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Use of Intermittent Preventive Therapy for Malaria During Pregnancy and Development of Febrile Illness Among Infants in Nigeria

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Abstract: In most African countries, a good number of pregnant women make multiple antenatal visits providing a major opportunity for the prevention of malaria (associated with febrile illness) in infants through the use of intermittent preventive treatment in pregnancy (IPTp). This study assessed the association between maternal use of IPTp with sulphadoxine and pyrimethamine (SP) and the development of febrile illness in infants. This was a secondary data analysis of the 2013 Nigeria Demographic Health Survey (NDHS) data. Mother-child pairs where the mother was aged 15-49 years and the child was less than one year at the time of the survey were included. Variables such as the use of IPTp-SP and development of febrile illness as well as the socio-demographic and other control variable were analyzed. Chi-square testing and logistic regression were used to determine the association between the use of IPTp-SP and the development of febrile illness. Statistical analysis was done using SPSS version 21 and Statistical significance was set at $P<0.05$. A total of 6,212 mother-child pairs were analyzed. Chi-square test showed that there was a significant association between the use of IPTp-SP and report of fever in infants. A higher proportion of mothers that used IPTp-SP (15.8%) reported fever in their infants compared with those whose mother did not receive IPTp-SP (11.6%) ($P<0.001$). Logistic regression showed that mothers that used IPTp-SP were about one and half times more likely to report fever in their infants, before adjustment for confounding variables (OR = 1.46, 95% CI: 1.24 – 1.71, $p<0.001$). Following adjustment, there was a weaker (though still significant) association between IPTp-SP use and fever in the infants (OR = 1.26, 95% CI: 1.04 – 1.52, $p = 0.019$). This study found a significant association between the use of IPTp-SP and mothers' report of febrile illness among infants in the two weeks before the survey. This requires further evidence to confirm but highlights the complex relationship between maternal drug exposure and long term susceptibility to illness in offspring.

Keywords: Intermittent Preventive Therapy, Sulphadoxine-pyrimethamine, Pregnancy, Febrile Illness, Malaria

1. Introduction

Malaria is a key public health problem both in the tropical and subtropical regions of the world and constitutes a major challenge to development and health, especially in sub-Saharan Africa, where children and pregnant women are at the greatest risk. Malaria in pregnancy is associated with many negative outcomes for mothers, fetuses, and infants [1-2]. Globally, approximately 125 million women living in malaria-endemic areas become pregnant annually; 30 million of whom live in sub-Saharan Africa [3]. In sub-Saharan Africa, malaria in pregnancy is responsible for 20% of all stillbirths [4]. Malaria in pregnancy thus contributes to a continuous cycle of illness, leading to an increased risk of

low birth weight babies with increased susceptibility to ill health and death [5].

The symptoms as well as the complications of malaria in pregnancy vary with the acquired immunity state of the pregnant woman and thus with the intensity of malaria transmission [1]. While these settings are presented as two distinct epidemiologic conditions, in reality, the intensity of transmission and immunity in pregnant women occurs on a continuum, with potentially different conditions occurring within a country. In areas of unstable malaria transmission where adult pregnant women have no immunity, malaria in pregnancy can lead to severe consequences to both mother and fetuses, including death [1].

In areas of stable malaria transmission where there is immunity against malaria, pregnant women are relatively protected from severe consequences of malaria, however, due to sequestration of the malaria parasite in the placenta, fetal nutrition can be impaired leading to associated neonatal morbidities [1, 6, 7]. In order to prevent the adverse consequences of malaria in pregnancy in moderate and high transmission areas, the WHO recommends the use of intermittent preventive treatment in pregnancy (IPTp); a full preventive course of antimalarial medicine given to pregnant women at routine prenatal visits, regardless of whether the recipient is infected with malaria [7]. The WHO recommends IPTp with Sulphadoxine-Pyrimethamine (SP) for all pregnant women at each of the four scheduled antenatal care visits except in the first trimester [7]. Use of IPTp reduces maternal malaria episodes, maternal and fetal anemia, placental parasitemia, low birth weight, and neonatal mortality [8]. In most African countries over 70% of pregnant women make multiple antenatal clinic visits providing a major opportunity for the prevention of malaria through the use of IPTp [9-10]. However, in the last few years, it has been noted that there is a declining effort to scale-up IPTp in some African countries [7]; no country has achieved the 80% coverage target for 2 doses of IPTp.

