Full Length Research Paper

An evaluation of the effect of women's perceptions IPTp$_2$ uptake to support the need for appropriate interventions to strengthen IPTp programs in malaria-endemic countries

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Intermittent Preventive Treatment in pregnancy (IPTp) with sulfadoxine-pyrimethamine is a key intervention for malaria prevention. Bungoma East District falls within the malaria-endemic zone of Kenya, with an infection risk class of 20%, or higher. Even though malaria accounts for about 41% of maternal deaths in the District, uptake of the second dose (IPTp$_2$) remains below the Roll Back Malaria target. Perceptions about a disease and prophylactic interventions are likely to influence health behavior. This study set to determine women's perceptions influencing IPTp$_2$ uptake to support the need for appropriate interventions to strengthen IPTp programs in malaria-endemic countries. We applied the cross-sectional survey design and sourced primary data from 278 women who were at the twenty-fourth week, or more of gestation, aged between 15 and 49 years, had not experienced malaria during the pregnancy, and were not on cotrimoxazole prophylaxis. Analysis techniques included independent samples t-test, cross-tabulations with Chi Square statistic and binary logistic regression. Women believing that they were 'very susceptible' to malaria infection had about 2.3 times the odds of taking IPTp$_2$+ as those indicating that they were 'not susceptible' (β = 0·813, SE = 0·239, 95% CI = 1·41-3·60). Women perceiving that SP tablets were 'very useful' had 1·7 times the odds of taking IPTp$_2$+ as those believing that SP tablets were 'not useful' (β = 0·552, SE = 0·139, 95% CI = 1·32-2·28). Women perceiving that SP tablets were 'very safe' for use during pregnancy had about 25·4 times the odds of taking IPTp$_2$+ as those believing that SP tablets were 'not safe' (β = 3·235, SE = 0·63, 95% CI = 21·54-29·40). The stronger the conviction about personal susceptibility to infection, as well as usefulness and safety of SP tablets, the higher the odds of IPTp$_2$+ uptake. Strengthening health education interventions at the antenatal clinics is likely to re-orient negative perceptions, dispel misconceptions, and clear the way for IPTp$_2$+ uptake.

Key words: Perceptions, service uptake, intermittent prophylactic treatment, sulfadoxine-pyrimethamine.

INTRODUCTION

Malaria remains a key public health issue globally, with about 3.3 billion people being at risk of infection by the end of 2012. The annual world malaria reports consistently show that Africa bears the heaviest burden and the highest risk of malaria infection. In this regard, about 80% of reported malaria cases and about 90% of reported deaths occur in Africa, with children below five

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years and pregnant women living in malaria-endemic regions bearing the brunt (World Health Organization [WHO], 2010, 2011, 2012a). Malaria infection during pregnancy is highly risky for the mother and her fetus, particularly due to low levels of immunity. Estimations show that malaria accounts for about 10,000 maternal deaths and about 200,000 fetal and infant deaths annually, with severe malarial anaemia contributing to more than one-half of reported deaths (WHO, 2011). Malaria in pregnancy accounts for 5 to 12% of all low-weight births. In low risk zones, episodes of severe malaria significantly associates with stillbirths, spontaneous abortion, premature delivery, and maternal death (Luxemburger et al., 1997). However, in high-risk areas, women are susceptible to asymptomatic infection, with potential results being maternal anaemia and placental parasitaemia. Both situations are conducive for low birth weight and subsequently, infant mortality (Steketee et al., 1996; WHO, 2005).

Intermittent Preventive Treatment in pregnancy (IPTp) with sulfadoxine-pyrimethamine (SP) is one of the key interventions recommended by WHO for the prevention of malaria infections among pregnant women living in moderate to high-risk regions (WHO, 2007, 2012b). All pregnant women in such regions should receive the first dose of three tablets ($IPTp_1$), as early as possible during the second trimester, which providers administer under their direct observation. In addition, providers should give each SP dose at least one month apart, with every scheduled visit. WHO recommends a schedule of four antenatal care visits; hence, recipients of $IPTp_1$ should access the second dose ($IPTp_2$) within the twentieth week of pregnancy.

Furthermore, WHO recommends a minimum of $IPTp_2$ protection against malaria for women residing in high-risk regions (WHO, 2007, 2012b). Providers can administer the last dose of IPTp up to the time of delivery, without safety concerns. WHO further recommends that providers can administer SP either in an empty stomach, or with food. However, providers are cautioned not to give SP together with folic acid at a daily dose equal to, or above 5mg as this counteracts efficacy of the tablets. Moreover, health providers should exempt pregnant women receiving cotrimoxazole prophylaxis (WHO, 2012b).

The Roll Back Malaria partnership initiative set the $IPTp_2$ uptake target at 80% by 2010 (WHO, 2005, 2012b). Similarly, in Kenya, the National Malaria Strategy [NMS] 2009-2017 set the $IPTp_2$ uptake target at 80%. Although the IPTp remains a powerful tool against malaria in countries with moderate to high stable malaria transmission, there have been lapses, and poor uptake in Sub-Sahara African (SSA) countries, with little progress towards the $IPTp_2$ coverage target (WHO, 2012b). In Kenya, for instance, the 2008-09 Demographic and Health Survey (KDHS) Report indicated that only 15·1% of the participants received $IPTp_2$ (Kenya National Bureau of Statistics [KNBS] and ICF Macro,

2010), while the Malaria Indicator Survey of 2010 recorded a national $IPTp_2$ coverage of 25·7% (Ministry of Public Health and Sanitation [MPHS] et al., 2011).

Bungoma East District falls within Kenya's malaria-endemic zones, reporting among the highest malaria prevalence rates in Kenya. Anecdotal information from the Health Management Information Systems suggest that the $IPTp_2$ coverage between July 2009 and June 2010 averaged at 47·5%, while the District Annual Operational Plan 2010-2011 places the $IPTp_2$ coverage at 35% (Ministry of Planning and National Development [MPND], 2010). Hence, available evidence suggests that the $IPTp_2$ uptake in the District remains below RBM target of 80% by 2010 (KNBS and ICF Macro, 2010; MPHS, 2009). However, a review of pertinent literature revealed a paucity of information regarding women's perceptions associated with the $IPTp_2$ uptake in Kenya, particularly in the District. Consequently, we conducted this study to document information on women's perceptions influencing IPTp uptake and suggest appropriate recommendations for public health facilities to improve $IPTp_2$ uptake in malaria-endemic zones.

THEORETICAL AND EMPIRICAL CONTEXTS

The uptake of health services associates with perceptions held by target recipients. The Health Belief Model (HBM) holds that perceptions about a disease and strategies available to minimize its occurrence determine health behavior (Hochbaum, 1958). The original HBM consisted of four constructs, namely: perceived seriousness, perceived susceptibility, perceived benefits, and perceived barriers. However, HBM scholars later improved model's accuracy by including three new constructs, namely, cues to action, modifying factors, and self-efficacy (Glanz et al., 2002). Perceived seriousness signifies an individual's belief about the severity of a disease. While the perception of seriousness arises from medical information, or knowledge, it may also come from beliefs a person holds about the difficulties a disease would create in his or her life (McCormick-Brown, 1999). For instance, an individual may view that flu is less serious than malaria infection, because, while flu would require a few days to clear, malaria requires a longer period and finances to treat. Hence, one is likely to change behavior faster when facing the risk of malaria than flu.

