Endline Survey for continuous distribution of LLINs in Eastern Region, Ghana

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ACKNOWLEDGEMENT

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ABBREVIATIONS

ANC	Antenatal Clinics
BCC	Behavioural Change Communication
CD	Continuous Distribution
CI	Confidence Interval
CWC	Child Welfare Clinic
EPI	Expanded Program on Immunization
HF	Health Facility
IEC	Information Education and Communication
IRB	Institutional Review Board
ITN	Insecticide Treated Nets
LLIN	Long Lasting Insecticidal Nets
MERG	Monitoring and Evaluation Reference Group).
NMCP	National Malaria Control Programme
PCA	Principal Component Analysis
RBM	Roll Back Malaria

EXECUTIVE SUMMARY

Distribution of long lasting Insecticidal nets (LLIN) is considered a key intervention for the prevention of malaria. Mass distribution is required to rapidly scale up LLIN coverage while continuous distribution systems are essential to sustain the results achieved. In the Eastern Region (ER), the National Malaria Control Programme and implementing partners supported mass LLIN distributions between December 2010 and April 2011. Continuous distribution (CD) activities were started in October 2012 and included antenatal care services, child welfare clinic services through the expanded program on immunization and primary schools. The outcome was evaluated through cross sectional surveys, conducted at baseline in April 2012, 12-16 months after the campaign and at endline in December 2013, after one year of CD implementation.

A representative sample of 900 households of ER was selected using a two-stage cluster sampling design. Household heads were interviewed using a structured questionnaire. Coverage of households with at least one LLIN) was 91.3% (95%CI 88.4 to 93.6) at baseline and fell to 88.4% (85.2 to 91.3) at endline 18 months later, but was only 81.0% (76.3 to 84.9) without the LLIN from CD. Population access to an LLIN within the household decreased from 74.5% (71.1 to 77.6) at baseline to 66.5% (62.9 to 69.9) and was 57.4% (53.0 to 61.8) without the CD contribution. Households reached by any of the CD channels were primarily those who had not been reached by the campaign with any or sufficient ITN. In addition, the different CD channels largely complemented each other with little overlap in the first year.

The continuous distribution of LLIN through primary schools and routine health services did not quite maintain the household coverage after one-year of implementation due to its late start almost two years after the campaign. Results show, however, that a CD approach is feasible..

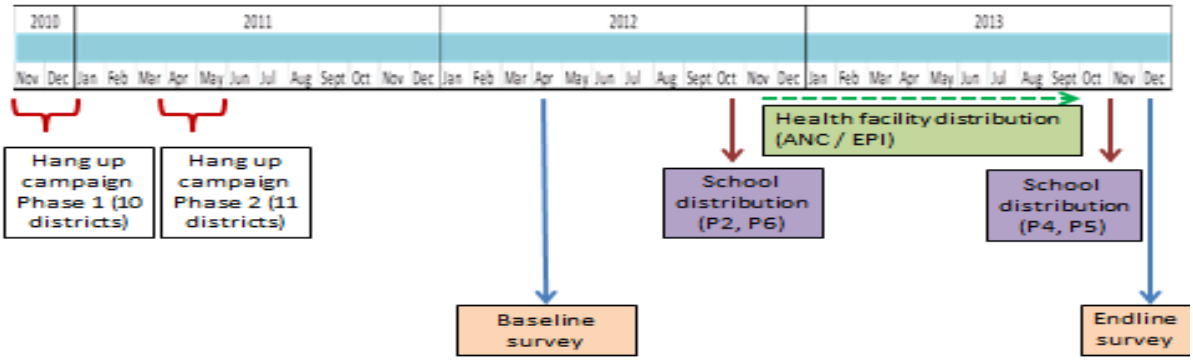
Again, although the ownership of 1 LLIN for every 2 people was not maintained after one year of CD implementation, households started to get rid of their older nets as new nets were introduced on a continuous basis in the community through the CD channels. The CD system therefore did serve its purpose in enabling households to replace their older nets as expected.

INTRODUCTION

Distribution of Long Lasting Insecticidal Nets (LLIN) to reach universal coverage is considered a key intervention for the prevention of malaria. Mass distribution is required to rapidly scale up LLIN coverage while continuous distribution systems are essential to sustain the results achieved. Ghana is currently engaging in a massive effort to scale up malaria prevention using mass distributions of LLIN. While previous LLIN distributions have focused at biologically vulnerable groups (children under 5 year of age and pregnant women), current efforts are aimed at reaching universal access to LLIN for the general population (on average one net for every two persons). In the Eastern Region, mass LLIN distributions took place between December 2011 and April 2012, supported by the National Malaria Control Programme (NMCP) and implementing partners. The Eastern Region was also the pilot region for a set of continuous distribution activities that was conducted in 2012 and 2013 During the pilot,LLINs were distributed through Antenatal Clinics (ANC), Child Welfare Clinics,(CWC) under the Expanded Programme for Immunization (EPI), schools, and also through the commercial sector.

The outcome of the LLIN continuous distribution (CD) was evaluated through surveys conducted at baseline (i.e. few months after the campaign) and at endline (i.e. few months after the start of CD activities). This report presents the results of the endline survey.

Figure 1: Timeline of activities



Aim, objectives and research questions

The purpose of this survey was to evaluate the outcome of the LLIN distribution campaign in Eastern Region with particular emphasis on the achieved level of universal coverage as defined by indicators recently revised by MERG (RBM Monitoring and Evaluation Reference Group).

The primary objectives of the survey were:

- To measure the outcome of the pilot of continuous LLIN distribution activities in Eastern Region
- To evaluate the durability of household LLIN obtained prior to April 2012 (baseline survey)
- To assess the use of nets in general and LLIN in particular at the end of the rains

The secondary objectives of the survey were:

- To measure the household coverage of LLIN achieved by each channel of continuous distribution
- To measure the retention of LLIN obtained through the universal LLIN access campaign after 2 years and through continuous distribution after 1 year
- To measure the equity in access to continuous distribution LLIN
- To evaluate the success of the IEC and BCC activities associated with the continuous distribution

The research question was:

Did the continuous distribution of LLIN through schools and health facilities maintain the household coverage achieved by the universal LLIN access campaign (i.e. baseline estimate: 49.8% households owning at least 1 LLIN for every 2 people)?

Expected benefit and value

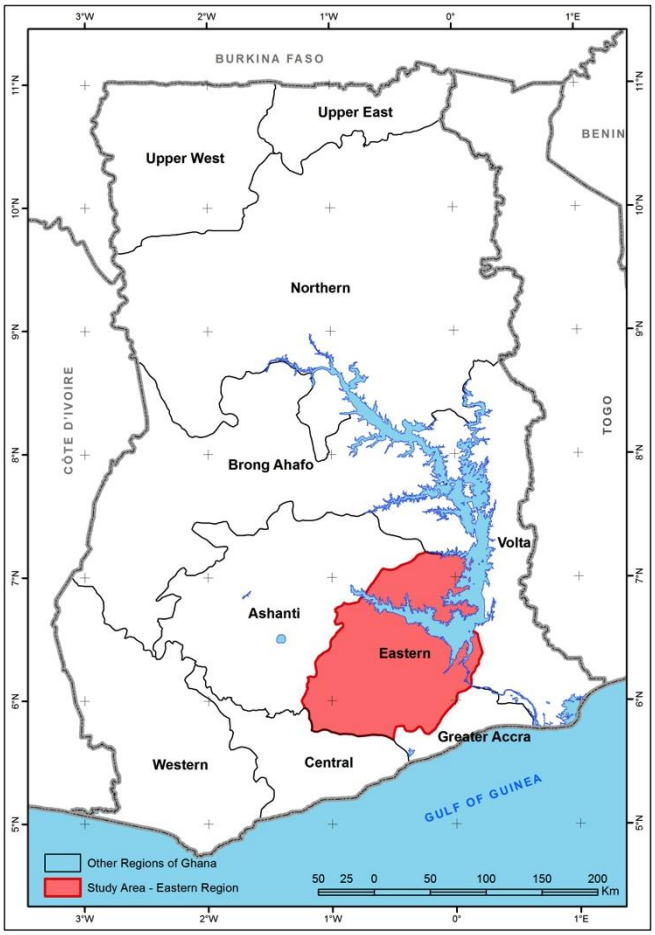
The results of the proposed study are expected to:

- Provide the Region and National Malaria Control Programme and RBM partners with valuable information over the success of current guidelines for mass campaign distribution, whether they reached the intended targets for universal coverage or – if not – what should be changed
- In addition, the study will give insight into behavioural aspects around ITN, namely retention and use that will inform the IEC/BCC component of future campaigns

METHODS

Study site

Figure 2: Location of Eastern Region

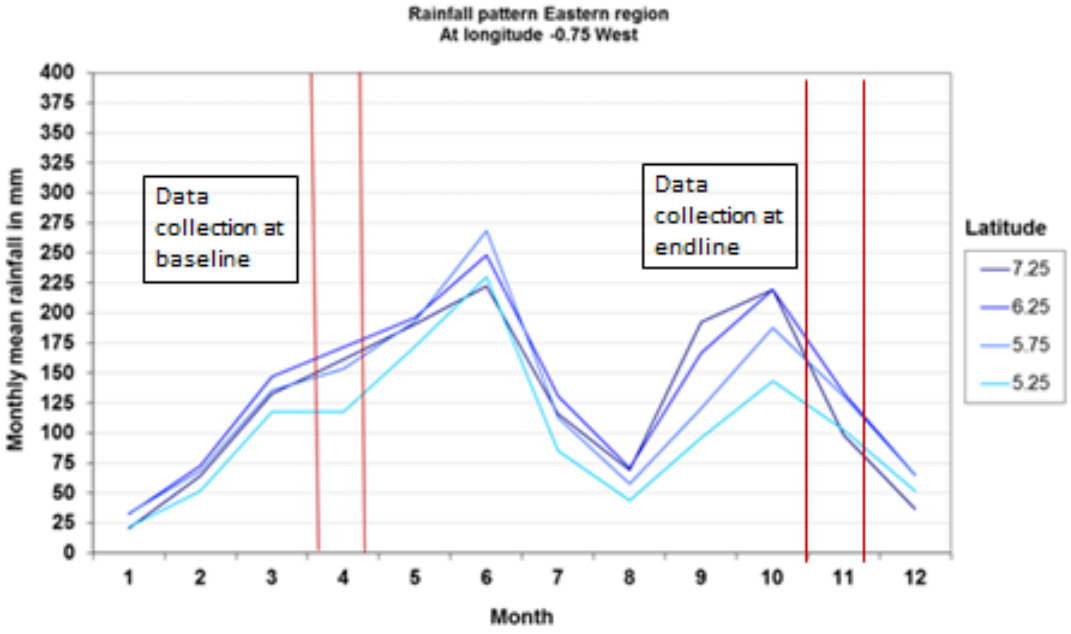


The target population was the population living in the Eastern region of Ghana. The Region had a population of 2,633,154 in 2010 a crude population density of 136.3 per square kilometer an intercensual growth rate of 2.1%. (2010 Population and housing census). It covers an area of 19,323 square kilometres, which is about 8.1% of Ghana's total land area. Eastern Region which was previously divided into 21 administrative districts has now been re-demarcated into 26 administrative districts. It is bordered on the north by the Ashanti region and the Brong Ahafo region, on the east by the Volta River, on the south by the Central region and the Greater Accra region, and on the west by the Ashanti region and the Central region. It is the sixth largest region in the country in

total area. The major ethnic group in the region is the Akan (51.1%), with Ga Adangbe and Ewe ethnic groups accounting for 17.9% and 18.9% respectively The Akan predominate in 15 of the 21 districts.

The climate of Ghana is tropical. In Eastern Region, the hottest months are February and March while July and August are the coolest months. Two rainy seasons occur, from April to July and from September to November. Annual rainfalls range from about 1,100 mm in the North to about 2,100 mm in the Southeast.

Figure 3: Rainfall intensity and pattern in Eastern region



This was measured at longitude 0.75 degree West from North to South. The red lines indicate the time periods of data collection for the surveys. The rainfall pattern was measured at longitude 0.75 degree West from North to South. The red lines indicate the time period of data collection for the surveys. It is worth noting that this figure does not represent any specific year but rather the data collection period in relation to rain falls in the Eastern Region.

LLIN distribution channels

The hang up campaign: supported by the National Malaria Control Program, donor agencies and implementing partners. After a period of staff training and mobilizations, teams went out to communities and performed door-to-door visits to distribute and hang up LLINs to households. The campaign was conducted in two phases.

ANC and CWC mechanism: a free LLIN is given to every pregnant woman visiting ANC for the first time, in all public and private health facilities. Clients are eligible for a new LLIN for each new pregnancy. For CWC, each child receiving the 18-month measles booster vaccination is given a free LLIN.

School-based distribution: at primary school level, free LLIN is distributed to children in the second and last grades (P2 and P6). Distribution is done according to class registers and enrolment figures.

Sampling and sample size

The sampling methods applied to the endline survey were exactly similar to what was done during the baseline survey to ensure comparison across time. This was a cross-sectional household interview survey with a two stage cluster sampling design. The total Eastern region was considered as one sampling domain with clusters defined as villages (communities). No urban/rural stratification was done during sampling (i.e. no oversampling of urban areas) but clusters were categorized as urban or rural based on administrative data. The sampling procedure was specifically designed to obtain a representative sample of the region population and allow the inclusion of any community or household that was not included in the LLIN distribution activities.

To demonstrate that the coverage of households with sufficient LLIN (1 LLIN for 2 people) was maintained between baseline and endline surveys, the standard formula for an equivalence study was used[4] (Blackwelder 1982). Assuming the following parameters:

- Confidence interval (alpha-error) 95%
- Power (beta-error) 80%
- % households with 1 LLIN for 2 people at baseline 49.8%

[4] http://people.ucalgary.ca/~patten/blackwelder.html

- % households with 1 LLIN for 2 people at endline 48%
- Sample size at baseline 1020 households

Therefore, the required sample size in each group was 458 to demonstrate that the difference in proportions between baseline and endline was less than 1%. After adjustment for clustering (1.75) and non-response (1.1), the required sample size for this evaluation was 900 households (15 households in 60 clusters).

For the selection of clusters (i.e. sampling stage one), the household registration lists from the campaign distributions was used. A cluster was defined as a community and the selection was done as follows: first a cumulative list of registered households by sub-district (forms 1 and 2 of the campaign documents) was compiled and 60 clusters selected using systematic sampling with probability proportionate to size (PPS). Second, a list of all communities and the number of registered households was compiled for each selected sub-district (form 1 of the campaign documents) and the required number of villages was selected again using PPS.

Then, within each selected community, 15 households were selected (i.e. sampling stage two) using the following methodology: if the community was small (less than 100 households) the field team would map the whole village and from the compiled list of eligible households the supervisor would randomly select 15 households with equal probability for each household. Following the household definition used in the LLIN distribution campaign the definition of a household was “people eating from the same pot”. If the community was large, i.e. exceeding 200 households, the equal size section-approach would be used. With the help of local chiefs the community would be divided in sections of approximately equal size each with 40-60 compounds. One of these sections would be randomly selected by the supervisor and within this section all households would be mapped and households selected as above.

Data collection

Questionnaire

For data collection, a pre-tested questionnaire exactly identical to the baseline tool was used. The primary respondent was the head of household or his/her spouse and the person who was present during the visit of hang up team. The household module included questions regarding all existing mosquito nets. The survey team inspected these nets after receiving approval from households.. The complete questionnaire used is presented in the Annex A.

Teams and Training

Interviewers and supervisors were carefully selected where chosen based on the criteria that they were familiar with the culture of the study area, had good knowledge of the local language, and were experienced in household surveys. Each team had one supervisor and four interviewers. The field team was trained for five days on the purpose and exact procedures of the interviews, Ethics net examination and net holes assessment, interviewing skills and translation into the local dialects. The training made use of role plays, pilot and mock interviews to ensure that interviewers and supervisors were conversant with the requirements of the field.