More deaths are attributed to malaria in Nigeria than in any other nation of the world. Malaria accounts for 11% of maternal deaths and 20% of deaths among children less than 5 years of age in Nigeria [11]. Coverage of IPTp lags noticeably behind other malaria control measures with first and second dose coverage being 49% and 15%% respectively [12]. Improving IPTp coverage requires more effective integration between maternal and child health (MCH) programs and malaria control programs [5]. Understanding the relationship between use of IPT during pregnancy and development of febrile illness (which is the major symptom of malaria) among infants in Nigeria may provide evidence to enhance synergy between malaria control programs and maternal-child health services and thus contributes to the reduction of malaria-attributable infant mortality in Nigeria. The objective of this study was therefore to determine the association between maternal use of intermittent preventive treatment in pregnancy with sulphadoxine-pyrimethamine (IPT_p-SP) and development of febrile illness among infants in Nigeria.

2. Methodology

2.1. Study Design

This was a descriptive epidemiological study that involved the analysis of secondary data obtained from the 2013 Nigeria Demographic and Health Survey (NDHS).

2.2. Study Setting

The study was conducted in Nigeria, the most populous country in Africa with a population of 177,155,754 [13]. Nigeria is made of 36 states. The states are divided into 774 local government areas (LGA's) which are split to localities. There are up to 374 various ethnic groups; the largest are the Hausa and Fulani mainly found in the northern part, the Igbo in the eastern part, and the Yoruba in the south-western part of the country. The Hausa and Fulani are predominantly Muslim, the Igbo mainly Christian, and there is a balance in the two religions among the Yoruba. Regional differences exist in service delivery as well as status and resource availability in the health sector, with more health care services in the south when compared with the northern region of the country [12].

2.3. Inclusion-exclusion Criteria/Sample Size

Mother-Child pairs where the mother was aged 15-49 years and the child was less than one year at the time of the survey were included. Women who had no birth in the past five years were excluded. A total of 38,948 women aged 15-49 years were included in the 2013 NDHS, of whom 6,212 met the inclusion and exclusion criteria.

2.4. Ethics

Individual-level data from the 2013 Nigeria Demographic Survey was made available by request from ICF macro USA. Informed consent was provided for the initial data collection; because this was a secondary analysis, no further consent was needed and local ethical approval was not sought.

2.5. Data Source

The data was derived from the women's questionnaire of the 2013 Nigeria Demographic and Health Survey (NDHS). It provided recent information on 'health indicators' including use of IPTp-SP, health of infants as well as other demographic characteristics of women of reproductive age (15-49 years).

2.6. Definitions of Variables

The development of febrile illness in the infant was the *dependent variable*. This is defined as a fever within the last two weeks in infants less than or equal to 12 months of age. The *independent variables* include the use of IPTp-SP to prevent malaria during pregnancy. This is defined as the use of any of the following drugs: Sulphadoxine-pyrimethamine (SP), fansidar, Amalar or Maloxine during pregnancy. For those who took the drugs, other variables include: the number

of times the drug was taken during pregnancy as well as place of access of the drug (was the drug given during an antenatal care visit or visit to other health facilities?) Other *control variables* include mother's age at last delivery, educational status, wealth quintile, place of residence (urban or rural), region of residence, marital status, religion and number of children.

2.7. Description of Primary Survey/Sampling Approach/Sampling Frame

The sampling frame of the primary survey was the list of enumeration areas (EA's) from the 2006 Nigerian national population census. The sample was got using a stratified three-stage cluster design. Stratification was obtained by splitting all states in the nation into urban and rural areas. During the first stage, a total of 839 different localities were selected using independent selection in every stratum with probability proportional to size. In the second stage, enumeration areas were chosen randomly from the localities with the selection of greater than one enumeration area from some bigger localities. A total of 904 clusters (EA's), 372 in the urban and 532 in the rural area were selected. Finally, during the third stage of selection, 45 households were selected from each urban and rural cluster by equal probability systematic sampling using updated households list from stage 2. A total of 40,680 households were selected and used for the survey. All women age 15- 49 years who were permanent residents or who slept in the house on the night before the interviews in the selected household were qualified for interviews. In total, 38,948 were interviewed. Interviewers were trained and the questionnaires were pre-tested by the trained interviewers. The questionnaires were designed in English but were translated to the 3 major indigenous Nigerian languages. Fieldwork and data collection was carried out in four months. The response rate was 98%. Data entry was done during fieldwork to allow for easy identification and correction of inconsistencies and errors [12].

