

**Post-Campaign Survey/Baseline Survey
for Continuous Distribution of Long
Lasting Insecticide Treated Nets (LLIN)
in Eastern Region, Ghana**

Final report

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Abbreviations

BCC	Behavioral Change Communication
CHPW	Child Health Promotion Week
CI	Confidence Interval
EPI	Expanded Program on Immunization
IRB	Institutional Review Board
ITN	Insecticide Treated Nets
LLIN	Long-Lasting Insecticidal Nets
MERG	Monitoring and Evaluation Reference Group
MICS	Multi-Indicator Cluster Survey
NGO	Non-Governmental Organization
NMCP	National Malaria Control Program
PCA	Principle Component Analysis
PPS	Probability Proportionate to Size
PW	Pregnant Woman
RBM	Roll Back Malaria
U5	Child under five years
WHO	World Health Organization

Summary of key findings

To evaluate the Ghanaian government's efforts to rapidly scale up ownership and use of long lasting insecticide-treated bednets (LLIN) in the country, a population-based household survey was conducted in the Eastern region in April 2012, just prior to the rainy season and a few months following a LLIN distribution campaign. The survey, using a standard two stage cluster sampling design, included 1016 households. Key survey results are included in the summary table below.

Indicator	Estimate	95% confidence interval
Effectiveness of the LLIN distribution campaign		
% households that received any LLIN (N=1016)	91.3%	88.1 to 93.8
% households with any LLIN hung by team (N=928)	30.9%	25.2 to 37.4
Mean number LLIN received by household	2.41	2.31 to 2.50
Mean number LLIN hung by team in household	2.17	2.01 to 2.33
% households that received BCC information on nets hanging or use (N=1016)	46.4%	42.1 to 50.7
Retention, hanging and condition of campaign LLIN		
% campaign LLIN retained on survey day (N=2274)	95.0%	93.4 to 96.3
% campaign LLIN with any hole (N=2158)	14.0%	11.2 to 17.5
% of households with any campaign LLIN hanging on survey day (N=928)	76.7%	72.8 to 80.2
Household coverage of any LLIN		
% households with any net before the campaign (N=1016)	12.0%	9.4 to 15.3
% households with any LLIN on survey day (N=1016)	90.2%	87.2 to 92.5
Universal coverage indicators on survey day		
% households with at least 1 LLIN per sleeping space (N=1016)	47.0%	41.7 to 52.5
% households with at least 1 LLIN for every 2 people (N=1014)	49.8%	45.7 to 53.9
LLIN use the previous night		
% population that slept under a LLIN last night (N=5052)	46.8%	42.9 to 50.7
% children under 5 that slept under a LLIN last night (N=574)	49.1%	43.9 to 54.4
% pregnant women that slept under a LLIN last night (N=62)	50.0%	35.6 to 64.4
% of all nets currently owned used last night (N=2340)	63.2%	58.6 to 67.7
% of LLIN currently owned used last night (N=2221)	64.0%	59.3 to 68.4
% households with all members using a LLIN last night (N=1014)	24.7%	21.6 to 28.0

As illustrated in the summary table of key results, the household survey demonstrated the following:

- the LLIN distribution campaign dramatically increased LLIN coverage (i.e. number of households with at least one net or LLIN). Coverage rose from 12.0% for any net before the campaign to 90.2% for any LLIN at the time of the survey, post-campaign.
- the quantity of LLIN distributed in the campaign was insufficient to reach universal coverage (i.e. all household members having access to a LLIN). Post-campaign, 47.0% of households had at least one LLIN per sleeping space and 49.8% had at least one LLIN for every two people in the household.
- volunteers to hang up household nets were well accepted by the population; more than three quarters of households estimated the hang-up volunteers' job was important and well done.
- in households with any LLIN, only 30.9% had a LLIN hung by a volunteer. This was likely due, in part, to the fact that people did not find hanging nets difficult. Among households that had hung a net themselves, less than 3% reported experiencing any difficulty in hanging up the net.
- on the day of the survey, the much higher proportion of households with any LLIN hanging (76.7%) than those with a LLIN hang up by a volunteer (30.9%) confirms that LLIN hang up was not a significant barrier to LLIN use in these communities.
- LLIN use by individuals at the beginning of the high malaria transmission season when the survey was conducted had not reached the target of 80%; 46.8% of the population slept under a LLIN the previous night. Further, only 64% of the LLIN in households were used the previous night. Reasons given by respondents for not using the nets suggest that season was a key factor rather than to lack of interest from the population.
- only 46.4% of the respondents reported receiving any BCC information about nets. Of those who did, the most frequently-cited message source was the hang up volunteer in their home visit. While the survey results suggest that the culture of net use is strong in the Eastern region, more BCC communications

about insecticide safety for net users and the importance of using LLIN all year would be beneficial for malaria prevention.

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 the best method 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 on biologically vulnerable groups (children under five years of age and pregnant women), current efforts are aimed at achieving universal access to LLIN (on average, coverage of one net for every two persons in a household). 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 is also the pilot region for continuous distribution activities to be conducted in 2012 and 2013; nets will be distributed through antenatal clinics (ANC), the expanded program on immunization (EPI), Child Health Promotion Weeks (CHPW), schools, and the commercial sector.

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

Survey Objectives

Primary Objectives:

- To capture the outcomes of the universal LLIN access campaign in Eastern Region
- To provide a baseline for piloting continuous LLIN distribution activities in Eastern Region
- To assess the level of net retention 10-14 months after the campaign distribution
- To assess the use of nets in general and LLIN in particular at the beginning of the rains

Secondary Objectives:

- To measure equity in access to campaign nets
- To obtain detailed information about net use and sleeping patterns in the family
- To evaluate the success of the IEC and BCC activities associated with the campaign

Use of Survey Results

The results of the survey are expected to be used in the following ways:

- to provide the Region and National Malaria Control Programme and RBM partners with valuable information on the success of current guidelines for mass campaign distribution and whether changes are warranted
- to offer insights into behavioral factors influencing net use and retention and to use that information to inform the IEC/BCC component of future campaigns
- to provide a baseline for the pilot of continuous distribution activities that will be conducted in 2012.

Methods

Study site

Figure 1: Location of Eastern Region

The target population of the survey was the population living in Eastern region of

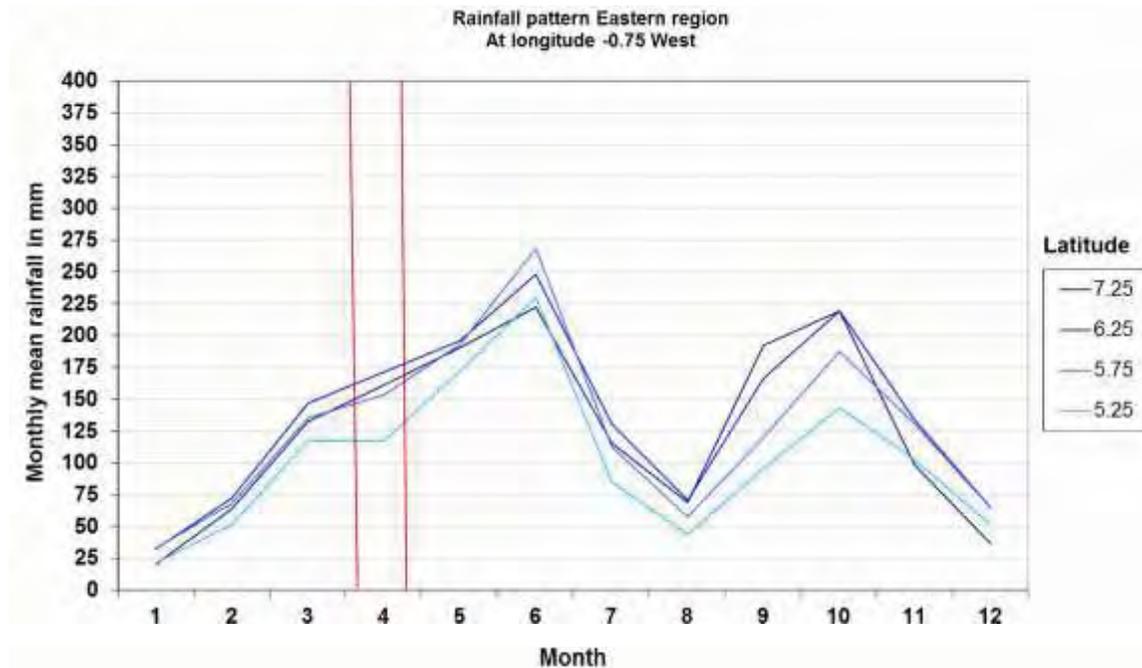


Ghana. The region had an estimated population of 2,194,508, with 3.1% growth rate in 2004. It covers an area of 19,323 square kilometers, approximately 8.1% of Ghana's total land area. Eastern Region is divided into 21 administrative districts. It is bordered on the north by the Ashanti region and the 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 (52.1%), with African Ghanaians accounting for approximately 71% of the total population. Other ethnicities in the region account for 29% of the total

population. The Akan predominate in 15 of the 21 districts, with variations from 68 to 80% of the population.

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 2: Rainfall intensity and pattern in Eastern region.



The rainfall pattern in figure 2 was measured at longitude of 0.75 degree West from North to South. The red lines indicate the time period of data collection for the survey.

LLIN campaign

The LLIN campaign in Eastern region was supported by the National Malaria Control Program, donor agencies and implementing partners.

Household Registration - Community Registration Assistants (CRAs) were selected from the various communities in the region in consultation with community opinion leaders. The CRAs were people who could read and write. These CRAs were trained and went into their communities to capture the household registration data which was the basis for the LLIN allocation to the communities. The LLIN allocations were done by sub district supervisors based on the sub-district's community data captured by the CRAs.

Door-to-Door and Hang Up Implementation - During the door-to-door distribution and hang up phase of the campaign, two more community volunteers were chosen and added to the already trained CRA in each community to form a hang up team of three.

These additional community volunteers were also selected from the communities in consultation with the community members. These community volunteers were not necessarily literate but rather people who are willing to support the community to hang the nets.

LLINs distributed and hanged for beneficiaries were given free of charge i.e. the nets were not sold to the beneficiaries. Community members were encouraged to motivate the hang up community volunteers. Community motivation was in many forms: foodstuffs, exemption from communal labour, token financial contribution by the household members and philanthropic community contributions.

Only households that were registered were allocated LLINs to be hanged on their registered sleeping places. Community hang up volunteers were instructed not to leave the LLINs in the households unchanged. Household members who insisted that they would be able to hang the LLINs were given the LLINs to hang themselves in the presence of the community hang up volunteers.

