Factors Associated with the Use of Insecticide-Treated Nets Among Women of Reproductive Age in Mozambique, 2018

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Abstract

Background: In 2018 there were approximately 228 million diagnosed cases of malaria and 405,000 deaths. The use of insecticide-treated nets (ITNs) is one of the main malaria prevention interventions. Despite widescale distribution resulting in improved ITN access, use remains an important challenge. This study determined factors associated with the use of ITNs among women of reproductive age in Mozambique in 2018.

Methods: A secondary analysis of data from the 2018 Malaria Indicator Survey (MIS) was implemented. Women of reproductive age (15-49 years) from households with at least one ITN were included in the analysis. Appropriately weighted descriptive analysis of sociodemographic characteristics and univariate and multivariate logistic regression were performed to identify factors associated with ITN use. The highest frequency categories were used as reference variables for the variables age, province, type of place of residence and wealth quintile and the lowest frequency category was used for education level. Variables that had p-value <0.05 were considered statistically significant.

Results: Of 6,184 total women of reproductive age in the MIS, 5,587 women (90%) were in households with at least one ITN, of whom 88% (4,908/5,587) reported prior night use of ITNs. Most women were in the 15-19 age group of whom 81% (975/1,206) reported ITN use. The odds of ITN use were significantly higher in all other age groups compared to these women aged 15-19 years. The odds of ITN use were significantly lower in lower prevalence provinces in southern Mozambique. In adjusted analysis, there was no significant association between the odds of ITN use and malaria knowledge, exposure to malaria messages, literacy, or other sociodemographic variables.

Conclusions: Young women and those in southern Mozambique are demographic groups that would benefit from targeted communication interventions, along with those in rural areas where the burden of malaria is higher.

Introduction

Malaria is a major cause of morbidity and mortality in developing countries (1,2). According to the World Health Organization (WHO), in 2018 there were about 228 million diagnosed cases of malaria and 405,000 deaths from malaria worldwide, with 93% of cases and 94% of deaths occurring in the African region (3). In Mozambique, malaria is endemic, ranging from hyper-endemic areas along the coast, meso-endemic areas in the interior lowlands and some hypo-endemic areas in the interior highlands (4). Most of the country has year-round transmission with peaks during the rainy season from December to April. The main vectors of malaria are *Anopheles funestus* s.l. and *Anopheles gambiae* s.l. (5). *Plasmodium falciparum* is the most frequently detected parasite in infected people, accounting for more than 90% of all malaria infections, while *Plasmodium malariae* and *Plasmodium ovale* infections are seen in 9% and 1% of the infected population, respectively (6). While all populations are susceptible to malaria, there is a higher incidence among pregnant women and children under 5 years of age (2).

One of the main interventions recommended to protect against malaria is the use of insecticide-treated nets (ITNs) (2,7). Sleeping under an ITN is effective in reducing the incidence of malaria by limiting contact with potentially infected mosquitoes by combining a physical barrier with an effective insecticide that will ultimately kill the mosquitoes that made contact with the ITN's surface (2). A primary driver of ITN use is access and factors associated with their use can be divided into individual, household and community influences (8,9). At an individual level, these influences may include age, gender, level of education, degree of control over household decision-making, preference over type of net, knowledge and beliefs about malaria and perception of risk (10,11). Household factors include household size, household composition, and number of bedrooms (8). Community factors include level of urbanization, perceived norms, environmental conditions and the seasonality of malaria transmission (2,8). There are also factors that contribute to non-use of ITNs, such as social factors that make its use impractical, such as working at night (12,13).

Different areas in the world also have different socio-cultural beliefs which may influence use, for example in Loreto, Peru and before the advent of ITNs, the use of hammocks was already integrated into people's habits, as the villagers already slept under hammocks from the beginning, regardless of the season (13,14). And we also find regions where women play an important role in the acquisition, installation and decision making about which people should sleep under an ITN as is the case in Mali and Nigeria, unlike Timor-Leste where this responsibility is subject to the man, in this case the head of the family (15).

