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Increased uptake of intermittent preventive treatment for malaria in pregnant women in Zambia (2006–2012): Potential determinants and highlight of lessons learnt

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ABSTRACT

Objective: To assess potential determinants of uptake and highlight lessons learnt from the implementation of intermittent preventive treatment (IPTp), given to pregnant women as early as possible during the second trimester in Zambia.

Methods: Data from four national malaria surveys (2006, 2008, 2010, 2012) were reviewed, and proportions of pregnant women attending antenatal clinics (ANCs) who received two or more doses of sulfadoxine–pyrimethamine (IPTp2) were compared by place of residence, education level, and wealth status. Malaria cases and deaths in pregnant women, from Health Information Management System 2011–2013, were analyzed to determine malaria burden in pregnancy in Zambia. A multiple logistic regression model was applied to identify potential determinants of IPTp uptake.

Results: The proportion of pregnant women who took IPTp at ANCs increased from near zero at inception in 2001 to 61.9% in 2006; and to 72% by 2012 ($P < 0.001$), and overall the uptake was 1.41 times higher in 2012 compared to 2006. From 2006 to 2012, IPTp2 uptake among women with no formal education increased from 51% to 68% ($P < 0.1$). Likewise, uptake among pregnant women with the lowest wealth index increased from 58.2% to 61.2%. By 2012, IPTp uptake among pregnant women within the lowest wealth index increased to a similar level as the women with high wealth index ($P = 0.05$). Incidence of malaria cases, hospital admissions and mortality during pregnancy decreased between 2011 and 2013. Overall, increased IPTp uptake was associated with being in urban areas (OR = 1.56, 95% *CI*: 1.39–1.74), having college (OR = 1.83, 95% *CI*: 1.25–2.75) or secondary education (OR = 1.68, 95% *CI*: 1.44–1.96) or of being of higher wealth status (OR = 1.86, 95% *CI*: 1.60–2.17).

Conclusions: Zambia has increased IPTp uptake through ANC for all women. The malaria control program has contributed to increasing access to health services and reducing demographic and socioeconomic disparities.

1. Introduction

Malaria infection during pregnancy is a major public health problem in sub-Saharan Africa with significant deleterious effects on the pregnant woman, her foetus and the newborn [1].

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The symptoms, adverse consequences or complications of malaria in pregnancy differ depending on the level of transmission intensity. In moderate-to-high stable malaria transmission areas, women of reproductive age often have high acquired immunity resulting in asymptomatic infections with fewer cases of fever or clinical illness. More commonly, these asymptomatic infections lead to maternal anaemia and low birth weight, and a higher risk of infant mortality [2].

The World Health Organization (WHO) recommends a package of interventions for prevention and control of malaria during pregnancy in areas of stable transmission of *Plasmodium falciparum* [3]. These interventions include: use of insecticide treated nets or indoor residual spraying; chemoprevention with three doses or more of intermittent preventive treatment (IPTp) using sulfadoxine–pyrimethamine; parasitological diagnostic testing and effective case management of malaria and anaemia [4]. In 2012, WHO updated the malaria in pregnancy policy for IPTp during pregnancy with sulfadoxine–pyrimethamine and recommended that women who live in moderate-to-high transmission areas should receive IPTp-sulfadoxine–pyrimethamine as early as possible in the second trimester of gestation and at each scheduled visit thereafter, provided that each sulfadoxine–pyrimethamine is given at least one month apart [5,6]. Zambia's preventive strategy for malaria in pregnancy aligns with the WHO recommendations.

WHO Malaria Policy Advisory Committee recognized that in many areas where parasites with quintuple mutations confer antifolate resistance, IPTp with sulfadoxine–pyrimethamine still maintained protective benefits in terms of pregnancy outcomes [6]. Despite these protective benefits conferred by IPTp to pregnant women, access to this life-saving intervention remains limited in most countries in the sub-Saharan Africa [7]. Zambia adopted IPTp in 2001 with implementation starting in 2002 [8]. The IPT strategy in Zambia is delivered at antenatal clinics (ANCs) as directly observed therapy.

Prior to the adoption of IPTp in 2001, the national malaria control programme estimated malaria in pregnancy to contribute about 20% of maternal deaths. However, with the recent increased coverage of malaria interventions, it is expected that the burden may have reduced [9]. Currently, Zambia is among countries with the highest IPTp coverage in the sub-Saharan African region at 73% (against the national target of 80%) [10].

Several years of consistent implementation of the IPTp-sulfadoxine–pyrimethamine strategy has yielded vital lessons for preventing malaria in pregnancy in Zambia. However, there has been no in-depth, systematic analysis of the strategy. As an early adopter of the IPTp strategy [11], Zambia has gained important lessons over the past decade that should be shared with other countries in the sub-region. The purpose of this study is to assess potential determinants of IPTp uptake and highlights lessons learnt between 2006 and 2013.

