28 ± 5.72	27.53 ± 5.78	25.32 ± 5.41	0.1
Age category				
15–24 years	160 (43.01)	121 (40.88)	39 (51.32)	0.29
25–34 years	173 (46.51)	142 (47.97)	31 (40.79)	
>=35 years	39 (10.48)	33 (11.15)	6 (7.89)	
Marital status				
Unmarried	87 (23.39)	62 (20.95)	25 (32.89)	0.04*
Married	285 (76.61)	234 (79.05)	51 (67.11)	
Woman's Education level				
Primary	142 (38.17)	108 (36.48)	34 (44.74)	0.48
Secondary	178 (47.85)	145 (48.99)	33 (43.42)	
Tertiary	52 (13.98)	43 (14.53)	9 (11.84)	
Woman's Employment status				
Not employed	252 (67.74)	193 (65.20)	59 (77.63)	0.17
Informal employment	95 (25.54)	82 (27.70)	13 (17.11)	
Formal employment	25 (6.72)	21 (7.10)	4 (5.26)	
Religion				
Catholic	20 (5.38)	13 (4.39)	7 (9.21)	0.15
Protestant	350 (94.09)	282 (95.27)	68 (89.47)	

*Statistically significant result at 5% significance level

Independent variables	All N = 372 n (%), Mean ± SD	Uptake of IPTp-SP		p-value
		Optimal N = 296 n (%), Mean ± SD	Sub-Optimal N = 76 n (%), Mean ± SD	
Muslim	2 (0.54)	1 (0.34)	1 (1.32)	
Ward of Residence				
Busali	85 (22.85)	68 (22.97)	17 (22.37)	0.84
Wodanga	49 (13.17)	37 (12.50)	12 (15.79)	
North Maragoli	31 (8.33)	24 (8.11)	7 (9.21)	
Chavakali	64 (17.20)	52 (17.57)	12 (15.79)	
Sabatia West	60 (16.13)	46 (15.54)	14 (18.42)	
Lyaduywa Izava	83 (22.31)	69 (23.31)	14 (18.42)	
Residence				
Rural	287 (77.15)	224 (75.68)	63 (82.89)	0.16
Urban	85 (22.85)	72 (24.32)	13 (17.11)	
Gestation age at 1st ANC visit				
<=16 weeks	197 (52.96)	179 (60.47)	18 (23.68)	< 0.001*
> 16 weeks	175 (47.04)	117 (39.53)	58 (76.32)	
Frequency of ANC visits				
< 4 visits	84 (22.58)	33 (11.15)	51 (67.11)	< 0.001*
>=4 visits	288 (77.42)	263 (88.85)	25 (32.89)	
Parity				
1 child	142 (38.17)	108 (36.48)	34 (44.74)	0.41
2 children	82 (22.04)	66 (22.30)	16 (21.05)	
3 + children	148 (39.78)	122 (41.22)	26 (34.21)	

*Statistically significant result at 5% significance level

Independent variables	All N = 372 n (%), Mean ± SD	Uptake of IPTp-SP		p-value
		Optimal N = 296 n (%), Mean ± SD	Sub-Optimal N = 76 n (%), Mean ± SD	
Experience of SP side effects				
No	197 (52.96)	154 (52.03)	43 (56.58)	0.29
Yes	173 (46.51)	142 (47.97)	31 (40.79)	
Not applicable	2 (0.54)	0	2 (2.63)	
Knowledge of MiP dangers				
Unknowledgeable	112 (30.11)	89 (30.07)	23 (30.26)	0.97
Low knowledge	136 (36.56)	110 (37.16)	26 (34.21)	
Moderate knowledge	94 (25.27)	73 (24.66)	21 (27.63)	
Adequate knowledge	30 (8.06)	24 (8.11)	6 (7.90)	
Knowledge of MiP prevention				
Unknowledgeable	5 (1.34)	4 (1.35)	1 (1.31)	0.86
Low knowledge	216 (58.06)	168 (56.76)	48 (63.16)	
Moderate knowledge	128 (34.41)	104 (35.13)	24 (31.58)	
Adequate knowledge	23 (6.18)	20 (6.76)	3 (3.95)	
Knowledge of IPTp-SP benefits				
Poor	77 (20.70)	50 (16.89)	27 (35.53)	< 0.001*
Good	295 (79.30)	246 (83.11)	49 (64.47)	
Knowledge of IPTp-SP start				
Poor	318 (85.48)	252 (85.14)	66 (86.84)	0.67

