INTERNATIONAL JOURNAL OF INNOVATIONS IN PUBLIC HEALTH PRACTICE AND POLICY

DETERMINANTS OF MALARIA PREVENTIVE SERVICES ADHERENCE AMONG HIV POSITIVE ANTENATAL ATTENDEES IN ABUJA, NIGERIA

Augustine Ajogwu[1], Gani Muhammad Idris[2], Abdullahi, Taqiyya Oyiza[3], Ukashah Hameedah Sulaiman[4] Chidumebi. F. Ajogwu[5]

[1,2]Department of Community Medicine and Public Health, Nile University of Nigeria, Abuja
[3,4]Department of Community Medicine, Nile University of Nigeria, Abuja.
[5]Department of Community Medicine, Godfrey Okoye University, Enugu

Email: **austine.ajogwu2@gmail.com**, ichubaebi@yahoo.com, ajogwudumebi@gmail.com

[*]**Corresponding Author:** Dr. Augustine Ajogwu, MBBS, MBA, MPH, FMCPH/CM: Consultant Public Health Physician and Senior Lecturer, Department of Community Medicine and Public Health, Nile University of Nigeria, Abuja, Nigeria. Tel: 08035527638, 09033364436

DOI: https://doi/10.5281/zenodo.19063477

Abstract

Some of the effects of malaria infection among pregnant women include maternal anemia, preterm delivery, low birth weight, and intrauterine death, however, various malaria-preventive measures are in place to prevent mortality and morbidity during pregnancy. The interventions are the use of intermittent preventive treatment in pregnancy (IPTp) with sulfadoxine-pyrimethamine (SP) in combination with insecticide-treated bed nets (ITNs). The study was a cross-sectional study among HIV positive pregnant women attending antenatal care. Multistage sampling was employed to select 250 respondents. Data were collected using a structured interviewer administered questionnaire. Majority of the respondents were urban dwellers (159, 63.6%), aged 25-34 years (171, 68.4%) and had tertiary level of education (163, 65.2%). High number of the respondents (152, 60.8%) have heard of IPTp. However, more than one quarter of the respondents 99(23%) had not received the drug, 151(36%) had at least one dose, 124(29%) had 2 doses and 49(12%) had up to 3 doses of IPTp as recommended. The number of ANC attendance and awareness of IPTp were found to be significantly associated with IPTp adherence (χ^2=3.89, df=1, p = 0.049) and (χ^2=51.13, df=1, p < .001). Similarly, increase number of ANC attendance (χ^2= 9.29, df=1, p = .002) were found to be significantly associated with adherence to long lasting insecticide treated net (LLIN) at p <0.05 level of significance. Continuous health education and Community engagement is needed to improve adherence to malaria prevention services among HIV-positive antenatal clinic attendees. Increase adherence, especially among special need patients such as HIV-positive pregnant women may not be achieved without proper sensitization and health education

at every anti-natal clinic visit to improve awareness and knowledge of the importance of anti-malaria preventive measures in HIV positive pregnant patients.

Keywords: *Determinants of adherence to Malaria Preventive services among HIV positive patients, Abuja, Nigeria.*

AUTHORS BIOGRAPHIES

Augustine Ajogwu; Consultant Public Health Physician and Senior lecturer, Department of Community Medicine, Nile University of Nigeria, Abuja, Nigeria.

Augustine Ajogwu is specialist public health physician and health care manager, with graduate degrees and fellowship in public health and community medicine. He has worked in the field for some years now and has broad background and knowledge in public health and community medicine, Health Management and medical research. He had specialized training and expertise in public health and Epidemiology, health management/policy and data analysis.

He finished basic medical degree in 2002, Master of Business Management/Health Management degree in 2011 and Master of Public health degree in 2012, from Nigerian Universities. Subsequently, he joined medical specialty residency training in public health/community medicine and bagged membership of West African College of Physicians in 2016 and a Postgraduate Fellowship degree from the National Postgraduate Medical College of Nigeria in 2019. Since graduation, he has been working with faculty members of other Nigerian Universities in addition to his colleagues in the department of public health and students to conduct operational research in health management and policy, health systems, communicable/non-communicable diseases, social determinants of health, maternal and child health and infection prevention and control in health care settings. These research activities and experiences have enabled him to gain experiences in quantitative and qualitative research, epidemiology, manuscript writing, literature reviews and data analysis. It has provided him the opportunity to publish scientific articles in peer-review journals. Email:austine.ajogwu2@gmail.com ORCID: https//orcid.ord/0000-0001-7546-0835

