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## Individual- and Community-level Correlates of Intermittent Preventive Treatment of Malaria in Pregnancy in Ghana

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# ABSTRACT

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**Background:** Ghana adopted the policy on intermittent preventive treatment of malaria in pregnancy using sulfadoxine-pyrimethamine (IPTp-SP) in 2003. Despite the government's and other stakeholders' efforts in Ghana, optimal uptake (three or more doses of IPTp-SP) has slightly declined since 2016. This study examined the individual- and community-level correlates of pregnant women who take optimal or none/partial doses (less than three doses) of IPTp-SP using the Ghana Malaria Indicator Survey (GMIS), 2019.

**Methods:** We conducted a secondary analysis of the GMIS 2019 data. Our analytical sample included 1,151 women age 15–49 whose most recent birth was in the previous two years before the survey.

**Results:** The results indicated that the overall uptake among participants was 39.0% for none/partial doses and 61.0% for optimal doses of IPTp-SP. The level of uptake differed depending on the individual rather than community-level characteristics of pregnant women. Individual-level demographic factors (religion and region of residence) and health-related factors (such as the number of antenatal (ANC) visits and scheduling of the first ANC visit) were associated with optimal IPTp-SP uptake among pregnant women in Ghana. Only the region of residence, number of ANC visits, and first ANC visit predicted IPTp-SP uptake.

**Conclusions:** There is a need for policy, interventions, and research on malaria prevention in pregnancy to improve the decline in uptake. We recommend that the Ministry of Health, the Ghana Health Service, the National Malaria Control Program, and other stakeholders consider the factors identified in this study to improve the delivery and uptake of IPT-SP services.

**Key words:** intermittent preventive treatment of malaria in pregnancy; antenatal visit; malaria; malaria indicator survey; pregnant women; Ghana



# 1 INTRODUCTION

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## 1.1 Background

Malaria and its related adverse outcomes in pregnancy pose a significant threat to global maternal health. Of the total global population, over 95% of malaria cases can be found in the World Health Organization (WHO) Regional Office for Africa (AFRO).<sup>1</sup> In the WHO AFRO, four countries in Sub-Saharan Africa (SSA) account for 48% of the global malaria cases.<sup>1</sup> Among the worst affected by malaria in Sub-Saharan Africa are children and pregnant women.<sup>2-6</sup> As Sub-Saharan Africa has worked to mitigate the prevalence of malaria through interventions and policies, malaria prevalence among pregnant women in Ghana has shown a steady decline by 2019.<sup>7</sup>

In Ghana, several studies during the past decade have shown that malaria and its related adverse outcomes, such as anemia, have severe consequences for human health and socioeconomic development.<sup>8</sup> In collaboration with international aid organizations, Ghana's government has prioritized efforts that focus on malaria vector (mosquitoes) control and host susceptibility such as insecticide-treated bed nets (ITN), social and behavior change communication (SBCC) messages, effective case management, insect repellents, dredging of standing water, and chemoprophylaxis.<sup>9-10</sup> Among these interventions, the use of ITN, SBCC messages, and chemoprophylaxis for preventing malaria have been emphasized in Ghana as part of the National Malaria Control Program for pregnant women.<sup>10-13</sup> The ITN use in Ghanaian households that followed the free mass distribution initiative in 2010 showed that pregnant women's use of ITNs increased from 32.6 to 49.7% in 2011 and 2017, respectively.<sup>12</sup> In addition, the frequency of exposure to SBCC messages on malaria prevention and early management among pregnant women has increased over the years.<sup>13</sup> The level of pregnant women's exposure to SBCC messages in Ghana has been shown to correlate significantly with ITN usage<sup>14</sup> and chemoprophylaxis for preventing malaria.<sup>10</sup>

In the 1990s, the primary chemoprophylaxis for preventing malaria during pregnancy among pregnant women in Sub-Saharan countries was the weekly administration of chloroquine prophylaxis through antenatal care (ANC).<sup>11,15</sup> Given the poor adherence to chloroquine and the parasite's tolerance to the drug in Sub-Saharan Africa, this intervention has proven to be unsuccessful in pregnant women.<sup>15,16</sup> Consequently, the WHO introduced daily or weekly doses of intermittent preventive treatment with sulfadoxine-pyrimethamine (IPTp-SP) in 2000 to replace the existing chloroquine chemoprophylaxis program for pregnant women.<sup>17-20</sup> Ghana adopted the IPTp-SP use for pregnant women policy in 2004, and later updated the policy in 2007, 2012, and 2017.<sup>20</sup> Despite IPTp-SP use during pregnancy being clinically successful, adherence among pregnant women in Ghana has not reached its optimum use of more than three doses.<sup>10,19,21</sup> According to Darteh et al., expectant mothers' adherence was influenced by sociodemographic factors such as age, region of residence, ethnic background, religion, and ethnic background.<sup>10</sup> In addition, inadequate supply of medication, ineffective behavior-change messages on malaria treatment, and the ANC staff's limited knowledge of the protocol also affected adherence to IPTp-SP among pregnant women in Ghana.<sup>10,21</sup>

