



An Association between the Mosquito Nets and the Wealth Status: Public Health Promotion Planning and Intervention

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ABSTRACT

The Government of Nepal (GoN) has approved the Malaria Strategic Plan with the aim of 'Malaria free Nepal by 2025'. This study aimed to determine the factors associated with the mosquito bed nets and its determinants of the ownership with reference to the households' wealth status in Nepal. The study used the secondary data from the Nepal Demographic and Health Survey 2016. The households' characteristics were considered independent variables and ownership of the mosquito nets as the dependent variable. We used IBM SPSS Statistics 22 to analyse the data. The data showed that three fourths of the total households had such nets, where 80 percent were urban households as compared to 68 percent rural households, 95 percent from the Terai region of Nepal as compared to 34 percent from the mountain region, 91 percent were of middle income, as compared to 39 percent the poorest wealth status of households, 84 percent of households that had TV as compared to 66 percent of the households with no TV used the nets. The poorest households were 52 percent less likely to own the nets as compared to the richest households (a OR = 0.48, 95% CI: 0.39-0.60, $p < 0.001$). The wealth status of households, residence setting in terms of urban or rural area, and eco-belt migration history of the households, and households having radio and TV were significant predictors for the nets ownership. Special attention was paid by the government and policymakers to the poorest families, rural households, households in the mountain region of Nepal, and households having no radio and TV to meet the national target of the government plan with the use of public health promotion planning and intervention.

KEYWORDS: Malaria, mosquito net, wealth status, health promotion

INTRODUCTION

The mosquito nets have been found to be an effective protective measure to help prevent the spread of mosquito borne diseases (MBD), and vector borne diseases (VBD) including neglected tropical diseases (NTD) such as malaria, kala-azar, lymphatic filariasis (LF) and dengue. About half of the population throughout the world are at risk from malaria only (Adedokun & Uthman, 2020; Okumu, 2020; Pates & Curtis, 2005). The World Health Organization (WHO) projected almost all (some 85% of the total population) needed some type of intervention for NTD in the South-East Asian Region (World Health Organization, 2019a). The mosquito net is considered as an effective, sustainable, side-effect instrument to protect from MBD, VBD and NTD as compared to the application of repellents to the skin, mosquito coil, indoor residual spraying, smoking room and use of liquid mosquito vaporiser (household insecticide). The insecticide treated the mosquito net can reduce malaria cases by 50 percent which further depends on the proper use of the net. It is further claimed that malaria can be eliminated if at least 75 percent of population use the net (Agusto et al., 2013). NTDs are closely associated with the socio-economic condition (Mitra & Mawson, 2017; Winkler et al., 2018). The people of poor or low socio-economic status is associated with the prevalence of NTDs where people may not have access to nets (Hotez et al., 2020). Interestingly, the mosquito net is not only a protective measure only for MBDs/VBDs but also for snake bites including other crawling creatures (Chappuis et al., 2007; Mallik et al., 2017). However, people can only use the mosquito nets if they have them in their homes.

MBDs are generally neglected tropical diseases and a limited attention to these serious health risks has been given by the policy makers and the government (Awasthi et al., 2022; Bayas et al., 2022). The government of Nepal has approved a National Malaria Strategic Plan (NMSPP) 2014-2025 which aimed to attain a "Malaria Free Nepal by 2025". On the other side, 18 districts are identified as kala-azar endemic districts (Department of Health Services, 2019). Likewise, the government has set a goal that no person would suffer from LF (Dengue). Dengue was first detected in Nepal in 2005, by the fiscal year 2017/18. Dengue cases were reported in 28 districts of Nepal and the government set a goal to control mortality and morbidity due to dengue. However, one-fourth of all households did not have the mosquito nets, nearly one third of the households in rural areas, and one fifth of the households in urban areas had no mosquito nets. On the other hand, almost all (95% and 96%) households from Terai, Madhes and Janakpur, and 91 percent of households having the middle level wealth status in Nepal had the mosquito nets (Ministry of Health et al., 2017).