In Mozambique, the National Malaria Control Programme (NMCP) is responsible for policy development, planning and coordination of all malaria control activities within the country (16). In 2009, Mozambique officially adopted a policy of universal ITN coverage, defined as one mosquito net per two people (17). Strategies to achieve coverage have varied over time as there are challenges related to the use of appropriate algorithms to determine the number of nets needed for distribution, limitations in promotion of the use and appropriate replacement of old and torn nets, and limited understanding of local social norms and other determinants that contribute to higher ITN uptake and use (18,19). In 2016/2017 the NMCP led the first national ITN mass distribution campaign that disseminated nearly twenty million ITNs throughout the country. This campaign was accompanied by communication efforts to promote campaign participation and appropriate ITN use. In 2018, the Mozambique National Statistics Institute and the Mozambique National Institute of Health conducted the Malaria Indicator Survey (MIS) throughout the country in collaboration with the NMCP. The objective of this study was to describe the factors related to the use of ITNs among women of reproductive age in Mozambique in 2018.

Methodology

A cross-sectional, descriptive study was conducted using data from the 2018 MIS. During the cross-sectional survey, each province was stratified into urban and rural areas, resulting in 21 sampling strata. A standard Demographic and Health Surveys (DHS) methodology was used for data collection from January 2018 to December 2018.

Data were analyzed using STATA 16.1 (StataCorp LLC., College Station, Texas). The database consisted of 6,272 households, including 6,184 women of reproductive age (15-49 years) who responded as to whether or not they used ITNs the prior night. The indicator possession was considered for analyses for all women (5,587) who belonged to households that had at least one ITN. A descriptive analysis of socio-demographic characteristics (age, province, type of residence area, level of education and wealth quintile) was conducted to determine the frequency of women using ITNs in each category.

Complete knowledge of malaria was assessed for women who knew the causes, symptoms, prevention, and treatment of malaria and considered whether they had heard messages about malaria over a 6-month period.

To identify factors associated with ITN use in women of reproductive age, univariate and multivariate logistic regression models were used with prior night use of ITNs as the dependent variable. To ensure data representativeness, weighted or adjusted analyses, as recommended by the DHS, were used for descriptive statistics and univariate and multivariate logistic regression models. The highest frequency categories were used as reference variables for the variables age, province, type of place of residence and wealth quintile and the lowest frequency category was used for education level. Variables that had p-value <0.05 were considered statistically significant.

Results

Socio-demographic characteristics of women aged 15-49, Mozambique

A total of 6,184 women of reproductive age (15-49 years) from across Mozambique participated in the MIS, of whom 90% (5,587/6,184) belonged to households that had ITNs. These 5,587 women with household possession of ITNs were the study population for this analysis. Of these women, 88% (4,908/5,587) reported prior night use of the ITNs.

Among women in households with ITNs, the highest percent (22%) were 15-19 years old and this group had the lowest reported prior night ITN use (81%). The group of women aged 45-49 years represented 7% of the sample and 89% used ITNs the prior night. Prior night ITN use was lower among women from urban areas (36% of sample), with 85% of urban women reportedly using ITNs. Overall, 50% of participants had primary level of education, of whom 89% used ITNs the prior night. Women with tertiary level of education had the lowest reported use of ITNs with 80% reporting prior night use. Use was also lower in women from the highest wealth quintile with only 82% reported sleeping under ITNs as compared to 92% among women from the very low wealth quintile. Regarding literacy, 48% (2,682) of the women could not read any part of a sentence, of whom 90% reported using ITNs, while 39% could read the entire sentence and 84% of these women reported using ITNs. A total of 57% (3,193) of the women did not have complete knowledge about malaria, defined as correctly answering a series of malaria prevention and treatment questions. A total of 87% of women with incomplete knowledge reported using ITNs. With

regard to whether they had heard malaria messages about malaria in the last six months, 66% (3,679) of the women across the country reported that they had not heard messages about malaria in that period, of which 88% reported using ITNs. (Table 1)

Table 1
ITN use among women aged 15-49 years, by sociodemographic characteristics,
Mozambique, 2018 (N=5,587)