Perceived susceptibility is one of the powerful perceptions influencing the adoption of prescribed health behaviors. The greater the perceived risk of infection, the higher the chance of behavior change. For instance, perceived susceptibility is what drives pregnant women to use Long Lasting Impregnated Nets (LLINs) to decrease their susceptibility to malaria infection. When people perceive that they are at risk of infection, they are likely to

prevent it from happening by adopting prescribed measures. However, when people believe that they are not at risk, the adoption of preventive behaviors remains low (Belcher, 2005). A study conducted in Nigeria to assess risk perceptions associated with malaria infection in pregnancy and IPTp uptake reported that respondents who perceived themselves to be at a high risk of malaria infection during pregnancy were nearly twice as likely to receive IPTp as those reporting low, or lack of risk (Arogundade et al., 2009). Another study reported that older women and women with higher parities were complacent and confident that they were not at risk of malaria infection due to their maternal experience, which in turn, constrained the IPTp uptake (Mufubenga and Kiwuwa, 2004).

Perceived benefits refer to an individual's opinion about the usefulness of a new behavior in decreasing the risk of contracting an infection. People tend to adopt healthier behaviors when they believe that such new behaviors will decrease their chances of developing a disease. Perceived benefits play an important role in the adoption of preventive behaviors, such as consistent use of LLINs, or regular visits to antenatal (ANC) clinics for IPTp. To start ANC visits early enough, a pregnant woman needs to believe that the benefits of such visits outweigh the consequences of non-visitation. A study conducted in Mubende District, Uganda indicated that a good number of participants considered IPTp a useful intervention for malaria prevention during pregnancy (Mufubenga and Kiwuwa, 2004). Another study found that most respondents perceived IPTp to be useful in malaria prevention and recommended that it should go hand in hand with the distribution of ITNs (Mangeni, 2003).

Perceived barriers refer to an individual's evaluation of obstacles to the adoption of new health behaviors. Of all the constructs constituting the HBM, perceived barriers are the most critical determinant of health behavior change (Janz and Becker, 1984). It is no wonder that many empirical investigations on IPTp uptake have concentrated most on the role of perceived barriers. For instance, a study conducted in Kenya found that perceived barriers such as the high risk of miscarriage and skin reaction discouraged the IPTp uptake (Guyatt et al., 2004). Earlier, SP drugs had been associated with effects such as Stevens-Johnson syndrome in people who are allergic to sulfa with possible dramatic and potentially fatal effects (Phillip-Howard et al., 1989, 2003).

Another study concluded that people's perceptions about a drug might significantly determine their acceptance of that drug. In this regard, consumers in some cultural contexts are less likely to comply with a drug that they perceive to be bitter, or a potential risk for issues such as abortion (Ribera et al., 2007). However, such perceptions thrive due to inadequacy of correct information. The situation is worse when health service providers share such sentiments and hence, are unable to provide correct information about the drug (Mubyazi et al., 2005).

In Uganda, a study conducted in Mukono District found that pregnant women believed that SP drugs were very strong and likely to weaken pregnant women, cause miscarriage, or abnormalities; thus, making women to steer clear of antimalarial drugs during pregnancy (Mbonye et al., 2006). Another study, which covered 17 districts in Uganda reported that 30% of the participants strongly believed that fever was an inherent attributed of pregnancy and that some SP drugs were dangerous to the fetus (Mufubenga, 2001). Similarly, a study conducted in Tanzania found that 74% of pregnant women believed that SP drugs taken during pregnancy could be harmful to women and their unborn babies (Mubyazi et al., 2005).

Women are generally reluctant to take medicines during pregnancy unless necessary due of misgivings about potential effects on fetuses. A study conducted in the rural southwest Nigeria found that out of the 209 respondents, about one-third (33%) said they were afraid to take medicines during pregnancy. In this regard, about 44% of those who had used IPTp during the index pregnancy expressed concern about possible adverse effect of SP on their pregnancies (Akinleye et al., 2009).

The quality of services at ANC facilities also emerges as a barrier to the IPTp uptake. For instance, a study conducted in Uganda found that inconsistent supply of clean drinking water and sharing of drinking cups were some of the barriers influencing IPTp uptake (Nankwanga and Gorette, 2008). Notably, some women refused to take SP drugs under the observation of providers due to inadequacy of water cups, which necessitated sharing. Another study conducted in Nigeria noted that not all ANC clients were comfortable sharing cups when taking drugs under the Direct Observation Therapy (DOT), consequently, up to 63% of the pregnant women opted to carry home their tablets. However, about 60% would have liked to take their drugs at the clinic if allowed to bring along their own drinking cups, further suggesting that women were uncomfortable sharing drinking cups (Akinleye et al., 2009).

Under the DOT strategy, it is easier to record and monitor the doses and the timing of doses, which is critical for success of the IPTp intervention. Furthermore, the effectiveness of the DOT strategy necessitates a consistent supply of clean drinking water and adequate provision of drinking cups. Without clean drinking water and cups, providers have no option but to allow women to carry the tablets home, which complicates monitoring and reporting of IPTp coverage (Ashwood-Smith et al., 2001; Mubyazi et al., 2005). In contexts where communities perceive SP drugs to be too strong for pregnant women, the uptake is constrained by the perception that they cannot take a strong drug in an empty stomach. In Uganda, for instance, pregnant women did not take their SP tablets under DOT due to the perception that the drug

was too strong for an empty stomach (Mubyazi et al., 2005). Similarly, a study conducted in Tanzania reported that up to 40% of those receiving SP drugs did not swallow the tablets at the clinic due to hunger and disgust of sharing water cups (Tarimo, 2007).

The attitude adopted by health providers is another form of perceived barriers to the IPTp uptake. In this regard, unfriendly approaches, mishandling, and arrogance towards pregnant women are some of the attitudinal elements discouraging subsequent ANC visits for SP and other services (Hill and Kazembe, 2006). On the same note, some women declined to attend clinic because they perceived Traditional Birth Attendants (TBAs) to be friendlier and more devoted than providers in ANC facilities (Mufubenga, 2001). Other forms of barriers to IPTp uptake include prolonged waiting time and lack of diagnostic facilities (Mboera et al., 2007).

Modifying variables such as gender, age, religion, marital status, parity, gravidity, education level, occupation, income, and knowledge about IPTp also influence health behavior change (Ali, 2002). Within the context of this study, these attributes influence women' perceptions about the seriousness of malaria during pregnancy, susceptibility to malaria infection, benefits of IPTp and barriers to IPTp uptake. Among the modifying variables, women's knowledge about IPTp has attracted most studies. For instance, studies conducted in Tanzania and Uganda, reported significant linkage between women's knowledge of the recommended drugs, dosage, dosage interval and the timing of ANC visits (Mubyazi et al., 2005; Tarimo, 2008). In Uganda, a study found that only 21% of participants had received information about IPTp, of which only 31.5% knew the recommended drugs and only 4.5% knew the recommended dose (Nankwanga and Gorette, 2008).

In Nigeria, a study found that although more than one-half of pregnant women had ever heard about IPTp, only 23·9% of this lot was able to provide a correct definition. About two-thirds of those that had heard of IPTp knew that SP was the recommended drug, while 67% of those who mentioned SP demonstrated knowledge of the correct dosage (Akinleye et al., 2009). In Uganda, a study conducted in 2008 found that the level of knowledge about IPTp was very low, with only 19% of the 240 participants demonstrating a high knowledge about the intervention. Of this lot, up to 82% cited Fansidar® as one of the medicines used for IPTp, while 56% correctly stated the recommended dose of three tablets per visit (Mpungu and Mufubenga, 2008). These studies confirm that knowledge about IPTp remains low among pregnant women in the SSA, a situation that ties to late and inconsistent attendance of ANC facilities (van Eijk et al., 2004; Nganda et al., 2004; Enato et al., 2007).