*Statistically significant result at 5% significance level

Independent variables	All N = 372 n (%), Mean ± SD	Uptake of IPTp-SP		p-value
		Optimal N = 296 n (%), Mean ± SD	Sub-Optimal N = 76 n (%), Mean ± SD	
Good	54 (14.52)	44 (14.86)	10 (13.16)	
Knowledge of optimal SP dose				
Poor	183 (49.19)	135 (45.61)	48 (63.16)	0.01*
Good	189 (50.81)	161 (54.39)	28 (36.84)	
*Statistically significant result at 5% significance level				

Pearson Chi square and Fishers Exact test results show that optimal uptake of IPTp-SP was significantly associated with marital status ($p = 0.04$), gestation age at first ANC visit ($p < 0.001$), frequency of ANC visits ($p < 0.001$), knowledge of IPTp-SP ($p < 0.001$) and knowledge of optimal SP dose ($p = 0.01$) (Table 2).

Table 3
Socio-demographic, obstetric and knowledge predictors of uptake of SP during pregnancy

Predictors	Uptake of IPTp-SP		COR (95% CI)	AOR (95% CI)	p-value
	Optimal N = 296	Sub-Optimal N = 76			
	n (%)	n (%)			
Age category					
15–24 years	121 (40.88)	39 (51.32)	Ref		
25–34 years	142 (47.97)	31 (40.79)	1.42 (0.84,2.41)		
>=35 years	33 (11.15)	6 (7.89)	1.77 (0.69,4.55)		
Marital status					
Unmarried	62 (20.95)	25 (32.89)	Ref		
Married	234 (79.05)	51 (67.11)	1.81 (1.04,3.14)	1.68 (0.92,3.08)	0.09
Woman's Education level					
Primary	108 (36.48)	34 (44.74)	Ref		
Secondary	145 (48.99)	33 (43.42)	1.38 (0.81,2.37)		
Tertiary	43 (14.53)	9 (11.84)	1.32 (0.60,2.91)		
Woman's Employment status					
Not employed	193 (65.20)	59 (77.63)	Ref		
Informal employment	82 (27.70)	13 (17.11)	1.77 (0.93,3.35)	1.68 (0.85,3.29)	0.85
Formal employment	21 (7.10)	4 (5.26)	1.60 (0.53,4.86)	1.44 (0.45,4.59)	0.45
Religion					
Catholic	13 (4.39)	7 (9.21)	Ref		
Protestant	282 (95.27)	68 (89.47)	2.19 (0.84,5.70)	2.48 (0.89,6.95)	0.08

*Statistically significant result at 5% significance level

Predictors	Uptake of IPTp-SP		COR (95% CI)	AOR (95% CI)	p-value
	Optimal N = 296	Sub-Optimal N = 76			
Muslim	1 (0.34)	1 (1.32)	0.54 (0.03,9.99)	1.28 (0.06,25.32)	0.87
Ward of Residence					
Busali	68 (22.97)	17 (22.37)	Ref		
Wodanga	37 (12.50)	12 (15.79)	0.77 (0.33,1.79)		
North Maragoli	24 (8.11)	7 (9.21)	0.86 (0.32,2.32)		
Chavakali	52 (17.57)	12 (15.79)	1.08 (0.48,2.47)		
Sabatia West	46 (15.54)	14 (18.42)	0.75 (0.34,1.65)		
Lyaduywa Izava	69 (23.31)	14 (18.42)	1.23 (0.56,2.69)		
Residence					
Rural	224 (75.68)	63 (82.89)	Ref		
Urban	72 (24.32)	13 (17.11)	1.59 (0.83,3.05)	1.56 (0.79,3.11)	0.62
Gestation age at 1st ANC visit					
<=16 weeks	179 (60.47)	18 (23.68)	Ref		
> 16 weeks	117 (39.53)	58 (76.32)	0.20 (0.11,0.35)	0.45 (0.21,0.95)	0.04*
Frequency of ANC visits					
< 4 visits	33 (11.15)	51 (67.11)	Ref		
>=4 visits	263 (88.85)	25 (32.89)	17.10 (9.36,31.21)	16.69 (7.90,35.27)	< 0.001*
Parity					
1 child	108 (36.48)	34 (44.74)	Ref		
2 children	66 (22.30)	16 (21.05)	1.20 (0.62,2.33)		
*Statistically significant result at 5% significance level					

