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Original Research Article

Effectiveness of intermittent preventive treatment for malaria with sulfadoxine-pyrimethamine in women attending antenatal clinic at the University of Benin Teaching Hospital

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ABSTRACT

Background: Intermittent preventive treatment for malaria using sulfadoxine-pyrimethamine (IPT-SP) is one of the methods proposed by the World Health Organization (WHO) to reduce the burden of malaria in pregnant women. This study evaluated the practice of IPT-SP in UBTH in terms of compliance with the WHO recommendations and maternal outcome; and to explore factors that may facilitate or hinder its implementation.

Methods: This study was a mixed method, using the explanatory sequential design. The study population were 420 booked women at term selected randomly. A written informed consent was obtained. A semi-structured questionnaire was used to obtain data from personal identification card, case notes, and computerized system. Trained medical doctors collected information and peripheral blood samples for malaria parasite (MP) testing and packed cell volume (PCV) using rapid diagnostic test (RDT) kit and automated haemoglobinometer. The results were grouped into sub-optimal (IPT-SP <3) and optimal (IPT-SP ≥3). The qualitative study was an in-depth interview of stakeholders and focus group discussion with booked women not up to term receiving IPT-SP. Quantitative data were analysed using IBM SPSS with P <0.05; thematic analysis was used for qualitative data.

Results: Of the 420 booked women, 60% (252) were given ≥3 doses while 40% (168) were given <3 doses. However, 17% (43) of those who collected ≥3 doses did not swallow up to 3 doses. Thus, 211 (50.2%) had suboptimal dosing while 209 (49.8%) had optimal dosing. A total of 45 (10.7%) were MP positive, of which 91.1% (41) had suboptimal dosing and 8.9% (4) had optimal dosing; (p<0.0001). A total of 30 (7.1%) had PCV<30%, out of which 83.3% (25) had suboptimal dosing (p<0.0001). Mean PCV in suboptimal group was 27.33±2.17 and 35.65±3.23 in optimal group; (p<0.001). Major factors were absence of directly observed therapy (DOT), ignorance and lack of proper knowledge among caregivers and recipients, while caregiver dedication was a positive factor.

Conclusions: There is significant difference in maternal malaria parasitaemia and anemia between suboptimal and optimal IPT-SP dosing in UBTH. The impediments to IPT-SP distribution are comparatively easy to overcome.

Keywords: Intermittent preventive treatment, Malaria, Optimal, Suboptimal, Sulfadoxine-pyrimethamine

INTRODUCTION

Malaria contributes significantly to disease burden with unacceptably high levels of morbidity and mortality, hence, the need for effective prevention strategies.¹⁻⁴ In the publication by the WHO 2020 world malaria report,

African region constitute 94% of malaria cases and mortality.⁵ The report stated that an estimated 215 million cases and 384,000 deaths out of 229 million cases and 405,000 deaths globally as recorded in 2019, occurred in the African region.⁵ An estimated 25 million pregnant women in sub-Saharan Africa are living at risk of

acquiring malaria infection by the protozoa *P. falciparum* which accounts for more than 60% of malaria infection and causes the most severe form as it is associated with high level of parasitemia.^{1,3,5-10} In another account, 247 million cases and 619,000 deaths occurred in 85 countries in 2021.¹¹ This showed increasing morbidity and mortality when compared to the report of 2019. Four African countries contributed to majority of this burden. Among the mortality from malaria in 2021, Nigeria contributed the highest quota 26.6%; while Mozambique, Uganda and Congo DR contributed 4.1%, 5.1% and 12.3% respectively.¹¹ A study in Africa reported that 25% of women have placental parasitaemia with malaria parasites at the time of delivery.¹² It is of note that, even in the absence of *P. falciparum* in the maternal peripheral blood but with placenta parasitaemia, maternal anaemia has been reported.¹⁰ The severity of malaria is worst in women with HIV infection which is relatively common in this era.^{10,12} Immuno-compromised state and pregnancy puts women at risk of severe infection more than non-pregnant women.¹⁰ Pregnant women are twice at risk of being bitten by mosquito than non-pregnant and also more likely to get infected and die from the disease.^{13,14}