2.8. Data Collection/Analysis Plan

This analysis used data collected in the women's questionnaire, which contained questions relating to maternal and child health, fertility, etc. Statistical analysis was done using SPSS version 21. For this analysis, only those with responses for the variables of interest were included in cross-tabulation (chi-square test) and logistic regression; all cases with missing data were also excluded using the complete case analysis method [14]. Also to address the differences in the probability of selection and produce an appropriate representation, weighting was applied in the tabulations [15]. The weight case option in SPSS was used for all the cross-tabulations and logistic regression analyses.

Descriptive statistics were used to show the socio-demographic characteristics of the participants. Frequency tables were used to show the percentage of socio-demographic characteristics as well as the use of IPTp. The Chi-square test was used to test for the association between the independent variables (socio-demographic characteristics, IPTp use) and dependent variables (development of febrile illness in infants). Multiple logistic regression models were used to test the relationship between the dependent and the independent variables as well as to address confounding. Data were considered statistically significant with $p<0.05$.

3. Result

3.1. Descriptive Statistics

3.1.1. Frequency Distribution of Mothers' and Childs' Sociodemographic Characteristics

Out of the total of 38,948 women aged 15-49 years included in the data set, the analysis included a total of 6,212 mother-child pairs where the child was less than one year at the time of the survey. The highest proportion of the women was aged 25-29 years (28.2%) followed by those aged 20-24 years (23.5%) and 30-34 years (20.4%) (Table 1). About two-thirds (66.2%) were from rural areas. Over half of the respondents (57.8%) were Muslims while almost half (44.3%) had no formal education. The majority of the women were currently in a union (95.7%). Except for infants less than 1 month, there were similar numbers of infants across each month (Table 2).

Table 1. *Frequency distribution of mothers' socio-demographic characteristics.*

Variable	Frequency	%
Age (years)		
15-19	548	8.8
20-24	1462	23.5
25-29	1754	28.2
30-34	1265	20.4
35-39	783	12.6
40-44	306	4.9
45-49	94	1.5
Region		
Northcentral	898	14.5
Northeast	1258	20.3
Northwest	1922	30.9
Southeast	574	9.2
South-south	755	12.2
Southwest	805	13.0
Place of residence		
Urban	2097	33.8
Rural	4115	66.2
Highest educational level		
None	2755	44.3
Primary	1184	19.1
Secondary	1865	30.0
Tertiary	408	6.6
Wealth index		
Poorest	1337	21.5
Poorer	1414	22.8
Middle	1274	20.5
Richer	1176	18.9
Richest	1011	16.3
Religion		
Catholic	510	8.2
Other Christian	2031	32.7
Islam	3588	57.8

Variable	Frequency	%
Traditionalist	45	0.7
Other	4	0.1
Missing	34	0.5
Number of children		
1-2	2595	41.8
3-4	1908	30.7
5+	1709	27.5
Marital status		
Never in union	170	2.7
Currently in union	5944	95.7
Formerly married	98	1.6

Table 2. *Frequency distribution of Childs' socio-demographic characteristics.*

Variable	Frequency	Percentage (%)
Age of child (months)		
0	277	4.5
1	537	8.6
2	526	8.5
3	553	8.9
4	572	9.2
5	531	8.5
6	566	9.1
7	547	8.8
8	539	8.7
9	561	9.0
10	554	8.9
11	449	7.2
Gender of child		
Male	3079	49.6
Female	3133	50.4

3.1.2. Proportion of Children Under 1 Year with Fever Two Weeks Before the Interview

Only 12.6% of children less than one year were reported to have had a fever in the two weeks before the interview (Table 3).

Table 3. *Proportion of children aged less than 12 months that had a fever 2 weeks before the interview.*

Variable	Frequency	%
Fever 2 weeks before interview		
Yes	780	12.6
No	5406	87.0
Don't know	2	0.0
Missing	24	0.4

3.1.3. Antenatal Care Attendance and IPT Use

Although about 51% of women reported having made at least 4 ANC visits, nearly one-third reported never visited ANC, and only 27% reported ever having used IPTp-SP (Table 4). Of this number, 39% used one dose, 36.9% used two doses, and less than a quarter (22.9%) used three or more doses. More than three-quarters of women reporting IPT use got the drugs during their ANC visit.