Gani Muhammad Idris; Nile University of Nigeria, Abuja

Gani Muhammad Idris is a public Health physician; He joined the Nile University of Nigeria and bagged Masters in Public health of the university and currently a public health professional in governmental organization in Abuja. Email. muhd_gani@yahoo.co.uk

Chidumebi.F. Ajogwu. Godfrey Okoye University

Chidumebi Ajogwu is a medical student with the Godfrey Okoye University and public health enthusiast and data analyst. Email.ajogwudumebi@gmail.com

Introduction

The World Health Organisation (WHO) reported that malaria remains a public health concern (World Health Organization, 2014). Malaria infection during pregnancy is a risk factor for high mortality and morbidity among pregnant women (Desai et al, 2018). Some of the effects of malaria during pregnancy include maternal anemia, preterm delivery, low birth weight, and intrauterine death (Desai et al, 2018, McClure et al, 2013). However, various malaria-preventive measures are in place to prevent mortality and morbidity during pregnancy. The interventions are the use of Intermittent Preventive Treatment in pregnancy (IPTp) with Sulfadoxine-Pyrimethamine (SP) in combination with Insecticide-Treated Bed Nets (ITNs) (World Health Organization, 2014). Studies have shown that the above intervention has proven to be 21 percent effective in preventing malaria in pregnancy in the first and second pregnancies if effectively utilized (Eisele et al, 2012, McClure et al, 2013).

About half of the global population residing in almost 100 countries and territories is susceptible to malaria infection (Adebayo, Akeyemi &Cadmus, 2015). In 2018, the WHO estimated that about 228 million malaria infections were reported globally. Out of this, about 93% were reported in the African region, mostly sub-Saharan African countries (World Health Organization, 2014). Additionally, an estimated 405,000 deaths were reported to have been caused by malaria infections worldwide.

Evidently, malaria infection is prevalent among pregnant women in Nigeria since 97% of the populations are at risk of malaria infection (Oladimeji et al, 201). This makes it a critical and disturbing public health concern for pregnant women. Malaria is the most common health condition during pregnancy (Osaro& Charles, 2011). The policy guideline by the WHO advised that the first dose of IPTp-SP should be given to pregnant women as early as possible in the second trimester and subsequent doses of SP should be administered at least a month interval until delivery (World Health Organization, 2014). This is to improve the effectiveness and outcomes of the IPTp-SP among pregnant women. Nevertheless, about 69% of pregnant women in sub-Saharan Africa still do not have access to the recommended three doses of IPTp-SP (World Health Organization, 2014).

Nigeria adopted the IPTp strategy in 2005. Nonetheless, there is a variation in the level of IPTp uptake across states in Nigeria. Estimates showed that 63.6% (72.6% in urban and 58% in rural areas) received at least one dose of SP as of 2018 (Islam & Moinuddin et al, 2021). However, only 16.6% (20.7% in urban and 14% in rural areas) received at least three doses (Islam & Moinuddin et al, 2021). In addition, there are also factors determining the adherence to Intermittent Preventive Therapy for Malaria in Pregnancy (IPTp) and Long-Lasting Insecticides Treated Nets (LLINs) (Ekholuenetale et al, 2021, Citrin et al, 2018, Bado & Susuma,2016, Chukwu et al, 2021, Diala et al, 2013).

Despite the importance of malaria prevention among pregnant women, only a few studies on the determinants or factors influencing adherence to the new IPTp-SP among HIV positive pregnant women in Nigeria. The main objective of this study was to assess the determinants of adherence

to Malaria Preventive measures among HIV Positive Antenatal Clinic Attendees in Abuja Municipal Area Council, FCT, Abuja.

Method

Study Design and Setting

The study was Cross sectional design to assess the determinants of adherence to Malaria Preventive Services among HIV Positive Antenatal Clinic Attendees in Federal Capital Territory, Abuja.

Study Population

The population for this study consisted of HIV positive pregnant women attending ante natal care in the PMTCT Primary Healthcare Centers in the FCT.

Sample Size Determination

Fisher's formula was applied to determine the minimum sample size for the study.

