



Factors influencing insecticide treated net utilization among women in Uganda

*¹Douglas Andabati Candia, ²Peter Jegrace Jehopio

¹ Assistant Lecturer, Department of Planning and Applied Statistics, Makerere University, Kampala, Uganda

² Lecturer, Department of Planning and Applied Statistics, Makerere University, Kampala, Uganda

Abstract

The study aimed at identifying factors influencing insecticide treated net utilization among women in Uganda. Assessment was done using a multinomial logistic regression model and secondary data from the Uganda Malaria Indicator Survey consisting of women age 15-49 selected from 5,802 households selected countrywide.

The significant determinants of ITN utilization were age of the respondent, region where the respondent resided, ownership of a radio, presence of a child under five in the household and the sex of the household head. ITN utilization generally increased with; increase in age, residing in regions other than the Central region, ownership of a radio, having a child under five in the household and belonging to a male headed household.

Keywords: ITN, utilization, women, Uganda

1. Introduction

Malaria is considered to be one of the main global health problems accounting for approximately 438,000 deaths in 2015 [24, 18]. Uganda, ranked third in the total number of malaria cases in sub-Saharan Africa, experiences weather conditions that often allow transmission to occur all year round with only a few areas that experience low or unstable transmission [21]. Malaria is the leading cause of morbidity in Uganda with 90–95 % of the population at risk [18]. Hospital records suggest that malaria is responsible for 30 to 50 percent of outpatient visits, 15 to 20 percent of admissions, and 9 to 14 percent of inpatient deaths [16].

Malaria transmission has a stable, perennial transmission pattern in 90 to 95 percent of the country with the rest of the country, particularly in the highlands, there being areas of low and areas of unstable transmission, with a potential for epidemics [21]. Areas of unstable transmission (very low or no malaria) include the southwest area of the country, Mt. Rwenzori in the west, Mt. Elgon in the east, and other areas with altitudes above 1,800 meters [21]. Although transmission occurs year-round, there is seasonal variation in the transmission intensity; peak transmission occurs at the end of the rainy seasons and several weeks after the end of rains in different geographic areas of the country [16].

Malaria can be prevented and treated using cost-effective interventions including; vector control, which reduces transmission of parasites from humans to mosquitoes and then back to humans achieved largely through use of insecticide-treated mosquito nets (ITNs) or indoor residual spraying (IRS); chemoprevention which suppresses blood-stage infection in humans; and case management which includes prompt diagnosis and treatment of infections [24]. In Uganda, the major national prevention activities include distribution of long lasting ITNs, IRS, and experimental larviciding with about 22 million long lasting ITNs being distributed between 2013 and 2014 [21]. Although ownership of at least one ITN is widespread throughout Uganda, less than two-thirds of households (62%) have at least one net for every two persons although overall,

there has been a substantial upward trend in ITN ownership in Uganda, from 16% in the 2006 to 90% [21]. But with a prevalence of malaria in children alone of 30% [22], this goes to show that ownership of ITNs doesn't necessarily lead to utilization calling for the need to understand the factors that influence ones decision to utilize ITNs. Specifically, this study will focus on women due to their significant contribution to uptake and utilization of health services at household level and hence their characteristics may influence utilization of ITNs by the rest of the household members.

1.1 Conceptual framework

The conceptual framework was based on the Behavioral Model of Health Care Utilization [4]. The model suggests that people's use of health services is a function of their predisposition to use services, factors which enable or impede use, and their need for care, thus providing a way to conceptualize these variations in utilization rates and consumption of medical resources [3, 13]. In this model, use of services is defined as a function of 3 main elements: need, enabling, and predisposing factors. Need factors are those factors that stimulate demand for health care services and these include an individual's perceived need for health care services, predisposing factors which mostly include demographic variables point to differences among individual's with regards to desire to utilize health services and finally enabling factors which include the availability of services, health insurance, income to enable one access and utilize health services. This study focused mainly on the predisposing factors including age, education level, religion children under 5 in the household and sex of household head and enabling factors including region and residence (rural/urban) where household is located, household wealth index, ownership of a radio and ownership of a television. These constituted the independent variables of the study. The dependent or outcome variable was the ITN utilization status of a woman constituting of three categories i.e. whether a woman slept with no net, whether a woman slept under an untreated net and whether a woman slept under an insecticide treated net (ITN).