Table 4. *ANC attendance and IPT use in last pregnancy by mothers of children aged less than 12 months.*

Variable	Frequency	%
ANC visits		
None	1922	30.9
1-3	889	14.3
4+	3163	50.9
Don't know/No response	238	3.8
Used IPT last pregnancy		
Yes	1658	26.7
No	4371	70.4
Don't know	78	1.3
Missing	105	1.6
Number of IPT used (n = 1658)		
1	646	39.0
2	611	36.9
3+	379	22.9
Missing	22	1.3
Source of IPT (n = 1658)		
ANC visit	1352	81.5
Other facilities	59	3.6
Other sources	16	1.0
Missing	231	13.9

3.2. Bivariate Result

3.2.1. Association Between Mothers' IP Use in Pregnancy and Fever in the Infant

There was a significant association between the use of IPTp-SP and fever in infants (Table 5). A higher proportion of mothers that reported IPT use in pregnancy (15.8%) reported fever in their infants compared with those whose mother did not receive IPTp (11.6%) (P<0.001). There was no significant association between the number of IPT doses and fever (P = 0.781).

Table 5. *Association between mothers' IPTp-SP use and fever 2 weeks before the interview.*

Variable	Fever 2 weeks before interview				
	Yes (%)	No (%)	Total	Chi square	P value
IPT use					
Yes	262 (15.8)	1391 (84.2)	1653	19.85	<0.001
No	503 (11.6)	3849 (88.4)	4352		
Number of IPT doses					
1	102 (15.8)	543 (84.2)	645		
2	92 (15.1)	518 (84.9)	610	0.49	0.781
3+	63 (16.8)	313 (83.2)	376		

3.2.2. Association Between Mothers' Characteristics and Fever in the Infant

There was a significant association between fever in the infant and regions, with fever most commonly reported in the North East and South East compared to other regions. Fever in the infants was significantly higher among older infants

(6-11 months) and women with fewer than 4 ANC visits and was lowest among women in the richest wealth index and women currently in union (Table 6).

Table 6. *Association between mothers/ infants characteristics and developments of fever 2 weeks before the interview.*

Variable	Fever 2 weeks before interview				
	Yes (%)	No (%)	Total	P value	Chi square
Mother's Age (years)					
15-19	77 (14.3)	463 (85.7)	540		
20-34	558 (12.5)	3909 (87.5)	4467	0.474	1.49
35-49	145 (12.3)	1034 (87.7)	1179		
Region					
Northcentral	54 (6.0)	839 (94.0)	893		
Northeast	273 (21.8)	980 (78.2)	1253		
Northwest	203 (10.6)	1711 (89.4)	1914	<0.001	218.03
Southeast	117 (20.5)	454 (79.5)	571		
South-south	97 (12.9)	655 (87.1)	752		
Southwest	36 (4.5)	767 (95.5)	803		
Place of residence					
Urban	254 (12.1)	1838 (87.9)	2092	0.428	0.63
Rural	526 (12.8)	3568 (87.2)	4094		
Mother's Highest educational level					
None	345 (12.6)	2393 (87.4)	2738		
Primary	154 (13.1)	1026 (86.9)	1180	0.277	3.86
Secondary	242 (13.0)	1619 (87.0)	1861		
Tertiary	39 (9.6)	368 (90.4)	407		
Wealth index					
Poorest	179 (13.4)	1155 (86.6)	1334		
Poorer	201 (14.3)	1203 (85.7)	1404		
Middle	172 (13.5)	1099 (86.5)	1271	0.003	16.07
Richer	132 (11.3)	1036 (88.7)	1168		
Richest	96 (9.5)	913 (90.5)	1009		
Religion					
Christianity	300 (11.8)	2232 (88.2)	2532	0.164	1.94
Islam	466 (13.0)	3106 (87.0)	3572		
Number of children					
1-2	322 (12.5)	2257 (87.5)	2579		
3-4	234 (12.3)	1670 (87.7)	1904	0.716	0.67
5+	224 (13.2)	1479 (86.8)	1703		
Marital status					
Never in union	30 (17.8)	139 (82.2)	169		
Currently in union	733 (12.4)	5186 (87.6)	5919	0.042	6.33
Formerly married	17 (17.3)	81 (82.7)	98		
ANC visits					
None	192 (10.0)	1720 (90.0)	1912		
1-3	148 (16.7)	737 (83.3)	885	<0.001	25.57
4+	412 (13.1)	2741 (86.9)	3153		
Age of child (months)					
Less than 1	6 (2.2)	269 (97.8)	275		
1-5	215 (7.9)	2492 (92.1)	2707	<0.001	148.69
6-11	559 (17.4)	2645 (82.6)	3204		
Gender of child					
Male	408 (13.3)	2657 (86.7)	3065	0.099	2.72
Female	372 (11.9)	2749 (88.1)	3121		