The WHO showed that 72 percent of the households had access to at least one insecticide treated bed net and 56 percent of the total population had access to the mosquito nets, but only 40 percent households had enough access to the mosquito nets in Sub-Saharan Africa. The WHO further estimated that about 8,228 million people were being infected by malaria alone in South East Asia and throughout the world respectively (World Health Organization, 2019b). The latest economic survey shows that one out of six (16.67%) of the Nepal national population are still living below the poverty line (Ministry of Finance, 2021). The households having poor housing conditions, low socioeconomic status, migratory behaviour and failure to use the mosquito nets lead to increased MBD and NTD (Wijeyaratne et al., 2004). Different types of mosquito nets such as insecticide-treated mosquito nets and long lasting insecticidal (bed) nets have been used by people to reduce the contact between infectious agents and susceptible hosts (Buonomo & Marca, 2017).

Various studies have been conducted about malaria and other tropical diseases, but limited studies have been conducted about the ownership of the mosquito nets, with no

studies publishing studies on this topic found concerning this important health promotion issue that were conducted in Nepal (Bawuah & Ampaw, 2021; Konlan et al., 2022; Polec et al., 2015). This study aimed to determine (i) the factors associated with the mosquito net use and (ii) the determinants of ownership of mosquito nets with reference to the households' wealth status in Nepal.

METHOD AND MATERIALS

The study used the secondary data from the Nepal Demographic and Health Survey [NDHS] 2016. The authors had no influence upon the data collected and the survey design. All methodological procedures and other details about the NDHS can be obtained from the NDHS 2016 report and the raw data are also available publicly. The survey was designed to collect quantitative information from households in Nepal from household members.

Research Design

The study used a cross-sectional design using the secondary data from a nationally representative survey conducted in 2016/17 in Nepal. The researchers' extracted data from the NDHS carried out by NEW ERA, supported by IFC and USAID under the aegis of the Ministry of Health of Nepal. It was the fifth survey of its type that has been conducted every five years since 1996. The NDHS 2016 included various households and household members' information related to the sustainable development goals with the numbers 2, 3, 5, 6, 7, 8, 16 and 17.

Sample and Sampling Procedure

The NDHS was a nationally representative sample survey; therefore, all households throughout the nation served as the population frame, and multistage random sampling was applied to determine the sample on the basis of an updated sampling frame from the National Census and Household Survey 2011. Some changes have been made since the implementation of the Constitution of Nepal 2015, especially regarding the political map. Nepal constitutes seven provinces replacing five developmental regions, 77 districts from 75, almost all districts have both *Gaupalika* [rural municipality] and *Nagarपालिका* [urban municipality] with wards as the smallest unit. The average size of a ward was 799 and there were 104 households, respectively, in *Nagarपालिका* and *Gaupalika* (Ministry of Health et al., 2017). Therefore, the sampling frame has been changed as per the new political boundaries of rural and urban areas. The survey used a stratified multistage sampling method to ensure the representativeness. Two and three stage sampling methods were applied in *Gaupalika* and *Nagarपालिका* regions, respectively, because *Nagarपालिका* had more households than *Gaupalika*. There were enumeration areas established by the Census of Bureau of Statistics (CBS) in each of the wards of *Gaupalika* and *Nagarपालिका*. A total of 14 sampling strata were established in every province, including both *Gaupalika* and *Nagarपालिका*. In the first multistage sampling step, 383 wards were selected applying the population proportional to ward size method. Then, 30 households were selected from each cluster applying an equal probability systematic sampling technique. Details about the sampling techniques can be obtained from the NDHS 2016 report that is freely available. In this way, a total of 11,490 households were selected for the study, but data were obtained from 11,040 households. Details about the sample distribution are presented on Table 1 (Ministry of Health et al., 2017).

Table 1
Population, Sample Size, and Sample Distribution

Particulars	Population and sample distribution							Total
	1	2	3*	4**	5***	6#	7##	
Province								
Households	992374	932308	1270797	576870	882818	302093	469971	5427901
Wards	5676	5824	5013	4055	4853	2922	3150	31493
Selected wards	57	56	58	52	56	52	52	383
Selected households	1710	1680	1740	1560	1680	1560	1560	11490

Note: * = Bagmati Province, ** = Gandaki Province, *** = Lumbini Province, # = Karnali Province, ## = Sudur Paschim Province