Predictors	Uptake of IPTp-SP		COR (95% CI)	AOR (95% CI)	p-value
	Optimal N = 296	Sub-Optimal N = 76			
3 + children	122 (41.22)	26 (34.21)	1.48 (0.83,2.62)		
Experience of SP side effects					
No	154 (52.03)	43 (56.58)	Ref		
Yes	142 (47.97)	31 (40.79)	1.32 (0.79,2.20)		
Not applicable	0	2 (2.63)	N/A		
Knowledge of MiP dangers					
Unknowledgeable	89 (30.07)	23 (30.26)	Ref		
Low knowledge	110 (37.16)	26 (34.21)	1.04 (0.56,1.94)	0.74 (0.38,1.45)	0.38
Moderate knowledge	73 (24.66)	21 (27.63)	0.90 (0.46,1.75)	0.57 (0.27,1.18)	0.13
Adequate knowledge	24 (8.11)	6 (7.90)	1.03 (0.38,2.82)	0.54 (0.18,1.64)	0.28
Knowledge of MiP prevention					
Unknowledgeable	4 (1.35)	1 (1.31)	Ref		
Low knowledge	168 (56.76)	48 (63.16)	0.88 (0.10,8.01)		
Moderate knowledge	104 (35.13)	24 (31.58)	1.08 (0.12,10.13)		
Adequate knowledge	20 (6.76)	3 (3.95)	1.19 (0.10,13.65)		
Knowledge of IPTp-SP benefits					
Poor	50 (16.89)	27 (35.53)	Ref		
Good	246 (83.11)	49 (64.47)	2.65 (1.51,4.62)	2.44 (1.33,4.49)	< 0.001*
Knowledge of IPTp-SP start					
*Statistically significant result at 5% significance level					

Predictors	Uptake of IPTp-SP		COR (95% CI)	AOR (95% CI)	<i>p</i> -value
	Optimal N = 296	Sub-Optimal N = 76			
Poor	252 (85.14)	66 (86.84)	Ref		
Good	44 (14.86)	10 (13.16)	1.17 (0.56,2.46)		
Knowledge of optimal SP					
Poor	135 (45.61)	48 (63.16)	Ref		
Good	161 (54.39)	28 (36.84)	1.96 (1.17,3.28)	1.90 (1.08,3.35)	0.03*
*Statistically significant result at 5% significance level					

From the bivariate logistic regression analysis, marital status (COR = 1.81; 95% CI 1.04, 3.14), gestation age at 1st ANC visit (COR = 0.20; 95% CI 0.11, 0.35), frequency of ANC visits (COR = 17.10; 95% CI 9.36, 31.21), knowledge of IPTp-SP benefits (COR = 2.65; 95% CI 1.51, 4.62) and knowledge of optimal SP dose (COR = 1.96; 95% CI 1.17, 3.28) were significant factors for the uptake of optimal IPTp-SP dose (Table 3). In the multivariable logistic regression analysis, receipt of optimal SP doses was higher among married women compared to single women (AOR = 1.68; 95% CI 0.92, 3.08), although not significant ($p = 0.09$). Gestation age at ANC initiation and frequency of the ANC visits remained significant predictors of optimal IPTp-SP uptake when other factors remained constant ($p = 0.04$), ($p < 0.001$) respectively. Pregnant women who started ANC attendance beyond 16 weeks gestation age were 55% less likely to receive optimal IPTp-SP (AOR = 0.45; 95% CI 0.21, 0.95). Women with at least four ANC visits were 16 times more likely to receive optimal IPTp-SP dose (AOR = 16.90; 95% CI 7.90, 35.27). Having knowledge of benefits of IPTp-SP uptake remained a significant predictor of optimal uptake of SP doses ($p < 0.001$). Women with good knowledge of benefits of optimal SP uptake were two-fold more likely to receive optimal doses than those with poor knowledge (AOR = 2.44; 95% CI 1.33, 4.49). Knowledge of optimal SP dose also remained a significant predictor of optimal uptake of IPTp-SP after adjusting for other covariates ($p = 0.03$). Women with good knowledge of optimal SP dose were more likely to receive optimal IPTp-SP (AOR = 1.90; 95% CI 1.08, 3.35) (Table 3).

