South Sudan Community–based LLIN Continuous Distribution Pilot Project

Lainya County, Central Equatoria State

Final Evaluation Report

(February 2014)

Funded by

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Abbreviations

ANC	Ante Natal Care
BCC	Behaviour Change Communication
CD	Continuous distribution
CI	Confidence Interval
DFID	(UK) Department for International Development
DHS	Demographic and Health Survey
EA	Enumeration Area
GBP	Great Britain Pound
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
IEC	Information, Education Communication
ITN	Insecticide-Treated Net(s)
LLIN	Long-Lasting Insecticidal Net(s)
MERG	Monitoring & Evaluation Reference Group
MIS	Malaria Indicator Survey
MoH	Ministry of Health
NCH	Net Coupon Holder
NMCP	National Malaria Control Programme
OR	Odds-Ratio
PCA	Principle Component Analysis
PPA	Programme Partnership Agreement
PHCC	Primary Health Care Centre
PHCU	Primary Health Care Unit
PPS	Probability Proportionate to Size
PMI	(US) President's Malaria Initiative
RBM	Roll Back Malaria
USAID	United States Agency for International Development
USD	US Dollar
WHO	World Health Organization

Executive Summary

Malaria Consortium South Sudan implemented a community-based Long Lasting Insecticidal Net continuous distribution pilot in Lainya County. The 18-months project was funded by DFID's Programme Partnership Arrangements (PPA) with co-funding from USAID's NetWorks Project. The main objective was to provide a sustainable method of replacing Long Lasting Insecticidal Nets (LLIN) in households where they had been damaged, destroyed or where not enough nets were available to allow access of all family members to an LLIN. The pilot included a system for determining the eligibility of persons/households that should get more nets, as well as criteria for selecting those members of the community who determined whether or not the household is eligible. The design also took into consideration the various stakeholders in the community and the county administrative structure, to ensure community participation and acceptance. In short: families contacted their local Net Coupon Holder (NCH) if they need replacement or additional nets who determined the eligibility and, if confirmed, issued a coupon that could be redeemed for an LLIN at designated distributions points (health facilities or mobile sites in remote areas). Social mobilizers informed the communities about the scheme and jointly with the NCH promoted the correct and regular use of nets.

Expected results of the continuous distribution included: equitable access to LLIN by households where nets had been damaged, destroyed or were not enough; continuous distribution systems established to increase and maintain LLIN coverage in targeted communities; culture of LLIN use promoted and improved for the prevention of malaria; and evidence established for the implementation and scaling up of continuous distribution systems in South Sudan including an assessment of the cost and cost-effectiveness.

The evaluation of outcome of the pilot comprises three elements of data collections:

1. Routine data from coupon and LLIN distributions
2. Two representative household surveys before and after the pilot
3. Detailed cost of implementation based on records from the implementing agency

The major outcomes can be summarized as follows:

- A total of 28,696 LLIN were distributed through communities within 10 months with a 94% coupon redemption rate, i.e. 30,530 coupons were distributed.
- Effectiveness of the programme was high with 88% of households that had heard about the scheme also receiving at least one LLIN and on average 2.3 LLIN
- Acceptance was good with 88% of respondents believing that the process of distribution and eligibility was fair
- Insecticide Treated Net (ITN) ownership at household level increased from 66% to 82% for any ITN and from 19% to 46% for one ITN for every two people.
- Population access to an ITN within the household increased from 38% to 66%
- Community-level protection (mass-effect on transmission) defined as "at least 80% of households in community have at least one ITN" increased from 40% to 83%
- The community-based scheme was the most important source of new ITN with 70% of households reached and for 53% it was the only source
- In addition 15% had any ITN obtained from Ante Natal Care (ANC) services, 12% still had a net from the previous campaign and 10% had a net from the commercial market

- While the proportion of households with enough[1] or almost enough[2] ITN increased from 31% to 63% the level of oversupply remained very low with only 8% of households having one ITN for every person or more
- Use of ITN the previous night increased from 23% to 54% and for children under five from 27% to 66%
- The proportion of the population that used an ITN if they had access increased from 60% to 81%, i.e. the use gap was reduced from 40% to 19%
- Of all households 55% were reached with Behaviour Change Communication (BCC) messages from the community volunteers and 76% of households that participated in the community scheme
- There was a clear association between exposure to message, intent to use nets regularly and actual use
- Overall costs were relatively high with GBP 10.32 or USD 16.52 per LLIN delivered of which the direct cost were GBP 4.30 and USD 6.87 respectively.
- The most essential delivery cost came to GBP 0.84 or USD 1.34 per LLIN delivered
- If one assumes that cost for training, supervision and BCC would be only half of the pilot in a routine programme, the running cost can be estimated at GBP 1.44 or USD 2.31 per LLIN distributed.

Major conclusions of the evaluation are:

- A demand-driven, community-based continuous distribution scheme in Lainya County, South Sudan was successfully implemented without major stock-outs and with a high level of community acceptance resulting in a high participation and very high redemption rate
- Not only were ownership levels from the previous campaign sustained, but also ownership gaps left by the campaign dramatically reduced reaching national targets for "80% of households with at least one ITN" and doubling the proportion of households with enough ITN for all household members
- Although expressed demand by the poorest households was less than that of wealthier families the requests for additional or new ITN came from those households that indeed were in need of ITN and filled the existing gaps without oversupplying ITN
- The community-based distribution complemented other channels such as ANC or private sector with very limited overlap
- Repeated exposure to net use messages through the community scheme contributed to an improvement of ITN use reaching 80% for households with ITN for all and re-emphasizing prioritizing preferential use by under-fives and women in reproductive age in households with insufficient ITN
- Taking into account that this was a "proof of principle" approach the medium term running cost of a programme based on this design can be estimated at approximately GBP 1.20 or USD 2.00.

[1] Enough: at least one ITN for every two family members
[2] Almost enough: at least one ITN for every three family members

Introduction

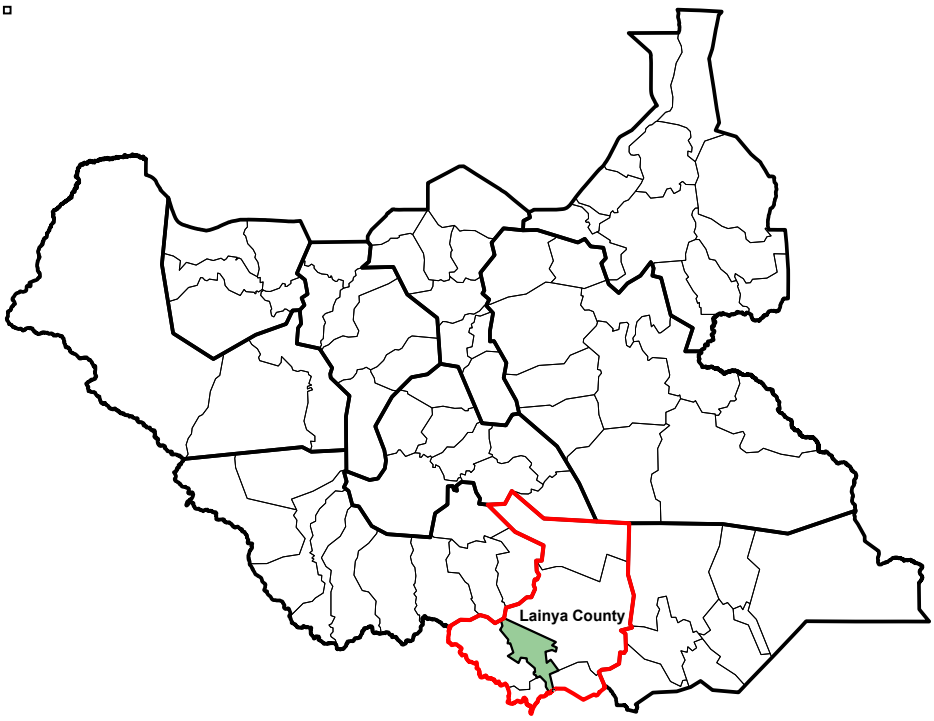
The South Sudan Community-based Long Lasting Insecticidal Net Continuous Distribution Pilot in Lainya County is an 18-month project funded by DFID's Partnership Programme Arrangements and USAID NetWorks Project to provide a sustainable method of replacing Long Lasting Insecticidal Nets (LLIN) in households where they may have been damaged, destroyed or not enough nets are available to allow access of all family members to an LLIN. The pilot includes a system for determining the eligibility of persons/households that should get more nets, as well as criteria for selecting those members of the community who will determine whether or not the household is eligible. The design also takes into consideration the various stakeholders in the community and the county administrative structure, to ensure community participation and acceptance. In short: families contact their local Net Coupon Holder (NCH) if they need replacement or additional nets who will determine the eligibility and, if confirmed, issues a coupon that can be redeemed for an LLIN at designated distributions points (health facilities or mobile sites in remote areas). Social mobilizers inform the communities about the scheme and jointly with the NCH promote the correct and regular use of nets.

