Perceptions on use of insecticide-treated bed nets to prevent malaria: a qualitative assessment in two rural districts of Zambézia province in Mozambique

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Abstract

Background. Malaria prevention in Africa merits particular attention as the world strives toward a better life for the poorest. The insecticide-treated bed nets (ITNs) are one of the malaria control strategies that, due to their cost effectiveness, are largely used in the country. Data on the actual coverage and usage of bed nets is unreliable, as it is based only on administrative data from distributed ITNs.

Objective. This study assesses knowledge about malaria and bed net use in two areas of high malaria transmission.

Methods. A qualitative study was conducted in 6 (six) rural communities in two malaria high-burden districts in Zambézia province. About 96 adults were recruited from the communities and enrolled to participate in focus group discussions. Data were transcribed verbatim, coded, and thematically analyzed using Nvivo11.0.

Results. Participants mentioned the mosquito as the only cause of malaria and that the use of bed nets was highlighted as the most proficient protection against mosquito bites and malaria. Children and pregnant women were described as being the priority groups to sleep under a bed net protection in the household. The use of bed nets was common among households, although not sufficient for the number of household members. In addition, the preservation of the nets was considered inadequate.

Conclusions. The findings of this study highlight the need to increase public knowledge about malaria and nets and to strengthen the communication and logistics component of the net distribution campaign to ensure that households have enough nets for their members and use them appropriately.

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Introduction

Malaria continues to be a major public health problem in Mozambique.[1] It caused about 435,000 deaths between 2017 and 2018, with almost 60% being children under five years old.[2] In 2015, Zambézia province, the second most populous in the country, accounted for the highest number of malaria cases being classified as the malaria hotspot province with a prevalence of 68%.[3] The insecticide-treated bed nets (ITNs) strategy has been widely implemented in Mozambique due to cost-effectiveness. In the campaign of the year 2016, 3.193.976 insecticide-treated bed nets were distributed in Zambézia province only.[4] Despite the lack of information on the use of bed nets, the use and quality of bed nets are known as being poor in many regions of the country. The currently available data on coverage are unreliable as they are administrative data on distributed ITNs.

The use of ITNs is considered to be one of the most effective means to prevent malaria and provides significant protection for its users as a barrier to mosquito bites.[5,6] In the context of Mozambique, malaria's endemic country, 63% of the population lives in rural areas at high risk of malaria transmission.[4] Malaria is known as a disease of stable transmission. However, there are peri-

ods of transmission peaks generally associated with the rainy season.[7] The use of ITNs has been mostly promoted to protect people who are more susceptible to get malaria, especially children under 5 years old and pregnant women.[8] In recent years, Mozambique had an increase in pregnant women who make use of ITNs in their households.[1] In Mozambique, the INTs are distributed free of charge to pregnant women using two mechanisms: the first is a community-based campaign for universal coverage of families with at least one bet net for every two people; the second is the distribution of bed nets to pregnant women during antenatal care visits.[9,10]

Having an ITN in the household is an indicator that the channels of distribution of the Mozambican National Health System are allowing high coverage. Despite the National Malaria Control Programme (NMCP) reporting an increase in ITN coverage few data are reported about its usage and factors that may affect its conservation and durability.[8]

This study aims to describe the perceptions of Maganja da Costa and Lugela community members in Zambézia province on the possession and use of insecticide-treated bed nets and to explore the determinants for its use within the community.

Materials and Methods

Study area and target population

This qualitative study was conducted between April and May of 2016 in two rural districts of Zambézia province: Maganja da Costa and Lugela. This province is one of the most populous in the country and has the highest malaria prevalence (68%) and case burden.[2,8] This study was carried out in 6 (six) communities, namely: Maganja da Costa sede, Nante, Alto Mutola, Cabuir, Lugela, and Munhamade. The communities were selected based on the number of malaria case reports and those with high notifications of malaria cases were selected.

Data collection

Data were collected using the focus group discussions (FGD) approach with community leaders and other members. We conducted a total of 10 FGD and enrolled a minimum of 8 and a maximum of 12 participants belonging to the same target group for each group. In all selected communities, eligible participants were adult (aged 18 or more) community leaders and community members as household chiefs and suitable individuals with adequate knowledge to answer questions on behalf of their households. These FGDs allowed participants to narrate and discuss perspectives, values, and experiences in response to a series of open-ended questions. Data collection was carried out in Portuguese or the local language (Chuabo), depending on the participants' preferences. FGD lasted approximately 60 to 90 minutes.