The complications seen in malaria in pregnancy (MiP); maternal anaemia is experienced by women in endemic regions.^{2,6,7,12} Although there are other causes of anaemia in pregnant women, malaria infection substantially contributes to anaemia in these women.¹⁵ About 10,000 maternal deaths per year was associated to malaria related anaemia, in Africa.¹⁰ Women in low transmission area suffer severe symptoms and more likely to have mortality.¹⁰ Sequelae to malaria and anaemia in pregnancy, women are at increased risk of hospital admissions, blood transfusion with placental insufficiency and resultant miscarriage, preterm birth, low birth weight, foetal exposure to malaria infection, congenital infection, impaired cognitive and behavioral development in children, neonatal pyrexia and deaths, intrauterine growth restriction (IUGR), foetal demise and in severe cases, maternal mortality.^{2,5-7,9,12,16,17} Low birth weight (LBW) has been associated with a 100,000 infant deaths per year in Africa.¹² With congenital malaria infection, newborns suffer anaemia which increases mortality for them.¹⁷ About 3-8% of all mortalities recorded in children was attributed to MiP.¹⁰ According to report by WHO, 20% of stillbirth in Sub-Saharan Africa is caused by MiP while 11% of newborn deaths is also attributed to malaria.^{9,17} Pregnant women are at risk of placental specific variants adhesion of *P. falciparum* erythrocyte membrane protein 1 (PfEMP1) to chondroitin sulfate A (CSA) in the placenta; resulting in placenta parasitaemia.^{6,7,18}

This is a source of economic and health burden to the women, their family and nation as a whole. MiP is a life-threatening condition with associated increased morbidity and mortality; constituting serious health issues to pregnant woman, foetus and newborn and therefore the need for prevention.^{1,5,9,19}

Several strategies have been implemented in the bid to reduce adverse effects associated with malaria infection. Roll back malaria initiative was launched in 1998 and since then several reviews has been upgraded to aid eradication of malaria. The role of clean environment, insecticide sprays, nets and insecticide-treated nets (ITN) for vector control; prompt and effective case management of malaria using Artemisinin-based combination therapy (ACT) and effective malaria chemoprophylaxis using intermittent preventative treatment Sulphadoxine Pyrimethamine (IPT-SP) constitute the hallmark of these initiatives.^{2,10,20} Generally, the use of mosquito nets and ITN are recommended for regions with low risk for *P. falciparum* transmission while chemoprophylaxis is to be added to use of mosquito nets in regions with moderate to high risk of transmission.¹⁷ The development of malaria vaccine, RTS,S/AS01 (RTS,S) is another method of malaria prevention so far targeted at children.¹¹ Malaria vaccine has been adopted by some countries as part of the routine immunization for children as it has shown good effect by reducing malaria infection in children.¹¹ When IPT-SP is used appropriately, giving therapeutic dose at predetermined interval of 4 weeks in pregnant women, maternal parasitaemia is cleared and re-infection prevented.¹⁶ There is proven benefits when malaria prevention and control is ensured. Such benefits include reduce maternal malaria infection and anaemia with improved foetal outcomes like reduction in LBW and its sequelae.²¹⁻²³ Several drugs have been listed for use as malaria chemoprophylaxis but SP remains the drug of choice for IPT in pregnant women due to its safety profile and beneficial effect even in the face of high resistance.^{8,17}

The University of Benin Teaching Hospital has adopted and integrated the WHO recommended IPT-SP chemoprophylaxis as part of its provision in routine ANC since 2004. The increasing morbidity and deaths recorded in 2021 is a cause for re-evaluation of the implementation of the national policy on malaria prevention and control.¹¹ In the face of evolving drug resistance, the need for a periodic review cannot be over-emphasized.