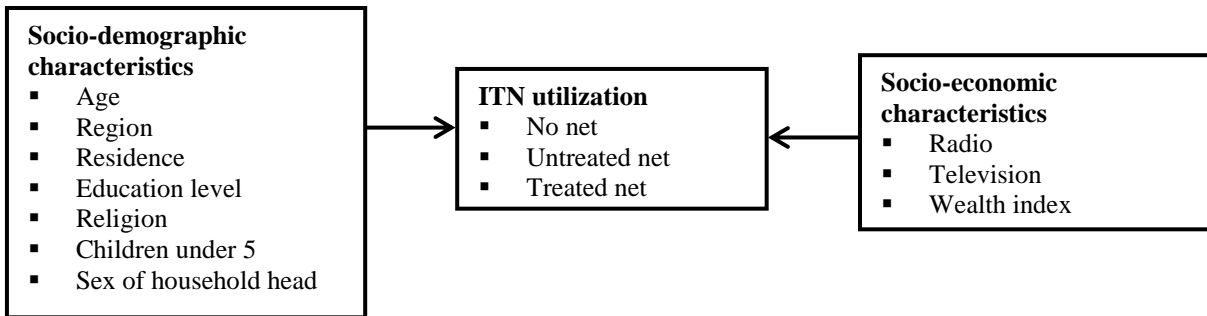


Fig 1: Conceptual framework adopted for the study

1.2 Objectives of the study

The objective of the study was to determine the factors influencing ITN utilization among women in Uganda. Specifically, the study focused on the effect of socio-economic and socio-demographic characteristics of the women on their decision to either not use an ITN, use an untreated net or use an ITN.

2. Materials and methods

2.1 Data source

The data used in this study was from the Uganda Malaria Indicator Survey [21]. A nationally representative sample of 5,802 households in 210 census enumeration areas was used. The sample was selected using a stratified two-stage cluster design consisting of 210 clusters with 44 in urban areas and 166 in rural areas. In the first stage, 20 sampling strata were created and clusters were selected independently from each stratum by a probability-proportional-to-size selection. In the second stage of the selection process, 28 households were selected in each cluster by equal probability systematic sampling. All women age 15-49 who were either permanent residents of the households in the sample or visitors present in the households on the night before the survey were eligible to be interviewed.

2.2 Data analysis

Data was analyzed using STATA Version 13.0 at three stages. Firstly, a descriptive summary of all plausible independent variables was done using frequency distributions. Secondly, using the Pearson’s chi-square test association between ITN utilization and plausible independent variables was tested and the variables that were significant at this level were considered for further analysis.

$$\chi^2 = \sum_{i=1}^k \sum_{j=1}^n \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \tag{1}$$

where O_{ij} is the number of individuals observed in the i th row and j th column cell, E_{ij} is the number of individuals expected in the i th row and j th column cell

Thirdly, since the dependent variable was treated as a nominal outcome, that is, either one didn’t sleep under a mosquito net, slept under an untreated mosquito net or slept under a treated mosquito net (ITN); the multinomial logistic regression model was fitted to determine its significant determinants of ITN utilization.

$$\log \left(\frac{\Pr(y_i=j)}{\Pr(y_i=1)} \right) = \alpha_j + \beta_{j1}X_{1i} + \beta_{j2}X_{2i} + \dots + \beta_{jk}X_{ki} \tag{2}$$

where α is the intercept corresponding to the j th outcome,

$\beta_{11} \dots \beta_{jk}$ are partial slope coefficients and $X_{11} \dots X_{ki}$ are plausible independent variables

3. Results

A descriptive summary of the socio-demographic and socio-economic characteristics of the women involved in the study is provided in Table 1.

Table 1: Description of respondents

Variables	Frequency	Percentage	
ITN utilization	No net	1,142	21.46
	Untreated nets	159	2.99
	Treated nets	4,021	75.55
Age	15-19	1,250	23.49
	20-24	1,112	20.89
	25-29	981	18.43
	30-34	715	13.43
	30 plus	1,264	23.75
Region	Central	1,260	23.68
	Northern	2,073	38.95
	Western	1,090	20.48
	Eastern	899	16.89
Residence	Urban	1,171	22.00
	Rural	4,151	78.00
Education level	None	976	18.43
	Primary	2,824	53.32
	Secondary	1,205	22.75
	Higher	291	5.49
Radio	No	2,154	40.53
	Yes	3,160	59.47
Television	No	4,452	84.67
	Yes	806	15.33
Religion	Catholic	2,358	44.35
	Anglican	1,663	31.28
	Moslem	611	11.49
	Others	685	12.88
Children under 5	None	1,318	24.77
	One	1,676	31.49
	Two plus	2,328	43.74
Sex of Household head	Male	3,891	73.11
	Female	1,431	26.89
Wealth index	Poorest	1,364	25.63
	Poorer	1,006	18.90
	Middle	894	16.80
	Richer	884	16.61
	Richest	1,174	22.06