BCC Activities - Various BCC activities were conducted before, during and after the campaign. These BCC activities were community mobile van announcements, community radio announcements and discussions, community durbars, LLIN education in the ANCs and CWCs. Also church and mosque announcements on the LLIN distribution were made.

Sampling

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 campaign.

The following assumptions underlay the calculations of sample size precision using standard formulas:

- confidence interval (alpha-error) 95%
- power (beta-error) 80%
- design effect of 1.75
- non-response of 5%
- 5.0 persons per household (based on 2008 Ghana DHS results)
- 15% of population under 5 (based on 2008 Ghana DHS results)
- 4.0% of population currently pregnant (based on 2008 Ghana DHS results)

A sample of 60 clusters with 17 households each (1020 households) was chosen, providing a precision estimate of $\pm 4.4\%$ points for household indicators if the estimate was around 50% and $\pm 2.7\%$ points if the estimate was around 90%. The study was not sufficiently powered to provide precise estimates on pregnant women but since the campaign used a universal access approach this was considered acceptable. According to the sampling estimates the number of children under five in the sample would be 765, the number of pregnant women 204 and the number of urban residents 225 (assuming 25% urban clusters).

Stage one: selection of clusters

For the selection of clusters the household registration lists from the campaign distributions was used. A cluster was defined as a community and the selection of clusters was done as follows: a cumulative list of registered households by sub-district (forms 1 and 2 of the campaign documents) was compiled and 60 clusters were then 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.

Stage two: selection of households

Within each selected community 17 households were selected using the following methodology: if the community was small (less than 100 households) the field team mapped the whole village and from the compiled list of eligible households the supervisor randomly selected 17 households with equal probability for each household. Following the household definition used in the LLIN distribution campaign, the definition of a household in the survey was “people eating from the same pot”.

If the community was large, i.e. exceeding 200 households, the equal size section-approach was used. With the help of local chiefs the community was divided into sections of approximately equal size, each with 40-60 compounds. One of these sections was randomly selected by the supervisor and within this section all households were mapped and selected as described above.

Data collection

Questionnaire

For data collection, a pre-tested questionnaire was used. The primary respondent was the head of household or his/her spouse and the person who was present during the visit of the hang up team. The household module included questions on all existing mosquito nets in the household and these were inspected by the survey team, provided permission was given by the household.

For a series of questions on knowledge, actions taken and attitudes towards malaria prevention and net use, questions were posed using scales for level of respondent agreement. 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 prevented 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). The complete questionnaire used is presented in the Annex A.

Data Collection Teams and Training

Interviewers and supervisors were carefully selected to be culturally acceptable, to have good knowledge of the local language, and to have experience conducting household surveys. Each team had one supervisor and four to five interviewers. The week before the fieldwork, the field team was trained for five days. The training covered the purpose and exact procedures of the interviews (following the interview guide) and net examination and involved role playing and mock interviews. All members of field teams also went to a rural community not included in the sample to conduct a pilot interview in real life setting.

Community sensitization

Local authorities were contacted for approval to conduct the survey prior to data collection. Visits were made to the relevant heads of communities and the purpose and procedures of the survey were explained to them. In all cases, the head of community granted authorization and either personally notified the relevant heads of villages or referred the team to the heads of village who were then also informed of the survey objectives and procedures. Community mobilization efforts were conducted in such a way as to ensure that no expectation was created of another distribution campaign after or during the survey.

Interviews

The survey interviews were conducted in the period of April 11-26, 2012. 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.

Assessment of net condition

Each campaign net found in the household was assessed for physical condition and signs of repair, provided permission was granted for the inspection. Visual aids and plasticized tally sheets for the hole assessment was prepared in advance. In the inspection each side and roof of the net was separately inspected and 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 existing holes. Data from the net hole assessment was transformed into the proportionate Hole Index (pHI) for each net in the following way:

$$pHI = \# \text{ size 1 holes} + (\# \text{ size 2 holes} \times 23) + (\# \text{ size 3 holes} \times 196) + (\# \text{ size 4 holes} \times 576).$$

Based on the pHI each net was 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 <0.01m ² or pHI<64
Serviceable:	total hole surface area <=0.12 m ² or pHI<=768
Too Torn:	total hole surface area >0.12m ² or pHI>768

Quality control

At the end of each day of data collection, the team supervisor reviewed all questionnaires for completeness and possible inconsistencies and ensured that missing information was corrected while still in the field.

Data processing, entry and analysis

Data entry was done using QPS software with double entry of all records. 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.

Data analysis was done using STATA 12.0 software based on the previously defined outcome indicators disaggregated 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 for nets, the quintile allocation of the household was applied. Concentration index and concentration curve was used to analyze 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 informed of the possibility that a repeat interview may be conducted by a different person to ensure data quality. They were also ensured 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 Ethics Review Committee as well as the Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health (IRB No: 4119).

Results

Sample characteristics

Of the 1020 targeted households, 1016 (99.6%) were visited and completed questionnaires obtained. Four households were missing because they refused to participate in the interview.

Overall, 64.5% of households were headed by a man and 34.6% by a woman. The difference was significantly more marked among rural households where 70.3% were headed by a man compared to 55.0% in urban households ($p < 0.01$). The average household size was 5.15, ranging from 1 to 22, and this did not differ much according to background characteristics.

Table 1: Background characteristics of sampled households (N=1016 households)

Background characteristic	Head of household			# persons in household (mean)	Any children <5yrs (%)	Any pregnant woman (%)	Households (#)
	Male (%)	Female (%)	Age in years (mean)				
Residence							
Urban	55.0	44.2	50.89	5.07	38.2	4.7	387
Rural	70.3	28.8	50.08	5.20	44.0	6.5	629
Wealth Index							
Lowest	73.0	25.0	49.13	5.17	41.2	4.4	204
Second	59.8	39.2	51.74	5.03	43.6	6.9	204
Third	60.1	39.4	52.61	5.23	40.4	6.9	203
Fourth	61.1	38.8	50.18	5.20	44.8	5.9	203
Highest	68.3	30.7	48.25	5.14	39.1	5.0	202
Total	64.5	34.6	50.39	5.15	41.8	5.8	1016

Nearly a quarter (24.3%) of the household heads did not have any education. This proportion was similar across type of residence but did significantly decrease with wealth ($p < 0.001$). Similarly, the level of education was higher among richer households ($p < 0.001$).

Table 2: Educational level of head of household (N=1016 households)

Background characteristic	No education (%)	Primary (%)	Secondary (%)	Higher (%)	Don't know (%)
Residence					
Urban	21.4	30.2	36.4	10.3	1.6
Rural	26.1	32.3	30.7	80.1	2.9
Wealth Index					
Lowest	40.7	34.8	19.6	2.5	2.5
Second	32.8	33.8	27.0	4.4	2.0
Third	22.7	32.0	35.5	7.4	2.5
Fourth	17.7	32.5	40.4	7.4	2.0
Highest	7.4	24.3	42.1	23.3	3.0
Total	24.3	31.5	32.9	9.0	2.4

The average number of rooms used for sleeping was 2.55, ranging from 1 to 16, and the average number of sleeping spaces (any habitual sleeping spaces, it can be beds, mattresses, mats or rugs etc.) was 3.38, ranging from 1 to 17. This resulted in a theoretical average number of people per sleeping space of 1.84. There was no significant variation in sleeping spaces according to background characteristics.

Table 3 also presents some of the household assets that were included in the wealth index. All were statistically significantly associated with wealth ($p < 0.001$). Having walls in bricks or concrete showed the steepest gradient, ranging from 10.8 among the poorest households to 79.7% among the richest.

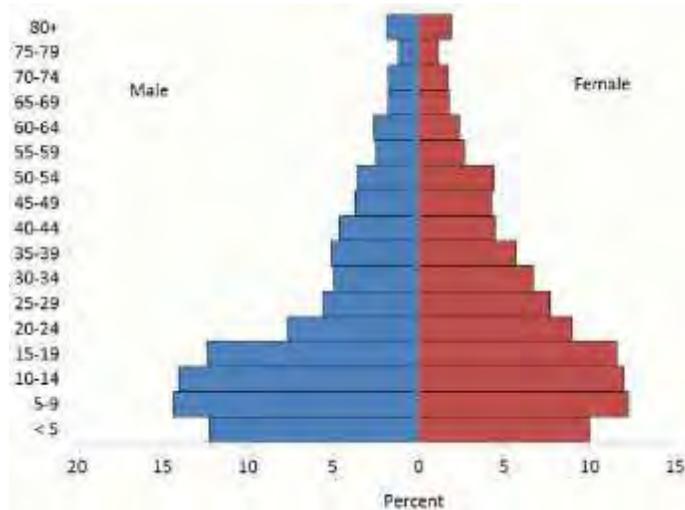
Table 3: House characteristics and selected assets (N= 1016 households)

Background characteristic	Rooms for sleeping (mean)	Sleeping places (mean)	Persons per sleeping place (mean)	Mobile phone %	Roof in zinc, iron %	Walls in bricks or concrete %	# of houses
Residence							
Urban	2.65	3.33	1.86	86.8	96.6	65.9	387
Rural	2.48	3.41	1.83	77.6	85.9	35.3	629
Wealth Index							
Lowest	2.32	3.60	1.71	57.8	58.3	10.8	204
Second	2.28	3.10	1.93	70.1	93.6	25.0	204
Third	2.52	3.31	1.84	82.3	98.5	48.8	203
Fourth	2.63	3.31	1.91	95.6	99.5	70.9	203
Highest	2.99	3.59	1.84	100	100	79.7	202
Total	2.55	3.38	1.84	81.1	90.0	46.9	1016

Among all sampled households, 5226 persons were registered on the household member's roster; 99.0% were usual residents in the household and 96.7% stayed in the house the previous night. The population distribution by gender and age, as presented in Figure 3, is comparable to the demographic distribution in the African context, with an important proportion of the population under 15 and significantly fewer elderly people.