Health Service Delivery Factors Influencing the Uptake of Optimal IPTp-SP

To reveal health service delivery factors associated with the uptake of optimal doses of SP, this study compared the health service characteristics with the outcome of IPTp-SP uptake.

Table 4
Health service characteristics associated with uptake of IPTp-SP

Health service delivery variables	All N = 372 n (%)	Uptake of IPTp-SP		p-value
		Optimal N = 296 n (%)	Sub-Optimal N = 76 n (%)	
Water provision at ANC clinic				
Never	4 (1.08)	4 (1.35)	0	0.07
Sometimes	3 (0.81)	3 (1.01)	0	
Always	352 (94.62)	282 (95.27)	70 (92.11)	
Not applicable	13 (3.49)	7 (2.37)	6 (7.89)	
Clean water at ANC clinic				
Never	1 (0.27)	1 (0.34)	0	0.38
Sometimes	2 (0.54)	2 (0.67)	0	
Always	352 (94.62)	282 (95.27)	70 (92.11)	
Not applicable	17 (4.57)	11 (3.72)	6 (7.89)	
Clean cups at ANC clinic				
Never	2 (0.54)	2 (0.67)	0	0.4
Sometimes	7 (1.88)	6 (2.03)	1 (1.32)	
Always	346 (93.01)	277 (93.58)	69 (90.79)	
Not applicable	17 (4.57)	11 (3.72)	6 (7.89)	
Enough cups at ANC clinic				
Never	44 (11.83)	37 (12.50)	7 (9.21)	0.46
Sometimes	13 (3.49)	11 (3.72)	2 (2.63)	
Always	298 (80.11)	237 (80.06)	61 (80.27)	
Not applicable	17 (4.57)	11 (3.72)	6 (7.89)	
ANC clinic working hours				
Half day	341 (91.67)	274 (92.57)	67 (88.16)	0.23
Full day	31 (8.33)	22 (7.43)	9 (11.84)	

*Statistically significant result at 5% significance level

Health service delivery variables	All N = 372 n (%)	Uptake of IPTp-SP		p-value
		Optimal N = 296 n (%)	Sub-Optimal N = 76 n (%)	
SP administration at ANC clinic				
Never missed administering	349 (93.82)	283 (95.61)	66 (86.84)	0.01*
Ever missed administering	23 (6.18)	13 (4.39)	10 (13.16)	
Maternal service fee				
Never paid	363 (97.58)	291 (98.31)	72 (94.74)	0.08
Ever paid	9 (2.42)	5 (1.69)	4 (5.26)	
ANC clinic waiting time				
<=30 minutes	214 (57.53)	167 (56.42)	47 (61.84)	0.34
> 30 minutes	158 (42.47)	129 (43.58)	29 (38.16)	
Health worker-client relationship				
Poor	79 (21.24)	60 (20.27)	19 (25.00)	0.41
Good	293 (78.76)	236 (79.73)	57 (75.00)	
*Statistically significant result at 5% significance level				

From Table 4 higher proportion of women who received optimal IPTp-SP doses never missed being administered with SP on their scheduled ANC visits compared to those who received sub-optimal SP doses (95.61% vs 86.84%, $p = 0.01$). There was no significant association between the uptake of IPTp-SP and water provision at ANC ($p = 0.07$), provision of clean water ($p = 0.38$), provision of clean cups ($p = 0.40$), provision of enough cups ($p = 0.46$), ANC clinic working hours ($p = 0.23$), maternal fee ($p = 0.08$), ANC clinic waiting time ($p = 0.34$) and pregnant woman's relationship with ANC health workers ($p = 0.41$) (Table 4).