This study looked at the practice of the WHO recommendation for IPT-SP chemoprophylaxis using outcome measures such as maternal peripheral blood parasitaemia and maternal anaemia. A qualitative review of factors influencing the achievement of effective chemoprophylaxis in booked women attending antenatal clinic in UBTH bearing in mind that IPT-SP coverage had remained low in Nigeria was evaluated.

METHODS

Study setting

This study was carried out at University of Benin Teaching Hospital, Benin City, Nigeria. The ANC was carried out using the traditional method of care where visits were scheduled four-weekly up until 28-week gestation, two-weekly till 36-week gestation and weekly till delivery. The

ANC were run by the 4 units in the obstetrics and gynecology department on separate days of the week, each unit using a day to run its ANC. About 300 women presenting for return ANC are seen per week giving an average of 1,200 pregnant women per month. At term, women were seen at the ANC where decision on the route of delivery was finally discussed. Women who go into spontaneous labour present at the labour ward for further care.

Study design

This was a mixed study comprising of prospective cross-sectional quantitative study of booked women at 37-week GA and above attending ANC in UBTH and qualitative study of stakeholders in IPT-SP actualization. It was an explanatory sequential design carried out from September 2023, to July 2024.

The research team comprised of the researcher as the team leader who co-ordinated and ensured the flow of communication among the research team members and participants. There were four trained research assistants in the person of registrars, each from the four units in obstetrics and gynaecology department. They helped to recruit booked women attending ANC in UBTH for the study and also conducted an in-depth interview of stakeholders (medical doctors prescribing IPT-SP, pharmacists dispensing medication and nurses) involved in IPT-SP provision to the women using a semi-structured questionnaire. Another set of trained research assistants comprising a house officer from each unit performed phlebotomy to collect peripheral blood samples for testing by the laboratory scientist.

Study population

The study population for the quantitative study were booked women at 37 completed weeks and above. A woman is booked in UBTH if she has had at least one return antenatal visit and had her booking investigations reviewed. Women who fall among the inclusion criteria were educated and enlightened on the research purpose and their role. The need for phlebotomy was highlighted and an informed written consent obtained. The women who had given their consent were allowed to pick from a concealed sac where yes and no printed-on paper was placed. Five hundred booked women picked yes and were taken as the representative of all booked women at term.

For the qualitative study, all unit heads and co-workers present on the day allotted to that health sector were interviewed using a closed and open-ended questionnaire to obtain information with regards to facilitators and barriers affecting IPT-SP use in UBTH. There were audio recordings during the interactions. The various units of the stakeholders were printed on sheets and placed into a box. A random selection was done and various unit was interviewed and all the workers present on that day was

noted on record sheet, together with the unit head, an in-depth interview was conducted, step by step.

In order to get information on consumers' view concerning the practice and use of IPT-SP in UBTH, a random selection of booked women whose gestational age at the time of interview were less than 36week and who had received at least 2 doses of IPT-SP were selected from each unit on their respective ANC day. A total of 32 pregnant women were randomly selected using a ballot paper. This was to ensure that booked women at term selected for the quantitative study did not participate in the qualitative study. For each group of pregnant women selected, a verbal consent was obtained and a focus group discussion was held with minutes recorded on both paper and recorder by one of the research assistants.

Inclusion criteria

All booked women at 37 completed week GA and above attending ANC during the period of study who were willing to participate and had consented.

Exclusion criteria

The exclusion criteria included women who were unbooked at the University of Benin Teaching Hospital (UBTH); those with retroviral disease on septrin prophylaxis or with HIV infection; women allergic to sulfonamides and therefore not on intermittent preventive treatment with sulfadoxine-pyrimethamine (IPT-SP); those who received malaria treatment during pregnancy with antimalarial drugs other than the study regimen; women with multiple pregnancies; those with diabetes mellitus; those with haemoglobinopathies; and women with antepartum haemorrhage.