In addition to the individual-level factors of pregnant women, community characteristics of these women in some studies in Africa had shown some significant influence on ANC attendance and IPTp-SP uptake. For example, studies conducted in Burkina Faso<sup>22</sup> and Uganda<sup>23</sup> have shown that using community health

workers to identify pregnant women in the community and encouraging them to attend ANC and community IPTp-SP distribution can facilitate early initiation of ANC and increase IPTp-SP coverage. Women residents in urban areas were less likely to take at least three doses because they perceived themselves as less susceptible to malaria during pregnancy. Communities and regions with more limited resources were less likely to have three or more doses of IPTp-SP.<sup>22,23</sup> A quasi-experimental study that evaluated the impact of community delivery of intermittent preventive treatment of malaria in pregnancy on its coverage in four Sub-Saharan Africa countries, which included the Democratic Republic of the Congo, Madagascar, Mozambique, and Nigeria, supported previous findings that community distribution of IPTp-SP was associated with higher uptake without a decrease in ANC attendance.<sup>24</sup> Although these studies suggested the importance of factors related to community in the Sub-Saharan region, little is known about these correlates in Ghana.

As Ghana works to attain the Sustainable Development Goal (SDG) Goal 3 to reduce maternal mortality, about 80% of pregnant women receive partial doses (at least two doses) of IPTp-SP.<sup>25</sup> Our limited literature review found little recent evidence that explored maternal sociodemographic and health-related characteristics associated with IPTp-SP uptake among pregnant women in Ghana by using a national representative sample. Most existing studies have offered essential demographic risk correlates and other characteristics such as knowledge-related factors, ANC attendance, and gestational age at ANC visits.<sup>11,26,27</sup> However, Chikwasha et al. noted that the uptake of IPTp-SP in Zimbabwe was affected by pregnant women's sociodemographic and health-related factors.<sup>28</sup> Thus, in addition to individual factors, there is a gap in examining key community characteristics that may be associated with IPTp-SP uptake among pregnant women in Ghana.

In addition, the WHO emphasized that IPTp-SP acceptance has been shown to reduce the rate of infant mortality and pregnancy-related complications globally. As Ghana seeks to attain Sustainable Development Goal 3 by 2030, increased uptake of IPTp-SP can help the nation to end malaria and child mortality and to reduce maternal deaths due to pregnancy-related complications.<sup>19</sup> Our study examined the individual- and community-level factors of pregnant women who take optimal or none/partial doses of IPTp-SP using Ghana's 2019 Malaria Indicator Survey.