Table 5
Health service predictors of uptake of IPTp-SP

Predictors	Uptake of IPTp-SP		COR (95% CI)	AOR (95% CI)	p-value
	Optimal N = 296 n (%)	Sub-Optimal N = 76 n (%)			
Water provision at ANC clinic					
Never	4 (1.35)	0	N/A		
Sometimes	3 (1.01)	0	N/A		
Always	282 (95.27)	70 (92.11)	3.39 (1.11,10.41)	2.54 (0.77,8.39)	0.13
Not applicable	7 (2.37)	6 (7.89)	Ref		
Clean water at ANC clinic					
Never	1 (0.34)	0	N/A		
Sometimes	2 (0.67)	0	N/A		
Always	282 (95.27)	70 (92.11)	2.16 (0.77,6.04)		
Not applicable	11 (3.72)	6 (7.89)	Ref		
Clean cups at ANC clinic					
Never	2 (0.67)	0	N/A		
Sometimes	6 (2.03)	1 (1.32)	3.27 (0.32,33.94)		
Always	277 (93.58)	69 (90.79)	2.15 (0.77,6.02)		
Not applicable	11 (3.72)	6 (7.89)	Ref		
Enough cups at ANC clinic					
Never	37 (12.50)	7 (9.21)	Ref		
Sometimes	11 (3.72)	2 (2.63)	1.22 (0.23,6.63)		
Always	237 (80.06)	61 (80.27)	0.86 (0.38,1.95)		

*Statistically significant result at 5% significance level

Predictors	Uptake of IPTp-SP		COR (95% CI)	AOR (95% CI)	p-value
	Optimal N = 296 n (%)	Sub-Optimal N = 76 n (%)			
Not applicable	11 (3.72)	6 (7.89)	0.41 (0.12,1.43)		
ANC clinic working hours					
Half day	274 (92.57)	67 (88.16)	Ref		
Whole day	22 (7.43)	9 (11.84)	0.61 (0.27,1.38)	0.59 (0.26,1.36)	0.13
SP administration at ANC clinic					
Never missed administering	283 (95.61)	66 (86.84)	3.24 (1.36,7.70)	2.86 (1.13,7.20)	0.03*
Ever missed administering	13 (4.39)	10 (13.16)	Ref		
Maternal services fee					
Never paid	291 (98.31)	72 (94.74)	Ref		
Ever paid	5 (1.69)	4 (5.26)	0.31 (0.08,1.20)		
ANC clinic waiting time					
<=30 minutes	167 (56.42)	47 (61.84)	Ref		
> 30 minutes	129 (43.58)	29 (38.16)	1.29 (0.77,2.15)		
Health worker-client relationship					
Poor	60 (20.27)	19 (25.00)	Ref		
Good	236 (79.73)	57 (75.00)	1.28 (0.71,2.32)		
*Statistically significant result at 5% significance level					

Bivariate analysis of health service predictors of optimal uptake of IPTp-SP demonstrated that women who were always provided with water (COR = 3.39; 95% CI 1.11, 10.41), always provided with clean water (COR = 2.16; 95% CI 0.77, 6.02), sometimes found clean cups (COR = 3.27; 95% CI 0.32, 33.94), always found clean cups (COR = 2.15; 95% CI 0.77, 6.02), sometimes found enough cups (COR = 1.22; 95% CI 0.23, 6.63), always administered with SP during scheduled ANC visits (COR = 3.24; 95% CI 1.36, 7.70), waited at the queue for more than thirty minutes (COR = 1.29; 95% CI 0.77, 2.15) and women who had

good relationship with ANC health workers (COR = 1.28; 95% CI 0.77, 6.02) had increased odds of receiving optimal IPTp-SP dose (Table 5). However, at multivariable level, only women who never missed being issued with SP drug for IPTp on scheduled ANC visits (AOR = 2.86; 95% CI 1.13, 7.20) remained significantly associated with optimal uptake of IPTp-SP after adjusting for other covariates.