Community sensitization

Local authorities were contacted for approval to conduct the survey. Visits were made to the relevant heads of communities and the purpose and procedures of the survey explained to them. In all cases, the heads of each village granted authorization and notified the relevant heads of sampled sub sections who were also informed of the survey objectives and procedures. The community mobilization specifically attempted to ensure that field teams were accepted in the community and to ensure that no further expectation of another mass distribution campaign after or during the survey was created.

Interviews

The interviews took place in December 2013. Each selected household was visited and the head of household or one of his or her adult dependents was interviewed. If no appropriate respondent was found at the house, a new visit was scheduled later that day. At least three attempts were made to reach a respondent before dropping the household without replacing it.

Net condition

A conscious effort was made to seek household approval for assessing the condition of nets in each household. Each net found in the household was assessed for physical condition and signs of repair. All sides and roof of the net were separately inspected. Existing holes in the net were counted and categorized into four different sizes based on the recently published WHO guidelines [1]: 0.5-2 cm, 2-10cm, 10-25 cm and larger than 25 cm in diameter. The presence and number of repaired holes were noted but these were not counted as holes. Data from the net hole assessment was transformed into the proportionate Hole Index (pHI) for each net in the following way:

pHI= # size 1 holes + (# size 2 holes x 23) + (# size 3 holes x 196) + (# size 4 holes x 576).

Based on the pHI each net was then categorized as "good", "serviceable" or "too torn" by adjusting previously suggested cut-off levels of the pHI for three hole size categories to the four categories now suggested by WHO:

Good:	total hole surface area <0.01m² or pHI<64
Serviceable:	total hole surface area <=0.12 m² or pHI<=768
Too Torn:	total hole surface area>0.12m² or pHI>768

Visual aids and laminated tally sheets for the net hole assessment was prepared in advance.

Quality control

At the end of each day, the team supervisor reviewed all questionnaires for completeness and possible inconsistencies and ensured that missing information was corrected while still in the field. In addition, spot-checks were performed on 10% of interviews conducted by each fieldworker.

Data processing, entry and analysis

Double entry of all records was done using Epi data software version 3.1. Both data sets were then compared and any discrepant record was verified from the original questionnaires. Once this first stage of cleaning was finished the data set was transferred to Stata Statistical 12.0 software package for further consistency checks and preparation of data files for analysis. The final data files (household, member and net) were sent to the evaluation team for further cleaning.

Final analysis was done using STATA 12.0 software based on the previously defined outcome indicators broken down by background characteristics, including place of residence (urban and rural) and socio economic status (wealth quintiles). Since sampling probability proportionate to size was used at the first stage and urban areas were not over-sampled the sample did not need sampling weights. All analysis was done adjusting for the cluster sampling by using the "svy" command family in STATA.

The wealth index was computed at the household level using principal component analysis (PCA). The variables for household amenities, assets, livestock, and other characteristics that are related to a household's socioeconomic status were used for the

computation. All variables were dichotomized except those of animal ownership where the total number owned was used. The first component of the PCA was used as the wealth index. Households were then classified according to their index value into quintiles. However, quintiles were calculated separately for urban and rural strata in order to adjust for rural-urban differences in socio-economic status. For analysis of individual members of the household or nets the quintile allocation of the household was applied. Concentration index and concentration curve was used to analyse outcome differences by wealth. Standard errors and confidence intervals for the concentration indices were calculated using the formula suggested by Kakwani *et al* [6].

Ethical considerations

Individual verbal informed consent was sought from all respondents before interviews were conducted. Before each interviewee was asked to give consent, the interviewer gave a brief description of the study objectives, the data collection procedure, the potential harm to participants, the expected benefits, and the voluntary nature of participation at all stages of the interview. In addition, consent was also sought from community representatives (chiefs). Participants were assured that data would be kept confidential and would not be shared with non-project staff. Participants in the final data set were rendered anonymous by removing the variable “name” and all other information within a particular cluster that could help to identify individuals or households, and replacing these with a new numerical identification number generated to uniquely identify the individuals and the households. Ethical clearance for the survey was obtained from the Ghana Health Service Ethical Review Committee as well as the Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health (IRB No: 4119).

RESULTS

1. Sample characteristics

Table 1: Characteristics of sampled households

Background characteristic	Head of household			Mean persons in household	Proportion with any children <5yrs	Proportion with pregnant woman	# of house-holds
	Male	Female	Mean age years				
Residence							
Urban	60.0	40.0	50.21	5.17	42.2	4.0	403
Rural	71.5	28.5	52.30	5.61	50.1	3.8	495
Wealth Index							
Lowest	63.9	36.1	50.77	5.24	46.1	2.2	180
Second	70.8	29.2	51.13	5.55	44.9	4.5	178
Third	57.8	42.2	52.24	5.51	47.8	7.2	180
Fourth	66.1	33.9	55.25	5.5	47.8	3.9	180
Highest	73.3	26.7	47.39	5.27	46.1	1.7	180
Total	66.4	33.6	51.34	5.41	46.5	3.9	898

Out of the 900 targeted households, 898 (99.8%) were visited and valid questionnaires were obtained. Overall, 66.4% of households were headed by a man and 33.6% by a woman. The difference was significantly more marked among rural households where 71.5% were headed by a man compared to 60.0% in urban households ($p<0.01$). The average household size was 5.41, ranging from 1 to 22 and it was fairly similar across background characteristic.

Table 2: Educational level of head of household

Background characteristic	No education (N=898)	Some education (N=671)				
		Primary	Secondary	Higher	Don't know	Secondary or higher
Residence						
Urban	22.3	44.7	41.5	11.8	1.9	53.4
Rural	27.7	52.5	38.8	5.9	2.8	44.7
Wealth Index						
Lowest	36.7	71.9	24.6	1.8	1.8	26.3
Second	28.7	54.3	39.4	2.4	3.9	41.7
Third	24.4	46.3	44.1	6.6	2.9	50.7
Fourth	20.6	44.1	44.8	9.1	2.1	53.8
Highest	16.1	33.8	44.4	20.5	1.3	64.9
Total	25.3	48.9	40.1	8.6	2.4	48.7

A quarter of the household heads did not have any education. This proportion was similar across type of residence but did significantly decreased with wealth ($p=0.001$).

Similarly, the level of education achieved was higher among richer households (p<0.001).

Table 3: House characteristics and selected assets

Background characteristic	Rooms for sleeping (mean)	Sleeping places (mean)	Persons / sleeping place (mean)	Mobile phone	Number of houses
Residence					
Urban	2.57	3.28	1.90	89.3	403
Rural	2.69	3.48	1.96	84.4	495
Wealth Index					
Lowest	2.25	3.32	1.80	62.8	180
Second	2.70	3.39	1.96	82.0	178
Third	2.57	3.35	2.03	91.7	180
Fourth	2.84	3.50	1.93	98.3	180
Highest	2.80	3.38	1.95	98.3	180
Total	2.63	3.39	1.93	86.6	898

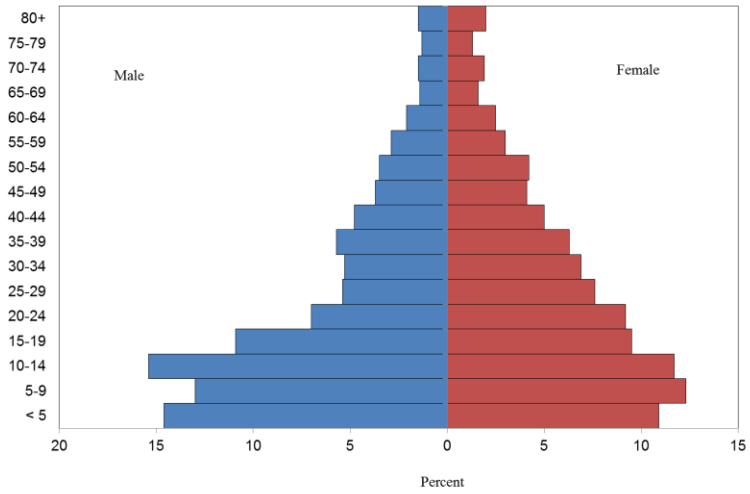
The average number of rooms used for sleeping was 2.63, ranging from 1 to 15 and the average number of sleeping space was 3.39, ranging from 1 to 23. This resulted in a theoretical average number of people per sleeping space of 1.93. No significant variation was detected across background characteristic. Ownership of mobile phone increased with wealth (p<0.001) while the variation across residence type was not significant.

Table 4: Composition of the sampled population

Background characteristic	% children under 1 year	% children under 5 years	% under 15 years	% of currently pregnant women	% usual resident	% stayed in house the previous night	Number of people in sample
Residence							
Urban	1.9	11.2	37.0	0.8	98.5	95.8	2083
Rural	3.5	13.6	39.9	0.7	98.3	95.4	2779
Wealth Index							
Lowest	2.8	12.5	39.1	0.5	97.3	96.7	943
Second	1.7	11.5	37.9	0.8	98.8	94.7	988
Third	2.4	12.9	39.5	1.4	98.6	95.8	992
Fourth	3.4	13.4	38.0	0.7	98.8	94.6	990
Highest	3.8	12.5	38.7	0.3	98.3	96.0	949
Total	2.8	12.6	38.6	0.8	98.4	95.6	4862

Among all sample households, 4,862 persons were registered of which 98.4% were usual residents and 95.6% were stayed in the house the previous night.

Figure 4: Population distribution by gender and age



The population distribution by gender and age is comparable to the demographic distribution in African context, with an important proportion of population under 15 and significantly fewer elderly people.

2. Outcome of LLIN distribution

Table 5: Effectiveness of each LLIN distribution channel

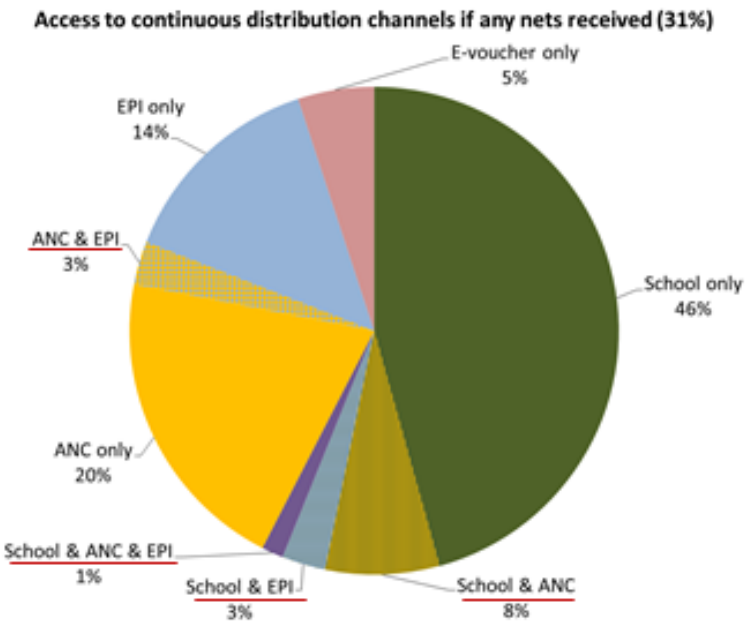
Background characteristic	% households that received any LLIN						% received any LLIN from any CD channel	% received any LLIN from any channel	# of house-holds
	Hang up campaign	Primary school CD	Health facility CD			e-coupon CD			
			ANC	CWC	HF CD (ANC or/and CWC)				
Residence									
Urban	74.7	17.4	8.9	4.2	12.9	1.5	28.3	85.4	403
Rural	87.3	18.2	10.9	8.5	17.2	2.6	33.1	93.9	495
Wealth Index									
Lowest	86.1	12.2	5.6	2.8	7.8	2.8	19.4	91.1	180
Second	84.3	19.1	10.7	6.2	15.2	1.1	28.7	89.3	178
Third	80.0	20.0	11.7	8.3	18.3	2.2	36.7	91.1	180
Fourth	80.6	17.2	12.8	9.4	20.6	1.7	34.4	88.9	180
Highest	77.2	20.6	9.4	6.1	14.4	2.8	35.6	90.0	180
Total	81.6	17.8	10.0	6.6	15.3	2.1	31.0	90.1	898

As expected, the hang up campaign reached the largest proportion of households with 81.6% of all households that received at least one LLIN. CD distribution through primary schools and health facilities reached 17.8% and 15.3% respectively. The e-coupon

channel had only reached 2.1% of all households (n=19) mostly due to the short period of implementation at the time of the survey. As a result, 90.1% of households received at least one LLIN from any channel and the coverage achieved by the CD channels only was 31.0%.

On one hand, comparison across residence type revealed that the campaign was significantly more effective in rural setting (87.3 vs. 74.7%; p<0.005) and this variation was also reflected in the effectiveness of the whole distribution system (93.9 vs. 85.4%; p<0.01). On the other hand, while the campaign effectiveness decreased with wealth, CD distribution channels coverage was higher among richer households. Consequently, the whole system equally reached families independently of wealth.

Figure 5: Contribution and overlap of the different CD channels



In addition to measuring the effectiveness of each distribution channels, it was important to understand whether there was any overlap in reaching households to an extent that would compromise the cost-effectiveness of the system. Figure 5 shows that 85% of households that received at least one LLIN accessed only one particular channel (EPI: 14% + ANC: 20% + School: 46% + e-coupon: 5%).

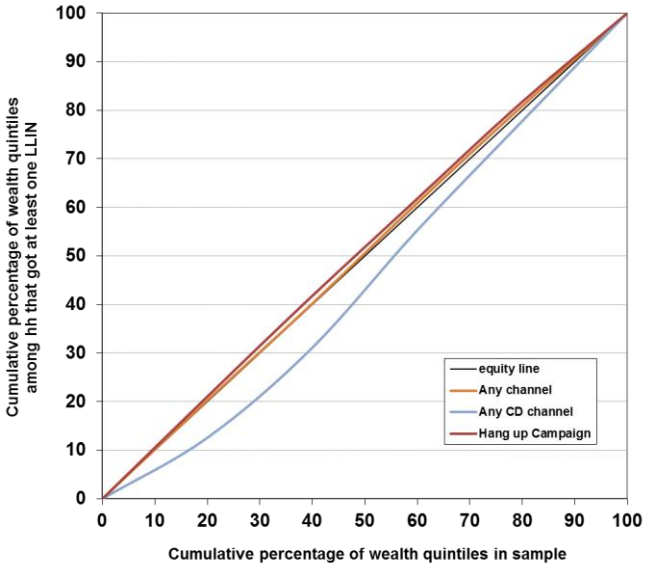
Table 6: LLIN ownership coverage in Eastern Region in December 2013

Location & time since campaign	HH with any LLIN		HH with 1 LLIN / 2 people		People with Access* to LLIN	
	%	95% CI	%	95% CI	%	95% CI
Eastern Region (34 months)						
All LLIN	88.4	85.0 , 91.1	40.4	36.4 , 44.6	66.5	62.9 , 69.9
Without school	85.0	81.0 , 88.3	37.4	33.5 , 41.6	62.5	58.3 , 66.5
Without ANC/EPI	84.6	81.1 , 87.6	36.6	32.9 , 40.6	62.8	59.0 , 66.5
Without any CD	81.0	76.3 , 84.9	32.7	29.0 , 36.7	57.4	53.0 , 61.8
Only campaign LLIN	72.2	66.5 , 77.2	25.8	22.7 , 29.2	48.3	43.9 , 52.8
Distr. Phase 1 (36 months)						
All LLIN	86.4	80.5 , 90.6	36.8	30.6 , 43.4	62.7	57.3 , 67.9
Without school	80.5	73.0 , 86.3	33.7	27.4 , 40.7	57.7	50.5 , 64.5
Without ANC/CWC	81.9	75.7 , 86.8	32.3	26.7 , 38.5	60.0	53.7 , 66.0
Without any CD	75.2	66.9 , 82.0	27.3	22.3 , 32.0	51.9	44.5 , 59.1
Only campaign LLIN	62.7	53.3 , 71.2	20.1	15.6 , 25.4	41.0	34.1 , 48.2
Distr. Phase 2 (32 months)						
All LLIN	89.8	85.4 , 93.0	42.9	37.8 , 48.2	69.2	64.6 , 73.4
Without school	87.9	83.6 , 91.3	39.9	35.1 , 41.6	66.0	61.4 , 70.3
Without ANC/CWC	86.5	82.2 , 89.8	39.5	34.8 , 44.4	64.9	60.2 , 69.2
Without any CD	84.8	79.6 , 88.9	36.4	31.8 , 41.2	61.4	56.4 , 66.2
Only campaign LLIN	78.5	72.3 , 83.6	29.7	26.0 , 33.6	53.6	48.8 , 58.4