3.3. Logistic Regression

3.3.1. Simple/Multiple Logistic Regression of Mothers' IPT$_p$-SP Use on Fever in Infants

Table 7. *Crude and Adjusted Odds ratios assessing the relationship between mothers IPTp-SP use and report of fever in the infants in the 2 weeks before the interview.*

Variable	Simple logistic regression			Multiple logistic regression		
IPT use	Crude Odds ratio	95% confidence interval	P-value	Adjusted* Odds ratio	95% confidence interval	P-value
Yes	1.46	1.24 – 1.71	<0.001	1.26	1.04 – 1.52	0.019
No (ref)	1			1		

*Adjusted for mother and child's socio-demographic characteristics, and antenatal visits as shown in Table 7.

Mothers that used IPTp-SP were about one and half times more likely to report fever in their infants, before adjustment for confounding variables (OR = 1.46, 95% CI: 1.24 – 1.71, p<0.001). Following adjustment, there was a weaker (though still significant) association between IPTp-SP use and fever in the infants (OR = 1.26, 95% CI: 1.04 – 1.52, p = 0.019) (Table 7).

3.3.2. Multiple Logistic Regressions of Mothers' and Infants' Characteristics on Fever in Infants

The odds ratio from multiple logistic regression of IPTp-SP use on fever in the infants, adjusted for mothers' socio-demographic status, antenatal care, and infant characteristics are shown in table 8. Respondents from the Southeast were most likely to report a fever in their children, while respondents from the Southwest were the least likely to report a fever in their children. Poorer women were significantly more likely to report fever in their infant in the two weeks before the interview. The odds of fever were significantly higher among older children, Muslims, and women that had attended more ANC visits.

Table 8. *Multiple logistic regression of having fever 2 weeks before the interview and mothers' socio-demographic characteristics.*

Variable	Odds ratio (OR)	95% CI OR	P value
IPT use			
Yes	1.26	1.04 – 1.52	0.019
No (ref)	1		
Age (years)			
15-19	1.07	0.73 – 1.57	0.736
20-34	1.04	0.82 – 1.33	0.726
35-49 (ref)	1		
Region			
Northcentral	1.23	0.78 – 1.94	0.375
Northeast	4.88	3.22 – 7.39	<0.001
Northwest	2.04	1.32 – 3.15	0.001
Southeast	5.49	3.59 – 8.39	<0.001
South-south	3.25	2.10 – 5.04	<0.001
Southwest (ref)	1		
Wealth index			
Poorest	1.56	1.05 – 2.33	0.030
Poorer	1.64	1.13 – 2.38	0.010
Middle	1.48	1.06 - 2.07	0.022
Richer	1.07	0.78 – 1.47	0.668
Richest (ref)	1		
Religion			
Christianity	0.69	0.52 – 0.92	0.012
Islam (ref)	1		
Number of children			
1-2	0.90	0.70 – 1.15	0.388
3-4	0.98	0.78 – 1.24	0.862
5+ (ref)	1		
Marital status			
Never in union (ref)	1		0.188
Currently in union	0.73	0.46 – 1.16	0.660
Formerly married	0.85	0.42 – 1.73	
Age of child (months)			
Less than 1 (ref)	1		
1-5	4.40	1.79 – 10.86	0.001
6-11	11.52	4.70 – 28.22	<0.001
Gender of child			
Male	1.12	0.96 – 1.32	0.157
Female	1		
ANC visits			
None (ref)	1		
1-3	1.55	1.19 – 2.02	0.001
4+	1.40	1.10 – 1.78	0.007

4. Discussion

Malaria which often presents as a febrile illness accounts for about 214 million cases and 438,000 deaths in 2015 and most of the disease burden occurs in Sub-saharan Africa [16]. This descriptive study examined the relationship between the use of intermittent preventive therapy for malaria during pregnancy (IPTp) and the development of febrile illness among infants in Nigeria. There was a significant association between IPTp-SP use and fever in infants. A higher proportion of mothers that had used IPT in pregnancy reported fever in their infants in the two weeks before the survey compared with mothers who did not receive IPTp during pregnancy. This finding is consistent with that of other studies in similar settings. In a birth cohort study, IPTp-SP was associated with a higher risk of 'malaria outcome' (febrile illness) among infants [17]. It has also been previously noted that in communities where there is widespread resistance to (SP), the use of IPTp-SP did not prevent placental malaria sequestration but rather was associated with increased malaria infections [18, 19].