Implementation of the Continuous Distribution

Study site

Lainya County is located in Central Equatoria state, 100 km south of Juba, the capital of South Sudan. The county has a population of 246,015 (35, 146 households) and is a rural area without any urban settlement other than the Lainya County Market area, on Juba-Yei road. The county inhabitants are mainly dependent on agriculture and commerce with neighbouring Uganda. The county has five Payams and 15 Bomas.

Figure 1: Map of Republic of South Sudan with Central Equatoria and Lainya County



The population is served by a network of 21 functional health facilities (one hospital, 4 PHCC and 16 PHCU) according to the 2009-2011 health facilities mapping. Three quarters of these facilities in 2009 required reconstruction or repairs. Only few had power or water supply and most lacked basic equipment and supplies. In 2009, 29 professional cadres provided services in Lainya County including one doctor, 10 nurses and 6 midwives.

Distribution process

The design and implementation process for the continuous distribution is described in detail in the implementation report but can be summarized as follows: Households were encouraged to request new or additional LLIN from a local community volunteer called Net Coupon Holder (NCH). Three eligibility criteria were established, namely: 1) existing nets were lost or seriously damaged; 2) there were less than one LLIN per two people in the household; 3) a woman delivered her baby in the village without having attended ante-natal care services. Once the NCH was satisfied that the household was eligible, he/she issued a coupon which could be redeemed at one of the health facilities against an LLIN. A household could only get one LLIN per coupon but could repeatedly request new LLIN coupons.

In total there were 50 NCH selected by the communities giving a ratio of on average 1 NCH per 700 households. The NCH were supervised by 11 NCH supervisors and supported by 19 social mobilizers. LLIN were initially transported and kept in the Lainya County store and the warehouse store keeper was given some incentive for his additional work load. Initially there were 9 redemption outlets in the Primary Health Care Centres or Units (PHCC/U) but these were extended to 14 based on complaints by remote communities that distances to PHCC/U were too far resulting in an average ratio of one LLIN outlet per 2,500 households. These "mobile" outlets were established in secure locations using metal boxes as containers for the LLIN. Each store had a store keeper and the larger ones (8) an assistant store keeper to ensure that households had access to LLIN during opening hours of the facility.

The Lainya County Health Department was the principle implementer (see Figure 2) with Malaria Consortium providing implementation support and coordination as well as handling funds and initial transport logistics for the LLIN.

The launch and implementation of the continuous distribution scheme was accompanied by mobilization and Behaviour Change Communication activities which are described in detail in the implementation report.

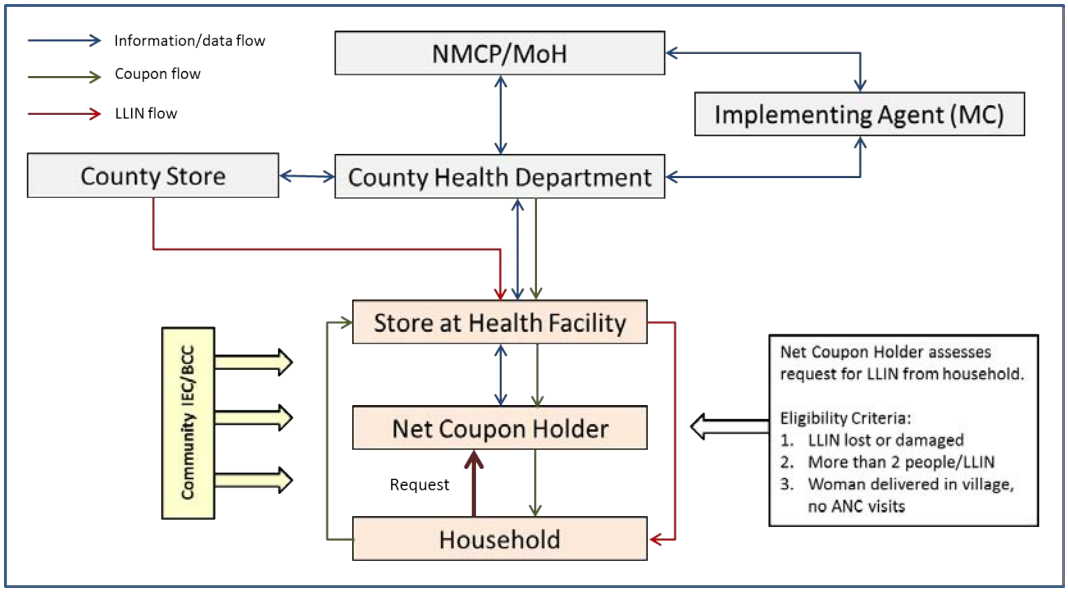
Evaluation Methods

Routine data

Details of the data flow for monitoring are provided in the implementation report. In short, data from two sources were collected on a monthly basis: 1) the LLIN issued from the outlets and 2) the coupons issued from the records of the NCH which included the reasons for giving the net based on the information marked on the issued coupon. This data was entered into

Excel-based data bases for each outlet by Malaria Consortium. This data was then merged into a single data base and transferred into STATA 11 software for further analysis.

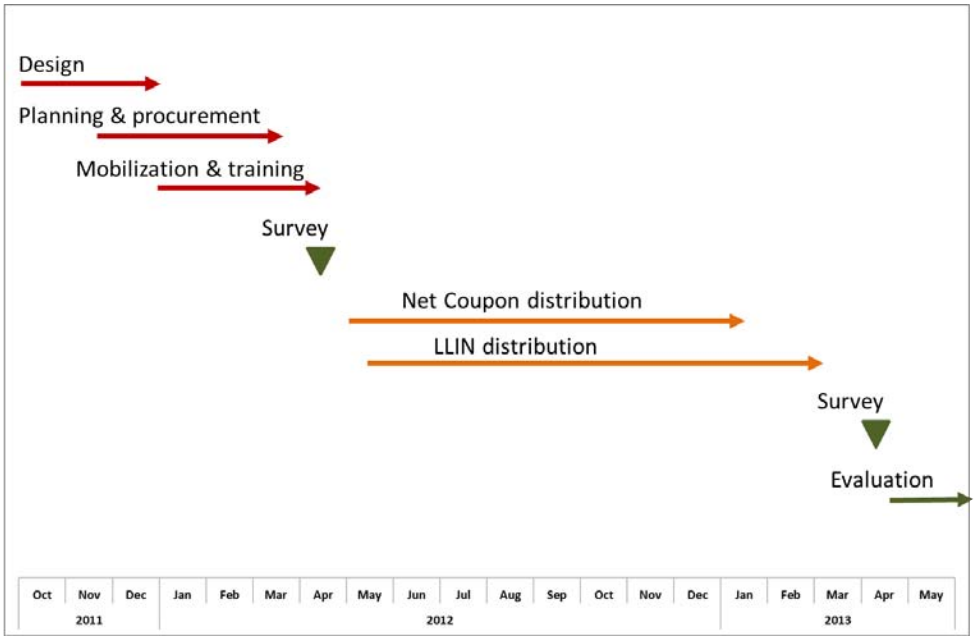
Figure 2: Flow diagram of the design of the continuous distribution scheme



Surveys

The assessment of population-based indicators involved two-stage cluster sampling household surveys at baseline and at the end (see Figure 3). Using the 2008 census as the sampling frame, 30 clusters were selected in stage one with probability proportionate to size (PPS). Three replacements clusters were selected to overcome potential issues with inaccessibility. No oversampling of urban areas was done, i.e. they are represented in the sample according to the urban proportion in the population. Stage two involved mapping the community (initially applying the equal size section approach if there are over 200 households), and 20 households were selected by the supervisor using a random number list.

