Vol. 22(3), pp. 19-27, April 2022
DOI: 10.5897/AJMHS2021.0200
Article Number: C5BAD1068938
ISSN 2384-5589

http://www.academicjournals.org/AJMHS

African Journal of Medical and Health Sciences

Full Length Research Paper

Utilisation of long-lasting-insecticide-treated nets among pregnant women and under-five children in selected sub-urban areas of Lusaka, Zambia

Mutinke Zulu[1]*, Kabwe Chitundu[2], Emmanuel Mwila Musenge[3], Mwaba Chileshe[3], Victoria Kalusopa[3], Natalia Mbewe[3], Martha Mbewe Mwelwa[3] and Dorothy Chanda[4]

[1]Department of Midwifery, Women and Child Health, University of Zambia, School of Nursing Sciences, Zambia.
[2]Department of Mental Health and Psychiatry, School of Nursing Sciences, University of Zambia, Zambia.
[3]Department of Basic and Clinical Sciences, School of Nursing Sciences, University of Zambia, Zambia.
[4]Department of Public Health Nursing, School of Nursing Sciences, University of Zambia, Zambia.

Receieved 26 December, 2021; Accepted 4 March, 2022

Malaria is endemic in Zambia and is more common among pregnant mothers and under-five-year-old children. Long lasting insecticide treated mosquito nets are effective against malaria among other measures. However, over the years, data has shown low utilisation of insecticide treated mosquito nets among pregnant women and children under-five. This study investigated the utilisation of long lasting insecticide treated mosquito nets among pregnant mothers and their under-five-children in Lusaka urban. A cross section descriptive study was conducted in Matero, Chainda, Mandevu and Chipata compounds of Lusaka District. A total of 420 pregnant mothers with under-five children were sampled. A semi-structured interview schedule was used to collect data. Data was analysed using SPSS version 22. Logistic regression analysis was done to assess the significance of the association among factors influencing use of long-lasting insecticide treated mosquito nets with the confidence interval of 95%. Almost all (99.5%) of the participants were females. Only 68% of the respondents owned and utilised the long-lasting-insecticide-treated nets. Almost all (98%) of the respondents denied that cultural beliefs cause fever in pregnant women. Health facilities should lobby and distribute long-lasting-insecticide-treated nets in order to scale-up utilization of long lasting insecticide treated mosquito nets. More awareness should be created on the importance of sleeping under long lasting insecticide treated mosquito nets.

Key words: Malaria, Utilisation, long-lasting-insecticide-treated nets, pregnant women and under-five children.

INTRODUCTION

Malaria is an intermittent and remittent fever caused by a protozoan parasite which invades the red blood cells and is transmitted by mosquitoes in many tropical and subtropical regions such as the sub Saharan Africa to which Zambia belongs (Steketee et al., 2001, WHO, 2014). The predominant malaria parasite species is

*Corresponding author. E-mail: mutinke.zulu@unza.zm. Tel: +260976725688.

Plasmodium falciparum, with *Plasmodium malariae* and *Plasmodium ovale* accounting for less than 5 percent (Chico et al, 2012). Nationally, the overall, number of reported malaria cases (clinical and confirmed) to the National Health Management Information System (HMIS) increased from 4,260,235 to 5,094,073 (2010-2015) with HMIS reporting rates averaging about 70%. The reported number of outpatient department (OPD) visits increased from 13,697,003 in 2009 to 21,668,763 in 2012 and 19,006,047 in 2015. Chipeta and Chico (2015) reported that there were 4.2 million cases of registered malaria cases in adults and 4,000/year among the under-five children. According to WHO (2021), 241 million malaria cases and 627 000 malaria deaths were estimated worldwide in 2020 which represents about 14 million more cases in 2020 compared to 2019, and 69 000 more deaths. About two thirds of these additional deaths (47, 000) were linked to the disruptions in the provision of malaria prevention measures, its diagnosis and treatment during the Covid-19 pandemic.

