

Factors Associated with the Use of Intermittent Preventive Treatment (IPTp) by Women During Pregnancy in Burkina Faso

Aristide Romaric Bado^{1,2,*}, Hermann Badolo^{3,4}, Mwinonè Hervé Hien^{1,3}, Ibrahim Lougué⁵, Sathiyasusuman Appunni⁴, Nicolas Méda⁶

¹Department of Biomedical and Public Health, Research Institute of Health Science, Ouagadougou, Burkina Faso

²West African Health Organization (WAHO), Bobo-Dioulasso, Burkina Faso

³National Institute of Public Health, Ouagadougou, Burkina Faso

⁴Department of statistics and Population studies, University of the Western Cape, Cape Town, South Africa

⁵Burkinabe Association for Family Welfare, Ouagadougou, Burkina Faso

⁶Department of Public Health, Faculty of Medicine, University Joseph Ki-Zerbo, Ouagadougou, Burkina Faso

Email address:

arbado@gmail.com (A. R. Bado), badholobi@gmail.com (H. Badolo), hien_herve@hotmail.com (M. H. Hien), lougue.ibrahim12@gmail.com (I. Lougué), sappunni@uwc.ac.za (S. Appunni), nicolas.meda@gmail.com (N. Méda)

*Corresponding author

To cite this article:

Aristide Romaric Bado, Hermann Badolo, Mwinonè Hervé Hien, Ibrahim Lougué, Sathiyasusuman Appunni, Nicolas Méda. Factors Associated with the Use of Intermittent Preventive Treatment (IPTp) by Women During Pregnancy in Burkina Faso. *World Journal of Public Health*. Vol. 6, No. 3, 2021, pp. 110-120. doi: 10.11648/j.wjph.20210603.15

Received: July 9, 2021; Accepted: August 4, 2021; Published: August 12, 2021

Abstract: Introduction: Malaria infection during pregnancy is more pronounced in endemic areas of sub-Saharan Africa and is a major risk factor for maternal and child morbidity and mortality. Intermittent preventive treatment in pregnancy (IPTp) is presented as an effective way of combating malaria. This study aims to identify the different factors that may influence the use of IPTp by pregnant women in Burkina Faso. Methods: The data used in this study were derived from two rounds of the Malaria Indicator Surveys (MISs) conducted in Burkina Faso in 2014 and 2017. The sample for this study consisted of women aged 15–49 years who had had a live birth in the two years prior to the survey and who might or might not have received IPTp doses. Data analysis was performed using the Stata 15 software. Bivariate analysis and a logistic regression model were used to determine the associated factors. Results: The study results show that 56% and 63% of pregnant women had received at least three or more doses of IPTp during pregnancy in 2014 and 2017, respectively. For the 2014 survey, religion, education level, household standard of living, region of residence and type of caregiver were the significant factors associated with receiving three or more doses of IPTp, while those in the 2017 survey were household standard of living, region of residence and access to malaria information. Conclusion: Plausible interventions to increase the reception of at least three doses of IPTp during pregnancy by explaining the benefits of SP could help to effectively control malaria in women and thus increase foetal and infant survival at birth.

Keywords: Determinants, Intermittent Preventive Treatment (IPTp), Malaria, Pregnancy, Chemoprevention, Burkina Faso

1. Introduction

Morbidity and mortality caused by malaria infection during pregnancy are most pronounced in endemic regions of sub-Saharan Africa [1]. In this part of the world, malaria infection during pregnancy is a major risk factor for maternal

and infant morbidity and mortality [2]. It causes maternal anaemia, which, when severe, increases the risk of maternal death [2, 3]. It can also lead to low birth weight [3] and congenital infection and increase the risk of miscarriage and stillbirth [1, 2]. In view of the serious health consequences of malaria for mother and child, the World Health Organization

(WHO) recommends a three-pronged approach to malaria prevention during pregnancy in areas of stable malaria transmission in Africa. This approach is based on the use of chemoprophylaxis and insecticide-treated bed-nets and the appropriate management of malaria cases in pregnant women [4, 5].

The efficacy of intermittent preventive treatment during pregnancy (IPTp) has been shown by several previous studies [6–8]. Indeed, a review of the literature summarised the results of various randomised or quasi-randomised studies. Its conclusions underline the fact that the use of IPTp in pregnant women reduces clinical episodes of malaria, parasitaemia and placental infection at birth [6–8].

