

Utilization of Long-lasting Insecticide treated Mosquito Nets amongst Households in Upper River Region, The Gambia

Alieu Bah¹, Elizabeth DaSilva Ninson^{2*}, Robert Ninson³

¹Malaria Project Officer, Catholic Relief Services (CRS), The Gambia Office

²Immunization Officer, Unicef Country Office, The Gambia

³Team Lead/Senior Public Health Consultant, Access for Humanity, Juba, South Sudan

Abstract

Long Lasting Insecticide-treated bed nets (LLINs) are known to be highly effective in reducing malaria morbidity and mortality. However, there exists availability and usage variations between countries and among households and such may seriously limit the potential impact of nets and cause a negative consequence on malaria transmission. This study examined LLIN ownership and underlying factors that may serve as barriers to utilization amongst households in two districts in Upper River Region. Malaria is the major cause of morbidity and mortality in children and pregnant women. LLINs are an effective option in the prevention of malaria because they serve as a barrier between man and mosquito. However, their utilization among the population is still a problem despite ownership been high. Surveys have shown that the region in which this study was conducted has the lowest utilization rate in The Gambia and the second highest malaria prevalence in the country. The study adapted a structured questionnaire and Focus Group Discussions (FGDs) to better understand the situation of net utilization in the two districts. The study revealed interesting findings: Respondents have clear understanding that LLINs are for the prevention of malaria. Factors such as heat, mesh size of net, texture were very important determinants for a person to use a net. A very important determinant for someone not using a net is the season as a lot of the people belief that mosquitoes are not many during the dry season. Indoor Residual Spraying was one “devil in disguise”.

Keywords: Long lasting Insecticides-treated Bednets, Malaria, Morbidity, Mortality, Prevention.

Introduction

According to the World malaria report 2018, there were 219 million cases of the disease in 2017, compared to 217 million the year before. Of particular concern is the report's finding that, among the 10 highest-burden African countries, there were 3.5 million more cases in 2017 over the previous year [1]. An estimated 228 million malaria cases and 405,000 malaria deaths occurred in the world in 2018. Of these, 93% of cases and 94% of deaths due to malaria occurred in the African region [1]. The Global Technical Strategy for Malaria 2016–2030 (GTS) calls for reducing malaria cases and deaths by at least 40% by 2020, at least 75% by

2025 and at least 90% by 2030. Without a major turnaround, these targets are unlikely to be met – a challenge further compounded by insufficient levels of funding for malaria control. Investments in 2017 represented less than half of the 2020 US\$ 6.6 billion funding target set by the GTS [1].

There has been substantial decrease in the prevalence of malaria globally and also in the African region in the last two decades. Between 2010 and 2015, malaria incidence rates (new malaria cases) fell by 21% and the malaria mortality rate by 31% in the African region. However, the rate of change in decline of

malaria incidence remained 57 per 1000 at-risk population per year from 2014 to 2018 [1].

Malaria, a preventable, treatable, and curable disease, is a major public health threat in The Gambia. Malaria affects the entire population and is a leading cause of morbidity and mortality, especially among children under age 5 [2]. In The Gambia, malaria is mesoendemic and has a marked seasonal variation. Around 90% of malaria cases occur in the rainy season, which usually lasts from June to October [2].

A malaria-free Gambia is the vision of the National Malaria Control Programme (NMCP), with the goal of reaching pre-elimination by 2020. To achieve this goal, the National Malaria Control Policy outlines strategies including (1) prevention; (2) case management; (3) advocacy, social mobilisation, behavioural change, and communication; and (4) surveillance, monitoring and evaluation, and operational research [2]. The 2014-2020 National Malaria Strategic Plan aims to sustain universal coverage by distributing a sufficient number of ITNs to cover all household members [2]. This indicator is operationalised as one ITN for every two household members. ITNs in The Gambia are distributed through mass distribution campaigns (every 3 years) and through routine child health services targeting children, mothers, and pregnant women [2].

The long-lasting insecticide-treated net (LLIN) is the cornerstone of malaria prevention in sub-Saharan Africa (SSA). Its effectiveness was dependent on universal coverage as well as consistent utilization [3]. Utilization of LLINs reduces the clinical attack of malaria, Plasmodium infection and death due to malaria. It reduced child mortality of all causes by 17%, which corresponds to 5.6 lives each year for every 1000 children protected compared to those who did not use bed nets. In addition, it reduced incidence of uncomplicated episodes of falciparum malaria by almost half [3].

Long-lasting insecticidal nets (LLINs) have played an important role in reducing the global malaria burden since 2000 [4]. They are a core prevention tool used widely by people at risk of malaria. Part of pillar 1 of the Global Technical Strategy for Malaria 2016–2030 (GTS) is to ensure universal coverage for all people at risk of malaria using effective vector control with either LLINs or the other core prevention tool, indoor residual spraying (IRS). Universal coverage for malaria vector control is defined as universal access to and use of appropriate interventions by populations at risk of malaria [5].

