



**The role of Home-based Communication on increase knowledge and practice regarding Utilization of Long-Lasting Mosquito Nets, Khartoum State, Sudan (2016 - 2018)**

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**Background:** In the absence of a vaccine or effective and sustainable means of vector control, use of LLINs is an effective way to limit vector borne diseases.

**Objectives:** The study aimed to assess the role of home-based communication in improving Knowledge and practice of nets owners and hence the LLINs utilization compared with the currently used BCC approaches in 2016 – 2018 in Khartoum state.

**Materials and methods:** A community based quasi-interventional study that utilized both pre and post design, and case – control study design study was conducted in four villages two served as intervention in Bahri Locality and the other two were selected as a control villages in Omdurman Locality. A multistage random sampling technique was used in selecting the required samples for this study and a semi- structured questionnaire was used to collect required information. The intervention composed of home-based communication includes messages and printable materials about the LLINs importance adapted from the national malaria control as well as distributing LLINs and training the community on hanging LLINs. A total of 1250 participants were deployed and divided equally between both the experimental and control groups and were followed up for a period of one year with interval every 3 months.

**Results:** There were no significant differences observed between the intervention and control groups concerning socio-demographic characteristics such as age, occupation and education level except for family monthly income, p-value > 0.05. The knowledge score about LLINs in the intervention villages was significantly increased for good knowledge in the dry season and wet season p-value= (0.001). This is most probably attributed to the four quarterly based follow-up visits, home based communication

method has significant impact affecting bed net use compared to routine behavioral change communication (BCC) and It have great role in promoting the proper use and utilization of LLINs in the study villages during dry and wet season.

**Conclusion:** The home-based communication is appearing effective in increase knowledge regarding utilization of nets. Therefore, it is suggested that there is a need to adopt by National Malaria Control Programme home-based communication during and after bed nets campaigns to enhance maximum utilization of LLINs. The study recommended adopting home-based BCC during and after LLINs campaigns and to a conduct more researches.

**Keywords:** *home based communication, knowledge, Khartoum state*

### **Introduction:**

Malaria in Khartoum state witnessed the lowest level during the 1960s, when the disease was believed to be nearly eradicated. However; during the following decades, malaria control efforts suffered major disruptions, Khartoum State increasingly suffered from malaria epidemics, with more than 700, 000 cases annually between 1998 and 2001. In 2002, Khartoum Malaria Free Initiative (KMFI) was launched with strong political and financial support from the Government, World Health organization and local partners who have complimented the governmental support. The great achievements, whereby malaria cases and malaria deaths were dramatically decreased however the late years witnessed slight increase in the cases Khartoum state Health Statistics dept, 2014) and (1).

WHO recommends the use of vector control (i.e. stopping mosquitoes from biting human beings) or chemoprevention (i.e. providing drugs that suppress infections) in specific population subgroups (i.e. pregnant women, children and other high-risk groups) or for specific contexts (elimination). The most commonly used methods to prevent mosquito bites are sleeping under an ITN and spraying the inside walls of a dwellings with an insecticide that is an intervention known as IRS. The use of ITNs has been shown to reduce malaria case incidence rates by 50% in a range of settings, and to reduce malaria mortality rates by 55% in children aged less than 5 years in sub-Saharan Africa. Historical and programmes documentation suggest a similar impact for IRS. These two core vector-control interventions use of ITNs and IRS are considered to have made a major contribution to the reduction in malaria burden since 2000. In a few specific settings and circumstances, ITNs and IRS can be supplemented by larval control, source management, environmental modifications, biological control or reduce mosquito biting of humans (2, 3).

This study aimed to assess the role of home-based communication in improving Knowledge and practice of nets owners and hence the LLINs utilization compared with the currently used BCC approaches in 2016 – 2018 in Khartoum state.

## **MATERIALS AND METHODS:**

### **Study design:**

This was a community based quasi-interventional study that utilized both pre and post design, and case – control study design, as follows:

**A pre and post design**, to determine changes in LLINs utilization and associated knowledge, attitudes, and practices following adopting of home-based communication (HBC), as BCC strategy, among members of households in the intervention villages in Khartoum State (objective 3)

**A case – control study design**, to compare the difference in LLINs utilization in Khartoum state between members of households in the intervention villages (exposed to HBC) and household members in the control villages (exposed to BCC strategy) .

### **Study Area:**

The study was conducted in Khartoum State which includes Khartoum city the capital of Sudan. Khartoum state is one of the eighteen states of Sudan.