Data analysis

All FGD were digitally recorded and fully transcribed by three experienced transcribers who were fluent in Portuguese and Chuabo and received specialized training in transcription techniques based on the study's Standards Operational Procedure. Interviews conducted in Chuabo were directly translated into Portuguese during transcription.

Transcripts were encoded and later analyzed using NVIVO11® (QSR International, Inc. Australia), which supported not only coding but also the extraction of coded text, organization of categories, and subcategories in a codebook, and the establishment of relationships between themes. Open coding of all transcripts was performed independently by authors AM and RC to build descriptive categories and extract content from data that spoke about perceptions of malaria and bed nets. All data were read and coded using the study objective script and interview guides. A thematic analysis was performed after extracting the thematic categories from the data encoded in NVivo, which allowed an improved analysis of each discussion topic.

Ethics approval

The study received ethical approval (012/CIBS-INS/2016) from the Institutional Bioethics Committee in Health of the National Health Institute (CIBS-INS). Administrative authorizations were provided by the Ministry of Health, the Zambézia Provincial Health Directorate and the Distrital Health Directorate in Maganja da Costa and Lugela. Authorization to engage with community members and perform the study was also first requested from neighborhood secretaries and the heads of each administrative post included in the study. In the field, written informed consents were signed by all participants previously to their participation in this study. The COREQ guidelines for reporting qualitative studies were performed.

Results

Participant sociodemographic characteristics

The sociodemographic characteristics of the FGD participants are summarized in Table 1. A total of 92 community leaders and other suitable members participated in 10 (ten) FGD. Of these, 55 were female. The median age was 48 [Interquartile Range (IQR): 38-53], most FGD participants were community members (58%), 14% did not have a formal education, and 35% had high school completed. The majority of them were farmers (78%).

Knowledge of causes and prevention of malaria

Participants were aware that malaria is caused by mosquito bites. Factors such as humidity, shrubs, litter, and standing water puddles are also declared by them to be the main breeding sites for mosquitoes and the consequent cause of malaria. The main causes of malaria mentioned were the standing water pools near the house and garbage.

Table 1. Socio-demographic characteristics FGD participants.

	Male 37 (40%)	Female 55 (60%)	Total 92 (100%)
Median Age (IQR)	47	49	48 (38-53)
Community Role			
Community leader	31 (34%)	08 (9%)	39 (42%)
Community members	22 (24%)	31 (34%)	53 (58%)
Education Level			
No formal education	2 (2%)	11 (12%)	13 (14%)
Primary education	17 (18%)	30 (33%)	47 (51%)
Secondary/high school	18 (20%)	14 (15%)	32 (35%)
Marital status			
Never married	7 (8%)	12 (13%)	19 (21%)
Married	12 (13%)	18 (20%)	30 (33%)
Cohabitating	15 (16%)	17 (18%)	32 (35%)
Divorced/Widowed	3 (3%)	8 (9%)	11 (12%)
Occupation			
Farmer	21 (23%)	51 (43%)	72 (78%)
Carpenter	5 (6%)	0 (%)	5 (6%)
informal seller	8 (9%)	2 (2%)	10 (11%)
Retired	3 (3%)	2 (2%)	5 (6%)

"... The mosquito is in a place where it is dark, where there is an uncontrolled garbage and dirty water..." (Focus Group 8, female).

Participants reported that general cleaning of the warm house, removing litter or water from the ditches, not allowing children to play with dirty water, providing a clean environment, and taking care of their hygiene can help to reduce the number of mosquitoes. The use of bed nets was also mentioned as one of the specific measures for malaria prevention. They have also described the following measures for malaria prevention: the cleanliness of the house, burning grass and litter, lightening the fire during the night, and using a local herb-based product and plant roots locally known as Mamaveia.

"... When we burn those *Mamaveia* leaves we manage to scare away the mosquitoes, they disappear because that smoke kills them" (Focus Group 3, female).

The use of bed nets was also mentioned as one of the specific measures for malaria prevention. Participants perceived protection against mosquito bites as the main objective of using bed nets. In addition, participants mentioned that by protecting themselves from mosquito bites, they also protect themselves from malaria.

In addition, the participants were able to recognize the signs and symptoms of malaria. They mention that chills joint pains, weakness in the body, body aches, headaches, fevers, dizziness, vomiting, and loss of appetite as some of the signs and symptoms of malaria.