Among ITN owners (n=387), 73% of women reported either always sleeping under the net during all trimesters of pregnancy, or always sleeping under the net after they acquired one during pregnancy. The primary reason for not always sleeping under the net was the heat (49%). Women of Muslim religion were less likely to always use a net during pregnancy compared to those of Christian religions. Owning more than 1 net was associated with a slightly increased likelihood of always sleeping under a net during pregnancy. Women in the wealthiest households were less likely to always use a net during pregnancy compared to women living in the poorest households. Participants were read a list of items and then asked to choose which item is the single most important influence over deciding to sleep under an ITN during pregnancy. Women who always slept under an ITN during pregnancy were more likely to be influenced by an advertisement on the radio/poster than being given an ITN free of charge. Paradoxically, women who always used their net during pregnancy were also slightly more likely to believe that sleeping under an ITN might be dangerous during pregnancy. No differences were found between other socio-demographic factors, pregnancy history, ANC use or socio-cultural factors [6].

About three-quarters (10,635, 74.0%) of all inspected bed nets were hung for use. Of the

35,419 people reporting sleeping in their households the previous night, fewer than three-quarters 25,896, (71.4%) reported sleeping under a bed net the previous night. Among children under five, the majority (79.3%) were reported sleeping under an LLIN the previous night while 81.5% reportedly slept under a bed net of any type including LLINs. Of the 427 pregnant women who slept in the household the previous night 77.5% slept under a LLIN, while 80.9% (347) reported sleeping under any type of bed net including LLINs [7].

Amongst 456 households owning LLIN, 85.1% (388) had used at least one LLIN the night before the survey took place. Higher LLIN utilization was also evident among households whose wall was painted or plastered within the 12 months preceding the survey [8]. In total, 944 ITNs were supplied to the households included in this study. Of these, 649 (68.8%) were reported as being used by households [9].

Factors associated with the use of malaria prevention measures: Married women were 3 times more likely to use ITN than those not married. Women who had ever delivered babies were 2 times more likely to use ITN the previous night before the survey than nulliparous women [10, 11]. While a study conducted in Bahir Dar City in North West Ethiopia among People Living with HIV and AIDS (PLHA), 76.8% of PLHA utilized ITNs properly [12, 13].

The percentage of any person passing the previous night under a bed net from the total participating households and households conditional to bed net ownership was 12.0% and 62.2% respectively. About 40.3% of participating SAC in the households owned at least one bed nets and 7.8% of all participating SAC passed the previous night under a bed net irrespective of bed net ownership. The percentage of bed net utilization among SAC conditional to adequate access of bed net in their household was 66.7% [14].

In these years, households LLIN ownership increased from 3.4% to 53.3%; while use among children under-five years of age and pregnant women increased from 1.5% and 1.1% to 33.1% and 35.2%, respectively [15-17].

In 33.5% (630) of the households, at least one LLIN was used in previous night of the survey and 66.5% (1249) did not use. Of these, 62.2% (392) of the households hanged at least one of their LLIN above bed/sleeping place in the room. Of 9629 persons in the LLIN owned households, only 25.5% (2453) household members, including 46.6% (767) of children under five and 37.2% (54) pregnant women slept under LLIN. LLINs ownership and use were higher in malaria endemic zone (89.2%) and (55.1%) than fringe zone (60.1%) and (26.2%), respectively. Proportion of LLINs ownership was greater in households residing in a house with corrugated iron sheet roof (68.2%) than thatched roof houses (55.5%) [18].

Slightly over two thirds (67.5%) of children under-five years of age slept under a LLIN the night preceding the survey while only about half (51.3%) of other members of the household use LLIN. Overall, the utilization rate for all respondents was 58.5% [19].

Use of ITNs: 44% of pregnant women age 15-49 and 44% of children under age 5 slept under an ITN the night before the survey. Nationally, 61% of de facto household members in The Gambia who stayed in the household the night before the survey could sleep inside an ITN if each ITN were used by up to two people. The results showed that 38% of the population slept under an ITN the night before the survey. Comparing these two indicators, it is evident that there is a large gap between access and ITN use of the population level. Overall, 55% of ITNs were used the night before the survey [2].

Despite the increase in net ownership, net utilization has declined amongst pregnant women (96.5% in 2012 and 94.4% in 2016), children under one (95.0% in 2012 and 94.4% in 2016 and the general population 89.1% in

2012 and 83.0% in 2016), (Saho 2016). Regionally, the gaps are even more significant. According to the 2016 BCC survey results, 78.3% of household members in the west coast region, 77.2% of household members in NBWR, 83.9% of household members in NBER, 87.7% of household members in LRR, 90.7% of household members in CRR and 75.8% of household members in URR were utilising LLINs to prevent malaria. It is evident that net utilisation is lowest in URR and this can have a negative consequence on the fight against malaria in the region.