Table 4: Composition of the sampled population (N = 5226 people)

Background characteristic	children under 1 year	children under 5 years	under 15 years %	currently pregnant women	# of people in sample
	%	%	%	%	
Residence					
Urban	1.8	10.0	34.5	0.9	1963
Rural	2.0	11.6	38.9	1.4	3263
Wealth Index					
Lowest	2.0	11.3	37.7	1.1	1044
Second	1.5	11.7	39.5	1.5	1027
Third	1.8	10.8	38.4	1.3	1061
Fourth	2.5	11.3	37.3	1.1	1056
Highest	1.9	10.1	33.3	1.0	1038
Total	1.9	11.0	37.3	1.2	5226

Figure 3: Population distribution by gender and age (N=5226 people)

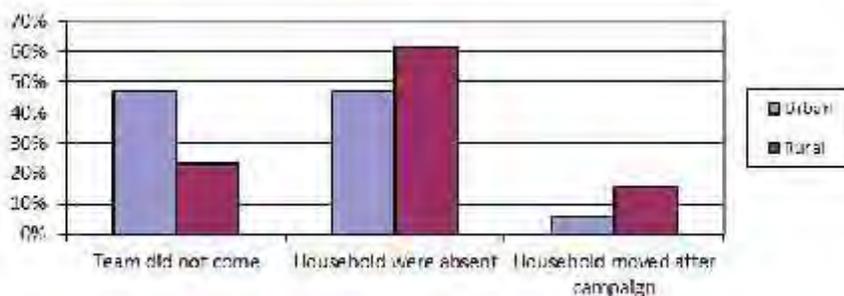
Process of LLIN distribution

Home visit completeness for the LLIN distribution campaign was first evaluated at the level of the cluster. Of the 60 selected clusters, most (93.3%) had a coverage of hang up visit of 80% or more, while in 4 clusters, the coverage was between 51% to 80%. This suggests that none of the communities were totally missed by the hang up team (Table 5).

Table 5: Coverage of hang up team visit by cluster (N= 60 clusters)

Households visited in cluster	Residence of cluster		Total
	Urban	Rural	
None	-	-	-
1-50%	-	-	-
51-80%	2/23 (8.7%)	2/37 (5.4%)	4/60 (6.7%)
>80%	22/23 (91.3%)	35/37 (94.6%)	56/60 (93.3%)

Figure 4 presents the reasons for non-visit by the hang up team, according to type of residence of the 43 missed households. It demonstrates that among urban communities households were missed both due to the hang up team's absence and the household's absence, in almost equal proportions. Rural households, on the other hand, were more likely to be missed because the household was absent on the day of the visit. The fact that so few households were missed, in either the urban or rural context, suggests that access to households by the hang up team was not a significant challenge for the success of the campaign.

Figure 4: Reasons for non-visit to household by hang up team (N=43 households)

Overall, 93.3% of sampled households were visited by the hang up team and 91.3% received any LLIN (i.e. at least one LLIN). When the 29 households that reported having enough nets to cover all their sleeping spaces before the distribution were excluded from the analysis, the results were similar. Among households that needed a LLIN, only 18 were visited but did not receive any LLIN.

Of the 928 households that received any LLIN from the campaign distribution, 30.9% had any LLIN hung by a hang up team. Rural households were more likely to have any LLIN hung by a team (34.8% vs. 24.7%) but this difference was not statistically significant ($p=0.07$).

Table 6: Outcome of hang up team visit (N=1016 households)

Background characteristic	All sampled households (N=1016)		Households with any uncovered sleeping space (N=987)		Among households that received any LLIN (N=928)		
	Was visited (%)	Received any LLIN (%)	Was visited (%)	Received any LLIN (%)	Any LLIN hung by team (%)	# of LLIN received (mean)	# of LLIN hung by team (mean)
Residence							
Urban	93.5	92.0	94.2	92.6	24.7	2.38	2.24
Rural	93.2	90.9	93.1	91.1	34.8	2.42	2.14
Wealth Index							
Lowest	94.1	92.6	94.6	93.1	24.9	2.36	2.27
Second	94.1	92.2	94.4	93.3	35.6	2.39	2.34
Third	94.6	92.6	94.9	92.9	29.3	2.33	2.06
Fourth	94.6	94.6	94.4	94.4	32.3	2.39	2.10
Highest	89.1	84.7	89.3	84.8	32.7	2.56	2.06
Total	93.3	91.3	93.5	91.7	30.9	2.40	2.17

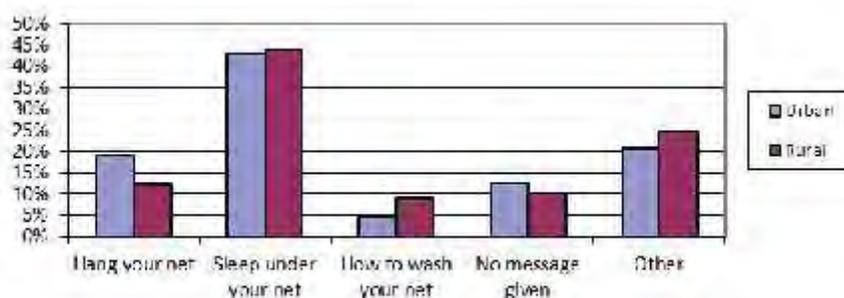
Among households that received any LLIN from the campaign, 64.1% estimated that the time to deliver the LLIN was short. Overall, 40.7% contributed financially for the LLIN, with the amount ranging from 0.50 to 50.0 cedi (less than 3 US\$), though in more than 80% of the cases it was less than 2.0 cedi (0.1 US\$). Making a financial contribution for the LLIN was not associated with having a net hung by the team ($p=0.53$), strongly suggesting that the low hang up by the teams was not due to financial considerations.

When asked to comment on the volunteer's help, 76.7% of households that received any LLIN from the distribution thought the volunteer's help was important to hang the LLIN. This proportion was similar among households that did not have any LLIN hung by the team and those that did. Further, 77.8% of respondents indicated that the volunteer did his or her job well.

Table 7: Process of net delivery and hanging by the hang up team (N=928 households)

Background characteristic	Estimated time to deliver and hang the net is short (%)	Any financial contribution from household for LLIN (%)	Think volunteer's help was important to hang the nets (%)	Think volunteer did his/her job well (%)
	Residence			
Urban	64.0	32.9	76.4	74.7
Rural	64.2	45.6	76.9	79.7
Wealth Index				
Lowest	67.2	39.2	82.0	84.1
Second	60.1	38.3	77.7	76.6
Third	69.7	46.3	79.8	83.0
Fourth	64.1	41.1	75.5	75.0
Highest	59.1	38.6	67.8	69.6
Total	64.1	40.7	76.7	77.8

Household respondents were asked to mention the main message about mosquito nets they remembered from the hang up team's visit. Excluding the "Other" category, the most answered options were "Sleep under your net" (43.6%), "Hang your net" (14.8%), and no message received (11.0%). Variations in response across type of residence were not significant.

Figure 5: Messages from hang up team mentioned by respondents (N=825 respondents)

Outcome of campaign LLIN distribution

Among all sampled households, 12.0% owned any net (insecticide treated or not) before the campaign distribution. The average number of nets owned was 0.19 and a slightly higher percent of wealthy households had a net (11.4% among the wealthiest vs. 6.9% among the poorest). On the survey day, after the campaign distribution, 90.2% of the households possessed any LLIN (86.6% among the richest households and 89.7% among the poorest). The average number of LLIN owned was 2.19.

Excluding the households that did not receive any LLIN from the campaign, the household coverage of any LLIN (i.e. at least one LLIN per household) on the survey day was 97.6%, confirming that few households were missed by the campaign (Table 8). It also indicates that only 2.4% (about 22 households) of households that received a LLIN from the campaign had discarded or lost all their campaign LLIN by the time of the survey.

Table 8: LLIN ownership before and after campaign on the survey day (N=households)

Background characteristic	Among all sampled households (N=1016)				Among households that received any LLIN (N=928)	
	Possess any net (%)		# of LLIN owned (mean)		Possess any LLIN on survey day (%)	# of LLIN owned on survey day (mean)
	Before (any type of net)	On survey day (any LLIN)	Before	On survey day		
Residence						
Urban	11.4	90.7	0.20	2.15	96.9	2.30
Rural	12.4	89.8	0.18	2.21	98.1	2.42
Wealth Index						
Lowest	6.9	89.7	0.11	2.05	96.3	2.21
Second	11.8	90.7	0.17	2.14	97.3	2.31
Third	14.3	93.1	0.23	2.28	100	2.46
Fourth	15.8	90.6	0.24	2.23	95.3	2.35
Highest	11.4	86.6	0.18	2.23	99.4	2.55
Total	12.0	90.2	0.19	2.19	97.6	2.37

On the survey day, less than half of the sampled households had reached universal coverage (everyone in the household having access to a LLIN) as only 47.0% possessed at least one LLIN per sleeping space and 49.8% possessed at least one LLIN for every two people. Excluding households that did not benefit from the campaign, 51.1% owned at least one LLIN per sleeping space and 53.9% at least one LLIN for every two people (Table 9). It appeared that urban households were more likely to have sufficient LLIN but this was not a significant difference and could be explained by the slightly smaller household size and somewhat higher ratio of people per sleeping spaces among urban households.

Table 9: Household LLIN coverage and universal access on day of survey (N=1016 households)

Background characteristic	Among all sampled households (N=1016)		Among households that received any LLIN in campaign N=928	
	Own 1 LLIN / sleeping space	Own 1 LLIN / 2 people	Own 1 LLIN / sleeping space	Own 1 LLIN / 2 people
	%	%	%	%
Residence				
Urban	49.6	50.9	53.1	54.5
Rural	45.5	49.1	49.8	53.6
Wealth Index				
Lowest	37.3	45.0	39.7	47.9
Second	50.5	48.5	54.3	52.1
Third	52.2	52.7	55.9	56.9
Fourth	50.2	49.8	53.1	52.6
Highest	45.0	53.0	52.6	60.8
Total	47.0	49.8	51.1	53.9

Table 10 shows that on the survey day, a few months after the campaign distribution, the numbers of LLIN present in the households were insufficient to ensure universal access to LLIN. This was true even in households that owned at least one LLIN, suggesting that the key barrier to universal coverage is more likely to be LLIN availability than lack of acceptability of LLIN by the population.

Table 10: Number of LLIN owned by households on survey day (N= 1016 households)

Background characteristic	Among all sampled households N=1016		Among households owning at least 1 LLIN N=915	
	# LLIN per sleeping space (mean)	# persons per LLIN (mean)	# LLIN per sleeping space (mean)	# persons per LLIN (mean)
Residence				
Urban	0.81	2.44	0.90	2.44
Rural	0.78	2.47	0.87	2.47
Wealth Index				
Lowest	0.69	2.68	0.77	2.68
Second	0.82	2.43	0.91	2.43
Third	0.84	2.47	0.90	2.47
Fourth	0.82	2.41	0.91	2.41
Highest	0.78	2.30	0.90	2.30
Total	0.79	2.46	0.88	2.46

On the survey day, several months following the campaign distribution, 85.0% of households had retained all the LLIN received in the campaign; 9.9% retained some and 5.2% did not retain any. Rural and poorer households were more likely to retain their LLIN though there was not a significant association between retention and urban/rural residence.

Of the 2274 LLIN distributed to the sampled households during the campaign, 95.0% were found in the households on the survey day. Of nets previously owned by the households, 88.9% were found on the survey day. This suggests that since the campaign distribution older nets were more likely to be lost or discarded compared to campaign LLIN.