Survey Method

There were six different survey questionnaires in NDHS 2016. It was an extensive survey and covered 12 different demographic and health related topic areas, such as background characteristics, maternal and child health, knowledge about family planning and domestic violence (Ministry of Health et al., 2017). The household questionnaire consisted of household and household head's information such as age, and sex, caste, residence setting, migration history and household assets, including radio, TV and mosquito nets. The study included the household related information with reference to the households having the mosquito nets. This study, therefore, extracted only the household related data as per the study objectives. The survey questionnaire was tested in different geographical locations of Nepal. The tool was translated into Bhojpuri, Maithili and Nepali languages from English. Three districts, Bara, Sarlahi and Dhading were selected for pre-testing, respectively, for Bhojpuri, Maithili and Nepali. A survey team was deployed for pre-testing in these districts. The team carried out a survey as pre-test covering both urban and rural areas of the district. Subsequently, the survey team came back to Kathmandu and shared their experiences and modified the tools as per the survey evaluation data collected in the pre-test (Ministry of Health et al., 2017).

Data Collection

A total of 80 field staff members were deployed for the data collection phase with a close supervision. There were 16 enumerator teams and 16 supervisors. Each team had one supervisor, three female enumerators and one male enumerator. Some of the field staff members (enumerators) had the previous experience with the survey conducted by the NDHS. However, they were all trained for two weeks for essential/basic training and for another week for technical assessment beginning on 15 May 2016. These data collectors were appointed initially in Kathmandu under the close monitoring of trainers and quality controllers. After completion of field work in Kathmandu, they were asked to go back to the Kathmandu Office where they reported whether they had any problems or confusion with the survey conduction. They shared their field experiences with trainers and quality controllers. After the completion of data collection work in the Kathmandu valley, they were deployed in the respective districts. The time for data collection took about seven months starting on 19 June 2016, and ending on 31 January 2017 (Ministry of Health et al., 2017).

Data Processing

The enumerators collected data using computer assisted personal interviewing. There was a mechanism of data transfer directly to the New ERA Office, Kathmandu. Initially, quality controllers and statisticians inspected the data to reduce any

inconsistencies and errors/mistakes. Consequently, they edited the data as required. CSPro software was used for data entry as well as data editing process. Finally, data editing was performed by the DHS Program and was completed in the last week of February 2017.

Data Analysis

The socio-demographic features of households and household respondents, such as age, sex, residence setting, wealth status, migration and household assets were used as independent variables and households having mosquito bed nets was used as the dependent variable. Descriptive analysis was conducted, specifically examining frequencies and percentage of variables, bivariate analysis for the association between socio-demographic characteristics and households having mosquito bed nets, and multivariate analyses to evaluate the predictors to interpret the results. Variables that were observed as significant variance in chi-square test, except age and migration history, were further analyzed by binary logistic regression to determine the predictors. In logistic regression, two models were developed. In model I, wealth status and its association with households having a mosquito bed nets were examined. Consequently, in model II socio-demographic features of households were adjusted to wealth status. For the analyses of data, the statistical software IBM SPSS Statistics 20 was used.

Ethical Consideration

Ethical approval was obtained from Nepal Health Research Council (NHRC) after the survey protocol was reviewed by NHRC and the IFC Institutional Review Board. Permission was taken from the respondents before interviewing. Privacy and confidentiality were maintained as per the established research ethics. The standard operating procedures were followed to ensure ethical protection of respondents as well as to ensure the research following the NHRC guidelines (Nepal Health Research Council, 2011).

RESULTS

Characteristics of the Study Population

Of the total respondents, 31 percent were female and 69 percent male. Nearly two-thirds of the respondents belonged to the age group 25 to 54 years, while around six percent were between the ages 15 to 24 years. More than three-fifths (61%) of the respondents were from a municipal area. An equal proportion, i.e., 47 percent and 46 percent of the respondents were from hill and Terai areas, respectively. Similarly, nearly a fourth (23%) were from Bagmati Province and 18 percent each from Province 1 and 2.

About one in five (21%) respondents were from the richest socioeconomic category, followed by 20 percent from the poorest, poor, and rich, but 19 percent from the middle wealth status. More than half (54%) of the respondents had no migration history over the decade preceding the survey. More than a fourth (29%) of the total respondents had radio, more than half (52%) had TV, and 75 percent had mosquito bed nets at their homes.