Minimum Sample Size Determination for the Study

Using Leslie Fisher's formula

$$n = \frac{z^2 \cdot p \cdot (1-p)}{d^2}$$

n= Minimum sample size

Z= 1.96 (value of the standard normal distribution corresponding to a significance level of a 1.96 for a 2-sided test at the 0.05 level) **)**

P= Previous prevalence of IPTp Uptake = 20.7% = 0.207

d= Absolute precision (margin of error) i.e. to say the result is within 5% of the true value) =5%=0.05

$$n = \frac{z^2 \cdot p \cdot (1-p)}{}$$

$$= \frac{(1.96)^2 (0.207) (1-0.207)}{(0.05)^2}$$

$$= 250.$$

A sample size of 250 was used for the study after accounting for non-response and multi stage sampling technique was used to select respondents for the study.

Study Instrument.

The study instrument was a pretested structured questionnaire adapted from previous study. The questionnaire consisted of different sections. The first section was socio-demographic characteristics of respondents. Section 2 dealt with clinical characteristics of participants. Section 3 addressed the level of knowledge of malaria preventive measures during pregnancy among participants and IPTp uptake. Section 4 dealt with the use of mosquito net to prevent malaria during pregnancy.

Data Collection Procedures

Four research assistants were used to help in data collection in the study. The assistants were trained by the researcher before the data collection. The assistants were recruited because most of the respondents could not read the questionnaire. The assistants helped the respondents to understand the questionnaire, and motivated them to complete the questionnaire. The research assistants were trained to be compassionate with them and ensure that their information remains confidential.

Data Analysis

Data entry and analysis were performed using Statistical Package for Social Sciences (SPSS) version 16.0. Data were summarized using frequency tables, proportions. Correct responses to knowledge questions were awarded one mark and wrong responses were awarded zero score. The total scores were converted to percentages and graded as poor (0-39%), fair (40-69%), and good (70-100%). HIV pregnant woman was considered adherent if she swallowed the prescribed dose under the supervision of health workers at the clinic. To identify factors associated with adherence, a bivariate analysis was done using the Chi-squared test as appropriate. Adjustments for confounding among factors were affected using multiple logistic regression analysis.

The crude odds ratio (OR) provided a measure of the strength of the relationship between adherence (has taken the recommended dose of IPT and consistent use of LLIN) to IPT (dependent variable) and each independent variable at the bivariate level. Adjusted odds ratios (AORs) were

obtained by including variables found to be significantly associated with adherence at the bivariate level en-bloc in a logistic regression model. This was to determine the independent effects of various levels of the independent variables while controlling for the effect of the others. The corresponding 95% confidence intervals was also reported. All statistical tests were considered significant if P<0.05.

Ethical Approval

Ethical approval was obtained prior to the commencement of the study from Nile University Ethics Committee. The officers in charge of the PMTCT primary health clinics selected were informed and a letter of introduction was also given to them. Equally, participants were adequately informed about the purpose of the study and the risk and benefits of participation. All participants were duly informed that they had the right to withdraw at any time from the research without any consequences. Informed consent was obtained from the respondents before the interview and all information obtained was treated with utmost confidentiality.

RESULTS

Socio-Demographic characteristics

A total of 250 respondents participated in the study with 97% response rate. Majority of the respondents were urban dwellers (159, 63.6%), aged 25-34 years (171, 68.4%) and had tertiary level of education (163, 65.2%). Table 1

Table 1: Socio-demographic characteristics of participants (N = 250)

Characteristic		Frequency	Percentage (%)
Region	Rural	91	36.4
	Urban	159	63.6
Age	15 – 24	26	10.4
	25 – 34	171	68.4
	35 and above	53	21.2
Level of education	None	10	4.0
	Primary	16	6.4
	Secondary	61	24.4
	Tertiary	163	65.2
Income level *(Naira/month)*	<10,000	82	32.8
	10,000 – 50,000	109	43.6

	>50,000	59	23.6
Occupational status	Unemployed	67	26.8
	Self-employed	112	44.8
	Employed	71	28.4
Marital Status	Married	237	94.8
	Divorced/Separated/Widowed	7	2.8
	Never married	6	2.4
Religion	Islam	55	22.0
	Christian	195	78.0
Ethnicity	Hausa	38	15.2
	Igbo	89	35.6
	Yoruba	32	12.8
	Others	91	36.4