The World Health Assembly adopted the strategy in May 2015 and set the target of reducing the global malaria burden and mortality rates by at least 90% by 2030. The strategy emphasises the need to achieve universal coverage of basic malaria interventions for all at-risk populations and the importance of using high-quality surveillance data for decision-making [9]. For example, in 2015, it recommended treatment with three or more doses of IPTp in areas of stable malaria transmission for all malaria-endemic countries.

In Burkina Faso, malaria remains a stable endemic throughout the country, with a seasonal peak (May to October) and also remains the leading cause of morbidity and mortality. The disease is the leading cause of consultation in health centres. In 2018, 26,353,768 consultations were recorded in basic health facilities, and 41.3% of these consultations were related to malaria [10]. Children under five years of age and pregnant women are vulnerable populations who pay a heavy price in terms of malaria-related morbidity and mortality. Following WHO recommendations, in 2005, Burkina Faso adopted a new treatment policy with the introduction of Artemisinin-based combination therapy (ACTs) and IPTp with sulfadoxine-pyrimethamine (SP) in pregnant women. All pregnant women must have at least three doses of IPTp during prenatal consultations. Results from the 2014 and 2017 Malaria Indicator Surveys (MISs) show that only 22% [11] and 58% [12] of women, respectively, aged 15–49 with a live birth in the two years prior to the surveys had received at least three doses of SP/Fansidar for malaria prevention during pregnancy. The trend is upward, and a greater knowledge of the factors associated with receiving three or more doses of IPTp is needed to enable policymakers to determine appropriate solutions to improve malaria prevention coverage in Burkina Faso.

In the literature, four groups of factors have been reported to directly or indirectly influence the observance of IPTp by pregnant women: sociocultural characteristics that determine the social and economic status [13], demographic characteristics, knowledge [5], attitudes and practices (KAP) with regard to malaria and the quality of antenatal consultations in health centres [14]. It is in this sense that this study was conducted, with the objective of identifying the factors associated with the use of IPTp by women during pregnancy in Burkina Faso and examining how these

determinants evolved between 2014 and 2017.

2. Materials and Methods

2.1. Data Source

The data used for this study were derived from two rounds of the MISs conducted in Burkina Faso in 2014 and 2017. These surveys were conducted by the National Institute of Statistics and Demography of Burkina Faso in collaboration with the National Malaria Control Programme, with technical assistance from Macro International. The main objective of the 2014 and 2017 MISs was to provide updated estimates of basic malaria-related indicators. During these surveys, information was collected on vector control interventions, such as the use of impregnated mosquito nets and indoor residual spraying, on IPTp of malaria in pregnant women, on care-seeking and treatment of fever in children and finally on knowledge of malaria and the means of prevention.

Both surveys used a nationally representative sample. A total of 6,448 households and 6,322 households were surveyed in 2014 and 2017, respectively. These samples were selected using a two-stage stratified cluster design, with enumeration areas as sampling units for the first stage and households for the second stage. All women aged 15–49 who were either permanent residents of the selected households or visitors who stayed in the households were interviewed.

2.2. Population Concerned

The sample for this study consisted of women aged 15–49 years who had had a live birth in the two years prior to the survey and who, during the pregnancy leading to the last live birth, had received or had not received doses of SP/Fansidar.

In the 2014 survey, 8,111 women aged 15–49 were surveyed, 4,824 of whom had had a live birth in the two years prior to the survey. In the 2017 survey, 7,628 women aged 15–49 were surveyed, 4,504 of whom had had a live birth in the two years prior to the survey.

2.3. Questionnaire

Two questionnaires were used during the survey: a household questionnaire and an individual questionnaire for women aged 15–49. The individual women's questionnaire collected information in the following five areas: (1) women's sociodemographic characteristics (age, level of education, literacy, etc.); (2) history of reproduction, including recent births and the woman's current pregnancy status: this information was used to identify women who had had recent pregnancies and children under five years of age; (3) IPTp: this section was only for women who had had a birth in the last five years (they were asked whether they had received antenatal care and whether they had received preventive treatment for malaria during their last pregnancy); (4) fever and treatment: this section was addressed only to women who had had a live child born in the last six years (if so, they were asked, for each child, whether he/she had had a fever recently and, if so, whether and how he/she had been

treated); (5) knowledge, beliefs and behaviours regarding malaria, its prevention and treatment, and exposure to malaria-related messages.