Figure 3: Time line of planning, implementation and evaluation of the distribution scheme



Preparation and Sensitization

The preparation and sensitization for the baseline took place from 26th of March to 6th of April 2012. The Preparation phase involved document review, sample planning, design of the training and sensitization programs, field planning, arrangement of logistics, and survey staff selection. The Sensitization took place on 4th and 5th April 2012 and involved communicating the purposes of the survey to local community leaders. This took place in each of the five Payams in Lainya, and was conducted by the survey team leaders.

Training

Training was conducted in the Lainya County meeting hall, from 10-12 April. It included a refresher on basic interview techniques for the team of experienced enumerators, and specific training on the sample plan and instrument used for this project. The survey teams composed of one supervisor and four enumerators each selected on the basis of team interactions during the training, the relative skills of each enumerator, and the community origin of certain enumerator (to allow those enumerators from Lainya to work in their home Payams which further enhanced team access).

Field work

Data collection for both surveys took place in April (see Figure 3), at the beginning of the rains which start in March and end in October and included mapping and fieldwork. The mapping involved marking each household within the EA (or specific sections of the larger EA), for the purposes of subsequent random selection of households for interview. Three field teams composed of one supervisor and four enumerators each conducted fieldwork. The teams were accommodated in tents whilst in the field, residing largely at boma centre compounds. The survey instruments were printed in Juba, and transported to Lainya on 15 April, when the teams were dispatched. Every Friday the supervisors returned completed forms, which were subsequently transported to Juba. Each of the enumerators was provided with mobile credit, and a satellite phone for use in remote regions.

Throughout the fieldwork process, the Integrity Research & Consultancy team maintained the high levels of quality assurance agreed to with Malaria Consortium. This included:

- Interview monitoring – in each EA, at least 3 of 20 interviews (15 percent) monitored by the supervisors.
- Back checking– in each EA, 3 of 20 interviews (15 percent) were back-checked, a process that involved the supervisors returning to the household interviewed to ensure that answers was recorded correctly. This proved to be the most challenging of the quality assurance processes, as in many EAs distances between households was significant (above 5 km), and Supervisors as such spent a great deal of their time in transit, both on foot and by vehicle(4x4).
- Response sheet review – The supervisors reviewed all completed survey response sheets within 24 hours of the interview having taken place. Corrections were made, and clarifications sought with households interviewed where and when necessary.

Additionally, the Project Manager reviewed approximately 25 percent of all completed questionnaires with the relevant supervisor in the field.

Data Processing and Analysis

Data entry was done using CSPRO software with double entry of all records. Both data sets were then compared and any discrepant records were verified using the original questionnaires. After the first stage of cleaning, the data set was transferred to the STATA 11 statistical software package for further consistency checks and preparation of data files. Final analysis was done using STATA 11 software based on the previously defined outcome indicators broken down by background characteristics, including place of residence (Payam) and socio-economic status (wealth quintiles). Having used PPS sampling the data can be considered self-weighted at the cluster levels. All analysis was done adjusting for the cluster sampling by using the survey command family in STATA.

The wealth index was computed at the household level using principal component analysis (PCA) [1]. 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 curves were used to analyse outcome differences by wealth. A method to express the result of a concentration curve as a single numeric estimate is concentration index which expresses perfect equity as 0, maximum "pro-poor" inequity as -1 and maximum pro-rich inequity as +1. Standard errors and confidence intervals for the concentration indices were calculated using the formula suggested by Kakwani et al [2].

Given that universal coverage with ITN aims at reduction of malaria transmission and hence a community mass effect, cluster level analysis of ITN ownership was done using a Lot Quality Assurance Sampling (LQAS) based approach as previously described by Biedron et al. [3] where the cluster is considered a the "lot". For each ITN ownership indicator the outcome of whether a defined target level of coverage was reached was determined by comparing the actual number of "successes" in the cluster against the decision rule. Decision rules were determined based on the target level ranging from 40% to 90% and using a 20-percentage point margin for the minimally acceptable performance (e.g. 60% for the 80% target etc.) They were obtained from the web-based "LQAS Decision Rule Calculator" provided by the Food and Nutrition Technical Assistance project (FANTA III)[3].

Ethical Consideration

The application for ethical approval for the evaluation surveys was submitted to the Division of Monitoring, Evaluation and Research of the Ministry of Health of the Republic of South Sudan on 24th November 2011. Ethical approval was received on 19th March 2012. Since all funding for the surveys was obtained from the DFID funds, no ethical clearance was needed from the

[3] http://www.fantaproject.org/calculators/decisionrule_calculator.shtml

Johns Hopkins School of Public Health. Verbal consent was obtained from each respondent prior to the interview.

Costing Data

Complete costs for both funding sources of the project (DFID and USAID) were obtained from the finance department of Malaria Consortium. These were then merged into a joint data base using Microsoft Excel software and each cost line was coded into three main categories, namely direct cost, indirect cost and cost of the two evaluation surveys. Within the direct and indirect cost categories, sub-categories were defined based on previous costing work by Kolaczinski and colleagues [4] which was also in accordance with WHO recommendations. Cost per categories, sub-categories and month were then extracted from the data base and related to the monthly cumulative number of LLIN distributed in the project. Currency of the original data base from Malaria Consortium was in GBP and this was converted to USD using an average exchange rate for the period of USD 1.60 per GBP. No cost from the County or national level from the government of The Republic of South Sudan were available for inclusion so that costing only reflects funding by the donors.

Results

Coupon Distribution and Redemption

Between May 2012 and January 2013 a total of 30.530 LLIN coupons were issued by the NCH in Lainya County and until the end of the distribution in March 2013 28,696 LLIN were issued against coupons resulting in an overall redemption rate of 94.0%. As shown in Figure 4 the monthly output in coupons as well as LLIN was very constant over time with no indication of significant seasonal variation of demand or phases of stock-out of LLIN. The mean number of LLIN given out per month was 3,188, equivalent to 78.1 LLIN per 100 households or 11.2 per 100 population. This represents approximately 80% of the LLIN need estimated by the NetCALC tool[4] for Lainya County to sustain 80% universal coverage with LLIN.