From table 1 above, majority of the respondents utilized ITNs (75.55%) followed by those who never slept under a mosquito net (21.46%) and lastly those who used untreated mosquito nets (2.99%). The highest proportion of respondents was aged

15-19 years (23.49%) and 20-24 years (20.89%). The northern region (38.95%) had the highest proportion of respondents with the majority of respondents residing in rural areas (78%) across all regions. Majority of the respondents were educated up to primary level (53.32%) with only 5.49% having attained tertiary or university education. The highest proportion of respondents had a radio (59.47%) and no television (84.67%) in their household. Catholic (44.35%) and Anglican (31.28%) religions had the highest proportion of respondents. As regards having children under five years in the household, the highest

proportion of the households had at least 2 children (43.74%) and majority were headed by males (73.11%). The highest proportion of households belonged to the poorest (25.63%) wealth quintile followed by the richest (22.06%) wealth quintile. In Table 2, a result of the association between utilization of ITNs and the plausible independent variables is provided.

Results of the association between the women’s socio demographic and socio-economic characteristics and ITN utilization are provided in Table 2.

Table 2: Association between plausible independent variables and ITN utilization

		No net	Untreated net	Treated nets
Age	15-19	32	2.96	65.04
	20-24	22.57	2.52	74.91
	25-29	18.25	4.08	77.68
	30-34	15.24	3.08	81.68
	30 plus	16.06	2.53	81.41
		Chi2(8) = 133.9636 p = 0.000		
Region	Central	25.24	7.86	66.9
	Northern	16.59	1.25	82.15
	Western	22.39	2.02	75.6
	Eastern	26.25	1.33	72.41
		Chi2(6) = 199.3992 p = 0.000		
Residence	Urban	22.29	7.17	70.54
	Rural	21.22	1.81	76.97
		Chi2(2) = 93.5279 p = 0.000		
Education level	None	19.26	1.64	79.1
	Primary	20.89	2.12	76.98
	Secondary	25.23	4.07	70.71
	Higher	18.21	11.68	70.1
		Chi2(6) = 110.1980 p = 0.000		
Radio	No	24.47	1.95	73.58
	Yes	19.3	3.7	76.99
		Chi2(2) = 31.0734 p = 0.000		
Television	No	21.59	1.98	76.44
	Yes	19.48	8.81	71.71
		Chi2(2) = 108.7854 p = 0.000		
Religion	Catholic	20.48	3.05	76.46
	Anglican	21.89	2.16	75.95
	Moslem	22.26	3.27	74.47
	Others	23.07	4.53	72.41
		Chi2(6) = 12.8629 p = 0.045		
Children under 5	None	24.73	4.93	70.33
	One	19.81	2.33	77.86
	Two plus	20.79	2.36	76.85
		Chi2(4) = 37.8200 p = 0.000		
Sex of household head	Male	19.25	2.72	78.03
	Female	27.46	3.7	68.83
		Chi2(2) = 47.9569 p = 0.000		
Wealth index	Poorest	19.43	0.88	79.69
	Poorer	18.39	1.39	80.22
	Middle	23.27	1.45	75.28
	Richer	25.45	2.49	72.06
	Richest	22.06	8.35	69.59
		Chi2(8) = 177.6457 p = 0.000		

3.1 Socio-demographic factors and ITN utilization

All socio-demographic factors had a significant association ($p \leq 0.05$) with utilization of ITNs. Regarding age, majority of the respondents across all age groups reported utilized an ITN with the majority being aged 30-34 years (81.68%) followed by those aged 30 and above (81.41%) with the lowest proportion among those aged 15-19 years (65.04%) with utilization

generally increasing with age. Pertaining to the region, majority of the respondents utilized ITNs across all regions though the Northern region (82.15%) had the highest proportion followed by the Western region (75.6%) then Eastern region (72.41%) and lastly the Central region (66.9%). As regards residence, majority of respondents in both rural (76.97%) and urban (70.54%) residences utilized ITNs.