2.4. Variables

2.4.1. Outcome Variable

The dependent variable was the use of IPTp with SP/Fansidar during pregnancy. This information was collected from women aged 15–49 years who had had a live birth in the two years prior to the interview. IPTp should be given at every antenatal visit (except in the first trimester and in doses at least one month apart) [15]. The new policy does not mention a specific number of doses, but scientific evidence has shown that three or more doses of SP for IPTp have been associated with higher average birth weight and fewer low-birth-weight infants, corresponding to a relative risk reduction of 20% for low birth weight and an absolute risk reduction of 33 per 1000 births [16]. In this study, the dependent variable had two modalities: 'At least three or more doses' and 'Less than three doses'.

2.4.2. Independent Variables

The selection of independent variables was based on a review of the literature, particularly the conceptual model of Chikwasha *et al.* [17] on predictors of IPTp uptake among pregnant women in Zimbabwe using DHS data. Their conceptual framework includes two groups of variables, namely, health-related and sociodemographic characteristics.

The independent variables included in this study were health-related characteristics such as the type of health worker consulted at the first antenatal care visit and the conduct of antenatal visits. In addition, sociodemographic characteristics such as parity, women's age, religion, household wealth quintile, education level and place of

residence were included. Variables on women's KAP in relation to malaria, such as access to malaria information, knowledge of malaria symptoms, causes and prevention methods, and types of prevention methods used, were included in the analysis.

2.5. Methods of Analysis

Data analysis was performed using Stata 15.1. Two types of analysis were used: a bivariate analysis and a logistic regression model. The bivariate analysis of each independent variable was performed in relation to the dependent variable to obtain the impact of each factor on the outcome variable. The chi-square (χ^2) significance level was set at $P < 0.05$. Bivariate and multivariate logistic regressions were used to estimate crude odds ratios (OR) and adjusted odds ratios (aOR) to determine the factors associated with IPTp compliance.

3. Results

3.1. Background Characteristics of the Respondents

Table 1 shows the percentage distribution of the sample. The majority of the sample is comprised of women aged 25–29 (25.8% in 2014 and 25.1% in 2017), women of Muslim religion (66.4% in 2014 and 63.1% in 2017) and women with no education (79.1% in 2014 and 75.4% in 2017). Regarding their place of residence, more than eight out of 10 women resided in rural areas in 2014 and 2017. Almost all (97% in 2014 and 99% in 2017) had made at least one antenatal visit, and the majority (46.8% in 2014 and 53% in 2017) had received antenatal care from a midwife. All of them appeared to be aware of the symptoms of malaria and the means to prevent the disease.

Table 1. Description of the study sample.

Variables	2014		2017	
	n	%	n	%
N	4824	100	4504	100
Number of IPTp doses received				
Less than three doses	2105	43.6	1675	37.2
At least three or more doses	2719	56.4	2829	62.8
Age group				
15–19	378	7.8	295	6.5
20–24	1,068	22.1	915	20.3
25–29	1,243	25.8	1,130	25.1
30–34	991	20.5	946	21
35–39	740	15.3	782	17.4
40–44	310	6.4	323	7.2
45–49	94	1.9	113	2.5
Parity				
1	810	16.8	776	17.2
2	802	16.6	771	17.1
3	728	15.1	696	15.5
4	690	14.3	681	15.1
5	558	11.6	546	12.1
6 and over	1,236	25.6	1,034	23
Religion				
Muslim	3,197	66.4	2,834	63.1
Christian	1,216	25.2	1,386	30.8
No religion/Other	403	8.4	274	6.1