### **Study duration:**

2016 - 2018

### **Study populations**

These are members of households in Khartoum state.

### **Sample size estimation**

The sample size was calculated using the formula:  $n = \frac{N}{1 + N(e^2)}$  <sup>(109)</sup> where (n) is the sample size, (N) is the population size, and (e) is the level of precision (0.03).

$N = 5,274,321$

$e = 0.03$

$n = 1111$

Refusal rate (11%) = 139

The total targeted housewives = 1250

### **Sampling technique**

Random multistage cluster sampling method was applied for the selection, as follows:

**First stage (selection of study localities)**

Randomly, by toss draw from the seven localities in Khartoum state, Omdurman locality was chosen as the (intervention villages) and Bahari locality was chosen as the (control villages). Also, the targeted villages in the intervention and control localities were obtained from the list of villages in the same report.

**Second stage (selection of the study villages)**

**Inclusion criteria**

Villages that reached the LLINs universal coverage (reached 100% LLINs total coverage according to WHO standards) were included.

**Exclusion criteria**

Villages which did not reach the LLINs universal coverage (reached 100% LLINs total coverage according to WHO standards) were excluded.

**The intervention villages** (in Omdurman locality) are villages that reached the LLINs universal coverage (reached 100% LLINs total coverage according to WHO standards). There were eleven villages (table 1), with a total of (20192) population, according to 2008 census and the annual growth rate updates. These villages were chosen and named as ‘intervention cluster frame’, as they were totally covered by the study intervention package. Moreover, housewives who were living in the villages for the last 3 years and received and retained LLINs in the last 3 years were included in the study as residents of intervention villages.

Table (1): Villages in Omdurman locality where LLINs were distributed till 2016

	Village Name	No of households (HH)	No of HHs	HH Sample	Health Promoter Code
1.	Eid Abu Zaid	10969	1738		
2.	Alsero	17630	2324		
3.	Alaushara	16810	2568	308	A
4.	Eastren Salha	14261	2375		
5.	Eastren Gaiaa	19289	2823		
6.	Eid Alhad	6895	1248		
7.	Almatabier	2712	534		
8.	Alshiek Albashir	5877	1182		
9.	Alsandodab	5667	1046		
10.	Algaiaa	17156	2645	317	B
11.	Almugadab	9910	1709		
	Total	127176	20192	625	

From a list of intervention villages, Alaushara and Algaiaa villages were selected for the study, using simple random method (by toss draw). The list of household members in the two villages (Alaushara and Algaiaa) who received LLINs (as per the annual LLINs distribution report, 2016) was taken as sampling frame.

**The control villages (in Bahri locality)**

The control Villages (Bahari locality): are villages that reached the LLINs universal coverage (reached 100% LLINs total coverage according to WHO standards). They were (10) villages with (20800) population according to 2008 census and the annual growth rate updates. These villages were named as control clusters (table 2) . Moreover, housewives who were living in the villages for the last 3 years before the study and received and retained LLINs for the last 3 years were included in the study as residents of control villages.

**Table (2):** The control villages where LLINs were distributed in Bahari locality till 2016

Village Name	HH	No of HHs	HH Sample	Health Promoter Code
1. Aljaili	14787	2624	308	A
2. Dairy	3432	634		
3. Wawisi Abdg	3686	725		
4. Wawisi Ali	5054	1088		
5. Aldohom & Alabiad	6526	1187		
6. Wad ramli	7694	2700	317	B
7. Alnikhaila	8820	1781		
8. Algarari	16410	3164		
9. Alkadaro	15595	2930		
10. Northern Um algora (A&B)	17925	3967		
Total	99929	20800	625	

From the villages list by toss draw Aljaili and Wad ramli villages were chosen and the sample was proportionally divided between the two villages (308) HHs and (317) HHs respectively and given code (A) and (B) to identify the team which will conduct the study survey.

**Third stage (selection of the study households)**

According to Khartoum state ministry of health LLINs were distributed to all villages however for the study purpose LLINs were again given to HHs who did not have access to LLINs before, sometimes LLINs were given to them as replacement to grantee

(100%) coverage during the intervention period. The calculated sample size (1250) was divided equally between intervention villages (625) HH and control villages (625) HHs. Then the sample of (625) HH were distributed over the two selected villages in the intervention locality and also over the two selected villages from the control locality. The calculated sample size was distributed over the four villages (Algaiaa, Alaushara, Wad Ramli, Aljaili) in proportionate to their population size. So the calculated sample size was 308, 317, 308 and 317 respectively.