Cues to action, including events, or people may move an individual to change behavior. Examples include illness of a family member, partner's opinion about antenatal care, peer influence, or health warnings in the media, associated with non-conformity (Ali, 2002). Self-efficacy refers to one's own belief about the ability to do something (Bandura, 1977). If someone believes that a new behavior is useful, but does not think he or she is capable of doing it, chances are high that such new behaviors may not be tried. For instance, if a pregnant woman believes that SP drugs may harm her fetus, then the IPTp uptake as a new behavior for reducing susceptibility to malaria infection may be constrained.

METHODOLOGY

Kenya has four malaria eco-epidemiological zones, namely, the highland epidemic-prone, malaria-endemic, seasonal malaria transmission, and low-risk malaria areas. The highland epidemic-prone zone, covering highlands to the west of the Rift Valley, has a risk class of 5% to less than 20%; the malaria-endemic zone, which covers the Lake Victoria, Western and Coastal regions, has a risk class of 20%, or higher. The seasonal malaria transmission zone, including parts of Rift Valley, Eastern and North Eastern regions, has a risk class of less than 5%, while the low-risk zone, which includes Nairobi and Central regions, has a risk class of less than 0.1% (MPHS et al., 2011).

The study area

Bungoma East District falls within the malaria-endemic zone on the malaria eco-epidemiological map of Kenya. According to the 2009 Population and Housing Census, the District had a population of 257,611 of which 61,827 were women in the reproductive age (KNBS, 2010). The Health Management Information Systems (HMIS) show that between the months of July and December 2010, the District recorded about 704 maternal deaths, of which malaria contributed 41%. Hence, malaria remains the single most important threat to pregnant women and their unborn babies. With an infection risk of 32%, the District reports one of the highest infection rates in Western Province (MPND, 2010). Prior to the study, we accessed consistent malaria epidemiological data for the period of July to December 2010 from five districts located in the malaria-endemic zone. Based on this, the selection of Bungoma East District from the set of five districts was purely random.

Design and target population

We applied the cross-sectional survey design, with both quantitative and qualitative approaches to source, process and analyze the requisite information. The quantitative approach elicited quantifiable and numerical data from pregnant women, which we used to generate

Table 1. Proportionate sample sizes for each health facility.

Strata	Sampled facilities	Registered patients at ANC facility (sN_0)	Stratum sample sizes($n_0 = f{*}sN_0$)	# of visits at the ANC facility (a)	Average monthly visits at the ANC facility (a/12)
Level 4	Webuye District Hospital	643	77	1,611	134
	Bokoli Sub-District Hospital	507	61	1,257	105
Level 3	Webuye Health Centre	575	69	1,442	120
	Milo Health Centre	351	42	878	73
Level 2	Khaoya Dispensary	327	39	813	68
	Mukhe Dispensary	239	29	592	49
	Sinokoo Dispensary	263	32	665	55
	Total	2,905	350	7,258	605

descriptive and inferential results. The qualitative approach targeted health service providers at the clinics. This article presents just a portion of the quantitative results. We have set qualitative results for publication in an upcoming manuscript on provider factors influencing IPTp uptake. The study targeted pregnant women coming to public health facilities, including dispensaries, health centres, as well as sub-district and district hospitals for routine antenatal care (ANC) services. The district statistical fact sheet indicates that about 3,091 pregnant women register at the ANC clinics each year, and making an average of 2.5 ANC visits. We designated this number (3,091) as the population from where we drew the sample.

Sample size determination

With a finite population of 3,091 in mind, we applied Fisher's formula for sample size determination to obtain a sample (n_i).

$$n_i = \left\{ \frac{\delta(1-\delta)}{\left[\left(\frac{\alpha}{z}\right)^2 + \delta(1-\delta)/N_i \right]} \right\} * \mu_i$$

(1)

Where, n_i = effective sample size, N_i = population: 3,091 pregnant women, δ = estimated population variance: 0.5, α = desired precision: 0.05, Z = confidence level: 1.96 for 95% on the normal distribution curve, μ_i = design effect: 1.024. Based on these parameters, the computation yielded an effective sample size of 349.89 ≈ 350 women.

Sampling process

Public health facilities in Bungoma East District fall into three tiers of classification, based on the number of

services offered, including level four, three, and two. Level four facilities included the district and sub-district hospitals; level three facilities were health centres, while level two facilities included dispensaries. We noted that all public health facilities provided IPTp services, irrespective of the tier. Based on this information, we applied a three-stage sampling process to obtain target respondents.

At the first stage, we developed a list of public health facilities, with the assistance of the District Medical Officer of Health (DMOH). The District had 10 public health facilities, including one district hospital, one sub-district hospital, two health centres, and six dispensaries. We stratified the list based on the tiers. In the strata of level four and level three facilities, we applied purposive sampling procedure to select Webuye District Hospital, Bokoli Sub-District Hospital, as well as Webuye and Milo Health Centres. In the stratum of level two facilities, we applied stratified random procedure to select Khaoya, Mukhe and Sinokoo Dispensaries. The stratification criterion ensured proportionate inclusion of rural and urban-based dispensaries. Stratified random sampling procedure ensures a fair representation of elements whose number in the sampling frame is small (Nachmias and Nachmias, 1996).

At the second stage, we applied proportionate sampling procedure to determine proportionate samples for each facility based on the previous workload. In this regard, we collected information from ANC clinic registers about the number of registered clients from July 2010 to June 2011. Table 1 shows the number of patients registered at the ANC clinics in each health facility over the reference period. To determine proportionate samples for each facility, we applied the formula stated below: -

$$n_o = f * sN_o$$

(2)

Where n_o = stratum sample size, f = the sampling fraction

(n_i/N_i) and sN_O = the stratum population. We established the average monthly ANC attendance in each facility. The quotient of the desired sample size (n_i) and the target population (N_i) yielded a sampling fraction (f) of 0.12048. Using the sampling fraction, we computed proportionate samples for each health facility as indicated in Table 1.

At the third stage of the sampling process, we targeted pregnant women visiting ANC clinics. In this regard, we applied systematic random sampling procedure to identify participants. To determine the sampling interval, we sourced information from clinic registers about the number of ANC visits recorded between July 2010 and June 2011 for each facility, as presented in Table 1. Using this information, we computed monthly averages because we scheduled data collection to last for one month. We then computed the quotient of average monthly visits (a/12) and stratum sample sizes (n_O), which gave us an interval of 1.7281 ≈ 2. Based on this, we sampled every second woman exiting ANC facilities. Sampled women were screened and those meeting the inclusion criteria taken through verbal consenting process before interviews.

Inclusion and exclusion criteria

We included pregnant women aged 15 to 49 years, who had gestated for at least six months (24 weeks) and consented to participate in the study voluntarily. WHO recommends that pregnant women should access $IPTp_2$ within the twentieth week of pregnancy. By pegging the inclusion criterion at twenty-fourth week, we provided an allowance for late clinic attendees, who may have not accessed the second dose within the recommended time. However, we excluded women who were on cotrimoxazole prophylaxis and those who had received treatment for malaria during the pregnancy at hand.