Discussion

IPTp-SP is one of the interventions recommended by the WHO for controlling malaria and its effects during pregnancy. This study sought to answer questions relating to the proportion of pregnant women receiving the optimal dose of IPTp-SP; the sociodemographic, obstetric, knowledge related factors and the health service delivery factors influencing the uptake of optimal IPTp-SP by pregnant women in Sabatia Sub County. It was expected that the study findings would contribute to improved optimization of IPTp-SP uptake. In this study, the prevalence of optimal uptake of IPTp-SP stood at 79.57%. The significant predictors of the uptake of optimal IPTp-SP were identified as gestational age at first ANC visit, frequency of ANC visits, knowledge of IPTp-SP benefits, knowledge of optimal SP dose and administration of SP drug. In the bivariate analysis, married women had significantly higher odds of optimizing IPTp-SP uptake versus the unmarried.

Almost all post-delivery women (99.46%) received at least one dose of IPTp-SP. Over three-quarters of the women (79.57%) took the recommended three or more doses of IPTp-SP. The uptake of optimal IPTp-SP in this study area is close to the national target of 80% but still far from universal uptake. The high prevalence of the optimal uptake of IPTp-SP in this study is consistent with other studies in Ghana and Sierra Leone (21, 22, 25). However, other studies in Uganda, Tanzania and Malawi that investigated the optimization of IPTp-SP found low uptake levels of IPTp-SP3 + doses (19, 20, 32). The high prevalence of optimal IPTp-SP could be attributable to the sustained efforts by the Kenyan government and development partners towards the elimination of MiP and continued investment in maternal health. For instance, provision of maternal health care services including IPTp-SP administration is free in Kenya. Health workers in the country have continuously been trained and mentored on the management and prevention of MiP. Also, advocacy, communication and social mobilization for malaria control including MiP continue to be implemented in Kenya. In this study, the uptake of optimal IPTp-SP was higher (79.57%) compared to the findings of the 2015 national malaria survey that reported IPTp-SP3 + prevalence of 37.5% (23). This difference could be due to the scale up of strategies for MiP prevention since 2015. This is also an indication of the variations in the uptake of the intervention across the country. Another possible explanation for the difference is use of different aspects of the study methods. For example, the survey sampled respondents from the entire malaria endemic zones in the country while this study drew the sample from one of the sub counties in the malaria endemic regions.

This study found that gestational age at initial ANC visit and the frequency of ANC visits were significantly associated with the optimal uptake of IPTp-SP. Pregnant women who first visited ANC clinic beyond 16 weeks gestational age were less likely to receive optimal IPTp-SP compared to those who first visited the ANC clinic at the gestational age of 16 or less weeks. These observations are similar to those

of a study in Tanzania that reported that having the first ANC booking before 17 weeks gestation age increased the odds of receiving at least three IPTp-SP doses (32). Consistent with these findings are two studies conducted in Zambia and Ghana, which reported that ANC start date was a significant predictor of optimal IPT-SP uptake (26, 33). Conversely, no relationship was found between ANC initiation and IPTp-SP dosage in another study in Tanzania (34). However, the analysis of this relationship was done on a small number of third trimester pregnant women (n = 138). In line with other studies in Uganda, Tanzania, Malawi, Sierra Leone and Ghana, this study found that women who made four or more ANC visits during their entire pregnancy period were more likely to optimize IPTp-SP uptake (19–22, 25, 26, 32). The WHO calls for integration of IPTp-SP with initiatives for promoting focused antenatal care services (9). Therefore, pregnant women who begin ANC attendance early before the 16th week of gestation are likely to achieve adequate ANC visits thus maximizing their contacts with the health workers and this translates to increased messaging on IPTp-SP and optimized administration of SP for IPTp. However, this study has also demonstrated that adequacy of ANC visits does not necessarily guarantee optimal uptake of IPTp-SP. Among the women who received sub-optimal IPTp-SP, 32.47% had made at least four ANC visits. This may be due to deficiencies from the health facility level such as SP drug's shortage.