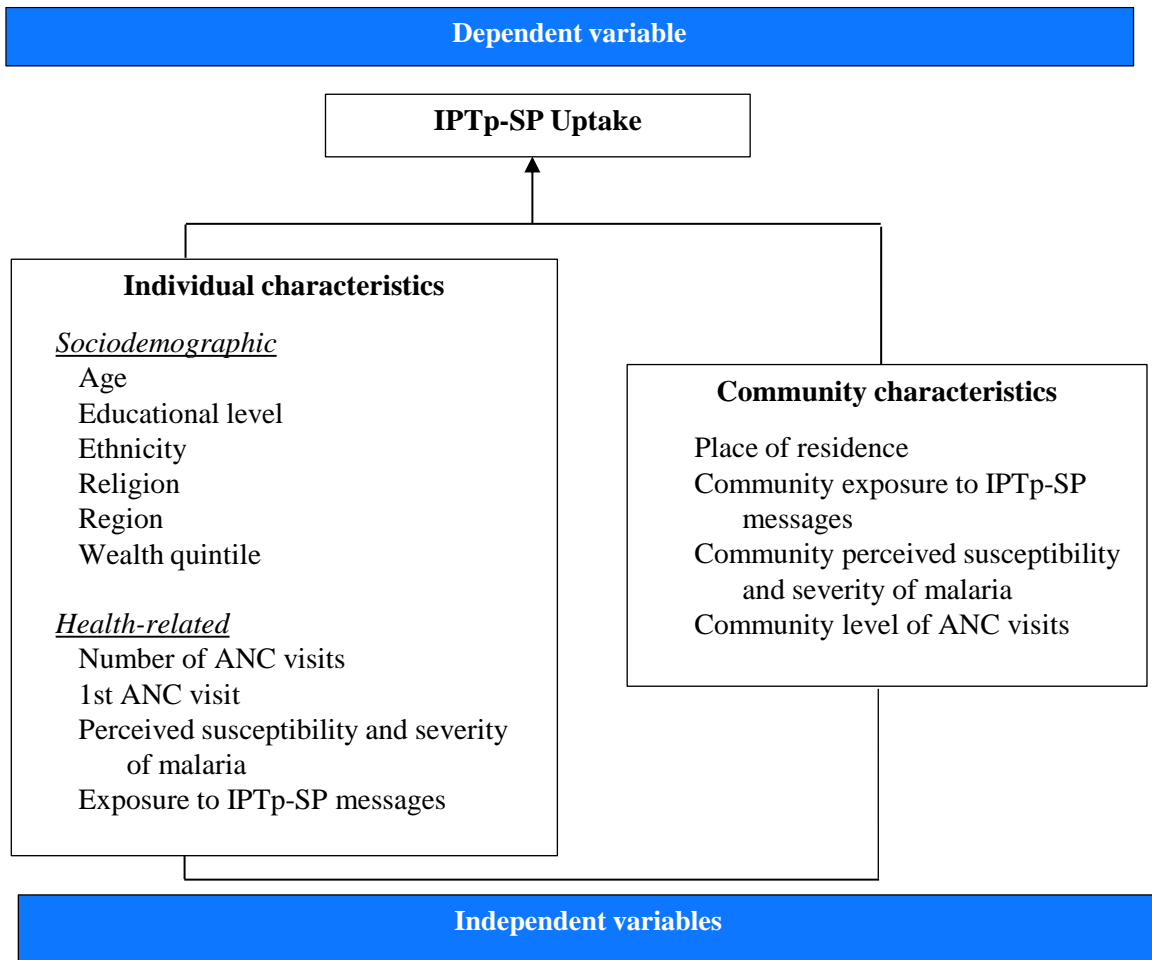
## **1.1 Research Question**

What individual- and community-level factors in Ghana predict uptake of none/partial and optimal doses of IPTp-SP among pregnant women?

## **1.2 Conceptual Framework**

Figure 1 shows the dependent and independent variables in the study's conceptual framework.

**Figure 1 Conceptual framework 1**



The dependent variable in this study is pregnant women’s IPTp-SP uptake in Ghana, categorized in this research as none/partial and optimal doses. The none/partial dose category includes those women who take fewer than three or no doses of IPTp-SP, since an optimal dose is at least three or more doses.<sup>10,19</sup>

Our study has two independent variables: individual- and community-level factors. The individual-level characteristics of pregnant women included sociodemographic factors (age, education, ethnicity, religion, region of residence, and wealth quintile) and health-related factors (health insurance coverage, number of ANC visits, first ANC visit, poorly perceived susceptibility and severity of malaria, and exposure to IPTp-SP messages).<sup>10,28,29</sup>

Based on previous literature, we also conceptualized that the community-level characteristics of pregnant women, such as place of residence, community exposure to malaria messages, perceptions of community susceptibility and severity of malaria, and community level of ANC visits, could influence the IPTp-SP uptake of pregnant women in Ghana.<sup>11, 28–30</sup>



## 2 DATA AND METHODS

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### 2.1 Data

We utilized data from the Ghana Malaria Indicator Survey 2019 (GMIS 2019). The survey used Ghana's 2010 Population and Housing Census sampling frame in the ten existing administrative regions. The GMIS 2019 sample was created through two rounds of stratification and selection from the sampling frame. After dividing respective regions into 200 enumeration areas (EAs) (97 urban and 103 rural areas), 20 strata were formed for sampling. In each stratum, separate census EA sample selections were made in two phases.<sup>25</sup> Following a stratified two-stage cluster design, interviews were open to all women between age 15 and 49 who were either long-term residents or guests the night before the survey of the selected households.

With a 99% response rate, a total of 5,181 eligible women were interviewed at the end of the survey.<sup>25</sup> In the current study, our analytical sample included 1,151 women age 15–49 with their most recent birth in the previous two years before the survey. The women had received varied doses of IPTp-SP, which ranged from none to nine doses. According to WHO,<sup>19</sup> three or more doses of IPTp-SP are recommended for every pregnant woman in malaria-endemic regions. All information that was obtained was kept confidential. The GMIS 2019 protocol was approved by both the ICF Institution Assessment Committee and the Ghana Health Ethics Review Board.\*

### 2.2 Variables

#### 2.2.1 Dependent variables

We selected the women's use of IPTp-SP during pregnancy as the outcome variable for the study. We constructed this variable from two survey items: "During this pregnancy, did you take SP/Fansidar to prevent you from getting malaria?" and "How many times have you received SP/Fansidar during this pregnancy?" The women's responses about the doses of SP/Fansidar taken during pregnancy were dichotomized into none/partial (<3 times)= 0 and optimal (3+ times)=1.

#### 2.2.2 Independent variables

The explanatory variables included two primary contextual categories: maternal individual and community characteristics. The individual-level characteristics of pregnant women included sociodemographic and health-related factors. With the sociodemographic factors, the age of women was categorized within a 5-year interval (15–19, 20–24, 25–29, 30–34, 35–39, and 40+). Educational level was also classified into none, primary, secondary, and higher levels. Ethnicity included four categories: Akan, Mole-Dagbani, Ewe, and others. The religion of participants was categorized into Catholic, Pentecostal/Charismatic, other Christian, Muslim, and others. The participants' region of residence was based on the original ten regions of Ghana, while the wealth quintile was classified into five groups (poorest, poorer, middle, richer, and richest). For the health-related factors, we selected and categorized the following variables: number of ANC visits at pregnancy (0–3, 4–7, and 8+), and scheduling of the first ANC visit (0–3, 4–6, and 6–9 months). The perceived susceptibility and severity of malaria were constructed from participants' stated belief that

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\* The dataset is available at [https://dhsprogram.com/data/dataset/Ghana\\_MIS\\_2019.cfm?flag=0](https://dhsprogram.com/data/dataset/Ghana_MIS_2019.cfm?flag=0).

they don't worry about malaria because it can be easily treated (agree = 0 and disagree = 1). We also created the variable "exposure to IPTp-SP messages" from the responses to the item that assessed if pregnant women have seen or heard messages in the past 6 months that they should take drugs to prevent malaria (yes = 1 and no = 0). Additional community-level explanatory variables included the place of residence (rural and urban), community exposure to malaria messages, community perception of susceptibility and severity of malaria, and community level of ANC visits. Using a STATA command, we created these community-level variables by constructing aggregate values based on the clusters in the survey.