In Eastern province, children with fever are not taken to the clinic due to beliefs that adult relatives are having sex and touching them with unclean hands (bamutyola mwana chifuba). Among the Bembas in the Northern and Luapula provinces this is known as Ichifuba chantanda bwanga. Fever among >2-year-old children are also believed to be caused by the same belief. Another belief is that the chemicals in LLINs cause allergy and suffocation to the users (Hamooya et al., 2015). Other causes include living in swampy and dambo areas that encourage mosquito breeding in the environment. Poor utilization of LLINs by households as well as poor adherence to other malaria preventive measures like refusal to allow in door residual spraying (IRS) in homes (Hamooya et al., 2015).

The utilisation of LLINs depends on a variety of inter-related factors that include ownership of the LLINs, socio-economic and cultural factors, seasons, perceptions on the use of LLINs, education and age, large family size, income, habitation and community participation in environmental and case management. Overall, ITN utilization among pregnant women and under-five children in sub-Saharan countries is very low. Poor educational and awareness level, and ITN related factors (that is, ITN accessibility, sufficiency, quality, physical condition, maintenance, replacement, and effectiveness) contribute to poor ITN utilization (Ozims and Eberendu, 2014). However, these factors could vary across settings and over time, and hence the relevance of understanding the situation in the Zambian context. The use of LLINs is highly recommended, as they greatly reduce the cost and operational difficulties associated with retreatment of nets (Ntuku et al., 2017).

The current generation of LLINs lasts three to five years, after which they should be replaced. So, this reduces the cost of acquiring the nets especially that in Zambia, most mosquito nets are provided free of charge with the goal of ensuring at least one net per sleeping space. However, longitudinal studies (WHO, 2011) have observed physical deterioration in LLINs well before 3 years and maintenance of insecticidal activity may be affected by varying conditions and handling practices (e.g. washing). The target for the NMSP 2011-2015 is 100% ownership of targeted households and 80% utilisation of LLINs by 2015 (Zambia Ministry of Health [MoH], 2011). The majority of these LLINs are long-lasting insecticidal nets; 67% of households own at least one LLINs. There has been an increase in household ownership of any type of net and of LLINs over the last six years, from 64 percent and 53%, respectively, in the 2007 ZDHS to 73 and 68%, respectively (Central Statistical Office [CSO] et al, 2015). With all the information, education and communication (IEC) on malaria prevention and control that are conducted by health care professionals (nurses) at Antenatal and under-five children's clinics in Lusaka, there should be little or no confirmed cases of malaria among the pregnant mothers and their under-five children in Lusaka province and surrounding compounds but on the contrary, between 2013-2015, the reverse is the prevailing situation. Therefore, there is an urgent need to bring about immediate interventions based on the study findings that would not only contribute to the prevention of malaria in human beings but also bring about vector–control. There is paucity of data in evidence-based studies on factors that are associated with the use of the LLINs among the vulnerable groups in the high density areas of Lusaka. Therefore, the study aimed at assessing the utilisation of LLINs among pregnant women and under-five children living in high malaria endemic areas of Lusaka, Zambia.

METHODOLOGY

This was a descriptive non interventional cross- sectional study that Matero and Chainda first level Hospitals as these are among the areas with the high malaria endermicity in Lusaka. Data on use of the LLINs was collected using a semi-structured interview schedule over a 15 months period beginning from October 2019 to January 2021. The proportion of pregnant women and children under the age of five who sleep under mosquito nets is unknown because the Health information management system and Zambia Demographic Health Survey standard collection do not collect this indicator. Therefore, the sample was calculated by a proportion of 50% plus or minus 5%. Based on a 10% non-response rate, the predicted sample size was increased to 420. Therefore, the interviews were done with 420 women with children under the age of five.

The pair of pregnant women and under-five children attending antenatal clinic between 08:30 and 12:30 h in each of the health facilities was sampled using a 1 in 2 systematic random sampling technique until the requisite sample size in each location was reached. The participants were identified through the health centre in-charges, and a private room for the interviews was provided with their assistance. Then, for women who had more than one child, a child was chosen at random and enrolled in the study with the mother.