In Tanzania, Cameroon and Zambia, maternal knowledge of IPTp-SP positively influenced the uptake of three or more IPTp-SP doses (32, 33, 35). This is an indicator that the optimization of IPTp-SP could be realized when pregnant women are adequately and properly informed of the intervention. Similarly, this study found that pregnant women with good knowledge of IPTp-SP benefits were more than twice as likely as those with poor knowledge to complete the recommended IPTp-SP3 + doses. Besides, in this study maternal knowledge of optimal SP dose significantly predicted the uptake of IPTp-SP3+. This could be attributed to the fact that good maternal knowledge of the benefits and optimal dose of IPTp-SP empowers pregnant women to develop positive attitudes and perceptions towards completion of the recommended IPTp-SP doses. Therefore, it is clear that having a good understanding of the importance of IPTp-SP and the recommended IPTp-SP dose for optimal pregnancy outcomes drives a woman to take a positive decision towards IPTp-SP optimization. In Ghana, a study found that pregnant women who understood the importance of taking SP during pregnancy and knew the number of SP doses to be taken positively influenced their subsequent visits for the third SP dose (36).

Marital status was a significant factor during bivariate analysis before controlling for confounding. The findings from this study show as it does in Ghana that married women were more likely to receive the recommended IPTp-SP3 + dose than unmarried women (37). Though a different study in Kenya did not consider optimal IPTp dosage, it also established that married women were highly likely to receive IPTp compared to the unmarried women (38). Possibly, married women get both financial and psychosocial support from their spouses to attend the ANC clinic for receipt of adequate IPTp-SP. Evidenced by a study in the Bungoma East district of Kenya, women who received support from their partners towards antenatal visits were 8.2 times more likely to receive subsequent IPTp-SP doses after the first one (39). It could also be that unmarried women may fear being mocked by the community when they get pregnant out of wedlock thus hide from adequate ANC attendance leading to reduced IPTp-SP3 + levels.

Previous studies have argued that suboptimal dosage of IPTp-SP was mainly due to the health system deficiencies (27–29). This study also investigated health service delivery factors influencing optimal IPTp-SP uptake. Most of the health service delivery factors were not significantly associated with the optimization of IPTp-SP. Only the administration of SP drug at ANC clinic that was significantly associated with the uptake of optimal IPTp-SP after adjusting for other covariates. Women who never missed being issued with SP drug for IPTp on scheduled ANC visits were more than twice as likely as those who ever missed being administered with the drug to receive optimal IPTp-SP. Ever missing to administer SP drug to pregnant women for intermittent malaria preventive therapy during scheduled ANC visits can create a sense of mistrust among pregnant women concerning the continued availability of the drug. Thus, subsequent ANC visits may be missed leading to sub-optimal IPTp-SP uptake. Additionally, late ANC initiators who qualify for only three SP doses may end up receiving sub-optimal IPTp-SP in case they ever miss being administered any dose. In relation to this, it was found that shortage of SP was a barrier to realizing high IPTp-SP optimization in Ghana (28). Inconsistent SP administration at ANC clinics could be attributed to the drug's shortage or the health workers' inadequacies to explain to the first trimester pregnant women their ineligibility for IPTp-SP receipt.

This study had some limitations. Firstly, it employed a cross sectional study design whose inherent weakness is the impossibility to infer causation. Secondly, only women with a live birth within one year before the study were considered to participate hence a missed opportunity to study factors that may have been unique to those who had still birth. In this study, responses were self-reported hence the possibility of recall bias. However, this was minimized by verification of some responses through the use of records such as Mother & Child Health booklet. Recall bias was also minimized by excluding the respondents who had a live birth beyond one year before the study. Lastly, the health service delivery factors were studied from the pregnant women's perspective leaving out health care workers who would have provided additional insights. Nonetheless, a key strength of this study was that it was household based and used documented evidence to validate some variables. By using household-based data collection, it was possible to capture study participants who would have otherwise been missed had it been hospital based due to poor care seeking behaviour among some women.