Data collection instrument

We applied a standard survey questionnaire to source information through exit interviews with women. Among other information, the questionnaire captured data on socio-demographic and economic attributes, knowledge of IPTp, ANC clinic attendance, health education attendance, IPTp uptake, as well as perceptions about various aspects of the IPTp intervention. We translated the questionnaire into Swahili language to facilitate communication, ease its implementation, and standardize responses. We pre-tested the questionnaire in July 2011 at Khaoya Dispensary using 36 respondents, with each member of the team conducting four interviews. We applied the split-half technique to estimate reliability of the instrument. The process yielded a Cronbach's Alpha value of 0.7448 for part one and 0.7418 for part two, which suggests a satisfactory level of internal consistency

(Berthoud, 2000; Westergaard et al., 1989).

Data collection process

We engaged seven research assistants on merit to support the data collection process. All the assistants were holders of bachelors' degrees in social sciences and had participated in similar research projects before. We trained them for three days to refresh them on the basics of data sourcing skills, approaches, and to understand the questionnaire.

The research assistants were assigned to specific health facilities and were facilitated to visit the facilities on clinic days each week. We coordinated data collection activities, supervised the assistants and controlled data quality.

We collected data in August 2011; although we targeted a sample size of 350, the process yielded a net of 278 (79.4%) successful interviews, which met the quality threshold. We attributed the sample size gap to the systematic sampling procedure, which we adopted as well as high prevalence of malaria, which led to the exclusion of women that had been treated for malaria during the pregnancy at hand. Besides, we excluded from the analysis nine questionnaires, which were either incomplete or contained inconsistent information.

Data processing and analysis

Data processing involved coding open-ended and multiple responses, digitalization and cleaning for misplaced codes. For some variables, we transformed the scale of measurement to suit the chosen analysis techniques.

Quantitative analysis techniques included cross-tabulations with Chi Square statistic and independent samples t-test for interval-scaled variables. We further applied binary logistic regression to determine the odds of women receiving $IPTp_2$ based on their perceptions. Binary logistic regression predicts the proportion of variance in a dichotomous variable from a set of independent variables (Wuensch, 2006). The predicted variable takes the value 1 with a probability of success θ, or the value 0 with a probability of failure 1-θ. The dependent variable in this study was the $IPTp_2$ uptake, with only two possible values – less than $IPTp_2$, or $IPTp_2+$. The model takes the form:

$$Logit[\theta(Y)] = log\left[\frac{\theta(Y)}{1-\theta(Y)}\right] = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots + \beta_i X_i + \varepsilon_i \qquad (3)$$

Where Y = dependent variable ($IPTp_2$ uptake); θ(Y) = the probability that a pregnant woman had received the $IPTp_2+$; 1- θ(Y) = the probability that a pregnant woman had received less than $IPTp_2$; α = the constant term of the equation; $\beta_1, \beta_2\ldots\beta_i$ = partial regression co-efficients

associated with independent variables; X_1, X_2...X_i = independent variables and ε = the error term. The logistic regression generated beta co-efficients (β), odds ratios [Exp (β)] and -2 Log Likelihood statistics, Hosmer-Lemeshow test of goodness-of-fit and Nagelkerke's R^2. Detailed description of the design and approaches that we used in this study are available in following publications (Nachmias and Nachmias, 1996; Wuensch, 2006; Bryman and Cramer, 1997; Rindfleisch et al., 2008).

Ethical considerations

The Institutional Research and Ethics Committee (IREC) of Moi Teaching and Referral Hospital and the School of Medicine, Moi University approved the study in July 2011. The formal approval number is IREC 000667. Other institutions that also approved the study included the Ministry of Education, Science and Technology and the Ministry of Health. We observed three universal ethical principles, including respect for participants, beneficence, and justice. All participants were consented by fully explaining purpose of the study, potential benefits, and the fact that their participation was voluntary. We also informed participants about their right to withdraw consent at any time during the process without a penalty. Since, the survey had no clinical components; the risks involved were minimal.

Furthermore, we kept the information sourced confidential and ensured the confidentiality of interviews, at least audibly. We avoided information on personal identifiers, assured participants that we would use the information for research purposes only, with access limited to the investigators only. We assured participants that we would share the report with the Government, Moi University, Moi Teaching, and Referral Hospital and other stakeholders to support decisions aimed at making the IPTp intervention more responsive and sensitive to perceptions held by pregnant women. In this regard, we adhered to the provisions of 45 Code of Federal Regulations (CFR) 46·101 (b) (2). Lastly, we accorded equal opportunity to participants who consented to participate in the study.

RESULTS

We requested participants to state if they had received SP tablets from ANC clinics to prevent malaria infection and the number of times they had received such tablets. Out of 278 participants, 157 (56·5%) had accessed two, or more doses (IPTp$_2$+), while 121 (43·5%) had received less than two doses (<IPTp$_2$). In the following sub-sections, we explore the relationship between IPTp$_2$+ uptake and participants' background profile as well as perceptions.

Background profile of participants

The onset of ANC visits is a key factor in the IPTp$_2$+ uptake, as suggested by previous studies (van Eijk et al., 2004; Olliaro et al., 2008). In this study, the results indicated that 127 (45.7%) participants started ANC visits within the fourth month of pregnancy, 65 (23.4%) started within the fifth month, while 48 (17.3%) indicated the third month. Overall, 209 (75.2%) participants started ANC visits within the second trimester, while 5 (1.8%) initiated attendance in the third trimester. On average, participants who had received IPTp$_2$+ started ANC visits at 3.79 months (SD = 0.877; SE about the mean = 0.093), while those who had accessed <IPTp$_2$ initiated clinic attendance a little later at 4.55 months (SD = 1.024; SE about the mean = 0.070).

Using the independent samples t-test, the analysis obtained a computed t statistic of 6.689, with 276° of freedom and a ρ-value of <0.01, which was significant at 0.01 error margin (95% CI = 0.539-0.989). This result confirms that participants who had received IPTp$_2$+ started their ANC visits significantly earlier than those who had received less than IPTp$_2$, further suggesting up to 99% chance that the two groups were significantly different in terms of the onset of ANC visits.

The participants were aged between 16 and 44 years, with 21 (7.6%) falling into the below 20 years category, 170 (62.2%) in the 20 to 29 years bracket, while 87 (31.2%) were aged 30 years, or more. The cross-tabulation analysis between background attributes and the IPTp$_2$ uptake yielded Chi Square (χ^2) statistic presented in Table 2. From the table it is notable that participants' age obtained a computed χ^2 value of 3.383, with 5° of freedom and a ρ-value of 0.641, suggesting lack of significant association between the IPTp$_2$ uptake and participants' age.

The participants included 104 (37.4%) Catholic faithful, 161 (57.9%) Protestants and 3 (1.1%) Muslims, while 10 (3.6%) expressed their affiliation to smaller religious groups. The results in Table 2 further suggest lack of a significant association between the IPTp$_2$ uptake and religious affiliation. Regarding marital status, up to 203 (73.0%) participants were in marital unions, 61 (21.9%) were single, while 10 (3.6%) were separated. The analysis obtained a computed χ^2 value of 17.267, with 4° of freedom and a ρ-value of 0·002, suggesting up to 99% chance that the IPTp$_2$ uptake significantly associated with marital status.

Furthermore, 142 (51.1%) participants reported having 1 to 2 children, 70 (25.2%) stated 3 to 4 children, 32 (11.5%) had no children, while 34 (12.3%) reported five, or more children. The summary of χ^2 tests in Table 2 suggests up to 99% chance that the IPTp$_2$ uptake significantly related to women's parity status. In addition, 136 (48.9%) participants had attained secondary education, 106 (38.1%) indicated primary education, 30 (10.8%) reported college education, while 2 (0.7%) were

Table 2. Participants' background attributes and the IPTp2 uptake.

