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Do Frequent Antenatal Care Visits Ensure Access and Adherence to Intermittent Preventive Treatment of Malaria in Pregnancy in an Urban Hospital in South West Nigeria?

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ABSTRACT

The relationship of antenatal clinic (ANC) attendance and factors that could affect intermittent preventive treatment (IPT) uptake among 339 parturient women was examined. Respondents were enrolled over a period of three months in a secondary healthcare facility within 24 hours of delivery. Demographic details, delivery and antenatal history, insecticide treated net (ITN) use, and history of IPTp-Sulfadoxine-Pyrimethamine (SP) use in the index pregnancy were recorded. Finger and heel pricks blood samples from mothers and neonates respectively were used to detect malaria parasitaemia and to determine packed cell volume (PCV). Median number of ANC visits made by the enrollees was 4.0 (IQR=2.0) with a range of 1-20 visits. Two hundred and eleven (62.2%) enrollees made ≥4 ANC visits. Primigravidae [70 (40.7%)] were more likely than multigravidae [67 (38.4%)] to make their first antenatal visits in the second trimester. Eighty-eight (26.0%) received at least one dose of IPT-SP while 17 (5.0%) received the recommended two doses (first dose after the first trimester and a month later). Adherence increased with the number of ANC visits. Adherence was significantly higher among those who had ≥4 ANC visits compared with those who had <4 ANC visits. Directly observed therapy (DOT) was reported in 35.3%. The main reasons given for not taking two doses of SP were: that SP was administered once, 27 (38.1%) and reasons unknown, 14 (19.7%). In this study, there was low IPT-SP uptake and adherence. Adequate supervision of health workers as well as health education of pregnant women is needed to encourage adherence to IPTp-SP.

Keywords: Intermittent preventive treatment uptake, Sulfadoxine-pyrimethamine, Antenatal clinic, Malaria in pregnancy.

INTRODUCTION

Malaria during pregnancy is a major cause of adverse pregnancy outcomes for both mother and baby in sub-Saharan Africa [WHO, 2010]. Not only is acute symptomatic malaria more frequent in the pregnant woman than in her non- pregnant counterpart, it may also lead to premature delivery, maternal anaemia and death. Nutrition to the unborn baby is compromised by placental malaria with resulting small for date babies, congenital malaria and neonatal anaemia [Falade *et al*., 2007; Uneke *et al*., 2008; Akinleye *et al*., 2009; Ndyomugyenyi and Katamanywa, 2010]. Key interventions recommended for the control of this treatable and preventable infection during pregnancy include the use of intermittent preventive treatment (IPT), insecticide treated nets (ITNs), and effective case management of malaria infection [WHO, 2004]. The

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World Health Organisation (WHO) recommends at least two doses of sulfadoxine-pyrimethamine (SP) after foetal quickening with each dose given one month apart. In year 2000, African Heads of State unanimously endorsed the Abuja Declaration part of which states that "At least 60% of all pregnant women who are at risk of malaria, especially those in their first pregnancies, have access to chemoprophylaxis or presumptive intermittent treatment by year 2005" [WHO, 2000]. However, in Nigeria, the proportion of women who take the recommended two doses of IPTp-SP during pregnancy has since remained low with figures as low as 5.0% nationally as reported in NDHS, 2008 report and 18.5% in a study in this study environment (Tongo *et al*., 2011)

The Antenatal Clinic (ANC) is recognised as a reliable place for the delivery of IPT during pregnancy based on the presupposition that many women will attend clinic at some point in their pregnancy; hence would have the opportunity of accessing IPT. However, studies have shown that high attendance with antenatal care does not necessarily translate into full coverage with IPT [Ouma *et al*., 2007; Kiwuwa and Mufubenga, 2008]. Other plausible causes include client attitude and awareness, health workers' attitude and quality of ANC services (Carroli *et al*., 2001). Not much has been documented on the relationship between ANC visits and adherence to IPTp-SP in hospitals offering antenatal care services in Nigeria including Ibadan more so, after the adoption of focused approach to antenatal care. Focused approach to ANC requires a minimum of 4 visits for pregnancies without complications scheduled as First visit: within 16 weeks or when woman first thinks she is pregnant, Second visit: At 20 - 24 weeks or at least once in second trimester, Third visit: At 28 - 32 weeks and Fourth visit: At 36 weeks or later. Poor or non-adherence to malaria prevention in pregnancy could result in adverse consequences in mother and the baby. This study set out to assess the relationship between ANC attendance and adherence to IPTp-SP and pregnancy outcome. In addition, factors associated with IPTp adherence and ANC visit among parturient women were sought. The findings of this study stand to provide additional information for policy making and planning of appropriate intervention to improve IPTp use and adherence.