Table 1: Outcome of coupon and LLIN distribution

Output	Result
Coupons issued	30,530
LLIN distributed	28,696
Coupon redemption rate	94.0%
Mean LLIN distributed per month	3,188
LLIN distributed in Pilot as % of annual population	11.2%
LLIN distributed in Pilot per 100 households	78.1

Figure 4: Cumulative monthly coupon and LLIN distribution and redemption rate

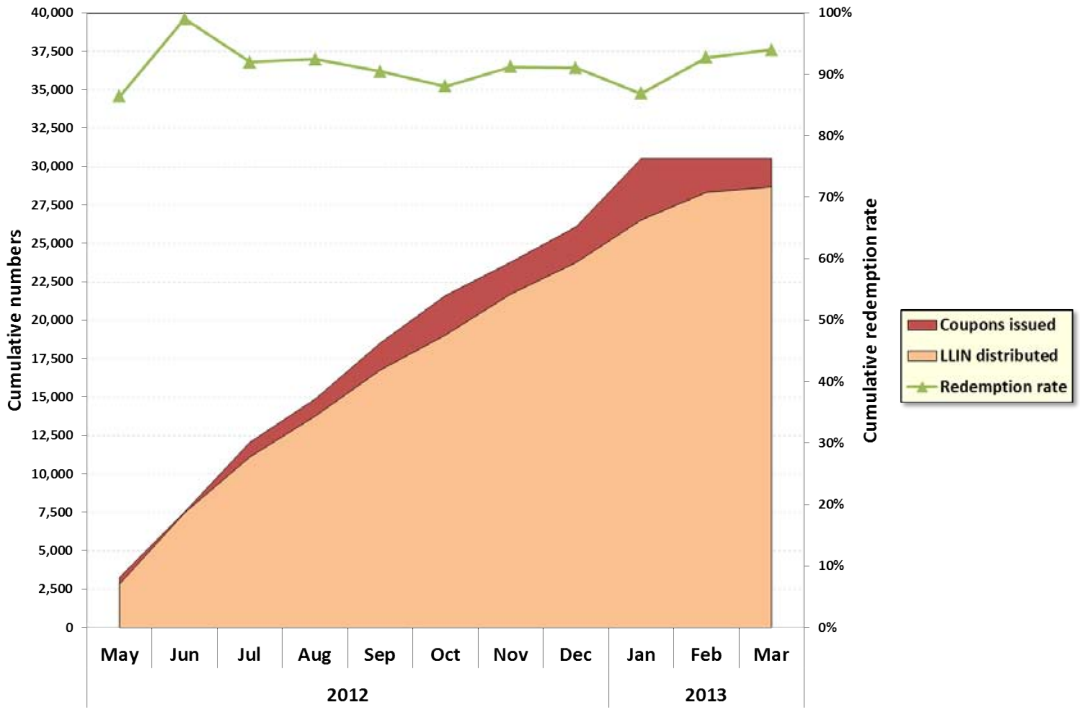
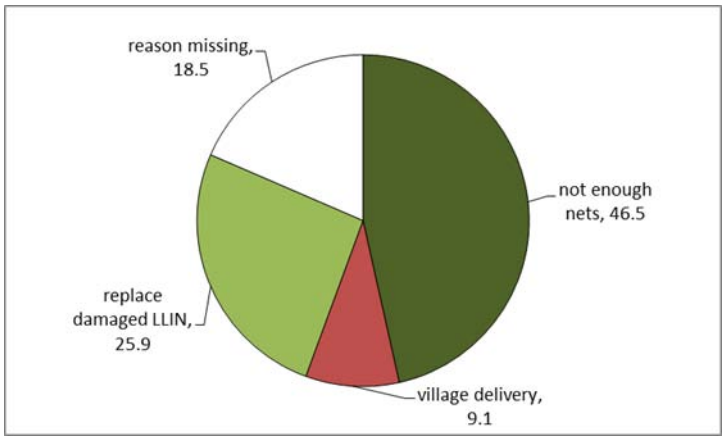


Figure 5 shows the reasons recorded for giving out the nets. This data showed some variation over time but no statistically significant trend so that an overall presentation appears valid. About every fifth coupon did not include any reason for giving out the LLIN. Close to half were given to top-up insufficient supply within the family, another quarter were given to replace

[4] Details of NetCALC can be found at: http://www.networksmalaria.org/networks/netcalc

existing nets and 9% went to women who had delivered in the village without having attended ANC or without having received an LLIN at ANC.

Figure 5: Reason coupon was given



Survey Sample Characteristics

Out of the 600 targeted household interviews 599 were successfully completed in the baseline survey and 597 in the endline survey. Table 2 shows the break-down by Payam which, based on the sampling methodology, should be a representation of each Payam within the overall county population. While most Payams had a very similar contribution in the two surveys there was a difference or shift between Kenyi and Lainya Payam with Kenyi being the largest contributor in the baseline survey. This is likely based on a different sampling list used by the survey implementation agent for the two surveys.

Table 2: Contribution of Payams to overall sample

Payam	Households interviewed		Proportion of sample		Total surveyed population	
	Baseline	Endline	Baseline	Endline	Baseline	Endline
Kenyi	120	180	20.0%	30.2%	697	910
Kupera	141	158	23.6%	26.5%	855	842
Lainya	178	120	29.7%	20.1%	1,059	610
Mukaya	60	60	10.0%	10.1%	347	314
Wuji	100	79	16.7%	13.2%	599	419
Total	**599**	**597**	**100%**	**100%**	**3,567**	**3,095**

Basic household characteristics

The vast majority of households were headed by a male (84%) and one in five (20%) were polygamous with most polygamous households (80%) having two wives, 14% three and only 6% four or more wives. There was no change in the gender composition and mean age between the two surveys as shown in Table 3. However, average number of usual residents (de-jure population) per household was 5.8 persons with 61% of households having any children under 5 at baseline and declined to 5.1 persons per household and 52% having a child under five. This could be an effect of the consolidation of families after absorption of returnees from North Sudan in 2011 and 2012. The proportion of households with a woman in reproductive age remained constant 88% at baseline and 91% at endline.

Table 3: Characteristics of sampled households

Background characteristic	Head of household		Mean family size	Proportion with any children <5yrs	Proportion with woman age 15-49
	Male	Mean age years			
Baseline					
Estimate	84.7%	41.5	5.8	60.8%	88.0%
95% CI	81.7, 87.2	40.5, 42.5	5.5, 6.1	55.5, 65.8	84.6, 90.7
Endline					
Estimate	82.8%	42.0	5.1	51.6%	90.6%
95% CI	79.0, 86.0	40.9, 43.2	4.9, 5.3	47.5, 55.3	88.0, 92.7

These figures are in keeping with what one would expect and compares favourably with the results of the Malaria Indicator Survey 2009 which showed an average household size in rural areas of 6.2 [5].

Variations between the five Payams were minimal, the most evident being a lower proportion of households with children under five in the central Lainya Payam (p=0.07). In contrast, there were notable difference by wealth quintile: female heads of households were much more common among the poorest households with 36% compared to the wealthiest with 10% (p<0.005), family size and the proportion of polygamous households increased linearly from the lowest to the highest wealth quintile (p<0.005) and these trends were very similar if not identical in both surveys.

The educational status of the head of household is shown in Table 4. As can be expected based on previous data from the area, the proportion of heads of household with no formal education was relatively high with over one third (36%) combined with a low proportion with secondary or higher education. The most striking differences in educational background were seen between females and males. However, there appeared to be some improvements in the year between the survey for education of female heads of households with a lower proportion having no education (marginally significant with p=0.07) and more with secondary education (p=0.06). However, it cannot be deducted from the data whether this is an effect of increased education or a shift in the type of women heading these households. Not surprisingly, educational status increased statistically with wealth of the household in both surveys.