Background attributes		Summary of Chi square tests		
		Computed χ^2	df	ρ-value
AGE	Age	3.383	5	0.641
RELIG	Religion	4.980	3	0.173
MSTAT	Marital status	17.267	4	0.002***
PARITY	Parity	28.441	4	<0.01***
EDULEV	Education level	13.375	4	0.010**
OCCUP	Occupation	39.021	5	<0.01***
MINCOM	Average monthly income	10.597	4	0.031**
MHINFO	Main source of health information	5.412	6	0.057*
SPARTN	Support from partner	6.671	1	0.010**

*, **, *** Represents significance at ρ=0.1, ρ=0.05 and ρ<0.01 error margins, respectively.

Table 3. Relationship between respondents' perceptions and the IPTp uptake.

Respondents' perceptions		Summary of Chi square tests		
		Computed χ^2	df	ρ-value
PSERIO	Perceived seriousness of malaria in pregnancy	4.251	2	0.119
PSUSCE	Perceived susceptibility to malaria	6.589	2	0.037**
PBENEF	Perceived benefits of SP drugs	6.647	2	0.036**
PBARR	Perceived barriers to the IPTp uptake			
SAFESP	Safety of SP drugs	15.915	2	0.002***
DTAKEN	Duration taken at the clinic before receiving services	7.468	2	0.024**
HWATT	Health workers' attitude	16.534	2	<0.01***
LEASE	Ease of language used during health education sessions	82.513	2	<0.01***
CHEDU	Consistency of health education sessions	17.129	1	<0.01***
THEDU	The timing of health education sessions	10.173	1	0.023**
DANCF	Distance to the ANC facility	37.066	2	<0.01***

*, **, *** Represents significance at ρ=0.1, ρ=0.05 and ρ<0.01 error margins, respectively.

university graduates. Those with no formal education were 4 (1.4%). Based on this, the results in Table 2 suggest up to 95% chance that the IPTp2 uptake significantly associated with women's educational attainment.

Most participants, 132 (47.5%) earned a living through farming, 72 (25.9%) were engaged in informal business, while 37 (13·3%) were running formal business ventures. Those in formal employment were 19 (6.8%), casual laborers were 7 (2·5%), while the rest, 11 (4.0%) stated their occupation as housewives. The analysis obtained a computed χ^2 value of 39.021, with 5° of freedom and a ρ-value of <0.01, again suggesting the presence of a significant relationship between the IPTp2 uptake and women's occupation. More still, 148 (53·3%) participants were earning less than US$ 118, those in the middle-income bracket of US$ 117.64 to 235.28 were 94 (33.8%) respondents, while top earners at US$ 235.29, or higher were 2 (9.0%). The results in Table 2 suggest up to 95% chance that the IPTp2 uptake significantly associated with women's average incomes.

Women's perceptions and the IPTp uptake

We considered four broad categories of perceptions, based on the original constructs of the Health Belief Model, including perceived seriousness of malaria in pregnancy, perceived susceptibility to malaria, perceived benefits/usefulness of SP drugs as well as perceived barriers to the IPTp2 uptake.

Perceived seriousness of malaria in pregnancy

The results showed that 79 (50·3%) participants who had received IPTp2+ and 75 (62·0%) who had accessed <IPTp2 perceived that malaria occurring during pregnancy was a 'very serious' health issue. However, 16 (10·2%) participants who reported IPTp2+ and 12 (9·9%) who had received <IPTp2 felt that malaria occurring during pregnancy was 'not a serious' issue. The results in Table 3 suggest lack of significant association between the IPTp2 uptake and perceived seriousness of malaria

infection during pregnancy. Hence, women's perceptions about the seriousness of malaria infection during pregnancy were near homogeneity between members of the two groups.

Perceived susceptibility to malaria

The analysis indicated that 105 (66.9%) participants who reported $IPTp_2+$ and 67 (55.4%) who had accessed $<IPTp_2$ believed that they were 'very susceptible' to malaria infection, given their condition. However, 4 (2.5%) participants who had obtained $IPTp_2+$ compared to 10 (8.3%) who had received $<IPTp_2$ thought that they were 'not susceptible' to malaria infection. The results in Table 3 suggest up to 95% chance that the $IPTp_2$ uptake significantly associated with women's perceptions about their susceptibility to malaria infection. Women's perceptions about their susceptibility significantly associated with age, education level, parity status, and attendance of health education sessions at ANC clinics.

Perceived usefulness of SP drugs in malaria prevention

The results indicated that 104 (66.2%) participants who stated $IPTp_2+$ and 62 (51.2%) who had accessed $<IPTp_2$ perceived that SP drugs were 'very useful' in the prevention of malaria during pregnancy. Contrastingly, 8 (28.7%) participants who had received $IPTp_2+$ compared to 11 (9.1%) who reported $<IPTp_2$ felt that SP drugs were 'not useful'. The result in Table 3 suggest up to 95% chance than the $IPTp_2$ uptake significantly associated with women's perceptions about the usefulness of SP drugs in the prevention of malaria infection during pregnancy. Again, women's perception about the usefulness of SP drugs varied across age groups, education level, parity, and attendance of health education sessions.

Perceived barriers to the IPTp uptake

Perceptions about the safety of SP drugs: The results showed that 97 (61.8%) participants who reported $IPTp_2+$ compared to 60 (49.6%) who had accessed $<IPTp_2$ believed that SP drugs were 'very safe', while 9 (5.7%) participants who had obtained $IPTp_2+$ and 15 (12.4%) who had received $<IPTp_2$ perceived that SP drugs were 'not safe' for pregnant women. Based on this, the results in Table 3 suggest up to 99% chance that the $IPTp_2$ uptake significantly associated with perceptions about the safety of SP drugs. This shows that women's perceptions about the safety of SP drugs were likely to influence the $IPTp_2$ uptake. Besides, perceptions about the safety of SP drugs significantly varied across the age groups,

education level, parity, access to partner's support, income level, and attendance of health education sessions.

We further requested those who felt that SP tablets were not safe to indicate the most important fear about the drugs. In this regard, 38 (31.4%) participants associated SP drugs with dizziness, 26 (21.5%) cited the risk of miscarriage, 25 (20.7%) linked the drugs to general weakness of the body, while 10 (8.3%) alluded to the risk of deformities. Other fears associated with SP drugs included skin rashes, 8 (6.6%), risk of death, 8 (6.6%) and 6 (5.0%) failed to identify any specific fear.

Perceptions about duration taken at ANC clinics before receiving services: The duration taken in a health facility before receiving services is a factor that can encourage, or discourage subsequent visits. The results indicated that 31 (19.7%) participants who reported $IPTp_2+$ compared to 35 (28.9%) who had received $<IPTp_2$ hinted that the duration that they usually took at clinics before being served was 'too long'. Contrastingly, up to 19 (12.1%) participants who had accessed $IPTp_2+$ and 5 (4.1%) who indicated $<IPTp_2$ described the duration taken at the facilities as 'short'. Based on this, the results in Table 3 suggest up to 95% chance that the $IPTp_2$ uptake significantly related with women's perceptions about the duration of waiting at ANC clinics before receiving services.

