

Using Andersen's Behavioural Model of Health Services use to Examine usage of Intermittent Preventive Treatment of Malaria in Pregnancy in Nigeria

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Abstract

Background: Studies in Nigeria and elsewhere in sub-Saharan Africa have explored factors influencing usage of intermittent preventive treatment of malaria in pregnancy (IPTp). However, most of the studies are not model or theory-based, which provides less satisfactory guidance to malaria control programming. This study fills the knowledge gap by adapting the Andersen's behavioural model of health services use to IPTp usage in Nigeria.

Methods: This study adopted a cross-sectional design that utilised secondary data extracted from the 2018 Nigeria Demographic and Health Survey (NDHS). A weighted sample of 4,772 women who had deliveries in the past year preceding the survey was analysed. The outcome variable was usage of IPTp dichotomised into optimal or otherwise. The explanatory variables cut across individual and community levels, and were divided into predisposing, enabling and need factors in line with the theoretical constructs of the Andersen model. Two multilevel mixed-effects logistic regression models were fitted to identify the factors influencing optimal usage of IPTp. Analyses were performed using Stata 14. Statistical significance was set at 5%.

Results: The realised level of optimal IPTp usage was 21.8%. The factors that either predispose or enables a pregnant woman to take optimal doses of IPTp are age, education, being employed, being autonomous on own healthcare, health insurance enrolment, partner education, receiving antenatal care in public health facility, rural residence, being resident in northern geo-political zones, community literacy level, and community perception of the consequences of malaria. Two significant need factors affecting optimal usage of IPTp are timing of first antenatal care contact and actual sleeping under mosquito bed net.

Conclusion: Optimal usage of IPTp is low among pregnant women in Nigeria. There is need to devise additional public health education programme promoting IPTp usage through the formation of Advocacy, Communication and Social Mobilisation (ACSM) core group in every ward in all the local government areas in the country. In addition, health planners in the country should adopt the use of the Andersen model for assessing key determinants of IPTp usage among childbearing women in the country.

Background

Malaria in pregnancy is a specific health condition peculiar only to pregnant women and characterised by the presence of malaria parasite in the red blood cells of the placental. It has serious adverse effects on the health of pregnant women, the foetus, and the neonate [1]. Malaria in pregnancy elevate the risks of maternal mortality or severe morbidity such as maternal anaemia among pregnant women. It may also result in still birth, preterm birth, and low birth weight, all of which increase the risk of infant and child mortality [1]. Based on WHO statistics, out of the estimated 33 million pregnancies in Africa, 12 million of the pregnancies (35%) were exposed to malaria infection in 2019. Across Africa, the prevalence of malaria in pregnancy is higher in Central and West Africa with Nigeria contributing a substantial

proportion of women infected with malaria during pregnancy [2]. Apart from the rate of infection among pregnant women in the country, malaria is a key factor responsible for substantial proportions of infant and under-five deaths [3]. Malaria also accounts for nearly 60 percent of hospital outpatient attendance and 30 percent of hospital admissions in Nigeria. This takes heavy toll on the inadequate healthcare delivery system in the country [4]. Malaria in pregnancy is thus a major public health problem requiring effective strategies in Nigeria where malaria remains endemic in all parts of the country [5].

Across developing countries, intermittent preventive treatment of malaria in pregnancy (IPTp) is one of the malaria control interventions widely promoted by the WHO to prevent malaria during pregnancy [6]. However, other malaria control interventions also being implemented in Nigeria include use of Long-Lasting Insecticidal Nets (LLINs), Indoor Residual Spraying (IRS), and Larval Source Management [7]. Attention on the IPTp emanate from increasing evidence that its use substantially reduces the risks of adverse maternal and fetal outcome [1, 8]. This is important because adverse maternal and child health outcomes remain crucial public health concerns in many developing countries. Currently in Nigeria, *Sulfadoxine-pyrimethamine* (SP) under the brand name *Fansidar* is the government approved medicine for IPTp in Nigeria. Pregnant women are expected to receive the therapy during routine antenatal care visits. The WHO recommends that pregnant women should receive at least three doses of the IPTp before delivery [6].

