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INSECTICIDE TREATED BED NET OWNERSHIP AND UTILIZATION IN HOUSEHOLDS OF UNDER-FIVE CHILDREN IN MALARIA ENDEMIC AREAS IN NUH, HARYANA

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ABSTRACT Context:	Vector control is an effective way to prevent and reduce malaria transmission. If coverage of			

Insecticide Treated Bed Net within a specific area is high enough (>80%), then a measure of protection will be conferred across the community. **Aims:** To describe the ownership and utilization of Insecticide Treated Bed Net in households of under-five children in rural areas. **Settings And Design:** The study was community based cross sectional study. Methods and Material: The final analysis was done on 440 households of under-five children. The mothers were interviewed with pre-designed, pre tested, semi-structured schedule. **Statistical Analysis Used:** The data were analyzed using Epi-Info. Descriptive statistics were used to summarize variables. Bivariate analysis and comparisons of proportions between groups were analyzed using chi square (χ 2) at 95% confidence interval (CI). **Results:** Out of 440 households, 305 household (39.3%) in which under-five children slept under LLIN. Following explanatory variables were statistically associated with under-five children slept under LLIN in the previous night: household belonging to nuclear family (OR = 1.92; CI [1.20-3.07]); Mothers received malaria prevention and control message in past month (OR = 1.65; CI [1.11-2.45]); Mothers knew benefits of bed net in the prevention of malaria (OR = 2.56; CI [1.33-4.89]). **Conclusions:** Communication programme with special focus on mothers for utilization of bed net should be well planned and implemented to achieve elimination of malaria from India by 2030.

KEYWORDS : Insecticide Treated Bed Nets, mosquito control, malaria elimination, Implementation.

INTRODUCTION

Malaria is caused by Plasmodium parasites. The parasites enter the human body through the bites of infected female Anopheles mosquitoes, called "malaria vectors".^[1] In 2019, there were 229 million cases of malaria world wide and estimated 0.4 million malaria related death and nearly half of the world's population was at risk of malaria. The population groups who are at high risk of contracting malaria and developing severe malaria include infants, children under-five years of age, pregnant women and patients with HIV/AIDS, as well as nonimmune migrants, mobile populations and travellers. Children aged under-five years accounted for about one third of all malaria deaths worldwide.^[2]

Even though death due to malaria has been drastically reduced due to the effects of malaria control activities, malaria is still a major public health problem in India with nearly half a million reported cases annually, of which nearly 50% cases were due to P.falcipuram. As per epidemiological report of malaria in the year 2018, Annual Parasite Incidence (API) of the Nuh (Mewat) (API = 1.42) was higher than of Haryana (API=0.11).^[3]

A study conducted in Nuh (Mewat) district found the following reasons for high incidence of malaria due to environmental factors which favour the breeding of mosquito such as perennial ponds, canals, low lying areas with the seepage of water due to high water table in the vicinity of villages and majority of houses having cemented water tank. Abundance of An. culicifacies and An. Stephensi were also found in the study area.^[4]

Until a suitable vaccine found, vector control is an effective way to prevent and reduce malaria transmission. If coverage of vector control interventions within a specific area is high enough (>80%), then a measure of protection will be conferred across the community.^[5]

Although different methods of preventing mosquito bites are currently in use, the one that received most attention and is insecticide impregnated bed net. Generally made of nylon, polyester, or cotton, these coverings are most often treated with permethrin, although deltamethrin and lambdacyhalothrin are also utilised. Insecticide Treated Net (ITN) offers double protection; not only does it safeguard the people inside the net, but it also kills the insect.^[6]

Long Lasting Insecticidal Nets (LLIN) are mosquito nets which have the insecticide incorporated in their fibre. Currently, an LLIN is expected to retain its biological activity for at least 20 standard WHO washes under laboratory conditions and 3 years of recommended use under field conditions. LLIN is more cost-effective than distribution of conventional bed nets and treating them with insecticide once or twice a year.^[7]

In the past, lapses in the intervention coverage and utilization have caused major epidemics of malaria with increased sickness and substantial loss of life. India also experienced resurgence event in the past due to technical and operational challenges in the past. The review of major resurgence of malaria were attributed at least in part to the weakening of malaria control programme for a variety of reasons.^[8]

Household surveys are used to estimate the following main indicators of ITN ownership and utilization: Net use (i.e. the percentage of a given population group that slept under an ITN the night before the survey); ITN ownership (i.e. the percentage of households that owned at least one ITN); Percentage of households with at least one ITN for every two people.^[5]