Variables	2014		2017	
	n	%	n	%
Instruction				
No level	3,814	79.1	3,396	75.4
Primary	620	12.9	610	13.5
Secondary and above	390	8.1	498	11.1
Wealth index combined				
Poorest	1,016	21.1	904	20.1
Poorer	1,066	22.1	983	21.8
Middle	1,130	23.4	937	20.8
Richer	1,049	21.7	918	20.4
Richest	563	11.7	762	16.9
Place of residence				
Urban	774	16	738	16.4
Rural	4,050	84	3,766	83.6
Administrative region				
Boucle du Mouhoun	403	8.4	369	8.2
Waterfalls	390	8.1	427	9.5
Centre	278	5.8	230	5.1
Central East	437	9.1	355	7.9
North Central	411	8.5	423	9.4
Central West	377	7.8	338	7.5
South Central	334	6.9	250	5.6
East	335	6.9	435	9.7
High-Basins	319	6.6	390	8.7
North	366	7.6	384	8.5
Central Plateau	403	8.4	373	8.3
Sahel	441	9.1	209	4.6
South West	330	6.8	321	7.1
At least one prenatal visit				
No	151	3.1	35	0.8
Yes	4,665	96.9	4,466	99.2
Access to information on malaria				
No	2,626	54.6	1,783	39.6
Yes	2,184	45.4	2,720	60.4
Knowledge of malaria symptoms				
No	148	3.1	151	3.4
Yes	4,675	96.9	4,335	96.6
Knowledge of how to prevent malaria				
Use of mosquito nets	2,090	46.9	1,966	46.4
Chemoprevention	291	6.5	144	3.4
Use of insecticide	245	5.5	114	2.7
Other	1,829	41.1	2,011	47.5
Means of prevention used				
Use of mosquito nets	2,279	50.9	839	19.9
Chemoprevention	222	5	32	0.8
Use of insecticide	226	5	373	8.8
Other	1,752	39.1	2,982	70.6
Knowledge of causes of malaria				
No	711	14.7	503	11.2
Yes	4,113	85.3	4,000	88.8
Antenatal care provider				
Doctor	61	1.3	58	1.3
Nurse	454	9.4	1,034	23
Midwife	2,256	46.8	2,429	53.9
Auxiliary birth attendant	1,846	38.3	838	18.6
Skilled birth attendant	47	1	90	2
Traditional	16	0.3	29	0.6
Other	144	3	26	0.6

3.2. Bivariate Associations of Independent Variables with the Number of IPTp Doses Received

Table 2 shows the distribution of women according to potential associated factors and IPTp adherence during pregnancy for the 2014 and 2017 surveys. The distribution

according to household standard of living showed that the proportion of IPTp compliance was highest among women living in middle-income households (49.02%) and the lowest among those living in the richest households, where only 27.66% took the recommended number of three or more doses ($P < 0.001$) in 2014. The same trend was observed in 2017. IPTp adherence varied significantly by residence and

region of residence in 2014, whereas in 2017, residence was not significant. In fact, it was significantly higher in rural areas (47.16%) than in urban areas in the 2014 survey. Regarding the regions, it varied from a minimum of 14.94% in the Hauts-Bassins region to a maximum of 64.83% in the Centre-East ($P < 0.001$). There were significant variations by region in the reception of at least three doses of IPTp among pregnant women. Women who had made at least one prenatal

visit during pregnancy and those who had consulted a doctor during pregnancy were proportionally more likely to have received at least three doses of IPTp during pregnancy in both the 2014 and 2017 surveys. Regarding women with access to malaria information, the results of the 2014 data show that they are more likely than those without access to information to have had at least three doses of IPTp during pregnancy.

Table 2. Bivariate associations of independent variables with the number of IPTp doses received.

Variables	Number of IPTp doses received			n	P value
	2014				
	Less than three doses	At least three doses	Total		
Age group					
15–19	41.8	58.2	100	378	
20–24	42.3	57.7	100	1,068	
25–29	44	56	100	1,243	
30–34	44.4	55.6	100	991	0.782
35–39	45.4	54.6	100	740	
40–44	43.5	56.5	100	310	
45–49	39.4	60.6	100	94	
Parity					
1	41.2	58.8	100	810	
2	43.3	56.7	100	802	
3	42	58	100	728	
4	45.5	54.5	100	690	0.448
5	45.2	54.8	100	558	
6 and over	44.7	55.3	100	1,236	
Religion					
Muslim	45.4	54.6	100	3,197	
Christian	40.5	59.5	100	1,216	0.003
No religion/ Other	39.5	60.5	100	403	
Women's education					
Not educated	43.8	56.2	100	3,814	
Primary	43.4	56.6	100	620	0.842
Secondary and above	42.3	57.7	100	390	
Wealth index combined					
Poorest	45.5	54.5	100	1,016	
Poorer	46.1	53.9	100	1,066	
Middle	44.2	55.8	100	1,130	0.001
Richer	43.5	56.5	100	1,049	
Richest	35	65	100	563	
Place of residence					
Urban	38.5	61.5	100	774	
Rural	44.6	55.4	100	4,050	0.002
Region					
Boucle du Mouhoun	40.7	59.3	100	403	
Waterfalls	53.6	46.4	100	390	
Centre	31.7	68.3	100	278	
Central East	36.8	63.2	100	437	
North Central	55.5	44.5	100	411	
Central West	60.2	39.8	100	377	
South Central	48.2	51.8	100	334	0.001
East	19.7	80.3	100	335	
High-Basins	19.7	80.3	100	319	
North	55.5	44.5	100	366	
Central Plateau	42.2	57.8	100	403	
Sahel	50.8	49.2	100	441	
South West	42.7	57.3	100	330	
At least one prenatal visit					
No	19.2	80.8	100	151	
Yes	44.4	55.6	100	4,665	0.001
Access to information on malaria					
No	42.1	57.9	100	2,626	
Yes	45.5	54.5	100	2,184	0.017
Knowledge of malaria symptoms					