Table 11: Retention of campaign LLIN since the distribution

Background characteristic	Campaign LLIN retained among households that received any LLIN (N=932 households)			Nets retained	
	None (%)	Some (%)	All (%)	Campaign LLIN (N=2274 nets) (%)	Older nets (N=2631) (%)
Residence					
Urban	7.6	6.5	86.0	95.5	88.2
Rural	3.6	12.0	84.4	94.8	89.4
Wealth index					
Lowest	2.6	5.3	92.1	95.4	88.8
Second	5.9	9.6	84.6	96.6	87.2
Third	3.2	12.2	84.7	96.4	89.5
Fourth	6.2	13.5	80.3	95.0	89.6
Highest	8.1	8.7	83.2	91.9	89.7
Total	5.2	9.9	85.0	95.0	88.9

The reasons given for non-retention of campaign LLIN were “Given away to other people” (44.2%), “Stolen or destroyed accidentally” (21.2%) and “Thrown away or used for other purpose” (10.6%). These results indicate that a substantial proportion of non-retained LLIN were redistributed within communities rather than being discarded or lost (Table 12).

Table 12: Fate of non-retained LLIN and reason for non-retention (N=113 LLIN)

Background characteristic	Fate of non-retained LLIN			Reason for not keeping the LLIN	
	Stolen or destroyed accidentally (%)	Given away to other people (%)	Thrown away or used for other purpose (%)	Unintentional* (%)	Intentional** (%)
Residence					
Urban	21.1	44.7	13.2	21.1	57.9
Rural	21.3	44.0	9.3	21.3	53.3
Wealth index					
Lowest	14.3	47.6	0.0	14.3	47.6
Second	20.0	40.0	13.3	20.0	53.3
Third	12.5	56.3	12.5	12.5	68.8
Fourth	8.3	62.5	12.5	8.3	75.0
Highest	37.8	27.0	13.5	37.8	40.5
Total	21.2	44.2	10.6	21.2	54.9

*Unintentional: stolen or destroyed accidentally

**Intentional: sold, given away to others, thrown away, used for other purpose

Nets Owned by households

Among the 2340 nets found in the sample households on the survey day (post-campaign distribution), 97.5% were insecticide treated nets and 2.5% were untreated nets. Overall, 2221 (94.9%) of the nets were Long Lasting Insecticide Nets, or 97.3% of all the insecticide treated nets. Most nets found in the households (92.2%) were obtained through the recent distribution campaign.

Table 13: Source of nets in households (N=2340 nets)

Background characteristic	Recent campaign	Previous campaign	Commercial sector	ANC	Child health promotion week	Primary school distribution	Other
Residence							
Urban	93.1	2.8	2.4	0.3	0.6		0.2
Rural	91.7	1.4	4.4	1.1	0.3		0.7
Wealth index							
Lowest	93.2	3.4	2.9	0.2	0.0		0.0
Second	91.9	1.1	3.8	1.3	0.2		0.6
Third	91.8	2.1	3.8	1.3	0.0		0.8
Fourth	91.8	1.4	3.9	0.8	1.0		0.4
Highest	92.4	1.7	3.7	0.4	0.6		0.6
Total	92.2	1.9	3.6	0.8	0.4		0.5

Of the 2340 nets owned by households at the time of the survey, 40.9% were purchased and 56.7% were obtained freely. Considering the nets from the hang up campaign only, 57.7% were obtained freely and 40.3% with a small financial contribution by the household of around 1 cedi (ranging from 0.10 to 50.0 cedi or less than \$0.01 to less than \$3.00 US).

Overall, 68.6% of the all nets were found hanging on the survey day and 63.2% were used the previous night, indicating that 126 nets (5.4%) had likely been taken down in the morning after being used the previous night. Net hanging and use appeared lower among richest households though these associations were not statistically significant ($p=0.07$ for both variables). Slightly more than 60% of all nets were used every night or most nights (49.8% and 11.1% respectively). For the interpretation of these results, it is worth noting that the survey data collection occurred before the rainy season; it is during rainy season that transmission of malaria is at its highest and people are more likely to use nets.

Table 14: Net hanging and use on previous night and previous week (N=2340 nets)

Background characteristic	Net hanging on survey day %	Net used on the previous night %	Use frequency the previous week	
			Every night %	Most nights %
Residence				
Urban	69.6	62.7	48.4	9.7
Rural	68.0	63.6	50.6	11.9
Wealth index				
Lowest	75.0	68.9	59.7	7.9
Second	74.0	69.7	53.3	12.2
Third	68.4	61.3	46.1	13.1
Fourth	68.5	63.0	50.3	9.4
Highest	57.5	53.6	40.2	12.7
Total	68.6	63.2	49.8	11.1

Among all sampled households, 14.8% had discarded or lost a previously owned net over a year ago while only 3.4% had discarded or lost one within the past 12 months. This may reflect increased awareness of the benefits of net use, though other factors such as age of nets and availability of new nets may also be relevant. Rural households tended to discard or lose more nets over a year ago than urban households (mean=1.53 vs. 1.40), while urban households discarded or lost more within the past 12 months (mean=1.35 vs. 1.53).

Table 15: Non retention of previously owned nets at household level

Background Characteristic	Had discarded previously owned net (N=1016 households)		# Nets discarded by household	
	More than 12 months ago (%)	Within the past 12 months (%)	More than 12 months ago (N=35) (mean)	Within the past 12 months (N=150) (mean)
Residence				
Urban	16.0	3.9	1.40	1.53
Rural	14.0	3.2	1.53	1.35
Wealth index				
Lowest	12.3	2.5	1.80	1.80
Second	17.6	2.9	1.64	1.50
Third	12.3	3.9	1.48	1.50
Fourth	16.7	4.4	1.26	1.11
Highest	14.9	3.5	1.27	1.43
Total	14.8	3.4	1.48	1.43

Among the 291 previously owned nets that were discarded or lost, 44.7% were thrown away or used for other purposes, 23.7% were stolen or destroyed accidentally, 19.6% were given away to other people and 1.4% were sold.

Similar proportions of nets were discarded for unintentional reasons with previously owned nets (23.7%) and campaign nets (21.2%) (Table 12). On the other hand, there was a higher proportion of previously owned nets discarded for intentional reasons than campaign nets (65.6% vs. 54.9%).

Table 16: Fate of non-retained previously owned nets and reason for non-retention (N=291 nets)

Background Characteristic	Fate of non-retained nets					Reason for not keeping the nets		
	Stolen or destroyed accidentally %	Sold %	Given away to other people %	Thrown away or used for other purpose %	Don't know %	Unintentional %	Intentional %	Don't know %
Residence								
Urban	29.3	0.0	14.7	43.1	12.9	29.3	57.8	12.9
Rural	20.0	2.3	22.9	45.7	9.1	20.0	70.9	9.1
Wealth index								
Lowest	32.1	0.0	16.1	44.6	7.1	32.1	60.7	7.1
Second	18.8	5.8	15.9	46.4	13.0	18.8	68.1	13.0
Third	32.1	0.0	8.9	53.6	5.4	32.1	62.5	5.4
Fourth	17.5	0.0	29.8	38.6	14.0	17.5	68.4	14.0
Highest	18.9	0.0	28.3	39.6	13.2	18.9	67.9	13.2
Total	23.7	1.4	19.6	44.7	10.7	23.7	65.6	10.7

LLIN hanging and use

Among the 928 households that received any LLIN from the campaign distribution, 69.1% had none of their nets hung by the hang up team. This percent was higher in urban than rural households (75.3% vs. 65.2%), though this association was not significant. Among these families that received any LLIN, 86.7% (52.1% + 34.6 % for

“same day” and “within a week” respectively) hung at least one LLIN within the same week that they received it. Rural and poorer households reported hanging the first net hung faster than urban and richer households. Across all groups, few had difficulty hanging the nets. Despite that 76.7% of all respondents indicated that volunteer's help to hang up the net was important (Table 7).

Table 17: Hanging nets from the distribution campaign (N=928 households)

Background characteristic	Received any LLIN but none were hung by team (N=928) %	Among households that received any LLIN and that hung any them selves: When was the first LLIN hung by household? (N=641)				Any difficulty in hanging the LLIN (N=616) %
		Same or next day %	Within a week %	Within a month %	Not hung yet %	
Residence						
Urban	75.3	45.9	35.4	11.6	6.3	3.6
Rural	65.2	56.6	34.0	6.4	2.1	2.2
Wealth index						
Lowest	75.1	57.7	35.2	4.9	2.1	4.3
Second	64.4	56.2	31.4	5.8	5.0	4.3
Third	70.7	51.9	32.3	9.8	4.5	0.0
Fourth	67.7	44.6	40.0	10.8	3.8	3.2
Highest	67.3	49.6	33.9	12.2	4.3	1.8
Total	69.1	52.1	34.6	8.6	3.9	2.8

Nearly three quarters (72.6%) of households that retained any campaign LLIN used at least one of them on the previous night. Households in the richest quintile were less likely to report having used any LLIN the night before the survey. Nearly two-thirds (65.1%) of the campaign LLIN found in the households on the survey day had been used the previous night. LLINs were used slightly more by rural households than urban households (66.1% vs. 63.3%) and used slightly less by the richest quintile (54.9% vs. 65.1% overall). Figure 6 shows that 62.8% of campaign LLIN that had been distributed were used every or most nights the previous week and 7.6% were never used at all.

Table 18: Use of campaign LLIN the previous night

Background characteristic	Among households that retained any campaign LLIN (N=888 households)				Among campaign LLIN retained (N=2158 nets)
	Used none (%)	Used some (%)	Used all (%)	Used any LLIN (%)	LLIN was used (%)
Residence					
Urban	29.6	19.0	51.4	70.4	63.3
Rural	26.0	22.8	51.2	74.0	66.1
Wealth index					
Lowest	25.3	18.8	55.9	74.7	69.8
Second	22.0	20.3	57.6	78.0	72.2
Third	27.9	22.4	49.7	72.1	62.6
Fourth	27.3	21.3	51.4	72.7	65.6
Highest	35.2	24.5	40.3	64.8	54.9
Total	27.4	21.4	51.2	72.6	65.1

The main reason given by respondents for not using the campaign LLIN was “Too hot” (26.8%) As illustrated in Figure 7, 21.8% of LLIN were not used for objective reasons (net dirty, net washed, net torn or user absent), 22.6% were not used because of it was perceived as not needed (no mosquito, no malaria) and 2.7% were not used because of subjective reasons (afraid, bad smell). This suggests that 49.4% of unused campaign LLIN were related to the season at the time of the survey; no rainfall was reported at that time.