Adherence and use of IPTp and LLIN for malaria prevention in pregnancy

Majority of the respondents (152, 60.8%) have heard of IPTp however, more than a quarter of the respondents 99(39.6%) had received no dose of the drug, 151(60.4%) had at least one dose, 124(49.6%) had 2 doses and 49(19.6%) had up to 3 doses of IPTp. There were an almost equal proportion of respondents who used mosquito net (126, 50.4%) and those who did not use mosquito net (124; 49.6%) for malaria prevention in the index pregnancy. About 35.6% of respondents stated that they used mosquito net always for malaria prevention in pregnancy. The level of adherence to LLIN among respondents was higher than the adherence to IPTp although not statistically significant at $p<0.05$. Table 2

Table 2a: The use of IPTp and LLIN for malaria prevention in pregnancy (N=250)

Variable		Frequency	Percentage (%)
Ever heard of IPTp?	No	98	39.2
	Yes	152	60.8
Taken IPTp in index pregnancy	No	98	39.2
	Yes	152	60.8

Doses of IPTp taken in index pregnancy	None	99	39.6
	1	27	10.8
	2	75	30.0
	3	49	19.6
Has dose been completed?	No	185	74.0
	Yes	65	26.0
Use of mosquito net (LLIN) in index pregnancy	No	124	49.6
	Yes	126	50.4
Pattern of use of mosquito net in pregnancy	Always	89	35.6
	Sometimes	84	33.6
	Rarely	38	15.2
	Never	39	15.6

Table 2b: Adherence to IPTp and LLIN in pregnancy (N=250)

Variable		Frequency	Percentage (%)	p-value
IPTp Adherence	Not Adherent	186	74.4	0.216
	Adherent	64	25.6	
LLIN Adherence	Not Adherent	168	67.2	
	Adherent	82	32.8	

Factors associated with IPTp adherence amongst participants

The number of attended ANC and hearing about IPTp were found to be significantly associated with IPTp adherence (χ^2=3.89, df=1, p = 0.049) and (χ^2=51.13, df=1, p < .001). Similarly, increased number of ANC attendance (χ^2= 9.29, df=1, p = .002) were found to be significantly associated with adherence to LLIN at p <0.05 level of significance. Table 3

Table 3: Factors associated with IPTp adherence amongst participants (N=250)

Variable	Not adherent		Adherent		p-value
	n	%	n	%	
Region					0.265

Rural	64	70.3	27	29.7	
Urban	122	76.7	37	23.3	
Age					
15 – 24	18	69.2	8	30.8	
25 – 34	129	75.4	42	24.6	0.787
35 and above	39	73.6	14	26.4	
Income level (Naira/month)					
<10,000	58	70.7	24	29.3	0.611
10,000 – 50,000	84	77.1	25	22.9	
>50,000	44	74.6	15	25.4	
Occupational status					
Unemployed	48	71.6	19	28.4	0.404
Self employed	81	72.3	31	27.7	
Employed	57	80.3	14	19.7	
Religion					
Islam	38	69.1	17	30.9	0.307
Christian	148	75.9	47	24.1	
First pregnancy					
No	118	72.4	45	27.6	0.320
Yes	68	78.2	19	21.8	
Trimester booked for ANC					
1st trimester	49	71.0	20	29.0	0.545
2nd trimester	104	74.3	36	25.7	
3rd trimester	33	80.5	8	19.5	
Pregnancy carried to 28weeks					0.775

1	88	76.5	27	23.5	
2	51	72.9	19	27.1	
3 or more	47	72.3	18	27.7	
Times attended ANC clinic					
<= 3 times	105	79.5	27	20.5	**0.049***
>= 4times	81	68.6	37	31.4	
Ever heard of IPTp					
No	97	99.0	1	1.0	**<0.001***
Yes	1	0.7	151	99.3	

** $p < 0.05$*

Multivariate logistic regression showed that awareness of IPTp (AOR = 69.96; 95% CI [9.29-527.02], p < .001) was a significant predictor of IPTp adherence. Those who had ever heard of IPTp were about 70 times more likely to be adherent to IPTp compared to those who had not. Also attending ANC at least 4 times (AOR=2.13; 95% CI: [1.20-3.79], p= .010) was a significant predictor of LLIN adherence. Those who booked in the 3rd trimester was about 3.5 times more likely to be adherent compared to those who booked in the 1st trimester, also those who attended ANC at least four times were about 2 times more likely to be adherent to LLIN. Table 4

Table 4: Multivariable analysis of factors associated with adherence to use of IPTp for prevention of malaria in pregnancy among participants