Variables	Number of IPTp doses received				
	2014				
	Less than three doses	At least three doses	Total	n	P value
No	39.9	60.1	100	148	0.349
Yes	43.7	56.3	100	4,675	
Knowledge of how to prevent malaria					
Use of mosquito nets	43.1	56.9	100	2,090	0.105
Chemo prevention	40.5	59.5	100	291	
Use of insecticide	42.9	57.1	100	245	
Other	46.3	53.7	100	1,829	
Means of prevention used					
Use of mosquito nets	43.2	56.8	100	2,279	0.121
Chemoprevention	39.6	60.4	100	222	
Use of insecticide	41.6	58.4	100	226	
Other	46.1	53.9	100	1,752	
Knowledge of causes of malaria					
No	42.2	57.8	100	711	0.401
Yes	43.9	56.1	100	4,113	
Antenatal care provider					
Doctor	31.1	68.9	100	61	0.001
Nurse	50	50	100	454	
Midwife	42.9	57.1	100	2,256	
Auxiliary birth attendant	44.9	55.1	100	1,846	
Skilled birth attendant	61.7	38.3	100	47	
Traditional	18.8	81.2	100	16	
Other	20.8	79.2	100	144	
N	43.6	56.4	100	4,824	

Table 2. Continued.

Variables	Number of IPTp doses received				
	2017				
	Less than three doses	At least three doses	Total	n	P value
Age group					
15–19	36.3	63.7	100	295	0.143
20–24	38.6	61.4	100	915	
25–29	38.1	61.9	100	1,130	
30–34	38.4	61.6	100	946	
35–39	35.5	64.5	100	782	
40–44	30.3	69.7	100	323	
45–49	39.8	60.2	100	113	
Parity					
1	38.8	61.2	100	776	0.189
2	38.8	61.2	100	771	
3	35.9	64.1	100	696	
4	39.8	60.2	100	681	
5	35.9	64.1	100	546	
6 and over	34.6	65.4	100	1,034	
Religion					
Muslim	38.4	61.6	100	2,834	0.014
Christian	36.1	63.9	100	1,386	
No religion/ Other	29.9	70.1	100	274	
Women's education					
Not educated	36.8	63.2	100	3,396	0.393
Primary	39.7	60.3	100	610	
Secondary and above	36.9	63.1	100	498	
Wealth index combined					
Poorest	36.9	63.1	100	904	0.042
Poorer	36.4	63.6	100	983	
Middle	36.3	63.7	100	937	
Richer	41.4	58.6	100	918	
Richest	34.5	65.5	100	762	
Place of residence					
Urban	36.6	63.4	100	738	0.711
Rural	37.3	62.7	100	3,766	
Region					
Boucle du Mouhoun	22	78	100	369	0.001
Waterfalls	56.9	43.1	100	427	