Ethical approval was sought from ERES converge. The research team was granted permission by the Lusaka District Health

Management to visit the study's health facilities. Access to the participants was granted by the respective health facility managers. The study's purpose was described to the participants, and all of them were given information about how they might participate and what the study's outcomes would be. The participants' anonymity and confidentiality were maintained, but it was made clear that the information they provided would be shared with medical personnel if they were found to be in danger. Participants were informed that they had the option to withdraw from the study at any time without facing any penalty. Those who agreed to take part in the interview signed the consent forms before the interview started.

The data were analyzed using SPSS version 22 and associations between quantitative variables were established using the Yate's corrected Chi-squared tests and Fisher's exact test. The logistic regression analysis was run in-order to adjust for confounding factors. The Odds Ratio and the 95% confidence interval were used to measure the magnitude of association. The level of significance was set at 5% level. Frequency tabulations described the problem under study while analytical cross tabulations compared groups so that the degree of impact of each associated factor on the use of the ITNs where measured.

RESULTS AND DISCUSSION

Socio-demographic characteristics

The study comprised of 420 participants of which only 0.5% (2) of them were males and the rest (418) were females. Only 25% (104) of the participants were aged above 50years while the majority 75% (316) was within the child bearing age of 15 to 49years old. Most of the respondents 36% (152) were from Chipata compound and majority 78% (326) lived within 12 km radius of the health facility. Three quarters (314) of the respondents were married. More than a quarter, 36% (152) of the respondents had been to secondary school level of education (Table 1).

Utilisation of long-lasting-insecticide-treated nets

This study showed that more than half, 68%, (286) of the pregnant mothers and their children utilised the LLIN (Figure 1). This number is still low as it is expected that everyone should utilise LLINs. The low utlisation can be attributed to lack of mosquito nets in most homes or because of preferences on whom should sleep under the LLIN. For instance, a little more than a quarter 27%, (113) of the respondents stated that their husbands slept alone under the LLIN depriving the mother and under 5 children. Similarly, a study by Taremwa et al. (2017), to determine knowledge, attitude and behaviour towards the use of insecticide treated mosquito nets among pregnant women and children in rural South-western Uganda reported that only 66.1% were using LLITNs regularly despite most of the respondents (84%) owning LLINs and over 90% understanding the value of LLINS use as a preventive measure against malaria. Similarly, another study by Aderibigbe (2014), to determine the ownership and utilization of long lasting insecticide treated nets following free distribution campaign in South-west Nigeria, reported that the overall utilization rate was low at 58.5%. Coverage and ownership of LLINs increased significantly following the free distribution campaign but the rate of use was lower than possession. On the contrary, a study conducted in Mbarara, Uganda by Nuwamanya et al. (2018), reported utilisation of LLINs among 91.1% of adult respondents and among 91.9% of children under-five. This is more likely because the participants were given mosquito nets six months prior to the study. Further, another study conducted by Ugwu et al (2013) to determine the utilization of insecticide treated nets among pregnant women in Enugu, South Eastern Nigeria reported that the use of ITNs was poor (39.1%) among pregnant women in Enugu.

Socio-cultural and traditional beliefs of the participants

This study revealed that almost all 99.5%, (418) of the respondents believed that the use of LLINs causes respiratory and skin problems. However, almost all 98%, (412) of the respondents denied knowing any cultural beliefs associated with fever in pregnant women (Table 2). Similarly, Taremwa et al. (2017) in a study to determine knowledge, attitude and behaviour towards the use of LLINs among pregnant women and children in rural South-western Uganda reported that almost 41% of respondents who were not using LLINs stated that they were concerned about side effects of the LLINs or had beliefs that chemicals used could cause cancer. Another study by Fokam et al. (2017), to determine the predictive factors of long-lasting insecticide-treated net ownership and utilisation in the Bamenda Health District of Cameroon showed that negligence, heat, discomfort/suffocation and torn nets were among other reassons for non-usage of bednets.

