KIU
Journal of Science, Engineering and Technology

KJSET Research Article

Assessment of Insecticide Treated Net Use as a Means of Child Malaria Prevention in Katagum LGA, Bauchi State, Nigeria

Umar Ibrahim[1] and Maryam Idris[1*]

[1]*Public and Environmental Health Department, Faculty of Basic Medical Sciences, Federal University Dutse, Jigawa State, Nigeria.*
[2]*Pharmaceutical Department, Federal Medical Centre, Azare, Bauchi State, Nigeria*

Corresponding Author: umar.i@fud.edu.ng

Paper history:
Received 22nd January 2023
Accepted in revised form 10th April 2023

Keywords
Insecticide, Net, Malaria, Under-five, Prevention

Abstract

Insecticide Treated Nets (ITNs) utilization possessed a great public health benefit, especially among the community with never ending malaria pandemic. Sustenance of ITNs practice in malaria endemic areas has a negative impact on the success and sustainability of its use as malaria prevention option. Indeed, ITNs reduced malaria related morbidity and mortality among children, if sustain. The study assessed the used of ITNs, as a means of malaria prevention, by exploring the level of awareness, knowledge and challenges confronting the utilization, focusing on children under the age of five, in Katagum Local Government Area (LGA), Bauchi state, Nigeria. Sixty (60) mothers of under five years children attending Matsango Primary Healthcare Centre in Azare town, Katagum LGA, Bauchi state, were conveniently selected as the respondents of the study. Structured questionnaire was administered to the respondents. The collated data was analyzed using SPSS version 21. 95% confirmed that awareness of ITN use influence its utilization, 55% said that ITN use offered direct malaria prevention effects, while 46% believed that the use of ITN make someone sweat, despite its malaria prevention potency. It was therefore concluded that appropriate health policies targeting the reduction of malaria related morbidity among the under-five children, should consider not only the ITNs availability for the household, but advocate the use of ITNs, through health education on the cause, transmission, symptoms, prevention, and control as a component of the ongoing efforts of malaria prevention programs among the mothers of children under the age of five.

Nomenclature and units

sh	Sunshine hours
rsh	Relative sunshine hours
ϕ	Latitude
ΔT	Change in temperature
T_{av}	Average temperature
H	Humidity
RH	Relative humidity

1.0 Introduction

Malaria is the leading cause of morbidity and mortality worldwide. Malaria is a known public health burden, globally, especially among pregnant women and children (Annan, et al. 2021; Ogunsanmi et al. 2016; Abdulla et al. 2011; Kitua et al. 2007). It has an established devastating effect, particularly in Sub-Saharan Africa, where at least ninety percent of malaria related morbidity occur and 35% of mortality among the children below the age of 5 years (Uhomoibhi, et al. 2022; Ogunsanmi et al. 2016; Yirsaw, et al., 2021).

Malaria prevention recognized the use of Insecticide Treated Net (ITN) as an effective tool. Sustainable use of ITNs reduce malaria transmission considerably by up to 90 percent (Abdulla et al. 2011). Reducing malaria-related mortality rate among the children under the age of five remains a major concern for endemic malaria countries (Scott, et al. 2021). Low under-five mortality rate is an indication of an improved child well-being and a roadmap to the success of child survival projects (Afoakwah et al. 2015; Scott, et al. 2021) and the success of Sustainable Development Goals number 3 (SDG 3). There are several public health endeavors targeting ITN use promotion, but a dearth in data on its effectiveness looms, due to poor acceptability of ITNs. The implication of such circumstance is that more work needs to be done by the authorities and health personnel, to raise the level of ITNs accessibility, affordability and use (Kitua et al. 2007; Asuquo et al. 2017).

Use of ITNs is among the leading malaria prevention techniques. ITN utilization is used by Roll Back Malaria (RBM) as strategic initiative that reduces the burden of malaria (Florey et al. 2017). Despite that there are few studies that assess the use of ITN and reduction in malaria related under the age of five children morbidity and mortality at the local level. In this regard, the study aims to assess the rate of ITN use in children under the age of five in the study area, so as to recommend appropriate interventions that will reduce the burden of malaria. Therefore, the study was conducted in Katagum LGA, Bauchi state, Nigeria. Bauchi state is located in the northeastern part of Nigeria. The state is one of the malaria endemic settings in Nigeria.