Figure 6: Frequency of reported campaign LLIN use the week before the survey (N=2158 LLIN)

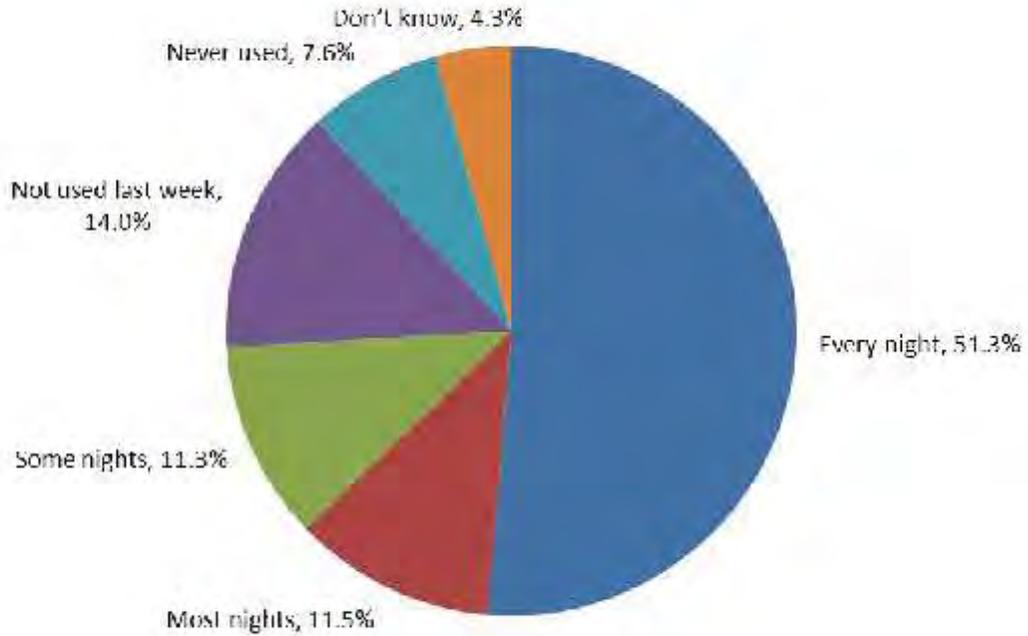
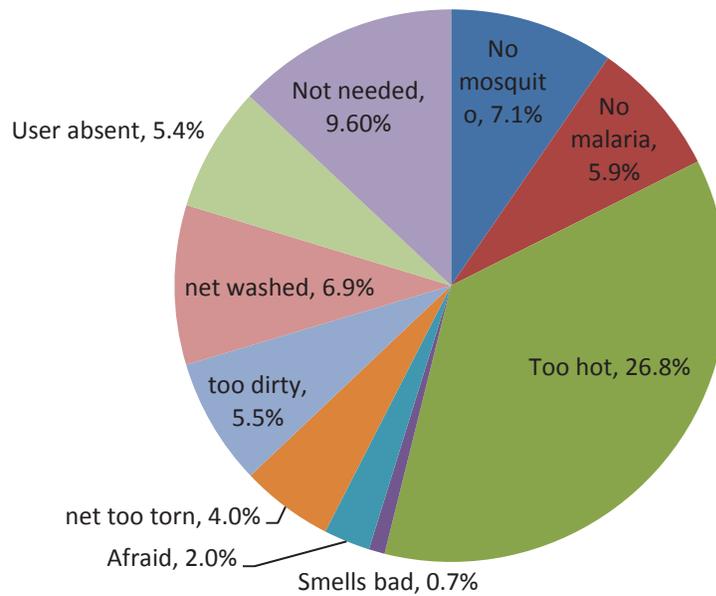


Figure 7: Reasons stated for not using the campaign LLIN (N=841 LLIN)

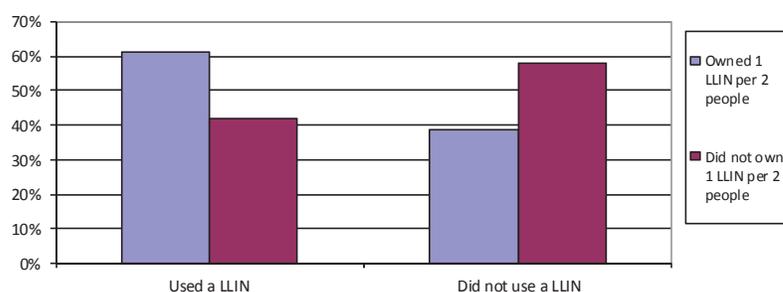


Among usual household residents that were present in the household the previous night, 46.7% used a LLIN the night before the survey (Table 19). People in rural households used slightly more than in urban households (47.2% vs. 45.9%) and richest people used less (38.2% vs. 46.7% overall). LLIN use was higher among household heads (56.4%), followed by pregnant women (50.0%), children under 5 (49.41%), adults over 15 (47.9%) and children from 5 to 14 years (43.0%).

Table 19: LLIN use the previous night by population group (N=5052 people)

Background characteristic	Usual members of household who stayed in the house the previous night					
	All people used (%)	Head of household used (%)	Pregnant women Used (%)	0 to 4 years Used (%)	5 to 14 years Used (%)	15+ years Used (%)
Residence						
Urban	45.9	54.6	66.7	52.6	42.1	46.2
Rural	47.2	57.5	43.2	47.4	43.4	49.0
Wealth index						
Lowest	49.4	59.3	54.5	49.6	42.5	52.3
Second	51.8	63.1	53.3	51.7	48.0	53.4
Third	47.8	61.9	57.1	44.7	41.9	50.8
Fourth	46.4	52.8	50.0	55.5	43.3	46.2
Highest	38.2	44.3	30.0	43.3	38.5	37.5
Total	46.7	56.4	50.0	49.1	43.0	47.9

Figure 8 shows that people living in households with universal coverage (one LLIN for every two people) were significantly more likely to use a LLIN the previous night than people living in households with insufficient LLIN ($p < 0.001$). This strongly suggests that an increase in LLIN access would result in an increase in LLIN use.

Figure 8: LLIN use the previous night in relation to LLIN ownership (N=5052 people)

Among households that retained any LLIN from the campaign distribution, 27.4% had none of their members using a LLIN the previous night, 46.7% had some but not all members using an LLIN and 25.9% had all their members sleeping under an LLIN the previous night.

Table 20: LLIN use previous night

Background characteristic	Among households that retained any LLIN (N=888 households)			Among all households (N=1016 households)		
	No member used LLIN previous night (%)	Some but not all members used LLIN previous night (%)	All member used LLIN previous night (%)	No member used LLIN previous night (%)	Some but not all members used LLIN previous night (%)	All members used a net previous night (%)
Residence						
Urban	29.3	44.1	26.6	35.1	39.0	25.8
Rural	26.2	48.3	25.5	32.8	43.4	23.8
Wealth index						
Lowest	25.3	47.8	26.9	30.4	44.1	25.5
Second	22.6	48.0	29.4	28.9	42.6	28.4
Third	26.2	44.8	29.0	31.0	41.4	27.6
Fourth	29.0	46.4	24.6	33.5	42.9	23.6
Highest	34.6	46.5	18.9	44.6	37.6	17.8
Total	27.4	46.7	25.9	33.7	41.7	24.6

Behaviour Change Communication

The survey also explored respondents' exposure to BCC information about bed net use as well as their knowledge about bednets and attitudes toward net use. Overall, 471 households (46.4%) reported having received any information about nets around the period of LLIN distribution. Among those households, 75.6% of the respondents remembered any message specifically related to net hanging or use, 51.0% the message "sleep under your net every night" and 26.1% "nets prevent malaria". Messages about net care and repair were more rarely recalled, with 14.2% remembering a message on the proper way to wash and hang the net.

Table 24 presents the source of BCC information received during the campaign. The main sources cited by respondents were "home visits by hang up volunteer" (42.7%), "Radio" (24.0%), "health worker" (22.9%) and "town announcer" (19.3%). Urban households were less likely than rural households to cite as a source of information the home visit (37.4% vs. 46.3% respectively) or the health worker (17.4% vs. 26.7%) but were more inclined to mention their relatives (11.1% vs. 5.7%) and the van (12.1% vs. 5.7%). This shows that among rural households, interpersonal communication strategies (outside the family) tended to be more effective than in urban areas. The radio appeared to be of equal importance as a source of information on bed nets to households in rural and urban areas.

The number of information sources may also be an important factor. Figure 9 illustrates that there was a positive correlation between number of information sources and number of message types recalled. Having diverse communication channels may be a critical component of an effective communications strategy for promoting bed net use.

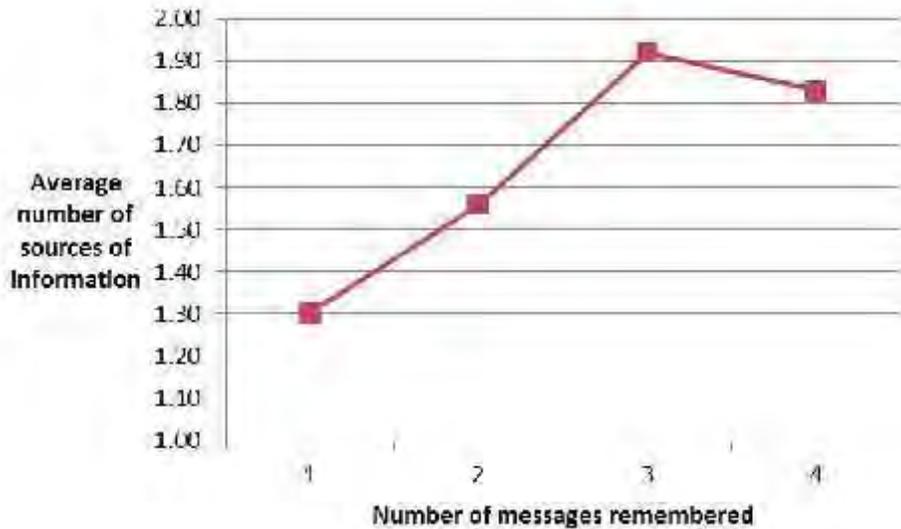
Table 21: Exposure to BCC information on net use and content of messages received during the distribution campaign

Background characteristic	Household received any information from any source (N=1016) %	Among households that received any information (N=471)								
		Mentioned any message about hanging or use (N=471) %	Content of the messages received							
			Use your net %	Value your net-%	Hang up your net %	Sleep under your net every night %	Nets prevent malaria %	Do not remember %	Proper way to wash and hang the net %	Repair holes and tears %
Residence										
Urban	49.1	75.8	27.9	3.7	25.8	51.1	28.4	5.8	13.2	0.0
Rural	44.7	75.4	34.2	7.1	22.8	50.9	24.6	6.8	14.9	0.4
Wealth index										
Lowest	42.2	79.1	23.3	5.8	18.6	60.5	19.8	7.0	10.5	0.0
Second	44.6	62.6	19.8	6.6	18.7	45.1	23.1	11.0	18.7	0.0
Third	42.9	73.6	34.5	6.9	31.0	42.5	31.0	8.0	5.7	0.0
Fourth	51.7	87.6	41.0	6.7	31.4	59.0	23.8	2.9	12.4	1.0
Highest	50.5	73.5	37.3	2.9	19.6	47.1	32.4	3.9	22.5	0.0
Total	46.4	75.6	31.6	5.7	24.0	51.0	26.1	6.4	14.2	0.2