In this study, all the respondents knew that malaria was caused by a bite from a mosquito and only about 2% of the respondents indicated that playing in the rains and spending time in the cold caused fever in under-five children. This is due to massive sensitisation that nurses and community health care provide regarding malaria during under-five and antenatal care clinic. This is similar to findings of a study to determine knowledge, attitude and behaviour towards the use of insecticide treated mosquito nets among pregnant women and children in rural South-western Uganda that more than three quarters 83.3% were aware that malaria is transmitted by mosquitoes (Taremwa et al, 2017). Equally, Jima et al. (2005), in a baseline survey for the implementation of insecticide treated mosquito nets in Malaria control in Ethiopia reported that almost all 93% of the respondents knew that malaria could be transmitted through mosquito bites, although the rest stated that malaria could be caused by eating maize stalk, breathing contaminated air, making contacts with malaria patients and bed bugs/fleas.

Table 1. Demographic characteristics of the participants.

Variable	Frequency	Percentage
Sex		
Male	2	0.5
Female	418	99.5
Total	**420**	**100.0**
Age (years)		
17-27	38	9.0
28-38	97	23.1
39-49	181	43.1
≥50	104	24.8
Total	**420**	**100.0**
Residential area		
Matero compound	108	25.8
Chipata compound	152	36.3
Mandevu compound	28	6.6
Chainda compound	132	31.5
Total	**420**	**100.0**
Distance to the clinic (km)		
>12	94	22.4
<12	326	77.6
Total	**420**	**100.0**
Marital status		
Single	106	25.2
Married	314	74.8
Total	**420**	**100.0**
Educational level		
Not been to school	60	14.3
Primary	98	23.3
Secondary	152	36.3
Tertiary	110	26.3
Total	**420**	**100.0**
Total number of children		
0-5	397	94.5
6-10	20	4.8
≥11	3	0.7
Total	**420**	**100.0**
Number of children under-five years		
Zero	12	2.9
One	332	79.6
Two	70	16.6
Three	6	1.4
Total	**420**	**100.0**
Number of children older than five years		
0-3	379	90.2
4-6	31	7.4
7-9	10	2.4

Table 1. Contd.

Total	**420**	**100.0**
Number of adults in the household older than 18 years		
0-3	342	81.4
4-6	74	17.6
7-9	4	1.0
Total	**420**	**100.0**
Number of women aged 15-49 years in the household		
0-3	389	92.6
4-6	28	6.7
7-9	3	0.7
Total	**420**	**100.0**
Total number of family members		
0-3	152	36.2
4-7	205	48.8
8-10	45	10.7
11-14	18	4.3
Total	**420**	**100.0**
Family income per month		
Under K500	294	70.0
K500-K1000	86	20.5
K1000-K2500	22	5.2
Over K2500	18	4.3
Total	**420**	**100.0**
Participant source of income		
Business for the father	294	70.0
Mother sells vegetables at the market	101	24.0
Movement worker	25	6.0
Total	**420**	**100.0**

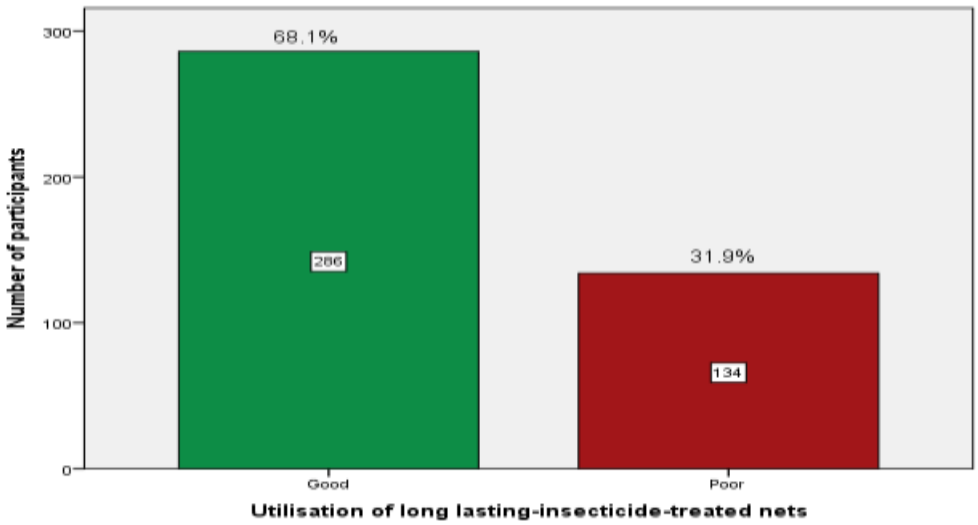

Figure 1. Utilisation of LLINs (n=420).