Though the use of bed nets is cultural in the Gambia, there are factors that impedes their universal use, such as the shape (preferably conical), the small size that doesn't fit with large new fashion beds, the perception of hanging nets is old fashion, claustrophobic and heat increase perception (Gambia Government, 2009). ITN utilization is also influenced by factors such as age, education, size of household and ethnicity. Children are less likely to use ITNs especially those living in rural areas.

According to the 2016 BCC survey, there are increases in the supply of mosquito nets, especially of Long Lasting Insecticide Treated Nets amongst the Gambian population. In 2014, 96% of the population of the Gambia was reached through a mass bed net distribution campaign whilst in 2017, 88.5% of the population was reached with another campaign. Despite the high coverage of LLINs amongst the population, net utilization remains a challenge. The 2016 BCC survey further indicated that LLIN ownership in the communities have increased from 94.0% in 2012 to 99.6% in 2016 nationally. Despite the increase in net ownership, net utilization has declined amongst pregnant women (96.5% in 2012 and 94.4% in 2016), children under one (95.0% in 2012 and 94.4% in 2016 and the general population 89.1% in 2012 and 83.0% in 2016.

Regionally, the gaps are even more significant. According to the same report, (2016 BCC survey) 78.3% of household members in the west coast region including KM, 77.2% of household members in NBWR, 83.9% of household members in NBER, 87.7% of household members in LRR, 90.7% of household members in CRR and 75.8% of household members in URR were utilising LLINs to prevent malaria.

According to a study carried out in Enugu state, Nigeria [20] out of a total of 832 pregnant women studied, three hundred and fifty-nine (43.1%) women owned insecticide treated nets (ITNs), however 325 (90.5%) slept under the nets during the index pregnancies; equivalent to 39.1% utilization rate among the 832 women studied. Out of the 325 (39.1%) women that used ITNs; 236 (28.4%) used it singly, while 89 (10.7%) used it in combination with other anti-vector measures. Educational status and social class of the women had strong association with the use of ITNs. Women who used ITNs were significantly less likely to have acute malaria, anaemia and babies with low birth weight than women who did not use ITNs.

Similar studies carried out in western Nigeria [19] amongst 2560 households, it was found out that (68.6%) of the households had at least one under-five child living in the household while 32.6% had at least one pregnant woman living in the household. A total of 2440 (95.3%) households received LLIN during the campaign. Overall, the utilization rate for all respondents was 58.5%. Even though 2440 households received LLINs during the campaign, only 84.3% of them were seen to have hung theirs during the survey. Meanwhile, in Ghana, [21] out of a total of 355 pregnant women who were interviewed, ownership of LLIN was 81.4% while usage was 42.5%. Level of education significantly influenced LLIN ownership and utilization. The main barriers to LLIN utilization were inconvenience due to heat (77.7%), lack of ownership of LLIN (12.9%) and absence of mosquitoes (4.3%).

Knowledge on LLINs was high (73%). It is evident that ownership of LLIN was high but utilization was very low. Over a quarter (27%) of the pregnant women had moderate knowledge on LLINs. This if left unchecked can have negative consequences on the health of these women and their unborn babies.

Similar studies carried out in Ethiopia, [22], out of a total of 540 households intended to be included in the survey, 507 responded to the study (94.24% response rate), covering the homes of 2759 people. More than 58% of the households had family size >5 (the regional average), and 60.2% of them had at least one child below the age of 5 years. The ownership of at least one LLIN among households surveyed was 89.9%, and using at least one LLIN during the night prior to the survey among net owners was 85.1% (n = 456). Only 36.7% (186) mentioned at least as the mean of correct scores of all participants for 14 possible malaria symptoms and 32.7% (166) knew at least as the mean of correct scores of all participants for possible preventive methods. Over 30% of nets owned by the households were out of use. However, poor knowledge of the transmission mechanisms and the symptoms of malaria, and vector control measures to prevent malaria were evident. Moderate proportions of nets were found to be out of use or in poor repair.

In India where malaria is also still a major public health problem, a study carried out by Kamaraju Raghavendra et al 2017 [23], out of a total of 2970 households that were interviewed with a total of 15,003 individuals present in the households during the night before the survey, 98% of households had at least one LLIN and 59.4% of the surveyed population reportedly used an LLIN the previous night. LLIN use varied from 41 to 94% between the study clusters. Nearly 89% of the LLINs were found in good physical condition (without holes). However, proportion of household with at least one LLIN per two persons was only 39%. Relatively there is high net use despite poor

access to LLINs and this indicates an overall desire to use nets when they are available. The main barrier to increased use of nets is the low coverage at household level.