In each of the four villages systemic random sampling technique was used as follows:

- The geographic center of the village was identified
- A pen was drowned at the village center to choose the main rood outside the village
- The first HH outside the village to the right hand was chosen as first HH
- The interval was 5 HHs
- The movement was clockwise
- The participation was voluntary based
- In case that there was no housewife, or she refused to participate immediately data collectors used to choose the neighboring HH and carry on
- If there were many families in a single houseby toss draw one was chosen also if there were more than one housewife by toss draw one was chosen.
- Data collectors were told to thank the participating HH and move to the second one
- Using random technique participating households were selected starting from the Northern east corner with a clockwise movement.

### **Study subjects**

Operational research by Khartoum malaria free initiative (KMFI) showed that at the household level housewives are usually responsible for LLINs. Also, that was clearly observed during the previous LLINs distribution campaign; that is why housewives in both intervention and control villages were targeted to be sources for data collection.

### **Study Phases**

#### **3Phase (1): Orientation of health authorities and stakeholders (1-7) Jan 2016**

During this phase the researcher offered orientation about the research objectives, benefits and methods to relevant sectors, including; the Social and Preventive Medicine dept DG (SMOH), Bahari and Omdurman localities leaders(executive DG, Health dept DG, Malaria control director, Administrative Units Officers, local

community leaders as heads of People's committees (*Allijan Alshabia*), Health leaders, all were contacted by the researcher through meetings they had had full explanation to the objectives and scope of the study and the benefit that their sectors and communities will gain.

### **Phase two: Data collectors recruitment and training (8-11) Jan 2016**

For the pre and post surveys purpose twenty data collectors were chosen according to prelisted criteria. The criteria for choosing the data collectors were restricted to data collectors with at least Bachelor degree and previous participation in community-based health research – with preference of data collectors who used to participate with (SMOH) in similar studies and surveys. Males and females were equally recruited, moreover data collectors living nearby the study villages were preferred. In addition to that a senior health officer in each locality was recruited as team facilitator to facilitate the field work. Then all data collectors and team facilitators were trained on how to conduct the survey specially how to fill the predesigned questionnaires using the predesigned manual (in Arabic language. According to the pre training and post evaluation data collectors proved that they gained the needed knowledge and skills to conduct their task perfectly.

### **Pilot study**

Under the direct supervision of the researcher Pilot testing took place in (16-19) January 2016 directly after the training of the survey team members they conducted a pilot survey in 125(10%) HHs in Khartoum locality villages which were not included in the actual study villages to test the tools and data collectors' skills and readiness. After field work, data collectors had had a session for discussion and evaluation and correction which showed clearly that they were ready to implement their assigned tasks.

### **Phase three: Health promoters recruitment and training (8-11) Jan 2016**

For the study intervention ten health promoters (all public were health officers) were recruited for house-to-house implementation of the intervention package. In addition to that a senior health officer in each locality was recruited as team facilitator to facilitate the field work. Health officers were selected according to prelisted criteria: holding Bsc degree in public health, previous engagement in similar community-based research. Males and females were equally recruited; moreover health officers who had ease access to the study villages were preferred. Then all the ten health officers and the team facilitator were trained on how to conduct the study, specially how to deliver the home-based BCC messages, they also had in depth training and orientation about how to act and react with household and community members,

general interviewing skills, administration of consent forms, field work, in addition to specific training on malaria control and prevention with focus on (IVM) specially LLINs use scale up. They were trained and facilitated with the pre-designed manual of the study (in Arabic language as well as needed prints). The target of this training was to give the health promoters (health officers) basic knowledge on malaria control activities as well as giving them complete idea about their tasks. The study manual was their main reference of the training as it was designed by the researcher for that purpose.

### **Intervention Pilot study**

Under the direct supervision of the researcher Pilot testing took place in (20 to 23) January 2016 directly after the training of the health promoters pilot covered 125 (10%) HHs in Khartoum locality villages which were not included in the actual study villages to test the tools and health promoters skills and readiness. After field work, health promoters had had a session for discussion and evaluation and correction which showed clearly that they were ready to achieve their jobs.