2.0 Materials and Methods

This section presents an overview of the study area and the adopted study design.

The Study Area

This study was conducted in Azare town, Katagum LGA of Bauchi state, Nigeria. Azare town is the study area, it is the headquarters of Katagum LGA, located at $11^{0}40^{0}27$'N, $10^{=}11^{1}28^{1}$E/11.67417^{0}N 10.19111^{0}E at an elevation of 436 meters. Majority of the people living there depends on farming and animal husbandry, as dictated by its climate and soil condition (Bauchi State, 2013).

The Study Design

The study adopts descriptive field survey approach. The study was conducted at Matsango Primary Health Care Center in Azare town, Katagum LGA, Bauchi State. The study population consists of mothers and care givers of children under the age of five, attending an out-patient clinic there. A total of sixty (60) respondents were conveniently selected, based on the mothers' complaints; those that complaint of fever made the selection criteria. A structured questionnaire constructed to seek the opinion of the respondents on the use of ITNs was used for data collection. The questionnaire was administered to the mothers and the caregivers by two research assistants. The questionnaire consists of socio-demographic distribution of the respondent, level of awareness, and barriers to ITNs utilization. The questionnaires were duly filled out and retrieved immediately for analysis. The two research assistants help those that cannot fill in the form to fill in their questionnaires. The contents analysis was done, ethic clearance was obtained, formal permission was sought from Katagum L.G.A Primary Health Care Department, Azare. Respondents consent was also obtained, and confidentiality of the information was provided and guaranteed. The collected data was analyzed using frequency distribution tables, and simple percentages to establish a relationship between categorical variables. SPSS Version 21.0 was used for data entry and analysis.

3.0 Results

This section presents the findings of the study. The presentation employs a narrative technique, descriptive statistics, quotations, frequency, and tables. The study sought among other things to understand the utilization of Insecticide Treated Nets (ITNs) by mothers of under the age of five children in Matsango Primary Healthcare Centre Azare, Katagum LGA of Bauchi state.

Table 1: Distribution of Respondents According to Age

Age	Frequency	Percentage
< 20	06	10
21-34	42	70
35-49	12	20
Total	60	100

Table 1 reveals the number of mothers who are below age 20, constitutes 10% of the respondents, while those within the ages of 21 to 34 years constitute 70%. This was followed by 20% of the respondents who were between the ages of 35 and 49.

Table 2: Distribution of Respondents According to Education

Level of Education	**Frequency**	**Percentage**
No Formal Education	15	25
Primary School	30	50
Secondary School	12	20
Tertiary	03	05
Total	**60**	**100**

Table 2 above reveals that most of the mothers had some form of education, possibly due to the presence of a number of schools in the study area. 50% of the respondents had primary school education. While 25 % of the respondents had no formal education, only 5% of the respondents had tertiary level education.

Table 3: Distribution of Respondents According to Occupation

Type of Occupation	**Frequency**	**Percentage**
Civil Servant	06	10
Trading	12	20
Unemployed	33	55
Farming	03	05
Craft work	06	10
Total	**60**	**100**

The Majority (55%) of the respondents were unemployed. While 20% were traders. This is followed by craft work and civil servants with 10% each respectively. Subsistence farming was surprisingly an activity least practiced by the respondents (5%), despite its dominance in the study area, due to farming favorable climatic condition and land availability.

Table 4: Level of Insecticide Treated Nets use Awareness.

	Statement	1	2	3	4	5
		% Response n=60				
1.	Awareness of ITNs use influence its utilization	60	35	03	02	00
2	ITNs use reduce mosquitoes	40	31	05	22	02
3	Targeted communication on ITN use sustain it use over time	38	35	10	14	03
4	Perception of sleeping better enhance the use of ITNs	43	49	00	08	00
5	Wrong beliefs in ITNs use have negative impacts on it use	00	05	10	40	45
6	Risk perception of malaria influenced the use of ITN	28	15	30	20	07
7	ITNs utilization is linked to household income.	14	17	21	36	12

1. SA= Strongly agreed 2.A =Agreed 3.U = Undecided 4. D=Disagreed 5. SD= Strongly agreed

Table 4 above reveals that 95% of the respondents' agreed that awareness of ITNs use influence its utilization, while 5% of the respondents disagree agreed with the assertion. Similarly, 71% of the respondents agreed that ITNs use reduce mosquitoes. 73% of the mothers believe that targeted communication on ITN use sustains it use over time against the 45%. Also, 92% of the respondents agreed that perception of sleeping better enhances the use of ITNs. Moreover, 85% of the respondents disagreed that wrong beliefs in ITNs use have negative impacts on it use. 43% of the respondents agreed that risk perception of malaria influenced the use of ITN. 21% were undecided while 48 % disagreed respectively. In same vein, 31% of the respondents strongly agreed that ITNs utilization is linked to household income.