Table 2. Sociocultural and traditional beliefs of the participants.

Variable	Frequency	Percentage
Husband sleep alone under LLINs		
Yes	113	26.9
No	307	73.1
Total	**420**	**100.0**
LLINs cause respiratory and skin problems		
Yes	418	99.5
No	2	0.5
Total	**420**	**100.0**
Number of wives in family		
One wife	397	94.5
More than one wife	23	5.5
Total	**420**	**100.0**
Causes of fever in under-five children		
Playing in the rains	4	1.0
Spending time in the cold	6	1.4
Others	410	97.6
Total	**420**	**100.0**
LLINs cause fever in pregnant women		
Yes	3	0.7
Not sure	5	1.2
No	412	98.1
Total	**420**	**100.0**

Utilisation of long-lasting-insecticide-treated nets by demographic characteristics of the participants

The chi-square test showed that age, number of adults in a household older than 18 years old, sex, participants distance from house to clinic, total number of children under-five year old children, number of women aged 15 to 45 years old and source of income were not significantly associated with utilisation of LLINs. However, marital status, total number of family members, residential area, and family income were associated with utilisation of LLINs.

On univariate binary logistic regression, husband sleeping alone under the LLITN and number of wives in a family were significantly associated with utilisation of LLITNs with a p-value of 0.01 and 0.037 respectively (Table 5).

Multivariate logistic regression model revealed that only the total number of family members was significantly associated with utilisation of LLINs. This could be due to accessibility that family members have to nets. If a household has one net but more members, only a few of them would utilise the net. The pattern of sleeping also affects the utilisation of nets in a household. If mothers sleep separately from under-five children in a household with only one net, then one of the two would not have access to the mosquito net (Tables 4 and 6).

Contrary to findings of this study, a systematic review of studies in 18 selected African countries conducted by Noor et al. (2009) showed that age was significantly associated with use of LLINs. The utilisation was higher among children under the age of 5 years and pregnant women as compared to school going children. This is most likely because of the fact that the distribution of LLINs focuses on children under the age of 5 years and pregnant women during under-five clinic and antenatal visits and also during mass-catch-up immunization campaigns programs for under-five years old children. Additionally, the high utilisation among the under 5 and the pregnant women could be related to the sleeping patterns where nursing and younger children share sleeping structures in a household with their mothers and/or both parents, while older children sleep on separate beds or mats elsewhere in the household (Tables 3 and 4).

Conclusion

The utilisation of LLINs was low among pregnant women and under 5 year old children because of low ownership

Table 3. Univariate binary logistic regression determining demographic characteristics associated with utilisation of LLINs.

Predictor variable	Use of LLINs		OR (95% CI)	P-value*
	Yes	No		
	No. (%)	No. (%)		
Marital status				
Single	61 (21.3%)	45 (33.6%)	1.87 (1.18-2.95)	**0.007**
Married	225 (78.7%)	89 (66.4%)	1.0 (Ref.)	
Total number of family members				
0-3	110 (38.5%	42 (31.3%)	0.24 (0.09-0.67)	**0.006**
4-7	133 (46.5%)	72 (53.7%)	0.34 (0.13-0.93)	**0.035**
8-10	36 (12.6)	9 (6.7)	0.16 (0.05-0.53)	**0.003**
11-14	7 (2.4%)	11 (8.2%)	1.0 (Ref.)	
Residential area				
Matero	86 (30.1%)	22 (16.4%)	0.30 (0.17-0.54)	**0.001**
Chipata compound	110 (38.5%)	42 (31.3%)	0.45 (0.28-0.74)	**0.002**
Mandevu compound	18 (6.3%)	9 (6.7%)	0.59 (0.25-1.41)	0.235
Chainda compound	72 (25.2%)	61 (45.5%)	1.0 (Ref.)	
Family income per month				
Under K500	178 (62.2%)	116 (86.6%)	1.69 (0.59-4.88)	0.328
K500-K1000	79 (27.6%)	7 (5.2%)	0.23 (0.06-0.84)	**0.026**
K1000-K2500	16 (5.6%)	6 (4.5%)	0.98 (0.24-3.93)	0.972
Over K2500	13 (4.5%)	5 (3.7%)	1.0 (Ref.)	