2. Materials and methods

Data on IPTp were analyzed in the period 2006 to 2013. The data sources were malaria surveys conducted in Zambia between 2006 and 2012 [12–15] and, routine data derived from Zambia's District Health Management Information System records [16] and national malaria programmatic gap analyses. Data on population percentage distribution in rural and urban areas were obtained from 2010 census of population and housing, Zambia [17] derived from the Zambian provinces (Figure 1).

In this regard, the focus of the IPTp analyses was on pregnant woman who should have taken at least two or more doses of sulfadoxine–pyrimethamine antimalarial medicine during antenatal care visits, as directly observed therapy, starting in the second trimester of pregnancy [18]. Trend analyses on women, who received at least two doses of IPTp, were carried out using the *Chi*-squared test, at 5% level, to confirm any significant difference in trends. The uptake of IPTp was compared between rural and urban, education level and wealth index. The classification into rural and urban was based on an analysis by the Department for International Development of the United Kingdom, which takes into account several parameters, including access to basic services-health, education (and other social services) and population density [19]. Figure 2 shows the distribution of the general population by province in Zambia [Data for Muchinga Province was unavailable]. Education was classified into four levels: none, primary, secondary and college, and the first level of education was used to compare uptake with the other education levels. Wealth index was calculated based on the demographic and health survey definition [20]. We then generated three levels: low, medium and high wealth status. In all comparison, the *Chi*-square was used. Furthermore, a multiple logistic regression of IPTp uptake with year, rural/urban, education, wealth index and province as explanatory variables was fitted.

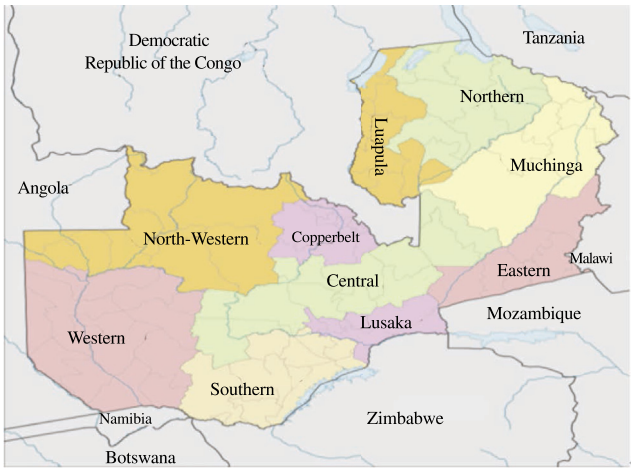

Figure 1. Map of Zambia showing provinces [Source: google].

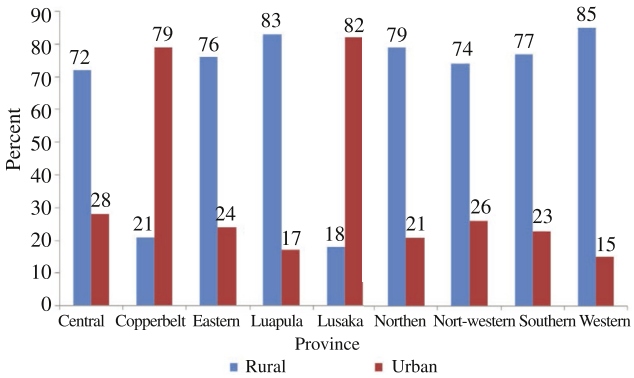

Figure 2. Population percentage distribution by Province, rural and urban areas, Zambia, 2006–2010.
Source: Living conditions monitoring survey 2006–2010, Zambia.

3. Results

3.1. Population distribution

A total of 7664 (814 in 2006; 2392 in 2008; 436 in 2010 and 2022 in 2012) pregnant and those women who had given birth prior to the survey were examined in 10 provinces of Zambia. The total number of women examined in rural and urban was 7639 (Table 1), whereas 4672 women were examined by wealth index: 457 in 2006; 1496 in 2008; 1529 in 2010 and 1190 in 2012.

3.2. Uptake of IPTp

The proportion of pregnant women attending ANCs who received a second dose of sulfadoxine–pyrimethamine regardless of their social-economic status, increased from 61.9% in 2006 to 72.0% in 2012 ($P < 0.001$).