Evidence however shows that in Nigeria and many other sub-Sahara African countries, the uptake of optimal doses of IPTp (3 or more doses) by pregnant women remains low and below national targets [9-15]. For example, in the 2018 Nigeria Demographic and Health Survey (NDHS), the prevalence of IPTp optimal doses of SP/Fansidar was 17% among childbearing women who had deliveries in the two years preceding the survey. There is need for further studies to identify more underlying factors of optimal usage of IPTp. This is important because low coverage reflects missed opportunities not only to deliver IPTp to pregnant women [16] but also missed opportunities to reduce adverse maternal and child health outcomes [17] in the country. Studies in Nigeria [18-20, 12] and elsewhere in sub-Saharan Africa [13-14] have explored the factors influencing use of IPTp with many of the studies identifying some important determinants of IPTp usage across sub-Saharan Africa. The identified determinants among others include type of antenatal care facility, health insurance enrolment, number of antenatal care visits [21], education, parity [22], timing of first antenatal visit [23], employment [24], place of residence [25], geographical region [13], knowledge of malaria preventive strategies [26], maternal age, and household wealth index [27-28].

However, most of the studies are not model or theory-based. This is less satisfactory due to three reasons. Firstly, non-use of models or theories in public health research may not properly guide health planners and policy makers in malaria control programming by not showcasing the interacting causal influences on usage of malaria prevention strategies. Secondly, models and theories are crucial to developing evidence-based health programmes [29] particularly in the promotion of new malaria control interventions. Thirdly, the use of models and theories provide a framework for malaria programme planners to build upon in efforts to develop more workable initiatives. Though, one Nigerian study [30]

adapted the socio-ecological model to IPTp usage, the study was however qualitative in nature and did not generate quantitative hierarchical data for the validation of the model. This study fills the knowledge gap by adapting the Andersen's behavioural model of health services use to IPTp usage in Nigeria.

The Andersen model is one of the analytical behavioural models developed in the 1960s to enhance identification and measurement of the diverse factors affecting family access to health care [31-32]. In its basic assertions, the model posits that utilisation of health services could be primarily explained by three sets of factors, namely, predisposing (sets of socio-demographic characteristics that may increase or reduce the likelihood of healthcare use prior to the need for a particular health service), enabling (sets of individual, household or health service resources that facilitate access to a particular health service), and need (conditions that show potential need for a particular healthcare service) factors. The model depicts four types of access to health care services. These are potential access which connote the availability of enabling resources or infrastructure; realised access which refer to the actual utilisation of the available health services; equitable access which occur when the three factors sufficiently explained the variation in health services use; and inequitable access which occur when the predisposing and enabling factors as well as health beliefs sufficiently explained health care utilisation [33].

Further modifications to the model have led to the inclusion of more variables to the Andersen model. These include healthcare system and personal health practices-related factors. In its current form, the model prescribes exploring contextual and individual factors affecting health services use [33]. Studies have adapted the Andersen model to the utilisation of diverse healthcare services such as antenatal care [34], institutional delivery [35], adolescent use of reproductive health services [36], HIV testing services [37], contraceptive use [38], and long-term services and support for older adults [39]. Findings in these studies have provided strength for the assertions of the model. The findings have also made contributions to the clarity of concepts and measures relevant to health care policy and programming. Based on the current theoretical position of the Andersen model, this study examines the individual and contextual factors influencing IPTp usage in Nigeria. This was with the view to informing the 2014-2020 National Malaria Strategic Plan (NMSP) currently being implemented in the country [7]. The NMSP targets ensuring that the country achieves her desire of transiting from malaria control to malaria elimination by using community structures to deliver diverse malaria interventions to the populace including pregnant women. The objective of the study was to examine the factors influencing optimal usage of IPTp in Nigeria based on the Andersen analytical framework.

Methods

Data Source

The study adopted a cross-sectional research design that utilised secondary data extracted from the 2018 Nigeria Demographic and Health Survey (NDHS). The NDHS was implemented in the country by the National Population Commission (NPC) in collaboration with the National Malaria Elimination Programme (NMEP) [40]. The Demographic and Health Survey (DHS) Programme provided technical

support for the implementation of the survey. Major international organisations such as Bill and Melinda Gates Foundation, The Global Fund, World Health Organisation (WHO), United States Agency for International Development (USAID), and United Nations Population Fund (UNFPA) provided funding support for the survey. The 2018 NDHS provided reliable information on basic demographic and health characteristics of the Nigerian populace including national information about malaria infection, treatment and control [40]. The data were analysed with authorisation from MEASURE DHS, and its available online via <https://dhsprogram.com/data/>.