Numerous individuals, household, community factors affect the possession and utilization of ITN. Median distance to health facility was greater among households that did not possess ITNs and did not use an ITN the previous evening.^[10] Israel *et al* found the following barriers to the utilization of LLIN such as heat, reactions to the chemicalls and unpleasant odour. $^{\scriptscriptstyle (11)}$

Obembe et alfound 85 percent LLIN ownership and 37 percent utilization in the previous night.^[12] In a study conducted in Zambia, it was found that children and adolescents were less likely to sleep under LLIN.^[13]

In 2017, there were 1,74,000 Long Lasting Insecticide Treated Net were distributed in Nuh (Mewat) district with Domestic Budgetary Support (DBS) under National Vector Borne Disease Control Programme. In 2019, every house in the study area was distributed with at least two LLIN (The information regarding status of LLIN distribution from civil surgeon office, Nuh). Even though LLIN were distributed freely as part of mass campaign at a regular interval, LLIN must be hung by vulnerable population before they sleep to be effective in prevention and reducing transmission of malaria.

Census 2011 findings have shown that literacy rate of the Nuh district was low i.e., 54.1% (Males = 69.9%; Females = 36.6%).^[14] Knowledge of malaria prevention and utilization of malaria control practices might be low due to low literacy level in the community.

With this background, the present study was conducted among the households of under-five children to identify the ownership and utilization of LLIN in the study area and the factors related to it.

MATERIAL AND METHODS

Study Design, Duration And Setting

The study was a community based cross sectional study. The study was conducted among mothers of under-five child, who were living in the villages of study area for more than 6 months and who were willing to participate. The data was collected from May to September 2019.

The Mewat (Nuh) district, as per latest census 2011, is constrained 4 tehsils, viz. Taoru, Nuh, Ferozepur Jhirka and Punhana. Nuh falls under the sub-tropical, semi-arid climatic zone with extremely hot temperature in summer. The annual rainfall varies considerably from year to year. Maximum rainfall is experienced during the monsoon season which reaches its peak in the month of July. The principal precipitation occurs during monsoon period from June to September when about 80% of the rainfall is received.

The study was carried out in areas under PHC Ujina because more than three fourth (80%) of the malaria cases in Nuh district were reported from this area in 2018 (source: Office of Civil surgeon, Nuh). PHC Ujina has total population of 72828 as per routine surveys by the field staffs i.e. multipurpose health workers / ASHA which spread over 22 villages under four sub-centers.

Sample Size And Sampling Technique

To have adequate sample size for the survey, assuming prevalence of under-five children slept under insecticide treated bed net as 50%, ^[15] confidence interval (CI) of 95%, and an acceptable absolute error of 5%, sample size was calculated to be 384. Hence for carrying out survey, a rounded figure of 440 was considered as final sample size to cover the assumed risk of non-responses up-to 10% among the selected study subjects.

Multistage random sampling technique was used for selection for study subjects. In first stage, two field areas of ASHA from each sub-centre were selected and in next stage 55 mothers from each field practice area of ASHA were selected randomly. Thus 110 mothers were selected from each subcentre to cover 440 mothers from 4 sub-centre. A total of three visits on different days were made to interview the study participants. If a study subject refused to participate in the study due to any reason or if, during the course of interview, she withdraws and leaves the interview in between, the subject was considered a non-respondent and was excluded from the final data analysis.

Data Collection Method

Ethical clearance for the study was obtained from the institutional ethics committee. Permission was also obtained from medical officer from Ujina PHC. Written informed consent was taken from all the study participant. The study participants were explained about the purpose of study and it was ensured to them regarding anonymity and confidentiality of data obtained from them. The participation in this study was voluntary. Study did not impose any kind of financial burden to the participants.

The data were collected on pre-designed, pre tested, semistructured interview schedule by the investigator. The first part of interview schedule was concentrated on demographic variables. Socioeconomic status was assessed on the basis of Modified B G Prasad Scale^[16] (Consumer Price Index, May 2019). The second part of interview schedule was designed to capture ITN ownership, utilization in the household and factors related to it.

Operational Definition

Insecticide Bed Net: It includes either bed net treated with Insecticides or Long lasting Insecticide Net Full Utilization for under-five: If all under- five children of the household slept under LLIN in the previous night of the day of the day of survey, the household was considered to have full utilization of LLIN for under-five children.