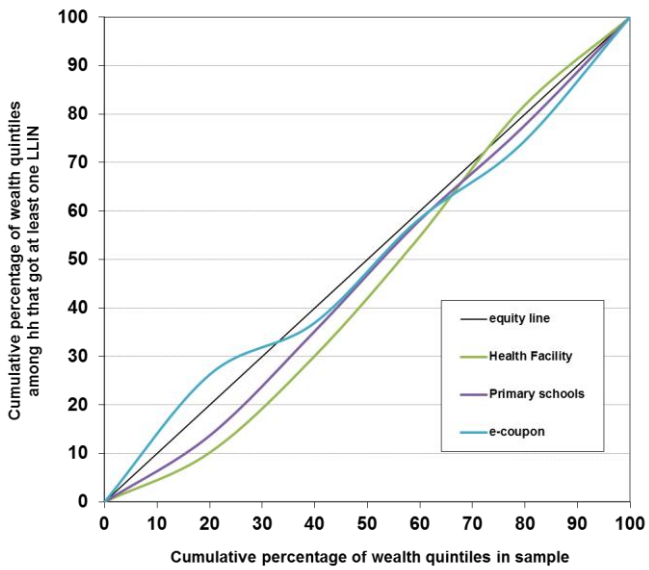
*Access to LLIN within the house for Household members who stayed in the house the previoius night (estimated based on number of LLIN present in houses and defacto number of people the night before the interview)

Thirty-four months since the hang up campaign, the distribution activities had resulted in 88.4% of households with at least one LLIN, 40% of households with one LLIN for every two people and 66.5% of the people that stayed in the house the previous night (i.e. de facto) having access to a LLIN if they wanted to use any. The different scenarios presented in Table 6 tell us that ownership would be significantly lower if there was no mechanism in place to replace LLIN since the hang up campaign and this was true for household ownership as well as population access to LLIN.

Figure 6: Equity in access to any LLIN by channel of distribution (N=898)



Concentration index (95%CI):
Hang up campaign: -0.20 (-0.04 to -0.00)
Any channel: 0.00 (0.01 to -0.02)
Any CD channel: 0.11 (0.03 to 0.05)



Concentration index (95%CI):
HF channel: 0.11 (0.04 to 0.03)
School channel: 0.09 (0.04 to 0.01)
e-coupon channel: -0.01 to 0.14)

This figure demonstrates that the CD channels were more likely to be accessed by richer households (ie pro rich). However, the whole distribution system using a mix of channels was very close to the perfect equity line. It confirms that different channels benefit to different wealth quintiles. It is worth highlighting that the e-coupon channel had only recently started at the time of the endline evaluation and only 9 households in the sample had accessed this channel.

Table 7: Average number of LLIN distributed by household by each distribution channel (N=898)

Background characteristic	Mean number of LLIN per household						Mean number of LLIN per household from any channel
			Health facility CD				
	Hang up campaign	Primary school CD	ANC	CWC	HF CD (ANC or/and CWC)	e-coupon CD	
Residence							
Urban	1.54	0.22	0.10	0.04	0.15	0.02	1.94
Rural	1.94	0.22	0.12	0.09	0.21	0.04	2.41
Wealth Index							
Lowest	1.75	0.15	0.05	0.03	0.08	0.05	2.04
Second	1.88	0.22	0.11	0.07	0.17	0.01	2.29
Third	1.63	0.25	0.13	0.09	0.22	0.03	2.13
Fourth	1.80	0.20	0.14	0.11	0.25	0.02	2.27
Highest	1.74	0.28	0.13	0.07	0.19	0.04	2.27
Total	1.76	0.22	0.11	0.07	0.18	0.03	2.20

As expected, sampled households received a larger quantity of LLIN through the hang up campaign compared to other CD channels. Rural households tended to have received more LLIN than urban households, reflecting the difference in household size. Overall, 2.20 LLIN were distributed to households, which in theory would be nearly sufficient to cover every two people with one LLIN as the average household size was 5.41.

Figure 7: Comparison of target and coverage achieved for primary school distribution

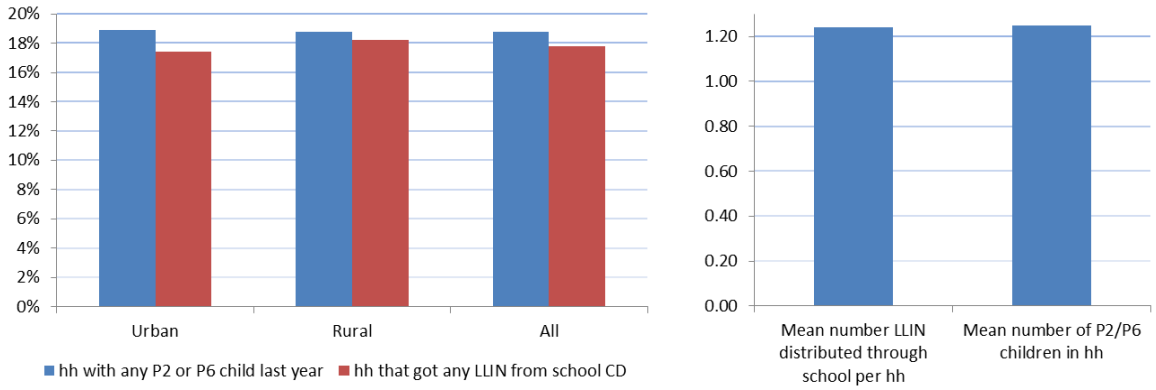


Figure 7 looks at the target and achievement of the CD of LLIN among primary schools. Nearly all households with any child in the targeted class (P2 and P6) did receive at least one LLIN from that channel and the average number of LLIN distributed was equal to the average number of children in targeted classes per households. Among these households, the average number of children registered in these classes was 1.22 (SE

0.04). This means that among the sampled households, 211 children would be entitled to receive a LLIN from the primary school channel.

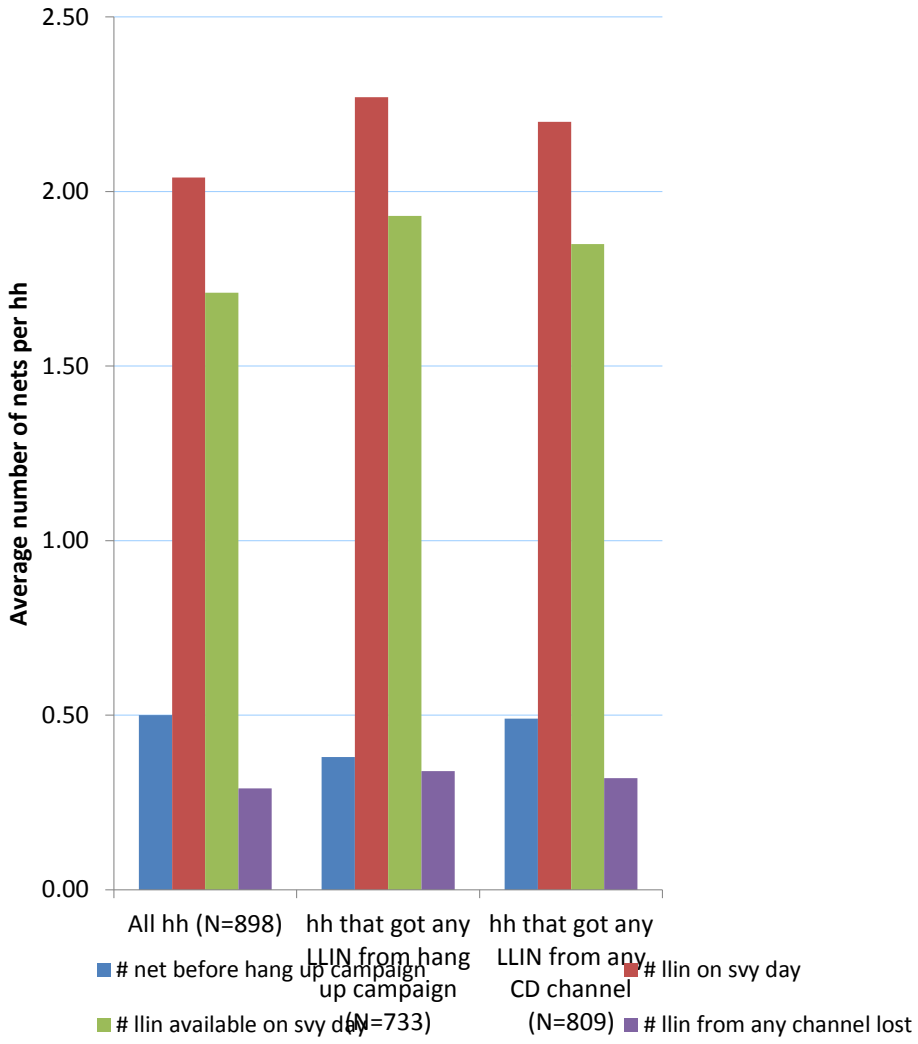
Table 8: LLIN ownership before and after the distribution

Background characteristic	Among all sampled households (N=898)		Among households that got any LLIN from the hang up campaign (N=733)	Among households that got any LLIN from any CD channel*(N=809)
	Owned any net before the hang up campaign	Owned any LLIN on survey day	Owned any LLIN on survey day	Owned any LLIN on survey day
Residence				
Urban	32.5	84.1	92.7	93.0
Rural	33.3	91.9	95.6	95.7
Wealth Index				
Lowest	21.7	88.9	94.2	94.5
Second	31.5	87.1	92.7	93.1
Third	40.0	90.0	94.4	95.1
Fourth	35.6	88.3	95.2	95.0
Highest	36.1	87.8	95.7	95.1
Total	33.0	88.4	94.4	94.6

*health facility distribution (ANC or CWC), primary school distribution, e-coupon distribution

While only 33.0% of households owned any LLIN before the hang up campaign, 88.4% possessed any LLIN on the endline survey day. As previously observed, LLIN ownership was higher among rural households, due to the campaign being more effective in this residence type. Also, we can see that ownership of at least one LLIN increased with wealth before the campaign but was much more similar across quintiles on the survey day. This confirms that the distribution system was highly equitable in reaching households.

Figure 8: Average number of LLIN owned per household before and after the distribution



NB: LLIN was considered "available" if on the survey day it was found unpacked from original package and not temporarily taken away for any reason (from question 104 of the questionnaire).

Figure 8 shows that in the sampled households, there was a certain quantity of LLIN that were stored away unpacked for future use and a similar quantity of LLIN that were lost. This means that actual LLIN available for use was lower than the quantity distributed.

Table 9: Intra-household LLIN coverage and universal access

Background characteristic	Among all sampled households (N=898)			Among households that got any LLIN from any channel (N=809)		
	Own 1 LLIN / sleeping space	Own 1 LLIN / 2 people	Have a LLIN / 2 people available* on svy day	Own 1 LLIN / sleeping space	Own 1 LLIN / 2 people	Have a LLIN / 2 people available* on svy day
Residence						
Urban	37.2	35.2	29.5	41.3	39.0	32.6
Rural	43.2	44.6	35.8	44.7	46.7	37.2
Wealth Index						
Lowest	35.6	37.2	31.1	38.4	39.6	32.9
Second	42.7	41.6	33.7	45.9	44.7	35.8
Third	41.7	43.3	33.9	43.3	46.3	36.0
Fourth	43.3	41.7	32.8	46.3	44.4	35.0
Highest	39.4	38.3	33.3	42.6	42.0	36.4
Total	40.5	40.4	33.0	43.3	43.4	35.2

*LLIN was considered "available" if on the survey day it was found unpacked from original package and not temporarily taken away for any reason (from question 104 of the questionnaire).

Table 9 presents the results for universal coverage indicators. It tells us that even if the whole distribution system was very efficient in reaching households, the quantity of LLIN distributed was insufficient to reach the target of 80% of households with enough LLIN to protect all people. It also shows that when excluding LLIN that are still stored away in their original package, the coverage estimates fall from nearly 7%-points although this was not a statistically significant difference.

Table 10: Retention of LLIN since the distribution

Background Characteristic	Households that lost any of the LLIN distributed by any channel (N=898)	LLIN retained among households that received any LLIN from any channel (N=809)		
		none	some	all
Residence				
Urban	14.4	5.5	11.3	83.1
Rural	16.8	6.0	11.8	82.2
Wealth index				
Lowest	14.4	6.1	9.8	84.1
Second	16.9	6.9	11.9	81.1
Third	15.6	4.9	12.2	82.9
Fourth	15.6	6.2	11.2	82.5
Highest	16.1	4.9	13.0	82.1
Total	15.7	5.8	11.6	82.6

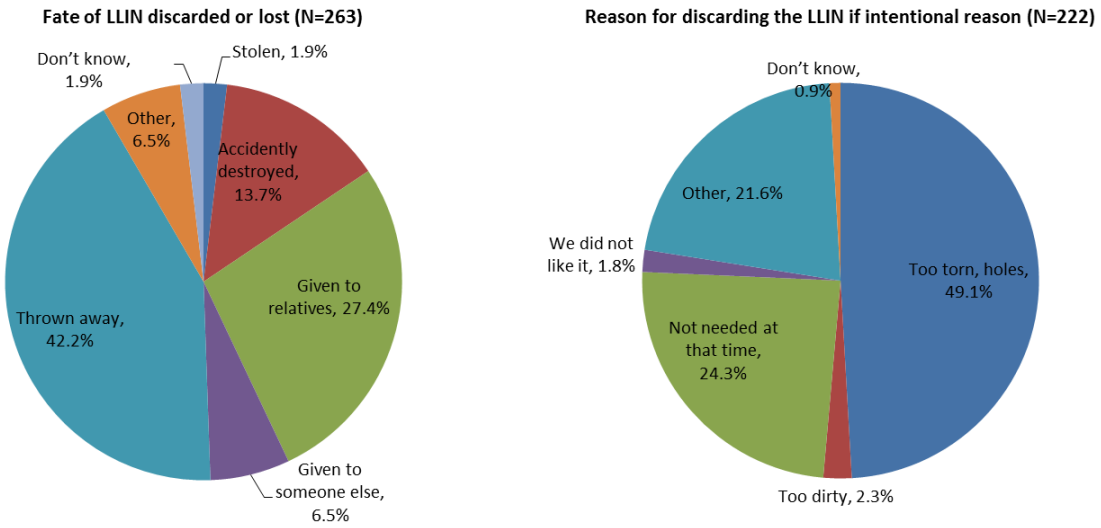
Some 15.7% of households had lost intentionally or unintentionally any of the LLIN they had received from the distribution system (i.e. any channel) and excluding those who did not receive any LLIN from either the campaign or any CD channel, 5.8% had lost all their LLIN. Table 11 shows that LLIN from the school distribution were less likely to be retained compared to LLIN from the health facility distribution but the difference was minor.

Table 11: LLIN retention at household level by distribution channel coverage

Household got any LLIN	# households	LLIN retained among households that received any LLIN from any channel		
		none	some	all
From hang up campaign (N=733)	733	5.9	12.4	81.7
From primary school distribution (N=160)	160	1.9	23.8	74.4
From HF distribution (ANC and/or CWC) (N=137)	137	1.5	16.1	82.5
From e-coupon (N=19)	19	-	21.1	78.9
Total	809	5.8	11.6	82.6

There were more households discarding or losing all the nets they received from the campaign compared to other channels. Also, looking more specifically at CD channels, retention of all the nets was lower among households that got any LLIN from school distribution. This tells us that lower retention is observed among households where adults were not involved in the decision to acquire a new net or sensitized by a health worker (ie health facility distribution).