Perceptions about the attitude of health workers: We requested participants to describe the attitude of most health workers at ANC clinics, whether they were friendly, or unfriendly. The results showed that 73 (46.5%) participants who reported $IPTp_2+$ compared to 28 (23.1%) who had received $<IPTp_2$ perceived that most health workers at the facilities were 'very friendly'; however, up to 14 (8.9%) participants who stated $IPTp_2+$ and 19 (15.7%) who indicated $<IPTp_2$ said that most providers were 'unfriendly'. The results in Table 3 suggest up to 99% chance that the $IPTp_2$ uptake and women's perception about health workers' attitude were significantly associated.

Perceptions about the ease of language used during health education: Out of 278 participants, 205 (73.7%) had attended health education sessions at ANC facilities during the pregnancy at hand. Of this lot, 98 (62.4%) had received $IPTp_2+$, while 107 (88.4%) reported $<IPTp_2$. We requested those who had attended health education sessions to indicate their perceptions about the ease of language used during such sessions. The results showed that 70 (71.4%) participants who reported $IPTp_2+$ and 12 (11.2%) who had received $<IPTp_2$ perceived that the language used was 'very easy' to understand. Contrastingly, 6 (6.1%) participants who had accessed $IPTp_2+$ compared to 48 (44.9%) participants reporting $<IPTp_2$ felt that the language used was 'difficult' to

understand. Based on this, the results in Table 3 suggest up to 99% chance that the IPTp$_2$ uptake significantly associated with women's perceptions about the ease of language used during health education sessions.

Perceptions about the consistency of health education sessions: The results show that 48 (49·0%) participants who had received IPTp$_2$+ and 22 (20·6%) who reported <IPTp$_2$ believed that health education sessions were 'consistent', while 50 (51·0%) participants who indicated IPTp$_2$+ compared to 85 (79·4%) who had accessed <IPTp2 felt that the sessions were 'inconsistent'. Overall, about 66% of the participants perceived that health education sessions were inconsistent, which is likely to constrain women's motivation to attend ANC clinics and subsequently, the uptake of IPTp$_2$. In Table 3, the results suggest up to 99% chance that the IPTp$_2$ uptake significantly associated with women's perceptions about the consistency of health education sessions.

Perceptions about the timing of health education sessions: The timing of health education sessions may be a critical barrier to the accessibility of knowledge about the prevention of malaria during pregnancy, which in turn, may influence the IPTp$_2$ uptake. In this regard, 34 (34.7%) participants who had accessed IPTp$_2$+ compared to 21 (19·6%) who had received <IPTp$_2$ felt that the timing was 'convenient'; while 64 (65.3%) participants who reported IPTp$_2$+ and 86 (80·4%) who reported <IPTp$_2$ hinted that the timing of health education sessions was 'inconvenient'. In Table 3, the summary of Chi Square tests suggests up to 95% chance that the IPTp$_2$ uptake and women's perceptions regarding the timing of health education sessions were significantly associated. Hence, perception about the timing of health education sessions was one of the factors likely to influence the IPTp$_2$ uptake.

We further requested those saying that the timing of health education sessions was 'inconvenient' to suggest the most appropriate timing. The results showed that 10 am to 12 pm was the most favourable time for health education, as noted by more than 80% of the women. Participants opined that early hours (before 10 am) were 'inconvenient' because it clashed with essential domestic chores, including assisting young children to go school, house cleaning, setting food for family members, collecting firewood, fetching water, as well as feeding the livestock, among other chores.

Perceptions about distance to the health facility: We further requested participants to indicate perceptions about the distance travelled from their residences to ANC facilities based on the duration taken while walking. The results indicated that 48 (30.6%) participants who had accessed IPTp$_2$+ and 9 (7.4%) who had received <IPTp$_2$ described the distance as 'short'. Contrastingly, 25

(15.9%) participants who reported IPTp$_2$+ compared to 53 (43.8%) who had accessed <IPTp$_2$ hinted that the distance travelled was 'too far'. This suggests up to 99% chance that the IPTp$_2$ uptake significantly associated with women's perceptions about the distance travelled on foot to health facilities.

Influence of women's perceptions on the IPTp$_2$ uptake

Bivariate results in the preceding sub-sections indicated that the IPTp$_2$ uptake significantly associated with women's background attributes, including marital status, parity, education level, occupation, income level and access to partner's support. Bivariate analysis also revealed significant relationships between the IPTp$_2$ uptake and the independent variables (IVs), including perceived susceptibility to malaria infection, perceived benefits of SP drugs and perceived barriers to IPTp2 uptake. Perceived barriers included variables such as safety of SP drugs; duration taken at clinics before receiving services and the ease of language used during health education sessions, among other IVs.

To determine the effect of each variable on the IPTp$_2$ uptake, we applied binary logistic regression, incorporating IVs and background variables, using the 'stepwise likelihood ratio' method. The analysis generated two models; with the first block, containing independent variables only and the second block adjusted to incorporate the effect of women's background profile attributes. In this paper, we have summarized the discussion to focus on key results in the adjusted model only. Table 4 provides summary of variables in the adjusted equation, showing partial regression co-efficients (β), Standard Error (SE), the Wald statistic, degrees of freedom (df), ρ-values, odds ratios [Exp(β)] and Confidence Intervals (CI) associated with the odds ratios, at 95%.

Collinearity diagnostics

We tested the interrelationship between independent variables and background factors for collinearity indicators.

Using the default outlier value of 2.0, we examined the Standard Error (SE) associated with regression coefficients (β). In this regard, standard errors larger than 2.0 indicated the existence of multicollinearity effects. We noted that the inclusion of marital status (MSTAT) and parity (PARITY) inflated the standard errors, with parity status having a stronger effect. Based on this, we excluded parity status from the analysis. We noted the same challenge with average income (MINCOM) and occupation (OCCUP), leading to exclusion of the latter from the analysis.

Table 4. Summary results of the logistic regression model.

Covariates	β	S.E.	Wald	df	ρ-value	Exp(β)	95% C.I. for EXP(β) Lower	Upper
PSUSCE			12.716	2	0.037**			
Very susceptible	0.813	0.239	11.571	1	0.047**	2.255	1.411	3.602
Susceptible	0.453	0.194	5.452	1	0.292	1.573	1.075	2.301
Not susceptible (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PBENEF			16.008	2	0.036**			
Very useful	0.552	0.139	15.771	1	0.013**	1.737	1.323	2.281
Useful	0.127	0.074	2.945	1	0.324	1.135	0.982	1.313
Not useful (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SAFESP			33.144	2	0.002***			
Very safe	3.235	0.563	33.017	1	<0.01***	25.406	21.542	29.401
Safe	1.552	0.424	13.398	1	0.024**	4.721	2.056	10.838
Not Safe (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DTAKEN			16.250	2	0.024**			
Short	1.004	0.261	14.797	1	0.011**	2.729	1.636	4.552
Moderate	0.847	0.320	7.006	1	0.407	2.333	1.246	4.368
Too long (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
HWATT			18.297	2	0.001***			
Very friendly	1.472	0.348	17.892	1	0.001***	4.358	2.203	8.620
Friendly	0.218	0.086	6.426	1	0.112	1.244	1.051	1.472
Not friendly (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
LEASE			14.902	2	<0.01***			
Very easy	2.299	0.601	14.633	1	<0.01***	9.964	6.409	11.027
Easy	0.713	0.198	12.967	1	0.002***	2.040	1.384	3.007
Not easy (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CHEDU			25.341	1	<0.01***			
Consistent	1.359	0.276	24.245	1	0.003***	3.892	2.266	6.686
Inconsistent (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
THEDU			23.773	1	<0.01***			
Convenient	2.279	0.490	21.632	1	0.001***	9.767	7.526	12.745
Inconvenient (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MSTAT			24.066	4	0.002***			
Single	1.952	0.402	23.578	1	<0.01***	7.043	3.203	15.486
Married	1.636	0.421	15.101	1	0.033**	5.135	2.250	11.718
Separated	-0.251	0.155	2.622	1	0.212	0.778	0.574	1.054
Divorced	-0.543	0.450	1.456	1	0.399	0.581	0.241	1.404
Widowed (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
EDULEV			15.944	4	0.010**			
University	1.283	0.327	15.394	1	0.025**	3.607	1.900	6.848
College	1.078	0.297	13.174	1	0.032**	2.939	1.642	5.260
Secondary	0.168	0.112	2.250	1	0.172	1.183	0.950	1.473
Primary	-0.399	1.381	0.083	1	0.144	0.671	0.045	1.052
None (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MINCOM			17.823	4	0.031**			
KES 20,000+	1.187	0.289	16.870	1	0.018**	3.277	1.860	5.774
KES 15,000-19,999	1.177	0.296	15.811	1	0.024**	3.245	1.816	5.796
KES 10,000-14,999	1.048	0.759	1.907	1	0.284	2.852	1.022	4.064
KES 5,000-9,999	0.406	1.305	0.097	1	0.756	1.501	0.352	2.602
<KES 5,000 (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SPARTN			16.581	1	0.010**			
Supported	0.880	0.229	14.767	1	0.022**	2.411	1.539	3.777
Not supported (RC)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Constant	7.162	1.049	46.614	1	<0.01***	1289.5		