## **2.3 Statistical Analysis**

All items were categorical and assigned respective codes before the final descriptive and inferential statistics were analyzed, except for the three community-level factors (community exposure to malaria messages, poorly perceived community susceptibility and severity of malaria, and community level of ANC visits). We used descriptive and inferential statistics for our data analysis. A chi-square ( $\chi^2$ ) statistic was used to examine the associations between individual- and community-level characteristics and IPTp-SP uptake. We used binary logistic regression to identify the factors that predict IPTp-SP adoption at both none/partial and optimal levels. Before conducting the actual statistical analysis, frequency distributions were weighted to correct the non-proportional distribution of the sample across different areas and the possibility of variances in response rates. Furthermore, we employed the survey command in STATA to account for the complex sampling design of the data in the binary logistic regression. Results from this analysis were shown as unadjusted and adjusted odds ratios (*OR*) with 95% confidence intervals (CIs).



## 3 RESULTS

### 3.1 Demographic Characteristics of Participants

For this data analysis, we used a total sample of 1,151 women between age 15 and 49 with their most recent birth in the previous two years before the survey. As shown in Table 1, 71.8% of women were between the reproductive ages of 20 and 35, with 59.0% having secondary and higher education. Approximately 40.9% of the women were Akan, and 76.6% were Christian. Greater Accra Region, the Capital of Ghana, and the Ashanti Region had 31.0% responses due to the dense populations. Most women (55.9%) reported a wealth index between the middle and the richest. About 89.8% of women had previously visited the ANC clinic more than four times, while more than half (65.9%) completed their first antenatal check. There was an equal number of participants selected from urban and rural settlements in Ghana.

**Table 1 Demographic characteristics of participants**

Percentage of women aged 15–49 who had children under age 24 months and had sought ANC during their pregnancy by selected demographic characteristics, Ghana 2019 Malaria Indicator Survey		
Variables	Number of participants (n)	Percent (%)
<b>Demographic characteristics</b>		
<b>Age (in years)</b>		
15–19	88	7.7
20–24	245	21.3
25–29	334	29.0
30–35	244	21.2
35–39	173	15.0
40+	67	5.8
<b>Educational level</b>		
None	224	19.5
Primary	248	21.5
Secondary and higher	679	59.0
<b>Ethnicity</b>		
Akan	471	40.9
Mole-Dagbani	254	22.1
Ewe	171	14.9
Other	256	22.2
<b>Religion</b>		
Catholic	78	6.8
Pentecostal/Charismatic	509	44.2
Other Christians	294	25.6
Muslim	231	20.1
Other	39	3.4
<b>Region</b>		
Greater Accra	174	15.1
Central	98	8.5
Western	114	9.9
Volta	121	10.5
Eastern	111	9.7
Ashanti	184	15.9
Brong Ahafo	95	8.2
Northern	161	14.0
Upper East	55	4.8
Upper West	37	3.2

*Continued...*

Table 1—Continued

Variables	Number of participants (n)	Percent (%)
<b>Wealth index</b>		
Poorest	242	21.0
Poorer	265	23.1
Middle	232	20.2
Richer	222	19.3
Richest	189	16.5
<b>Number of antenatal visits during pregnancy</b>		
0–3 visits	117	10.1
4–7 visits	546	47.4
8+ visits	488	42.4
<b>Scheduling of 1st antenatal check (in months)</b>		
0–3 months	758	65.9
4–6 months	375	32.6
7–9 months	17	1.5
<b>Poorly perceived susceptibility and severity of malaria</b>		
Disagree	452	39.3
Agree	699	60.7
<b>Exposure to messages on IPTp-SP (in the past 6 months)</b>		
No	1,082	94.0
Yes	69	6.0
<b>Place of residence</b>		
Urban	500	43.4
Rural	651	56.6
<b>Total</b>	<b>1,151</b>	<b>100</b>

Source: 2019 GMIS dataset

### 3.2 Bivariate Analysis of Pregnant Women’s IPTp-SP Uptake in Ghana

The bivariate analysis presented in Table 2 shows the results of the percentage of women between age 15 and 49 with their most recent birth in the previous two years before the survey who had received none/partial or optimal doses of IPTp-SP. The overall uptake among participants was 39.0% for none/partial doses (less than three doses of IPTp-SP) and 61.0% for optimal doses of IPTp-SP (three or more doses of IPTp-SP).