Regarding education level, majority of respondents across all levels of education utilized ITNs with the highest among those with no education (79.1%) followed by primary (76.98%), secondary (70.71%) and lastly higher (70.1%) indicating a negative association between ITN utilization and education level. ITN utilization was high across all religions though the highest proportion was among Catholics (76.46%) and Anglicans (75.95%). As regards to having children under five in a household, ITN utilization was highest in households with one child (77.86%), then households with two or more children (76.85%) and lastly households with no children under five (70.33%). Regarding sex of household head, male (78.03%) headed households had the highest proportion of respondents utilizing ITNs compared to female (68.83%) headed households.

3.2 Socio-economic factors and ITN utilization

All the socio-economic factors had a significant association ($p \leq 0.05$) with ITN utilization. With regards to radio ownership, majority of households which owned (76.99%) and didn't own (73.58%) a radio had high ITN utilization. As for television ownership, utilization of ITNs was highest among members from households that didn't own a television (76.44%) compared to households that owned a television (71.71%). Regarding the wealth quintile of a household, respondents from households in the poorer (80.22%) and poorest (79.69%) wealth quintiles reported the highest ITN utilization with the lowest being among respondents from households in the richest quintile (69.59%) indicating a negative relationship between ITN utilization and wealth quintile of a household. Results of the significant determinants of ITN among women in Uganda are provided in Table 3 below.

Table 3: Determinants of ITN utilization

Variables		Untreated net	Treated nets
		Coefficients	Coefficients
		No net (base outcome)	
Age	15-19	Base category	
	20-24	0.08	0.52**
	25-29	0.85**	0.78**
	30-34	0.84**	1.00**
	30 plus	0.60**	0.99**
Region	Central	Base category	
	Northern	-0.37	0.74**
	Western	-0.69**	0.22**
	Eastern	-1.04**	0.08
Residence	Urban	Base category	
	Rural	-0.08	-0.10
Radio	No	Base category	
	Yes	0.42**	0.43**
Television	No	Base category	
	Yes	0.35	0.21
Religion	Catholic	Base category	
	Anglican	-0.41	0.02
	Moslem	-0.36	0.11
	Others	0.13	-0.08
Children under 5	None	Base category	
	One	-0.39	0.21**
	Two plus	-0.33	0.05
Sex of household head	Male	Base category	
	Female	-0.28	-0.44**
Wealth index	Poorest	Base category	
	Poorer	0.55	0.14
	Middle	0.40	-0.02
	Richer	0.58	-0.23
	Richest	1.42**	-0.11

** implies significant with $p < 0.05$

3.3 Age and ITN utilization

Untreated nets versus No net

The relative log odds of a respondent utilizing an untreated net versus utilizing no net will increase by 0.85 units if moving from the 15-19 years age group to the 25-29 years age group other factors constant.

The relative log odds of a respondent utilizing an untreated net versus utilizing no net will increase by 0.84 units if moving from the 15-19 years age group to the 30-34 years age group other factors constant.

The relative log odds of a respondent utilizing an untreated net versus utilizing no net will increase by 0.60 units if moving from the 15-19 years age group to the 30 plus years age group other factors constant.

Treated nets versus No net

The relative log odds of a respondent utilizing a treated net versus utilizing no net will increase by 0.52 units if moving from the 15-19 years age group to the 20-24 years age group other factors constant.

The relative log odds of a respondent utilizing a treated net versus utilizing no net will increase by 0.78 units if moving from the 15-19 years age group to the 25-29 years age group other factors constant.

The relative log odds of a respondent utilizing a treated net versus utilizing no net will increase by 1 unit if moving from the 15-19 years age group to the 30-34 years age group other factors constant.

The relative log odds of a respondent utilizing a treated net versus utilizing no net will increase by 0.99 units if moving from the 15-19 years age group to the 30 plus years age group other factors constant.

3.4 Region and ITN utilization

Untreated nets versus No net

The relative log odds of a respondent utilizing an untreated net versus utilizing no net will decrease by 0.69 units if moving from the Central region to the Western region other factors constant.

The relative log odds of a respondent utilizing an untreated net versus utilizing no net will decrease by 1.04 units if moving from the Central region to the Eastern region other factors constant.