Variable	**Univariate logistic**		**Multivariate logistic**	
	COR [95% CI]	**p-value**	**AOR [95% CI]**	**p-value**
Times attended ANC				
<= 3 times	1			
>= 4times	1.78 [1.00 – 3.16]	0.050		
Ever heard of IPTp				
No	1		1	
Yes	68.66 [9.33 – 505.48]	<0.001*	69.96 [9.29-527.02]	<0.001*
Sleeps under ITN				

Disagree	1	
Unsure	0.10 [0.01 – 0.81]	0.031
Agree	0.97 [0.48 – 1.96]	0.937
Health unit is far		
Disagree	1	
Unsure	0.08 [0.09 – 1.13]	0.077
Agree	1.11 [0.62 – 2.01]	0.720
No drugs at ANC		
Disagree	1	
Unsure	0.54 [0.23 – 1.25]	0.152
Agree	1.27 [0.64 – 2.51]	0.488
Not aware of use of SP		
Disagree	1	
Unsure	0.13 [0.06 – 0.31]	0.037
Agree	0.16 [0.09 – 0.29]	0.017*

** $p < 0.05$, COR = crude odds ratio, AOR = adjusted odds ratio*

Discussion

Prevention and control of malaria infection during pregnancy among HIV-infected women remains a major public health challenge in Nigeria. This study explores factors determining adherence to ITPs among HIV-positive pregnant women attending clinics for antenatal services. From the study, it was found that factors that prevent IPTp (SP) dose completion such as no drug at ANC (χ^2=10.69(df=2, N=250), p=0.005) and lack of awareness (χ^2=45.57(df=2, N=250), p <0.001) on the use of SP were significantly associated with adherence to IPTp for malaria prevention in pregnancy. It is argued that most antenatal clinics in Nigeria do not have enough of these drugs. There is need for proper logistic management especially in clinics that offers antenatal services to ensure that pregnant women have access to the routine drugs. Existing studies agreed that it is not

possible to achieve higher adherence rate when ITPs-SP drugs are not available in sufficient quantity (Yaya et al, 2018).

Previous studies from Nigeria indicated that SPs were not always available for free distribution. Even when available, they were insufficient as only a few pregnant women received it on first come-first serve basis (Ndong et al, 2019). The same results were obtained from studies in Tanzania and Malawi (Kitojo et al, 2020, Nkosi-Gondwe,2021). In these countries, SPs were reported to be inadequately available for pregnant women, and it has led to adverse maternal and pregnancy outcomes in the country. It is argued that adherence to it depends on adequate provision of the recommended drugs as well as regular and appropriate distribution to pregnant women.

Also, lack of awareness of the need and importance of ITPs could affect the adherence level among pregnant women. Lack of appropriate information and education about the need for antimalarial treatments among HIV-infected pregnant women may adversely affect adherence rate among them. The majority of pregnant women in rural areas are non-adherents because of the lack of proper enlightenment and sensitization. To increase the adherence rate, there is the need for regular, appropriate information and education about the need and importance of receiving antimalarial drugs with special target on HIV-infected pregnant women. Existing studies agree that sensitization and enlightenment of pregnant women especially those in limited-resource countries, rural areas and uneducated women should be regularly done to improve the level of adherence and compliance with the use of antimalarial drugs for preventing malaria during pregnancy especially the HIV positive pregnant women (Yaya et al,2018, Anchang-Kinbi et al, 2014).

A study conducted by Chukwuocha et al, (Chukwuocha et al, 2020) among pregnant women attending ANC at health centres in Owerri municipality showed that the participants had poor knowledge about IPTp-Sp for malaria in pregnancy. Most of the pregnant women in their study claimed that they had not heard about or know that Sulfadoxine-Pyrimethamine (SP) is the drug choice for IPTp. Also, they argued that they did not even know when to take it and the correct dose of IPTp-SP to receive (BMC Pregnancy & Childbirth, 2013, Nkoka, Chuang & Chen, 2018, Adewole et al, 2019). While many women know that malaria is one of the biggest threats to pregnancy, yet majority are not aware that it can be prevented through IPTp-SP use during pregnancy. This shows that there need to improve knowledge about malaria and its prevention during pregnancy by health education at every antenatal clinic visit. It is suggested that discussions about malaria and its prevention should be included as a necessity/priority by the healthcare professions dealing with pregnant women.