Laboratory procedures

The booked women were selected randomly as described under the study population on presentation at term, 37 completed weeks and above, at the ANC. The study was explained to them and written consent obtained. A semi-structured questionnaire containing closed and open-ended question was administered to them and their socio-demographic data in addition to number of IPT-SP taken, collected from their personal identification card, case note and the computerized system. Trained Research Assistants collected the data. The blood sample collected from participants for MP as the primary outcome were assessed using AdvDx™ Malaria Pf, a RDT kit while PCV done as a secondary outcome was performed using automated haemoglobinometer (SEJOY®). Peripheral blood about 4ml was drawn from a vein following application of a tourniquet and placed into a sample bottle containing EDTA for malaria parasites testing using the RDT kit within 30 minutes of collection following the provider instruction. PCV check was performed for all using SEJOY® for uniformity. The outcome of RDT, presence or absence of malaria parasite in the blood samples was

grouped based on the number of IPT received; group A (sub-optimal dose) those who had <3 doses and group B those who had 3 or more doses (optimal dose).¹

Manufacturer's instruction for MP testing

AdvDx™ Malaria Pf rapid malaria Ag detection test for detection of Pf (HRP-II) antigen uses the principle of immune-chromatography. The pack contains sample dropper, buffer solution containing casein, Triton X-100 inside sodium azide preservative and other stuffs like alcohol swab etc. The expiry date was September 2024. The control blue band was noted which usually disappear and does not affect the result.

The blood sample (4 ml) was placed into EDTA bottle and submitted to the laboratory scientist. The machine was placed on the table, under aseptic condition, the dropper was dipped into the blood sample bottle and 5 µl was drawn. The blood is dropped into port 1 marked 'S' and 4 drops of the buffer (110 µl) dropped into port 2 marked 'B'. then read after 20 minutes. When only the control band turns purple, the result was negative, meaning no malaria parasite antigen was present. But when 2 bands appear at the control and Pf bands, it was positive; meaning malaria parasite antigen for *P. falciparum* was present. Accordingly, if the control blue band remained blue or only Pf band appeared or no purple band at all, the result was invalid. The outcome was recorded against the patient's serial number, name and hospital number.

Manufacturer's instruction for PCV testing

Following the manufacturer's instructions, using Sejoy HS-101 test stripe only on the Sejoy HB-101 haemoglobinometer and fresh whole blood, the level of PCV was tested for. It is a quantitative test that can be used as stand-alone for making the diagnosis of anemia.

With the switched-on meter set on the table, a stripe was inserted into the meter. A 2 ml syringe used only once to collect blood sample from the sample bottle. Blood was dropped at the center of the test strip to fill up application area to avoid inaccurate result. The meter read the result both in gm/dl and percentage. PCV result was documented along-side individual MP result. All data were forwarded to the statistician for analysis.

The result of the quantitative study served as the template for the qualitative study. This involved interviews of the medical doctors prescribing IPT-SP, pharmacists dispensing medication, CHEW and nurses who are part of the team providing care for the women. The focus group discussion (FGD) with pregnant women who were not at term provided insight on the consumer's side.

Sample size calculation

This was calculated using sample size calculation for a cross-sectional study (Cochrane formula) with prevalence of malaria in pregnancy of 41%.² This gave a total sample size of 372 with 10% for non-response of 409 participants. However, in this study, participants recruited were 420.

Outcome measures

Quantitative study

The peripheral blood parasitaemia was the primary outcome measure. Universal access to parasitological diagnosis of malaria is now possible with the use of quality-assured rapid diagnostic tests (RDT), which were used in this study.¹ The RDT was used to determine the presence or absence of malaria parasite in the maternal peripheral blood. Thus, deduction on the capacity of IPT-SP to act as an effective chemoprophylaxis can be done. The secondary outcome measure was the presence of anaemia among participants using PCV<30%.

Qualitative study

The outcome of the interactions between the research team and various stakeholders using semi-structured questionnaires, audio recorders and video recorders were used to potentiate findings from the quantitative study. The qualitative data was analysed using a thematic approach.

Data management

The results of experimental data and investigations were analyzed using IBM SPSS version 25. Categorical data was expressed as absolute numbers and percentages. Continuous variables were stated as means, median and standard deviations and significant differences were determined with student t-test. The level of significance was set at p<0.05.