Table 5: Insecticide treated nets utilization.

	Barriers	1	2	3	4	5
		Percentage response n=60				
1.	ITNs leads to decrease in malaria prevalence among children.	35	10	20	20	15
2	Protective effects of ITNs used is notable among children.	30	25	10	22	13
3	Community bed net use could provide considerable protection.	50	28	02	15	05
4	ITN used offered direct malaria protective effects.	35	45	15	00	05
5	Protection from mosquitoes is a factor for increased use of ITNs.	50	22	13	17	03
6	Protective perceptions of malaria through ITNs enhance it use	64	6	11	0	19
7	ITNs use knowledge is multi-dimensional	78	22	0	0	0

1. SA=Strongly agreed 2. A=Agreed 3.U=Undecided 4.D=Disagreed 5. SD=Strongly disagreed

In Table 5 majority of the respondents (45%) agreed that ITNs leads to decrease in malaria prevalence among children. About 55% of the respondents strongly agreed that protective effects of ITNs use was notable among children. The Table also reveals that community bed net use could provide considerable protection by 78% of the respondents. It could also be observed from the table above that 80% of the respondents agreed that ITN used offered direct malaria protective effects. About 72% of the respondents agreed that protection from mosquitoes is a factor for increased use of ITNs, while 13% of the respondents were undecided. Table 5 also reveals that 71% of the respondents agreed that protective perceptions of malaria through ITNs, enhance it use, while 11% of the respondents were undecided, and 19% disagreed. Additionally, 100% of the

respondents strongly agreed that ITNs use knowledge is multi-dimensional.

Table 6: Barriers to utilization of Insecticide Treated Nets

	Barriers	1	2	3	4	5
		Percentage response n=60				
1.	Costs of ITNs limit it use	84	6	10	0	0
2	Non-availability of ITNs is a major constraint to it use	39	7	24	27	3
3	Use of ITNs make someone sweat	36	10	24	20	10
4	Perceptions of ITNs use determine its malaria prevention success	45	23	12	15	5
5	Insecticide found on the ITN can be harmful	11	10	14	35	20
6	Health messages provide scientific knowledge on ITNs use	67	13	13	17	3

1. SA= Strongly agreed 2.A =Agreed 3.U = Undecided 4. D= Disagreed 5. SD= Strongly

Table 6 reveals that 90% of respondents agreed that costs of ITNs limit it use, while 46 % of them agreed that non-availability of ITNs is a major constraint to it use. 46% strongly agreed and agreed, 24% were undecided; while 30% of the respondents disagreed that the use of ITNs make someone sweat. Perceptions of ITNs used determine its malaria prevention success was perceived by majority (70%) of respondents as serious while 12% were undecided. Only 11% and10% of the respondents strongly agreed and agreed that insecticide found on the ITN can be harmful, while some of the respondents (14%) were undecided while 55% of the respondents disagreed. The study found that 80% of the respondents strongly agreed that Health message provide scientific knowledge on ITNs use, 17% of them disagreed, and 13% of the respondents were undecided.

4.0 Discussions

The variables explored in this study were age, level of education and occupation as demographic data, with level of insecticide treated nets use awareness, insecticide treated nets utilization and barriers to utilization of the insecticide treated nets as the focus of the study. From the direction of the study findings, there is a tendency to think that it is only the literate ones used ITNs, since they presumably hold a higher level of knowledge. In Table 4 the responses on the awareness of ITN use among mothers was generally high, with some few mothers not aware of ITN used. The findings in this study, was in conformity with Snow et al., (1999) and Njumkeng, et al. (2019), in which they reported that few people in the community use mosquito nets. This may be connected to the fact that few of the community members are not familiar with the use of bed nets for the prevention of mosquito bites and such they could be easily convince through advocacy on the use of ITN. The findings in the present study however agree with reports by Alaii et al. (2003) and (Balami, et al. 2018).