"The person with malaria gets a headache, and also feels very cold...these are fevers that you feel when you feel cold, you get a warm body" (Focus Group 4, male).

Perceptions on conditions and conservation of bed nets

Participants gave varied responses regarding the condition and storage of bed nets for malaria prevention. On the one hand, those who received the ITNs from public and free campaigns stated that the nets weren't well conserved because their quality was not very good enough, and the condition of the conservation of these nets worsened mainly with frequent washing of them.

"... As we received them as nets a long time ago, they are now all torn or due to lack of conservation, others because they were washed too much, but also other nets were very weak and because of that they were torn..." (Focus Group 1, male).

On the other hand, participants also considered that washing ITNs in the river with soap and water is a conservation method to keep the nets clean and in a good state of conservation, especially in situations where the net has been very dirty due to dust from houses made of sand mud. Some participants reported that they wash their ITNs with river water only, others use bar soap or washing powder which generally has the highest cost compared to bar soap.

"Many times, we take it to the river and wash it normally like we wash clothes, with Klin [Powder detergent] or soap…" (Focus Group 2, female).

Participants also mentioned that hand sewing is one of the maintenance and conservation mechanisms for bed nets with holes and holes to keep them usable and without holes that allow the entry of mosquitoes.

"…Here when the nets break down, there are holes we are sewing with a needle" (Focus Group 6, male)

Participants also mentioned that the bed nets with large, irremediable holes were discarded for other domestic activities, such as covering beds to protect them from insects, chickens, and ducks.

Some participants mentioned that they did not receive recommendations on how often their nets should be washed, so they only washed with water only because they were concerned about the insecticide.

Perceptions on bed net use

Participants are aware of the relevance of using bed nets to prevent mosquito bites at bedtime. These participants mentioned that they were informed during the bed nets distribution campaign on how to make proper use of bed nets at home. In addition, respondents strongly urged the vast benefit of ITNs.

"When we received the bed nets, we were informed that these bed nets are not for fishing or farm barriers or other things" (Focal Group 2, female).

On one hand, participants stated that bed nets are usually hung in different places depending on the type and size of the compartment in the house and the number of individuals who will sleep under it. In some cases, the bed nets are hung and stretched to cover two mats to protect several members of the household.

"The bed nets here are usually placed to cover many people at once, this type of bed nets we have here, we hang it on above..." (Focus Group 1, female).

"Sometimes we can stretch the bed nets very well, to cover two mats so that everyone is protected inside the bed nets so that no one gets caught by the mosquitoes..." (Focus Group 1, male).

On the other hand, some bed nets considered by the participants as being inappropriate for malaria prevention due to lifespan and conservation status are used for other purposes such as artisanal fishing, harvesting flour, or building poultry houses.

"When it is no longer suitable for sleeping with him, then we take them to hunt little fish either" (Focus Group 4, male)

Perceptions related to the prioritization of bed nets users in the household

Both male and female participants showed that in situations of insufficiency of ITNS in the households, the group that has priority to sleep within the existing bet nets are children, as they are more vulnerable to mosquito bites, and pregnant women, as they are in fragile health condition. In addition, participants mentioned that women, in general, are the group that should sleep in bed nets as they are more sensitive than men.

"…pregnant women and children have to be given priority, now I can't sleep inside the bed net and leave my children outside I have to at least give the hammock to my children and I sleep outside the bed nets…" (Focus Group 4, male).

However, some participating men reported that in cases where there is more than one-bed net in the household, men sleep in the worn and patched bed nets because the new, well-maintained bed nets are for pregnant women and children. Some participants believed that men are strong enough not to catch malaria easily. One participant stated:

"… Men are stronger than women and children, so they are sacrificed to cope with mosquitoes…" (Focus Group 4, male).

Discussion

Considering that universal ITN coverage goals have not yet been met in Mozambique, especially in priority areas, this study sought to understand individuals' perceptions of the use of insecticide-treated nets to prevent malaria in a rural setting in central Mozambique. This information was used to inform the NMCP to make decisions about the course of upcoming bed nets distribution campaigns. This study aimed to assess knowledge about malaria and bed net use in two areas of high malaria transmission.