Table 22: Source of BCC information on bed nets received during the campaign (N=471 households)

Background characteristic	Campaign leaflet %	Radio %	Song on radio %	Drama %	Health worker %	Community leader %	Town announcer %	Hang up volunteer %	Relatives %	Mosque / church %	Van %
Residence											
Urban	3.2	23.7	0.5	0.0	17.4	6.8	17.9	37.4	11.1	3.2	12.1
Rural	2.8	24.2	0.4	1.4	26.7	11.4	20.3	46.3	5.7	2.1	5.7
Wealth index											
Lowest											
Second	1.2	14.0	0.0	0.0	32.6	8.1	20.9	40.7	7.0	1.2	1.2
Third	2.2	14.3	1.1	1.1	26.4	16.5	26.4	35.2	7.7	1.1	11.0
Fourth	5.7	26.4	1.1	1.1	16.1	9.2	19.5	47.1	6.9	3.4	8.0
Highest	2.9	32.4	0.0	1.0	18.1	8.6	19.0	44.8	8.6	2.9	10.5
Total	2.9	30.4	0.0	1.0	22.5	5.9	11.8	45.1	8.8	3.9	9.8
Total	3.0	24.0	0.4	0.8	22.9	9.6	19.3	42.7	7.9	2.5	8.3

Figure 9: Correlation between number of BCC information sources on nets and number of messages remembered



Eight questions were then posed regarding the knowledge of net use as preventive method and respondents were asked to state their level of agreement with these statements. All statements about using net as a prevention method against malaria received around 90% or more agreement. The one exception was the statement “Some people who sleep under a bed net still get malaria”. Similarly, the highest mean score (1.66) was obtained by the statement “Sleeping under a bed net is the best protection from mosquitoes”.

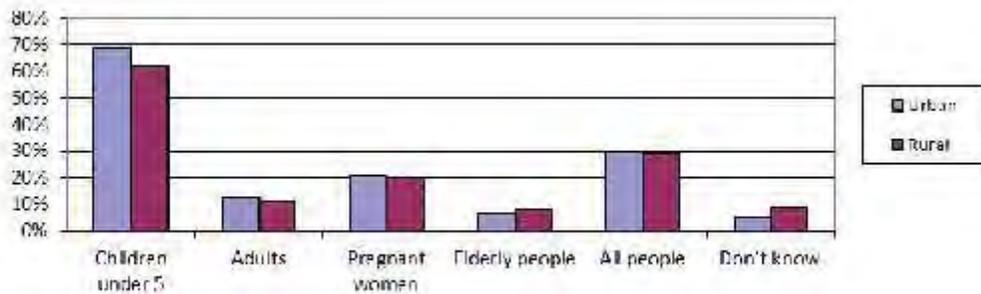
On the other hand, statements about net care in relation to certain type of beds had negative mean scores; 37.9% (17.1% + 20.8%) did agree with the statement “It only takes a few months for a bed net to get too many holes to stop mosquitoes” and 36.5% (14.2% + 22.3%) agreed with “Bed nets only prevent mosquito bites when used with certain types of beds”. Lastly, a substantial proportion of respondents or 43.4% (21.2% + 22.2%) agreed with “More expensive bed nets are more effective than less expensive or free bed nets”.

Table 23: Knowledge of net use as a prevention method (N=1016 respondents)

Statement	Level of agreement				Agreement score* (mean)
	Strongly agree (%)	Somewhat agree (%)	Somewhat disagree (%)	Strongly disagree (%)	
Some people who sleep under a bed net still get malaria <i>(True)</i>	28.9	19.9	16.5	34.6	-0.08
Sleeping under a bed net is the best protection from malaria <i>(True)</i>	70.6	26.5	2.8	0.2	1.64
New bed nets protect a person from malaria for several years <i>(True)</i>	53.4	38.0	7.3	1.3	1.35
Dead mosquitoes on the ground are a good way to tell that your bed net is still effective <i>(False)</i>	71.0	22.9	3.8	2.3	1.56
Sleeping under a bed net is the best protection from mosquitoes <i>(True)</i>	73.0	23.9	2.5	0.7	1.66
It only takes a few months for a bed net to get too many holes to stop mosquitoes <i>(False)</i>	17.1	20.8	29.1	33.0	-0.40
Bed nets only prevent mosquito bites when used with certain types of beds <i>(False)</i>	14.2	22.3	21.1	42.4	-0.55
More expensive bed nets are more effective than less expensive or free bed nets <i>(False)</i>	21.2	22.2	15.1	41.4	-0.33

* Agreement scored 1 and 2, disagreement -1, -2.

Figure 10: Perception of the most vulnerable group(s) to malaria, by type of residence (N=1016 respondents)



Respondents' perception of their ability to take action for malaria prevention was then assessed. All statements obtained a positive mean score, meaning respondents agreed with statements as phrased in Table 26. The statement "Protect yourself and your children from getting malaria" had the highest mean score as 93.1% agreed while "Obtain enough nets for all your children" had the lowest mean score with only 68.6% (41.1% + 27.5%) who agreed. On the other hand, 16.3% of respondents disagreed with "Sleep under a net every night of the year". This suggests that while respondents tended to feel confident about their ability to protect themselves and their family against malaria, universal access and use of nets appeared to be more of a challenge for the sample households.

Table 24: Knowledge of appropriate actions to be taken for malaria prevention (N=1016 respondents)

Statement	Level of agreement				Agreement score* (Mean)
	Strongly agree (%)	Somewhat agree (%)	Somewhat disagree (%)	Strongly disagree (%)	
Obtain enough nets for all your children (True)	41.1	27.5	15.2	16.2	0.62
Hang a net above your children's sleeping spaces (True)	66.3	22.8	6.6	4.3	1.40
Protect yourself and your children from getting malaria (True)	68.8	24.3	4.2	2.8	1.52
Save enough money to obtain nets for all your children (True)	44.8	28.6	13.9	12.8	0.79
Sleep under a net every night of the year (True)	53.3	30.5	12.4	3.9	1.17
Get all your children to sleep under a net every night of the year (True)	50.8	31.7	12.9	4.7	1.11

* action level scored 1 and 2 for positive, -1 and -2 for negative

Most respondents (83.5%) agreed with the statement “It is difficult to sleep under a bed net when the weather is warm”. Most respondents correctly agreed that “The insecticide on bed nets cannot harm children” (76.8%) and “The insecticide on bed nets cannot harm pregnant women” (76.8%). However, 42.3% erroneously agreed that “The insecticide on bed nets can be dangerous to the people who sleep under them”.

Table 25: Attitude towards net use (N=1016 respondents)

Statement	Level of agreement				Agreement score* (mean)
	Strongly agree (%)	Somewhat agree (%)	Somewhat disagree (%)	Strongly disagree (%)	
The insecticide on bed nets can be dangerous to the people who sleep under them (False)	19.1	23.2	23.1	34.6	-0.31
It is difficult to sleep under a bed net when the weather is warm (False)	60.2	23.3	9.0	7.5	1.20
Sleeping under a bed net is a good way to get privacy in a crowded house	27.0	37.5	25.0	10.6	0.45
The insecticide on bed nets cannot harm children (True)	41.7	35.1	13.1	10.1	0.85
Many people in this area would prefer not to sleep under a bed net	11.7	24.5	37.5	26.3	-0.42
Many people will choose not to sleep under a bed net if they don't like its color	11.3	16.5	27.7	44.5	-0.77
The insecticide on bed nets cannot harm pregnant women	48.7	28.1	14.4	8.7	0.94

* Agreement scored 1 and 2, disagreement -1, -2.

In general, 47.6% of household respondents reported discussing using the nets with their family and this proportion was similar across rural or urban residence. While the stated intention to use the nets every night was high (about 60%), few respondents (about 20%) perceived that their neighbors actually used nets every night. However, nearly half of respondents did not know about actual net use among neighbors.

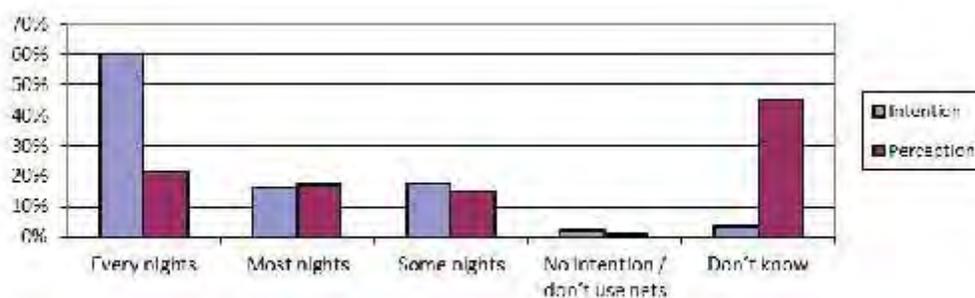
Figure 11: Reported personal intention to use nets and perception of neighbors' level of use of nets (N=1016 respondents)

Table 26 shows that 98.4% of respondents thought they should sleep under a net, 96.4% believed that sleeping under an ITN would reduce their risk of malaria and 39.7% thought they could still get malaria if they slept under an ITN. Interestingly, these proportions decreased as wealth increased suggesting lower levels of awareness among richer households.

Table 26: Personal beliefs about net use (N=1016 respondents)

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	99.0	97.2	38.5
Rural	98.1	95.9	40.4
Wealth index			
Lowest	98.5	94.6	44.6
Second	99.0	97.5	42.6
Third	98.5	97.5	39.9
Fourth	98.5	96.6	33.0
Highest	97.5	95.5	38.1
Total	98.4	96.4	39.7

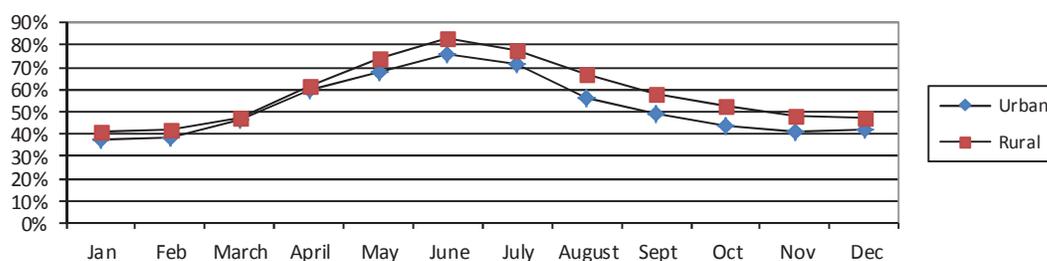
Then households respondents were asked to mention any other preventive methods used by members of their household. The most popular methods were coils (53.1%),

mosquito spray (29.2%), repellent (9.7%) and herbs or plants (5.2%). Overall, 63.8% of sampled households reported using any other preventive method. Urban and richer households were significantly more likely to use any other preventive method ($p < 0.001$).