Figure 9: Fate and reason for non-retention of LLIN distributed



More than three quarters of LLIN (76.1%) that were not retained were intentionally discarded. Overall, 33.9% of nets were given to someone else and 42.2% were simply thrown away. The investigation of reasons for non-retention if the net were intentionally discarded, 51.4% were given or thrown away for objective reasons (too torn, too many holes or too dirty), compared to 27.9% of LLIN discarded because the households judged they did not need any LLIN at the time or they did not like it. While these results reflect a lack of "net culture" among the sampled households, it shows that progress could be achieved by promoting net care and repair behaviours.

3. Nets Owned by the households

Among the 1,866 nets found in the sample households on the survey day, 1,831 (98.1%) were LLIN and 35 (1.9%) were untreated nets or conventional ITN. The information about household nets was collected through direct observation of each net by the survey team whenever it was possible; 1432 nets (76.7%) were inspected.

Table 12: Source of nets (N=1866)

Background characteristic	Campaign (recent or previous)	ANC	CWC	Primary school	Retailers / shop / market	Other	Number of household nets
Residence							
Urban	74.1	4.4	1.7	9.7	4.6	5.5	745
Rural	75.1	4.2	3.3	7.1	4.6	5.6	1121
Wealth index							
Lowest	80.2	2.4	0.9	5.9	6.5	4.1	338
Second	77.6	3.6	2.1	8.6	5.2	2.9	384
Third	70.2	5.3	3.7	8.4	4.5	7.9	379
Fourth	75.0	4.5	4.5	7.3	3.0	5.6	396
Highest	71.0	5.4	1.9	10.3	4.1	7.3	369
Total	74.7	4.3	2.7	8.1	4.6	5.6	1866

Unsurprisingly, the main source of household LLIN was the campaign and that was especially marked among poorer quintiles. Among the 1866 nets owned by the households at the time of the survey, 20.5% were bought with money while 77.9% were obtained freely. This proportion would reflect the small compensation amount paid by most households for hang up volunteers during the campaign. The average amount paid for the net that were bought with money was 2.91, ranging from 0.25 to 20 cedi.

Table 13: Position of household nets on the survey day

Background characteristic	Position of the net on the survey day (N=1866)							LLIN available (neither stored in package or temporarily taken away) (N=1831)
	Hanging loose	Hanging folded	Not hanging but not stored	Stored away unpacked	Stored away in package	Temporarily taken away	Don't know	
LLIN								
No	40.0	20.0	11.4	25.7	2.9	-	-	
Yes	36.4	24.2	14.6	8.9	9.6	6.2	0.1	
Residence								
Urban	37.3	22.0	14.9	9.7	10.5	5.6	-	83.7
Rural	36.0	25.5	14.3	8.9	8.8	6.4	0.1	84.3
Wealth index								
Lowest	47.0	19.5	11.2	9.5	7.4	5.0	0.3	86.8
Second	37.2	24.7	13.5	7.6	9.1	7.8	-	82.9
Third	37.2	21.6	13.2	10.6	10.6	6.9	-	82.3
Fourth	32.3	24.5	15.9	8.3	12.6	6.3	-	81.0
Highest	29.8	29.8	18.4	10.3	7.3	4.3	-	88.3
Total	36.5	24.1	14.5	9.2	9.5	6.1	0.1	84.1

Among all net owned by the sampled households on the survey day, 60.6% were found hanging, either loose (ie 36.5%) or folded (ie 24.1%). Nets were more likely to be hanging among rural households and poorer wealth quintiles. However, 18.7% of all nets were stored away, either unpacked (ie 9.2%) or in package (ie 9.5%). Lastly, 84.1% of LLIN were available for use on the survey day, excluding untreated nets, those stored away in package or temporarily taken away. This confirms that a significant quantity of LLIN are kept away by households and not used for sleeping, as presented in Figure 8.

Table 14: Net hanging and use on previous night and previous week (N=1866)

Background characteristic	Net hanging on survey day	Net used on the previous night	Use frequency the previous week					
			Every night	5 to 6 nights	1 to 4 nights	Not used last week	Never used at all	Don't know
Residence								
Urban	59.3	54.6	45.1	9.5	8.1	10.9	20.1	6.3
Rural	61.5	56.2	47.1	6.4	9.3	10.6	19.7	6.9
Wealth index								
Lowest	66.6	62.7	53.3	9.2	8.3	8.9	18.9	1.5
Second	62.0	55.2	46.9	8.9	6.0	12.5	18.5	7.3
Third	58.8	54.9	48.3	5.3	7.1	7.9	23.5	7.9
Fourth	56.8	49.7	39.1	8.8	10.6	13.4	17.7	10.4
Highest	59.6	56.4	45.0	6.2	11.9	10.6	20.9	5.4
Total	60.6	55.6	46.3	7.7	8.8	10.7	19.9	6.6

There was a 5%-point difference between proportions of net hanging and actually used the previous night. Also, 19.9% of all nets were reported to be never used at all, which matches the 18.7% of nets stored away (ie Table 14). On the other hand, more than half of all nets were used either every night (ie 46.3%) or most nights (ie 7.7%), showing that although the use of LLIN already available in the houses could be significantly improved, there is a substantial proportion of households that use their LLIN on a regular basis.

Table 15: Net care

Background characteristic	Ever been washed (N=1866)	Average number of washing in past 3 months (N=1051)	Used soap bar for last wash as opposed to detergent or bleach (N=1051)	Drying method (N=1051)			
				Bush or fence or on the ground	Outside on line	Inside	Don't know
Distribution channel							
Campaign	59.6	2.67	29.7	9.6	79.4	8.7	2.3
ANC	36.3	2.37	24.1	-	82.8	10.3	6.9
CWC	38.0	2.35	21.1	-	89.5	10.5	-
Primary school	26.3	2.34	27.5	2.5	90.0	5.0	2.5
Retailers / shop	74.4	3.17	42.2	6.3	84.4	4.7	4.7
Other	65.4	2.92	25.0	2.9	79.4	13.2	4.4
Residence							
Urban	56.2	2.48	41.5	11.2	79.0	7.2	2.6
Rural	56.4	2.83	22.0	6.3	81.3	9.7	2.7
Wealth index							
Lowest	59.8	2.34	32.7	16.8	75.7	6.4	1.0
Second	62.0	3.06	27.3	7.1	80.3	8.8	3.8
Third	56.7	2.84	33.5	6.0	79.1	12.1	2.8
Fourth	49.7	2.42	23.4	7.6	81.2	9.1	2.0
Highest	53.9	2.75	32.2	4.0	85.9	6.5	3.5
Total	56.3	2.69	29.8	8.3	80.4	8.7	2.7

Among all nets owned by the sampled households, 56.3% had ever been washed. Nets acquired from CD channels were less likely to have been washed, as one would expect as they were obtained more recently. It was worrying to observe that 29.8% of the nets that ever had been washed were cleaned with soap bar, as recommended to preserve the insecticide on the LLIN. Indeed, this means that 70.2% of the nets were washed with detergent or bleach, known to be detrimental for the effectiveness of the insecticide on the net. This was even more marked in rural households were only 22.0% of the nets were washed with soap bar. Lastly, 80.4% of the nets were dried outside on a line while 8.3% were put on the ground in the bush for drying. These practices are not recommended not only to protect nets from holes but also because it should not be exposed to the sun to preserve the insecticide.

Table 16: Net condition on survey day

Background characteristic	Ever had any hole (N=1866)	Hole index (N=1866)				Net modified in any way (N=568)
		Mean pHI	in good condition*	somewhat damaged but still usable**	Severely damaged or too torn***	
LLIN						
No	48.6	186.54	74.3	5.7	20.0	-
Yes	30.1	124.25	84.7	6.4	8.8	0.4
LLIN acquired before baseline survey (Apr 2012)						
No	30.8	111.81	84.9	6.8	8.3	0.5
Yes	30.4	199.46	82.6	4.7	12.7	-
Don't know	26.4	92.75	85.1	6.6	8.3	-
Residence						
Urban	30.6	109.13	86.6	5.1	8.3	0.4
Rural	30.3	136.24	83.1	7.3	9.5	0.3
Wealth index						
Lowest	35.5	197.74	79.9	8.0	12.1	-
Second	29.9	133.41	84.1	5.5	10.4	0.9
Third	36.7	145.24	79.7	8.2	12.1	-
Fourth	23.7	66.37	91.4	4.5	4.0	1.1
Highest	27.1	93.86	86.7	6.2	7.0	-
Total	30.4	125.42	84.5	6.4	9.1	0.4

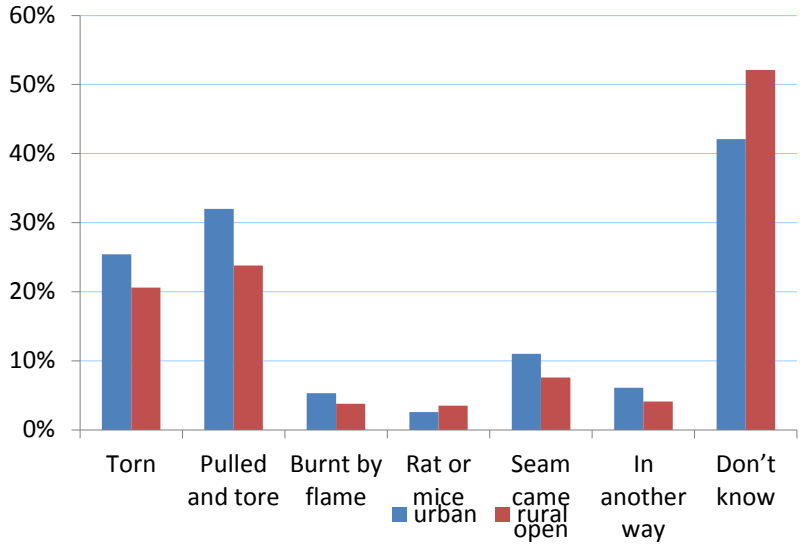
*Hole index based on WHOPES weights for four size categories, pHI 0 to 64

** Hole index based on WHOPES weights for four size categories, pHI 65 to 400

*** Hole index based on WHOPES weights for four size categories, pHI 401 to max

Each net found in the houses on the survey day was observed by the survey team to assess the condition of the net in regard to number of holes and size. Among all nets, 30.4% ever had any hole, either repaired on the survey day or not. Untreated nets were more likely to ever have any hole, which is consistent with the probability that these nets were obtained earlier than most of the LLIN. Also, nets in the two richer quintiles were less likely to ever have any holes, probably due to lower use frequency. The estimation of the hole index revealed that 90.9% of all nets were either in good condition (ie 84.5%) or somewhat damaged but still usable (ie 6.4%) while 9.1% were found to be too damaged to effectively protect people from getting malaria. Net in urban residence type were generally in better condition, as well as nets in richer wealth quintiles.

Figure 10: Origin of holes mentioned, by type of residence (N=568)



While most household respondent could not tell the origin of the holes in the nets, the main reasons mentioned were "Pulled and tore" and "Torn", which seem to be due to net usage. The fact that respondent in urban setting were more likely to know were the holes come from also rather suggest the holes came from manipulation during usage, while one would expect more unknown reasons in rural setting, especially as nets are being dried outside sometimes in the bush.

4. LLIN use the previous night of the survey

Table 17: LLIN use by population group

Background characteristic	Among all members who stayed in the house last night					
	All people (N=4646)	Head (N=861)	Pregnant women (N=36)	0 to 4 years (N=597)	5 to 14 years (N=1241)	15+ years (N=2807)
Household own 1 LLIN per 2 people	60.1	65.8	69.2	70.3	57.7	59.3
Household has 1 LLIN available* for 2 people	64.4	69.4	62.5	76.1	64.1	62.7
People have access to a LLIN	57.5	52.7	48.3	89.7	63.0	49.6
Residence						
Urban	34.0	41.1	31.3	44.4	32.3	32.7
Rural	41.4	50.6	45.0	46.0	39.0	41.5
Wealth index						
Lowest	38.5	49.7	40.0	46.6	35.2	38.2
Second	39.2	53.3	50.0	43.1	34.8	40.5
Third	39.1	45.8	42.9	48.3	37.6	37.8
Fourth	37.4	42.6	33.3	44.7	42.1	33.7
Highest	37.0	40.4	-	44.1	42.1	38.0
Total	38.2	46.3	38.9	45.4	36.2	37.6

*LLIN was considered "available" if on the survey day it was found unpacked from original package and not temporarily taken away for any reason (from question 104 of the questionnaire).

Among all people that stayed in the house the previous night, 39.3% used a net of any type, compared to 38.2% using a LLIN. Therefore, only 1.1% of the population used a net that was untreated or treated with an insecticide pack (i.e. conventional ITN). As expected, net use was higher among households owning sufficient LLIN (ie 60.1 vs. 27.5%) and even higher excluding LLIN stored away on the survey day (ie 6.4%). Also, LLIN use was higher among rural and poorer households. Assessing LLIN use by people category shows that overall, household heads were more likely to access LLIN, followed by children under five, the pregnant women. However, considering households with sufficient LLIN only, vulnerable people (ie children under five and pregnant women) were more likely to use LLIN the previous night. This was even more marked looking at LLIN use among these people who have access to nets where LLIN use among children under five reached almost 90%. This strongly suggest that a proportion of the sampled households is sensitized about vulnerability to malaria and the importance to protect children under five and that the children are given the priority to use nets. On the other hand, LLIN use among pregnant women who had access to nets was only 48.3%.

Table 18: LLIN universal coverage at household level (N=898)

Background characteristic	No member used a net	Some member used a net	All member used a net
Household own 1 LLIN per 2 people			
No	47.5	48.4	4.1
Yes	24.8	41.3	33.9
Household has 1 LLIN available for 2 people			
No	46.2	49.0	4.9
Yes	22.3	38.5	39.2
Residence			
Urban	44.2	42.4	13.4
Rural	33.5	48.1	18.4
Wealth index			
Lowest	35.6	45.6	18.9
Second	38.2	43.8	18.0
Third	36.1	48.3	15.6
Fourth	40.6	45.0	14.4
Highest	41.1	45.0	13.9
Total	38.3	45.5	16.1

This table confirms that it is not uncommon for households to store LLIN away before using it as 33.9% of households with sufficient LLIN had all members using a net while this proportion rose to 39.2% considering only LLIN available for use. The gap was narrower for some but not all people using a LLIN suggesting that households tend to "save" some but not all their LLIN for future use.