Treated nets versus No net

The relative log odds of a respondent utilizing a treated net versus utilizing no net will increase by 0.74 units if moving from the Central region to the Northern region other factors constant.

The relative log odds of a respondent utilizing a treated net versus utilizing no net will increase by 0.22 units if moving from the Central region to the Western region other factors constant.

The relative log odds of a respondent utilizing a treated net versus utilizing no net will increase by 0.08 units if moving from the Central region to the Eastern region other factors constant.

3.5 Ownership of radio and ITN utilization

Untreated nets versus No net

The relative log odds of a respondent utilizing an untreated net versus utilizing no net will increase by 0.42 units if moving from the not owning a radio to owning a radio other factors constant.

Treated nets versus No net

The relative log odds of a respondent utilizing a treated net versus utilizing no net will increase by 0.43 units if moving from the not owning a radio to owning a radio other factors constant.

3.6 Having children under five and ITN utilization

Treated nets versus No net

The relative log odds of a respondent utilizing a treated net versus utilizing no net will increase by 0.21 units if moving from a household with no child under five to a household with one child under five other factors constant.

Sex of household head and ITN utilization

The relative log odds of a respondent utilizing a treated net versus utilizing no net will decrease by 0.44 units if moving from a household headed by a male five to a household headed

by a female other factors constant.

3.7 Wealth quintile and ITN utilization

Untreated nets versus No net

The relative log odds of a respondent utilizing an untreated net versus utilizing no net will increase by 1.42 units if moving from the poorest quintile to the richest quintile other factors constant.

4. Discussion

The study sought to ascertain the effect of socio demographic and socio economic factors on ITN utilization among females in Uganda. The significance and positive relationship between age and ITN utilization is consistent with findings by [12, 2] who reported increased ITN use among adults compared to children. Other studies to report significant age effect on ITN utilization include [7, 10]. The significance of region where a household is located can be attributed to its implication on distribution and access to ITNs [11]. The significant effect of radio ownership on utilization of ITNs can be attributed intense media campaigns done mostly over radio regarding use of ITNs coupled with the low cost of acquiring a radio even for the majority poor households. This was consistent with findings by [8, 5, 6, 19]. As for the significance of having children under five in a household, its significance is consistent with findings by [14]. The significant positive effect of male household heads on ITN utilization was consistent with findings by [1].

5. Conclusion

The purpose of the study was to determine the factors influencing insecticide treated net utilization among women in Uganda. The significant determinants of ITN utilization were age of the respondent, region where the respondent resided, ownership of a radio, presence of a child under five in the household and the sex of the household head. ITN utilization generally increased with; increase in age, residing in other regions of the country other than the Central region, ownership of a radio, having a child under five in the household and belonging to a male headed household. Based on the results of the study, the following recommendations are provided towards improving ITN utilization; Firstly, considering that majority of the households own radios, government should upscale its use of radio messages to sensitize people on the use and importance of ITNs as well as issue warnings and alerts to those who misuse ITNs for other activities such as fishing due to their widespread coverage and cost-effectiveness. Secondly, government should ensure a balance in regional coverage of government programmes aimed at providing citizens with free ITNs other than concentrating on specific regions of the country. Community health workers (CHWs) should be trained in order to carry out sensitization drives within their communities on the importance of adopting government recommended health practices towards improving the welfare of their households especially in households with teenage mothers and orphaned homes who are vulnerable members of society and may not easily access information and services in the community.

5. References

1. Adjah ESO, Panayiotou AG. Impact of malaria related messages on insecticide-treated net (ITN) use for malaria prevention in Ghana. *Malaria Journal*. 2014; 13:123.