Table 2

Respondents' and Households' Characteristics

Variables	Category	N	%
Head of household	Male	7581	68.7
	Female	3459	31.3
Age	15-24	625	5.7

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	25-34	2240	20.3
	35-44	2562	23.2
	45-54	2358	21.4
	55-64	1810	16.4
	65 and above	1445	13.1
Residence setting	Urban	6781	61.4
	Rural	4259	38.6
Eco-belt	Hill	5134	46.5
	Mountain	781	7.1
	Terai	5125	46.4
Province of respondents	Bagmati Province	2521	22.8
	Province 1	2004	18.2
	Province 2	2014	18.2
	Gandaki Province	1173	10.6
	Province 5	1793	16.2
	Karnali Province	619	5.6
	Sudur Paschim Province	915	8.3
Wealth category	Poorest	2234	20.2
	Poorer	2225	20.2
	Middle	2065	18.7
	Richer	2240	20.3
	Richest	2276	20.6
Migration history over a decade	No	5911	53.5
	Yes	5129	46.5
Having Radio	No	7811	70.7
	Yes	3229	29.3
Having TV	No	5346	48.4
	Yes	5694	51.6
Having mosquito net	No	2750	24.9
	Yes	8290	75.1
Total		11040	100.0

Association of Respondents and the Ownership of Mosquito Nets

The data showed that male headed households had more mosquito nets than female headed households, which accounted for 76 and 73 percent, respectively ($p < 0.01$). A higher proportion of respondents who belonged to the age group 45 to 54 years (77%) had the mosquito nets as compared to other age groups. Four out of five (80%) of the urban respondents had the mosquito nets as compared to more than two thirds (68%) of the rural respondents ($p < 0.001$). Almost all (95%) of the respondents from the Terai region had the mosquito nets as compared to 61 and 34 percent of hill and mountain respondents, respectively ($p < 0.001$). Likewise, almost all (96%) of the respondents from Province 2 and 83 percent respondents from Province 5 had the mosquito nets, but more than half (57%) of the respondents from the Karnali Province had no mosquito nets ($p < 0.001$). Interestingly, nine out of ten (91%) respondents from the middle wealth status had the mosquito nets at their homes, but more than three fifths

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(61%) of the respondents from the poorest wealth status group had no mosquito nets at their homes ($p < 0.001$). There was a negative association between households having radio and households having mosquito nets because, surprisingly, 76 percent of the respondents who had no radio had mosquito nets as compared to 73 percent of those who had radio ($p < 0.01$). However, TV and mosquito nets had a positive association. 84 percent of those who had TV had mosquito nets as compared to 66 percent of those who had no TV at their homes ($p < 0.001$).

Table 3

Percentage of Households with Mosquito Nets according to Background Characteristics

Variables	Categories	Have mosquito net		Total	
		No	Yes	Row %	No.
Household head**	Male	24.1	75.9	100.0	7581
	Female	26.6	73.4	100.0	3459
Age	15-24	27.1	72.9	100.0	625
	25-34	24.7	75.3	100.0	2240
	35-44	24.6	75.4	100.0	2562
	45-54	23.2	76.8	100.0	2358
	55-64	26.3	73.7	100.0	1810
	65 and above	25.8	74.2	100.0	1445
Residence setting***	Urban	20.2	79.8	100.0	6781
	Rural	32.4	67.6	100.0	4259
Eco-belt***	Hill	38.6	61.4	100.0	5134
	Mountain	66.0	34.0	100.0	781
	Terai	5.0	95.0	100.0	5125
Province of respondents***	Bagmati Province	32.1	67.9	100.0	2521
	Province 1	25.0	75.0	100.0	2004
	Province 2	3.7	96.3	100.0	2014
	Gandaki Province	27.7	72.3	100.0	1173
	Province 5	16.8	83.2	100.0	1793
	Karnali Province	57.3	42.7	100.0	619
	Sudur Paschim Province	42.2	57.8	100.0	915
Wealth category***	Poorest	60.7	39.3	100.0	2234
	Poorer	21.5	78.5	100.0	2225
	Middle	9.0	91.0	100.0	2065
	Richer	13.2	86.8	100.0	2240
	Richest	19.1	80.9	100.0	2276
Migration history over a decade	No	26.5	73.5	100.0	5911
	Yes	23.1	76.9	100.0	5129
Having radio**	No	24.2	75.8	100.0	7811
	Yes	26.7	73.3	100.0	3229
Having TV***	No	34.5	65.5	100.0	5346
	Yes	15.9	84.1	100.0	5694
Total		24.9	75.1	100.0	11040