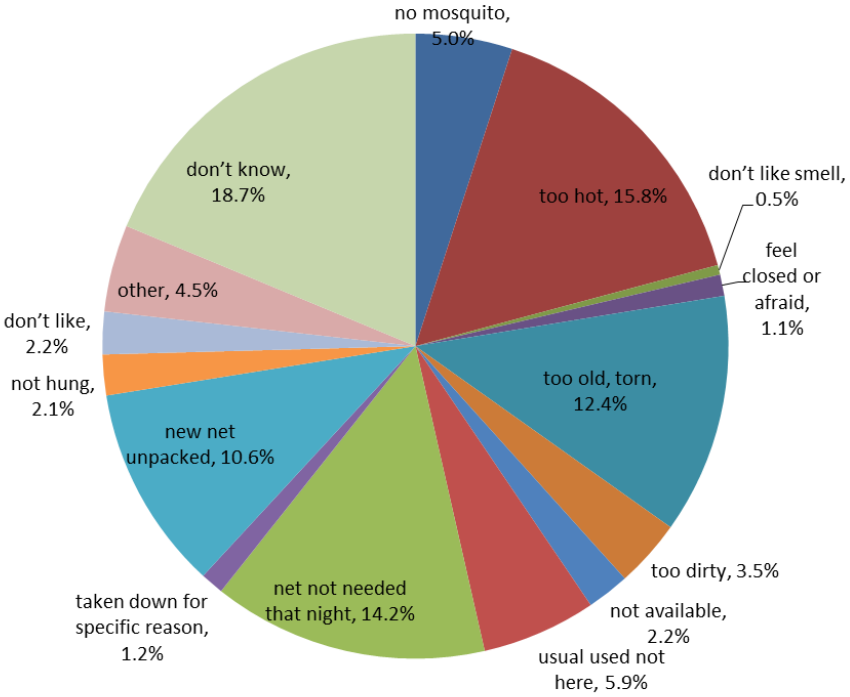
Table 19: Household member access to LLIN the previous night

Background characteristic	Among households that retained any LLIN from any channel				Among LLIN found in households		
	Used none	Used some	Used all	Number of households	LLIN used	LLIN hanging on svy day	Number of LLIN
Household own 1 LLIN per 2 people							
No	34.4	7.7	57.9	401	56.8	59.9	794
Yes	23.2	20.0	56.8	345	54.3	61.1	1037
Household has 1 LLIN available* for 2 people							
No	34.5	11.1	54.4	467	51.9	54.5	1025
Yes	20.4	17.2	62.4	279	59.8	68.4	806
Residence							
Urban	33.3	10.8	55.9	315	54.5	59.3	732
Rural	26.2	15.3	58.5	431	56.0	61.5	1099
Wealth index							
Lowest	27.3	11.3	61.3	150	62.0	66.9	326
Second	27.8	18.1	54.2	144	55.0	61.8	380
Third	28.9	13.2	57.9	152	55.2	59.2	373
Fourth	30.4	12.8	56.8	148	49.5	56.6	394
Highest	31.6	11.8	56.6	152	56.4	59.5	358
Total	29.2	13.4	57.4	746	55.4	60.6	1831

*LLIN was considered "available" if on the survey day it was found unpacked from original package and not temporarily taken away for any reason (from question 104 of the questionnaire).

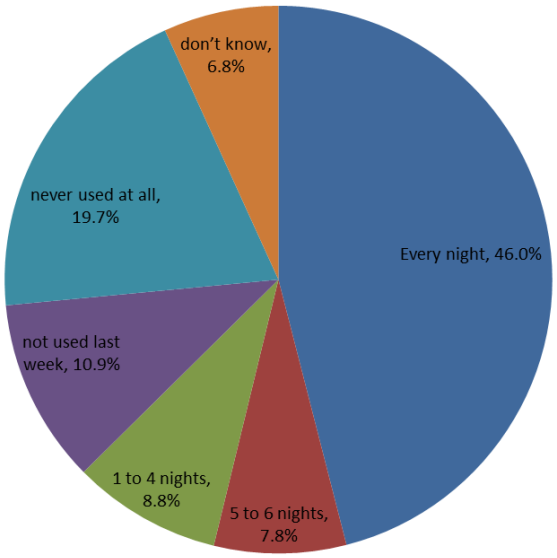
LLIN use at household level shows again that there was a difference of 5.6%-points in the proportion of households that used all their LLIN considering only "available" LLIN. Looking at the proportion of all LLIN found in the sampled households, 60.6% of the LLIN were hanging on the survey day and there was no major variation according the quantity of LLIN owned (ie 1 LLIN for every 2 people). However, there was 68.4% of LLIN hanging among those households with LLIN "available" on the survey day. This again confirms that households do keep some of their LLIN stored away, even if they don't have sufficient LLIN to protect all their members.

Figure 11: Reasons stated for not using the LLIN (N=817)



Among all reasons mentioned for not using the nets, 59.2% of explanations were objective compared to 17.5% were subjective. In total, 10.6% of the unused LLIN were new nets still unpacked.

Figure 12: Frequency of reported LLIN use the week before the survey (N=1831)



Among all household LLIN, 53.8% were used every or most night while 19.7% were never used at all.

5. Knowledge, attitudes and practices

Table 20: Exposure and message coverage on net use in the past six months

Background characteristic	Households that heard any info on hanging or use of nets from any source (N=898)	Among households that heard any information (N=219)			Households that discussed using nets within the family within past 6 months (N=898)
		Mentioned any message about hanging or use (N=219)	Mean source of info	Mean message remembered	
Household got any LLIN from campaign					
No	23.6	82.1	1.38	2.13	32.7
Yes	24.6	85.6	1.57	2.54	34.8
Household got any LLIN from health facility					
No	24.0	85.2	1.57	2.52	33.2
Yes	26.3	83.3	1.33	2.17	40.9
Household got any LLIN from primary school					
No	22.8	83.9	1.51	2.45	32.8
Yes	31.9	88.2	1.63	2.51	41.9
Residence					
Urban	23.6	84.2	1.59	2.23	43.4
Rural	25.1	85.5	1.49	2.64	27.1
Wealth index					
Lowest	15.0	92.6	1.48	2.96	42.8
Second	17.4	80.6	1.42	2.19	32.0
Third	27.8	92.0	1.42	2.22	32.2
Fourth	30.6	81.8	1.51	2.21	28.9
Highest	31.1	80.4	1.75	2.84	36.1
Total	24.4	84.9	1.53 (ranging from 1 to 3)	2.46 (ranging from 0 to 6)	34.4

Overall, nearly a quarter (24.4%) of all sampled household respondents heard any information on hanging or use of nets from any source. Unsurprisingly, coverage of information was not depending on whether the household had received any LLIN from the campaign as the mass distribution had happened more than six months before the survey. However, it was interesting to find that household reached by the school CD channel were more likely to have received any information (31.9 vs. 22.8%), as well as those reached by the health facility distribution to a lesser extent (26.3 vs. 22.8%). Therefore, coverage of information increased with wealth, which is consistent with the higher proportion of richer households accessing CD channels.

Among the 219 household respondents that heard any information, 84.9% could remember any message on net hanging or use and that proportion was particularly higher among households that received any LLIN from primary schools (88.2%) and among poorest quintile (92.6%).

Lastly, 34.4% of all sampled households had discussed about using nets within their family in the past six months. That proportion was higher among those households reached by any CD channel (ie 40.9% for health facility and 41.9% for school CD) and interestingly, it was also higher among urban households (ie 43.4%) and the poorest wealth quintile (ie 42.8%). This suggests that although the CD channels appeared to be positive to spread preventive messages about malaria and net use, other factors are also involved in promoting discussion within the family.

Figure 13: Messages remembered (N=219)

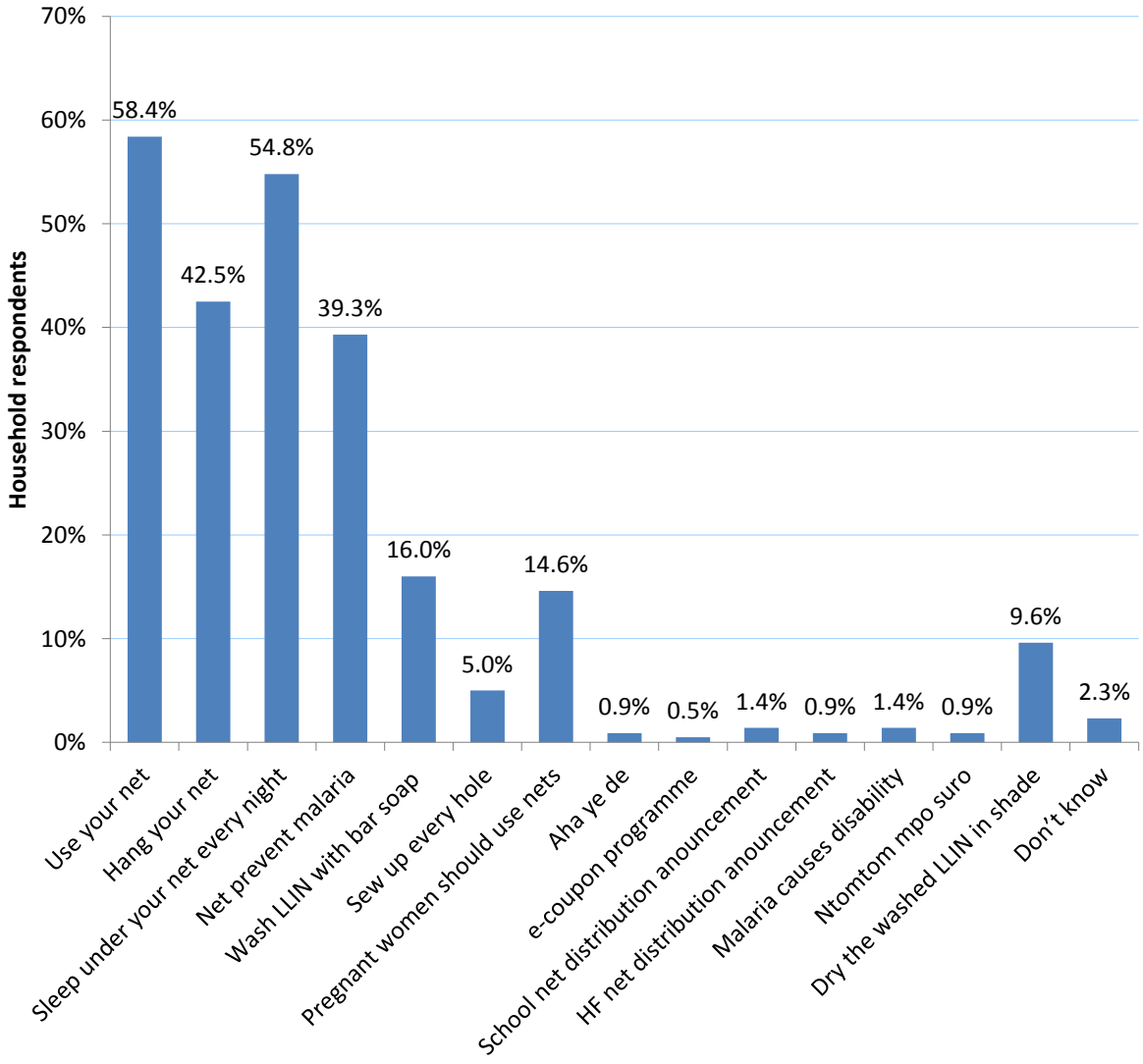
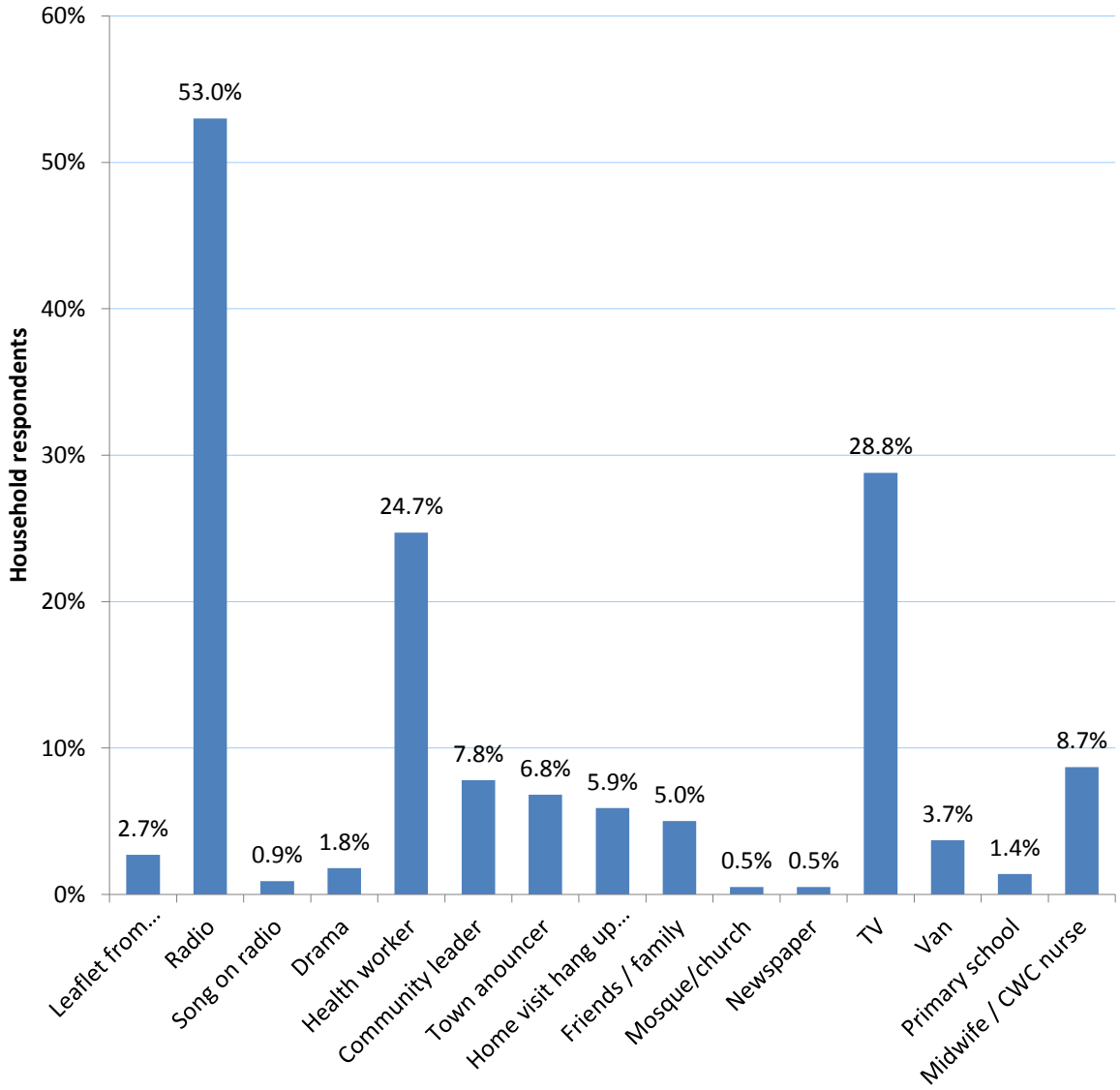


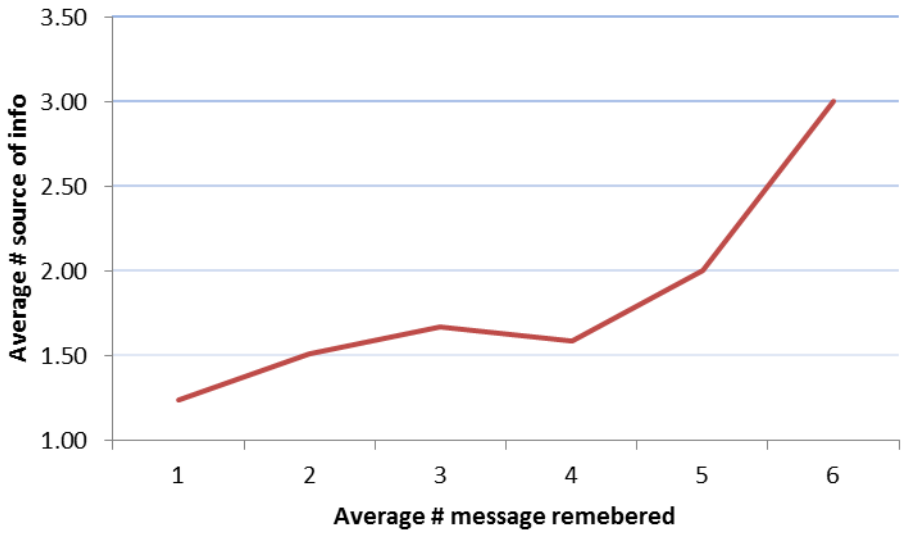
Figure 13 presents the BCC messages remembered by the 24.4% household respondents who had received any information in the past six months (N=219). Messages about net hanging and use were the most commonly cited messages, followed by messages about net care and repair while announcements for CD channels were rarely mentioned.