Table 4: Educational level of head of household

Background characteristic	Educational level of head of household		
	None	Primary	Secondary or higher
Baseline			
Male	20.2%	48.9%	21.9%
95% CI	24.8, 33.9	44.2, 53.6	18.0, 26.5
Female	76.7%	21.1%	2.2%
95% CI	65.9, 84.3	14.0, 30.6	0.5, 8.6
Endline			
Male	30.6%	50.2%	19.2%
95% CI	25.2, 36.5	44.3, 56.1	15.6, 23.5
Female	58.2%	27.6%	14.3%
95% CI	47.9, 67.7	19.0, 38.1	8.2, 23.7

The average number of sleeping places available per household was 3.4 at baseline and increased statistically significantly to 3.9 at the endline survey (Table 5). With the lower mean household size this implied an even more pronounced decline of the average persons per sleeping place from 2.0 at baseline to 1.5 at endline. Both, sleeping places and family size increased with wealth quintile ($p<0.05$) which resulted in an even "persons per sleeping place" across wealth for the baseline survey. However, at endline the gradient for additional sleeping places with wealth was stronger resulting in a declining rate for persons per sleeping place with increasing wealth or a decreasing in "crowding".

Almost all houses (>95%) were built with mud walls, thatch roof and earth floor with no difference between the two surveys. Availability of latrines was very poor at baseline with overall only 35% having access to any latrine, i.e. 65% of households using the bush but this rate increased significantly at endline to 55% having access (see Table 5). In contrast, three quarter of households had access to safe water, mainly through bore holes and this did not vary much by wealth nor did it differ between surveys. Almost all households cooked with firewood and only in the two highest wealth quintiles did some families use charcoal (overall 6%) or kerosene (0.5%).

Some of the assets that are owned by the households are shown in Table 5. Interestingly, the ownership of mobile phones was quite high with overall 54% at baseline increasing to 61% at endline. Even among the poorest quintile still 14% owned a phone at baseline increasing to 25% at endline. This appears much higher than in the MIS of 2009 when only 9% of the rural households owned a phone. Although Lainya County is situated rather centrally with good phone coverage and, therefore, may have a mobile phone ownership rate above the national average, this still suggests a significant recent increase of mobile phone possession. Assets that were commonly owned were radios and means of transport (mainly bicycles) and both slightly increased from baseline to endline. Among other assets an iron was the most common increasing from 34% at baseline to 51% at endline while ownership of a television or access to electricity were very uncommon.

Table 5: House characteristics and selected assets

Background characteristic	Sleeping places (mean)	Persons / sleeping place (mean)	Access to latrine	Radio	Any transport	Mobile phone
Baseline						
Estimate	3.4	2.0	34.7%	45.9%	51.4%	53.7%
95% CI	3.3, 3.6	1.9, 2.1	29.1, 40.8	39.3, 52.7	46.2, 56.6	47.0, 60.3
Endline						
Estimate	3.9	1.5	55.3%	63.6%	60.3%	60.5%
95% CI	3.7, 4.2	1.4, 1.5	46.4, 63.8	57.8, 69.1	54.9. 65.5	55.2, 65.5

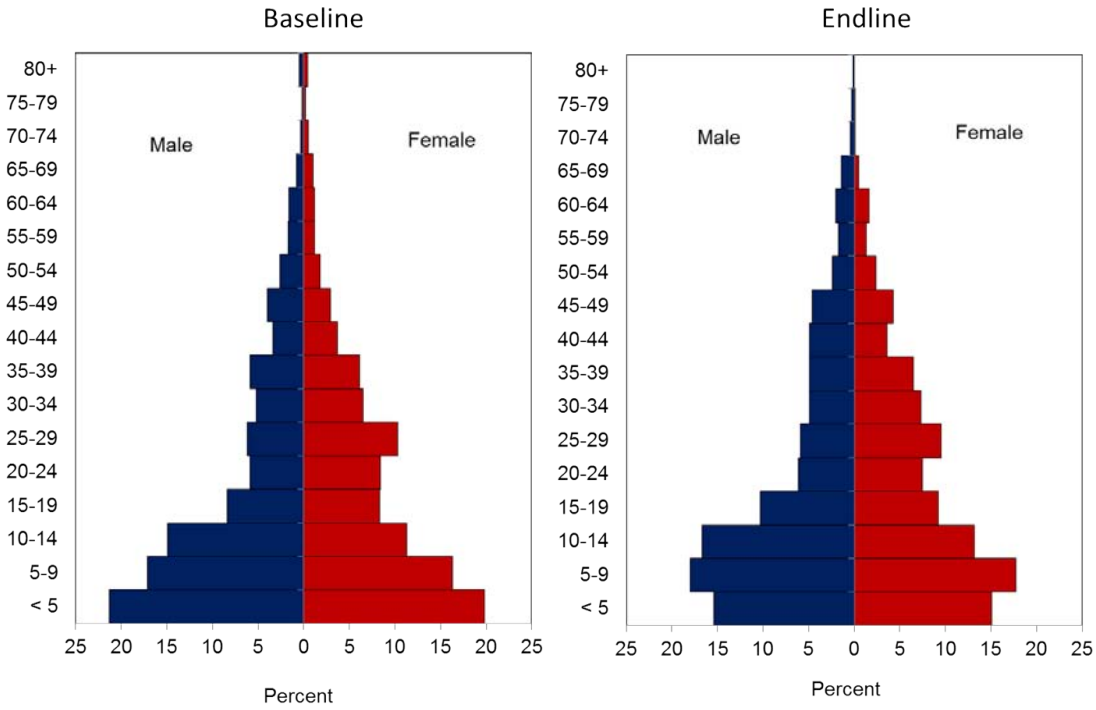
Structure of sampled population

The demographic characteristics of the two samples are shown in Table 6 and Figure 6 and are as expected and typical for a rural population in South Sudan with about 50% being less than 14 years old, 20% less than 5 and 7% less than 1. There was however, an issue around age groups for children under five in the endline survey with a lower than expected rate of under-fives. The overestimation of the 5-9 year age group compared to baseline suggests, however, that this is not an absence of young children but rather a misclassification by elevating "almost" five year olds to the five year category (age heaping).

Table 6: Composition of the sampled population

Background characteristic	% children under 5 years	% under 15 years	% of women 15-49 years
Baseline			
Estimate	20.2%	49.8%	22.9%
95% CI	17.6, 22.9	47.6, 52.1	21.7, 24.0
Endline			
Estimate	15.3%	48.1%	23.7%
95% CI	14.1, 16.6	46.4, 49.8	22.7, 24.8

Figure 6: Population structure of survey population



Access to LLIN from community distribution

Overall slightly more than three quarter of all households (78.3%, see Table 7) had heard about the continuous distribution scheme. However, there was a clear increase of awareness with wealth quintiles (p=0.003). By far the most common source of information (multiple sources were allowed in the response) were those community members directly involved in the scheme, namely the social mobilizers (77.0%) and the Net Coupon Holders (71.3%). This was followed by the supervisors (28.9%), clergymen (21.7%), health workers (18.5%), Boma chiefs (7.5%) and Village Health Committee members (6.6%) while neighbours (3.0%), community meetings (3.0%) and other officials (1.3%) played a minor role.

Among the 20 households who had asked for new or additional nets but did not get a coupon 13 (65%) said the coupon holder was not available and four (20%) said they had not been found eligible while three were not sure about the reason. Similarly, of the eight households that had tried to redeem the coupon but could not get a net, half said the store keeper was not around, three said the nets had run out and one mentioned that they came when the health centre was already closed.

Table 7 summarizes the chain of events from awareness about the scheme to the actual receiving and retaining an LLIN at the end of the pilot. Effectiveness was very high with overall

89% of those households that had heard about the possibility of getting new LLIN through the scheme also receiving at least one. The largest "losses" of effectiveness occurred in the first two steps, from knowing to actually contacting the NCH (96%) and from requesting to getting a coupon (96%) while 99% of those who received a coupon also went to redeem it and 98% of those going to an outlet also getting an LLIN. Therefore, the biggest barrier to getting any new LLIN through the community scheme was not being aware about it and this information deficit was also strongly biased towards the wealthier households (p=0.003) with an equity ratio of 0.76 and a concentration index of 0.046 (95% CI 0025, 0.68). Effectiveness of the distribution process then added to this pro-rich bias as effectiveness was better among the wealthiest (94%) compared to the poorest (80%) which was again due mainly to poorest households not requesting a coupon. This increased the inequity of having received any LLIN to an equity ratio of 0.64 and a concentration index of 0.075 (0.046, 0.105).