Characteristics	Use of ITNs	
	Yes %(n)	No %(n)
Age		
15-19	81% (975)	19% (231)
20-24	88% (1,023)	12% (141)
25-29	90% (827)	10% (96)
30-34	90% (633)	10% (71)
35-39	92% (552)	8% (48)
40-44	92% (549)	8% (48)
45-49	89% (349)	11% (45)
Province		
Niassa	91% (257)	9% (25)
Cabo Delgado	95% (399)	5% (19)
Nampula	94% (1,019)	6% (61)
Zambezia	94% (904)	6% (58)
Tete	83% (396)	17% (81)
Sofala	92% (479)	8% (40)
Manica	88% (343)	12% (48)
Inhambane	83% (329)	17% (68)
Gaza	73% (253)	27% (95)
Maputo Province	79% (317)	21% (83)
Maputo City	68% (212)	32% (100)
Type of place of residence		
Rural	89% (3,231)	11% (386)
Urban	85% (1,678)	15% (293)
Highest educational level		

	Use of ITNs	
Primary	89% (2,480)	11% (321)
Secondary	84% (1,305)	16% (240)
No education	91% (1,045)	9% (98)
Higher	80% (78)	20% (20)
Wealth index		
Poorest	92% (922)	8% (77)
Poorer	90% (915)	10% (101)
Middle	90% (947)	10% (111)
Richer	88% (1,035)	12% (145)
Richest	82% (1,089)	18% (245)
Literacy		
Cannot read at all	90% (2,424)	10% (259)
Able to read whole sentence	84% (1,832)	16% (342)
Able to read only parts of sentence	89% (645)	11% (78)
Blind/visually impaired	100% (6)	0
No card with required language	100% (2)	0
Complete knowledge		
Yes	89% (2,136)	11% (258)
No	87% (2,773)	13% (420)
In the past 6 months, saw or heard malaria messages		
Yes	88% (1,677)	12% (231)
No	88% (3,231)	12% (447)

Of the women in this analysis, 81% (4,522/5,587) reported having given birth to a child in the five years preceeding the survey, between 2013 and 2018. Of the total women who had children, 44% (1,985) had a one child during 2013-2018 of whom 90% reported using ITNs. Of the women who had antenatal care (ANC) visits, 72% (2,210) reported receiving an ITN at the first ANC visits and 91% reported using the ITNs. (Table 1)

Factors Associated With The Use Of Insecticide-treated Nets

The odds of ITN use were significantly higher across all age groups when compared to women aged 15-19 years old (reference group). Use of ITNs among women with household access was also significantly associated with province of residence. The adjusted odds of ITN use among women from the southern province of Maputo, a low malaria burden province, was significantly lower compared to women from Niassa province, a moderate malaria burden province. Women from the southern provinces of Maputo City, Maputo Province, Gaza, and Inhambane, had 0.16, 0.031, 0.22 and 0.40, lower odds of using ITNs when compared to Niassa province, respectively, and the differences were statistically significant. The moderate transmission province of Tete also had significantly lower ITN use (aOR=0.43 [0.27-0.70]; $p=0.001$). The adjusted odds of ITN use among women from highest burden province Cabo Delgado was 1.88 times greater compared to women from Niassa province (aOR=1.88 [1.09-3.23]; $p=0.023$). Rural women had 1.46 higher odds of reported use of ITNs when compared to urban women and the results in an unadjusted analyses were statistically significant (OR=1.46[1.09-1.96]; $p=0.012$), but after adjustment the differences were no longer statistically significant. (Table 2)

Table 2

Factors associated with the use of ITN by women aged 15-49 years, Mozambique, 2018 (N=5,587)

Use of ITN Yes/No	Univariate analysis		Multivariate analysis				
	Ref.	OR	IC-95%	<i>p-value</i>	a-OR	IC-95%	<i>p-value</i>
Age							
15-19	Ref.						
20-24		1.72	1.26-2.33	0.001	1.82	1.32-2.51	<0.001
25-29		2.03	1.46-2.84	<0.001	2.09	1.48-2.93	<0.001
30-34		2.11	1.57-2.82	<0.001	2.34	1.68-3.28	<0.001
35-39		2.73	2.03-3.68	<0.001	3.07	2.12-4.35	<0.001
40-44		2.73	1.90-3.93	<0.001	2.86	1.89-4.32	<0.001
45-49		1.83	1.26-2.68	0.002	2.07	1.35-3.17	0.001
Province							
Niassa	Ref						
Cabo Delgado		2.01	1.18-3.41	0.010	1.88	1.09-3.23	0.023
Nampula		1.63	0.86-3.11	0.134	1.51	0.80-2.87	0.206
Zambezia		1.53	0.82-2.85	0.184	1.46	0.76-2.78	0.252
Tete		0.47	0.30-0.76	<0.001	0.43	0.27-0.70	0.001
Sofala		1.15	0.64-2.09	0.637	1.04	0.56-1.96	0.894
Manica		0.69	0.41-1.18	0.176	0.65	0.38-1.11	0.113
Inhambane		0.47	0.26-0.86	0.015	0.40	0.21-0.76	0.006
Gaza		0.26	0.15-0.44	<0.001	0.22	0.12-0.41	<0.001