In general, few explanatory variables were significantly associated with IPTp-SP, whereas some had no relationship with the result variable. A pregnant woman’s uptake of IPTp-SP was significantly associated with religion, region of residence, number of ANC visits, and scheduling of the first ANC visit. Approximately 45.1% of women who were Pentecostal/Charismatic Christians and took less than three doses, while 74.4% of Catholics took three or more doses of IPTp-SP. More than half of women (57.8%) from the Eastern Region took less than three doses, while most women (77.8%) in the Upper West took three or more doses of IPTp-SP. For the health-related characteristics, 71.9% of women who took less than three doses reported three or fewer ANC visits, compared to 71.7% who took three or more doses of IPTp-SP and had eight or more ANC visits. Furthermore, scheduling of the first ANC visit showed that 64.3% of women whose first ANC visit was initiated within 7 to 9 months of pregnancy (third trimester) had less than three doses of IPTp-SP, while 66.7% who took three or more doses of IPTp-SP were between 0 to 3 months of pregnancy (first trimester).

**Table 2 Bivariate analysis of pregnant women's IPTp-SP uptake**

Percentage of women aged 15–49 who had children under age 24 months and had sought ANC during their pregnancy who received less than three IPTp doses and who received 3+ doses, with Chi<sup>2</sup> and t-test *p*-values, Ghana 2019 Malaria Indicator Survey

Variables	<3 doses		3+ doses		<i>p</i> value
	%	CI	%	CI	
<b>Individual-level: Sociodemographic</b>					
<b>Age (in years)</b>					.148
15–19	48.0	[35.7, 60.6]	52.0	[39.4, 64.3]	
20–24	45.8	[38.8, 53.0]	54.2	[47.0, 61.2]	
25–29	36.2	[29.0, 44.0]	63.8	[56.0, 71.0]	
30–35	36.8	[28.9, 45.5]	63.2	[54.5, 71.1]	
35–39	37.2	[28.5, 46.9]	62.8	[53.1, 71.5]	
40+	28.2	[17.8, 41.7]	71.8	[58.3, 82.2]	
<b>Educational level</b>					.059
None	35.7	[26.6, 46.0]	64.3	[54.0, 73.4]	
Primary	48.0	[39.7, 56.4]	52.0	[43.6, 60.3]	
Secondary and higher	36.7	[32.7, 41.0]	63.3	[59.0, 67.3]	
<b>Ethnicity</b>					.127
Akan	36.8	[32.3, 41.6]	63.2	[58.4, 67.7]	
Mole-dagbani	34.6	[28.5, 41.2]	65.4	[58.8, 71.5]	
Ewe	41.4	[32.2, 51.2]	58.6	[48.8, 67.8]	
Other	45.7	[37.1, 54.6]	54.3	[45.4, 62.9]	
<b>Religion</b>					.008
Catholic	25.6	[17.3, 36.2]	74.4	[63.8, 82.7]	
Pentecostal/Charismatic	45.1	[39.5, 50.9]	54.9	[49.1, 60.5]	
Other Christians	35.8	[30.1, 42.0]	64.2	[58.0, 69.9]	
Muslim	33.4	[26.7, 40.8]	66.6	[59.2, 73.3]	
Other	41.6	[23.8, 61.8]	58.4	[38.2, 76.2]	
<b>Region</b>					.016
Greater Accra	43.0	[34.5, 51.9]	57.0	[48.1, 65.5]	
Central	37.6	[29.5, 46.3]	62.4	[53.7, 70.5]	
Western	32.5	[25.4, 40.4]	67.5	[59.6, 74.6]	
Volta	46.8	[29.2, 65.3]	53.2	[34.7, 70.8]	
Eastern	57.8	[47.0, 67.9]	42.2	[32.1, 53.0]	
Ashanti	35.8	[29.0, 43.2]	64.2	[56.8, 71.0]	
Brong Ahafo	36.8	[26.2, 48.9]	63.2	[51.1, 73.8]	
Northern	35.5	[24.6, 48.3]	64.5	[51.7, 75.4]	
Upper East	22.6	[14.3, 33.8]	77.4	[66.2, 85.7]	
Upper West	22.2	[13.3, 34.7]	77.8	[65.3, 86.7]	
<b>Wealth index</b>					.961
Poorest	40.4	[31.7, 49.7]	59.6	[50.3, 68.3]	
Poorer	38.5	[31.4, 46.1]	61.5	[53.9, 68.6]	
Middle	39.0	[32.5, 45.9]	61.0	[54.1, 67.5]	
Richer	36.7	[29.7, 44.2]	63.3	[55.8, 70.3]	
Richest	40.5	[31.5, 50.1]	59.5	[49.9, 68.5]	
<b>Individual-level: Health-related</b>					
<b>Number of antenatal visits during pregnancy</b>					.001
0–3 visits	71.9	[59.2, 81.9]	28.1	[18.1, 40.8]	
4–7 visits	41.4	[36.6, 46.5]	58.6	[53.5, 63.4]	
8+ visits	28.3	[23.8, 33.4]	71.7	[66.6, 76.2]	
<b>Scheduling of 1st antenatal check (in months)</b>					.001
0–3 months	33.3	[29.0, 37.8]	66.7	[62.2, 71.0]	
4–6 months	49.3	[43.0, 55.7]	50.7	[44.3, 57.0]	
7–9 months	64.3	[40.6, 82.6]	35.7	[17.4, 59.4]	
<b>Perceived susceptibility and severity of malaria</b>					.897
Disagree	38.7	[33.4, 44.2]	61.3	[55.8, 66.6]	
Agree	39.1	[34.5, 44.0]	60.9	[56.0, 65.5]	

Continued...