Regarding malaria prevention, none of the statements about malaria such as "treated bed nets reduce malaria" and "treated bed nets prevent malaria" were associated with either ITN use, a night before or the week before the survey. In a study conducted elsewhere shows that caregivers believe that target message leads to reduction in mosquitoes through ITNs use (Njumkeng, et al. 2019; Alaii et al 2003; Binka and Adongo 1997). Therefore, the result of this study as evidenced; it maintains that abundance may not be likely to encourage the use of ITN over time, but advocacy, as observed in a study conducted in Solomon Islands as reported by Atkinson et al. (2009) and in Burkina Faso by Toe et al. (2009).

The results further shows that children whose caregivers agreed that treated bed nets help you sleep better were more likely to have used it before responding to the survey. The finding is in consistence with a study from Tanzania that found perception of sleeping better is related to protection from mosquitoes and other insects; this may encourage the use ITNs (Njumkeng, et al. 2019; Gunasekeran et al., 2009). In this study, children whose mothers agreed that used of treated reduced mosquito bites were also more likely to have used daily when compared to those who responded in the negative (Sidiki, 2020). This shows that mothers give preference to their children to use the ITNs over themselves; similar findings have been reported from studies in other sub-Saharan countries (Teh, et al. 2021; Alaii et al., 2003; Adongo et al., 2005; Omonijo, et al. 2019). The results also point to the fact that wrong beliefs in ITNs use have negative impacts on it use.

In Table 6, the respondents confirmed that the costs of ITNs limit it use; it leads to increase in malaria prevalence among children (Cheng, 2021). The finding of this study on non-availability of ITNs constitute a major constraint to it use agreed with the report of a study conducted by Killeen et al. (2007) and Fru, et al. (2021) which reveals that few numbers of children slept under a net in the community, due to the issues of non-availability. Also, perceptions of ITNs use determine its malaria prevention success. Indeed, sleeping under ITN enhance the health of the bearer. An association between ITN use and malaria reduction among children of under 5 years was established in some studies (Aung, et al. 2022; Gimnig et al. 2003; Klu, et al. 2022). The findings are in conformity with those of these studies.

The present study suggests that health message provided scientific information on ITNs protection from mosquito bites; it is a factor that encouraged the use of ITN on children. In the same vein, health information enhanced mothers' perception of ITNs protection from other household insects and thereby increased the potential use of ITN on their children (Maung, et. Al. 2018; Yohannes et al., 2000). This has proven that protection from other household insects motivates the use ITN (Taremwa, et, al. 2017; Yohannes et al., 2000; Pooseesod, et, al. 2021).

This study shows that knowledge of ITN is multi-dimensional, and the results of previous studies obtained have not provided much insight on the multi-dimensional effects of malaria knowledge in particular and on the ITN use in general. This study highlights the need for understanding the important ITN

use through an effective health education that support the global effort of malaria eradication (WHO, 2012; Wekere, et.al. 2020; (Hambisa, et.al. 2018).

Insecticide found on the ITNs can be harmful. Perceived harmfulness of ITNs were major constraints to their use. A consistent finding reported in previous studies (Afolabi, et al. 2009; (Konlan, et a 2022). In this regard, the respondents had a favorable attitude toward the use of ITN. These findings agree with other reports which assert for children less than five years of age, that the correct use of ITN save lives in sub-Saharan Africa.

Understanding people's perceptions of ITNs is an important determinant of success in malaria prevention programs that have ITN use as its central focus (Nkoka, et al. 2018). Therefore, this study identifies mothers' perceptions on the use of ITN by their children to be positive. As such, negative perceptions do not translate well in the world of malaria prevention. This finding is supported by another study, which compared the efficacy of ITNs to other ITNs and observed that very few negative comments were made about nets (Linn, et al. 2019; Brieger et al., 1996).

Health message is used to provide not only evidence-based information but targeted knowledge that can address malaria information deficit. Health educators can also be used to discredit the belief in alternative causes of malaria and other incorrect malaria knowledge (Ahorlu, et al. 2019; Arogundade et al., 2011). Additionally, the study reported that correct ITN use prevent malaria related morbidity and mortality, as such proper ITN use is an effective malaria prevention measure.