Variables	Number of IPTp doses received			n	P value
	2017				
	Less than three doses	At least three doses	Total		
Centre	35.7	64.3	100	230	
Central East	42.3	57.7	100	355	
North Central	28.8	71.2	100	423	
Central West	44.4	55.6	100	338	
South Central	40.8	59.2	100	250	
East	37.2	62.8	100	435	
High-Basins	34.6	65.4	100	390	
North	39.8	60.2	100	384	
Central Plateau	32.2	67.8	100	373	
Sahel	48.3	51.7	100	209	
South West	23.1	76.9	100	321	
At least one prenatal visit					
No	11.4	88.6	100	35	0.002
Yes	37.4	62.6	100	4,466	
Access to information on malaria					
No	38.4	61.6	100	1,783	0.190
Yes	36.4	63.6	100	2,720	
Knowledge of malaria symptoms					
No	40.4	59.6	100	151	0.412
Yes	37.1	62.9	100	4,335	
Knowledge of how to prevent malaria					
Use of mosquito nets	36.9	63.1	100	1,966	0.373
Chemo prevention	41.7	58.3	100	144	
Use of insecticide	31.6	68.4	100	114	
Other	37.8	62.2	100	2,011	
Means of prevention used					
Use of mosquito nets	38.3	61.7	100	839	0.435
Chemoprevention	28.1	71.9	100	32	
Use of insecticide	39.4	60.6	100	373	
Other	36.6	63.4	100	2,982	
Knowledge of causes of malaria					
No	36.6	63.4	100	503	0.770
Yes	37.2	62.7	100	4,000	
Antenatal care provider					
Doctor	31	69	100	58	0.002
Nurse	39.7	60.3	100	1,034	
Midwife	35.9	64.1	100	2,429	
Auxiliary birth attendant	40.1	59.9	100	838	
Skilled birth attendant	34.4	65.6	100	90	
Traditional	13.8	86.2	100	29	
Other	15.4	84.6	100	26	
N	37.2	62.8	100	4,504	

3.3. Factors Associated with Receiving at Least Three Doses of IPTp During Their Last Pregnancy

Regarding the factors associated with receiving at least three doses of IPTp during the last pregnancy (Table 3), it was found that religion, education level, household standard of living, region of residence and type of caregiver were the significant variables for the 2014 survey, while in the 2017 survey, the significant variables were household standard of living, region of residence and access to malaria information.

For the 2014 survey, with regard to religion, it was found that Christian women (aOR=1.18; 95% CI: 1.01–1.38) were more likely to have three or more doses compared to Muslim women. In relation to women's education level, it was found that women with secondary school or higher qualifications were 25% less likely (aOR=0.741; 95% CI: 0.568–0.965) than women with no education to have three or more doses of IPTp during pregnancy. With regard to household standard of living,

women from very wealthy households (aOR=1.678; 95% CI: 1.19–2.356), wealthy households (aOR=1.433; 95% CI: 1.55–1.778) or middle-income households (aOR=1.377; 95% CI: 1.119–1.696) had a higher probability of having three or more doses of IPTp during their pregnancies compared to women from poor households. Compared to the Boucle du Mouhoun region, women in the Eastern region (aOR=2.658; 95% CI: 1.807–3.910) and the Hauts-Bassins region (aOR=2.491; 95% CI: 1.677–3.699) were more likely to receive three or more doses of IPTp during their pregnancy. However, for women in the Cascades (aOR=0.564; 95% CI: 0.410–0.774), North Central (aOR=0.581; 95% CI: 0.429–0.786), West Central (aOR=0.387; 95% CI: 0.283–0.528) and the North (aOR=0.489; 95% CI: 0.352–0.679), the probability of receiving three or more doses of IPTp during pregnancy was low compared to women in Boucle du Mouhoun. Regarding the antenatal care provider variable, women who had had antenatal visits with a nurse (aOR=0.437; 95% CI: 0.237–

0.805) or with a skilled birth attendant (aOR=0.257; 95% CI: 0.107–0.617) were less likely to have three or more doses compared to women who had had antenatal visits with a doctor

Other characteristics such as age, parity, area of residence (urban vs. rural) and knowledge of malaria signs were not associated with receiving three or more doses of IPTp during pregnancy.

In the 2017 survey, only the variables region of residence and access to malaria information were associated with receiving at least three or more doses of IPTp during

pregnancy. Compared to the region, except for the South-West region, women in the other regions were less likely to receive at least three or more doses of IPTp during pregnancy, compared to women in the Boucle du Mouhoun region. Regarding access to malaria information, women who had access (aOR=1.162; 95% CI: 1.006–1.342) were more likely to have at least three or more doses of IPTp during pregnancy compared to women who did not have access to malaria information.

Table 3. Factors associated with receiving at least three doses of IPTp during their last pregnancy from logistic regression.