**Phase four:** This phase included two surveys, as follows: a) Dry season Pre-intervention survey (1-2) January 2016, and b) Wet season Pre-intervention survey (1-2) Sept 2016. The pre intervention surveys were conducted during the dry season and the wet season for the study purpose in the four selected villages: Algaiaa and Alaushara in Omdurman locality and Wad Ramli & Aljaili in Bahari locality. As calculated, 1250 HHs was divided equally between the two localities, 625 HH per each locality, divided proportionally to the population in each village. Data collectors were distributed in Algaiaa, Alaushara, Wad Rramli, Aljailito interview the study subjects in the selected households, using systemic random sample technique as follows:

- The geographic Centre of the village was identified
- A pen was drawn to choose the main road outside the village
- The first HH outside the village to the right hand was chosen as first HH
- The interval was 5 HHs
- The movement was clockwise
- The participation was voluntary based
- In case that there was no housewife, or she refused to participate immediately data collectors used to choose the neighboring HH and carry on
- If there were many families in a single household, then the data collectors used to select (by toss draw) one housewife to interview.



- When they finish data collection, data collectors used to thank the participating HH and move to the second one

### **Phase (5): Intervention 5 Jan- 31Dec 2016**

**LLINs promotion educational package was designed to address the following aspects:**

#### **A. Knowledge**

- a. General information about vectors borne diseases (with focus on malaria)
- b. General information about vectors (with focus on mosquitoes)
- c. control of vectors mounted diseases (with focus LLINs)
- d. LLINs importance, use and the Suitable time for hanging bed nets
- e. Benefits gained from having and using LLINs

#### **B. Practice**

- a. How to fix the LLINs
- b. How to keep the LLINs
- c. Ideal Practices concerning LLINs

### **The first home visit (Jan - March) 2016**

In the intervention villages, the trained health promoters (n,10) were distributed in two groups of five, each group responsible of one village in Omdurman (Algaiaa&Alaushara), they used to move from HH to the other in each selected village till they covered all the targeted number of households with home-based (BCC). In each HH, they used to conduct LLINs promotion plan in the wet and dry seasons as follows:

1. Conduct **LLINs promotion plan**
2. Distributing and explaining content of printable materials including posters, manuals and pamphlets about the LLINs importance
3. Distribute (LLINs) to the targeted (HHs) if they lost their LLINs or their LLINs became not effective.
5. Giving the targeted (HHs) full chance to explain their ideas, beliefs, practice, and their experience and barriers using LLINs, if any.
7. Training the targeted (HHs) on how to hang the (LLINs) properly, how to keep it and how to wash it. The team of health promoters includes two members (male and female). They targeted the housewife and all HHs members who were present at the visit time. The visits usually used to start at eleven o'clock in the morning till 2 o'clock afternoon. However, if the housewife is absent or she chooses certain time as suitable time, then the visit used to be postponed to that time. Moreover, the team of health promoters used to leave the house only after being sure that the health messages they delivered were well understood and the skills of hanging the LLIN

were well acquired, wrong believes and misconceptions and fears were alleviated. The ten Health promoters used to cover (30 – 50) HHs per day covering the (625) HHs in (2-3) weeks this represents one round, the household visits used to be conducted once every (3) months, and this continued for one year so that 4 rounds were conducted throughout the study period.

### **The second home visit (April - June) 2016**

1. LLINs promotion plan contents were again reviewed to make sure that HHs remember the messages
2. Distributing and explaining content of printable materials about the LLINs importance
3. Inspect the LLINs to see if it is used, well-kept and if it needs replacement
3. Distribute(LLINs) to the targeted (HHs) if they lost their LLINs or their LLINs became not effective.
5. Give the targeted (HHs) full chance to explain their ideas, beliefs, practice, and their barriers using LLINs, if any.
6. Ask the HHs to demonstrate how the LLINs hang.

### **The third home visit (July - Sept) 2016**

### **The fourth home visits (Oct - Dec) 2016**

The third and fourth home visits followed the same procedure as in visit one and two.

### **3Phase (6):**

Dry season Post intervention evaluation was on (6<sup>th</sup> - 8<sup>th</sup>) Jan 2017 while the wet season Post intervention evaluation was conducted on (30<sup>th</sup> - 31<sup>st</sup>) Dec 2017. After the intervention, data collectors who have participated in the pre-evaluation in the wet and dry season again participated in the post intervention evaluation in both the intervention and control villages. For the post test the same sampling process used in the pre-evaluation was followed again. To measure the change in the knowledge

1. The predesigned questionnaire was used as too
2. Respondents were asked to explain their knowledge about vectors, malaria and LLINs and hang the LLIN

### **Data entry and analysis 15 Feb - 15 Aug 2018**

Data was processed and entered in SPSS software version 16.0. Descriptive statistic and inferential statistic have been used where appropriate. P-value was considered significant at 0.05 levels.