The study found that LLIN adherence was lower amongst primigravida (40.2% vs 55.8%). This could be possible because they may be shy, inexperienced or lack knowledge of the importance of sleeping under insecticide bed net during pregnancy. However, it is expected that they have higher adherence rate due to anxiety that surrounds the safety of the first pregnancy. They tend to be skeptical of their pregnancy, and wanting to know everything that is happening. As a result, they are more likely to attend ANC regularly, and consequently, complete their doses.

There are mixed results on the relationship between primigravida and adherence rate to IPTp among pregnant women. While some studies found that primigravida is associated with lower

LLIN adherence (Ahadzie-Soglie et al, 2022, Olukosi et al, 2020); other studies reported that it is associated with higher LLIN (Hughes, 2020, Jauniax et al, 2022). However, those who presented during the 3rd trimester had higher LLIN adherence (73.2%) compared to those who presented during the 1st and 2nd trimester (39.1% and 49.3% respectively). Trimester of booking for ANC was significantly associated with LLIN adherence (χ^2=12.18 (df=2, N=250),p=0.002). Likewise, the number of clinic attendance was significantly associated with LLIN adherence (χ^2=4.67(df =1, N=250), p=0.032).

Also, the results revealed that participant's region (rural vs urban) affect adherence to LLIN though not significant. This is possible because those in rural areas may not have adequate access to antenatal services compared to those pregnant women in urban areas. Existing studies revealed that the odds of having malaria infection doubled when migrating to rural areas from urban centre. This implies that residing in rural areas is a risk factor of malaria infection among pregnant women perhaps because of greater exposure to mosquitoes because of poor drainage, waste management and thick vegetation. Moreover, those in rural areas are less likely to use insecticide treated nets compared to residents of urban centre. Due to poor ANC facilities and lack of awareness in rural areas in Nigeria and elsewhere in sub-Saharan Africa, late registration and irregular attendance for ANC were observed (Alene et al, 2022). Existing studies have revealed that late registration and irregular attendance could be affecting proper delivery and compliance with IPTp (Ogba et al, 2022, De-Gaulle et al, 2022).

The strength of the study is that it assessed the adherence to Malaria Preventive Services among HIV Positive Antenatal Clinic Attendees in Abuja Municipal Area Council (AMAC), FCT, Abuja and the limitation is misreporting as data collection was by self- reporting. Also, casual inference cannot be made as it was cross-sectional study in nature.

Conclusion

Based on the results of the study, factors such as limited or no drug at ANC, poor awareness on the use of SP, and poor ANC attendance were among the major factors determining adherence to malaria preventive services among HIV-positive antenatal clinic attendees in Abuja, Nigeria. Improved adherence level, especially among special need patients such as HIV-positive pregnant women may not be achieved without adequate supply of antimalarial drugs. There is need resuscitate the drug revolving fund policy to mitigate stock-out in health facilities Also, proper sensitization and health education at every anti-natal clinic visit to improve awareness and knowledge of the importance of anti-malaria in pregnancy especially the HIV positive patients.

What is already known on this topic?

1.) What is known on this topic has been the fact that malaria preventive measures such as the use of SP and LLIN in pregnancy reduce malaria infection among pregnant women.

What this study adds:

1). what this study has added is that there is need to intensify health education on the need to adhere to the anti-malaria preventive measures among HIV positive pregnant women for a better pregnancy outcome among them.

Competing interest

The authors declared no competing interests.

Authors Contribution

Conceptualization: Augustine Ajogwu, Gani Muhammad Idris, Chidumebi. F. Ajogwu
Study design: Augustine Ajogwu, Gani Muhammad Idris, Chidumebi. F. Ajogwu
Data collection: Gani Muhammad Idris, Abdullahi Taqiyya Oyiza, Ukashah Hameedah Sulaiman
Data analysis: Augustine Ajogwu, Gani Muhammad Idris
Interpretation of data: Augustine Ajogwu, Gani Muhammad Idris, Chidumebi. F. Ajogwu
Review of Literature: Augustine Ajogwu, Gani Muhammad Idris
Writing and critical review of the manuscript: Augustine Ajogwu

Funding

Not Applicable

Acknowledgement

We are grateful to the people of Federal Capital Territory, for participating in the study.

References

World Health Organization (2014). WHO policy brief for the implementation of intermittent preventive treatment of malaria in pregnancy using sulfadoxine-pyrimethamine (IPTp-SP). *World Health Organization malaria policy brief*.