Variables	2014 MIS		2017 MIS	
	Adjusted odds ratio (aOR)	95% Confidence interval	Adjusted odds ratio (aOR)	95% Confidence interval
Age group				
15–19				
20–24	0.996	[0.753, 1.316]	0.853	[0.620, 1.174]
25–29	0.908	[0.665, 1.239]	0.797	[0.561, 1.134]
30–34	0.829	[0.590, 1.164]	0.706	[0.479, 1.040]
35–39	0.832	[0.573, 1.206]	0.813	[0.539, 1.226]
40–44	0.82	[0.533, 1.264]	1.019	[0.635, 1.634]
45–49	1.149	[0.632, 2.090]	0.61	[0.344, 1.080]
Parity				
1				
2	0.886	[0.701, 1.121]	1.085	[0.845, 1.392]
3	1.012	[0.776, 1.319]	1.204	[0.904, 1.603]
4	0.902	[0.678, 1.202]	1.085	[0.795, 1.481]
5	0.966	[0.706, 1.323]	1.286	[0.910, 1.817]
6 and over	0.948	[0.692, 1.298]	1.242	[0.881, 1.752]
Religion				
Muslim				
Christian	1.185**	[1.010, 1.389]	0.932	[0.796, 1.092]
No religion/Other	1.214	[0.931, 1.583]	1.01	[0.715, 1.426]
Education				
No				
Primary	0.849	[0.699, 1.032]	0.869	[0.712, 1.061]
Secondary and above	0.741**	[0.568, 0.965]	0.914	[0.717, 1.167]
Wealth index				
Poorest				
Poorer	1.182	[0.963, 1.452]	1.12	[0.904, 1.389]
Middle	1.377***	[1.119, 1.696]	1.106	[0.889, 1.377]
Richer	1.433***	[1.155, 1.778]	0.927	[0.744, 1.155]
Richest	1.678***	[1.195, 2.356]	1.343*	[1.007, 1.791]
Residence				
Urban				
Rural	1.034	[0.817, 1.309]	0.975	[0.767, 1.239]
Region				
Boucle du Mouhoun				
Waterfalls	0.564***	[0.410, 0.774]	0.184***	[0.131, 0.259]
Centre	1.196	[0.817, 1.752]	0.437***	[0.282, 0.677]
Central East	1.183	[0.867, 1.615]	0.333***	[0.232, 0.479]
North Central	0.581***	[0.429, 0.786]	0.615***	[0.430, 0.878]
Central West	0.387**	[0.283, 0.528]	0.333***	[0.228, 0.485]
South Central	0.767	[0.552, 1.065]	0.381***	[0.256, 0.566]
East	2.658***	[1.807, 3.910]	0.467***	[0.319, 0.683]
High-Basins	2.491***	[1.677, 3.699]	0.451***	[0.317, 0.643]
North	0.489***	[0.352, 0.679]	0.365***	[0.252, 0.529]
Central Plateau	0.859	[0.620, 1.189]	0.56***	[0.386, 0.814]
Sahel	0.783	[0.555, 1.105]	0.219***	[0.138, 0.349]
South West	0.845	[0.600, 1.190]	0.918	[0.594, 1.419]
Access to information on malaria				
No				
Yes	0.957	[0.837, 1.096]	1.162**	[1.006, 1.342]
Knowledge of malaria symptoms				
No				
Yes	1.057	[0.668, 1.673]	1.148	[0.725, 1.820]

Variables	2014 MIS		2017 MIS	
	Adjusted odds ratio (aOR)	95% Confidence interval	Adjusted odds ratio (aOR)	95% Confidence interval
Knowledge of how to prevent malaria				
Use of mosquito nets				
Chemoprevention	1.102	[0.773, 1.570]	0.904	[0.621, 1.314]
Use of insecticide	0.98	[0.698, 1.377]	1.311	[0.852, 2.018]
Other	0.961	[0.799, 1.157]	0.924	[0.795, 1.073]
Means of prevention used				
Use of mosquito nets				
Chemoprevention	1.138	[0.764, 1.695]	2	[0.866, 4.616]
Use of insecticide	1.036	[0.728, 1.474]	1.111	[0.846, 1.459]
Other	0.924	[0.772, 1.106]	1.145	[0.953, 1.374]
Knowledge of causes of malaria				
No				
Yes	0.963	[0.768, 1.208]	0.93	[0.714, 1.211]
Antenatal care provider				
Doctor				
Nurse	0.437***	[0.237, 0.805]	0.716	[0.391, 1.312]
Midwife	0.596	[0.333, 1.066]	0.843	[0.464, 1.532]
Auxiliary birth attendant	0.583	[0.322, 1.056]	0.684	[0.370, 1.266]
Skilled birth attendant	0.257***	[0.107, 0.617]	0.534	[0.246, 1.163]
Traditional/Other	1.252	[0.305, 5.134]	2.815	[0.722, 10.98]
Constant	2.294	[0.972, 5.41]	4.296	[1.688, 10.934]