MATERIALS AND METHODS

Study Area: the study was conducted at Adeoyo Maternity Hospital, a secondary health facility in Ibadan, south western Nigeria. Ibadan is located in the rainforest belt of Nigeria where transmission of malaria is perennial with a major peak during the rainy season months of May to October and a lower peak during the dry season months of November to April [Salako *et al*., 1990]. The temperature ranges between 23 ºC and 32ºC with annual rainfall of 1530–2050 mm (Nigerian Metrological Services). The study hospital has a 16 bedded labour ward, holds its antenatal clinics on Mondays, Tuesdays and Thursdays while booking clinic is on Wednesdays. Pregnant women are given health talks on how to maintain optimal health during pregnancy. Specific attention is paid to nutrition and malaria preventive measures including IPTp-SP. Insecticide Treated Nets [ITNs] are distributed to women attending the clinic. Sulfadoxine-pyrimethamine is given free and the pregnant woman is expected to take it in the clinic while the nurses observe to ensure it is actually taken. All the pregnant women received thorough clinical examination which includes checking for anaemia and feet swelling. The blood pressure, weight, fundal height and haematocrit are also measured. Folic acid and iron supplementation in tablet formulation are made available to each woman after clinic visit. The hospital has two lying-in wards. Newly delivered mothers are transferred from the labour ward to the lying-in ward where they are monitored and necessary medications given to them before they are discharged. On the average, 510 deliveries take place in the hospital monthly.

Study design and population: A cross-sectional design was used. Women studied were those who met the following criteria: delivery of a live infant(s) at the hospital, residence within the catchment area of the hospital for at least 6 months before enrolment, attendance of ANC at the hospital and provision of a signed or witnessed verbal informed consent.

Sample size and subject selection

The sample size was calculated using IPTp use [27.3%] among participants in a study carried out in Ekiti, Nigeria [Akinleye *et al*., 2009]. The sample size needed to achieve a precision of 5% at 95% confidence interval was 339. Women who delivered at the study hospital were enrolled consecutively by one of the investigators [DCO] and a research assistant within twenty four hours of delivery if they fulfilled the inclusion criteria.

Data collection: Information collected on each mother-baby pair was entered into a case record form (CRF) designed specifically for the study by the investigators. The CRF was face validated as well as pre-tested prior to use. The CRF was used to obtain information on the participant's socio-demographic characteristics, use of IPTp-SP, practice of Directly Observed Therapy [DOT]

at the ANC and use of ITN. Information such as the number of ANC visits, gestational age at first ANC visits and gestational age at parturition were also obtained from the hospital record of the mothers. However, the fact that the women received IPTp-SP was from verbal report as this was not documented in most of the hospital case record. In addition the possible effect of IPTp-SP on malaria parasitaemia and outcome of pregnancy was explored by estimating the weight of the baby at birth as well as Packed Cell Volume (PCV) of mother and child.

Capillary blood was collected from mother and neonates by finger and heel pricks respectively for preparation of thick blood smears and haematocrit. Maternal and neonatal blood samples were spun for 10 minutes in a Hawksley™ micro-haematocrit centrifuge after which the haematocrit was determined using Hawksley™ reader. The mean haematocrit was determined from the average readings of the two capillary blood samples. Blood smears were air dried without convection, and stained with 10% freshly prepared Giemsa stain maintained at a pH of 7.2. Stained blood smears were viewed under a light microscope at x1000 magnification. Diagnosis of malaria was based on identification of asexual stages of *Plasmodium* on the thick blood smears. Malaria parasite density was determined by counting the number of asexual parasites against at least 200 leukocytes on the thick blood smears and converted to parasites/μL using an assumed total white blood cell count of 8,000/μL [Trape, 1985]. Blood films were declared negative if no parasite was seen after viewing 500 white blood cells (WBC).