Figure 14: Source of messages (N=219)



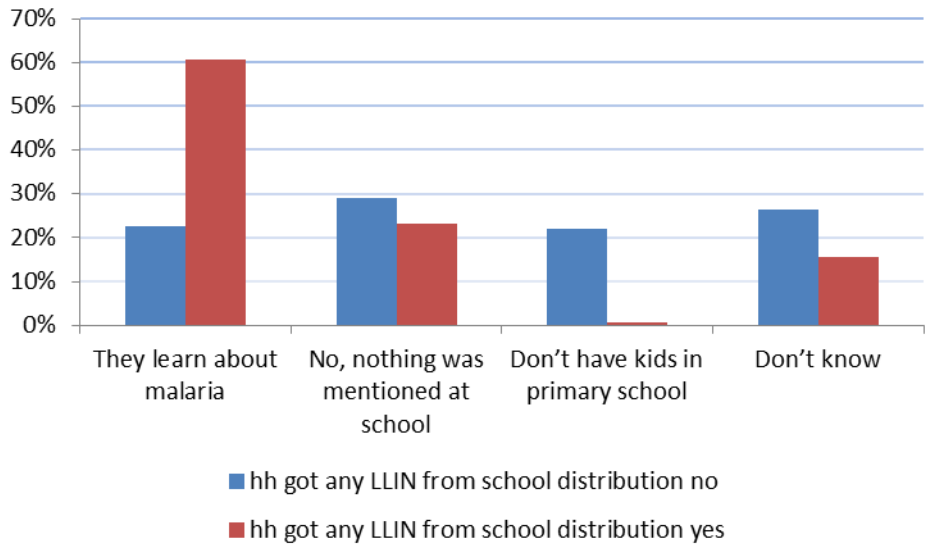
The three main channels of communication messages were the radio, the television and health workers. Interpersonal communication among the community was less commonly cited but information came through a variety of sources such as community leader (7.8%), town announcer (6.8%), home visit from the hang up team (5.9%) and friends and family (5.0%).

Figure 15: Correlation between information sources and messages remembered (N=219)



There was a clear correlation between the number of sources of information and the number of messages remembered. Household respondent were able to cite an increasing number of message content as the number of source of information rose.

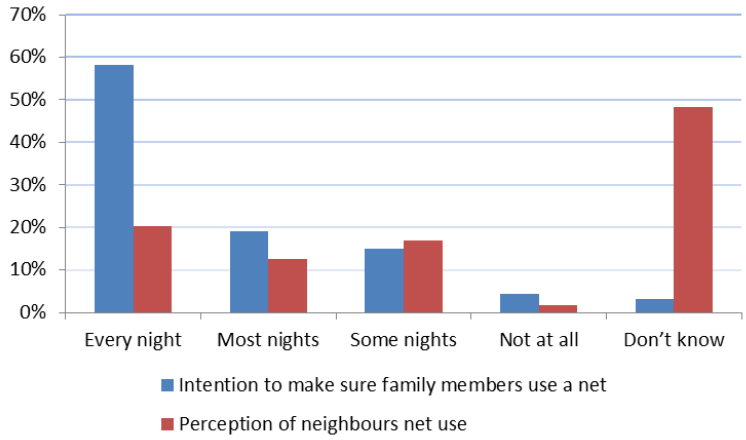
Figure 16: BCC messaging in primary schools (N= 898)



Household respondents were then asked whether they think children learn about malaria at school. Figure 16 shows that among households that did not benefit from school LLIN distribution, proportions were similar across response options (ie between 20 and 30%). However, respondents in households that were reached by school CD were significantly more likely to think children do learn about malaria at school (60%),

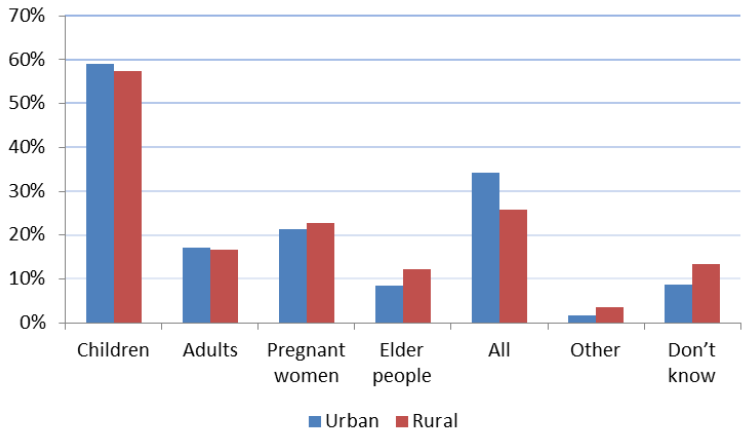
suggesting that the child came home with the LLIN and talked about malaria with other members of the family.

Figure 17: Reported intention to use and perceived neighbor's use (N=898)



While nearly 60% of all respondents reported having the intention to make sure the family would use the LLIN every night, almost 50% did not know whether their neighbours actually use nets. This could suggest that net use is not as common as expected in the targeted communities.

Figure 18: Perception of most vulnerable group to malaria, by type of residence



The assessment of the vulnerable groups to malaria revealed that almost 60% of respondents thought that children under five were most at risk for malaria while pregnant women did not seem to be considered as particularly vulnerable compared to other people (ie about 20%). There was no major variation across residence type, except

that urban household respondents were more likely to think that all people are vulnerable to malaria.

Table 21: Personal attitude of respondent towards net use (N=898)

Background characteristic	Think they should sleep under a net	Think sleeping under an ITN reduces their risk of malaria	Think they can still get malaria if they sleep under an ITN
Residence			
Urban	98.8	97.5	42.9
Rural	97.6	96.6	40.6
Wealth index			
Lowest	96.7	97.8	42.2
Second	100	97.8	42.1
Third	98.3	97.2	42.8
Fourth	97.2	94.4	37.8
Highest	98.3	97.8	43.3
Total	98.1	97.0	41.6

Interestingly, the vast majority of respondents thought they should use a net every night and that consistent LLIN use reduces the risk of malaria. Also, significantly fewer respondents (ie 41.6%) thought they could still get malaria even if they use a net suggesting that people do rely on ITN as a personal protection against malaria. These results were fairly similar across background characteristics.

Table 22: Use of other preventive methods at household level (N=898)

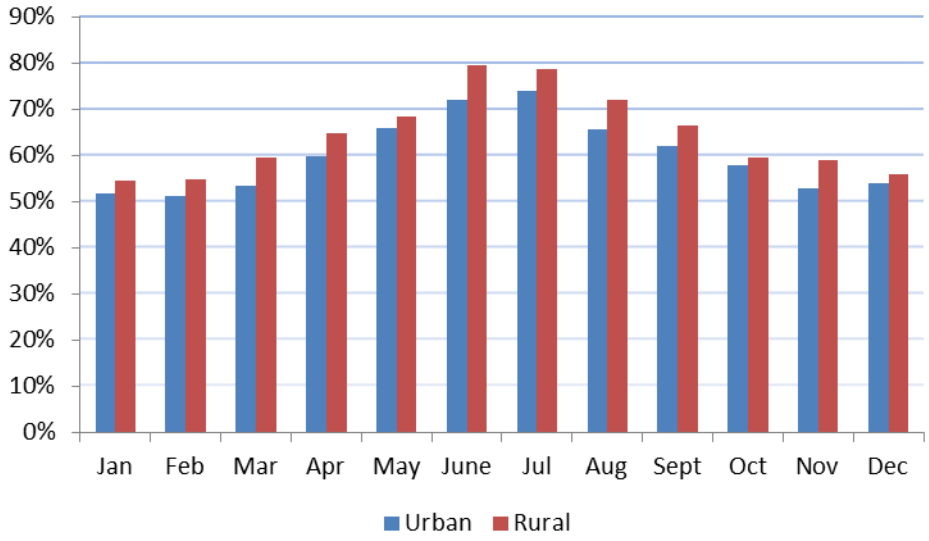
Background characteristic	Mosquito spray	Mosquito repellent	Coil	Herb or plant	Use at least 1 other method	Don't use any other method
Households with any member using an LLIN the previous night						
No	36.9	11.6	60.2	5.8	74.1	25.9
Yes	29.6	11.7	58.7	8.3	69.0	31.0
Residence						
Urban	40.7	14.9	60.3	7.4	74.9	25.1
Rural	25.7	9.1	58.4	7.3	67.7	32.3
Wealth index						
Lowest	12.8	6.1	46.7	9.4	53.9	46.1
Second	23.6	11.2	60.1	9.6	69.1	30.9
Third	33.3	12.2	65.6	10.6	75.6	24.4
Fourth	36.1	16.1	67.8	4.4	80.0	20.0
Highest	56.1	12.8	56.1	2.8	76.1	23.9
Total	32.4	11.7	59.2	7.3	70.9	29.1

Overall, 70.9% of all sampled households use at least one alternative method than ITN for personal protection against malaria. This proportion was higher among households

that do not use LLIN (ie 74.1 vs. 69.0%), as well as in urban setting (ie 74.9 vs. 67.7%); it also seemed to increase with wealth, as one would expect. The most common methods were coil (ie 59.2%) and aerosol spray (ie 32.4%).

Mosquito spray was the method most associated with LLIN use whereas other methods were used fairly independently of net use among the family. Also, mosquito spray and repellents were more commonly used among urban households while coil and herbs or plants were used equally used across residence type, suggesting that the differences observed are due to access issues as opposed to willingness to use it. This is also consistent with the increase in spray use in relation with wealth.

Figure 19: Net use in relation to season



For each month of the year, net use was reported by at least half of all household respondents. Low season in terms of net use was from November to March and the peak was June and July. Net use in rural setting was consistently higher than in urban residence type. Reported net use at the time of these data collection (ie December) was similar to actual LLIN use among people who had access to nets (ie 57.5%).

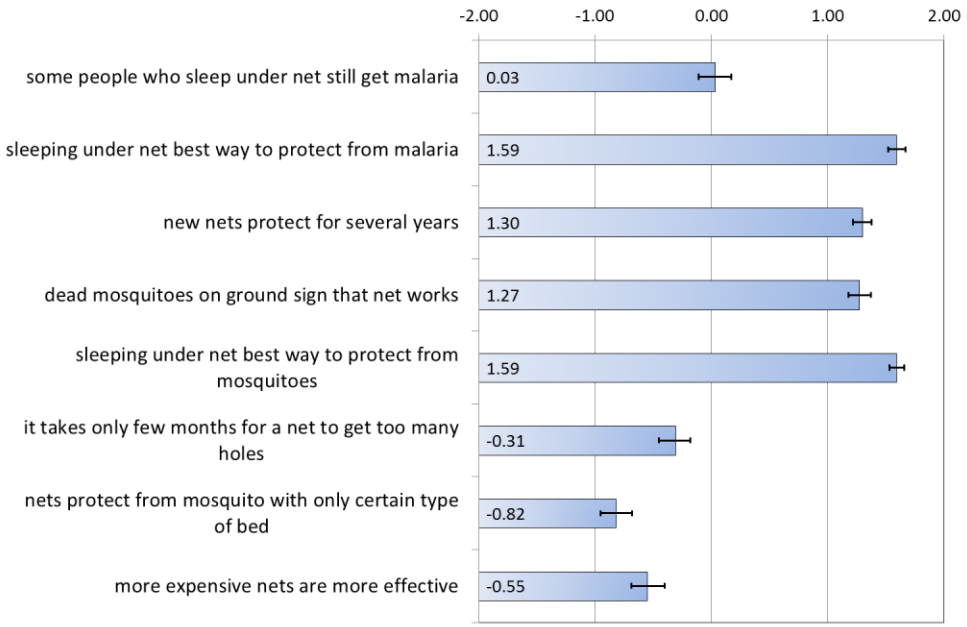
Table 23: Net use among children

Background characteristic	Frequency of net use by children			Number of households with any child
	Always	Sometimes	Never	
Household own 1 LLIN per 2 people				
No	50.6	32.7	16.7	502
Yes	61.1	32.9	6.0	319
Household has 1 LLIN available for 2 people				
No	51.4	32.3	16.3	566
Yes	62.0	33.7	4.3	255
Household got any LLIN from primary school				
No	54.1	32.2	13.7	664
Yes	57.3	35.0	7.6	157
Residence				
Urban	54.9	30.8	14.3	364
Rural	54.5	34.4	11.2	457
Wealth index				
Lowest	58.2	30.0	11.8	170
Second	58.4	29.5	12.0	166
Third	55.5	31.7	12.8	164
Fourth	52.5	33.3	14.2	162
Highest	48.4	39.6	11.9	159
Total	54.7	32.8	12.5	821

Net use among children was not as frequent as expected with 12.5% of respondent with children reporting that their children never use a net. This proportion was mostly affected by net ownership in the household, with little variation between household with 1 LLIN for every 2 people and 1 LLIN "available" for every 2 people, showing that children under five have priority to use LLIN in households where nets are used. Net use among children was slightly higher among households that were reached by school CD (ie 57.3 vs. 54.1% of households where children always use a net).

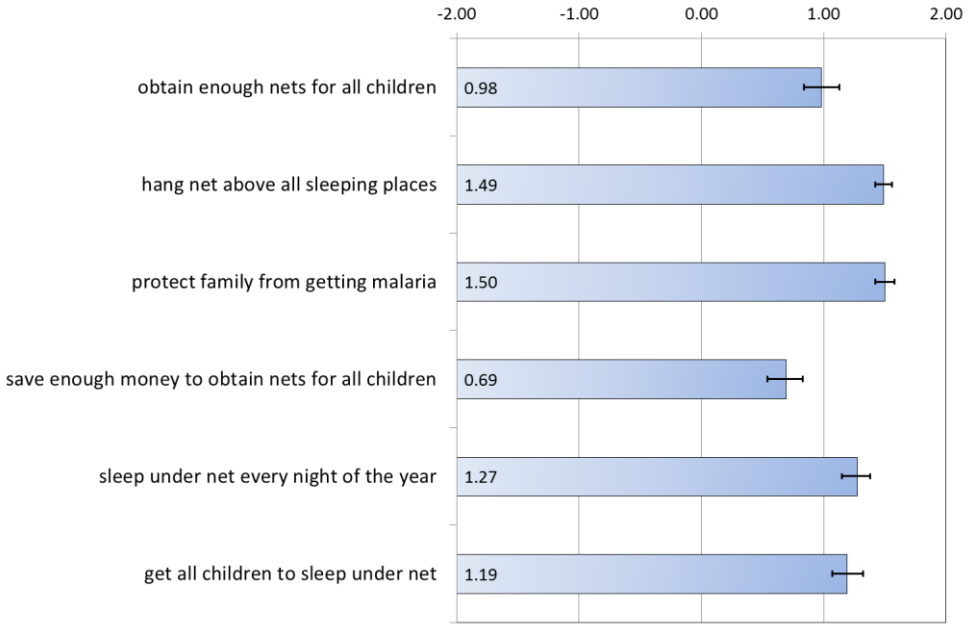
Information of knowledge, action taken and attitude towards malaria prevention and net use are then presented in Tables 25 and Figures 20, 21 and 22. Response options were recoded to read 2 for "strongly agree," 1 for "somewhat agree," –1 for "somewhat disagree," and –2 for "strongly disagree." The recoding prevents distortion when computing the mean because, in general, for scaled responses people tend to choose the highest score ("definitely could" or "strongly agree"). After recoding all the questions, a mean score was computed to reflect the household ability/willingness to take action to prevent malaria infection and household knowledge about malaria. The households were then classified into two groups, the ones which are less likely to take action (score equal or less than 0) and those which are more likely to take action (score more than 0). For questions on knowledge, households were also classified into two groups (good knowledge for a score more than 0 and poor knowledge for a score equal or less than 0).