Procedure

The 2018 NDHS sampled survey participants using a multi-stage sampling technique that ensured a nationally representative sample. The whole country was stratified into urban and rural areas after which some urban and rural areas were selected randomly. The selection was based on localities used as Enumeration Areas (EAs) in the penultimate national housing and population census. The EAs served as the primary sampling unit (cluster) in the survey. In the selected EAs, households were randomly selected for the survey following appropriate household listing. From the selected households, eligible men aged 15-59 and women aged 15-49 were randomly selected for the survey. Comprehensive details of the methodology adopted for the 2018 NDHS have been widely published [40].

Participants

Though, the 2018 NDHS covered 41,821 women of reproductive age. Women who had no live birth in the past year preceding the survey (34,549 women), women who had less than three antenatal care visits (2,359 women), and women who do not know their number of antenatal care visits (178 women) were excluded from the analysis. The inclusion criteria were having had at least a live birth in the past year preceding the survey, and having had at least three antenatal care visits during the last pregnancy. These criteria resulted in a weighted sample size of 4,772 women.

Measures

The outcome variable in the study was usage of IPTp through the use of *Sulfadoxine-pyrimethamine* (SP) under the brand name *Fansidar*. This was measured in the study by the number of IPTp dose a woman received during her last pregnancy. We categorised the responses into two, namely optimal (woman receives 3 or more doses) or otherwise (woman receives less than 3 doses). This categorisation was not only based on the WHO recommendation that pregnant women should take at least 3 doses of IPTp before delivery [6]. It was also consistent with categories adopted in many existing studies [23, 22, 14, 13]. The explanatory variables examined in the study cut across individual and community levels, and were selected based on existing literature [21-22, 13-14, 18-19]. The variables were however divided into predisposing, enabling and need factors in line with the theoretical constructs of the Andersen model.

The predisposing factors are age group (15-24, 25-34, and 35+), parity (primiparity, multiparity, and grand multiparity), formal education (none, primary, secondary, and higher), employment status (unemployed or employed), autonomy on own health care (not autonomous or autonomous), household wealth (poorest, poorer, middle, richer, and richest), place of residence (urban or rural), geo-political zone (north-central, north-east, north-west, south-east, south-south, and south-west), proportion in community who perceived that malaria can cause death (low, middle, and high), and proportion in community who perceived that malaria is easy to treat (low, middle, and high).

The enabling factors are health insurance enrolment (not enrolled or enrolled), source of antenatal care (government or private), partner education (none, primary, secondary, and higher), community literacy level (low, middle, and high). The need factors are experience of death of a child (ever or never experienced), timing of first antenatal visit (first trimester, second trimester, and third trimester), possession of mosquito bed net for sleeping (no or yes), and actual sleeping under mosquito bed net (no or yes). A number of these variables were re-coded in the study. The community variables were generated from individual responses through aggregation at the cluster level, and then divided into three equal proportions (low, middle and high), using tertile value as cut off reference. This method is generally used for the generation of community variables using DHS data sets [41-45].

Data analysis

Two types of analyses were carried out. Firstly, frequency distribution was used to describe the socio-demographic characteristics of the respondents as well as the realised access to IPTp. Secondly, two multilevel mixed-effects logistic regression models were fitted to examine the predictors of optimal usage of IPTp. Prior to fitting the model, three mini analyses were carried out. One, variables were selected into the two models based on results of a bivariate analysis. Any variable not showing significance at $p < 0.025$ was not selected. Two, a Variance Inflation Factor (VIF) was performed to ensure no multicollinear variable was selected for modelling. The bench mark for this test was that no variable with VIF score of five or higher values should be selected into the models [46]. Three, a 'null model' was fitted. This model did not include any explanatory variables. The essence of the null model was to ascertain whether significant variation exists in the optimal usage of IPTp across the communities. This is determined by the significance of the intercept of the model. Model 1 used the predisposing and enabling factors to explain inequitable use of IPTp in the country. Model 2 used all the predictor variables to examine equitable use of IPTp in Nigeria. The analytical tool adopted not only aligned with the theoretical position of the Andersen model but is also suitable for examining predictors of an outcome with hierarchical influences such as individual and community levels. This tool is widely applied in multilevel studies [41-45]. The multilevel mixed-effects logistic model partitions influences on an outcome into fixed and random effects [47]. The fixed effects in the current study were examined using the adjusted Odds Ratio (aOR) while the random effects were examined using the Intra-Cluster Correlation Coefficient (ICC). The ICC which ranges from zero to one indicate the importance of the community factors in the overall variance observed in the outcome variable. The models were checked for adequacy using the Akaike

Information Criterion (AIC). The model with the lowest AIC value is dim to have the best goodness-of-fit. All analyses were performed using Stata 14 [48]. Statistical significance was set at 5%.