Desai M, Hill J, Fernandes S, Walker P, Pell C, Gutman J, Kayentao K, Gonzalez R, Webster J, Greenwood B, Cot M (2018). Prevention of malaria in pregnancy. *The Lancet infectious diseases*.18(4):e119-32.

McClure E.M, Goldenberg R.L, Dent A.E, Meshnick S.R (2013). A systematic review of the impact of malaria prevention in pregnancy on low birth weight and maternal anemia. *International Journal of Gynecology & Obstetrics.*121(2):103-9.

Eisele T.P, Larsen D.A, Anglewicz P.A, Keating J., Yukich J., Bennett A., Hutchinson P., Steketee R. W. (2012). Malaria prevention in pregnancy, birthweight and neonatal mortality: a meta-analysis of 32 national cross-sectional datasets in Africa. *The Lancet infectious diseases.*12(12):942-9.

McClure E.M., Goldenberg R. L., Dent A. E., Meshnick S. R. (2013). A systematic review of the impact of malaria prevention in pregnancy on low birth weight and maternal anemia. *International Journal of Gynecology & Obstetrics*. 121(2):103-9.

Adebayo A. M., Akinyemi O. O., Cadmus E.O. (2015). Knowledge of malaria prevention among pregnant women and female caregivers of under-five children in rural southwest Nigeria. *Peer Journal*. 3:e792. 7

Oladimeji K.E., Tsoka-Gwegweni J.M., Ojewole E., Yunga S.T. (2019). Knowledge of malaria prevention among pregnant women and non-pregnant mothers of children aged under 5 years in Ibadan, South West Nigeria. *Malaria journal*. 18(1):1-2.

Osaro E., Charles A.T. (2011). The challenges of meeting the blood transfusion requirements in Sub-Saharan Africa: the need for the development of alternatives to allogenic blood. *Journal of blood medicine*. 2011;2:7.

Islam M.R., Moinuddin M., Ahmed A., Rahman S.M. (2021). Association of sickle cell disease with anthropometric indices among under-five children: evidence from 2018 Nigeria Demographic and Health Survey. *BMC medicine*.19(1):1-1.

Ekholuenetale M., Nzoputam C.I., Barrow A. (2021). Prevalence and socioeconomic inequalities in eight or more antenatal care contacts in Ghana: findings from 2019 population-based data. *International Journal of Women's Health.* 13:349.

Citrin D., Thapa P., Nirola I., Pandey S., Kunwar L.B., Tenpa J., Acharya B., Rayamazi H., Thapa A., Maru S., Raut A. (2018). Developing and deploying a community healthcare worker-driven, digitally-enabled integrated care system for municipalities in rural Nepal. *InHealthcare.* Vol. 6, No. 3, pp. 197-204. Elsevier.

Bado A.R., Sathiya Susuman A. (2016). Women's education and health inequalities in under-five mortality in selected sub-Saharan African countries, 1990–2015. *Plos one.*11(7):e0159186.

Chukwu C., Onuoha H., Okorafor K.A., Ojomo O., Mokuolu O.A., Ekholuenetale M. (2021). Geopolitical zones differentials in intermittent preventive treatment in pregnancy (IPTp) and long lasting insecticidal nets (LLIN) utilization in Nigeria. *Plos one.*16(7):e0254475.

Diala C.C., Pennas T., Marin C., Belay K.A. (2013). Perceptions of intermittent preventive treatment of malaria in pregnancy (IPTp) and barriers to adherence in Nasarawa and Cross River States in Nigeria. *Malaria journal*. 12(1):1-6.

Yaya S., Uthman O.A., Amouzou A., Bishwajit G. (2018). Use of intermittent preventive treatment among pregnant women in sub-Saharan Africa: evidence from malaria indicator surveys. *Tropical medicine and infectious disease.*3(1):18.

Ndong I.C., Okyere D., Enos J.Y., Mensah B.A., Nyarko A., Abuaku B., Amambua-Ngwa A., Merle C.S., Koram K.A., Ahorlu C.S. (2019). Prevalence of asymptomatic malaria parasitaemia following mass testing and treatment in Pakro sub-district of Ghana. *BMC Public Health*. 19(1):1-0.