Ethical Approval: Ethical clearance was obtained from the Oyo State Ethical Review Committee, Ministry of Health (reference no. AD13/479/141; dated 23rd August, 2010). Permission was obtained from the appropriate health authorities of Adeoyo Maternity Hospital and informed consent was obtained from the each enrollee or a parent of enrolees below 18 years of age. All information disclosed was kept confidential. The CRFs bore only coded identification number and only the researchers had access to the coding sheet.

Data Analysis

Data entry and analysis was performed using Statistical Package for Social Sciences (SPSS) version 16.0 SPSS Inc, Chicago, IL, USA. The dependent variables were adherence to IPTp-SP, number of ANC visits and pregnancy outcome such as birth weight, gestational age at delivery as well as maternal and neonatal haematocrit. Preterm delivery was defined as delivery before 37 weeks of gestation, Post-term as delivery after 40 week gestation, low birth weight as child weighing <2500g at birth and anaemia as haematocrit <33%. Adherence in this study was defined as the use of two or more doses of Sulfadoxine-Pyrimethamine after the first trimester during the index pregnancy under DOT. Data was summarized using frequency tables and means while differences in proportions were compared using Chi-square test. For the purpose of testing for association, occupation was regrouped as skilled, semi-skilled and unskilled while level of education was regrouped as Primary or none, secondary and technical and tertiary education. The independent t-test was used to compare means. Logistic regression was performed to compute Odds Ratio (OR) and 95% Confidence Interval which was used to determine the strength of association between a risk factor and particular categorical outcome variable. The level of significance was set at 5%.

RESULTS

Three hundred and thirty nine parturient women and 345 new-born babies (six sets of twins) participated in the study. The mean ± SD maternal age was 28.1 ± 5.2 years and ranged from 14 to 45 years. Most of the women were married [235 (69.3%)], about a third [106 (31.3%)] had tertiary level of education, 230 (67.8%) were Muslims and 126 (37.2%) were primigravidae. The mean ± SD distance from residence to ANC was 7.1 ± 4.4 km and the mean transportation cost to and from the clinic was N135.00 (85 cents USD). Further demographic details are on Table 1.

Delivery history and pregnancy outcome

The mean ± SD gestational age at delivery was 39.2 ± 2.5 weeks, 164 (48.4%) women had term delivery while 125 (36.9%) were post-term. More than half of the neonates 185 (54.6%) were male. Neonates with normal birth weight were 312 (91.2%). The delivery history is shown in Table 2. Primigravidae 16 (57.1%) were significantly more likely to give birth to low birth weight (LBW) babies than secundigravidae, three (10.7%) and multigravidae, nine (32.1%). Low birth weight was associated with gravidity (OR=2.5, 95%CI=1.1 – 5.5). The odds of given birth to LBW babies was two times more with primigravidae than secundigravidae and multigravidae. Low birth weight was more among the female neonates 20 (13.1%) than among male neonates 8 (4.4%). Female neonates were three times more likely to be low birth weight than their male counterparts (OR=3.4, 95% CI= 1.4 – 8.0).

Malaria parasitaemia and haematocrit

The prevalence of patent malaria parasitaemia at parturition was 13.3% (45/339) and 3.5% (12/345) among the mothers and neonates respectively. The

geometric mean malaria parasite density in mother was 158 /µl with a range of range 39/µl – 5623 /µL while it was 50.2/µl with a range of 40/µl -309/µl in the neonates. None of the newly delivered mothers or neonates was symptomatic for malaria infection. Mean ± SD maternal haematocrit was 33.2% ± 5.0% and mean ± SD neonatal haematocrit at delivery was 51.0% ± 7.3%.