Table 4. Multivariate binary logistic regression determining demographic charcteristics associated with utilisation of LLINs.

Predictor variable	Use of LLINs		OR (95% CI)	P-value
	Yes	No		
	No. (%)	No. (%)		
Marital status				
Single	61 (21.3%)	45 (33.6%)	1.62 (0.99-2.65)	0.057
Married	225 (78.7%)	89 (66.4%)	1.0 (Ref.)	
Total number of family members				
0-3	110 (38.5%	42 (31.3%)	0.51 (0.04-0.53)	0.003
4-7	133 (46.5%)	72 (53.7%)	0.22 (1.07-0.72)	0.012
8-10	36 (12.6)	9 (6.7)	0.13 (0.03-0.53)	0.004
11-14	7 (2.4%)	11 (8.2%)	1.0 (Ref.)	
Residential area				
Matero	86 (30.1%)	22 (16.4%)	0.58 (0.29-1.12)	0.105
Chipata compound	110 (38.5%)	42 (31.3%)	0.72 (0.36-1.35)	0.291
Mandevu compound	18 (6.3%)	9 (6.7%)	1.06 (0.39-2.85)	0.912
Chainda compound	72 (25.2%)	61 (45.5%)	1.0 (Ref.)	
Family income per month				
Under K500	178 (62.2%)	116 (86.6%)	1.55 (0.49-4.86)	0.45
K500-K1000	79 (27.6%)	7 (5.2%)	0.22 (0.06-0.85)	**0.028**
K1000-K2500	16 (5.6%)	6 (4.5%)	1.05 (0.24-4.65)	0.945
Over K2500	13 (4.5%)	5 (3.7%)	1.0 (Ref.)	

Table 5. Univariate binary logistic regression determining utilisation of LLINS by sociocultural and traditional beliefs of the participants.

Predictor variable	Use of LLINs		OR (95% CI)	P-value*
	Yes	No		
	No. (%)	No. (%)		
Husband sleep alone under LLINs				
Yes	88 (30.8%)	25 (18.7%)	1.94 (1.17-3.20)	**0.01**
No	198 (69.2%)	109 (81.3%)	1.0 (Ref.)	
Number of wives in the family				
One	275 (96.2%)	122 (91.0%)	2.46 (1.06-5.73)	**0.037**
More than one	11 (3.8%)	12 (9.0%)	1.0 (Ref.)	

Table 6. Multivariate binary logistic regression determining utilisation of LLINS by sociocultural and traditional beliefs of the participants.

Predictor variable	Use of LLINs		OR (95% CI)	P-value*
	Yes	No		
	No. (%)	No. (%)		
Husband sleep alone under LLINs				
Yes	88 (30.8%)	25 (18.7%)	1.90 (1.15-3.14)	**0.013**
No	198 (69.2%)	109 (81.3%)	1.0 (Ref.)	
Number of wives in the family				
One	275 (96.2%)	122 (91.0%)	2.34 (1.00-5.49)	**0.050**
More than one	11 (3.8%)	12 (9.0%)	1.0 (Ref.)	

of mosquito nets by the study respondents and also large number of members in households against the available mosquito nets. Health facilities must lobby and distribute LLINs to the community if the utilisation can be scaled up in order to achieve the desired level of prevention of malaria among pregnant women and children under the age of 5 years old. Further, More awareness should be created on the importance of sleeping under Long Lasting Insecticide Treated Mosquito Nets.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

ACKNOWLEDGMENTS

The authors would like to thank Dr Dorothy Chanda the PI for her efforts in seeing to it that this study is conducted. Many thanks also to the Directorate of Research and Graduate Studies- University of Zambia for the financial support that facilitated conducting of this study.