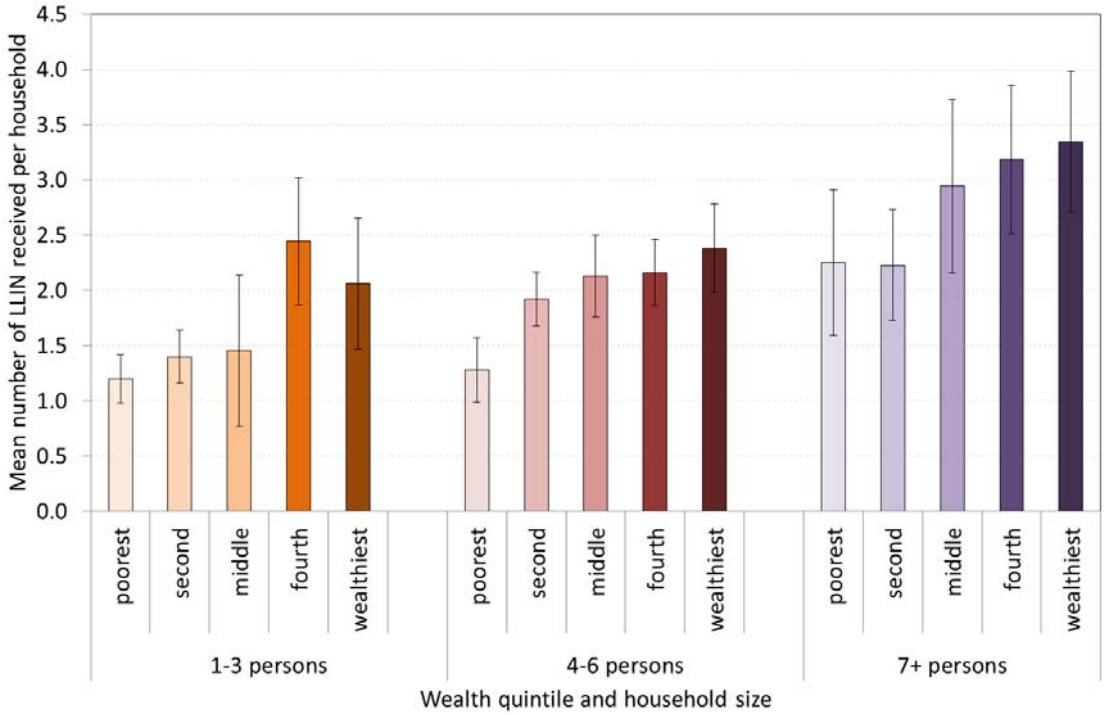
Table 7: Effectiveness of community-based distribution programme

Background characteristic	Heard about coupon	Requested coupon	Received coupon	Went to redeem coupon	Received LLIN	Effectiveness: Got LLIN if knew about coupon
Endline						
Estimate	78.3%	75.2%	71.9%	71.2%	69.9%	88.7%
95% CI	72.6, 83.8	68.3, 81.1	64.1, 78.5	63.4, 77.9	61.6, 77.0	82.4, 93.0
Wealth Index						
Lowest	67.2%	60.5%	56.3%	55.5%	53.8%	80.0%
Second	79.8%	74.8%	72.3%	71.4%	70.6%	88.4%
Third	75.0%	72.5%	68.3%	66.7%	64.2%	85.6%
Fourth	83.2%	79.8%	77.3%	77.3%	77.3%	92.9%
Highest	88.3%	88.3%	85.0%	85.0%	83.3%	94.3%

The mean number of LLIN received per household via the coupons was overall 2.25 (95% CI 2.10, 2.39) per family that received any nets from the pilot with 36% of the receiving households getting just one LLIN, 27% two LLIN, 21% three and 16% four or more. The number depended on family size increasing from 1.65 LLIN per household if there were up to three members, 2.13 LLIN for households with 4-6 members and 2.88 for those with seven or more. As shown in Figure 7 the number received also depended on the families from higher wealth quintiles systematically getting more LLIN than those in the lowest wealth quintiles (p<0.0001).

Among the households that had heard about the community-based LLIN access 63.6% (95% CI 52.7, 73.3) felt that distance to the Net Card Holder (NCH) was very close (40.3%) or acceptable (23.4%) while 36.4% (26.7, 47.3) said it was too far for them. This was different for the perceived distance for the LLIN redemption point: only 47.8% (36.0, 59.9) said it was very close (25.1%) or acceptable (22.7%) and 52.2% (40.1, 64.0) said it was too far. The perception of unacceptable distance ("too far") did depend on location as it was significantly lower in the central Lainya Payam compared to the peripheral Payams both for the coupon (16% vs. 42%, p=0.058) and the redemption point (24% vs. 59%, p=0.004). The perception also differed between those households that actually participated in the pilot and those that did not: among those that requested a coupon 35% felt that the NCH was too far away while among those that had heard of the pilot but never requested a coupon 63% felt it was too far (p=0.04).
Overall 88.0% (82.1, 92.1) of respondents who had heard about the pilot felt the eligibility criteria for getting LLIN were very fair (63.2%) or fair (24.8%) but this view was very much dependent whether the households actually succeeded to obtain any new LLIN: if they did 91% felt it was very fair or fair, but if they did not ask for a coupon or asked but did not get, then only 57% thought the criteria were fair (p<0.0001).

Figure 7: Mean number of LLIN received from community scheme by wealth and family size



Respondents who had received any new LLIN from the pilot were asked what they did with the packaging the net came in and 410 out of the 417 provided a response. One in six respondents (18.8%) said they received the net without the bag. Of those receiving a bag 48.6% threw the bag in the trash, 39.6% burned it, 10.0% buried it and only 1.9% said they used it to carry other things in it.

Ownership of nets

In this section we will look at the ownership of nets at the time of each survey and explore the contribution of different channels to reaching and sustaining universal coverage.

Net characteristics

At the baseline survey a total of 773 nets were registered and 92% were directly observed by the interviewer. This number increased to 1,251 nets in the endline survey with 96.6% directly observed. Allowing access to the nets for inspection was similar in the five Payams, but was less for the poorest wealth quintile (83%, p=0.04) at baseline but not at the endline survey (p=0.4).

In both surveys almost all nets were rectangular in shape (95% and 98%) and white in colour (91% and 97%). At baseline the dominating brand was Permanet (79%) followed by unbranded nets (6%) while other brands of LLIN such as Olyset, Duranet, Netprotect and Interceptor were between 1% and 4% and the proportion of home- or tailor-made nets was 2%. This situation changed in the endline survey as the nets distributed through the pilot were Netprotect which now made up 63% of all nets while the share of Permanet had gone down to 30%.