Data Management And Statistical Analysis

The collected data were entered on an Excel spreadsheet and cleaned. During the data collection process, periodic quality checks of collected data were done. The quantitative variable was summarized using mean (Standard Deviation) and median (Inter Quartile Range). The qualitative variable were summarized using frequency and proportion. The data were analyzed using Epi-Info version 7.2.2.16 (Centers for Disease Control and Prevention, Atlanta, GA). Bi-variate analyzed using chi square (χ 2) at 95% confidence interval (CI). The association between under-five children slept under insecticide bed net and explanatory factors were assessed using odds ratio (OR). The statistical level of significance was set at P <0.05.

RESULTS

Characteristics Of Study Subjects

In total, 440 households were visited in 22 villages under 4 subcentre covering 3066 individuals including 728 under-five child. Of the total 440 study subjects (mother of under-five children) interviewed in the study area, 35.9% study subjects (158/440) were in the age group 21-25 years. The median age of study subjects was 26 years (IQR: 23-32 years). Of 440 households, 74.8% belonged to Muslim religion (329/440) and 25.2% belonged to Hindus (111/440). Of total households, 66.8% study subjects (293/440) were illiterate and 99.8% (439/440) were home maker. More than four fifth of household (373/440) were living in Pucca house. Three fourth study subjects (330/440) family belonged to nuclear family. The mean family size of study subjects was about 7 members. Majority of the study subjects (62.5%) household came under Socioeconomic Status (SES) class IV according to Modified B.G Prasad classification (CPI 2019).

Owning Of Mosquito Net

Out of 440 households, 384 households (87.3%) possessed minimum of one mosquito net, 305 households (69.3%)

possessed minimum one ITN, 163 households (37.0%)								
possessed one ITN for every two family members (Fig 1). Out of								
384 household which owned bed net, 282 households								
obtained bed net from government (73.4%) (Fig 2).								

Utilization Of Mosquito Net In Previous Night

Out of 384 households which possessed mosquito net, 173 household in which mosquito net were not utilized in the previous night. Of the 163 households who were not utilizing the owned mosquito net, the reason for non-utilization told by study subjects were: using fan and cooler (n=138/163; 84.7 %); no mosquito in the house (n=68/163; 41.7%); due to hot weather (n=29/163; 17.8%), rash and irritation occurred when using mosquito net (n=12/163; 7.4%) and mosquito net in bad condition (n=11/163; 6.7%). Out of 440 households, less than half of households (n=173; 39.3%) in which under-five children slept under insecticide net (Fig 1).





Aassociations Between Selected Exposure Variable With Under-five Children Slept Under Insecticide Net In The Previous Night.

Statistically significant association (P < 0.05) was observed between under five children slept under insecticide net last night with: Nuclear family [odds ratio (OR)= 1.92; 95% Confidence interval (CI) = 1.20-3.07]; study subjects known about the benefits of bed net in the prevention of malaria [OR= 2.56; 95% CI = 1.33-4.89]; study subjects who received malaria prevention message in past one month [OR= 1.65; 95% CI = 1.11-2.45].

Table 1: Association between selected socio demographic and exposure variable with under-five children slept under insecticide bed net. n=440.

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Selected demographic	Under -5 children	Odds Rat (95% CI)	Ρ- value						
and exposure variable	slept in LLIN previous night	Yes (N=173) n (%)	No (N=267) n (%)						
Level of education									
Illiterate Literate	124(43.3) 49(33.3)	169(57.7) 98(66.7)	1.47 (0.97- 2.21) (Ref)	0.06					
Type of family									

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s (37.0%)	Nuclear	142(43.0)	188(57.0)	1.92(1.20-	0.00*			
g 1). Out of	Joint family	31(28.2)	79(71.8)	3.07)				
useholds	_			(Ref)				
	SES							
o net, 173 ed in the t utilizing on told by 3; 84.7 %) lue to hot rred when net in bad less than under-five	Lower class	136(40.8)	197(59.2)	1.30 (0.82-	0.24			
	Middle and upper			2.05)				
	class	37(34.6)	70(65.4)	(Ref)				
	Study subject known about bite of mosquito as route of transmission of malaria							
	Known	161(39.8)	244(60.2)	1.26 (0.61-	0.52			
	Not known	12(34.3)	23(65.7)	2.61)				
				(Ref)				
	Study subject knew benefits of mosquito net in the prevention of malaria							
	Known	160(42.0)	221(58.0)	2.56 (1.33-	0.00*			
	Not known	13(22.0)	46(78.0)	4.89)				
N				(Ref)				
e Net; five	Study subject who received malaria prevention message in past month							
	Yes	110(44.5)	137(55.5)	1.65 (1.11-	0.01*			
	No	63(32.6)	130(67.4)	2.45)				
267 (60.7%)				(Ref)				
-	*statistically significant							