Use of IPTp-SP could exacerbate placental malaria infection which in turn predicts increased risk of malaria parasitemia as well as the occurrence of overt clinical malaria in offspring [20-22]. Evidence has suggested that IPTp- SP use in humans could decrease anti-malaria antibodies in mothers though this is modified by HIV status and parity [23, 24]. However, it also possible that the use of IPTp-SP may decrease the variety of the 'maternal anti-malaria antibodies' resulting in increased infant vulnerability to diverse malaria parasite populations [17]. Treating malaria in mice before pregnancy has been linked with reduced anti-malaria antibodies, increased malaria parasitemia, as well as increased morbidity and mortality in their pups after infection with malaria [25]. Similarly, it was demonstrated that the use of IPTp during pregnancy was unexpectedly associated with low cord blood levels and a higher risk of fetal anemia in Tanzania [19]. Fetal anemia plays a large role in predicting infant mortality and morbidity. Anemia in fetuses predisposes to anemia in infancy [26] which may be implicated in childhood diseases like respiratory infection, diarrhea or malaria (that may be associated with febrile illness) and increased occurrence of persistent diseases as well as an increased collective incidence of disease morbidity [27]. Decreasing compliance, growing resistance to SP treatment as well as other anti-malarial medicines draws attention to the complex nature of IPTp-SP treatment [29] The suggested alternative to IPTp drug treatment in places with considerable resistance against SP is 'the Intermittent Screening and Treatment (IST) [29]. This regimen involves using a rapid diagnostic test (RDT) to screen for malaria infection at a scheduled antenatal care visitation and then subsequently

treat women who are positive with very effective anti-malarial treatment [30].

However, other groups have failed to replicate the findings by Harrington et al. Use of IPTp-SP did not exacerbate pregnancy-associated morbidities despite the increasing prevalence of SP resistant strains of *Plasmodium falciparum* and it was noted that even in the presence of appreciable resistance, (SP) could still be taken as IPTp [28]. However, the need to find an alternative drug for prevention was reiterated. In a prospective randomized, placebo-controlled trial, it was noted that IPTp with SP in Mozambican pregnant women also led to a significant reduction in neonatal mortality in their offspring that were followed up to 12 months [8]. Decreasing compliance, growing resistance to SP treatment as well as other anti-malarial medicines draws attention to the complex nature of IPTp-SP treatment [29].

4.1. Study Strengths

The major strength of this study was that the data was representative of Nigeria. The large sample size used for this analysis, the high rate of response and participation and standard method of collection of data all ensured reliability and representativeness of data. The span of the data collected allowed a deep analysis that went beyond counting prevalence but enabled the determination of the relationship between the use of IPTp-SP and the occurrence of febrile illness in infants. Therefore the result from this study reflects the use of IPTp-SP and the development of febrile illness among infants in the nation.

4.2. Study Limitations

This data was derived from a cross-sectional survey, and therefore causality cannot be determined. The use of (IPTp) was significantly associated with mother's reporting a febrile illness in the two weeks preceding the survey. However, it was not possible to conclude a cause-effect relationship. It was assumed that the major cause of febrile illness especially Nigeria is malaria. However, other conditions may cause fever, and these were not differentiated by our study. There is also the possibility that the association we found might be a result of increasing exposure to malaria among the children of mothers that used IPTp as this was not a randomized controlled trial. This may not necessarily be the case as the use of IPTp was national policy and distribution was done without preference to malaria disease prevalence.

5. Conclusion

In conclusion, this study found a significant association between the use of intermittent preventive therapy for malaria during pregnancy (IPTp) using Sulphadoxine-pyrimethamine (SP) and mothers' report of febrile illness among infants in the two weeks before the survey. These findings, along with that of other studies as discussed above, raised concerns of potential harm following the use of Sulphadoxine- pyrimethamine and may imply that the continued use of a possibly failing drug could worsen instead of alleviating disease and infections in certain individuals. It also highlighted the complex relationship between maternal drug exposure and long term susceptibility to illness in offspring. Future research should aim at a comparative study of IPTp-SP and Intermittent screening and treatment (IST) during pregnancy or in the alternative, trying differing drugs to find a better alternative to use for the global malaria control programs.

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