Note: *** Chi square test significant at $p < 0.001$; ** = $p < 0.01$ and * = $p < 0.05$

Determinants of Mosquito Nets in Relation to Household Characteristics

The multivariate analysis showed nearly the same results in Model I and Model II. The wealth status of the household was a significant predictor for having the mosquito

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nets. The household having the middle level wealth status had almost 2.3 times more odds of having the mosquito nets as compared to the richest household (aOR = 2.29, 95% CI: 1.84 – 2.84, p<0.001). However, the poorest families were 52 percent less likely to have the mosquito nets at their homes as compared to the richest families (aOR= 0.48, 95%CI: 0.37 - 0.60, p<0.001). Data showed that the female headed households were seven percent less likely to have the mosquito nets as compared to the male headed households. The rural households had lower odds (aOR = 0.73, 95% CI: 0.64-0.82, p<0.001) of having the mosquito nets as compared to the urban households. The households in the mountain region had lower odds (aOR = 0.54, 95% CI: 0.45-0.64, p<0.001) whereas the households in Terai had higher odds (aOR = 9.28, 95% CI: 7.73-11.15, p<0.001) of having the mosquito nets as compared to the households located in the hill areas.

The households from Province 1 and Sudur Pashchim Province had lower chances of having the mosquito nets, which accounted for aOR = 0.78 (p<0.01) and aOR = 0.46 (p<0.001) respectively as compared to the households from Bagmati Province. The households having a migration history over a decade tended to be 25 percent more likely to have the mosquito nets as compared to the households having no history of migration over the past 10 years (aOR = 1.25, 95% CI: 1.12-1.40, p<0.001). In the same way, the households having radio were 1.16 times more likely to have the mosquito nets as compared to the households having no radio (aOR = 1.16, 95% CI: 1.04-1.31, p<0.05). Similarly, the households having TV had higher odds of having the mosquito nets as compared to the households having no TV (aOR = 1.51, 95% CI: 1.31-1.74, p<0.001).

Table 4
Adjusted Odds Ratio (aOR) and 95% Confidence Interval (CI) for Mosquito Nets

Variables	Categories	OR	95%		aOR	95%	
			Lower	Upper		Lower	Upper
Wealth category	Poorest	.153***	.134	.175	.480***	.386	.596
	Poorer	.863*	.746	.998	1.446***	1.186	1.764
	Middle	2.396***	1.994	2.879	2.285***	1.841	2.837
	Richer	1.546***	1.317	1.816	1.558***	1.302	1.863
	Richest (ref.)	1.00			1.00		
Sex	Male (ref.)				1.00		
	Female				.933	.830	1.048
Age	15-24 (ref.)				1.00		
	25-34				1.046	.824	1.328
	35-44				.901	.709	1.145
	45-54				1.026	.802	1.313
	55-64				.861	.668	1.109
	65 and above				1.073	.828	1.391
Residence setting	Urban (ref.)				1.00		
	Rural				.727***	.643	.821
Eco-belt	Hill (ref.)				1.00		
	Mountain				.537***	.449	.644
	Terai				9.281***	7.727	11.147
Province of respondents	Bagmati Province (ref.)				1.00		
	Province 1				.778**	.656	.923
	Province 2				1.213	.887	1.659
	Gandaki Province				1.132	.956	1.342

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	Province 5	.970	.801	1.176
	Karnali Province	.818	.663	1.008
	Sudur Paschim Province	.458***	.369	.568
Migration history over a decade	No (ref.)	1.00		
	Yes	1.249***	1.116	1.397
Having radio in household	No (ref.)	1.00		
	Yes	1.163*	1.037	1.305
Having TV in household	No (ref.)	1.00		
	Yes	1.507***	1.305	1.740