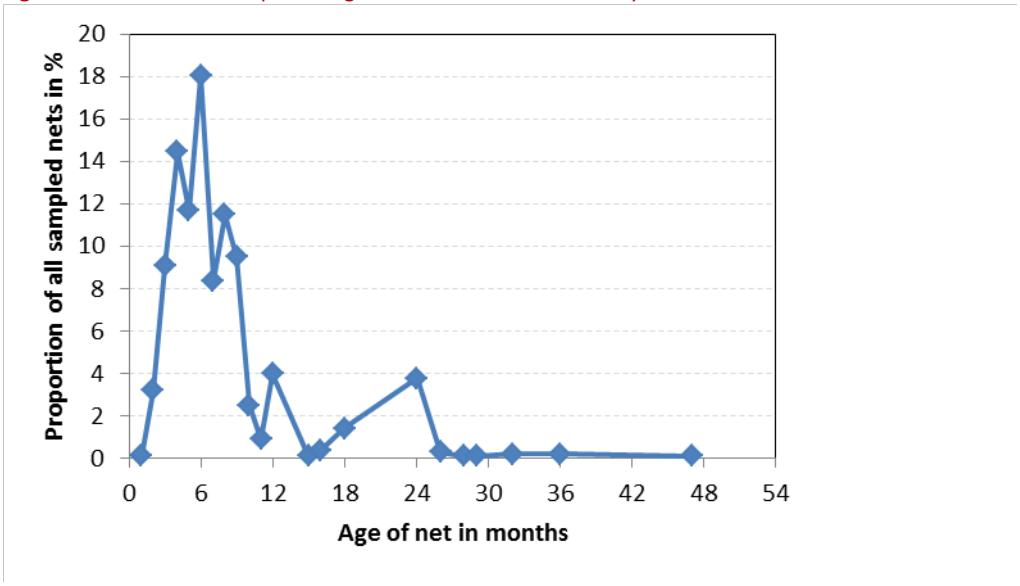
Not surprisingly, the vast majority of the nets were LLIN, 92% at baseline and 99% at endline. The number of nets reportedly conventionally treated with insecticide within the last 12 months decreased from three nets to zero and untreated nets from 63 (8%) to just 13 (1%).

This implies that all ITN were also LLIN and in the remainder of this report the two terms are used exchangeable.

The public sector was the most common source for the nets at baseline with 79.8% (73.2, 85.2). Although source was reported as health facilities (58%), community agents (17%) and "recent campaign" (5%) it can be assumed that all or most were from the last campaign where facilities and some community agents had been used as distribution points. At the endline survey the relative contribution of the public sector as source of nets had increased to 92.0% (90.1, 93.5) and this time community agents (NCH) were the most common source (71%) followed by ANC services (11%) and the last campaign (9%). In contrast, the contribution of nets obtained from the commercial market decreased from 15.9% (10.7, 23.1) at baseline to 6.4% (5.1, 8.1) with shops and markets being the most common sources within this category. Other sources were religious organizations and friends/family and these contributed 4.2% (2.6, 6.8) at baseline and 1.6% (0.8, 3.1) at endline.

Age of nets at the endline survey is shown in Figure 8. The peak of the community-based distributions in the 9 months preceding the survey is clearly visible. The second peak at about two years prior to the survey is most likely the previous campaign.

Figure 8: Distribution of reported age of nets from endline survey



Net ownership coverage

A comparison of net and ITN ownership coverage between baseline and endline surveys is shown in Table 8. While the overall ownership of any mosquito nets only increased by 8%-points from 74% to 82%, the ownership of at least one ITN increased by 15%-points from 66% to 82% and this difference was statistically significant ($p<0.0001$). More importantly, the number of ITN owned per ITN owning households increased from 1.8 ITN to 2.5 resulting in a proportion of 46% of households having one ITN for every two people in the household which is a 27%-point increase and more than double the result from the pre-pilot survey.

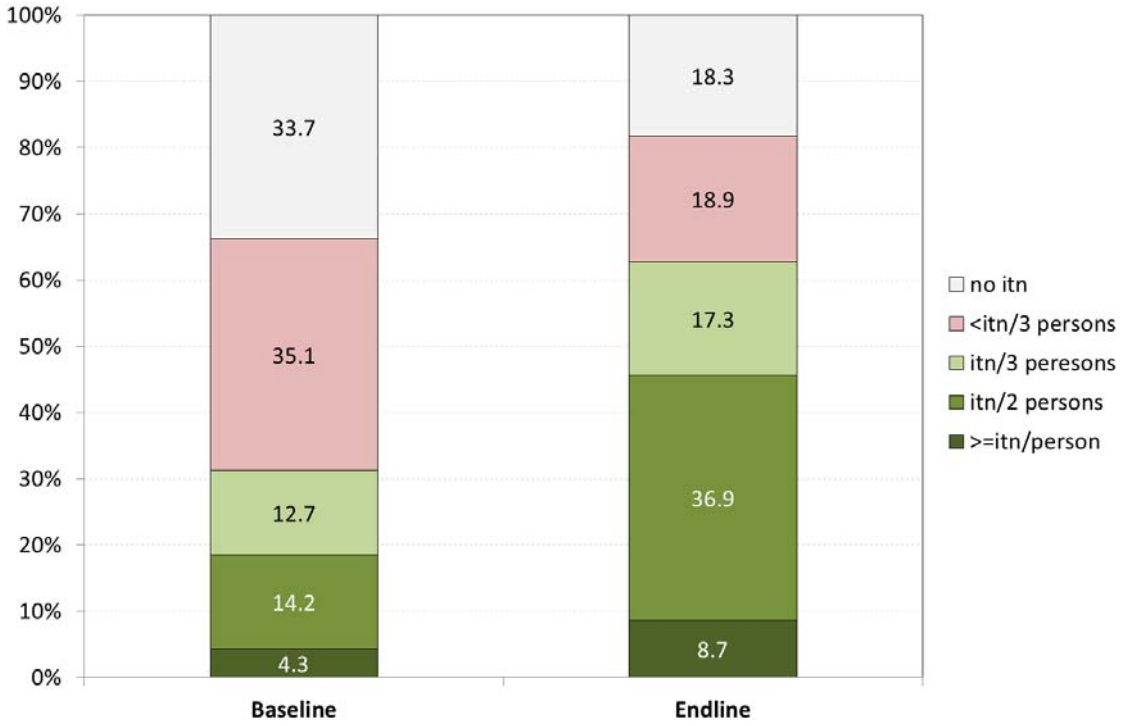
A closer look at the intra-household supply situation at the two surveys is presented in Figure 9. During the year of the community-based distribution pilot both, the proportion of households without any ITN as well as those with less than one ITN for every three members halved. In contrast, gains were mainly in the category of exactly one ITN for every two people increasing 2.5-fold while those with "almost enough ITN" and those oversupplied (One ITN per person or better) only increased marginally. While there were no differences in the supply

situation between Payams, the level of supply with one ITN per person or better was significantly higher (p<0.0001) for small households of not more than three people (25%) compared to medium size families of 4-6 persons (6%) and large households of seven or more (0%). Looking only at families with three or less members supply with one ITN per person was again higher, if there was no child under five (28%) compared if there was (16%) which reflects the higher probability that in these families of adults and/or adolescents sharing of nets is less common. Overall the proportion of households with enough or almost enough ITN, i.e. one ITN for every three people or better, increased from 31% at baseline to 63%.

Table 8: Net and ITN ownership at time of survey

Background characteristic	All sampled households				Among households with at least one ITN	
	Any net	Any ITN	Mean # of ITN	One ITN for two people	Mean # of ITN	One ITN for two people
Baseline						
Estimate	74.3%	66.3%	1.19	18.5%	1.79	28.0%
95% CI	67.6, 80.0	60.1, 71.9	1.03, 1.34	15.2, 22.5	1.65, 1.92	23.2, 33.3
Endline						
Estimate	82.4%	81.7%	2.07	45.6%	2.54	55.7%
95% CI	77.4, 86.5	76.8, 85.8	1.89, 2.26	39.2, 52.0	2.39, 2.68	49.0, 62.2