Figure 20: Mean score of agreement for general malaria prevention knowledge (N=898)



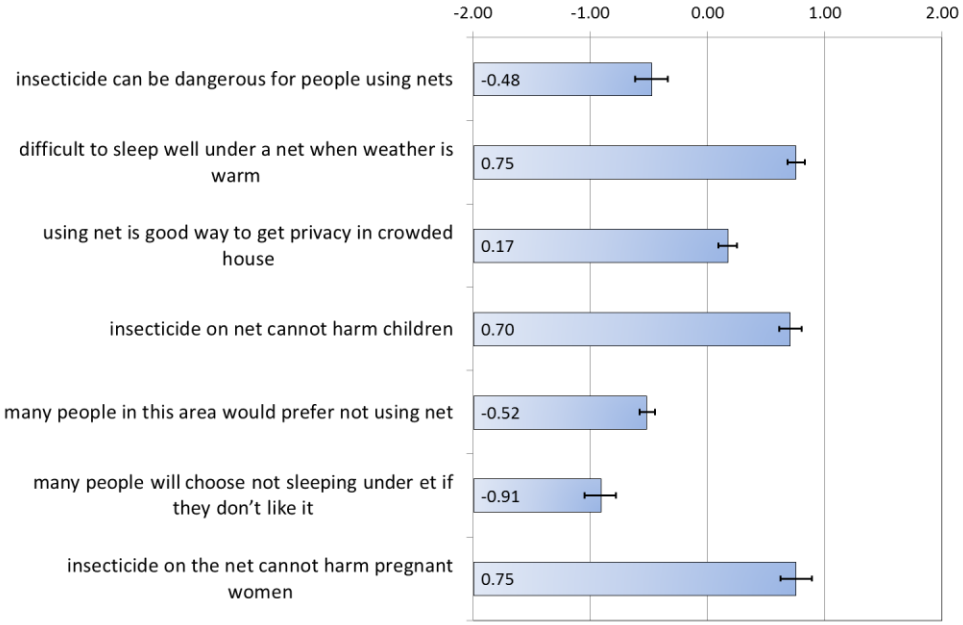
Eight questions were asked regarding the knowledge of net use as preventive method and respondents were asked to state their level of agreement to these statements. In general, household respondents agreed to statements about net use, showing good knowledge about the main concept about LLIN and the protection it provides to individuals. Awareness of LLIN duration was lower with overall disagreement to the statement “It takes only few months for a net to get too many holes”. It was also encouraging to see that most respondents disagree with false statements such as “nets protect from mosquito with only certain types of bed” or “More expensive nets are more expensive”.

Figure 21: Mean score of willingness to take action to prevent malaria (N=898)



The assessment of the willingness to take action to prevent malaria was positive as all statements resulted in a positive mean score of willingness. It revealed that household respondents agreed with statements about wiliness to protect themselves as well as their family from malaria but were less sure about willingness to save enough money to obtain nets for all children or obtain enough nets.

Figure 22: Mean score of agreement for perception on net use (N=898)



Mean score of agreement for the perception of household respondents on net use showed that in general respondents feel confident in the safety of LLIN use as well as in the preference to use nets in the community if people have access to nets. The difficulty of sleeping under a net when the weather is warm received the highest positive agreement score (ie 0.75).

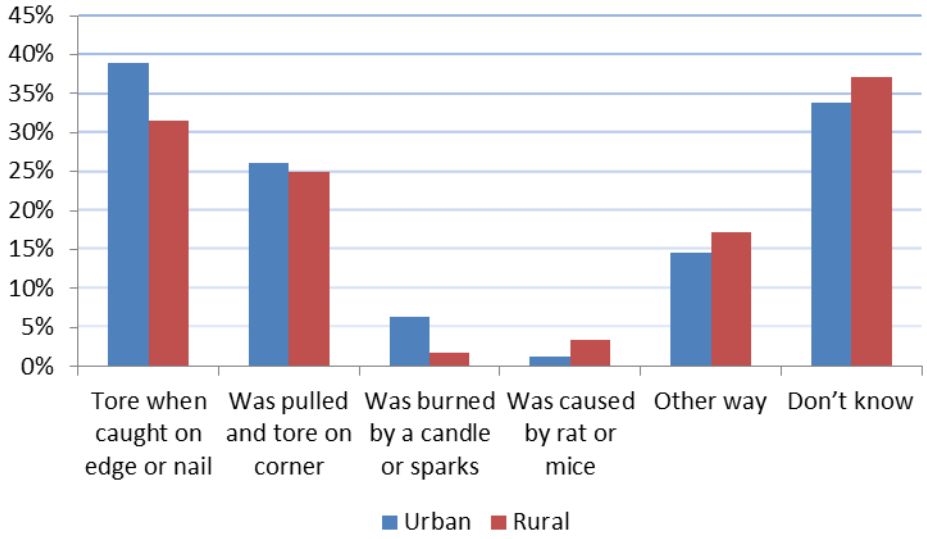
6. Net care and repair

Table 24: Experience of household in net care and repair

Background characteristic	Have experienced any hole in net owned (N=800)	Have tried to repair any holes themselves or by someone else (N=394)	Techniques mentioned to repair the net (N=144)			
			Stitched	Knotted or tied	Used a patch	Other way
Residence						
Urban	45.9	40.1	81.0	22.2	3.2	-
Rural	51.7	34.2	76.5	30.9	1.2	-
Wealth index						
Lowest	48.1	38.5	70.0	36.7	-	-
Second	51.3	37.5	76.7	26.7	-	-
Third	59.5	40.2	71.8	33.3	2.6	-
Fourth	44.7	29.6	95.2	19.0	4.8	-
Highest	42.5	35.3	87.5	12.5	4.2	-
Total	49.3	36.5	78.5	27.1	2.1	-

Nearly half of households experienced any hole in the net they own; this proportion was higher among rural households and tends to be higher among poorest quintiles as well. This is consistent with higher frequency of net use among these households. Among these households who had experienced any hole in their nets, 36.5% tried to repair it; that proportion was higher among urban households but was not clearly related to wealth. The most common method to repair the net was “stitched”, with 78.5%.

Figure 23: Origin of holes mentioned, by type of residence



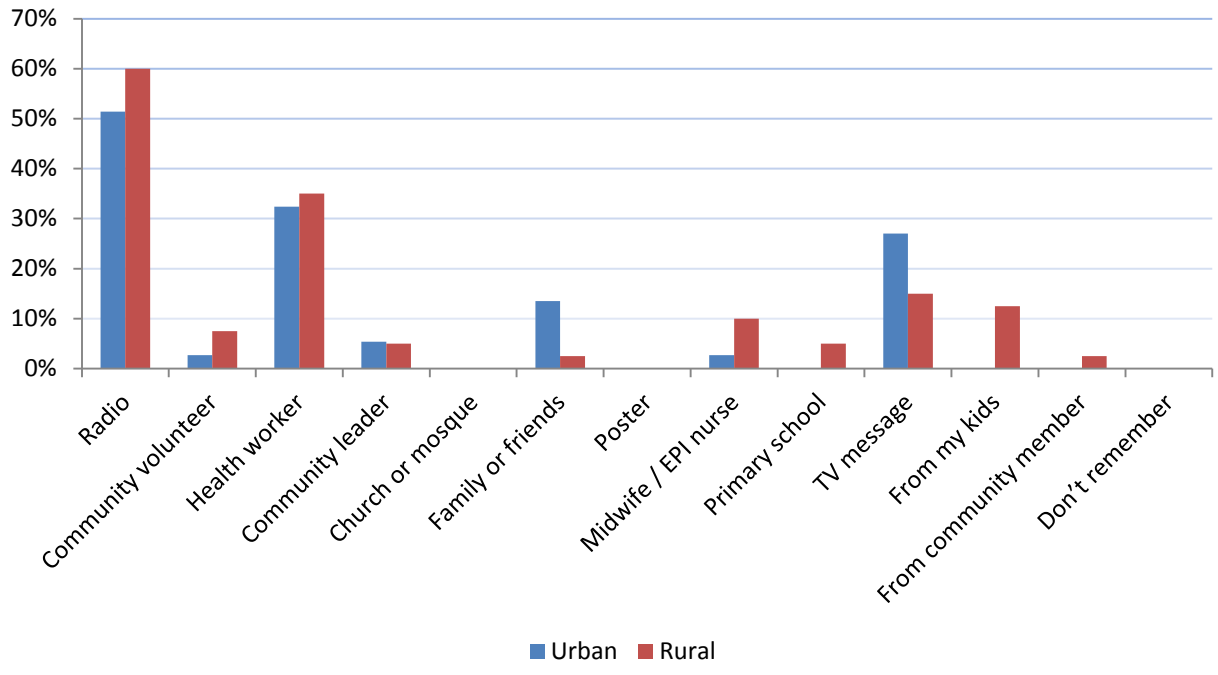
In general, the origin of holes in the net as reported by household respondents were due to a cause related to net use such as “Tore when caught on edge or nail” or “Pulled and tore on corner”. The same pattern across residence type was observed as the pattern found during the direct observation of household nets (ie Figure 10), where urban households were more likely to know the cause of the hole while rural households were more likely not to know.

Table 25: Net repair in the past 6 months

Background characteristic	Have experienced any hole in net and any hole repaired in past 6 months (N=394)	Reason mentioned for not repairing the hole within past 6 months (N=250)					Heard any message on net care and repair in past 6 months (N=898)
		No time	Not necessary	Don't know how	Other	Don't know	
Residence							
Urban	40.1	10.6	24.5	54.3	6.4	4.3	9.2
Rural	34.2	11.5	22.4	46.8	9.0	10.3	8.1
Wealth index							
Lowest	38.5	8.3	25.0	52.1	8.3	6.3	5.0
Second	37.5	6.0	22.0	50.0	6.0	16.0	7.9
Third	40.2	12.1	24.1	56.9	3.4	3.4	12.2
Fourth	29.6	16.0	24.0	40.0	12.0	8.0	10.0
Highest	35.3	13.6	20.5	47.7	11.4	6.8	7.8
Total	36.5	11.2	23.2	49.6	8.0	8.0	8.6

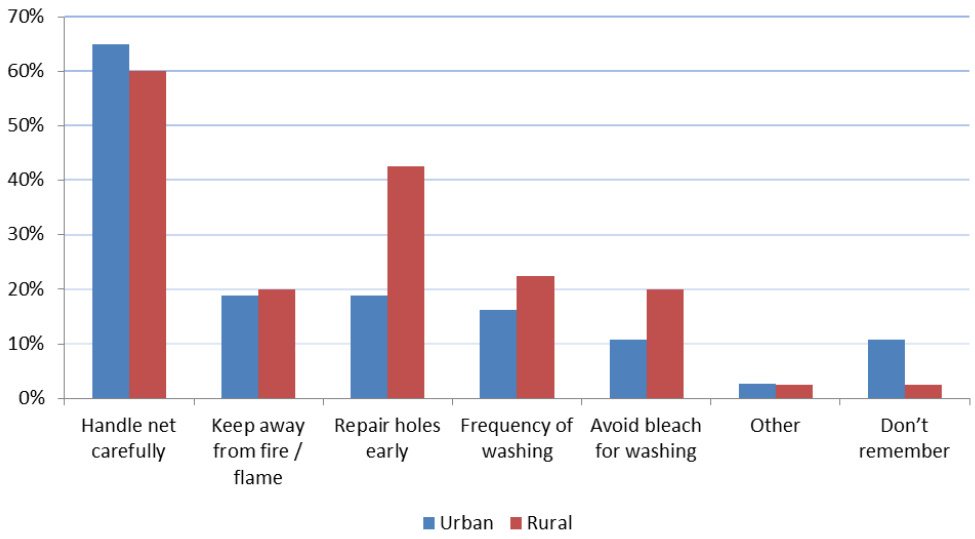
The main reason for not repairing the nets even if holes were found was "Don't know how" and this reason was more frequent among urban residence type (ie 54.3 vs. 46.8%). It is also worth noting that 23.2% thought that repairing the nets was not necessary. Lastly, only 8.6% of household respondents had heard any message specifically about net care and repair in the past six months, which is consistent with the low awareness of these aspects among the sampled households.

Figure 24: Source of message mentioned



Sources of information were similar to what was observed for general BCC messaging; the most common channels were the radio, the television or the health worker.

Figure 25: Content of messages mentioned



The message content focussed primarily on care when handling the net and this was true across both rural and urban residence type. Rural households were significantly more likely to mentioned "Repair holes early".

7. Comparison with baseline results

Table 26: Comparison of key indicators across baseline and endline evaluations

Indicator	Denominator	Baseline		Endline	
		Estimate	95%CI	Estimate	95%CI
Outcome of the distribution system					
% households that received any LLIN from any channel	All households	**91.3**	88.1 to 93.8	**90.1**	87.3 to 92.4
Household ownership of LLIN					
% households with any LLIN on survey day	All households	**90.2**	87.2 to 92.5	**88.4**	85.0 to 91.1
% households with 1 LLIN per 2 people on survey day	All households	**49.8**	45.7 to 53.9	**40.4**	36.4 to 44.6
% households with 1 LLIN per sleeping place on survey day	All households	**47.0**	41.7 to 52.5	**40.5**	36.6 to 44.6
% people having access to a LLIN the previous night	All de facto population	**73.0**	69.7 to 76.1	**66.5**	62.8 to 69.9
LLIN use the night before the survey					
% people using a LLIN the previous night	All de facto population	**46.8**	42.9 to 50.7	**38.2**	34.8 to 41.8
% people with access to LLIN using a LLIN the previous night	All de facto population	**64.0**	60.5 to 67.6	**57.5**	53.6 to 61.4
% children under five using a LLIN the previous night	All de facto under five	**49.1**	43.9 to 54.4	**45.4**	40.0 to 50.9
% children under five with access to LLIN using a LLIN the previous night	All de facto under five	**93.6**	88.5 to 97.8	**89.7**	82.9 to 95.5
% households with 1 LLIN per 2 people where all members used a LLIN the previous night	All households	**38.4**	33.8 to 43.3	**33.9**	28.6 to 39.6
Source of household LLIN					
% household LLIN acquired through mass distribution	All household LLIN	**94.2**	91.9 to 95.9	**76.1**	72.3 to 79.6
% household LLIN acquired through any CD channel	All household LLIN	**0.5**	0.3 to 1.0	**15.4**	12.8 to 18.4
% household LLIN acquired through retail sector	All household LLIN	**1.3**	0.7 to 2.2	**3.5**	2.4 to 5.2
LLIN retention					
% net from any channel (campaign or CD) retained on the survey day	All nets acquired before the campaign	**95.0**	93.4 to 96.3	**87.6**	84.6 to 90.2
Mean number of weeks since net discarded	All discarded nets	**19.99**	16.50 to 23.48	**36.91**	30.89 to 42.93
% nets thrown away	All discarded nets	**10.6**	5.5 to 19.5	**42.2**	34.3 to 50.5
% nets discarded for intentional reason	All discarded nets	**54.9**	43.2 to 66.0	**76.0**	66.6 to 83.5
% discarded nets given to other people	All discarded nets	**44.2**	31.1 to 58.2	**33.8**	24.6 to 44.5