3.3. IPTp uptake in rural compared to urban women

Table 1 shows comparisons in the uptake of two doses of sulfadoxine–pyrimethamine (IPTp2) among pregnant women who attended at least one ANC between 2006 and 2012. During this period, the uptake of IPTp2 among pregnant women in rural areas increased from 58.1% (n = 616) in 2006 to (67.0% (n = 1674) in 2012, P = 0.00. Likewise, in urban areas the uptake increased from 71.2% (n = 198) in 2006 to 74.6% (n = 323) in 2012 but the increase was not significant (P = 0.45). The IPTp2 uptake among women in rural areas was generally lower than women in urban areas in 2006 (58.0% *vs* 71.2%); in 2008 (58.1% *vs* 65.2%); in 2010 (65.2%) *vs* 77.3%) and in 2012 (67.0% *vs* 74.6%).

3.4. Education levels and IPTp uptake

Table 2 shows IPTp2 uptake by levels of education in Zambia between 2006 and 2012. During this period, the proportion of women with no formal education who took IPTp2 increased from 58.2% to 66.0% but the increase was not significant (P = 0.12). In general, women with no formal education attending ANCs showed lower IPTp2 uptake than women having secondary education, evident from 2008; 54.0% *vs* 66.9% (P = 0.00); 63.0% *vs* 76.3% in 2010 (P = 0.00) and (66.0% *vs* 73.7%) in 2012 (P = 0.02). Similar statistically significant differences were notable between the women with no formal education compared to those with higher qualification (college or university) but a statistically significant result was only observed in 2012; For example, for the no formal education *vs* college, compare 54.0% *vs* 70.4% in 2008 (P = 0.12); 63.0% *vs* 72.6% in 2010 (P = 0.16) and 66.0% *vs* 84.3% in 2012 (P = 0.02).

3.5. Wealth index and IPTp uptake

In 2006 uptake of IPTp2 in lowest wealth index category was 58.2% *vs* 61.2% in the highest wealth index (P = 0.73) among pregnant women. However, by 2012 uptake among lowest wealth index increased to 71.5%, a level similar to that in the highest wealth index with 74.2% (P = 0.41).

3.6. Provincial variations in IPTp

In 2012, IPTp2 uptake reported in the Eastern Province (85.4%) was comparable with that of Copperbelt Province (85.3%), which has a higher population density and is more urbanized than the Eastern. IPTp2 among women residing in other rural provinces were generally lower than those experienced in urban provincial areas. For example, compare 85.4% IPTp2 reported in Copperbelt with 53.50% in Muchinga, 61.4% in Western, 62.1% in North-Western Province and 76.00% in Luapula Province.

3.7. Logistic regression model estimates

Table 3 presents estimates from the logistic regression. Across the years, there was evidence of increased uptake of IPTp

Table 1
Uptake of IPTp2 rural compared to urban among pregnant women who attended at least one ANC, Zambia from 2006 to 2012.

Region	Year				P value
	2006	2008	2010	2012	2006 *vs* 2012
Rural	616 (58.1)	1648 (58.1)	1595 (65.2)	1674 (67.0)	0
Urban	198 (71.2)	745 (65.2)	840 (77.3)	323 (74.6)	0.45

Table 2
Uptake of IPTp by education level among women attending antenatal care in Zambia. n (%).

Year	No. formal education	Primary	Secondary	College
2006	148 (58.2)	479 (59.3)	174 (67.8)	–
2008	387 (54.0)	1358 (58.8)	616 (66.9)*	30 (70.4)
2010	262 (63.0)	1301 (66.3)	798 (76.3)*	75 (72.6)
2012	346 (66.0)	1155 (67.6)	452 (73.7)*	44 (84.3)*

*: There is statistical significant difference when primary, secondary and college women compared with no formal education women; –: Data unavailable for 2006 women in college.

Table 3
Odds ratios derived from a multiple logistic regression on the IPTp uptake between 2006 and 2012 in Zambia.

Variable		Odds ratio	95% *CI*
Year	2006	1.00	
	2008	0.95	0.80–1.12
	2010	1.37	1.16–1.62
	2012	1.41	1.19–1.68
Wealth index	Low	1.00	
	Medium	1.19	1.03–1.37
	High	1.86	1.60–2.17
Education	None	1.00	
	Primary	1.14	0.99–1.30
	Secondary	1.68	1.44–1.96
	College	1.83	1.25–2.75
Residence	Rural	1.00	
	Urban	1.56	1.39–1.74
Province	Central	1.00	
	Copper belt	2.17	1.72–2.74
	Eastern	1.07	0.87–1.30
	Luapula	0.90	0.73–1.11
	Lusaka	1.28	1.03–1.61
	Northern	0.95	0.77–1.17
	North western	1.27	0.98–1.63
	Southern	0.65	0.53–0.79
	Western	0.45	0.35–0.57

in the latter years: 2010 and 2012, relative to 2006. In 2012 uptake was 1.41 times higher, while in 2010 this was 1.37 times higher compared to the uptake in 2006. The uptake in 2008 compared to that in 2006, showed no significant difference. With regards to wealth status, it was observed that women from high and medium wealth households were more likely to access IPTp compared to those in the low wealth status, with OR = 1.86 (95% *CI*: 1.60–2.17) for the high level, and OR = 1.19 (95% *CI*: 1.03–1.37) for those in the medium class.