In a study carried out in Mbarara on the perceptions about Malaria prevention [24], avoiding mosquitoes was the most common method mentioned for prevention of malaria. Other preventive strategies mentioned include boiling of drinking water, improved sanitation, clearing of bushes around the compound, avoiding cold weather, good nutrition, burning mosquito coils, screening of buildings, taking anti-malarials regularly and closing windows early. While most people in this study said LLINs were efficacious both in preventing mosquito bites and malaria, they expressed ignorance of insecticide treated nets and could not tell whether a bed net was treated or not. Barriers towards use of bed nets that would negate their use include; being expensive, being difficult to keep from holes, being inconvenient by increasing heat and sweating, causing suffocation and that it is impossible to buy a net for everybody in a big family. Some people said that they use bed nets when mosquitoes are plentiful but keep them when there are no mosquitoes in the dry season.

In a study carried out in Mbarara district, western Uganda, found that mosquitoes were perceived as a cause of malaria but at the same time use of bed nets was low (26 percent). People who did not use bed nets cited discomfort due to heat and humidity; and the high cost of LLINs as reasons for non-use [24].

Methods

Study Design and Sampling Process

Sampling Methodology

The research would be carried out in the URR south since 70% of the total population of the region resides in this area. This comprises four districts of which only two districts were selected randomly. The four districts in URR South namely Jimara, Fulladu East (Basse),

Tumanna and Kantora were written on pieces of paper and folded and placed in a box. A child was asked to select two pieces from the box and the districts of Fulladu East (Basse) and Jimara were the ones that came out hence the selected districts for the study. These two districts have a total population of 92563 people based on the 2013 population census.

A list of all the villages in the selected districts were obtained from the Gambia Bureau of Statistics 2013 census list and all of them written and folded in pieces of paper with the list of each district separated. Another child was asked to pick piece by piece. All the villages that appeared were recorded and regarded as the study villages. Upon arrival in the village, the head of the village is visited and informed of the data collection. After the introduction, a pen is tossed and the first compound in the direction in which the pen points to is visited. To select the next household, it was decided that the first digit of the serial number of a hundred-dalasi note would be used and that happens to be number 5. Thereafter, four households were counted in the same direction and every fifth household visited. In each village, ten respondents were interviewed. The data was entered, cleaned and analyzed using Statistical Package for Social Sciences (SPSS) version 25.

The qualitative data was analyzed using thematic network approach. The thematic analysis approach is recognized as the core method for analyzing qualitative data has been stated by Smith and Firth, 2011 [25]. It provides a flexible and very useful tool which helps to provide a rich and detailed account of analysis [25]. It is a useful approach in this research by capturing experiences of the participants regarding the issue been investigated.

Data Collection Tools

Structured Questionnaire

Data was collected using a pretested structured questionnaire and an FGD guide prepared in English. Field coordinators, public health officers and teachers who are resident in

the region and are very fluent with the languages of the region (Fula, Mandinka and Sarahuleh) were engaged and recruited for the data collection. The data collected were oriented on the questionnaire for common understanding and interpretation of the questions before data collection started. The questionnaire included variables related to socio-demographic characteristics, net possession, net utilization, net preference, reasons for not using LLINs and indoor residual spraying. Pretest was carried out in communities that weren't part of the selected places and region of study. Necessary modifications were made thereafter. Each filled questionnaire was reviewed in the community just after the administration of the questionnaire to correct wrong responses with a view to assess appropriateness, comprehensiveness of the questions, any ambiguities and inaccuracies.

Focus group discussions was conducted for pregnant women, caregivers and household heads in the region to provide deeper understanding about net utilization and the factors that prevent net usage.

Limitations of the Study

One of the greatest limitations of the study was the overambition of the researcher in that the sample size was so large. Another major constraint was the lack of funding for the research which affected the study. The study was planned to be conducted in forty villages in the two districts covering a total of four hundred household heads but due to lack of funds to pay field workers to help in the data collection, the research was concentrated mostly around Basse (Mansajang, Basse Santo-su, Manneh Kunda, Kaaba Kama), Koba Kunda and Allunhareh. Only Gambissara, the largest and most populated village in Jimara district was visited. These villages account for 43.62% of the total population of the two districts (40376 of 92563 people). Of the four hundred households planned to be interviewed, only 73.25% (n=293) were successfully interviewed. Of this

total, 72.4% (n=212) were from the Basse district and 27.6% (n=81) were from Jimara district. Another limitation was that some of the respondents were not the actual household heads of the homes visited. This was clearly shown during the interview.