Indicator	Denominator	Baseline		Endline	
		Estimate	95%CI	Estimate	95%CI
Net position on the survey day					
% household LLIN hanging	All household LLIN	**69.1**	64.6 to 73.3	**60.6**	56.8 to 64.3
% household LLIN stored away in package or unpacked	All household LLIN	**18.2**	15.6 to 21.2	**18.5**	15.9 to 21.5
% household LLIN temporarily taken away	All household LLIN	**9.3**	6.6 to 12.9	**6.2**	4.7 to 8.3
% LLIN used every or most night the previous week	All household LLIN	**61.6**	57.0 to 66.1	**53.8**	49.4 to 58.1
Net care and repair					
% household LLIN ever washed	All household LLIN	**35.4**	30.5 to 40.6	**56.0**	51.2 to 60.6
% household LLIN that ever had any hole	All household LLIN	**14.6**	11.6 to 18.1	**30.1**	26.4 to 34.1
% household LLIN in good condition*	All household LLIN	**93.7**	91.4 to 95.3	**84.7**	81.7 to 87.3
% household LLIN damaged but usable**	All household LLIN	**3.1**	2.2 to 4.3	**6.4**	5.3 to 7.9
% household LLIN severely damaged***	All household LLIN	**3.2**	2.2 to 4.8	**8.8**	7.0 to 11.1
Knowledge, attitude and practice					
% respondents that heard any information about net use in the previous 6 months	All hh respondents	**46.4**	42.1 to 50.7	**24.4**	21.1 to 28.0
% respondents that remembered any message on net hanging or use	Respondents that heard any information	**75.6**	67.8 to 81.8	**84.9**	78.9 to 89.4
% respondents that discussed using nets within the family in past six months	All hh respondents	**47.6**	43.0 to 52.3	**34.4**	29.7 to 39.4
% respondents intending to make sure family members use a net every or most night	All hh respondents	**76.8**	72.5 to 80.6	**77.4**	72.6 to 81.5
% respondents perceiving that neighbours use net every or most night	All hh respondents	**38.8**	35.1 to 42.6	**32.9**	29.0 to 36.9
% respondents perceiving under five and pregnant women as most vulnerable to malaria	All hh respondents	**18.0**	15.3 to 21.1	**20.6**	17.2 to 24.5
% respondents perceiving that all people are most vulnerable to malaria	All hh respondents	**29.2**	25.3 to 33.5	**29.5**	25.9 to 33.4
% respondents thinking they should sleep under a net	All hh respondents	**98.4**	97.4 to 99.0	**98.1**	96.5 to 99.0
% respondents thinking using a net reduces their risk of malaria	All hh respondents	**96.4**	94.7 to 97.5	**97.0**	95.5 to 98.0
% respondents thinking they can still get malaria if they sleep under an ITN	All hh respondents	**39.7**	35.6 to 43.9	**41.6**	37.4 to 46.0
% households using any alternative methods for personal protection	All hh respondents	**63.8**	58.6 to 68.6	**70.9**	66.2 to 75.3
% respondents more likely to take action for malaria prevention	All hh respondents	**66.9**	63.1 to 70.5	**68.7**	63.4 to 73.6

*Hole index based on WHOPES weights for four size categories, pHI 0 to 64

** Hole index based on WHOPES weights for four size categories, pHI 65 to 400

*** Hole index based on WHOPES weights for four size categories, pHI 401 to max

The proportion of household with one LLIN per every two people decreased since baseline (40.4% vs. 49.8%) and this difference was statistically significant. Therefore the proportion of de facto population having access to a LLIN the night before the survey also decreased (73.0% vs. 66.5%) at baseline. On the other hand, the LLIN retention rate at baseline was higher (95.0% vs. 87.6%). However, nets were less likely to be thrown away (10.6% vs. 42.2%) and would rather be given someone else (44.2% vs. 33.8%) while at endline, retention was lower but nets were more likely to be thrown away and less likely to be given to someone else. Also, the average number of weeks since the net was acquired till it was discarded was significantly higher at endline (36.9 vs. 19.1).

LLIN use among de facto population with access was lower at endline (57.5% vs. 64.0%), as was the LLIN hanging rate (60.6% vs. 69.1%) and the proportion of LLIN that were reported being used every or most night the previous week (53.8% vs. 61.6%). However, there was a similar proportion of LLIN stored away, either in their original package or unpacked (18.2% vs. 18.5%). Among all household LLIN, a higher proportion was acquired through net retailers at baseline (3.5% vs. 1.3%).

There was a higher proportion of household LLIN ever been washed at endline (56.0 vs. 35.4%), as well as a higher proportion of LLIN that ever had any hole (30.1 vs. 14.6%). The LLIN condition did decrease across surveys as less LLIN were in good condition (84.7 vs. 93.7%) but more LLIN were damaged (6.4 vs. 3.1%) or too torn (8.8 vs. 3.2%).

There was a slight increase in respondents with intention to make sure the family would use nets most or every night (77.4 vs. 76.8%). Also, the proportion of respondents perceiving under five and pregnant women are most vulnerable to malaria had increased (20.6 vs. 18.0%) and the proportion of respondent perceiving that all people are vulnerable to malaria was similar (29.5 vs. 29.2%). Equal proportions of respondents thought they should use a net (98.1 vs. 98.4%) because it reduces the risk of malaria (97.0 vs. 96.4%). There were more respondents thinking that they can still get malaria even if they use nets (41.6 vs. 39.7%) as well as more respondents more likely to take action for malaria prevention (68.7 vs. 66.9%).

On the other hand, there were significantly fewer households discussing about using nets among the family (34.4 vs. 47.6%) and a lower proportion of respondents perceiving neighbours use nets (32.9 vs. 38.8%). However, more household used alternative personal protection methods (70.9 vs. 63.8%).

DISCUSSION OF THE METHODS AND KEY FINDINGS

Survey methodology and data validity

The intention of this data collection was to obtain information from households on the outcome of the pilot of LLIN continuous distribution through primary schools and health facilities that would be statistically representative of the population of Eastern Region. In order to achieve such representativeness, the sampling methodology was critical. In this survey, the classical two-stage cluster sampling was applied as it is also used in standard national surveys such as MICS and DHS. A list of villages with the census population was used to allocate clusters to villages proportionate to population density. At cluster level, the survey also followed standard DHS/MICS protocol by compiling a complete list of eligible households at the day of the survey from which the interviewed households were selected using random number lists. By applying sampling weights proportionate to the selection probabilities of clusters and households based on the actual response rate in the data analysis, the survey methodology used all the "state of the art" approaches and can be considered a truly representative sample.

The survey consciously did not use any data or listing from the LLIN campaign for selection of respondents in order to ensure that any village or household that did not participate in the campaign but was eligible at the time would be included in the sampling frame. The only caveat of this procedure is that a family that had only moved to the location after the campaign would also be included in the survey. However, if this family moved within Eastern Region, they would have been equally eligible to participate in the campaign and the proportion of out-of-state immigration in a predominantly rural population is very unlikely to be of a magnitude that would have distorted the results.

Like any survey that relies on interviews with household respondents, this survey was prone to potential recall and misclassification biases. Age heaping and misclassification were likely to be present to a certain degree in a number of responses. Nonetheless, many aspects of demography such as proportion of children under five, currently pregnant women and socio-economic characteristics regarding education and household assets were found to be as one would expect from other data sources suggesting a high level of consistency. Furthermore, results were consistent in many ways within the dataset regarding trends with age and/or wealth quintiles as well as previously known net ownership so that in total the results can be considered as valid within the limits of the described range of precision.

Outcome of the LLIN distribution

Overall, 90.1% of households received at least one LLIN from any channel. The mass distribution reached a vast proportion of households (ie 81.6%, Table 5) compared to CD channels (31.0%) that were intended to introduce a small quantity of nets on a continuous basis to maintain ownership. As usually observed in other countries, the campaign was more effective in rural setting and among poorer wealth quintiles. On the other hand, access to continuous distribution was rather pro-rich. This is logical as access to health care services are usually more likely to be attended by richer households. Also, although primary schools enrollment in Ghana is quite high (ie 87%)[7], access to education is still more common among richer households (ie Table 2). As a result, the whole distribution system using a mix of channels including the hang up campaign was highly equitable in terms of access. The combination of mass distribution and continuous distribution was not the only reason for this; indeed, there was little overlap across CD channels with 85% of households that received at least one LLIN accessed only one particular channel.

Even if the whole distribution system was very efficient in reaching households (ie households that received at least one LLIN), the quantity of LLIN distributed was insufficient to reach the target of 80% of households with enough LLIN to protect all people. Indeed, an average of 2.20 LLIN (ie Table 7) was distributed to households, considering all channels including mass campaign. This finding was not surprising as the results from the baseline survey had highlighted that the quantity of nets distributed through the hang up campaign was insufficient to achieve universal coverage. Also, the process evaluation of the implementation of continuous distribution in Eastern Region revealed that at the startup phase, the concept of continuous distribution was generally misunderstood and confused with some “mop up” distribution activity. Indeed, health staff in routine health services used to give out a LLIN to people who had not benefited from the hang up campaign as oppose to any targeted people attending the services.
LLIN retention rate at baseline was higher (ie 95.0 vs. 87.6% in Table 27) but net were less likely to be thrown away (10.6 vs. 42.2%) and would rather be given someone else (44.2 vs. 33.8%). On the other hand, more LLIN had been discarded since the starts of CD but the discarded nets were older than those discarded before the implementation of CD channels (ie average number of weeks since the net was acquired till it was discarded was 36.9 vs. 19.1 in Table 27). Moreover, lower retention was observed among households where adults were not involved in the decision to acquire a new net or sensitized by a health worker (ie health facility distribution). At endline, more than three quarters of LLIN (76.1%) that were not retained were intentionally discarded (ie Figure 9). If the net were intentionally discarded, 51.4% were given or thrown away for

objective reasons (too torn, too many holes or too dirty), compared to 27.9% of LLIN discarded because the households judged they did not need any LLIN at the time or they did not like it. This strongly suggests that households tend to keep their older nets until new nets are available and that the CD system actually served its purpose in enabling households to replace their older nets.

Lastly, the NetCalc tool estimated that household ownership of one LLIN for every two people would be about 8%-points lower if CD activities had not been implemented after the hang up campaign in Eastern Region (ie 32.7% vs. 40.4% in Table 6). The gap was even wider considering people with access to LLIN the night before the survey (ie 57.4 vs. 66.5%). This confirms that the combination of CD channels did impact on the household ownership of sufficient LLIN to achieve universal coverage.

LLIN use the night before the survey

Among household LLIN, 60.6% of LLIN were hanging either loose (36.4%) or folded (24.2%) and more than half of all nets were used either every (46.3%) or most nights (7.7%) the week preceding the survey (ie Table 14). Among all people that stayed in the house the previous night, 38.2% used a LLIN and considering only those with access to LLIN on that night, the use rate was 57.5% (ie Table 18). Although LLIN use was lower than expected among people who had access, information about net care and repair (washing, hole experience, net condition) do suggest that a substantial proportion of nets were used since they were obtained which suggest that the decrease in use rate since baseline is most probably attributable to the season as oppose to a decrease in interest in LLIN. Indeed, among all reasons mentioned for not using the nets, 59.2% of explanations were objective such as the net was not available or it was too torn, compared to 17.5% were subjective such as “we don’t like the net” (ie Figure 11). In total, 10.6% of the unused LLIN were new nets still unpacked. Also, the order of priority for LLIN access within household shows that considering households with sufficient LLIN only, vulnerable people (ie children under five and pregnant women) were more likely to use LLIN the previous night. This strongly suggests that households with enough LLIN to ensure universal access within the family are also more aware of malaria risk as most vulnerable people such as young children and pregnant women have priority access to nets. On the other hand, 18.7% of all nets were stored away, either unpacked (ie 9.2%) or in package (ie 9.5%). The fact that this proportion was similar across surveys (ie Table 27) means that it is unlikely to be related to weather or seasonality and could be explained by household willingness to save nets for future use, for example to replace their current nets when necessary. This wide spread habit was not without any effect on

overall coverage as when excluding LLIN that were still stored away in their original package, the coverage estimates fell from nearly 7%-points (ie Table 9).

Net care and repair

Among all nets owned by the sampled households, 56.3% had ever been washed but 70.2% of these nets were washed with detergent or bleach, known to be detrimental for the effectiveness of the insecticide on the net and 80.4% of the nets were dried outside on a line while 8.3% were put on the ground in the bush for drying (ie Table 16). Among all nets, 30.4% ever had any hole, either repaired on the survey day or not (ie Table 17). The estimation of the hole index revealed that 90.9% of all nets were either in good condition (ie 84.5%) or somewhat damaged but still usable (ie 6.4%) while 9.1% were found to be too damaged to effectively protect people from getting malaria. The main reasons mentioned for the holes were “Pulled and tore” and “Torn”, which seem to be due to net usage (ie Figure 10). Nearly half of households experienced any hole in the net they own; this proportion was higher among rural households and tends to be higher among poorest quintiles; 36.5% tried to repair it. In general, the origin of holes in the net as reported by household respondents were due to a cause related to net use such as “Tore when caught on edge or nail” or “Pulled and tore on corner”. The main reason for not repairing the nets even if holes were found was “Don’t know how” (ie Table 26) and this reason was more frequent among urban residence type (ie 54.3 vs. 46.8%). Comparison of net care and repair across baseline and endline surveys (ie Table 27) revealed that net were increasingly likely to ever been washed over time (56.0 vs. 35.4%) as well as more likely to ever had any hole (30.1 vs. 14.6%). Also, the proportion of LLIN in “good” condition was lower at endline (84.7 vs. 93.7%) and of those damaged and too torn higher (respectively 6.4 vs. 3.1% and 8.8 vs. 3.2%). This also strongly suggests that a substantial proportion of LLIN were used between the two evaluations.

Knowledge, attitude and practices

Overall, 24.4% of all household respondents (ie Table 21) heard any information on hanging or use of nets from any source. Coverage of information was not depending on whether the household had received any LLIN from the campaign as the mass distribution had happened more than six months before the survey. Household reached by the school CD channel were more likely to have received any information (31.9 vs. 22.8%), as well as those reached by the health facility distribution to a lesser extent (26.3 vs. 22.8%). Among the 219 household respondents that heard any information,

84.9% could remember any message on net hanging or use; 34.4% of all sampled households had discussed about using nets within their family in the past six months; that proportion was higher among those households reached by any CD channel (ie 40.9% for health facility and 41.9% for school CD). The three main channels of communication messages were the radio, the television and health workers. There was a clear correlation between the number of sources of information and the number of messages remembered (ie Figure 14).

Respondents in households that were reached by school CD were significantly more likely to think children do learn about malaria at school (60%), suggesting that the child came home with the LLIN and talked about malaria with other members of the family (ie Figure 16). While nearly 60% of all respondents reported having the intention to make sure the family would use the LLIN every night, almost 50% did not know whether their neighbours actually use nets (ie Figure 17). Also, 60% of respondents (ie Figure 18) thought that children under five were most at risk for malaria while pregnant women did not seem to be considered as particularly vulnerable compared to other people (ie about 20%). The vast majority of respondents thought they should use a net every night and that consistent LLIN use reduces the risk of malaria (ie Table 22). Among all households, 70.9% use at least one alternative method than ITN for personal protection against malaria (ie Table 23). This proportion was higher among households that do not use LLIN (ie 74.1 vs. 69.0%), as well as in urban setting (ie 74.9 vs. 67.7%); it also increases with wealth. The most common methods were coil (ie 59.2%) and aerosol spray (ie 32.4%).

In general, attitude towards net use and awareness level of malaria prevention slightly increased after one year implementation of LLIN CD (ie Table 27). Considering that BCC efforts significantly decreased in the sampled community after the campaign, it was encouraging that positive attitude was maintained across survey. The decrease in discussion within the family can be attributed to the drop in BCC coverage as these 2 variables were significantly associated at baseline ($p<0.001$). This strongly suggests that the sudden increase in LLIN availability and more intense BCC messaging stimulated discussions as oppose to be an indicator of awareness level. Also, the lower perception on neighbours LLIN use is consistent with the decrease in use rate due to season. On the other hand it is positive to note that households do widely use alternative prevention methods.

CONCLUSION AND POTENTIAL RECOMMENDATIONS

Although the ownership of 1 LLIN for every 2 people was not maintained after one year of CD implementation, households started to get rid of their older nets as new nets were introduced on a continuous basis in the community through the CD channels. The CD system therefore did serve its purpose in enabling households to replace their older nets as expected. However, the quantity of LLIN distributed was not sufficient and resulted in a lower than expected household ownership after one year of implementation of distribution activities through CD channels.

The “net culture” boosted by the hang up campaign and the punctual and intense BCC efforts were maintained after one year implementation of CD activities. However, household motivation to increase positive attitude and practices consistently throughout the year was not sufficient to maximize the effects of available LLIN on malaria transmission.

In the light of the main findings highlighted in this report, NMCP and programme managers could consider distributing a larger quantity of LLIN at the startup phase of CD to make up for any potential and likely implementation challenge at the beginning of distribution activities. This could be done, for example, by including more classes for the primary schools distribution.

Also, behaviour change communication messaging should be maintained throughout the first years of CD implementation. BCC efforts should focus on the importance of using LLIN all year long, by all people as well as emphasize on the vulnerability of young children and pregnant women to malaria. Positive attitude toward net care and repair is also an area to be strengthen in Eastern Region in order to reduce the frequency of net replacement while still preserve the optimal efficacy level of the nets.

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