The qualitative data was analysed using the thematic approach. Themes were construed based on reports from the in-depth interviews of stakeholders and focus groups discussion with booked women receiving IPT-SP who were not at term, using the inductive method. Colour coding was used to identify similar responses to enable placement under various themes placed in tabular form. Similar response was shaded with same colour and listed under the various themes. Further review, re-grouping and reshuffling of views to obtain better themes which were used to write up the discussion.

RESULTS

The total of 420 randomly selected booked women at term in UBTH, participated in this study.

Table 1: Sociodemographic characteristics of the respondents in quantitative study.

Variables	Categories	Frequency n=420	Percentage
Age (years)	15-20	113	26.9
	21-25	188	44.8
	26-30	119	28.3
	Mean±SD	22.92±4.297	
Level of education	Primary	12	2.9
	Secondary	76	18.1
	Tertiary	332	79.0
Occupation	Unskilled	58	13.8
	Skilled	204	48.6
	Professional	158	37.6
Spouse occupation	Unskilled	4	1.0
	Skilled	153	36.4
	Professional	263	62.6
Gravidity	Primigravida	137	32.6
	Secundigravida	67	16.0
	Multigravida	216	51.4
EGA at booking (Weeks)	<21	220	52.4
	21-30	125	29.8
	>30	75	17.9

Table 2: Comparing sociodemographic characteristics with IPT-SP received.

Variables	Categories	IPT-SP received group (%)		χ^2	P value
		Sub-optimal n=168	Optimal n=252		
Age (years)	15-20	45 (39.8)	68 (60.2)	0.775	0.679
	21-25	79 (42.0)	109 (58.0)		
	26-30	44 (37.0)	75(63.0)		
Level of education	Primary	4 (33.3)	8 (66.7)	3.969	0.137
	Secondary	38 (50.0)	38 (50.0)		
	Tertiary	126 (38.0)	206 (62.0)		
Occupation	Unskilled	29 (50.0)	29 (50.0)	6.320	0.042*
	Skilled	87 (42.6)	117 (57.4)		
	Professional	52 (32.9)	106 (67.1)		
Spouse occupation	Unskilled	1 (25.0)	3 (75.0)	2.853	0.240
	Skilled	69 (45.1)	84 (54.9)		
	Professional	98 (37.3)	165 (62.7)		
Gravidity	Primigravida	53 (38.7)	84 (61.3)	0.403	0.818
	Secundigravida	29 (43.3)	38 (56.7)		
	Multigravida	86 (39.8)	130 (60.2)		
EGA at booking (weeks)	<21	57 (25.9)	163 (74.1)	131.39	<0.0001*
	21-30	37 (29.6)	88 (70.4)		
	>30	74 (98.7)	1 (1.3)		

*Statistically significant, χ^2 = Chi-square.

Table 1 shows that majority of respondents (44.8%) were in the age group 21-25 years with mean age of 23±4 years. Those with tertiary level of education (79%) were more than other levels of education. Their spouse were professionals (62.6%) mostly and majority booked earlier before 21 weeks gestation (52.4%). They were mainly

multigravida (51.4%); 32.6% were primigravida while 16.0% were secundigravida.

In Table 2, the sociodemographic features were compared among pregnant women who presented for ANC in UBTH and it was noted that occupation of the woman and gestational age at booking had significance on the number of IPT-SP received; (p value 0.042 and <0.0001).

Table 3: Comparing sociodemographic characteristics with IPT-SP taken.