Reliability and Validity

Accuracy of the data collected using the research tools and techniques are essential. Reliability and validity are two important concepts that are of great value in determining the impact of results of a well-planned research and interpreting the findings of the study. To ensure reliability and validity during the study, the questionnaires and FGD guidelines were pre-tested among a group of household heads with the same characteristics with the study participants but outside the study area. The reason of pre-testing the interview guidelines was to assure that the language used and the way and manner the questions were asked were appropriate to the respondents. Reliability was also ensured by asking in-depth questions in addition to FGD and comparing that responses were the same during the interviews. For the research instrument to be reliable, the result of the study should be produced under a similar methodology (Golafshani, 2003). There was no problem with language throughout the study. Reliability is all about the extent to which results are consistent over time (reliability/repeatability) and an accurate representation of the total population under study (validity).

Results

Socio-demographic Characteristics of Household Heads that Participated in the Study

Table 1 shows the summary of the socio-demographic characteristics of respondents in the area in which the study was conducted. 89.42% (n=262) were males whilst 10.58% (n=31) were females. The mean age of the respondents is 39.98 years with standard

deviation of ± 10.91 . When the mean age of male and female household heads/ respondents was compared using the independent sample t-test, there was a statistically significant difference level 0.05. Majority of the respondents were between the age group of 35-44 which accounted for 71.67% (n=210) followed by 25-34 age group which accounted for 14.68% (n=43), 45-54 years 9.9% (n=29) and finally 55 and above years 3.75% (n=11).

In terms of Ethnicity, the larger proportion of the respondents were Sarahuleh 47.90% (n=140), followed by fulas 42.01% (n=123), Mandinka's form 9.12% (n=27) and a very tiny proportion of the respondents 0.97% (n=3) belongs to other ethnic minorities. The number of respondents who claimed to be in one form of employment or another is as follows. Majority of the respondents 89.42% (n=262) were working whilst 10.58% (n=31) were not working.

In terms of education, 23.55% (n=69) of the respondents said that they have never gone through any western education but have studied the Quran, 36.86% (n=108) have completed primary education, 22.87% (n=67) completed secondary school education and 7.85% (n=23) said that they completed tertiary education. Eight-point eight seven percent 8.87% (n=26) are said to have gone through vocational training.

Of the 10.58% (n=31) female respondents, none has gone to school as they have been married since their early years. All the respondents, 100% (n=293) are all Muslims.

In terms of occupation, 58.36% (n=171) are involved in business, 15.70% (n=46) are farmers, 10.58% (n=31) are housewives and they don't consider that as an occupation. For them, an occupation is doing something for pay at the end of the month, 10.58% (n=31) are not employed whilst 4.78% (n=14) are civil servants.

In terms of income gained monthly, 95.22% (n=279) earn more than GMD6000 monthly (US\$127).

In terms of marriage, all respondents n=293 were all married before. At the time of the survey, 71.33% (n=209) were still married,

26.62% (n=78) were in polygamous marriages and 2.05% (n=6) were women who are widowed.

Table 1. Socio-demographic Characteristics of Household Heads

Variables	Frequency (n)	Percent (%)
Sex of the respondents		
Male	262	89.42
Female	31	10.58
Age of respondents		
25 – 34	43	14.68
35 – 44	210	71.67
45 – 54	29	9.90
55 and above	11	3.75
Family size per household		
10+	95	32.42
11 – 20	111	37.88
21 – 30	63	21.50
31 – 40	18	6.14
40+	6	2.05
Attended school		
Yes	233	79.52
No	60	20.48
Ethnicity		
Sarahuleh	140	47.90
Fula	75	42.01
Mandinka	27	9.12
Others	3	0.97
Currently working		
Yes	262	89.42
No	31	10.58
Educational level		
Never attended school	69	23.55
Primary	108	36.86
Secondary	67	22.87
Tertiary	23	7.85
Vocational	26	8.87
Religion		
Muslim	293	100
Occupational status		
Not working	31	10.58
Business	171	58.36
House wife	31	10.58
Farmer	46	15.70
Civil Servant	14	4.78

Average monthly income		
Less than D2500	0	0
D2501 - D3500	0	0
D3501 - D4500	0	0
D4501 - D5500	14	5.34
More than D5500	248	94.66
Nationality		
Gambian	293	100
Marital status		
Married (monogamy)	209	71.33
Never married	0	0
Divorced/Separated	0	0
Married (polygamy)	78	26.62
Widowed	6	2.05

Magnitude of LLIN Ownership and Preference among Household

As shown in table two [2], 278 (94%) households representing 7021 people have nets at the time of the study. Only a small proportion, 15 (5.12%) households, representing 379 people didn't have nets during the time of the study. Most of these household heads produced vouchers they got from the last mass bed net distribution campaign but couldn't collect the net because the custodian of the vouchers has travelled at the time of distribution whilst others said that they have vouchers but couldn't produce them at the time of the interview. From the data obtained from the study, 86.35%, representing 6390 people prefer conical nets ("julu kilingo" translated as the one string net) whilst 9.56% representing 707 people prefer the rectangular. A very small proportion 4.10% don't have any preference. It was also observed that building design was a factor in net preference as most of the house structures would find it difficult to hang a rectangular net.