Table 1:
Socio-demographic characteristics of enrolled parturient mothers N= 339

Characteristics	n (%)
Gravidity	
Primigravidae	126 (37.2)
Secundigravidae	80 (23.6)
Multigravidae (gravida ≥3)	133 (39.2)
Mother's level of education	
None	4 (1.2)
Primary	47 (13.9)
Secondary education	179 (52.8)
Technical/vocational	3 (0.9)
Tertiary	106 (31.3)
Spouses' level of education	
None	9 (2.7)
Primary	17 (5.0)
Secondary education	160 (57.1)
Technical/vocational	4 (1.2)
Tertiary	149 (44.0)
Respondents' occupation	
Trading	166 (49.0)
Artisan	68 (20.1)
Professional/Business woman	38 (11.2)
Student/Unemployed	46 (13.6)
Civil servant	11 (3.2)
Other	10 (2.9)
Spouses' occupation	
Professional	85(25.1)
Trading/farming	87(25.7)
Artisan	55 (16.2)
Civil servant	38 (11.2)
Student/ Unemployed	16 (4.7)
Other	58 (17.1)
Religion	
Christianity	109 (32.2)
Islam	230 (67.8)
Estimated distance from residence to ANC	
<5km	52 (15.3)
5.0km – 15.0 km	247 (72.9)
>15.0km – 25.0km	40 (11.8)

Antenatal history

About half 172 (50.7%) of the women had their first antenatal visit during their second trimester while 165 (48.7%) made their first ANC visit in the 3rd trimester. The median number of ANC visits made by the enrolees was 4.0 (IQR=2.0) with a range of 1-20 visits.

Table 2:
Delivery history of the parturient women

Characteristics		n (%)
Gestational age at delivery (wks)		
Pre-term delivery (< 37wks)		50 (14.7)
Term delivery (>37 - 40 wks)	**N=339**	164 (48.4)
Post-term delivery (> 40 wks)		125 (36.9)
Sex of child		
Male	**N=345**	185 (54.6)
Proportion of neonates with LBW (<2500g)	**N=342**	30 (8.8)
Proportion of mothers with anaemia (haematocrit < 33%)	**N=339**	134 (39.5)
Proportion of neonates with anaemia (haematocrit < 33%)	**N=345**	5 (1.5)
Prevalence of malaria parasitaemia in mother	**N=339**	45 (13.3)
Prevalence of malaria parasitaemia in neonates	**N=345**	12 (3.5)

Three hundred and eight (90.9%) of the parturient women attended at least two ANC visits while 211 (62.2%) had four or more antenatal visits. Primigravidae [70 (40.7%)] were more likely to attend their first ante natal visit in the second trimester compared with secundigravidae [37 (20.9%)] and multigravidae [67 (38.4%)]. Only two of the parturient mothers (0.6%) had their first ANC visit in the first trimester [before 13 weeks of gestation]. Women aged 26-31 years, multigravidae and those whose husbands had post-secondary education attended more ANC visits than other enrolees but the differences were not significant ($\rho>0.05$). Reasons given for attending clinic for the first time later than second trimester [>26 weeks] were: sickness (2; 0.6%), pressure of work (3. 0.9%), non-registration on earlier visit (s) to ANC clinic due to too many pregnant women attending on the day (6; 1.8%), relocation (10; 2.9%), travelling (11; 3.2%) and change of health facility (12; 3.5%). Twenty (5.9%) parturient women said that they were not sick and saw no reason for starting ANC early while another 20 (5.9%) gave no reason.

Insecticide treated net use during pregnancy

Forty-seven of 339 (13.9%) women reported the use of ITN and 25 (53.3%) of them claimed they used it always. Eighteen (38.3%) of the nets used were short lasting ITN, 18 (38.3%) were long-lasting ITN and 11 (23.4%) could not specify the type of ITN used.

Table 3.
Relationship between adherence and socio-demographic characteristics of the parturient women