Note: *** Significant at $p < 0.001$; ** = $p < 0.01$; and * = $p < 0.05$

DISCUSSION

The household headship, residence setting and province of residence along with eco-belt, wealth status and access to radio and TV were significantly associated with the ownership of mosquito nets in the households. Additionally, wealth status, eco-belt, place of residence, migration history and access to radio and TV were found to be significant predictors for having the mosquito nets in the households. Moreover, the households from Province 1 and 7 appeared to have lower chances of having the mosquito nets as compared to those from Province 4 and households belonging to the middle wealth status had higher odds of owning the mosquito nets as compared to the richest and poorest households. A related study from Kenya showed that nearly one third (32%) households had no mosquito nets in the highlands region as compared to just two percent in the lowlands region (Santos et al., 2019), which was similar to the results found in this study that were two thirds (66%) of the households in the mountain region and just five percent in Terai had no mosquito nets in Nepal. Another study from Ghana showed different results that the poorest and rural households were more likely to use the mosquito nets (Ricotta, Oppong, Yukich, & Briët, 2019). In another study from Tanzania showed that the socio-economic status was significantly associated with an access to the mosquito nets, the households having the middle or above wealth status were about two times more likely to have the mosquito nets as compared to the households having the poorest wealth status (Mboma et al., 2018), which was the similar results from this study. Another study from Southern Africa showed contrasting the results that above half (55%) of the total households had an access to the insecticide-treated mosquito nets (Kanyangarara et al., 2018) as compared to three fourths (75%) in Nepal.

The households having an access to radio and television were found to be more likely to use the mosquito nets if they were exposed to the mosquito nets related messages from the mass media (Zalisk et al., 2019). In the same way, a qualitative study from Ghana showed that the socio-economic factors influenced the use of mosquito nets and an appropriate information from the healthcare providers and public officials encouraged the use of mosquito nets. The housing conditions and weather conditions also have been found to contribute to the regular use of mosquito nets (Aberese-Ako et al., 2019). A vast majority (86%) of the households in western Kenya were found to have had at least one mosquito net (Ndenga et al., 2016). Similarly, about nine out of ten (91%) households near Lake Victoria, Kenya had at least one mosquito net (Okoyo et al., 2015) which was a higher percentage when compared to the NDHS 2016 data (75%) and the prevalence of malaria infection was lower among those who used the mosquito nets in both studies. A study conducted in Morang, Nepal, showed that almost all households had the mosquito nets, but just nine percent had no hole in the net. Similarly, four percent households had the mosquito nets with at least one hole and 25 percent had at

least three holes in the net (Thapa et al., 2018). Such an instance shows that merely having the mosquito nets does not assure a proper application and protection as well. Another study from Mali showed that only three percent households had no the mosquito nets and 82 percent of the household members slept under the mosquito nets (Storey et al., 2018). These studies showed the variation of mosquito nets and applications.

Studies from Zimbabwe and Zambia showed that 75 percent of the households had at least one mosquito net at their home and more than half (55%) of the population had an access to the insecticide-treated mosquito nets; however, only about half (49%) slept under the insecticide-treated mosquito nets (Kanyangarara et al., 2018). Different socio-demographic features were significantly associated with the use of the mosquito nets in Nigeria (Balogun et al., 2018). A Nigerian study showed that 26 percent of older people (aged more than 50 years) used the mosquito nets during sleep while age, sex, residence setting, educational and economic status were identified as significant predictors for using the mosquito nets. Interestingly, people having the highest socioeconomic status had lower odds of using the mosquito nets while sleeping (Balogun et al., 2018) which was not the similar results from Zambia and Zimbabwe (Kanyangarara et al., 2018). The evidence showed the controversial results in different times and places, suggesting that the health promotion interventions to increase the mosquito nets should not be used universally across populations, but should be guided by data collected from specific intended audiences (Kreps & Sivaram, 2008).