RC= Reference category; *, **, *** show significance at ρ=0.1, ρ=0.05 and ρ<0.01, error margins, respectively.

Odds ratios

The results summarized in Table 4 suggest that participants perceiving that they were 'very susceptible' had 2.3 times the odds of taking IPTp$_2$+ as those feeling that they were 'not susceptible' (β = 0.813, SE = 0.239, 95% 95% CI = 1.41-3.60). Besides, women believing that they were 'susceptible' to malaria infection had 1.8 times the odds of taking IPTp$_2$+ as those indicating that they 'not susceptible' (β = 0.453, SE = 0.194, 95% CI = 1.08-2.30). The results in Table 4 further show that women perceiving that SP tablets were 'very useful' to them in terms of malaria prevention had 1.7 times the odds of taking IPTp$_2$+ as those believing that SP tablets were 'not useful' (β = 0.552, SE = 0.139, 95% CI = 1.32-2.28).

Besides, women indicating that SP drugs were 'useful' had about 1·1 times the odds of taking IPTp$_2$+ as those saying that SP tablets were 'not useful' (β = 0.127, SE = 0.074, 95% CI = 0.98-1.31). The results suggest that the stronger the perception about the benefits of SP tablets the higher the odds of women taking IPTp$_2$+. The analysis found that women perceiving that SP tablets were 'very safe' for use during pregnancy had about 25.4 times the odds of taking IPTp$_2$+ as those believing that SP tablets were 'not safe' (β = 3.235, SE = 0.63, 95% CI = 21.54–29.40). In addition, those indicating that SP tablets were 'safe' had about 4.7 times the odds of taking IPTp$_2$+ as those opining that the drugs were 'not safe' (β = 1.552, SE = 0.424, 95% CI = 2.06–10.84). Again, the stronger perception about the safety of SP tablets the better the odds of uptake by women.

The results show that women perceiving the duration taken at the clinics before receiving services to be 'short' were about 2.7 times as likely to take IPTp$_2$+ as those saying that the duration was 'too long' (β = 1.004, SE = 0.261, 95% CI = 1.64-4.55). In addition, women indicating that the duration was 'moderate' had about 2·3 times the odds of taking IPTp$_2$+ as those describing the duration of waiting as 'too long' (β = 0.847, SE = 0.320, 95% CI = 1.25-4.34). The results suggest that the shorter the perceived duration of waiting at the clinics the higher the likelihood of women visiting the clinics for IPTp$_2$+. Furthermore, the women perceiving that most health workers at the clinics were 'very friendly' had about 4·4 times the odds of taking IPTp$_2$+ as those indicating that health workers were 'not friendly' (β = 1.472, SE = 0.348, 95% CI = 2.20-8.62). Women indicating that most health workers were 'friendly' were about 1.2 times as likely to take IPTp$_2$+ as those perceiving that health workers were 'unfriendly' (β = 0.218, SE = 0.086, 95% CI = 1.05-1.47). The more positive the perception about health workers' attitude, the higher the likelihood of women visiting health facilities for IPTp$_2$+.

The analysis indicated that women perceiving that the language used during health education sessions was 'very easy' to understand had about 10 times the odds of taking IPTp$_2$+ as those indicating that the language was 'not easy' to understand (β = 2.299, SE = 0.601, 95% CI = 6.41–11.03). Those hinting that the language used was 'easy' were about 2 times as likely to take IPTp$_2$+ as those indicating that the language used was 'not easy' (β = 0.713, SE = 0.198, 95% CI = 1.38–3.01). The results suggest that the easier the language used during health education sessions the higher the odds of women taking IPTp$_2$+.

Table 4 further shows that the women perceiving that health education sessions were 'consistent' had about 3·9 times the odds of taking IPTp$_2$+ as those hinting that the sessions were 'inconsistent' (β = 1.359, SE = 0.276, 95% CI = 2.27-6.69). The results suggest the more affirmative the perception about the consistency of health education sessions the higher the likelihood of women taking IPTp$_2$+. More still, those indicating that the timing of health education sessions was 'convenient' were about 9.8 times as likely to take IPTp$_2$+ as those feeling that the timing was 'inconvenient' (β = 2.279, SE = 0.490, 95% CI = 7.53-12.75). Hence, the more affirmative the perception about the timing of health education sessions the better the odds of IPTp$_2$+ uptake. As for women's background profile, we highlight results associated with education level, average income and access to partner's support. In this regard, the results indicate that women having university education had about 3.6 times the odds of taking IPTp$_2$+ as those lacking formal education (β = 1.283, SE = 0.327, 95% CI = 1.90-6.85). Those having college education were about 2.9 times as likely to take IPTp$_2$+ as those reporting lack of formal education (β = 1.078, SE = 0.297, 95% CI = 1.64-5.26). The results suggest that the odds of IPTp$_2$+ uptake increases with the unit increase in education level.

Regarding average income, the results in Table 4 indicate that women in the top income group of US$ 235.29+ had about 3.3 times the odds of taking IPTp$_2$+ as those earning less than US$ 58.82 (β = 1.187, SE = 0.289, 95% CI = 1.86–5.77). Besides, women earning between US$ 176.47 and 235.28 were about 3.2 times as likely to take IPTp$_2$+ as those in the bottom income bracket (β = 1.177, SE = 0.296, 95% CI =1.82–5.80). The results indicate that the odds of IPTp$_2$+ uptake increases with the unit increment in average income. Furthermore, women receiving support from their partners towards ANC visits had about 2.4 times the odds of taking IPTp$_2$+ as those who never accessed such support (β = 0.880, SE = 0.229, 95% CI = 1.54–3.78). Hence, partner's support added value by increasing the odds of IPTp$_2$+ uptake.