Table 27: Use of other preventive methods at household level (N=1016 respondents)

Background characteristic	Mosquito spray (%)	Mosquito repellent (%)	Coil (%)	Herb or plant (%)	Use at least 1 other method (%)	Don't use any other method (%)
Residence						
Urban	40.8	12.7	62.3	5.4	74.4	25.6
Rural	22.1	7.9	47.5	5.1	57.2	42.8
Wealth index						
Lowest	13.2	6.4	42.2	8.3	50.0	50.0
Second	17.2	2.9	53.4	5.9	58.3	41.7
Third	27.1	8.9	63.1	2.0	67.5	32.5
Fourth	35.0	12.3	60.6	6.4	70.0	30.0
Highest	54.0	18.3	46.5	3.5	73.3	26.7
Total	29.2	9.7	53.1	5.2	63.8	36.2

Respondents were asked to name any of the months of the year when they would generally use the net. The trend in reported use was similar to the first peak of rain falls, as presented in Figure 2. The months with lowest net use (~40%) and lowest rainfall were December and January. As previously observed, rural households tended to report slightly higher net use across the year. Net use in April was also consistent with actual net use the previous night as 63.2% nets were used the previous night as presented in Table 14.

Figure 12: Net use by Month in Rural and Urban Households (N=1016 respondents)

Overall, 49.0% of household respondents reported that children always use a net for sleeping while 40.2% sometimes or never use a net. The most common reasons cited for children not using a net were “Too hot” (58.6%) and “Not enough nets” (13.4%).

Table 28: Net use among children (N= 1016 respondents)

Background characteristic	Frequency of net use by children in the household			
	No child in household	Always	Sometimes or never	Don't know
	%	%	%	%
Residence				
Urban	8.8	47.3	43.7	0.3
Rural	11.1	50.1	38.0	0.8
Wealth index				
Lowest	7.4	52.5	39.7	0.5
Second	11.3	52.5	36.3	0.0
Third	10.3	40.9	48.3	0.5
Fourth	11.3	53.2	35.0	0.5
Highest	10.9	46.0	41.6	1.5
Total	10.2	49.0	40.2	0.6

Net care and repair

Condition of nets owned by the households

Among the 2340 nets found in the households, 35.8% had ever been washed; the average number of washings in the past three months was 2.28 and in 73.3% of the washings a soap bar was used, as currently recommended because the use of any detergent would be detrimental for the LLIN efficacy. Campaign LLIN were less likely to

have ever been washed than other nets ($p < 0.001$), likely because they were newer and in better condition. Rural nets were more likely to have ever been washed but the association between rural residence and washing the net was not significant ($p = 0.06$). It is also worth noting that households among the richest quintile were less likely to have used a soap bar but they tended to use detergent more frequently than other socio economic groups (30.6% versus 22.6% on overall).

The main drying methods were: “outside on a line” (79.6%), “Bush or fence or on the ground” (9.4%) and “Inside” (7.8%). Urban households were more likely to dry their net outside than rural households (90.0% vs. 75.0%; $p < 0.05$).

Table 29: Net care (N=2340 nets)

Background characteristic	Ever been washed among all nets in households (N=2340) (%)	Among all nets ever been washed (N=838)					
		# of washings in past 3 months (mean)	Used soap bar for last wash (%)	Drying method			
				Inside (%)	Outside on line (%)	Bush or fence or on the ground (%)	Don't know (%)
Source of net							
Campaign	34.5	2.21	73.3	8.2	79.3	9.4	3.1
Other nets	51.6	2.93	73.4	4.3	81.9	9.6	4.3
Residence							
Urban	29.8	2.31	70.3	3.5	90.0	3.9	2.7
Rural	39.4	2.26	74.6	9.7	75.0	11.9	3.5
Wealth index							
Lowest	37.2	2.61	75.2	3.0	76.4	17.0	3.6
Second	36.2	1.9	72.9	9.4	73.5	14.1	2.9
Third	36.6	2.33	77.0	6.9	85.6	6.9	0.6
Fourth	32.5	2.45	79.2	6.9	85.5	4.4	3.1
Highest	36.7	2.15	62.4	12.4	77.1	4.7	5.9
Total	35.8	2.28	73.3	7.8	79.6	9.4	3.2

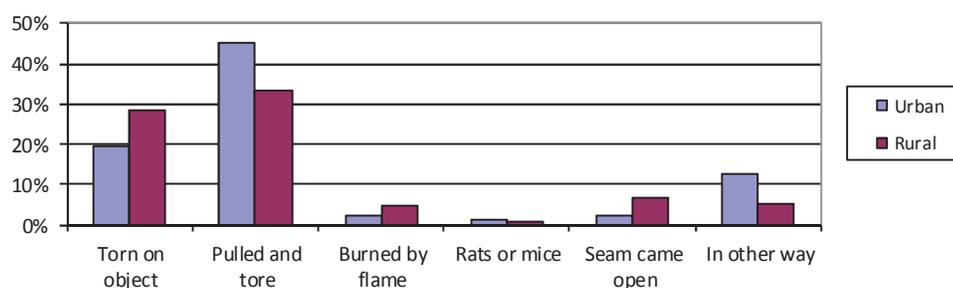
Household respondents reported that 359 nets (15.3% of the nets present in the households on the survey day) ever had a hole (including any hole that had been

repaired) and 0.8% of these 359 nets had been modified in some way (either shape or length was changed or the net was reinforced). It was not surprising that campaign LLIN were less likely to have ever had a hole than other nets (65.4% vs. 82.4%; $p < 0.001$) given that they were newer. Nets in rural households were less likely to have had a hole than those in urban households (17.6% vs. 11.5%) and this difference was of borderline significance ($p = 0.05$).

Table 30: Condition of nets in household on survey day

Background characteristic	Ever had any hole (N=2340 nets) (%)	# of holes in nets that had any hole (N=359 nets)				Net had been modified in some way (N=359 nets) (%)
		Size 1 (mean)	Size 2 (mean)	Size 3 (mean)	Size 4 (mean)	
Source of net						
Campaign	14.0	3.77	3.30	2.08	2.21	0.7
Other nets	30.8	4.09	3.58	4.09	2.78	1.8
Residence						
Urban	11.5	3.12	3.24	2.33	1.94	0.0
Rural	17.6	4.03	3.38	2.52	2.51	1.2
Wealth index						
Lowest	14.4	3.61	2.64	2.69	3.8	1.6
Second	16.8	4.25	3.45	2.60	2.5	2.5
Third	17.1	4.47	4.81	2.55	2.61	0.0
Fourth	12.7	3.05	1.7	2.36	1.67	0.0
Highest	15.8	3.48	3.37	2.15	1.45	0.0
Total	15.3	3.81	3.35	2.48	2.35	0.8

Respondents were asked how the hole occurred; multiple answers were possible (Figure 13). The most cited responses were “Pulled and tore” (36.5%) and “Torn on object” (26.1%). Rats or mice did not appear to be a serious factor in torn nets (0.9%). As few of the nets had been modified, it does not appear to be an important factor contributing to holes. In total, 5 nets were modified; the shape was modified on 2 of them, 1 was lengthened, and 2 were reinforced.

Figure 13: Origin of holes mentioned, by type of residence (N=329 nets)

Net care and repair at household level

Among households that possessed any net at the time of the survey, 25.4% had experienced any hole in the net currently owned and among these 238 households, 26.5% had tried to repair any hole themselves or by someone else. The most popular technique to repair the net was stitching (65.1%) followed by knotted or tied (28.6%). While rural households more frequently experienced any hole in their nets than urban households (28.5% vs. 20.3%), urban households more frequently attempted to repair their nets when they had a hole (35.6% vs. 22.4%).

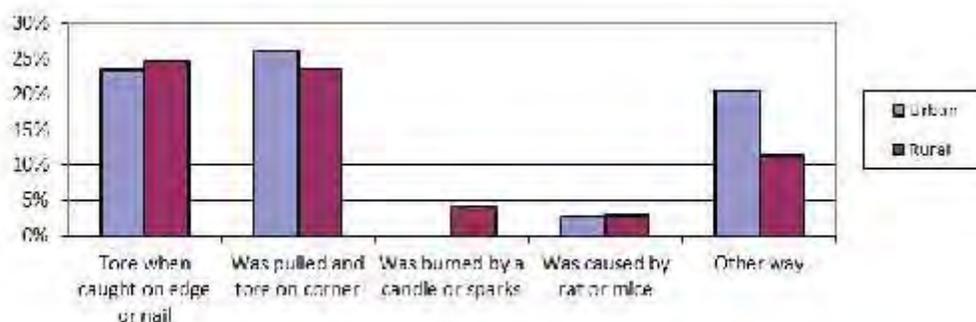
Table 31: Experience of household in net care and repair (N=938 households) +

Background characteristic	Have experienced any hole in net owned (N=938) (%)	Have tried to repair any holes themselves or by someone else (N=238 that had experienced any hole) (%)	Technique used to repair the net (N=63 households that tried to repair net)			
			Stitched (%)	Knotted or tied (%)	Used a patch (%)	Other way (%)
Residence						
Urban	20.3	35.6	65.4	30.8	0.0	3.8
Rural	28.5	22.4	64.9	27.0	2.7	2.7
Wealth index						
Lowest	26.0	22.0	72.7	27.3	0.0	0.0
Second	23.6	35.6	62.5	37.5	0.0	0.0
Third	28.7	16.7	77.8	11.1	0.0	0.0
Fourth	23.0	38.6	64.7	23.5	0.0	11.8
Highest	25.6	22.2	50.0	40.0	10.0	0.0
Total	25.4	26.5	65.1	28.6	1.6	3.2

+ Only one repair method was noted per respondent (though multiple responses were possible).

The two main origins of holes in the nets reported by the household respondent were “Tore when caught on edge or nail” and “Was pulled and tore on corner”. The latest was slightly more frequent among urban households, probably reflecting the higher proportion of sleeping spaces consisting in bed with a wood frame to hang up the net.