5.0 Conclusions

The study assessed the practice of ITNs used among the mothers of children under the age of five attending Matsango Primary Healthcare Centre in Azare town, Katagum LGA of Bauchi state. The study found ITNs to be effective malaria prevention tool, particularly among children, if used correctly. The study has furthermore identified that the use of ITNs in the study area is a clear indication that malaria prevention program needs to be intensified for a maximum output. As such, based on the observed wide use of ITNs in the study area, achieving Roll Back Malaria and other elimination goals is within reach. Also, to keep the threat of mosquitoes and other insects on children under the age of five, in check; policies targeting the reduction in malaria related morbidity and mortality, should consider not only availability and accessibility to ITNs by the households, but advocacy on its proper use.

Acknowledgements

The authors appreciate the contributions of all those that help in one way or the other, in ensuring the successful conduct of this study.

Declaration of conflict of interest

No conflict of interest to be declared.

References

Abdulla, S., Schellenberg, J.A., Nathan, R., Mukasa, O. Marchant, T., Smith, T et al. (2011). Impact on malaria morbidity of a program supplying insecticide treated nets in children aged under 2 years inTanzania: community cross sectional study. BMJ Volume 322, 3

Ahorlu, C. S., Adongo, P., Koenker, H., Zigirumugabe, S., Sika-Bright, S., Koka, E., Olapeju, B. (2019). Understanding the gap between access and use: a qualitative study on barriers and facilitators to insecticide-treated net use in Ghana. Malaria journal, 18(1), 1-13.

Adongo, P.B., Kirkwood, B and Kendall C. (2005). How does local community knowledge about malaria affects insecticide-treated net use in northern Ghana. *Tropical Medicine & International Health*, 10:366–378.

Afoakwah, C., Nunoo, J., and Andoh, F.K. (2015). Effect of insecticide-treated bed net usage on under-five mortality in northern Ghana. Malar J. 14:309

Afolabi, B. M., Sofola, O. T., Fatunmbi, B. S., Komakech, W., Okoh, F., Oladele, Saliu O., Otsemobor, P., Oresanya, O. B., Amajoh, C. N., Fasiku, D and Jalingo, I., (2009). Household possession, use and non-use of treated or untreatedmosquito nets in two ecologically diverse regions of Nigeria – Niger Delta and Sahel Savannah. Malar J.; 8

Alaii JA, Van Den Borne H, Kachur SP, Shelley K, Mwenesi H, Vulule JM, Hawley WA, Nahlen BL, and Phillips-Howard PA. (2003). Community reactions to the introduction of permethrin-treated bed nets for malaria control during a randomized controlled trial in western Kenya. *American Journal of Tropical Medicine and Hygiene*, 68:128–133.

Annan, R. A., Gyimah, L. A., Apprey, C., Asamoah-Boakye, O., Aduku, L. N. E., Azanu, W., Edusei, A. K. (2021). Predictors of adverse birth outcomes among pregnant adolescents in Ashanti Region, Ghana. Journal of Nutritional Science, 10.

Arogundade ED, Adebayo SB, Anyanti J, Nwokolo E, Ladipo O, Ankomah A, Meremikwu MM: Relationship between care-givers' misconceptions and non-use of ITNs by under-five Nigerian children. *Malaria Journal* 2011, 10:170.

Asuquo, E. F., Edet, O.B., Sampson- Akpan, P.E., Duke, E., Nsemo, A.D. and Ajah, C.I. (2017). Utilization of insecticide treated nets among pregnant women and mothers with under five children in Ikotomin Community, Calabar, Nigeria. Global Journal of Pure and Applied Sciences Vol. 23, 167-175

Atkinson J-AM, Fitzgerald L, Toaliu H, Taleo G, Tynan A, Whittaker M, Riley I, Vallely A. (2010). Research Community participation for malaria elimination in Tafea Province, Vanuatu: Part I. Maintaining motivation for prevention practices in the context of disappearing disease. *Malaria Journal* 2010, 9:93.

Aung, P. L., Win, K. M., & Show, K. L. (2022). Utilization of insecticide-treated bed nets among pregnant women in Myanmar–analysis of the 2015–2016 Demographic and Health Survey. PloS one, 17(3), e0265262.