The model's goodness-of-fit

We tested the goodness of this model using Nagelkerke's R^2 and Hosmer-Lemeshow (H-L) goodness-of-fit statistic. In this regard, the analysis obtained a Nagelkerke's R^2 of 0.677, implying that the model predicted up to 67.7% of

variance in IPTp$_2$ uptake; and suggesting a strong relationship between women's perceptions and IPTp$_2$ uptake. The H-L goodness-of-fit statistic shows that a logistic regression model is well fitting the observed data at an acceptable level when the resultant ρ-value is greater than 0.05, further indicating that the model prediction does not significantly differ from the observed frequencies. In this study, the H-L Table obtained a χ^2 value of 1.360, with 8° of freedom and a p-value of 0.113, which is not significant at 0.05-error margin. This result confirms that our model was a good fit. In addition, omnibus tests of model co-efficients obtained a computed χ^2 value of 71.531, with 33° of freedom and a p-value of <0·01 which was significant at 0.01 error margin, confirming up to 99% chance that the model-fit was statistically significant.

Conclusions

The purpose of this study was to document information on women's perceptions influencing the IPTp$_2$ uptake, with a view to justifying the need for appropriate interventions that would improve the uptake in malaria endemic zones towards the realization of the Roll Back Malaria targets. There is no doubt that the success of IPTp projects at the facility level will feed into and contribute to the excellence of national programs, by reducing maternal, fetal and infant mortality arising from malaria infection.

Women's perceptions about their susceptibility to malaria infection, the usefulness of SP tablets and the safety of SP tablets emerged as key factors influencing IPTp$_2$ uptake in Bungoma East District. In this regard, women believing that they were 'very susceptible' to malaria had about 2.3 times the odds of taking IPTp$_2$+ as those feeling that they were 'not susceptible'; while women perceiving that SP tablets were 'very useful' to them in terms of malaria prevention had 1.7 times the odds of taking IPTp$_2$+ as those believing that SP tablets were 'not useful'. In view of this, continuous sensitization of pregnant women through a multi-media approach is a critical intervention in which the government and development partners should invest to improve knowledge about malaria in pregnancy, influence perceptions about personal susceptibility and the usefulness of SP tablets, as well as dispel misconceptions associated with the safety of SP tablets. Furthermore, the Government should improve the programming and content of health education, while minding the needs and circumstances of pregnant women from various cultural contexts. Sensitization should also target the public to re-orient perceptions and dispel misconceptions associated with SP tablets.

The duration of taken in health facilities before receiving services is an element of quality of care that also influences the uptake of IPTp services. In Bungoma

East District, women perceiving the duration taken at the clinics before receiving services to be 'short' were about 2.7 times as likely to take IPTp$_2$+ as those saying that the duration was 'too long'. This factor connects to a number of human resource issues, including understaffing, inadequate remuneration, poor work environment, ineffective supervisory system, and lack of appropriate motivation programs. Of all resources in an institution, human resource is the most critical, because it plans and manages the utilization of other resources to achieve institutional goals. Consequently, the Government should recruit and deploy more health workers to improve staffing level and staff motivation for quicker and better services to pregnant women. Improving staffing and staff welfare as well as supervisory systems are likely to improve the IPTp$_2$ uptake.

The attitude of health workers towards patients is also an element of quality of care. In the study area, women perceiving that most health workers at the clinics were 'very friendly' had about 4.4 times the odds of taking IPTp$_2$+ as those indicating that health workers were 'not friendly'. Negative attitudes arise from the human resource issues highlighted in the preceding paragraph, as well as lack of training in the practice of customer care. Many studies have recommended the need for staff training and retraining in customer care practices to improve attitudes. However, inadequate budgetary allocation to the health sector constrains implementation. Although training health workers in public health facilities may be a costly undertaking, bearing in mind other recurrent costs, the Government should consider establishing partnership initiatives with the private sector and development partners to training health workers in appropriate skills and improve the quality of care.

Health information is important in shaping knowledge, perceptions, and attitudes to facilitate behavior change. An informative and entertaining health education program at ANC facilities is crucial for encouraging pregnant women to attend ANC clinics for services. However, the quality of health education in terms of the ease of language use, consistency, and timing are key elements that can either encourage, or discourage ANC visits and ultimately IPTp$_2$+ uptake. In Bungoma East District, women perceiving that the language used during health education sessions was 'very easy' to understand had about 10 times the odds of taking IPTp$_2$+ as those holding contrary perceptions. Women perceiving that health education sessions were 'consistent' had about 3.9 times the odds of taking IPTp$_2$+ as those hinting that the sessions were 'inconsistent'. More still, those indicating that the timing of health education sessions was 'convenient' were about 9.8 times as likely to take IPTp$_2$+ as those feeling that the timing was 'inconvenient'. Improving the quality of health education in terms of content with non-technical language, adequate staffing for consistency and better programming to match the most preferred timing are key

measures that should improve IPTp$_2$+ uptake. Reaching out to development agencies for partnership arrangements is an option that the Government should consider to access supplementary resources to support health education at ANC facilities.

Partners have an important role to play in the realization of IPTp program targets. Their involvement is not only socially logical, but also and more importantly, a matter of women's rights. In Bungoma East District, women receiving support from their partners towards ANC visits had about 2.4 times the odds of taking IPTp$_2$+ as those who never accessed such support. However, in most patriarchal communities, matters related to pregnancy forms part of women's responsibility, alongside childcare and domestic chores. Too many roles during pregnancy may compromise the time and resources that would be enable women to access ANC services in time for IPTp services. Thus, men have an immense responsibility to support women to facilitate early and consistent attendance of ANC clinics. The success of the IPTp program depends on the extent to which men are involved and targeted with information for better knowledge, understanding, and attitude change. Thus, the Government and development partners should consider the sensitization of men through the mass media, work place paternal programs, and peer education.

Among participants' personal attributes, education and income level emerged as the most critical for programmatic interventions. In the study area, women having university education had about 3.6 times the odds of taking IPTp$_2$+ as those lacking formal education, while women in the top income group of US$ 235.29+ had about 3.2 times the odds of taking IPTp$_2$+ as those earning less than US$ 58.82. Generally, the odds of IPTp$_2$+ uptake increases with the unit increase in education level and average income. In view of these results, supporting women to initiate income-generating activities and keeping the girl child longer in school are key interventions that should go a long way in improving IPTp$_2$+ uptake in Bungoma East District. Already the Government has initiated Women's Enterprise Development Fund and the free basic education to enhance access, issues of funding inadequacy and inconsistency, as well as institutional capacity, ethnicity, financial misappropriation and access to basic needs for the girl child remain key challenges. Detaching these initiatives from political influence, strengthening responsible institutions through legislation and involving partners are key options that the Government should consider to empower women, improve girl-child education, and improve the IPTp$_2$ uptake in Kenya.

Competing interests

The findings of this study supported ACN to earn a Master of Public Health Degree from Moi University in 2012. AMK and JBB were appointed and paid by Moi University to supervise and guide the study. AMK, JBB and ACN agreed to involve TO for technical support in data processing, quality control, interpretation and analysis. ACN facilitated TO's operations during data processing, analysis, and development of this article.

LIMITATIONS OF THE STUDY

The sample size that we used in this study was about one-tenth of the target population. However, the maximum likelihood estimation (MLE) method used in logistic regression relies on large-sample asymptotic normality, implying that the reliability of estimates decline when cases for each observed independent variable reduce significantly. We coped with this limitation by excluding some background profile variables from the analysis and merging some variable categories. However, future studies should expand the scope of variables and sample size to generate better regression models of perceptions influencing the IPTp$_2$ uptake.

ACKNOWLEDGEMENTS

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