### **Ethical considerations**

1. Ethical clearance and permission to conduct the interviews were obtained from the Ministry of Health, Khartoum state also the local authorities and the community committees (ligan shabia) were told.
2. Informed verbal consent was obtained from all individuals interviewed respectively.
3. Respondent housewives were told that the participation is voluntary, and they have the right to accept or refuse, moreover they were told that codes are used to guarantee their confidentiality, and then the questionnaire was completed.
4. Measures were taken to ensure the respect, dignity, and freedom of each individual participating in the study.
5. During training of the interviewers, emphasis was placed on the importance of obtaining informed consent (orally) and the avoidance of any kind of coercion.
6. To ensure confidentiality, all household members were identified by a unique code and the main researcher, beside the health promoter, were the only persons who could access for personal data.

## **RESULTS:**

Numbers of (1250) housewives were interviewed. Table 1 shows that more than half (n,374- (59.8%) of the interviewed housewives in the intervention villages were aged between 25 - < 50 years, and 206 (33.0%) were aged between 50 - < 75 years; while in the control villages 338 (54.1%) of interviewed housewives were aged between 25 - < 50 years and 229 (36.6%) were aged between 50-< 75 years. Most of the respondents in the intervention villages were housewives 571(91.4%) while in the control villages 562 (89.9%) were housewives. Regarding the educational level the housewives in intervention villages 311(49.8%) of them had secondary level compared to 314(50.2%) of them in the control villages, while 189(30.2%) of them had primary/basic/intermediate compared to 183(29.4%) in the control villages. Khalwa and informal education represent 83(13.3%) in the interventional villages compared to 87(13.9) in the control villages, more than half of the respondents 351(56.2%) in intervention villages compared to 361(57.8%) in the control villages had monthly income ranging between (1001-1500) SDG, while 146(23.4%) of the respondents in the intervention villages and 143(22.9%) in the control villages had a monthly income ranging between ((500 - 1000) SDG. The mean number of family members in the intervention villages was 2.39 with a standard deviation of .76, and 2.34 with standard deviation of .48 in the control villages. Regarding all socioeconomic characteristic of respondents in the intervention and control villages,

no statistically significant differences were demonstrated ( $p>0.05$ ) as shown in table 1 below:

**Table 1:** Distribution of socio-demographic characteristics among housewives in the intervention and control villages, Omdurman and Bahri localities, Khartoum state, 2016 - 2018

Socio-demographic	Response	Intervention Villages		Control Villages		P-value
		No.	%	No.	%	
Age	< 25 yrs.	38	06.1	54	8.6	<b>0.121</b>
	25 < 50 yrs.	374	59.8	338	54.1	
	50 < 75 yrs.	206	33.0	229	36.6	
	> 75 yrs.	07	01.1	04	0.7	
Occupation	Public employment	11	01.8	19	03.0	<b>0.432</b>
	Free duties	34	5.4	38	06.1	
	Housewife	571	91.4	562	89.9	
	Other	9	01.4	6	01.0	
Household education	Illiterate	26	4.2	22	3.5	<b>0.653</b>
	Khalwa and informal education	83	13.3	87	13.9	
	Primary/basic/intermediate	189	30.2	183	29.4	

	Secondary	311	49.8	314	50.2	
	University and above	16	2.6	19	03.0	
Family monthly income	< 500 SDG	16	2.6	8	1.3	<b>0.090</b>
	500-1000 SDG	146	23.4	143	22.9	
	1001-1500 SDG	351	56.2	361	57.8	
	> 1501-2000 SDG	76	12.2	72	11.5	
	> 2000 SDG	36	5.8	41	06.6	
Family size		2.39±.76		2.34±.48		<b>0.615</b>

*Figures in parenthesis indicate percentage; Plus-minus values are mean± SE. of the mean*