Balami, A. D., Said, S. M., Zulkefli, N. A. M., Norsa'adah, B., & Audu, B. (2018). Knowledge, motivation, self-efficacy, and their association with insecticidal net use among pregnant women in a secondary health centre in Maiduguri, Nigeria. Malaria journal, 17(1), 1-17.

Bauchi State (2013). Development Plan 2013-2015, Bauchi state government of Nigeria Pg1-2.

Binka, F.N., and Adongo P. (1997). Acceptability and use of insecticide impregnated bednets in northern Ghana. *Tropical Medicine & International Health*, 2:499–507.

Brieger WR, Onyido AE, Sexton JD, Ezike I, Breman JG, Ekanem OJ. (1996). Monitoring community response to malaria control using insecticide impregnated bednets, curtains and residual spray at Nsukka, Nigeria. *Health Education Research*, 11:133–145.

Cheng, B., Htoo, S. N., Mhote, N. P. P., & Davison, C. M. (2021). Association between biological sex and insecticide-treated net use among household members in ethnic minority and internally displaced populations in eastern Myanmar. PloS one, 16(6), e0252896.

Florey, L.S., Bennett, A., Hershey, C.L. Bhattarai, A., Nielsen, C.F. Ali, D. et al. (2017). Impact of Insecticide-Treated Net Ownership on All-Cause Child Mortality in Malawi, 2006–2010.

Am. J. Trop. Med. Hyg., 97(Suppl 3), 2017, pp. 65–75

Fru, P. N., Cho, F. N., Tassang, A.N., Fru, C. N., Fon, P. N., & Ekobo, A. S. (2021). Ownership and Utilisation of Long-Lasting Insecticidal Nets in Tiko Health District, Southwest Region, Cameroon: A Cross-Sectional Study. Journal of parasitology research.

Gimnig JE, Kolczak MS, Hightower AW, Vulule JM, Schoute E, Kamau L, et al. (2003). Effect of permethrin-treated bed nets on the spatial distribution of malaria vectors in western Kenya. Am J Trop Med Hyg;68(4 suppl):115–20.

Hambisa, M. T., Debela, T., Dessie, Y., & Gobena, T. (2018). Long lasting insecticidal net use and its associated factors in Limmu Seka District, South West Ethiopia. BMC public health, 18(1), 1-7.

Klu, D., Aberese-Ako, M., Manyeh, A. K., Immurana, M., Doegah, P., Dalaba, M., Ansah, E. K. (2022). Mixed effect analysis of factors influencing the use of insecticides treated bed nets among pregnant women in Ghana: evidence from the 2019 Malaria Indicator Survey. BMC Pregnancy and Childbirth, 22(1), 1-11.

Killeen GF, Smith TA, Ferguson HM, Mshinda H, Abdulla S, Lengeler C et al (2007) Preventing childhood malaria in Africa by protecting adults from mosquitoes with insecticide-treated nets. PLoS Med 4:e22

Kitua, A.Y., Smith, T.A., Alonso, P.L., Urassa, H., Masanja, H., Kimario. J, et al. (2007). The role of low level Plasmodium falciparum parasitaemia in anaemia among infants living in an area of intense and perennial transmission. Trop Med Int Health; 2:325-33

Konlan, K. D., Kossi Vivor, N., Gegefe, I., & Hayford, L. (2022). Factors associated withownership and utilization of insecticide treated nets among children under five years in sub-Saharan Africa. BMC public health, 22(1), 1-11.

Linn, S. Y., Maung, T. M., Tripathy, J. P., Shewade, H. D., Oo, S. M., Linn, Z., & Thi, A. (2019). Barriers in distribution, ownership and utilization of insecticide-treated mosquito nets among migrant population in Myanmar, 2016: a mixed methods study. Malaria journal, 18(1), 1-16.

Maung, T. M., Tripathy, J. P., Oo, T., Oo, S. M., Soe, T. N., Thi, A., & Wai, K. T. (2018). Household ownership and utilization of insecticide-treated nets under the Regional Artemisinin Resistance Initiative in Myanmar. Tropical medicine and health, 46(1), 1-8

Njumkeng, C., Apinjoh, T. O., Anchang-Kimbi, J. K., Amin, E. T., Tanue, E. A., Njua-Yafi, C., & Achidi, E. A. (2019). Coverage and usage of insecticide treated nets (ITNs) within households: associated factors and effect on the prevalance of malaria parasitemia in the Mount Cameroon area. BMC public health, 19(1), 1-11

Nkoka, O., Chuang, T.-W., Chuang, K.-Y., & Chen, Y.-H. (2018). Factors associated with insecticide-treated net usage among women of childbearing age in Malawi: a multilevel analysis. Malaria journal, 17(1), 1-16.