Regarding texture preference, 90.78% of respondents prefer a soft net by texture whilst 5.12% prefer a hard net. A very small proportion of respondents, 4.10% don't have any texture preference. Another determinant in

net preference is the mesh size. Through discussions, a lot of the respondents said that the holes on the net are large. This was also revealed by the mass LLIN campaign evaluation survey conducted by CIAM.

The study revealed that utilization rate was 79.14% (n=220) households whilst 20.86% (n=58) of the households weren't using LLINs at the time of the study. Of the 58 households, 25.86% (n=15) were households without LLINs. According to the post evaluation report of the mass LLIN campaign report conducted by CIAM, "Reasons reported by respondents (n=245) for not using the bed nets include the shape of the nets 32.81% and the size of the nets 24.69%". this would account for 57.5% not utilizing the nets. This is a real cause for concern. The CIAM report also revealed that 9.05% of the nets supplied during the campaign to households were not seen and don't know what happen to them. These are probably the nets found hanged at the community and household gardens.

According to the 2016 BCC survey report, 84.9% of the population prefer soft texture whilst 78% expressed that they prefer a conical net. Preference for conical nets is an important determinant for utilization but it's not exclusively the most important determinant for utilization. The 2016 BCC survey revealed that

household heads were also asked whether they would use the net if issued a net of a texture different from their choices. Apparently, the texture of a mosquito does not significantly determine whether the net would be used by household heads with more than 90.0 % of household heads across regions indicating that

if issued with a net with a texture different from their choice they would use it. The observed proportion of household heads who would use nets if issued with nets different from their choices ranges from 91.2 % in WR to 100.0 % in URR.

Table 2. Magnitude of LLIN Ownership and Preference among the Respondents

Variables	Frequency (n)	Percent (%)
Mosquito nets in household		
Yes	278	94.88
No	15	5.12
Net preference by type/shape		
Conical/round	253	86.35
Rectangular	28	9.55
Any of the two	12	4.10
Net preference by texture		
Soft	266	90.78
Hard	15	5.12
Any of the two	12	4.10
Sleeping under net without preference		
Yes	220	79.14
No	58	20.86
Using net when sitting outside		
Yes	81	27.65
No	212	72.35
Source of mosquito net		
Mass campaign	212	76.26
Govt. Health Facilities/Posts	34	12.23
Mobile/Outreach clinic	30	10.79
Friends/Relative/Neighbors	2	0.72
Slept under an LLIN the night Before		
Yes	199	71.58
No	79	28.42
Utilization amongst Ethnic groups		
Sarahuleh	102	72.90
Fula	63	84.0

Utilization of LLINs and Incidence of Malaria among Households

The findings of the present study provide an important account on the utilization of LLIN

and the relationship between utilization and malaria episodes in the study population. The study revealed that 71.58% (n=199) of the household heads and their families used bed

nets when sleeping a night before the study as shown in Table 3. A total of 11 household heads, accounting for 5.53% reported malaria episodes in their households.

Of the households that reported malaria episodes during the year, 90.91% didn't sleep under bed nets. This clearly shows that bed nets play a very significant role in the prevention of malaria.

Majority of the respondents, 96.25% believed that bed nets can help in reducing the incidence of malaria in the region. Only 3.75% of respondents believed that other interventions can reduce the incidence of malaria in the region. Among these interventions mentioned are IRS and SMC for children under five years.

Table 3. Utilization of LLINs and Cases of Malaria among the Households

Variables	Frequency (n)	Percent (%)
Current use of treated bed net		
Yes	199	71.58
No	79	28.42
Malaria episode this season		
Yes	11	5.53
No	43	54.43
Slept under bed net before contracting diseases (n=11)		
Yes	1	9.09
No	10	90.91
Outcome of malaria episodes		
Treated and Discharged	11	100
Died	0	0
Bed net can reduce the incidence of malaria		
Yes	282	96.25
No	0	0
Other intervention	11	3.75

Qualitative Analysis

The focus group discussion revealed interesting findings regarding the use of LLINs amongst members of the households. Two FGDs were held, one in Basse and One in Gambissara and each FGD brought together heads of households, caregivers, pregnant women and health workers. The method used for the analysis of the FGD data was based on thematic areas. After a thorough analysis, the researcher came up with seven (7) thematic areas namely: 1) Knowledge of participants on LLIN; 2) benefits of LLINs; 3) sources of LLINs within the community; 4) reasons for low utilization of ITNs; 5) how to improve net

utilization amongst households; 7) indoor residual spraying (IRS).