Table 2 indicates the knowledge of respondents about LLINs utilization. Knowledge questions were asked in the dry season and again repeated in the wet season. The percentage of respondents in the intervention villages who heard about the importance of using LLINs in the dry season increased after the intervention by (45.9%) and in the rainy season increased by (43.3%), this change was significant (p-value was 0.001). In the control villages the increase was (6.7%) in the dry season and (8%) in the wet season; this change was not significant (p-value 0.176 and 0.286 respectively). The correct knowledge of respondents in intervention villages about the suitable time for hanging LLINs was significantly increased by (39.1%) after the intervention during the dry season and by (47%) during the wet season (p-value 0.003 and 0.001) respectively. In the control villages the increase was by (6%) in the dry season and by (12.9%) in the wet season (p-value was 0.273 and 0.347) respectively. Regarding the increase in correct knowledge concerning malaria transmission in the wet and dry seasons respectively, findings in the intervention villages were (40.5%) and (35.0%) (p-value= 0.001) in the wet and dry season. While the increase in the control villages was (2.3%) and (5.7%) (P-value= 0.324 and 0.881). Regarding change in knowledge of the respondents about the place of mosquito breeding, following the intervention, an increase by (57.4%) was demonstrated during the dry season and by (49.2%) in the wet season in the intervention villages (p-value 0.001) in the wet and dry season, while in the control

villages the increase was by (21%) in the dry season and by (13%) in the wet season (p-value, 0.140 and 0.726) respectively. The correct knowledge of respondents in the intervention villages about mosquitoes control methods increased after the intervention by (26.4%) in the dry season and by (40%) in the wet season (p –value, 0.002 and 0.001) respectively. In the control villages the increase was (10.8%) in the dry season and (0.4) in the wet season (p – value, 0.112 and 0.823) respectively.

**Table 2:** The reported changes in the correct knowledge concerning the use of LLINs during dry and wet seasons among housewives in the intervention and control villages in Omdurman and Bahari localities, Khartoum state (2016 – 2018) (n,625).

Respondents' Knowledge parameter	Season	Housewives in intervention villages n=625				Housewives in control villages n=625			
		Pre # (%)	Post # (%)	$\chi^2$	p-value	Pre # (%)	Post # (%)	$\chi^2$	p-value
Heard about LLINs	Dry season	337 (53.9%)	624 (99.8%)	16.0	<b>0.001</b>	313 (50.1%)	355 (56.8%)	12.7	<b>0.176</b>
	Wet season	353 (56.5%)	624 (99.8%)	15.1	<b>0.001</b>	422 (67.5%)	472 (75.5%)	14.2	<b>0.286</b>
Know the Suitable time for hanging LLINs	Dry season	349 (55.8%)	593 (94.9%)	14.6	<b>0.003</b>	384 (61.4%)	421 (67.4%)	30.0	<b>0.273</b>
	Wet season	300 (48%)	594 (95%)	54.2	<b>0.001</b>	283 (45.3%)	364 (58.2%)	13.3	<b>0.347</b>
Know how malaria is transmitted	Dry season	363 (58.1%)	616 (98.6%)	15.0	<b>0.001</b>	332 (53.1%)	346 (55.4%)	68.9	<b>0.324</b>
	Wet season	361 (58.1%)	582 (93.1%)	156.3	<b>0.001</b>	406 (64.9%)	441 (70.6%)	6.6	<b>0.881</b>
know mosquito breeding sites	Dry season	199 (31.8%)	557 (89.2%)	38.6	<b>0.001</b>	193 (30.8%)	324 (51.8%)	17.2	<b>0.140</b>
	Wet season	193 (30.8%)	500 (80.0%)	35.0	<b>0.001</b>	193 (30.8%)	274 (43.8%)	42.8	<b>0.726</b>
know mosquito control Methods	Dry season	346 (55.4%)	611 (81.8%)	21.8	<b>0.002</b>	338 (54.1%)	406 (64.9%)	10.1	<b>0.112</b>
	Wet season	343 (54.9%)	593 (94.9%)	19.1	<b>0.001</b>	324 (51.8%)	326 (52.2%)	7.6	<b>0.823</b>

Table 3 compares changes in the practice of households in the intervention and control villages regarding utilization of bed nets. In the intervention villages LLIN use significantly increased from 328 (38.2%) to 623 (99.4%), p-value 0.001 in the dry season, and 239 (38.2%) to 625 (100%), p-value 0.001 in the Wet season. In the control villages the increase was from 282 (45.1%) to 356 (52.5%) - P - value 0.215 in the dry season and from 386 (61.7%) to 390 (62.4%) - p - value (0.313) in the wet season. It was found that during the dry season the participation of HHs in the intervention villages in formal discussions including exchange of information about LLINs utilization significantly increased from 310(49.6%) to 608(97.3%) (p value 0.001) and from 389(62.2%) to 619(99.0%) - p value (0.001) in the wet season. while the increase in the control villages in the dry season was from 192(30.7%) to 248(39.7%) - p value (0.423) and from 248(39.6%) to 251(40.2%) - p value (0.512) in the wet season. The practice of sleeping under bed nets among households of the intervention villages during the dry season was increased from 83 (13.3%) to 509 (81.4%) - p value (0.001), and in the wet season it increased from 97(15.5%) to 507(81.1%), p value (0.001). In the control villages the increase in the dry season was from 75(12.0%) to 127(20.3%) (p value 0.610, and 140 (22.4) to 193(30.8%) - p value (0.701) in the wet season.