4. Discussion

The national guidelines for the management of malaria in health facilities in Burkina Faso in 2014 and 2017 stated that IPTp, which starts in the second trimester after the onset of active foetal movements, consists of three tablets of SP in one oral dose from the second trimester of pregnancy until delivery, with a minimum interval of one month between doses. At least three doses of SP have been recommended during pregnancy in Burkina Faso since March 2014 [18].

The objective of this study was to identify the different factors that may influence the use of IPTp by pregnant women in Burkina Faso. The results show that the determinants of IPTp use were different between 2014 and 2017.

In Burkina Faso, 56% and 63% of pregnant women had received at least three or more doses of IPTp during pregnancy in 2014 and 2017, respectively. Although progress has been made, it is far from the target, of 80% of eligible pregnant women receiving at least three doses of IPTp during pregnancy, set by the Ministry of Health and WHO [19, 20]. Regarding factors associated with receiving three or more doses, religion, education level, household standard of living, region of residence and type of caregiver were the significant variables for the 2014 survey, while in the 2017 survey, the significant variables were household standard of living, region of residence and access to malaria information. In the 2014 survey, Muslim women, women from low-income households and women having consulted a health worker other than a doctor reported low use of IPTp. In a study in Tanzania, a significant relationship was found between IPTp uptake and certain sociodemographic characteristics of women, such as education level, age, occupation, wealth, gender and region of residence [5]. Unexpectedly, the results of the study show that women with a secondary education or higher qualifications were less likely to have received three

or more doses than women with no education. A similar result was found in the study by Yaya *et al.* [21]; education was positively associated with receiving at least one dose of IPTp in Kenya [22, 23], Malawi [24] and Uganda [25]. Hill *et al.* [26] found that women with higher levels of education were more likely to receive IPTp than women with less or no education, as were wealthier women.

In the 2017 survey, women from wealthy households and women who had access to information on malaria were more likely to receive at least three doses of IPTp during pregnancy. Lack of knowledge of malaria has been found in several studies [13, 26, 27] to be an important determinant of receiving IPTp doses during pregnancy.

Only two variables (region of residence and household standard of living) were found to be significantly associated with receiving at least one dose of IPTp during pregnancy. This result seems to indicate regional disparities in IPTp administration, lack of implementation of clear policies/guidelines on IPTp administration, regional variation in health-care worker behaviour in dispensing IPTp and insufficient awareness of women during antenatal visits to receive IPTp doses. Hill *et al.* [26] found that the lack of clear policies and guidelines as well as inadequate training, supervision and quality assurance at the health facility level were responsible for many of the barriers to effective implementation of IPTp.

Strengths and limitations of the study

The main strength of this study is the use of a nationally representative dataset that used a multistage sampling technique to select respondents, making it possible to generalise the results to the national level. The main limitation is that it was based on self-reporting and therefore is susceptible to recall bias. This analysis was also limited to the variables available in the dataset. Mix of quantitative and qualitative methodology is recommended for further studies with women during prenatal consultations to identify factors that influence the uptake of IPTp.

5. Conclusion

Malaria during pregnancy often leads to maternal anaemia and low birth weight in cases of stable endemic transmission. In Burkina Faso, malaria is endemic, and women and children are the most vulnerable. The study results show that 56% and 63% of pregnant women had received at least three or more doses of IPTp during pregnancy in 2014 and 2017, respectively. Regarding factors associated with receiving three or more doses, religion, education level, household standard of living, region of residence and type of provider were the significant variables in the 2014 survey, while in the 2017 survey, the significant variables were household standard of living, region of residence and access to malaria information. Plausible interventions should be made to increase reception of at least three doses of IPTp during pregnancy by explaining to women the benefits of SP to help effectively control malaria and thus increase foetal and infant survival at birth. Interventions could target women from disadvantaged social backgrounds through awareness-raising on the importance of IPTp during pregnancy.

Conflict of Interests

All the authors do not have any possible conflicts of interest.

Availability of Data and Materials

The datasets used and/or analysed during the current study are freely available from <http://dhsprogram.com/data/available-datasets.cfm> upon request.

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