**Table 2—Continued**

Variables	<3 doses		3+ doses		p value
	%	CI	%	CI	
<b>Exposure to messages on IPTp-SP (in the past 6 months)</b>					.052
No	39.9	[35.9, 44.0]	60.1	[56.0, 64.1]	
Yes	24.8	[14.4, 39.4]	75.2	[60.6, 85.6]	
<b>Community-level</b>					
<b>Place of residence</b>					
Urban	40.5	[35.5, 45.8]	59.5	[54.2, 64.5]	.475
Rural	37.8	[32.5, 43.4]	62.2	[56.6, 67.5]	
<b>Community exposure to malaria messages</b>	5.2	[3.3, 7.1]	6.5	[4.8, 8.3]	.086
<b>Perceived community susceptibility and severity of malaria</b>	61.2	[56.3, 66.2]	60.4	[55.9, 64.9]	.697
<b>Community level of ANC visits</b>	655.8	[623.5, 688.0]	715.3	[690.0, 740.8]	.697
<b>Total</b>	39		61		

Note: *p* values for all categorical variables were derived from the Pearson Chi-Squared tests, *p* values for all continuous variables (Community exposure to malaria messages, Perceived community susceptibility and severity of malaria, and Community level of ANC visits) were derived from t-test.  
Source: 2019 GMIS dataset

### 3.3 Results of Binary Logistic Regression Analysis

In the binary logistic regression analysis, we used a total sample of 1,151 women between age 15 and 49 with their most recent birth in the previous two years before the survey to examine the magnitude of the relationship between individual- and community-level factors and IPTp-SP uptake. Table 3 shows the unadjusted and adjusted *OR* and *CI* of the explanatory variables of participants. In the unadjusted model, a pregnant woman’s uptake of IPTp-SP was significantly predicted by age, religion, region of residence, number of ANC visits, scheduling of first ANC visit, and community level of ANC visits. However, the region of residence, number of ANC visits, and scheduling of the first ANC visit significantly predicted IPTp-SP uptake in the adjusted model.

Among the individual-level sociodemographic factors in the unadjusted model, women age 40 and older had 2.4 times greater odds of IPTp-SP uptake than those between the age 15 and 19. Pentecostal/Charismatic women had 60% lower odds of IPTp-SP uptake than Catholics. Women who were residents in the Eastern Region had 40% lower odds than those in Greater Accra Region. Nonetheless, participants in Upper East and Upper West regions had 2.6 times greater odds of IPTp-SP uptake than those in the Greater Accra Region. In the adjusted individual-level sociodemographic model, only residents in the Upper East and Upper West regions had 3.0 and 5.3 times greater odds of IPTp-SP uptake than those in the Greater Accra Region, respectively.

The unadjusted individual-level health-related model showed that women with 4 to 7 ANC visits during pregnancy had 3.6 times higher odds of IPTp-SP uptake than those with only 0 to 3 visits. A similar trend was reported in the adjusted model, where women with 4 to 7 ANC visits had 3.3 times greater odds of IPTp-SP uptake than those with 0 to 3 visits. Likewise, participants with 8 or more ANC visits had 4.9 times greater odds of IPTp-SP uptake than women with 0 to 3 visits. In the unadjusted model, women who attended their first ANC in the second and third trimesters had 50% and 70% lower odds of IPTp-SP uptake, respectively, than those in their first trimesters. The adjusted model showed that only women in the second

trimester had 30% lower odds of IPTp-SP uptake. Beyond the individual factors, only the community level of ANC visits during pregnancy had 1.3 times higher odds of IPTp-SP uptake in the unadjusted model.

**Table 3 Binary logistic regression of participants**

Odds ratios from logistic regression analysis of factors associated with the uptake of optimal doses (3+) of IPTs among pregnant women aged 15–49 who had children under age 24 months compared to those who had partial uptake (1–2 doses), Ghana 2019 Malaria Indicator Survey