**Table 3:** Reported Utilization of LLINs during dry and wet seasons among housewives in the intervention and control villages in Omdurman & Bahri localities, Khartoum state, 2016 – 2018(n,625).

Practices concerning LLIN utilization	Season	Intervention villages n=625				Control villages n=625			
		Pre # (%)	Post# (%)	$\chi^2$	P-value	Pre # (%)	Post # (%)	$\chi^2$	p-value
Families having LLINs	Dry season	328 (52.5%)	623(99.7%)	52.5	<b>0.001</b>	282(45.1%)	356 (52.5%)	48.0	<b>0.215</b>
	Wet season	239(38.2%)	625(100.0)	48.1	<b>0.001</b>	386 (61.7%)	390(62.4%)	3.9	<b>0.313</b>
Family members participated in formal discussion includes information about LLINs	Dry season	310 (49.6%)	608(97.3%)	49.1	<b>.001</b>	192 (30.7%)	248 (39.7%)	6.2	<b>0.423</b>
	Wet season	389 (62.2%)	619 (99.0%)	351	<b>0.001</b>	248 (39.6%)	251 (40.2%)	8.3	<b>0.512</b>
Sleep under LLINs last night (prior to the survey)	Dry season	83 (13.3%)	509(81.4%)	58.3	<b>.001</b>	75 (12.0%)	127(20.3%)	5.3	<b>0.610</b>
	Wet season	97 (15.5%)	507 (81.1%)	34.5	<b>.001</b>	94 (15.0%)	193(30.8%)	7.6	<b>0.701</b>

## DISCUSSION:

LLINs have emerged as a potent and effective weapon in the armory of vector control options for the prevention of morbidity and mortality caused by vector borne diseases (Lengeler, 2019). Besides providing personal protection to the users against mosquito and other vectors bites, LLINs also produce ‘mass effect’, if comprehensive coverage by LLINs of the community is ensured, by killing many vectors, substantially reducing their longevity and entomological inoculation rate (4) However, community-oriented interventions to create awareness are vital to the achievement of the vector borne diseases control in the community, not only to educate the public about the commodity but the need to induce the interventions that include the use of LLINs (4) .

The present study aimed to assess the role of home-based communication in improving knowledge and practice of LLINs owners and hence the LLINs utilization compared with the currently used BCC approaches in 2015-2017.

The study indicated that knowledge of households concerning the use of LLINs during dry and wet seasons was significantly increased ( $p < 0.05$ ) after the home – based LLINs promotion programme in the intervention villages compared to the control villages where campaign – based LLINs promotion was implemented. Hence, the study revealed that knowledge about suitable time for hanging LLINs was significantly increased during the dry and wet seasons. This is most probably attributed to the four quarterly based follow-up visits conducted by the health promoters under the supervision of the researcher. This finding was in line with findings of a survey conducted in Togo following the second mass distribution campaign where baseline LLINs utilization was found to be low (54%) and showed a much larger increase (78%) in this case (24 percent difference) in the proportion of LLINs hanging eight months after a campaign when comparing households that received a ‘hang-up’ visit (5).

Furthermore, the study indicated that knowledge of respondents about the transmission of malaria disease was significantly increased during dry and wet season intervention  $< 0.05$ . This could most probably attribute to the four quarterly based follow-up visits for the households during the intervention in summer and rainy seasons. Other study in Nepal conducted by Joshi and Banjara, (6), found that the majority of the respondents (73.7%), replied that malaria is transmitted by the mosquitoes Similarly, 41.9 and 9.6% replied that encephalitis and filariasis respectively are also the diseases transmitted by the mosquitoes, (6). Similar results were also reported in Bangladesh (7) Knowledge, and practices regarding malaria control among the slash and burn cultivators in Rangamati Hill tracts of Bangladesh,



Malaria Journal, 2019.