Table 3 also shows that education level was an important determinant for IPTp uptake. For women with secondary or college education relative to those with no education, there was increased uptake of IPTp, with the highest probability of uptake among those who attained college education (OR = 1.83) followed by those who achieved secondary education (OR = 1.68). However, there was no evidence of difference between those with primary education and those without education, despite having OR = 1.14 in those with primary education. Comparing women in rural and urban areas, those in urban areas were more likely to access IPTp (OR = 1.56, 95% *CI*: 1.39–1.74) than those in rural areas.

Turning to province of residence, there was distinct differences among provinces, with highest probability of uptake observed in the Copperbelt province (OR = 2.17, 95% *CI*: 1.72–2.74) and Lusaka province (OR = 1.28, 95% *CI*: 1.03–1.61) compared to the Central province. On the other hand, women from the Southern and Western provinces were less likely to have increased uptake of IPTp compared to the Central province (OR = 0.65, 95% *CI*: 0.53–0.79 and OR = 0.45, 95% *CI*: 0.35–0.57, respectively). The other provinces: Eastern, Luapula, Northern and North western did not show a significant uptake of IPTp compared to the Central province.

4. Discussion

This study suggests an increased uptake of IPTp, especially for the second dose of sulfadoxine pyrimethamine (IPTp2) among pregnant women attending antenatal clinics in rural locations of Zambia. In the study, women in both the lowest and highest wealth index categories attained high IPTp2 uptake of 72% by 2012.

Zambia has a scattered population living in a large geographical area with diverse terrain which makes the provision of universal coverage of health services to communities challenging [21]. Therefore, improved uptake of IPTp in rural settings reported in this study is a positive observation.

Increased uptake of preventive malaria services by women with low social economic status and with limited formal education in hard-to-reach rural areas underscores the important contribution of malaria control programmes towards bridging the rural and urban disparities and inequities in accessing malaria health services in Africa [22]. Additional benefits of IPTp in improving uptake of other interventions in rural settings have been documented in Uganda, located within Central Africa, where increased uptake of ivermectin for the treatment of onchocerciasis was demonstrated in rural settings where IPTp services for malaria in pregnancy were introduced for pregnant women [23].

Despite increasing trends of pregnant women's uptake of IPTp in rural areas, disparities still exist among women attending antenatal visits in rural and urban settings in Zambia. Additionally, not all women attend all the recommended four antenatal clinic visits. It has been observed that a large part of the "unfinished business" in reproductive, maternal, newborn and child health in the African region is related to addressing inequities that seek to ensure that women and children receive health services they need regardless of wealth, gender and ethnic group [22]. Disparities in the provision of health services between rural and urban communities are an important impediment that negatively affects the attainment of national and global goals and targets [24]. In 2012, the IPTp2 coverage in rural provinces reached a high of 85% and was comparable with uptake among women living in some urban provinces. However, there were variations in IPTp uptake among the rural provinces.

National uptake data of three doses of IPT remains low among pregnant women in the African region [25]. In 2013, among nine reporting countries, 17% of all pregnant women received three or more doses of IPTp; 43% received two doses and 57% received at least one dose of IPTp [25,26]. However, a median of 89% of pregnant women in 31 reporting countries attended ANC at least once among a total of 31 reporting countries. In Zambia, 97% pregnant women attended at least one ANC visit but only 72% took the recommended two or more doses according to the Zambia Malaria Indicator Survey 2012 quoted under the materials and methods section.

The gap between the proportion of pregnant women attending ANCs and those who receive IPTp is a missed opportunity for delivering all doses of IPTp in Zambia and other sub-Saharan African countries. WHO has shown that the proportion of women receiving at least one dose of IPTp increased markedly from 2000 to 2007 but slowed between 2008 and 2013 for reasons yet to be identified [20,26].

In the current study, the observation that malaria accounted for approximately 3% of reported deaths among the pregnant women, attest to the protection conferred by interventions [27], including IPTp implemented through focused antenatal care that is integrated with reproductive health services.

The increasing trend in women's uptake of preventive interventions such as IPTp at ANCs in rural and urban settings with and without formal education underpins the positive contribution of malaria control programmes towards increasing uptake of health services and reducing disparities between rural and urban women.

Conflict of interest statement

We declare that we have no conflict of interest.

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