Characteristics	Users of IPTp-SP		Non-users of IPTp-Sp N= 251	p-value
	Adhered N=17	Not-adhered N= 71		
Gravidity				
Primigravidae	4 (23.5)	24 (33.8)	98 (39.0)	
Secundigravidae	7 (41.2)	21 (29.6)	52 (20.7)	0.671
Multigravidae	6 (35.3)	26 (36.6)	101(40.2)	
Mother's level of education				
Primary/none	1 (5.9)	11 (15.5)	39 (15.5)	
Secondary and technical	8 (47.1)	38 (53.5)	136 (54.2)	0.244
Tertiary	8 (47.1)	22 (31.0)	76 (30.3)	
Spouses level of education				
Primary/none	0 (0.0)	5 (7.0)	21 (8.4)	
Secondary and technical	9 (52.9)	32 (45.1)	123 (49.0)	0.281
Tertiary	8 (47.1)	34 (47.9)	107 (42.6)	
Respondent's occupation				
Skilled	5 (29.4)	12 (16.9	30 (12.0)	
Semi-skilled	5 (29.4)	9 (12.7)	59 (23.5)	0.133
Unskilled	7 (41.2)	50 (70.4)	162 (64.5)	
Spouse's occupation				
Skilled	7 (41.2)	23 (32.4)	69 (27.5)	
Unskilled	5 (29.4)	15 (21.1)	56 (22.3)	0.112
Semi-skilled	5 (29.4)	33 (46.5)	126 (50.2)	
Religion				
Christianity	4 (23.5)	20 (28.2)	85 (33.9)	
Muslim	13 (76.5)	51 (71.8)	166 (66.1)	0.233
Estimated distance to ANC				
<5km	2 (11.8)	14 (19.7)	36 (14.3)	
5.0km – 15.0 km	13 (76.5)	47 (66.2)	187 (74.5)	0.958
15.0km – 25.0km	2 (11.8)	10 (14.1)	28 (11.2)	

IPTp use and antenatal care attendance

Overall, 88 (26%) enrollees received at least one dose of IPTp-SP. Twenty of them attended ANC less than four times while 68 attended four or more times.

Table 4:
Reasons for not using two doses of IPTp-SP as reported by the parturient women

Reasons	n (%)
SP was administered once	27 (38.1)
I was not given for reasons unknown to me	14 (19.7)
I forgot to take the next dose	5 (7.0)
Industrial action by health workers	4 (5.6)
Fear of adverse drug effect	4 (5.6)
Lack of awareness	4 (5.6)
Attending ANC only once	1 (1.4)
Others	8 (11.4)

Seventy one (80.7%) of these received one dose of SP while 16 (18.2%) received two doses of SP and 1 (1.1%) received three doses of SP during the index pregnancy. Adherence was significantly higher among women who had 4 or more ANC visits 12/211 (5.7%) compared with women who had less than four ANC visits 5/128 (3.9%). There was no significant association between adherence and socio-demographic characteristics. (Table 3) Reasons reported for not using two doses of IPTp-SP are shown in Table 4.

Considering timing of ANC first visit, of the 88 who took IPTp-SP more than half [53, 60.2%] had their first ANC visit during the 2nd trimester of pregnancy but the relationship between the timing of first ANC visit and the number of IPTp dose received was not significant, p=0.67. Thirty two (32/88; 36.4%) mothers took the SP at the antenatal clinic. Thirty of these 32 (93.8%) took the SP supervised by the clinic staff. Only 6 of the 17 (35.3%) who took two doses or more of IPTp- SP did so at the antenatal clinic under observation. At the time of

the study (immediate postpartum period) one of the women reported that she still had one of the tablets she was given with her because she didn't know she was to take all the tablets at once. Nineteen of the 32 (59.4%) who took the drug in the clinic reported they bought water at the ANC, 12 (37.5%) bought water outside the clinic and 1 (3.1%) took her water along with her to the clinic.

Pregnancy outcome

There was no significant relationship between the use of two doses of IPTp and maternal and neonatal haematocrits (p= 0.92; p=1.00 respectively). Of the seventeen who received two or more doses of IPTp, none (0%) had patent malaria parasitaemia but this was present in 9 of the 71 (12.7%) who received less than two doses. In a similar manner, none (0.0%) of the neonates whose mother received two or more doses of SP had patent malaria parasitaemia but 4 (5.6%) of those whose mother used less than two doses had patent malaria parasitemia. The relationship between IPTp use and prevalence of malaria parasitaemia in the neonates was not statistically significant.

The prevalence of low birth weight babies (LBW) were higher, among those who had taken less than 2 doses of IPTp-SP (16.0%) compared with those who received two doses or more (5.9%), p=0.86. Both mean birth weight and gestational age at delivery were not significantly different among those who had ≥ 2 IPTp-SP doses and those who had < 2 IPTp-SP dose ($\rho>0.05$). The mean ± SD birth weight of neonates whose mothers received two or more doses was 3144 ± 428g while that of neonates whose mother had less than two doses was 2973 ± 447g (F-stat= 0.301, p=0.58).