Variables	Unadjusted		Adjusted	
	OR	CI	OR	CI
<b>Individual-Level: Sociodemographic</b>				
<b>Age (in years)</b>				
15–19		Ref		Ref
20–24	1.1	[0.6, 2.0]	1.0	[0.5, 1.7]
25–29	1.6	[0.9, 2.9]	1.4	[0.8, 2.5]
30–35	1.6	[1.0, 2.6]	1.6	[0.9, 2.6]
35–39	1.6	[0.8, 3.0]	1.4	[0.7, 2.8]
40+	2.4*	[1.0, 5.5]	1.9	[0.8, 4.4]
<b>Educational level</b>				
None		Ref		Ref
Primary	0.6*	[0.4, 0.9]	0.6	[0.4, 1.0]
Secondary and higher	1.0	[0.6, 1.5]	1.0	[0.6, 1.8]
<b>Ethnicity</b>				
Akan		Ref		Ref
Mole-Dagbani	1.1	[0.8, 1.6]	0.6	[0.3, 1.1]
Ewe	0.8	[0.5, 1.3]	1.3	[0.8, 2.2]
Other	0.7	[0.5, 1.0]	0.7	[0.4, 1.2]
<b>Religion</b>				
Catholic		Ref		Ref
Pentecostal/Charismatic	0.4**	[0.2, 0.7]	0.5	[0.3, 1.0]
Other Christians	0.6	[0.4, 1.1]	0.8	[0.4, 1.6]
Muslim	0.7	[0.4, 1.2]	1.0	[0.5, 1.8]
Other	0.5	[0.2, 1.4]	0.7	[0.3, 1.9]
<b>Region</b>				
Greater Accra		Ref		Ref
Central	1.3	[0.8, 2.1]	1.4	[0.7, 2.9]
Western	1.6	[1.0, 2.6]	1.3	[0.7, 2.5]
Volta	0.9	[0.4, 2.0]	1.2	[0.5, 2.9]
Eastern	0.6*	[0.3, 1.0]	0.7	[0.3, 1.4]
Ashanti	1.4	[0.8, 2.2]	1.5	[0.8, 2.7]
Brong Ahafo	1.3	[0.7, 2.4]	1.7	[0.9, 3.1]
Northern	1.4	[0.7, 2.6]	1.9	[0.9, 4.1]
Upper East	2.6**	[1.3, 5.0]	3.0*	[1.2, 7.3]
Upper West	2.6**	[1.3, 5.4]	5.3**	[1.9, 14.7]
<b>Wealth index</b>				
Poorest		Ref		Ref
Poorer	1.1	[0.7, 1.6]	1.2	[0.7, 2.0]
Middle	1.1	[0.7, 1.7]	1.0	[0.6, 1.8]
Richer	1.2	[0.7, 1.9]	1.3	[0.7, 2.6]
Richest	1.0	[0.6, 1.7]	0.9	[0.4, 1.9]
<b>Individual-level: Health-related</b>				
<b>Number of antenatal visits during pregnancy</b>				
0–3 visits		Ref		Ref
4–7 visits	3.6***	[2.0, 6.5]	3.3***	[1.8, 6.0]
8+ visits	6.5***	[3.7, 11.4]	4.9***	[2.6, 9.3]
<b>Scheduling of 1st antenatal check (in months)</b>				
0–3 months		Ref		Ref
4–6 months	0.5***	[0.4, 0.7]	0.7*	[0.5, 1.0]
7–9 months	0.3*	[0.1, 0.8]	0.9	[0.3, 2.6]

Continued...

Table 3—Continued

Variables	Unadjusted		Adjusted	
	OR	CI	OR	CI
<b>Perceived susceptibility and severity of malaria</b>				
Disagree		Ref		Ref
Agree	1.0	[0.7, 1.3]	1.1	[0.8, 1.6]
<b>Exposure to messages on IPTp-SP (in the past 6 months)</b>				
No		Ref		Ref
Yes	2.0	[1.0, 4.1]	1.6	[0.6, 4.0]
<b>Community-Level</b>				
<b>Place of Residence</b>				
Urban		Ref		Ref
Rural	1.1	[0.8, 1.5]	1.2	[0.8, 1.8]
<b>Community exposure to malaria messages</b>	3.3	[0.7, 16.7]	1.0	[0.1, 9.8]
<b>Perceived community susceptibility and severity of malaria</b>	0.9	[0.5, 1.7]	1.4	[0.6, 3.1]
<b>Community level of ANC visits</b>	1.3***	[1.1, 1.4]	1.2	[1.0, 1.4]
<b>Total</b>	61		39	

Note. \*\*\*  $p < .001$ , \*\*  $p < .01$ , \*  $p < .05$   
Source: 2019 GMIS dataset

## 4 DISCUSSION

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Our study examined the individual- and community-level predictors of IPTp-SP uptake among pregnant women in Ghana using the 2019 GMIS. The study's findings showed that 61% of pregnant women in Ghana received optimal (3+) doses of IPTp-SP, while 39% received only none/partial (<3) doses of IPTp-SP. This 61% optimal IPTp-SP uptake by the women was higher compared with the prevalence reported in other Sub-Saharan African countries such as 13% in Malawi,<sup>31</sup> 16.8% in Nigeria,<sup>32</sup> 25% in Uganda,<sup>31</sup> 31% in Sierra Leone,<sup>31</sup> 37% in Kenya,<sup>31</sup> 43% in Tanzania,<sup>33</sup> and 60% in Zimbabwe.<sup>28</sup> Nonetheless, our study's prevalence estimate of optimal uptake (61%) in Ghana is slightly lower than the country's 2016 IPTp-SP optimal uptake estimate of 63% using the GMIS by Darteh et al.<sup>10</sup> Furthermore, the prevalence of 61% of optimal doses in this present study is lower than the target of the National Malaria Control Programme of 100% and the global target of 80% for IPTp-SP uptake of at least two or more doses.<sup>34, 35</sup>

Our results also indicated that IPT-SP uptake tends to be associated with the religion of pregnant women. This study supports evidence from previous research on the relationship between religious beliefs and IPTp-SP uptake in Ghana among pregnant women.<sup>10</sup> The importance of religion in IPTp-SP uptake in Africa cannot be underestimated, because it drives socialization and health behaviors.<sup>10,36</sup> In addition, findings in our study indicated a significant association between IPT-SP uptake and the region of residence of pregnant women. Compared to the Greater Accra Region, the regression analysis showed that residents in the Upper East and Upper West regions were more likely to have optimal uptake. These findings support the findings of Darteh et al.<sup>10</sup> and Doku et al.<sup>37</sup> who found that pregnant women from northern Ghana are more likely to receive optimal doses of IPTp-SP compared to other regions. This finding could be due to the high intensity of malaria preventive interventions that are often targeted at the northern communities in response to increased maternal and child mortality rates.<sup>38</sup>