Results

Respondents' socio-demographic profile and IPTp usage

Table 1 presents the socio-demographic profile of respondents. Women in the age group 25–34 years were more than half of the sample (51.6%). Nearly half of the women (48.3%) were multiparous (had between two to four children). However, nearly one-third (31.1%) of respondents were grand multiparous (had five or more children). Nearly one-third of the women (32.9%) had no formal education, while slightly more than two-fifths of respondents (40.2%) attained secondary level of education. With the exception of women in the poorest households, the distribution of household wealth level was similar among respondents. Two-thirds of respondents (66.5%) were employed. However, more than half of them (57.1%) had no autonomy on their own healthcare. Nearly all the respondents did not enrol for the national health insurance scheme.

Table 1
 Respondents' socio-demographic characteristics and realised usage of IPTp

Characteristic	Frequency (n = 4,772)	Percentage	Characteristic	Frequency (n = 4,772)	Percentage
IPTp dose			Death of a child		
Otherwise	3,731	78.2	Ever experienced	1,306	27.4
Optimal	1,041	21.8	Never experienced	3,466	72.6
Maternal age group			Timing of first antenatal care visit		
15–24	1,472	30.8	First trimester	1,198	25.1
25–34	2,461	51.6	Second trimester	3,512	73.6
35+	839	17.6	Third trimester	62	1.3
Parity			Possession of mosquito bed net		
Primiparity (one child)	984	20.6	No	1,323	27.7
Multiparity (2–4 children)	2,306	48.3	Yes	3,449	72.3
Grand multiparity (5+ children)	1,482	31.1	Actual sleeping under bed net		
Maternal education			No	1,970	41.3
None	1,569	32.9	Yes	2,802	58.7
Primary	740	15.5	Place of residence		
Secondary	1,917	40.2	Urban	2,216	46.4
Higher	546	11.4	Rural	2,556	53.6
Household wealth			Geo-political zone		
Poorest	654	13.7	North-central	642	13.5
Poorer	923	19.3	North-east	822	17.2
Middle	1,044	21.9	North-west	1,539	32.2
Richer	1,092	22.9	South-east	628	13.2
Richest	1,059	22.2	South-south	415	8.7
Work status			South-west	726	15.2
Unemployed	1,597	33.5	Community literacy level		

Characteristic	Frequency (n = 4,772)	Percentage	Characteristic	Frequency (n = 4,772)	Percentage
Employed	3,175	66.5	Low	1,569	32.9
Autonomy on own healthcare			Middle	1,551	32.5
Not autonomous	2,724	57.1	High	1,652	34.6
Autonomous	2,048	42.9	Proportion in community who perceived malaria is easy to treat		
Health insurance enrolment			Low	1,576	33.0
Not enrolled	4,654	97.5	Middle	1,888	39.6
Enrolled	118	2.5	High	1,308	27.4
Partner education			Proportion in community who perceived malaria can cause death		
None	1,380	28.9	Low	1,462	30.6
Primary	587	12.3	Middle	1,702	35.7
Secondary	1,834	38.4	High	1,608	33.7
Higher	971	20.4			
Source of antenatal care					
Public health facility	3,842	80.5			
Private health facility	930	19.5			

The distribution of respondents by partner education was similar to that of maternal education, but the proportion of women with no formal education was higher than that of their partners (32.9% vs. 28.9%). The majority of respondents (80.5%) received antenatal care from public health facility. The majority (72.6%) had never experienced death of a child. The second trimester of pregnancy was the dominant period when majority of the women (73.6%) had their first antenatal care visit. While the majority of respondents (72.3%) had mosquito bed net, only 58.7% of the women actually slept under mosquito bed net. More than half of the respondents (53.6%) were rural dwellers. Women from the northern geo-political zones were dominant in the sample. The distribution of the level of community literacy was nearly equal among the respondents. More women reside in communities with moderate proportions who perceived either that malaria is easy to treat or that malaria could cause death. The realised level of optimal IPTp usage among the women was 21.8% compared with the majority (78.2%) who received less than the optimal doses of IPTp during pregnancy.