Relative to normal birth weight babies, mothers of LBW babies reported significantly less than four ANC visits during pregnancy (OR=2.90, 95% CI= 1.26 – 6.67). There was no association between low birth weight and patent malaria parasitaemia in mothers. The presence of malaria parasite in neonates was associated with LBW but the relationship was no longer statistically significant at multivariate analysis.

Parturient women who used ITN were significantly less likely to have patent malaria parasitaemia [11/45; 24.4%] versus [34/45; 75.6%)] who did not use ITN (χ^2= 4.86, p= 0.03). The Odds of having patent maternal parasitaemia was two times more likely among those who did not use ITN (OR=2.32, 95% CI=1.08 – 4.98). The Odds of having maternal anaemia was two times more among mothers with patent malaria parasitaemia (OR= 1.91, 95% CI=1.02 – 3.60). Of the 134 anaemic parturient women, 17.9% had patent parasitemia. Presence of neonatal malaria parasitaemia was significantly associated with malaria parasitaemia in mothers (OR=6.0, 95% CI= 1.75 – 20.57)

DISCUSSION

The IPTp strategy has been shown to be a useful method for the prevention of malaria and its adverse consequences during pregnancy. The IPTp strategy relies on ANC to access pregnant women; however, IPTp-SP uptake is generally low in sub-Saharan Africa (Hill and Kazembe, 2006). In this study we evaluated IPTp-SP uptake among recently delivered mothers (within 24hours postpartum) in a secondary healthcare facility in the city of Ibadan. The uptake of IPTp-SP among pregnant women attending ANC in the hospital was poor. Only 26.0% of the enrolled parturient women received at least one dose of IPTp-SP while only 5.0% received the stipulated minimum of two doses. This is similar to the 6.0% reported in the 2008 Nigeria

Demographic Health Survey for south-western Nigeria [NDHS, 2008]. The uptake recorded in our study is however lower than the 84.4% and 14.6% reported elsewhere in south-western Nigeria by Falade *et al*., 2007, and Amoran *et al.*, 2012, respectively. The study by Falade *et al*. was conducted during the pilot phase of IPTp in an urban hospital under a regulated and closely monitored condition with SP provided by the Federal Ministry of Health and this could explain the high uptake and adherence while the study reported by Amoran *et al.* was conducted in a rural community. Many of our study participants reported that they were given SP only once during pregnancy while some reported that they were not given at all for unknown reasons. These are similar to findings reported by previous workers [Anders *et al*., 2008; Sangare *et al*., 2010; Ndyomugyenyi and Katamanywa, 2012]. Other reasons for low uptake reported by previous workers include SP stock-out [Akinleye *et al*., 2009] and perception that SP could be dangerous to the unborn child could have been factors in the poor uptake of IPT. Efforts should therefore be made that there is regular supply of SP at the health facilities to improve uptake of SP. This study found that over 30% of those who were given SP took it in the clinic.

From our findings and previous studies [Akinleye *et al.*, 2009] it is clear that availability of cups and free clean water will greatly improve access and adherence to IPTp. Thirty of the 32 (93.8%) parturient women who took the SP in the clinic reported they were not observed when taking the drug. In addition only 6 of the 17 mothers who received at least 2 doses of IPTp-SP received it as Directly Observed Therapy (DOT) making the adherence (use of two or more doses and under DOT) to IPTp-SP in the study population extremely low at

1.8%. Failure to implement the DOT aspect of the IPTp strategy suggests that the ANC staffs were either ignorant of DOT or negligent of their duties. It would be important to determine the reasons for failure to carry out DOT at the ANC. Past studies have suggested need for better training of staff, regular availability of SP at the health facilities, provision of clean water and regular support supervisory visits by program managers as critical to the implementation of the DOT strategy [Akinleye *et al*., 2009; Le Port *et al*., 2011; Onoka *et al*., 2012]

The number of ANC visits and the time of first visit to antenatal clinic reported among many women in this study provided ample opportunity for them to receive at least two doses of SP especially as more than 60% of the women made four or more ANC visits and about 50% had their first ANC visit during their 2nd trimester. However, this was not reflected in the proportion of those who adhered to two doses of IPTp use. This finding is in agreement with a study conducted in rural Uganda which reported that frequent ANC visit does not necessarily translate to accessing two or more doses of SP [Ndyomugyenyi and Katamanywa, 2010]. Onoka et al. also reported that even though nearly all the women received antenatal care and made enough visits the overall coverage of IPTp was low.