Furthermore, the study revealed that, knowledge of respondents about how malaria disease is transmitted during dry and wet season was significantly increased after the HBC intervention,  $p < 0.05$ . The high level of awareness in this study was almost similar to other findings of a study in Rahad River basin, Sudan which found that the low awareness of malaria transmission significantly increased ( $p < 0.05$ ) after an awareness raising interventions (8). The current study showed that, Knowledge regarding how LLINs protect a person from diseases during the dry and wet seasons was significantly increased ( $p < 0.05$ ) in the intervention group than the control group, mainly attributed to the home-based BCC sessions conducted during the intervention phase. These follow up home based sessions were very important for the success of community vectors borne diseases control programmes, since the knowledge of care givers towards control and preventive measures could predict how well they can apply relevant knowledge of preventive measures onto the general population, as well as assist them to get prompt and correct treatment in case of a vectors borne diseases attack. Supporting the findings from this study, knowledge on preventive use of LLINs had been observed to be high in some countries such as Nepal (7) and Ghana (9), Also the study was consistent with a survey conducted in Tanzania (10) and malaria indicator survey (2011) and South Sudan Malaria indicator survey (2017).

Follow-up visits during the intervention also enhanced the adoption of households to positive attitudes in support to the use of LLINs on daily basis during dry and wet seasons. In another study in rural Tanzania, baseline interviews and surveys revealed incorrect practices and attitudes regarding the use of LLINs in the dry season, need to retreat LLINs, children napping under LLINs, need to repair LLINs, and LLINs procurement as a priority with 53- 88.6% incorrect responses and 11.4-47% correct responses. A three-week follow-up demonstrated 83-95% correct responses. Fifteen-months follow-up showed statistically significant ( $p < 0.01$ ) corrections from baseline findings in all the five assessed practices and attitudes (39.4-93.3% correct answers). The majority (89.4%) of respondents reported using their nets every night, and 93.3% affirmed the purchase of nets as a financial priority. (11).

As shown by the study among the intervention group there was significant increase regarding participating in discussions about LLINs during the dry season from 310(49.6%) to 608(97.3%)  $p$ -value was (0.001) and wet season from 389(62.2%) to 619(99.0%)  $p$ - value was (0.001). while the control group showed no significant change. The high participation showed in the intervention group has supported the good knowledge and practice of respondents regarding LLINs which should be

encouraged.

The study revealed that, sleeping under LLINs last night was significantly greater from 83(13.3%) to 509(81.4%) p-value (0.001) in the wet season and from 97(15.5%) to 507(81.1%) p-value (0.001) in the dry season while there was no significant change in the control villages, this slight improvement in LLINs utilizations attributed to the home-based BCC. This finding is in agreement with the previous study in Uganda which showed that both hanging and use of LLINs increased during follow-up, where the proportion of the population using an LLINs the previous night was 64.0% (95% CI 60.8, 67.2), for one additional visit, 68.2% (63.8, 72.2) for two visits. The study concluded that behavior change communication (BCC) provided during the home visits was sufficient to induce high levels of net hanging and use. (12) Concerning seasonal variations, the level of LLINs usage can be affected by climatic factors such as temperature and humidity, both affecting mosquito density. Mosha *et al*, (13) reported that LLIN usage levels might therefore be higher or lower depending on whether the LLIN utilization assessment surveys were conducted in the dry or the wet season. Discomfort during LLIN use (primarily due to heat) might be experienced in dry season, leading to low LLIN use rates. Heat was identified as a factor contributing to partial mosquito LLINs use (i.e. use for part of the night, but not all) (14).

#### **Limitations of the study:**

1. Budgetary constraints made the study to be only restricted to two localities in Khartoum State. Such studies will have more beneficial results if done on more representative communities with complete randomization all over Khartoum State or the Country.
2. The lack of internet, communication network, electricity in many cases, in addition to transportation difficulties and road cuts due to the rain and floods in the wet season and its consequences constituted a great challenge and limitation during the study period.
3. The closure of the country due to the COVID-19 pandemic and its consequences constituted a great challenge and limitation during the study period.

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#### **CONCLUSION:**

The home-based communication is appearing effective in increase knowledge regarding utilization of nets. Therefore, it is suggested that there is a need to adopt by

National Malaria Control Programme home-based communication during and after bed nets campaigns to enhance maximum utilization of LLINs. The study recommended adopting home-based BCC during and after LLINs campaigns and to a conduct more researches.

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### **CONFLICTS OF INTEREST**

The authors declare no conflicts of interest.

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