Factors influencing optimal usage of IPTp

Table 2 presents the fitted multilevel mixed-effects logistic regression models. Model checking reveal that the models were adequate with Model 2 showing a better fit (AIC = 0.046) than Model 1 (AIC = 0.721). The null model (not shown) reveals that the variance in IPTp usage across the communities was high (ICC = 0.731). But the ICC values decline consistently in successive models as more variables are included in the models. Nevertheless, the ICC in Models 1 and 2 confirm the significance of the contextual factors. When the predisposing and enabling factors were included in Model 1, all the included variables with the exclusion of parity showed significant influence on optimal usage of IPTp. The likelihood of optimal IPTp usage was higher among women in age group 35 + compared to younger women (aOR = 2.118, 95% CI: 1.259–3.564). As maternal education improved from secondary to higher, the odds of optimal IPTp usage also increased consistently. Likewise, as household wealth improved from richer to richest, the odds of optimal IPTp usage increased. Employed women were more than three times more likely to utilise optimal doses of IPTp compared to unemployed women (aOR = 3.292, 95% CI: 2.670–4.059). Women who were autonomous on own healthcare and women who enrolled in health insurance scheme had higher likelihood of optimal IPTp usage.

Table 2
Fixed and random effects on optimal IPTp usage in Nigeria

Characteristics predicting IPTp optimal use	Model 1			Model 2		
	aOR	p-value	95% CI	aOR	p-value	95% CI
Maternal age group						
15–24 ^{RC}	1.000	-	-	1.000	-	-
25–34	1.491*	0.027	1.047–2.124	1.243	0.210	0.885–1.746
35+	2.118*	0.005	1.259–3.564	1.643*	0.049	1.002–2.694
Parity						
Primiparity ^{RC}	1.000	-	-	1.000	-	-
Multiparity	1.165	0.407	0.812–1.670	1.338	0.115	0.932–1.923
Grand multiparity	0.903	0.677	0.560–1.458	1.221	0.425	0.747–1.994
Maternal education						
None ^{RC}	1.000	-	-	1.000	-	-
Primary	1.270	0.276	0.826–1.951	0.915	0.680	0.599–1.397
Secondary	2.203**	p < 0.01	1.045–2.363	1.543	0.053	0.994–2.396
Higher	2.488**	p < 0.01	1.536–4.0311	4.073**	p < 0.01	3.467–4.786
Household wealth						
Poorest ^{RC}	1.000	-	-	1.000	-	-
Poorer	1.565	0.312	0.657–3.727	0.855	0.524	0.529–1.384
Middle	1.969	0.142	0.798–4.859	0.834	0.485	0.501–1.388
Richer	3.717*	p < 0.01	2.855–4.838	0.745	0.310	0.422–1.314

Notes: RC (Reference category), *p < 0.05, **p < 0.01

Characteristics predicting IPTp optimal use	Model 1			Model 2		
	aOR	p-value	95% CI	aOR	p-value	95% CI
Richest	4.158**	p < 0.01	3.171–5.452	1.200	0.578	0.632–2.279
Work status						
Unemployed ^{RC}	1.000	-	-	1.000	-	-
Employed	3.292**	p < 0.01	2.670–4.059	2.591**	p < 0.01	2.227–3.014
Autonomy on own healthcare						
Not autonomous ^{RC}	1.000	-	-	1.000	-	-
Autonomous	2.058*	0.005	1.247–3.397	2.015*	0.042	1.026–3.957
Health insurance enrolment						
Not enrolled ^{RC}	1.000	-	-	1.000	-	-
Enrolled	1.765**	p < 0.01	1.418–2.197	1.259*	0.040	1.011–1.568
Partner education						
None ^{RC}	1.000	-	-	1.000	-	-
Primary	4.647**	p < 0.01	2.641–8.176	3.882**	p < 0.01	2.273–6.631
Secondary	5.058**	p < 0.01	2.949–8.676	4.798**	p < 0.01	2.836–8.119
Higher	2.997**	p < 0.01	1.733–5.185	3.786**	p < 0.01	2.142–6.690
Source of antenatal care						
Public health facility ^{RC}	1.000	-	-	1.000	-	-
Private health facility	1.909**	p < 0.01	1.292–2.820	2.263*	0.024	1.116–4.591
Place of residence						
Urban ^{RC}	1.000	-	-	1.000	-	-