DISCUSSIONS

The present study estimated the ownership and utilization of insecticide bed net and identified the factors associated with it in the malaria endemic areas of Nuh district, Haryana. A significant determinant of insecticide bed net use is insecticide bed net ownership. Although LLIN was distributed once in 2017 and again in 2019 in the study area. In the present study, household with minimum of one LLIN was found to be 69.3% and household with one LLIN for every two family members was found to be 37.0%.

No matter how effective a mosquito net is in the laboratory, it cannot provide optimal protection unless it is used. In the study area, it was found less than half of households in which all under-five children slept under insecticide bed net. This finding is similar to other studies which also found less than 80% vulnerable population slept under mosquito bed net.^[11,12,18,19] Universal distribution of free nets is the reason for higher ownership of mosquito net in the study area but there was existing gap between receipt and utilization of LLIN. This finding of gap between ownership and utilization of bed net is similar to previous studies.^[11,12]

Obembe *et al* found that even in the household of LLIN users claimed to have experienced at least one malaria episode and mosquito bite because of inappropriate net use and net washing practices.^[12]

Regular usage of bed net every night depends on complex multilevel interactions between individual characteristics, household characteristics, social and cultural factors, community-level factors, aspects of the physical environment and characteristics of the net itself.

In a study conducted in Zambia, the following factors were associated with LLIN use such as distance from health facility, presence of mosquito, during rainy season and households with three or more nets.^[13]

A qualitative study found that future communication message for long term LLIN use should capitalize on the non-malaria benefits of net use that provide a long-term rationale for consistent use even when the immediate threat of malaria transmission has been reduced.^[17] Lower socioeconomic status appeared to be directly associated with bed net use in some studies.^[18,19] Baume *et al* found the following predictors of higher net use such as shape of bed net, colour of net, new nets, nets with few holes, purchased net, net density.^[19]

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In nuclear family, under-five children may have better access to bed net in the present study. The important factors for underfive children to sleep under insecticide net found by the present study were mother perception about benefits of bed net in the prevention of malaria and mother who received malaria prevention message in past one month. Graves *et al* also found increased net use was associated with: fewer nets with holes; increasing net density; increased women malaria knowledge.⁽²⁰⁾

Graves et al also found decline in net use was observed, despite increased in overall net ownership over time.^[20] As transmission and perceived risk decline, LLIN access and use need to be maintained with continued education and distributions.

The strength of this study is the adequate sample size of study subjects, probability sampling technique and communitybased study to have the meaningful conclusion.

Limitations

The present study has some of the following limitations. The cross-sectional design provides information about a particular point in time, but it is unable to determine rates of change in utilization of insecticide net. The data were collected by interviewing mothers of under-five children, so recall bias and social desirability bias are also possible. The factor for interrupted net use among regular net users were not explored in the present study.

CONCLUSION

Less than half of under- five children slept under insecticide bed net in the previous night which is far less than 80% target. Awareness campaigns can be planned and organized periodically to improve utilization of bed net in the community. Sensible and sustainable replacement of mosquito net should be planned and implemented instead of blanket mass distributions at predetermined intervals for the demand generation of bed net.