REFERENCES

Aderibigbe SA, Olatona FA, Sogunro O, Alawode G, Babatunde OA, Onipe AI, Bolarinwa OA, Ameen HA, Osagbemi GK, Sanya EO, Olarinoye AO, Akande TM (2014). Ownership and utilisation of long lasting insecticide treated nets following free distribution campaign in South West Nigeria. Pan African Medical Journal 17:263. doi: 10.11604/pamj.2014.17.263.3927

Central Statistical Office (CSO) [Zambia], Ministry of Health (MOH) [Zambia], and ICF International. (2015). Zambia Demographic and Health Survey 2013-14. Rockville, Maryland, USA: Central Statistical Office, Ministry of Health, and ICF International.

Chico RM, Mayaud P, Ariti C, Mabey D, Ronsmans C, Chandramohan D (2012). Prevalence of malaria and sexually transmitted and reproductive tract infections in pregnancy in sub-Saharan Africa: a systematic review. JAMA 307(19):2079-2086. https://doi.org/10.1001/jama.2012.3428.

Chipeta J, Chico R (2015). High burden of malaria infection in pregnant women in a rural district of Zambia: a cross‑sectional study. Malaria Journal 14:380. DOI 10.1186/s12936-015-0866-1.

Fokam EB, Kindzeka GF, Ngimuh L, Dzi KT J, Wanji S (2017). Determination of the predictive factors of long-lasting insecticide-treated net ownership and utilisation in the Bamenda Health District of Cameroon. BMC Public Health 17:263.

Hamooya BM, Chongwe G, Sitali L, Halwindi H (2015). Reported incidence of fever for under-5 children in Zambia: a longitudinal study. Archives of Public Health 73:46. https://doi.org/10.1186/s13690-015-0097-5.

Jima D, Tesfaye G, Deressa W, Woyessa A, Kebede A, Alamirew D (2005). Baseline survey for the implementation of insecticide treated mosquito nets in Malaria control in Ethiopia. Ethiopian Journal of Health Development 19(1):16-23.

Noor AM, Kirui VC, Brooker SJ, Snow RW (2009). The use of insecticide treated nets by age: implications for universal coverage in Africa. BMC Public Health 9:369. https://doi.org/10.1186/1471-2458-9-3.

Ntuku HM, Ruckstuhl L, Julo-Réminiac JE (2017). Long-lasting insecticidal net ownership, use and cost of implementation after a mass distribution campaign in Kasaï Occidental Province, Democratic Republic of Congo. Malaria Journal 16:22

https://doi.org/10.1186/s12936-016-1671-1.
Ozims SJ, Eberendu IF (2014). Awareness, ownership, and utilization of long-lasting insecticide-treated nets (LLIN) among pregnant women attending Antenatal clinic in Imo State University Teaching Hospital, Orlu, Imo State. International Journal of Medical Research and Health Sciences 4(8):14-21.
Steketee RW, Nahlen BL, Parise ME Menendez C (2001). The burden of malaria in pregnancy in malaria-endemic areas. American Journal of Tropical Medicine and Hygiene 64(1-2 Suppl):28-35. doi:10.4269/ajtmh.2001.64.28.
Taremwa IM, Ashaba S, Adrama HO (2017). Knowledge, attitude and behaviour towards the use of insecticide treated mosquito nets among pregnant women and children in rural South-western Uganda. BMC Public Health 17:794 https://doi.org/10.1186/s12889-017-4824-4.
Ugwu E, Ezechukwu P, Obi S, Ugwu A, Okeke T (2013). Utilization of insecticide treated nets among pregnant women in Enugu, South Eastern Nigeria. Nigerian Journal of Clinical Practice 16(3):292-296.
World Health Organization (2011). Guidelines for monitoring the durability of long-lasting insecticidal mosquito nets under operational conditions. Geneva: [http://apps.who.int/iris/bitstream/10665/44610/1/9789241501705_eng.pdf].
World Health Organization (2014). World Malaria Report. Geneva 27 Switzerland. Accessed from https://www.who.int/malaria/publications/world_malaria_report_2014/wmr-2014-no-profiles.pdf.
World Health Organization (2021). World malaria report 2021. Geneva. accessed from https://www.who.int/publications/i/item/9789240040496. ISBN 978-92-4-004049-6 (electronic version).