Conclusions

Optimal uptake of IPTp-SP is high in the study area. Gestational age at first ANC visit, frequency of ANC visits, maternal knowledge of IPTp-SP benefits and maternal knowledge of optimal SP dose are the significant pregnant woman related factors for IPTp-SP optimization. Administration of SP drug at ANC clinic is the only health service delivery factor that significantly predicts optimal IPTp-SP uptake. Efforts towards early and more frequent ANC attendance should be enhanced and sustained. Structured and targeted health education should be adopted and health workers should always administer SP drugs or explain to some pregnant women their ineligibility for initial IPTp-SP receipt. Future studies considering large sample drawn from the whole country and health workers' perspective of the health system delivery factors are recommended.

Abbreviations

ANC Antenatal Care

AOR Adjusted Odds Ratio

CI Confidence Interval

COR Crude Odds Ratio

IPTp Intermittent Preventive Treatment of malaria in pregnancy

IPTp-SP Intermittent Preventive Treatment of malaria in pregnancy with Sulphadoxine Pyrimethamine

IPTp-SP3 + Three and above doses of Sulphadoxine Pyrimethamine for Intermittent Preventive Treatment of malaria in pregnancy

MiP Malaria in Pregnancy

SD Standard Deviation

SP Sulphadoxine Pyrimethamine

SPSS Statistical Package for the Social Sciences

WHO World Health Organization

Declarations

Ethics approval and consent to participate: Ethical approval was obtained from Jaramogi Oginga Odinga University of Science and Technology Ethics Review Committee (Approval Number: 7/17/ERC/11/3/20-21). Informed consent was sought from all respondents using an approved informed consent form

Consent for publication: Not applicable.

Availability of data and materials: All data generated and used for statistical analysis during this study are included in this article (Supplementary information file name: Joshua_IPTp-SP Study Data.sav).

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: JAM conceived, designed and implemented the study. DOO and SOO were involved in the study design, guided and supervised the implementation. LBA carried out statistical analyses. JAM drafted the manuscript. All authors read and approved the final manuscript.

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Figures

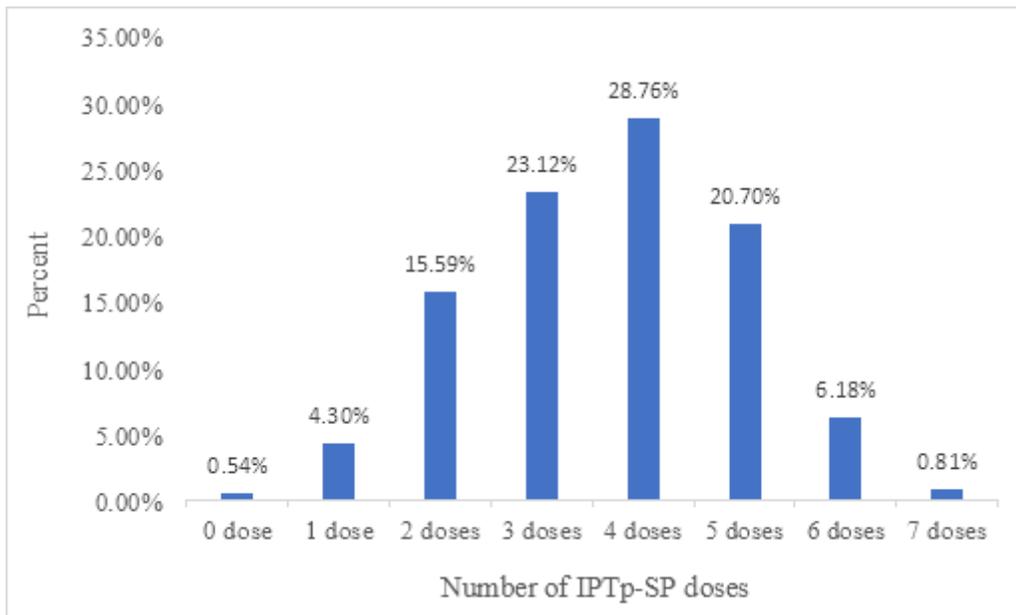


Figure 1

Distribution of IPTp-SP uptake levels against the drug's dosage

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [J.MutanyiIPTpSPIndependentVariablesDefinitions.docx](#)
- [JoshuaIPTpSPStudyData.sav](#)