Variables	Categories	IPT-SP taken group (%)		χ^2	P value
		Sub-optimal n=211	Optimal n=209		
Age (years)	15-20	62 (54.9)	51 (45.1)	1.410	0.494
	21-25	90 (47.9)	98 (52.1)		
	26-30	59 (49.6)	60 (50.4)		
Level of education	Primary	6 (50.0)	6 (50.0)	1.499	0.473
	Secondary	43 (56.6)	33 (43.4)		
	Tertiary	162 (48.8)	170 (51.2)		
Occupation	Unskilled	34 (58.6)	24 (41.4)	7.582	0.023*
	Skilled	111 (54.4)	93 (45.6)		
	Professional	66 (41.8)	92 (58.2)		
Spouse occupation	Unskilled	1 (25.0)	3 (75.0)	2.921	0.232
	Skilled	84 (54.9)	69 (45.1)		
	Professional	126 (47.9)	137 (52.1)		
Gravidity	Primigravida	67 (48.9)	70 (51.1)	2.029	0.363
	Secundigravida	39 (58.2)	28 (41.8)		
	Multigravida	105 (48.6)	111 (51.4)		
EGA at booking (weeks)	<21	91 (41.4)	129 (58.6)	81.457	<0.0001*
	21-30	47 (37.6)	78 (62.4)		
	>30	73 (97.3)	2 (2.7)		

*Statistically significant, χ^2 = Chi-square.

Table 4: Effect of IPT-SP taken on peripheral blood malaria parasitemia.

Variable	Categories	IPT-SP taken (%)		X2	P value
		Sub-optimal n=211	Optimal n=209		
Malaria Parasite	Negative	170 (45.3)	205 (54.7)	33.680	<0.0001*
	Positive	41 (91.1)	4 (8.9)		

*Statistically significant, χ^2 = Chi-square.

Table 5: Mean PCV and prevalence of anemia among IPT-SP taken.

Variable	Categories	Mean PCV	Number with anemia (n=30) (%)	t-test	P value
PCV	Sub-optimal	27.33±2.17	25 (83.3%)	-10.924	<0.0001*
	Optimal	35.65±3.23	5 (16.7%)		

*Statistically significant p value <0.05

In Table 3, despite the fact that 252 (60%) pregnant women out of the 420 recruited for the study, received optimal dose of IPT-SP; optimal dose of IPT-SP taken was noted in only 209 (49.8%) pregnant women out of 420, (see Figure 2). Table 3 is representative of intake of IPT-SP and the occupation of the pregnant woman and gestational age at booking showed statistical significance also, (p value 0.023 and <0.0001).

The prevalence of intake of suboptimal and optimal doses of IPT-SP in this study were 50.2% and 49.8% (Figure 1).

In Table 4, a total of 45 (10.7%) pregnant women out of 420 were positive for malaria parasite. This put the prevalence of malaria parasitaemia in this study at 10.7%. The proportion of malaria parasitaemia in term pregnant women receiving suboptimal 41 (91.1%) and optimal 4 (8.9%) intake of IPT-SP in UBTH. (p value <0.0001).

Thus, the prevalence of malaria was less in women who had optimal doses of IPT-SP when compared with those who do not take optimal dose of IPT-SP. P value <0.0001.

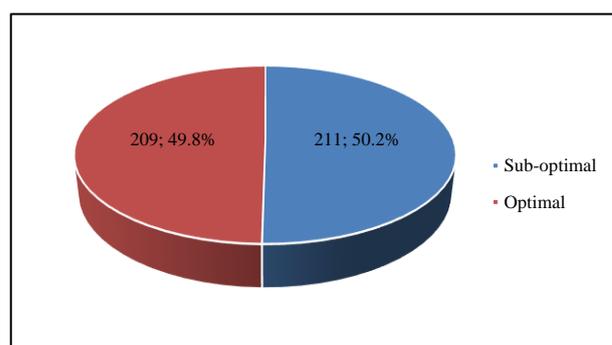


Figure 1: Distribution of women in relation to IPT-SP intake.

In Table 5, the mean PCV in term pregnant women who had suboptimal dose and optimal dose of IPT-SP in UBTH were 27.33 ± 2.17 and 35.65 ± 3.23 respectively. This study reported anaemia in 30 (7.1%) pregnant women, 25 (83.3%) cases were reported among the suboptimal group while only 5 (16.7%) were noted from those who had optimal dose. This was statistically significant with p value at <0.0001 .

The dispersion of PCV in the participants was shown in the box plot; Figure 2. Among pregnant women who had suboptimal dose the PCV interquartile range was 31-35% with a median of 33% while that of those who had optimal dose was 35-39% with a median of 36%.