REFERENCES

- Government of India, National vector borne disease control programme, Ministry of Health & Family Welfare. Operational Manual for malaria elimination in India (version 1). India: NVBDCP; Directorate General of Health Services, Ministry of Health & Family Welfare, Government of India 2016. 236
- WHO. Malaria Fact Sheet [Internet]. Geneva: World Health Organization 2020 Nov [cited 2020 Dec 26]. Available from: https://www.who.int/newsroom/fact-sheets/detail/malaria
- Government of India, National vector borne disease control programme, Ministry of Health & Family Welfare. Malaria annual report 2018 [Internet]. New Delhi: National vector borne disease control programme 2018 [cited 2020 Jun 03]. Available from: https://nvbdcp.gov.in/Doc/Annual-Report-2018.pdf
- Nanda N, Singh SP, Prajapati BK, Ranjan K, Kar NP, Sharma SK, et al. Entomological determinants of malaria transmission in an epidemic prone area of District Nuh (Haryana state), India. J Vector Borne Dis 2017;54(4):334-40.
- WHO. Global Technical Strategy for Malaria 2016–2030 [Internet]. Geneva: WHO 2015 Jun [cited 2020 Jun 03]. Available from: https://www.who.int/ malaria/publications/atoz/9/789241564991/en/
- Heggenhougen K, Hackenthal V, Vivek Pramila. Behavioural and social aspects of malaria and its control. Geneva: WHO 2003; pl-2l4.
- WHO. Guidelines for monitoring the durability of long-lasting insecticidal mosquito nets under operational conditions [Internet]. Geneva: WHO 2011 [cited 2021 Feb 02]. Available from: https://www.who.int/malaria/ publications/atoz/9789241501705/en/
- Cohen JM, Smith DL, Cotter C. Ward A, Yamey G, Sabot OJ, et al. Malaria resurgence: a systematic review and assessment of its causes. Malar J [Internet] 2012 [cited 2021 Feb 02];11 (122): [about 17p]. Available from: https://malariajournal.biomedcentral.com/articles/10.1186/1475-2875-11-122
- WHO. World Malaria Report 2019 [Internet]. Geneva: World Health Organization 2019 Dec [cited 2020 Jun 03]. Available from: https://www.who. int/malaria/publications/world-malaria-report-2019/en/
- Larson PS, Mathanga DP, Campbell CH, Wilson MI. Distance to health services influences insecticide-treated net possession and use among six to 59 month-old children in Malawi. Malar J [Internet] 2012 [cited 2021 Feb 02]; 11(18). Available from: https://malariajournal.biomedcentral.com/ articles/10.1186/1475-2875-11-18#citeas
- Israel OK, Fawole OI, Adebowale AS, Ajayi IO, Yusuf OB, Oladimeji A, et al. Caregivers' knowledge and utilization of long-lasting insecticidal nets among under-five children in Osun State, Southwest, Nigeria. Malar J [Internet] 2018 Jun [cited 2021 Feb 02];17(231):1-9. Available from: https://www.ncbi.nlm.nih.

gov/pmc/articles/PMC6006692/

- Obembe A, Anyaele OO, Oduola AO. Lessons from the implementation of LLIN distribution campaign in Ilorin Kwara State, Nigeria. BMC Public Health 2014 [cited 2021 Feb 02]; 14(514):1-8. Available from: https:// bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-14-514
- Pinchoff J, Hamapumbu H, Kobayashi T, Simubali L, Stevenson JC, Norris DE, et al. Factors associated with sustained use of long-lasting insecticide-treated nets following a reduction in malaria transmission in southern Zambia. Am J Trop Med Hyg 2015;93(5):954–60
- Government of India, Census of India. Mewat District [Internet]. India: Office of the Registrar General & Census Commissioner, India, Ministry of Home Affairs, Government of India 2011 [cited 2020 Jun 03]. Available from: https://www.census2011.co.in/census/district/226-mewat.html
- Lwanga SK & Lemeshow S. Sample Size Estimation in Health Studies. A Practical Manual. Geneva, Switzerland: World Health Organization 1991.
 Pandev VK. Agaarwal P. Kakkar B. Modified BG Prasad Socio-economic
- Pandey VK, Aggarwal P, Kakkar R. Modified BG Prasad Socio-economic Classification, Update-2019. Indian J Comm Health 2019; 31(1): 123-25.
- Koenker HM, Loll D, Rweyemamu D, Ali AS. A good night's sleep and the habit of net use: perceptions of risk and reasons for bed net use in Bukoba and Zanzibar. Malaria Journal 2013;12(203):1-12.
- Kanyangarara M, Hamapumbu H, Mamini E, Lupiya J, Stevenson JC, Mharakurwa S et al. Malaria knowledge and bed net use in three transmission settings in southern Africa. Malar J 2018 Jan 19; 17(41):1-12.
- Baume CA, Franca-Koh AC. Predictors of mosquito net use in Ghana. Malar J 2011;10(265):1-6.
 Grane DM, Maandi JM, Human J, Catacham A, Cabao T, Mashar AW et al.
- 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. Malar J 2011;10(354):1-12.