Use of ITN Yes/No	Univariate analysis		Multivariate analysis				
	Ref.	OR	IC-95%	<i>p-value</i>	a-OR	IC-95%	<i>p-value</i>
Maputo Province		0.37	0.22-0.60	<0.001	0.31	0.17-0.58	<0.001
Maputo City		0.20	0.13-0.31	<0.001	0.16	0.09-0.31	<0.001
Type of place of residence							
Urban	Ref.						
Rural		1.46	1.09-1.96	0.012	0.85	0.60-1.22	0.375
Highest educational level							
Primary		1.96	1.48-4.97	0.020	1.25	0.68-2.29	0.476
Secondary		1.38	0.80-2.40	0.249	1.29	0.75-2.22	0.344
No education		2.72	0.98-2.89	0.001	1.34	0.68-2.65	0.395
Higher	Ref.						
Wealth index combined							
Poorest		2.69	1.68-4.29	<0.001	1.18	0.61-2.26	0.622
Poorer		2.04	1.38-3.00	<0.001	1.05	0.57-1.91	0.882
Middle		1.93	1.29-2.87	0.001	1.09	0.64-1.86	0.735
Richer		1.60	1.16-2.24	0.005	1.22	0.85-1.75	0.282
Richest	Ref.						
Literacy							
Cannot read at all		1.75	1.31-2.33	<0.001	0.84	0.59-1.20	0.341
Able to read whole sentence		1.54	1.13-2.12	0.007	1.22	0.83-1.79	0.305
Able to read only parts of sentence	Ref.						

Use of ITN Yes/No	Univariate analysis		Multivariate analysis				
	Ref.	OR	IC-95%	<i>p-value</i>	a-OR	IC-95%	<i>p-value</i>
Blind/visually impaired		1	—	—	1	— —	—
No card with required language		1	—	—	1		
Complete malaria knowledge							
Yes		1.25	0.98- 1.59	0.062	1.10	0.90- 1.35	0.342
No	Ref.						
In the past 6 months, saw or heard malaria messages							
Yes		1.00	0.77- 1.31	0.978	1.05	0.79- 1.36	0.739
No	Ref.						

Despite significant univariate association, after adjustment for OR the difference in odds of ITN use by education, literacy, or socioeconomic class were not statistically significant. Similarly, there were non-significant differences in use by complete knowledge of malaria, and number of children. In univariate analysis, there was no association of reported ITN with having heard messages about malaria in the past 6 months or complete malaria knowledge. (Table 2)

Discussion

This analysis showed the impact of efforts of the Mozambique NMCP to improve access to malaria prevention through increased access to ITNs. Of all the women of reproductive age who participated in the 2018 MIS, 90% belonged to households that had at least one ITN, which exceeds the NMCP's target of “85% of households should have at least one ITN by 2022” (20). This marked increase in ITN access represents an important milestone in the fight against malaria, but underscores the need for high ITN use in order to reduce malaria transmission.

In Mozambique, relatively high use of ITNs has increased over time, but certain groups are still significantly less likely to report ITN use. Women in all age groups had higher (OR>1) odds of ITN use compared to young women (15-19 years old). Given that malaria is endemic throughout Mozambique with under five year of age prevalence exceeding two-thirds of all infections? in some parts of the country, ITN use is an important vector control intervention and this youth population is not sufficiently protected. Health services such as ANC services are an important source of ITNs and of malaria health information, but this younger population is less likely to access these services. As such, better access to positive

norms and information to support appropriate use of ITNs and address misconceptions about ITN use (21) are needed for youth. Lower ITN use in youth has been noted in various other settings (22). Young women in Mozambique are an important target for interventions to improve malaria behaviors to both improve their individual health outcomes and to reduce their role as a malaria reservoir. There is growing evidence of the roles that schools can play in influencing malaria understanding and fostering more positive ITN use norms (23). The expansion of such interventions might be an appropriate strategy in Mozambique to help improve ITN use.