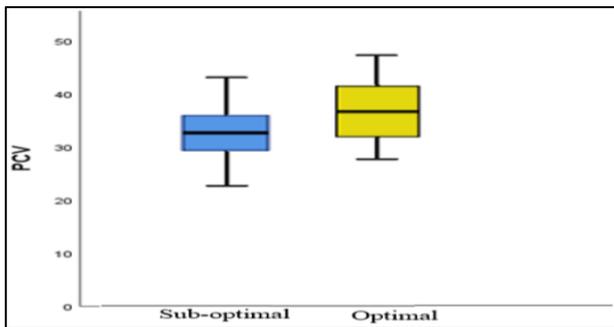


Figure 2: Box plot showing effect of IPT-SP on maternal PCV (%).

Qualitative study

A total of 33 health caregivers were engaged in in-depth interview; 18 medical doctors, 6 nurses, 6 pharmacist and 3 CHEW while 32 booked women that had not reached 37 completed weeks were involved in the focus group discussion (Figure 3).

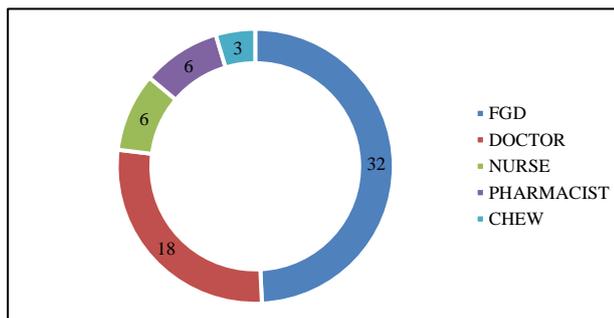


Figure 3: Total participants in the qualitative study.

Results of qualitative study as themes

Providers factors

Awareness of IPT-SP policy

All members of the health caregiver who attend to the ANC mothers that were interviewed, except the laboratory scientist, were aware of IPT-SP.

Proper knowledge of IPT-SP policy

Among the 33 health caregivers, only 4 (22%) of the 18 Doctors had correct knowledge of WHO policy on IPT-SP. None of the other health caregivers had correct knowledge. The stated time to commence first dose of IPT-SP by many were 16 weeks GA, some 12 weeks and others 20 weeks GA. The stated interval of administration of IPT-SP ranged from 4 weekly to 8 weekly, while some stated once per trimester including first trimester. Some stated that only 2 doses of IPT-SP should be given from 20 weeks GA.

DOT application

All participant agreed that DOT was not a practice in UBTH.

Provision of IPT-SP

This was always available. There were no periods of out of stock.

Training of health care providers

All participant agreed that there was none in UBTH. None had attended any of such training in the last 1 year.

Patient factors

Knowledge of IPT-SP policy

Despite the fact that majority of women attending ANC in our setting were highly educated (tertiary level of education =79%), their level of knowledge of IPT-SP, a vital component of their ANC care, was low or none existent. None of the participants had correct knowledge of IPT-SP policy.

IPT-SP use

The study reported failure to comply to instruction in 78% (25) of the 32 pregnant women.

Other concerns

There were no extra charges with respect to IPT-SP purchase. Concerns on effect of IPT-SP on their foetuses and worries of the drug side effects, making them feel very sick, were expressed. Certain women for no just cause do not like taking medications including the haematinics and expressed the need for interval MP testing and treatment.

The response from participants was colour coded manually and grouped under eight themes; five themes for the health caregivers and three themes for the booked pregnant women. The themes for in-depth discussion were awareness of IPT-SP policy, proper knowledge of IPT-SP policy, DOT application, provision of IPT-SP and training of health care providers. When analysing the data from

FGD, the following themes were used: knowledge of IPT-SP policy, IPT-SP use and other concerns. Two of the themes under provider factors; awareness of IPT-SP policy and proper knowledge of IPT-SP policy were merged together during the discussion as it delivered better information than stand-alone.