Knowledge of Participants on LLINs

The discussions revealed that the level of knowledge regarding the use of LLINs was very high among respondents because the majority of the respondents could give an in-depth description of LLINs. Female respondents gave clearer responses to questions which indicates that females have more understanding regarding LLINs. This could be possible since women visit clinics more often where IEC/ BCC is conducted on a regular basis, they are also seen in larger numbers

during LLIN campaigns at distribution sites. Some of the responses are as below:

"It is a net that kills mosquitoes. They are very good. I like sleeping under them but most of my sons don't want to sleep under them. They should, especially in the rainy season when mosquitoes are many",

"Previously we are supplied two types of treated nets, conical and the other one is rectangular, they are supplied at health facilities to pregnant women and women with babies, all the villages are usually supplied through campaigns every three years.

Benefits of LLINs

Responding to questions on the benefits of LLINs to the households, discussions on both sites (Basse and Gambissara), reveals that members had different opinions about the benefits on the use of LLINs. Whilst some respondents have a clear understanding of the benefits and purpose of LLINs, especially the women, a few men only nodded their heads in agreement with what the women were saying. The comment from the FGDs interviews revealed that LLINs have numerous benefits. One respondent nearly moved everyone to tears when he said,

"Bed nets have really averted a lot of troubles within our families and communities". "Few years ago, when malaria and other diseases like measles were so many in our communities, it was really very difficult for some of our very old women who were often accused of witchcraft".

"It went to the extent that old women cannot visit children who are sick and either at home or admitted in hospitals".

"I also remembered that year when there was an outbreak of measles in our circumcision camp that killed two children, old women names were mentioned and attacked as witches".

'All this has now changed because people are now more aware and malaria has also

drastically reduced. People now know the causes and consequences of malaria he concluded".

Other responses are here transcribed:

"They prevent one from catching malaria. When you sleep under an LLIN, you don't get bitten by mosquitoes and therefore will never have malaria".

"LLINs prevents one from expenditure on malaria says another respondent. When you are sick, you pay money for treatment and when you are well you don't spend money".

"LLINs makes one to sleep and rest well at night because I am not disturbed by mosquitoes especially when I close from work and I am very tired. You know we are farmers and we need good rest at night".

Another comment that made me emotional was when one elderly man of Gambissara said

"In my home I have a Dara with more than one hundred talibehs, we do farming to supplement feeding. Few years ago, when the rainy seasons starts, my talibehs would be queuing at the health center like no other, work is affected in my farms to the extent that I must pay for labor. But since I started having adequate nets for everyone and benefited from the spraying done by you people, I and my talibehs have taken a break from the health center and we no longer pay for labor. Its only God who can pay you people".

Another man also said,

"This is the only exam that the government has passed in the health sector".

Sources of LLIN within the Community

There was consensus that the LLINs in the communities were free of charge and that and all pregnant women and women with babies can get a net for free when they visit the clinics. Another respondent said that the mass LLIN campaign was another source and all the respondents agreed. All the respondents said they benefited from the last campaign.

Reasons for low utilization of LLINs

Despite the high level of ownership of LLINs amongst the communities, there has been a concern for the low utilization in the region. The major factors highlighted as barriers to utilization were texture (too hard), shape (majority preference for conical), and majority of the man who responded said that they are mainly meant for pregnant women and children. Some respondents also mentioned that the holes of the net are large and that it makes no difference when you sleep inside the net as mosquitoes will still gain access to you. However, a major barrier to utilization is mosquito populations and indoor residual spraying. Generally, it was agreed that the last IRS was very effective and the chemical that was used was very good. It kills mosquitoes as well has a repellent effect. The issue of heat as well as causing irritation especially amongst children were raised.

“You see, this spraying done last year was good. For a month after the spraying, I never heard a mosquito bite in my house” the chemical is very good and I hope you people continue to use it next time as well. When we spray our houses with that chemical, there were no mosquitoes for a very long period.

Another respondent said,

“The previous chemical used was either not good or they add too much water to it. It doesn’t even smell like a chemical and it invites mosquitoes especially on the day the spraying was done”. The spray men leave your house dirty and with a lot more mosquitoes”.

“I think the essence of sleeping under LLINs is to prevent mosquito bites, well if spraying is done, all the mosquitoes die or run away, in that case, I prefer to sleep without a net because using a net adds to the heat already present inside the house.”

From the above responses, it’s very clear that IRS is a very important component in the fight against malaria yet still a barrier for the

utilization of LLINs amongst communities it is conducted.

How to improve the utilization of LLINs amongst household members

Household heads can play a very important role in the improvement of LLIN utilization in their respective households and communities. As one household head puts it

“This is all geared towards our own and our family’s benefits”. Henceforth, “I will ensure that everyone in the family continue to sleep under a net regularly.

Another household member said,

‘Please try and get us the “julu kilingo” meaning the net with one string (conical). In as much as I want to tie a net in my house, the type of house and bed I have, it’s difficult to tie the four-cornered net’.