Out of the reasons given for making the first ANC visit later than the second trimester, "not sick" and "saw no reason to start ANC" were most mentioned. This alludes to the fact that the ANC was viewed as curative rather than preventive. Similar observations have been found elsewhere [Titaley *et al*., 2010; Ndidi and Oseremen, 2010]. Titaley *et al*. reported that women reporting not having any pregnancy complications had an increased odds of underutilizing antenatal care services because they felt well during pregnancy and perceived no need to attend the ANC. Ndidi and Oseremen also reported that women did not book early since they had no problem in early pregnancy that warranted a doctor's intervention. This calls for intensified public health education to raise awareness on the importance of ANC attendance and early booking even when the pregnant women perceived no health problem.

Another reason mentioned was the fact that they could not be admitted for registration on their first day of visit because of overwhelming attendance. ANC is highly subsidised by the state government in the study hospital and the large population of patients seeking ANC there was probably due to the subsidized fees charge. The provision of adequate number of midwives and other cadres of staff to match the increased turn out of pregnant women will facilitate early booking.

Enrolees who had secondary education and whose husband had post-secondary education tended to make more than four ANC visits even though the relationship was not significant. Education and support of spouse have been found to play a great role in the utilization of ANC [Kulmala *et al*., 2000; Kabir *et al*., 2005; Awusi *et al*., 2009]. Multigravidae had more ANC visits than other gravidae which is in concordance with the report of Titaley *et al*. but unlike the report of Oduro *et al*. where primigravidae had more frequent ANC visits. Although reason for this was not sought in this study it is possible that their experience of complication in their previous pregnancies could account for this [Titaley *et al*., 2010]. Another likely reason could also be that these women have learnt the benefits of ANC visits during the previous pregnancies.

The prevalence of malaria parasite in mothers and neonates in this study was 13.3% and 3.2% respectively. Our finding on maternal parasitaemia is in agreement with that of previous studies conducted in Ibadan [Falade *et al*., 2007] and other parts of Nigeria [Omalu *et al*., 2012; Panti *et al*., 2012]. Omalu *et al*. reported a malaria parasitaemia prevalence of 13.82% in Minna, North Central Nigeria while Panti *et al*. made a similar report from Sokoto. The prevalence of congenital malaria reported from Minna (Omalu *et al*., 2012.) and Sokoto (Panti *et al*., 2012) were also similar to our findings.

The overall prevalence of LBW was 8.8%, with primigravidae significantly associated with increased risk of delivering a low birth weight infant. This corroborates what has been documented in the literature [Omalu *et al*., 2012; Guyatt and Snow, 2004; Aribodor *et al*., 2009].

This study re-confirmed that malaria is an important risk factor for anaemia. Women with peripheral malaria parasitaemia were more likely to have anaemia. The association of malaria in pregnancy and anaemia is not unexpected as the association has been recognized and reported by previous workers [Egwunyenga, 1997; Shulman *et al*., 2001]. The use of ITN was found to be protective for malaria in parturient women. This corroborates the findings of ter Kuile *et al*, 2003where the use of ITN was associated with reduced incidence of malaria parasitaemia.

Conclusion

The reason for poor adherence to IPTp as highlighted in this study is health system failure which includes staff non-adherence to guideline, poor supervision of delivery of services in the ANC clinics, and inadequate capacity of the clinic to accommodate pregnant women whenever they present. Efforts

should be made by the government to improve on the logistics of delivering IPT including employment of more staff to run the antenatal clinic. Continuing supervision of health workers should be intensified to encourage adherence with intermittent preventive treatment and especially directly observed treatment. Women should also be educated to increase awareness on the importance of ANC visits.

Authors' contributions:
DCO was involved in data collection. DCO, IOA and COF participated in research design, data analysis, data interpretation and writing of draft. All authors read and approved the final manuscript.

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