This analysis also found that women in southern provinces were significantly less likely to report ITN use than women of moderate and higher transmission areas in central and northern Mozambique. This is perhaps explained by the fact that higher burden areas are the focus of most communication activities related to malaria control and prevention, allowing the population living there to have access to information on prevention. Populations in lower prevalence provinces and more urban areas may face specific barriers to ITN use such as a misconception that malaria is not common. For example, a study conducted at a research unit in Gabon interviewing people living in the town of Lambaréné found that poorest people living in houses with windows and doors often believed that they were sufficiently protected against mosquito bites and therefore did not make use of ITNs even though they have them in their homes (24). Additional research is warranted to explore barriers and facilitators to ITN use in lower transmission areas to inform and tailor communication efforts to improve usage.

Similar to other settings, in bivariate analysis, women without education and with a primary level education had higher odds of using ITNs than women with higher education. Nevertheless, these results were non-significant after controlling for potential confounders in multivariate regression. This suggests that level of education may not influence use in different provinces of Mozambique. This differs from research in other settings such as a study in Kinshasa, Democratic Republic of Congo, which reported that women who had general secondary education or higher were between three to four times more likely to have an ITN and two to eight times more likely to use an ITN in bed when compared to women with less education (21,25).

This analysis provided relevant results for understanding ITN usage in Mozambique and, importantly, showed non-associations between ITN use given access and variables such as socioeconomic status, complete malaria knowledge, and exposure to malaria messages. This underscores the need for SBC interventions that go beyond knowledge, but rather facilitate enabling environments and influence norms, particularly for younger women and those in lower burden provinces.

Limitations

Inclusion in this analysis was restricted to households with at least one ITN, however, it is possible that access was a barrier for certain respondents, such as women aged 15-19, as they were less likely to have received ITNs from ANC services. For households with insufficient ITNs, the household might have given preferential access to others, such as children.

Conclusion

This analysis of factors associated with ITN use among women with access showed that age and province were significantly associated use of ITNs. These results show the relevance of targeting malaria prevention messages to reach populations with lower ITN use such as younger women and those in lower burden settings. Most of the activities related to malaria control are targeted at rural and higher burden areas. Nevertheless, in settings such as Mozambique where malaria transmission is endemic and heterogeneous throughout the country, it is critical to appropriately target messages to improve ITN use and, in turn, continue to drive down transmission.

Abbreviations

ANC- Antenatal Care

aOR- Adjusted Odds Ratio

CDC- Centers for Disease Control and Prevention

DHS-Demographic and Health Survey

ICBH NIH - Institutional Committee on Bioethics for Health of the National Institute of Health

ICBH - National Committee on Bioethics for Health

CI- Confidence Interval

IRS- Indoor Residual Spraying

ITN- Insecticide-Treated Nets

MIS- Malaria Indicators Survey

NIH- National Institute of Health

NMCP- National Malaria Control Programme

OR- Odds Ratios

SBC- Social and Behavior Change

WHO- World Health Organization

Declarations

Ethics approval and consent to participate

The MIS 2018 protocol has been approved by the NIH Scientific Technical Committee, the Institutional Committee on Bioethics for Health of the National Institute of Health (ICBH NIH), by the National Committee on Bioethics for Health (NCBH) of Mozambique and by the ICF Institutional Review Board. All data and other information collected was kept confidential.

Consent for publication

Not applicable

Conflict of interest

The authors declare no competing interests

Availability of data and materials

All data generated or analysed during this study are included in this published article. The data analysed during the current study are not publicly available due to belonging to the demographic and health survey (DHS), but are available from the corresponding author upon reasonable request.

Disclaimer

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the U.S. Agency for International Development.

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Authors' contribution

Fabião Edumundo Maússe, responsible for data analysis, interpretation and manuscript writing. Erika Valeska Rossetto and Rose Zulliger helped design the evaluation methodology. All authors reviewed the analysis and contributed to manuscript development.

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Authors' information

Not applicable

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