A vast majority (86%) of the population had the mosquito nets while 68 percent households had enough the mosquito nets in Uganda which was more than this study in Nepal, where two thirds (65%) of the respondents had used the mosquito nets during sleeping every night (Perkins et al., 2019). The highest household wealth quintiles had higher odds of using the mosquito nets while sleeping as compared to the lowest ones (Perkins et al., 2019). A study in Madagascar showed that 66 to 83 percent households had the mosquito nets in the households (Meekers & Yukich, 2016). The urban households were more likely to have the mosquito nets as compared to the rural households, which was a similar trend found in this study in Nepal. The study further showed that the wealthiest households were more likely to have the mosquito nets as compared to the poorest households, which is also similar to the findings in this study (Meekers & Yukich, 2016). More than half (51%) to 88 percent of households had the mosquito nets in different seasons, with most households having more the mosquito nets during the rainy season in Malawi. Interestingly, households having the lowest wealth status were more likely to sleep under the mosquito nets as compared to the middle and the highest wealth status in Malawi (Buchwald et al., 2016). Another study from Ethiopia showed that almost all (99.6%) pregnant women had the mosquito nets but 28 percent did not use the net while sleeping. The households having the incomes of more than \$150 in Malawi were more likely to use the mosquito nets while sleeping (Yitayew et al., 2018).

One study conducted in Southeast Nigeria showed that 72 percent households had at least one mosquito net. Interestingly, this study found that mass media campaigns had no positive effect on the use of mosquito nets and the study suggested the use of alternative community based intervention programs (Russell et al., 2015). Eight out of 10 caregivers (81%) of children in Nigeria had the insecticide-treated mosquito nets (Orji et al., 2018) which was higher than this study's findings in Nepal. The households having at least one mosquito net were six percent in 2003 and 90 percent in 2014. Consequently, two percent in 2003 and 67 percent in 2014 of household members used the mosquito nets while sleeping in Burkina Faso. Comparatively, the households having the poorest wealth status had less the mosquito nets as compared to the households having the

wealthiest status in the survey years and rural households had less mosquito nets as compared to the urban households (Samadoulougou et al., 2017). The results from this study in Nigeria showed the similar results to this study in Nepal. Similarly, the next study from Uganda showed that during the pre-distribution of the mosquito nets, one fourth of the households had at least one mosquito net. However, 73 percent of the households had the mosquito nets three months' post distribution. The poorest households were less likely to have the mosquito nets as compared to the households with higher wealth status (Clark et al., 2016). This result also supported the findings of this study in Nepal.

STRENGTHS AND LIMITATIONS OF THE STUDY

The study used the national representative data covering all provinces including rural and urban areas so that the findings of the study represent the nation as a whole. Bivariate and multivariate analyses were performed to ensure the associated and predictive factors for the mosquito nets. The study analyzed the quantitative variables only, so the qualitative aspects were missed since the survey was quantitative in nature. It would be useful to conduct in-depth qualitative studies with the key population representatives to guide the development of strategic health promotion programs to promote the mosquito nets in Nepal (Kreps, 2008, 2012). There may be recall and social desirability biases while collecting the data, which had no control over the data collection. The cross-sectional design was used; therefore, it is difficult to determine the root factors of the ownership of the mosquito nets. It would be valuable to conduct studies that track the adoption of the mosquito nets in Nepal over time, proxy measures of assets and consumption patterns were assessed to determine the household's wealth status, so there may be some weaknesses in categorizing the wealth quintiles. Limited variables that were available in the data sets of NDHS as well as the available literature were analyzed. Future research can build on the findings from this study to guide the design and implementation of evidence-based programs to promote the use of the mosquito nets in Nepal.

CONCLUSION

In conclusion, this study highlights the challenges faced by a significant portion of the Nepali population in accessing the mosquito nets. It is estimated that about half of the total population are at risk of malaria and about 85 percent of the world population need some type of intervention to help combat the risks of neglected tropical diseases. This study showed that still one fourth of the total population in Nepal did not have an access to the mosquito nets. The wealth status of the households was associated with the ownership of mosquito nets and was a significant predictor. The households having the poorest wealth status, female headed households, rural residence, households at mountain and hills, households from Karnali Province, the households having no migration history over a decade, and the households having no radio and TV were more vulnerable to the mosquito borne diseases including the vector borne diseases since they had a limited access to the mosquito net. These factors should be considered while policy planning to promote the public health in Nepal and used to guide the designing strategic health communication interventions by the government, policy makers and stakeholders to promote the goal of achieving malaria free Nepal through a universal access to the mosquito nets.

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