The role of ANC attendance could be viewed from two perspectives in the present study. We observed that pregnant women's schedule of first ANC visits and the number of ANC visits are vital to IPTp-SP uptake. With the timing (month) of the ANC visit, pregnant women who initiated their first ANC visit between the first three months of gestation were more likely to take optimal IPTp-SP dose than those who had their first visit between the second and third trimesters months of pregnancy. Several studies have also shown that the timing of the first ANC visit is associated with IPT uptake.<sup>26, 28, 39, 40</sup> Thus, pregnant women who initiated ANC visits early in their pregnancy were more likely to receive optimal IPTp-SP doses than those who completed their ANC visits later.<sup>26</sup>

Our findings aligned with studies that found that the number of ANC visits strongly predicts IPTp-SP uptake.<sup>40, 41</sup> The findings showed that pregnant women with four or more ANC visits had greater chances of taking optimal IPTp-SP doses than those who reported fewer ANC visits. Since IPTp-SP medication is obtained during routine ANC visits, pregnant women who completed four or more visits may have more opportunities to meet the minimum three doses required for optimal uptake. Buh et al.<sup>40</sup> and Martin et al.<sup>41</sup> also reported that ANC visits were strongly associated with IPT uptake. Since IPTp-SP was typically provided during ANC visits, the frequency of attendance matches women's opportunities to receive chemoprophylaxis. Moreover, ANC attendance also allowed healthcare providers to administer IPTp-SP and offer education that reinforced the importance of adherence to the regimen.<sup>10, 37, 42</sup>

The study found no significant associations between covariates of pregnant women such as age, educational level, ethnicity, wealth quintile, and IPTp-SP uptake. The findings related to educational level and wealth quintile were not anticipated given that past studies conducted in Sub-Saharan Africa countries, including Sierra Leone, Democratic Republic of Congo, Madagascar, Mozambique and Nigeria, have reported that socioeconomic factors such as wealth status and education may also play a role in optimal IPTp-SP dose.<sup>40,43</sup> Another important finding was that perceived susceptibility and severity of malaria had no significant association with IPTp-SP uptake in the current study. This finding agrees with results obtained by Awantang et al.<sup>44</sup> that found that perceived severity and susceptibility to malaria were not associated with greater odds of optimal uptake of IPT-SP among pregnant women. Possible explanations could be that some pregnant women in this context lack adequate knowledge of the IPTp-SP regimen, and they may not perceive themselves to be at high risk of contracting malaria nor perceive the disease as severe. In addition, some women may perceive IPTp-SP as harmful or unnecessary.

With community-level characteristics, the place of residence of pregnant women had no significant association with IPTp-SP uptake. This is consistent with other research that reported that the association between place of residence and intermittent preventive treatment in pregnancy with IPTp-SP uptake might vary depending on the context and specific factors.<sup>10,28</sup> Therefore, it is essential to consider context-specific factors such as region of residence when examining the relationship between place of residence and IPTp-SP uptake. Beyond this relationship, our study found no significant IPTp-SP uptake differences among the other community-level factors such as exposure to malaria messages, perceived susceptibility and severity, and level of ANC visits. These findings contradicted those of previous studies that exposure to malaria messages and community norms and beliefs towards IPTp-SP could influence IPTp-SP uptake.<sup>10,21,45</sup> Previous research has reported significant associations between community exposures to malaria messages, community perceived susceptibility, the severity of malaria, and place of residence in the uptake of IPTp-SP in pregnancy.<sup>10,21,45</sup> This inconsistency may be related to the potency of individual-level factors' influence on optimal IPTp-SP uptake rather than community-related variables. While these community-level factors may not predict optimal IPTp-SP dose, their potential in promoting optimal IPTp-SP uptake among pregnant women cannot be overlooked.



## 5 CONCLUSION

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Ghana has slightly declined in the gains made in 2016 with the optimal uptake of IPTp-SP among pregnant women. Therefore, there is a need for policy, interventions, and research to further understand this decline in uptake. Our study found that pregnant women's region of residence, number of ANC visits, and scheduling of the first ANC visit predicted IPT-SP uptake. We recommend that the Ministry of Health, Ghana Health Service, the National Malaria Control Programme, and other malaria prevention and control stakeholders pay attention to these factors to improve the delivery and uptake of IPTp-SP services. Strategies and policies that enhance the uptake of optimal doses of IPTp-SP in Ghana should include engaging religious leaders in IPTp-SP campaigns, tailoring information and messages on IPTp-SP to fit early initiation of first ANC, and increasing ANC visits during pregnancy. Interventions and policies at all levels of health care should promote positive perceptions of ANC services at the regional level. Furthermore, equitable access and budgetary allocations should be made to cover ANC services and additional interventions in regions with high levels of none/partial uptake of IPTp-SP.



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