Notes: RC (Reference category), *p < 0.05, **p < 0.01

Characteristics predicting IPTp optimal use	Model 1			Model 2		
	aOR	p-value	95% CI	aOR	p-value	95% CI
Rural	0.566*	0.038	0.331–0.968	0.425**	p < 0.01	0.239–0.753
Geo-political zone						
North-central ^{RC}	1.000	-	-	1.000	-	-
North-east	1.006	0.956	0.807–1.255	1.031	0.915	0.592–1.794
North-west	0.745*	0.013	0.591–0.939	0.447*	0.009	0.244–0.819
South-east	3.717**	p < 0.01	2.855–4.838	5.045**	p < 0.01	4.057–6.273
South-south	1.808**	p < 0.01	1.382–2.369	3.386*	0.001	1.664–6.891
South-west	2.008**	p < 0.01	1.570–2.570	4.374**	p < 0.01	2.153–8.889
Community literacy level						
Low ^{RC}	1.000	-	-	1.000	-	-
Middle	0.918	0.838	0.818–1.177	1.042	0.858	0.664–1.635
High	1.289*	0.018	1.045–1.589	1.749*	0.030	1.055–2.898
Proportion in community who perceived malaria is easy to treat						
Low ^{RC}	1.000	-	-	1.000	-	-
Middle	1.066	0.436	0.908–1.252	1.203	0.375	0.799–1.812
High	0.598**	p < 0.01	0.491–0.729	0.344**	p < 0.01	0.198–0.597
Proportion in community who perceived malaria can cause death						
Low ^{RC}	1.000	-	-	1.000	-	-
Middle	1.235	0.069	0.983–1.552	1.108	0.636	0.724–1.698

Notes: RC (Reference category), *p < 0.05, **p < 0.01

Characteristics predicting IPTp optimal use	Model 1			Model 2		
	aOR	p-value	95% CI	aOR	p-value	95% CI
High	1.346*	0.017	1.054–1.718	1.128	0.578	0.738–1.724
Death of a child						
Ever experienced ^{RC}				1.000	-	-
Never experienced				1.128	0.448	0.827–1.538
Timing of first antenatal care contact						
First trimester ^{RC}				1.000	-	-
Second trimester				1.470**	p < 0.01	1.287–1.678
Third trimester				0.531*	0.037	0.293–0.964
Possession of mosquito bed net						
No ^{RC}				1.000	-	-
Yes				1.012	0.955	0.673–1.522
Actual sleeping under mosquito bed net						
No ^{RC}				1.000	-	-
Yes				0.721*	0.046	0.522–0.995
AIC	5282.459			5179.575		
ICC	0.557 (55.7%)			0.506 (50.6%)		
Notes: RC (Reference category), *p < 0.05, **p < 0.01						

Also, optimal usage of IPTp was more likely among women whose husbands had improved educational attainments excluding higher education. Women who received antenatal care from private health facility were nearly twice more likely to take optimal doses of IPTp compared to women who received antenatal care from public health facility (aOR = 1.909, 95% CI: 1.292–2.820). Rural women were less likely to take optimal doses of IPTp (aOR = 0.566, 95% CI: 0.331–0.968), while women in the three Southern geopolitical zones had higher odds of optimal IPTp doses. Women who resided in communities with high literacy level were 28.9% more likely to take optimal doses of IPTp compared to those in communities with low literacy level (aOR = 1.289, 95% CI: 1.045–1.589). Women who resided in communities with high

proportion of people who believed malaria is easy to treat had lower odds of IPTp optimal usage (aOR = 0.598, 95% CI: 0.491–0.729). In contrast, women who resided in communities with high proportion of people who believed that malaria can cause death were more likely to take optimal doses of IPTp compared to other women (aOR = 1.346, 95% CI: 1.054–1.718).