It is therefore important for the national malaria program to look in more detail into people’s preferences regarding the use of LLINs and embark on intensive sensitization across all communities.

Discussion

In this study I examined the determinants of ownership and utilization of treated bed nets among households in two districts of upper river region, Fulladu East (Basse) and Jimara. I also assessed the factors responsible for the low utilization of LLINs amongst households. The study revealed that knowledge that sleeping under bed nets prevents malaria transmission and belief that bed nets prevent malaria were important predictors positively associated with LLIN utilization. The presence of hanging nets was the strongest predictor of high LLIN utilization among net owning households in this study. These findings agreed with those from a study in Port Harcourt Nigeria by C. I Tobin-West et al [11] as well as a study done in Ethiopia by Sena et al [17].

Socio-demographic factor that was statistically significant was found to be ethnicity. Ethnicity is linked to culture. It was

found that the ethnicity with the lowest utilization rate in the study were the Sarahuleh. This fact can also be interpreted in other ways. In terms of absolute numbers in the study population, they form the majority but in terms of utilization in percentage terms, they are the lowest. The researcher can link cultures such as; regarding malaria as caused by other spiritual factors as well as other myths may hinder people from using bed nets. Education level, family size, marriage status, economic status was not found to be statistically associated with bed nets utilization.

The study further reveals that whilst ownership of LLINs was high amongst respondents, utilization was relatively low at 71.58%. Similar studies carried out in Ethiopia by Yibeltal Berie et al [12] found that utilization rate of LLINs was 76.8%, whilst other studies in Kenya revealed utilization rate of 76.9% [13]. According to the World Health Organization (WHO) annual report of 2017, in 2016 in sub Saharan Africa, 54% of the population at risk slept under an LLIN, increasing from 30% in 2010.

According to the same report, household ownership of at least one LLIN was high (80%) in 2016, rising from 50% in 2010. This result suggests that the channels NMCPs use for delivery of LLINs can reach most households; hence, individual access to LLINs increased from 34% in 2010 to 61% in 2016.

The proportion of households with sufficient nets, however, was only 43% in 2016, up from 19% in 2010 but still substantially lower than the universal coverage targets. This relatively low level in the adequacy of available nets explains, in part, the relatively low use rates in most African countries.

Furthermore, the study revealed that 72.35% don't use bed nets outside their sleeping spaces. This is very significant because household members will encounter infective mosquitoes especially during hot weather conditions. From the data, 90.91% of those that don't use nets either outside or inside the

sleeping places reported having malaria episodes whilst only 5.53% of those that reportedly use LLINs experienced malaria episodes. This is a very clear indication that bed nets can prevent malaria.

Conclusion

Despite free distribution of LLINs during mass campaigns and routine distribution through government health facilities, the ownership was found to be high but utilization remains low and a challenge. Therefore, there is a need to refocus on people's choice of bed nets including the textural properties to increase the utilization of LLINs to effectively and efficiently control malaria in The Gambia. Government should consider the bed nets choices of individuals as in conical and soft texture and should therefore increase the quantities of these types of LLINs when procurement of LLINs is done.

In addition, IRS should be strengthened and conducted regularly as there is evidence that IRS can be a barrier for the utilization to LLINs. SBCC activities should also be strengthened within communities throughout regions where IRS is conducted.

Finally, further research needs to be conducted to properly and fully understand the phenomenon of low utilization of LLINs in our communities.

Recommendations

1. For the Gambia to remain on course to eliminate malaria as a disease, it is very crucial for Government and its malaria partners to focus on the following as indicated by several surveys conducted in this country.
2. Focus on buying the choices of nets for the intended beneficiaries in terms of both texture and shape.
3. Ensure that IRS is regularly and consistently done in the regions and scaled up countrywide.

4. Strengthen and intensify SBCC activities to sensitize communities that IRS is not a replacement of LLINs.
5. National Malaria Control Program and its implementing partners should carry out a more detailed study to better understand the issue of low net utilization in our communities and this can greatly hinder the goal of malaria elimination.

Conflict of Interest

I do declare that there is no conflict of interest.

Ethical Consideration

This research has no adverse potential risks to participants and myself as it did not involve any sensitive issues that will violate the norms and values of these communities involved in the study. It did not also involve any other forms of invasive procedures. During data collection, written informed consent was sought to administer the questionnaires. Each study participant was given information about the

study before administering the questionnaire. Assurance of anonymity was observed at all stages. The participants were also informed that they are free to drop out from the study at any time they feel to and that the results obtained will be shared with them through their various community health nurses and public health officers at RCH clinics. Where possible, the results will be shared with the various village development committees of the villages that participated in the research. To ensure confidentiality, no names of household members or household heads would be written on any of the questionnaires used during the data collection. Questionnaires were only identified using unique serial numbering.

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