2. Alaii JA, Hawley WA, Kolczak MS, ter Kuile FO, Gimnig JE, Vulule JM *et al.* Factors affecting use of permethrin-treated bed nets during a randomized controlled trial in western Kenya. *American Journal of Tropical Medicine and Hygiene.* 2003; 68(4):137-41.
3. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *Journal of Health and Social Behavior.* 1995; 36:1-10.
4. Andersen R, Newman JF. Societal and individual determinants of medical care utilization in the United States. *Milbank Mem Fund Q Health Soc.* 1973; 51:95-124.
5. Ankomah A, Adebayo SB, Arogundade ED, Anyanti J, Nwokolo E, Inyang U *et al.* The Effect of Mass Media Campaign on the Use of Insecticide-Treated Bed Nets among Pregnant Women in Nigeria. *Malaria Research and Treatment.* 2014, 694863.
6. Biadgilign S, Reda A, Haji Kedir H. Determinants of Ownership and Utilization of Insecticide-Treated Bed Nets for Malaria Control in Eastern Ethiopia. *Journal of Tropical Medicine.* 2012, 235015.
7. Baume CA, Marin MC. Intra-household mosquito net use in Ethiopia, Ghana, Mali, Nigeria, Senegal, and Zambia: are nets being used? Who in the household uses them? *American Journal of Tropical Medicine and Hygiene.* 2007; 77(5):963-71.
8. Belay M, Deressa W. Use of insecticide treated nets by pregnant women and associated factors in a predominantly rural population in northern Ethiopia. *Tropical medicine & international health.* 2008; 13(10):1303-1313.
9. Desai M, ter Kuile FO, Nosten F, McGready R, Asamoah K., Brabin B *et al.* Epidemiology and burden of malaria in pregnancy. *The Lancet Infectious Diseases.* 2007; 7(2):93-104.
10. Eisele TP, Keating J, Littrell M, Larsen D, Macintyre K. Assessment of insecticide-treated bednet use among children and pregnant women across 15 countries using standardized national surveys. *American Journal of Tropical Medicine and Hygiene.* 2009; 80(2):209-14.
11. Eni DD, Ibor UW, Ojong OE, Ogundele, FO. Location, Distribution and Utilization of Insecticide Treated Nets (ITNs) in Cross River State, Nigeria. *International Journal of Humanities and Social Science.* 2012; 2(2):249-255.
12. Graves PM, Ngondi JM, Hwang J, Getachew A, Gebre T, Mosher AW *et al.* Factors associated with mosquito net use by individuals in households owning nets in Ethiopia. *Malaria Journal.* 2011, 10:354
13. Jahangir E, Irazola V, Rubinstein A. Need, Enabling, Predisposing, and Behavioral Determinants of Access to Preventative Care in Argentina: Analysis of the National Survey of Risk Factors. *PLoS ONE.* 2012; 7(9):e45053.
14. Krezanoskia PJ, Comfort AB, Tsai AC, Bangsberg DR. Households with young children and use of freely distributed bednets in rural Madagascar. *International Health.* 2014; 6:29-34.
15. Ministry of Health. Uganda Malaria program review report 2001-2010. Kampala, Uganda: Ministry of Health, 2011.
16. National Malaria Control Programme (NMCP). Uganda Malaria Reduction Strategic Plan 2014-2020. Kampala, Uganda. National Malaria Control Programme, 2014.
17. Okello PE, van Bortel W, Byaruhanga AM, Correwyn A, Roelants P, Talisuna A *et al.* Variation in malaria transmission intensity in seven sites throughout Uganda. *American Journal of Tropical Medicine and Hygiene.* 2006; 75:219-225.
18. Roberts D, Matthews G. Risk factors for malaria in children under the age of five years in Uganda. *Malaria Journal.* 2016; 15:246.
19. Sangare LR, Weiss NS, Brentlinger PE, Richardson BA, Staedke SG, Kiwuwa MS *et al.* Determinants of Use of Insecticide Treated Nets for the Prevention of Malaria in Pregnancy: Jinja, Uganda. 2012; 7(6):e39712.
20. Snow RW, Guerra CA, Noor AM, Myint HY, Hay SI. The global distribution of clinical episodes of Plasmodium falciparum malaria. *Nature.* 2005; 434:214-217.
21. Uganda Bureau of Statistics (UBOS) and ICF International. Uganda Malaria Indicator Survey 2014-15. Kampala, Uganda and Rockville, Maryland, USA: UBOS and ICF International, 2015.
22. Uganda Bureau of Statistics (UBOS) and ICF. Uganda Demographic and Health Survey 2016: Key Indicators Report. Kampala, Uganda. UBOS and Rockville, Maryland, USA: ICF, 2017
23. Van Eijk AM, Hill J, Noor AM, Snow, RW, ter Kuile FO. Prevalence of malaria infection in pregnant women compared with children for tracking malaria transmission in sub-Saharan Africa: a systematic review and meta-analysis. *Lancet Global Health.* 2015; 3:e617-28
24. WHO. World Malaria Report 2015. Geneva, Switzerland. World Health Organization, 2015.