When the need factors are included in Model 2, parity remained an insignificant influence on optimal IPTp usage, while household wealth and proportion of women in community who believed malaria can cause death no longer exert significant influence on the likelihood of taking optimal doses of IPTp. Older women were more likely to take optimal doses of IPTp compared to younger women (aOR = 1.643, 95% CI: 1.002–2.694). The influence of maternal education on IPTp usage was weakened in Model 2 compared to Model 1 because in Model 2, only higher education showed significant influence on IPTp optimal usage (aOR = 4.073, 95% CI: 3.467–4.786). Employed women, health insurance enrolment and being autonomous on own healthcare were significant predictors of IPTp optimal usage among the women. As partner education improved, the odds of IPTp optimal usage increased consistently until attainment of higher education when a dip occurred. Source of antenatal care remain a significant predictor with higher odds among women who received antenatal care from private health facility (aOR = 2.263, 95% CI: 1.116–4.591). Rural women were less likely to take optimal doses of IPTp compared to urban women (aOR = 0.425, 95% CI: 0.239–0.753). While women resident in the North-west zone were less likely to optimally utilise IPTp, women resident in all the three southern zones had higher likelihood of optimal IPTp utilisation. Both community literacy level and perception of malaria as easy to treat reveal significant influence on IPTp usage. Two of the need factors reveals significant influence on IPTp optimal usage. Women who had their first antenatal contact in the second trimester of pregnancy were more likely to take the optimal doses (aOR = 1.470, 95% CI: 1.287–1.678). Likewise, women who actually slept under mosquito bed net were less likely to take optimal doses of IPTp (aOR = 0.721, 95% CI: 0.522–0.995).

Discussion

This study examined factors influencing optimal usage of IPTp in Nigeria using the framework provided by the Andersen behavioural model of health services use. Using analytical framework such as the Andersen model is important in malaria in pregnancy research because it properly guide health planners and malaria control programmers by improving understanding of the wide spectrum factors underlying IPTp uptake in the country. In addition, developing additional evidence-based malaria elimination programmes in Nigeria may be tailored to the Andersen model. This is because the model reveals sets of predisposing, enabling and need factors at both individual and contextual levels that should be targeted in developing workable malaria elimination strategies.

The study found that the realised usage of optimal doses of IPTp among women with recent deliveries in Nigeria is low (21.8%). This is consistent with evidence provided in government reports [7] and several hospital or population-based studies [25, 9, 11, 20, 13]. However, the observed prevalence deviates widely from findings in few other studies [18, 23, 22, 19, 14]. Two reasons may account for the disparity. Firstly, there is lack of uniformity in the categorisation of IPTp usage in literature. Contrary to the categorisation

of IPTp usage in this study, many existing studies [26, 11] grouped IPTp usage into three or more categories which undermines the opportunity to observe the extent of optimal usage in the studied population. Secondly, many of the studies [28] derive IPTp prevalence among women who had births in the last two or three years, while the current study focused only women who had births in the past one year. The differentials in the group of women examined may be the reason for the different levels of usage observed in this study compared to some existing studies.

Nevertheless, one key take away from the low level of optimal IPTp usage found in this study is that the National Malaria Strategic Plan [7] being implemented in the country needs to be rejuvenated to achieve set objectives. For instance, objective one of the Plan seeks to ensure that at least 80% of targeted population utilises appropriate preventive measures by 2020. Since we studied only women who had at least three antenatal contacts, our finding suggests that some of the women may have some barriers in accessing the IPTp which is one of the important preventive measures for pregnant women. This may not only elevate the extent of missed opportunity [17] to reduce adverse maternal and child health outcomes, but also suggests missed opportunities to deliver IPTp to pregnant women [16] in the country. Furthermore, the low level of optimal IPTp usage observed in the study undermines the third objective of the Plan. The Plan seeks to treat all individuals with confirmed malaria detected in public or private facilities with effective antimalaria drug by 2020. Our finding thus suggests that not all confirmed cases of malaria among pregnant women are receiving effective care particularly IPTp therapy. The reasons for low usage may probably be due to either poor knowledge of the IPTp by pregnant women [12] or the existence of some health system barriers such as stock out of IPTp and poor training of providers [25, 17, 10, 24, 15] which adversely affects utilisation. The Federal Ministry of Health may need to devise additional public health education programme that promote IPTp usage by pregnant women. One means of achieving such is by ensuring that in each Local Government Area, the Advocacy, Communication and Social Mobilisation (ACSM) core group suggested in the Plan are constituted in every Ward to further engage the community, and also to distribute more Information, Education and Communication (IEC) materials. The health sector barriers may also be identified and addressed through timely monitoring and evaluation activities.