The results of our study show that participants are knowledgeable about the causes, signs, and symptoms of malaria, forms of prevention, and the value of ITN use as a preventive measure, although it is thus clear that it is crucial to accompany them with

additional information on related topics such as malaria transmission, signs and symptoms, prevention, and treatment, as well as ways to use and conserve bed nets as a way to improve community knowledge about malaria using culturally appropriate health education materials and networks (such as local community radio), is a potential strategy that may help to decrease infection rates in these communities and could be used by the NMCP to make updated information on malaria to marginalized populations.[11] These results are similar to the results presented in studies from other countries, such as Mali and Kenya.[8,12] Interestingly, in other places of low malaria transmission not only in Mozambique, similar results that show the need for sensitization to provide additional knowledge for malaria prevention were also presented.[13,14]

Campaigns for the free distribution of ITNs have been an integral part of many advancements in malaria control, especially in settings with a high incidence of the disease.[11] The key to making ITNs a sustainable solution in these settings is to understand what drives the use in preventing mosquito bites and malaria.[1] Four additional themes were identified in this study, concerning the perception of ownership and use of insecticide nets for malaria prevention, which are: knowledge of causes and prevention of malaria, perceptions on conditions and conservation of bed nets, perceptions on bed nets use, and perceptions related to the priority of use of bed nets after the 2015 and 2016 free ITN distribution campaign.

Although they referred to the adoption of other measures to prevent malaria, the participants highlighted the use of bed nets as the most effective measure in protecting against mosquito bites and, consequently, against malaria. However, it should be noted that some groups still use them as nets for other purposes, such as fishing and around the vegetable garden. Similar to our findings, the misuse of bed nets for fishing or other domestic uses because bed nets are free or cheap has also been reported in previous studies.[12] Furthermore, our results indicate that although most of the participants had at least one mosquito net at home after the free distribution campaign, only some of the household members used them regularly due to the number of nets per household. The fact that there are households with many members means that only some sleep under a net, taking into account the number of members in each household it's because the distribution of ITNs in the 2016 free campaign did not consider the number of nets according to the number of members in each household. Children and pregnant women were considered by participants as the priority group in the use of bed nets in the household.[15] Similar findings were found in studies conducted in Tanzania where infants and other vulnerable groups were also most likely to sleep under the bed nets.[15]

Our results showed that individuals who sleep without the protection of bed nets, especially men, are strong individuals who do not easily contract malaria, but these showed that despite being considered strong, they scare away mosquitoes by burning dry leaves or roots of local plants. This process is also used to ward off mosquitoes around the house to protect household members before bedtime for the night. However, there are other reasons for non-use found in other studies that were not reflected in our results.[13] In general, the method of using bed nets mentioned by participants is appropriate, nonetheless, the conservation method was found to be incorrect as some participants reported that they wash the nets in rivers using powder detergents or soap and afterward dry them in the sun. The results showed that it might be possible that the ITNs distributed in the NMCP campaign were in a critical state of conservation due to the practices of the beneficiaries, and also to nets' lifespan.

Our findings also suggest two main causes for the existence of holes in the bed nets mentioned by the participants: the first one is because the tree stake used to fix the nets at bedtime makes small holes in the four corners used to stretch the net. These holes increase in size each day the net is hung on the stake. The second one is that the hammocks catch wet and sun when stretched out in the backyard of the house, this contributes to the fragility of the hammock's fabric. These results suggest a clear explanation campaign on the use and conservation of bed nets.

Study strengths and limitations

This study presents notable strengths that can be used to design messages that can be used to improve community knowledge of malaria prevention and the importance of using bed nets for malaria. This study has some important limitations that may have influenced the reliability of the data. First, the data was collected using only one data collection technique, which may have limited the breadth and depth of data quality. In addition, study participants were randomly selected from communities in two districts with a high rate of malaria. The findings of this study are consistent with some findings from studies in low-incidence areas in the south of the country, so their transferability outside Mozambique may be limited. In addition, the study was conducted by a team of researchers from the National Institutes of Health who presented government credentials, which may have influenced responses.

Conclusions

Our study findings indicate that our participants are aware of malaria and are aware of what causes malaria, considering the different signs and symptoms and prevention measures, including the use of bed nets at bedtime. However, the knowledge about Malaria and the possession of ITNs in almost all households whose members were interviewed does not translate into overall use due to the number of members in the households. This compromised the prevention of some household members. Furthermore, the results of this study suggest the need to strengthen the communication and logistics component of the campaign on door-to-door net distribution at the community level to ensure that households have enough ITNs for their members and use them appropriately. This will be critical to the success and sustainability of upcoming campaigns to distribute ITNs and reduce malaria prevalence.

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