Figure 14: Origin of holes by type of residence (N=239 households)



In the previous six months from the survey day, 4.6% of households had experienced any hole and had tried to repair the net. Urban households were slightly more likely than rural households to have heard any message about net care and repair (6.7% vs 3.2%).

Table 32: Net repair in the past 6 months (N= 1016 households)

Background characteristic	Experienced hole in net and repaired it in past 6 months (N=938 households that owned net) (%)	Reason for not repairing hole within past 6 months (N=13 that experienced a hole but did not repair it)			Heard message on net care and repair within past 6 months (N=1016 households) (%)
		No time (%)	Not necessary (%)	Other (%)	
Residence					
Urban	4.2	42.9	28.6	28.6	6.7
Rural	4.8	33.3	16.7	50.0	3.2
Wealth index					
Lowest	2.1	33.3	33.3	33.3	6.4
Second	5.8	33.3	33.3	33.3	4.4
Third	3.7	1.0	0.0	0.0	2.0
Fourth	6.8	50.0	25.0	25.0	3.0
Highest	4.5	0.0	0.0	100	6.9
Total	4.6	38.5	23.1	38.5	4.5

As presented in Figure 15, the most frequently cited sources of messages about net care and repair were “radio”, “health worker” and “mosque or church”. The hang up volunteer was mentioned by less than 20% of respondents. The most remembered message was “handle the net carefully”.

Figure 15: Source of message on net care and repair among households that heard any message on net care and repair (N=46 respondents)



Figure 16: Content of messages recalled on net care and repair among households that heard any message on net care and repair (N=46 respondents)

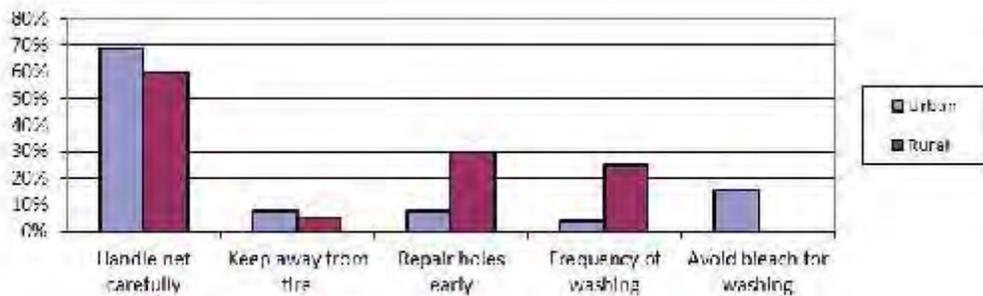


Table 33 presents the results of the assessment of campaign LLIN condition. The observers found that a few months after distribution, most LLIN were in good condition or still usable as defined by current WHO guidelines. Only 72 (3.2%) of campaign LLIN retained in households were damaged to an extent that would impede their effectiveness.

Table 33: Hole index² of campaign LLIN (N=2221 nets)

Background characteristic	Mean proportionate hole index	LLIN in “good” condition* (%)	LLIN somewhat damaged but still usable** (%)	LLIN severely damaged or “too torn”*** (%)
Campaign nets				
No	121.07	88.3	3.1	8.6
Yes	45.56	94.0	3.1	2.9
Residence				
Urban	36.61	95.8	1.9	2.3
Rural	57.86	92.4	3.8	3.8
Wealth index				
Lowest	36.46	95.2	3.3	1.4
Second	64.49	92.9	2.8	4.4
Third	79.77	91.4	4.7	3.9
Fourth	24.22	96.2	1.5	2.2
Highest	43.35	92.7	3.1	4.2
Total	49.91	93.7	3.1	3.2

*Hole index based on WHO Pesticide Evaluation Scheme (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

² The hole index is calculated by weighting each hole by size and summing for each net. If the weight of hole sizes 1, 2, 3 and 4 was A, B, C and D, respectively, the hole index would be calculated as: Hole index = (A x no. of size-1 holes) + (B x no. of size-2 holes) + (C x no. of size-3 holes) + (D x no. size-4 holes).

Discussion and conclusion

Survey methodology and data validity

The intention of this survey was to obtain information from households on the process and outcomes of the Eastern region LLIN distribution and hang up campaign that would be statistically representative of the population of Eastern region. In order to achieve such representativeness, appropriate sampling methodology was critical. Standard two stage cluster sampling was used, as it is in standard national surveys such as Multiple Indicator Cluster Survey (MICS) and Demographic Health Survey (DHS). The only difference was that instead of having a complete list of all communities from the most recent census data, the registration list from the LLIN distribution campaign was used. That list was cross checked with local authorities to ensure that none of the communities had been missed during the campaign. Clusters were selected randomly and with proportionate to size sampling methods. At cluster level, the survey followed standard DHS/MICS protocol by updating the household registration list on the survey day, to ensure that all eligible households in the village were included. Households were then selected for interviews using random number lists. By accounting for this clustering design in analyses, the survey methodology used “state of the art” approaches, yielding a representative sample. As expected, demographic characteristics of the sample such as proportion of children under five, currently pregnant women and socio-economic characteristics regarding education and household assets were consistent with other data sources.

As with any survey that relies on interviews with household respondents about events that occurred in the past, there may have been recall problems for some questions (i.e. respondents not remembering something that happened several months ago). To ensure that questions were understood and responses were valid, the questionnaire was pre-tested. Survey results were consistent in many ways within the dataset regarding patterns of practices with age and/or wealth quintiles as well as with previously known net ownership. Given the survey methodology used, this consistency of results was expected, and the survey results can be considered valid within the limits of the described ranges of precision.

Results

LLIN distribution and hang up by the volunteers

The declared objective of malaria prevention with ITN/LLIN in Ghana is universal coverage, i.e. access to LLIN by all people. The campaign delivered LLIN to 91.3% of households. On average, 2.41 LLIN were distributed to each household. The LLIN campaign resulted in 90.2% household ownership of at least one LLIN on the survey day. However, the target of reaching universal access was not yet reached as only 47.0% owned at least one LLIN per sleeping space and 49.8% at least one LLIN for every two people on the survey day. While this is short of the universal access target, this is also a tremendous improvement over the 12.0% household ownership of at least one net pre-campaign and 90.2% ownership of at least one LLIN post-campaign.

Among those who received at least one LLIN in the campaign, only 30.9% had a LLIN hung by the volunteer hang up team though 76.7% of respondents stated that the volunteer help was important and 77.8% thought they did a good job. This could suggest that the studied population welcomed having volunteers inside their houses helping them but perceived the net delivery as their main task as opposed to hanging up nets.

Retention, hanging and use of nets on the survey day

Retention of campaign nets in the Eastern Region was 95.0%, i.e. there was a loss/attrition rate of 5.0% in the few months after the distribution. It appeared that the main reason for not retaining the 113 discarded or lost LLIN was to give it away to other people (44.2%), while about a fifth (21.2%) were reported to be destroyed accidentally. This suggests that selling the received campaign LLIN in the commercial market did not occur at household level and if any such leakage to the commercial market occurred, it was at higher levels of the distribution chain.

Among the 641 households that received a LLIN that was not hung by the team, most hung the net within a month of the campaign. Of those households only 2.8% reported any difficulty in hanging the net, providing evidence that most households know how to hang their net in Eastern region. Such low rates of difficulty in hanging nets have also been seen in the other post-campaign surveys in Nigeria and Uganda. This suggests that the major reason for not hanging nets was lack of motivation to use the nets in general

or at the time of the survey which was the end of the dry season with rains just beginning.

Of all people who usually live in the sampled households and stayed in the house the previous night, 46.7% had used a LLIN the night before the interview. The groups with the highest LLIN use rates were household heads (56.5%), pregnant women (50.0%) and children under five (49.1%). On the day of the survey, 68.6% of the nets owned by the households were found hanging and 63.2% were used the previous night.

The main reasons stated for not using the nets were the heat (26.8%), the perception that nets were not needed at that time (22.6%), objective reasons pertaining to net dirty, washed, torn or user absent (21.8%) and subjective reasons such as user too afraid or don't like the smell (2.7%). Data about net use by month confirmed that the pattern of net use in the region was similar to rainfall data.

These results point to the importance of seasonal factors (time of the survey) rather than lack of interest from the population in explaining lower than expected net use. The survey evidence suggests that there is a strong net culture in Eastern region and if the nets were available, most of the population would use them, particularly during the season of high transmission.

Behavioural Change Communication

Of all households in the survey, 46.4% reported having been exposed to BCC communication about nets during the time of the hang up campaign. The assessment of the source of messages mentioned by household respondents showed that interpersonal communication channels (such as with hang up team members or health workers) were more effective in reaching rural households than mass media. However, there was a correlation between the number of sources of BCC information about nets and the number of messages remembered by the households. This highlights the importance of using a BCC strategy with diverse communication channels.

Knowledge of nets as a preventive method against malaria was very high although the study showed that a non-negligible proportion of the population believed net effectiveness was related to bed type or the cost of nets and 42.3% thought the insecticide could be harmful for LLIN users.

Conclusion

The major conclusions from this survey can be summarized as follows:

- the LLIN distribution campaign dramatically increased LLIN coverage (i.e. number of households with at least one net or LLIN). Coverage rose from 12.0% for any net before the campaign to 90.2% for any LLIN at the time of the survey, post-campaign.
- the quantity of LLIN distributed in the campaign was insufficient to reach universal coverage (i.e. all household members having access to a LLIN). Post-campaign, 47.0% of households had at least one LLIN per sleeping space and 49.8% had at least one LLIN for every two people in the household.
- volunteers to hang up household nets were well accepted by the population; more than three quarters of households estimated the hang-up volunteers' job was important and well done.
- in households with any LLIN, only 30.9% had a LLIN hung by a volunteer. This was likely due in part to the fact that people did not find hanging nets difficult. Among households that had hung a net themselves, less than 3% reported experiencing any difficulty in hanging up the net.
- on the day of the survey, the much higher proportion of households with any LLIN hanging (76.7%) compared to LLIN hang up by a volunteer (30.9%) confirms that LLIN hang up was not a significant barrier to LLIN use in these communities.
- LLIN use by individuals at the beginning of the high malaria transmission season when the survey was conducted had not reached the target of 80%; 46.8% of the population had slept under a LLIN the previous night and 64% of the LLIN in households were used the previous night. Reasons given by respondents for not using the nets suggest that lower than expected net use was likely due to seasonal factors rather than to lack of interest from the population.
- only 46.4% of the respondents reported receiving any BCC information about nets. For those who did, the most popular source of message was the hang up volunteer's home visits. While the survey results suggest that the culture of net use is strong in the Eastern region, they also suggest that more BCC

communications about insecticide safety for net users and the importance of using LLIN all year would be beneficial for malaria prevention.

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Annexe: the questionnaire