Kitojo C., Chacky F., Kigadye E.S., Mugasa J.P., Lusasi A., Mohamed A., Walker P., Reaves E.J., Gutman J.R., Ishengoma D.S. (2020). Evaluation of a single screen and treat strategy to detect asymptomatic malaria among pregnant women from selected health facilities in Lindi region, Tanzania. *Malaria Journal.*19(1):1-8.

Nkosi-Gondwe T., Robberstad B., Mukaka M., Idro R., Opoka R.O., Banda S., Kühl M.J., Ter Kuile F., Blomberg B., Phiri K.S. (2021). Adherence to community versus facility-based delivery of monthly malaria chemoprevention with dihydroartemisinin-piperaquine for the post-discharge management of severe anemia in Malawian children: A cluster randomized trial. *PloS one*. 16(9):e0255769.

Yaya S., Uthman O.A., Amouzou A., Bishwajit G. (2018). Use of intermittent preventive treatment among pregnant women in sub-Saharan Africa: evidence from malaria indicator surveys. *Tropical medicine and infectious disease.* 3(1):18.

Anchang-Kimbi J.K., Achidi E.A., Apinjoh T.O., Mugri R.N., Chi H.F., Tata R.B., Nkegoum B., Mendimi J.M., Sverremark-Ekström E., Troye-Blomberg M. (2014). Antenatal care visit attendance, intermittent preventive treatment during pregnancy (IPTp) and malaria parasitaemia at delivery. *Malaria Journal*.13(1):1-9.

Chukwuocha U.M., Ihejirika C.O., Obasi C.C., Pricella C.E., Igwe C.N., Ozoh F.C., Akanazu C.O., Judith E. (2013). Awareness and compliance with intermittent preventive treatment of malaria (IPTp) among pregnant women in parts of South Eastern Nigeria. *Research in Infectious Diseases and Tropical Medicine.*29;2(1):38-48.

Nkoka O., Chuang T.W., Chen Y.H. (2018). Association between timing and number of antenatal care visits on uptake of intermittent preventive treatment for malaria during pregnancy among Malawian women. *Malaria journal.* 17(1):1-1.

Adewole A.O., Fawole O., Ajayi I., Yusuf B., Oladimeji A., Waziri E., Nguku P., Ajumobi O. (2019). Determinants of intermittent preventive treatment of malaria among women attending antenatal clinics in primary health care centers in Ogbomoso, Oyo State, Nigeria. *The Pan African Medical Journal*. 33.

Ahadzie-Soglie A., Addai-Mensah O., Abaka-Yawson A., Setroame A.M., Kwadzokpui P.K. (2022). Prevalence and risk factors of malaria and anaemia and the impact of preventive methods among pregnant women: A case study at the Akatsi South District in Ghana. *PloS one*.17(7):e0271211.

Olukosi A.Y., Olakiigbe A., Ajibaye O., Orok B.A., Aina O.O., Akindele S.K., Akinyele O.O., Onajole A.T., Awolola S.T., Arowolo T., Afolabi B.M. (2020). Socio-economic

behavioural indicators of falciparum malaria parasitaemia and moderate to severe anaemia among pregnant women attending antenatal clinics in Lagos, Southwest Nigeria. *Malaria Journal*.19(1):1-1.

Jauniaux E., Hecht J.L., Elbarmelgy R.A., Elbarmelgy R.M., Thabet M.M., Hussein A.M. (2022). Searching for placenta percreta: a prospective cohort and systematic review of case reports. *American Journal of Obstetrics and Gynecology*. 226(6):837

Alene K.A., Elagali A., Barth D.D., Rumisha S.F., Amratia P., Weiss D.J., Atalell K.A., Erena A.K., Gething P.W., Clements A.C. (2022). Spatial codistribution of HIV, tuberculosis and malaria in Ethiopia. *BMJ global health*. 7(2):e007599.

Ogba P., Baumann A., Chidwick H., Banfield L., DiLiberto D.D. (2022). Barriers and facilitators to access and uptake of intermittent preventive treatment with sulfadoxine-pyrimethamine among pregnant women in Nigeria: a scoping review. *Malaria World Journal.* 13.

De-Gaulle V.F., Kamgno J., Orish V.N., Kotoh A., Mbacham W., Tagbor H., Magnussen P. (2022). A qualitative assessment of the health systems factors influencing the prevention of malaria in pregnancy using intermittent preventive treatment and insecticide-treated nets in Ghana. *Malaria Journal*. 21(1):1-5.