The study found that the utilisation of optimal usage of IPTp by pregnant women is strongly influenced by their socio-demographic and health-related conditions which either predispose them to poor use or enable optimal usage among them. In line with existing studies [25, 28, 22] poor maternal education, rural residence and lack of autonomy on own health care hinders optimal usage of IPTp while improvement in such condition facilitate optimal usage of IPTp. Improved education and female autonomy are significant source of empowerment that help women not only to understand health needs but also to access needed health services. Urban residence often promotes use of health services due to more availability of such services in urban settings. It was revealed also that younger age, unemployment and northern residence reduces likely usage of optimal IPTp. These findings are consistent with findings in similar studies [27, 24, 13]. Younger women may have lower usage probably due to insufficient use of healthcare services while unemployed women may face peculiar difficulties such as sourcing money for transportation to

facility. One likely cause of lower usage in Northern Nigeria is the dominance of Islamic practices which in many instances may not encourage use if female health providers are not available at facilities.

It was revealed in the study that source of antenatal care, health insurance enrolment and partner education significantly enabled optimal usage of IPTp. This agrees with findings in some existing studies [19, 21, 13]. However, contrary to the finding in a recent study in Tanzania [13], we found higher use of IPTp among pregnant women receiving antenatal care in private health facility compared to public health facility. In Nigeria, maternal and child health services are mostly provided in government health facilities. The few pregnant women patronising private facilities are often well-educated and wealthier which may suggest that the facilities patronised are likely to possess sufficient drugs and resources needed for effective treatment. In contrast, the high patronage of public facilities sometimes leads to stock out of drugs which may reduce use. Our study further revealed that timing of first antenatal contact and use of insecticidal treated nets are important conditions that provoke optimal usage of IPTp. This is in consonance with many existing studies [27, 18, 23, 14, 14]. Early antenatal contact by pregnant women is crucial for prompt detection and effective treatment of malaria. In addition, the IPTp is meant to be given at specified weeks of gestation [6] which presuppose that most pregnant women adhere to the prescribed antenatal care attendance.

In understanding the inferences drawn from the study, it is important to borne in mind that the analyses performed in the study have few drawbacks. One, the data analysed are self-reported data which were not subjected to additional scrutiny. We assumed that the NDHS datasets are trustworthy having been collected through standard procedure. Two, the study only focused the use of the IPTp by pregnant women, whereas there are other types of treatment available to pregnant women which may lead to non-use of the IPTp. The implication of this fact is that the usage of the IPTp may not accurately mirror malaria control strategies among pregnant women in the country. Three, the data analysed are cross-sectional in nature and do not permit any claim of cause-effect. Hence, the use of the term 'influence' in the multivariable analysis actually established strong association between the research variables, and not necessarily causality.

Conclusion

This study using secondary data analysis examined the factors influencing optimal usage of IPTp in Nigeria. The study was underpinned by the Andersen behavioural model of health services use. The study provided evidence for continued application of the Andersen model in public health research. A number of predisposing, enabling and need factors underlying IPTp optimal usage were identified. Findings implies that the low usage of optimal IPTp may be improved through additional public health education initiative that promotes the IPTp therapy.

Abbreviations

ACSM Advocacy, Communication and Social Mobilisation

FMoH Federal Ministry of Health

IPTp Intermittent preventive treatment of malaria in pregnancy

IRS Indoor Residual Spraying

LLINs Long Lasting Insecticidal Treated Nets

NDHS Nigeria Demographic and Health Survey

NPC National Population Commission

WHO World Health Organization

NMSP National Malaria Strategic Plan

Declarations

Ethics approval and consent to participate

I confirm that all methods were performed in accordance with the relevant guidelines.

The 2018 NDHS survey protocol was review and approved by the ICF Institutional Review Board with approved number ICF IRB FWA00000845. The protocol was also approved in Nigeria by the National Health Research Ethics Committee of Nigeria (NHREC) with NHREC Approval Number NHREC/01/01/2007. Prior to the interview participants provided both written and verbal consent. Formal request to use the data for the purpose of the study was made by the authors and authorisation was granted by MEASURE DHS, the custodian of the datasets. The analyses are in anonymised forms. The datasets are available in the public domain via <https://dhsprogram.com/data/>

Consent to publish

Not Applicable

Availability of data and materials

Secondary data analysed could be accessed online at <https://dhsprogram.com/data/>.

Competing Interests

The authors declare no competing interests.

Compliance with Guidelines

I confirm that all methods were performed in accordance with the relevant guidelines

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Authors' contributions

BLS developed the concept with assistance of OBO. YRA and OJO reviewed literature. BLS analysed the data with assistance of OBO, BBI and TOO. All authors discussed the results, certified the content, and approved the final manuscript.

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