DISCUSSION

The benefits identified with IPT-SP were mostly with optimal dosing of three doses or more.¹⁹ Late booking among women presenting for ANC prevents them from receiving optimal chemoprophylaxis with resultant disease burden on the pregnant woman, her family and healthcare system. A total of 420 booked women at term in UBTH participated. Majority (44.8%) were aged 21-25 years with mean age 23±4 years, contrasting with Nnewi where majority were 30-39 years.¹⁴ Most had tertiary education (79%) similar to the 2009 UBTH study.² Their spouses were mostly professionals (62.6%) and many booked before 21 weeks (52.4%), factors known to impact IPT-SP uptake.² They were mainly multigravida (51.4%) similar to southeast Nigeria, though primigravidae were more in this study (32.6% versus 18.7%).¹⁴

A total of 252 (60%) women received ≥3 doses, but only 209 (49.8%) actually swallowed optimal doses (Figure 2). Only occupation and gestational age at booking were significantly associated with intake. The prevalence of optimal versus suboptimal intake (49.8% versus 50.2%) aligns with northern Ghana (42.4% versus 57.6%) but contrasts with later Ghanaian and Tanzanian studies reporting higher optimal uptake.^{3,7,16} Despite proven benefits of IPT-SP on maternal parasitemia and fetal outcome, uptake remains poor.^{1,9,15,19,24-38}

Malaria parasitemia prevalence was 10.7%, similar to 11.9% previously in UBTH but lower than 41% in a later UBTH study, 21.7% in Nnewi, and 58.4% in southern Nigeria.^{2,14,19} Optimal dose users had significantly lower parasitemia (8.9%) compared to suboptimal users (91.1%); $p < 0.0001$. The relationship between IPT-SP dose and parasitemia mirrored findings in northern Ghana.³

Mean PCV was significantly higher in women with optimal dosing (35.65±3.23 versus 27.33±2.17; $p < 0.0001$). Anemia prevalence (7.1%) was lower than in Nnewi and Ghana but higher than reports from Southeast Nigeria, Calabar and UBTH in 2009.^{14,15,18,19,39} Only 2% of optimal-dose users were anemic compared to 12% of suboptimal users. Optimal IPT-SP use also corresponded with lower anemia than ITN alone in Cameroon.¹³

Quantitative findings informed the qualitative study. Among 33 health workers, only 12% had correct knowledge of WHO IPT-SP policy, similar to Ebonyi and Enugu.³⁷⁻⁴² Knowledge gaps, inaccurate gestational age estimation and missed opportunities hinder uptake. DOT was non-existent in UBTH, and 10.2% of women did not

take IPT-SP at home. Stock-outs and user fees were not barriers in UBTH.

Despite high education levels, none of the booked women had correct IPT-SP knowledge. Failure to comply occurred in 18.8%, mainly due to fear of side-effects and concerns about drug safety, similar to Sub-Saharan African reviews.³⁷ Some kept the drugs for family use. DOT absence, late booking and caregiver knowledge gaps remain major barriers.

The strength of the study is that it used a mixed-methods approach, allowing quantitative findings on IPT-SP uptake and outcomes to be complemented by qualitative insights from health care workers. The relatively large sample size and use of objective measures such as malaria parasitemia and packed cell volume strengthened the reliability of the findings.

The limitation of this study is that it was a single-centre, hospital-based study, the results may not be generalizable to women who do not access tertiary antenatal care. Nevertheless, the merit of the study is that it provided an appraisal of the level of practice and implementation of IPT-SP policy in our centre. Provider and policy-related factors are major contributors to impediments to IPT-SP coverage. Policy-related factors were not analyzed in this study.

CONCLUSION

Knowledge gaps played a major role in hindering actualization of set strategies. Health care workers as well as women, for instance, were not aware of the dose, time, and number of doses or the advantages of IPT-SP or its preventative value and the rationale for its administration. In line with other studies, the systematic review and meta-analysis done in Sub-Saharan Africa concluded that many impediments to IPT-SP distribution and uptake are comparatively easy to overcome and may be done very quickly.

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