Ogunsanmi O, Essang A, Olaoye T, Solademi A, Makinde B. (2016). Insecticide Treated Nets Usage and Barriers Among PregnantWomen Attending AnteNatal Clinic in Ogun State, Nigeria. European Scientific J;12(30):67-78.

Omonijo, A., & Omonijo, A. O. (2019). Assessment of the status of awareness, ownership, and usage of long-lasting insecticide treated nets after mass distribution in Ekiti State, Nigeria. Journal of parasitology research.

Pooseesod, K., Parker, D. M., Meemon, N., Lawpoolsri, S., Singhasivanon, P., Sattabongkot, J., Phuanukoonnon, S. (2021). Ownership and utilization of bed nets and reasons for use or non-use of bed nets among community members at risk of malaria along the Thai-Myanmar border. Malaria journal, 20(1), 1-12.

Scott, J., Kanyangarara, M., Nhama, A., Macete, E., Moss, W. J., & Saute, F. (2021). Factors associated with use of insecticide-treated net for malaria prevention in Manica District,

Mozambique: a community-based cross-sectional survey. Malaria journal, 20(1), 1-9.

Sidiki, N. N., Payne, V. K., Cedric, Y., & Nadia, N. A. (2020). Effect of impregnated mosquito bed nets on the prevalence of malaria among pregnant women in Foumban Subdivision, West Region of Cameroon. Journal of parasitology research.

Snow, R. W., Craig, M., Deichmann, U and Marsh, K. (1999). Estimating mortality, morbidity and disability due to malaria among Africa's non-pregnant population. Bull World Health Organ. 77: 624–640.

Taremwa, I. M., Ashaba, S., Adrama, H. O., Ayebazibwe, C., Omoding, D., Kemeza, I., Hilliard, R. (2017). Knowledge, attitude and behaviour towards the use of insecticide treated mosquito nets among pregnant women and children in rural Southwestern Uganda. BMC public health, 17(1), 1-8.

Teh, R. N., Sumbele, I. U. N., Meduke, D. N., Nkeudem, G. A., Ojong, S. T., Teh, E. A., & Kimbi, H. K. (2021). Insecticide-treated net ownership, utilization and knowledge of malaria in children residing in Batoke–Limbe, Mount Cameroon area: effect on malariometric and haematological indices. Malaria journal, 20(1), 1-13.

Toé L, Skovmand O, Dabiré K, Diabaté A, Diallo Y, Guiguemdé T, Doannio J, Akogbeto M, Baldet T, Gruénais M-E. (2009). Decreased motivation in the use of insecticide-treated nets in a malaria endemic area in Burkina Faso. *Malaria Journal*, 8:175.

Uhomoibhi, P., Okoronkwo, C., Ajayi, I. O., Mokuolu, O., Maikore, I., Fagbamigbe, A., Kawu, I. (2022). Drivers of long-lasting insecticide-treated net utilisation and parasitaemia among under-five children in 13 States with high malaria burden in Nigeria. PloS one, 17(5), e0268185.

Wekere, F. C. C., Kua, P. L., Kalio, D., & Iwo-Amah, R. S. (2020). Assessing the awareness, ownership and utilization of insecticide-treated bed nets amongst antenatal clinic attendees: a tertiary hospital-based study. Asian Research Journal of Gynaecology and Obstetrics, 3(1), 21-29.

World Health Organization (WHO) (2012). World malaria report 2012. Geneva, Switzerland: World Health Organization.

Ye Y, Patton E, Kilian A, Dovey S, and Eckert E. (2012). Can universal insecticide-treated net campaigns achieve equity in coverage and use? The case of northern Nigeria. *Malaria Journal;* 11:32.

Yirsaw, A.N., Gebremariam, R.B., Getnet, W.A., and Mihret, M.S. (2021). Insecticide-treated net utilization and associated factors among pregnant women and under-five children in East Belessa District, Northwest Ethiopia: using the Health Belief model. Malaria journal, 20(1), 1-12.