Figure 9: Level of intra-household supply with ITN relative to family size

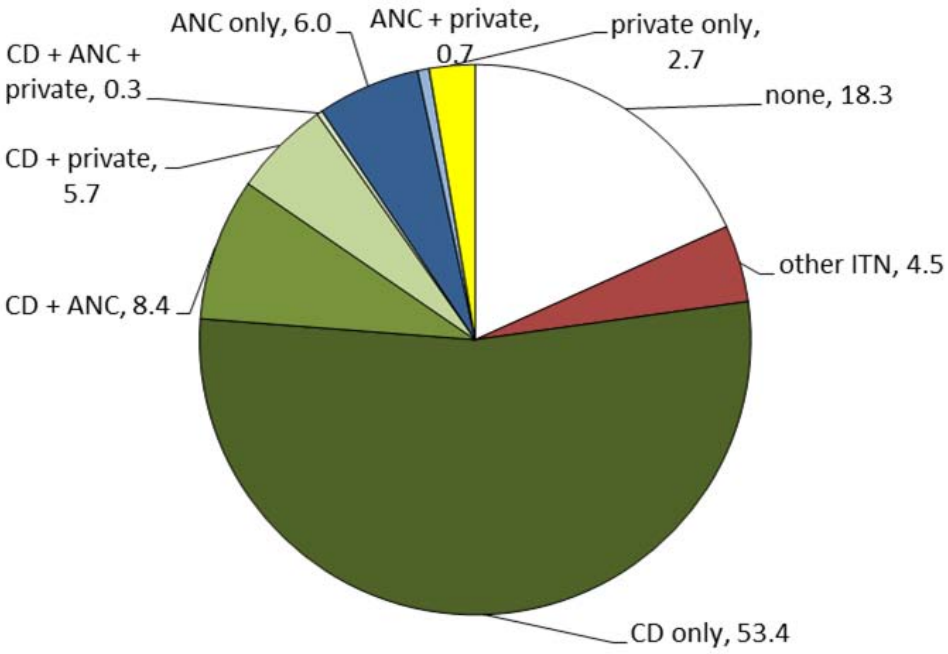


Contribution of different channels to household coverage

As shown above (Table 7), 69.9 % of households had received any ITN from the community-based CD pilot and by the time of the endline survey 67.8% (95% CI 59.7, 75.0) still had any ITN from this channel implying that 95.9% (93.3, 97.6) of those households receiving any also still had any of them at the time of the final survey. In addition, 15.4% (12.4, 19.0) of households owned any nets they had obtained through ANC services, 12.4% (8.9, 17.0) had any nets from the last mass distribution campaign in 2011 and 10.1% (8.0, 12.5) owned any nets they had bought from the retail market. Households that had not received any nets from the previous campaign were more likely to have obtained a net from the community-based scheme (70% vs. 50%, p=0.003). Similarly households that did not get a net from ANC were more likely to have a community-distributed ITN (70% vs. 56%, p=0.01) suggesting that nets were primarily requested by those who indeed did not have enough nets from other sources.

The contribution of different supply channels during the CD-pilot, i.e. after the campaign is shown in Figure 10. More than half (53%) of households had the community scheme as the only source for new ITN while 6% had only nets from ANC and 3% only from the private sector. In contrast, only 15% of households had nets from more than one source showing that the CD channels were mainly complementary, serving different households.

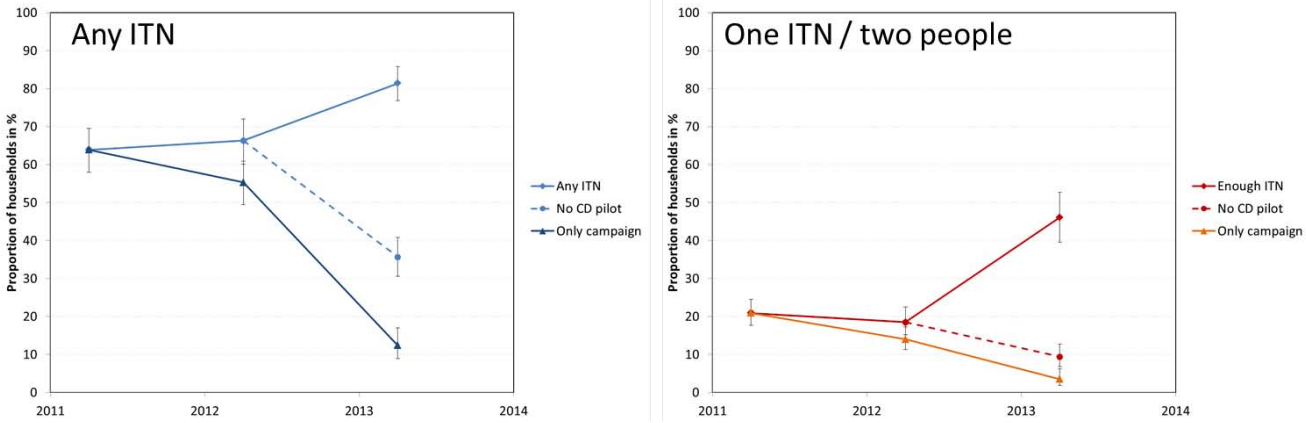
Figure 10: Contribution of channels during time of pilot



The trend in ITN ownership coverage from the campaign in 2011 up to the endline survey in 2013 is shown in Figure 11 giving the overall trend and what it would look like without the contributions of the CD pilot and only considering the ITN remaining from the campaign. Results show that the proportion of households with any ITN increased moderately from the campaign from 64% to 66% at the start of the CD-pilot and then to 81% at the endline survey while the proportion of households with at least one ITN for every two people actually slightly decreased after the campaign from 21% to 19% but then sharply increased to 46% at endline. Excluding the community-based distributions would have resulted in coverage of 36% with any ITN and only 9% with at least one ITN for every two people in 2013. There also was a clear difference between only campaign nets and coverage without the community-based distributions showing that nets from ANC, private sector and "other sources", i.e. friends, family and civil society, contributed to post-campaign coverage but not enough to prevent

decline of coverage rates. Noteworthy is also the observation that "loss" of campaign nets (at least one ITN) seems to accelerate after the start of the pilot with a steeper decline than expected. Whether this is due to households discarding the old campaign nets at a faster rate once new ones were available or an out-migration of people after the campaign (or a mix of the two) can – unfortunately – not be answered by the survey data.

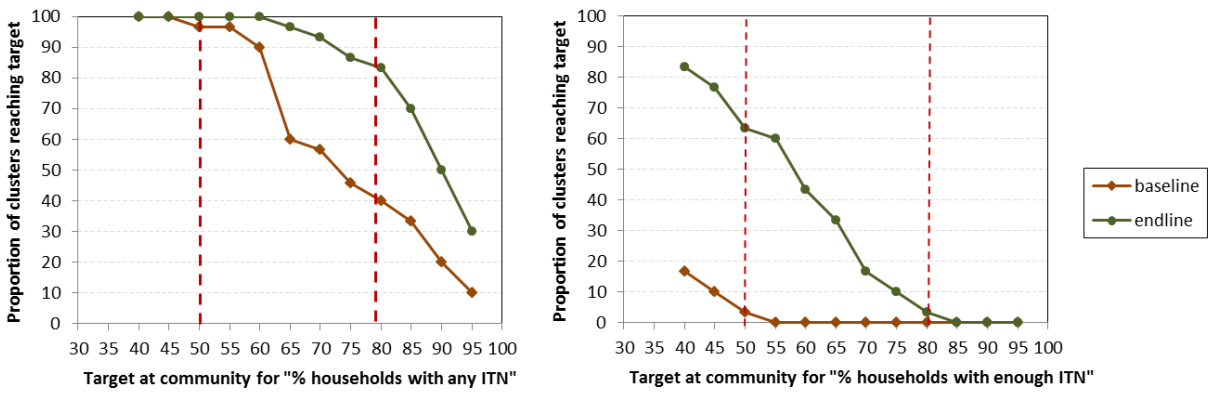
Figure 11: Trends in ITN ownership with and without community-based distribution



Community level coverage

The community-level ITN coverage is an important indicator for the expected mass-effect of ITN, i.e. the reduction of transmission at community level and hence the protection also of households that do not have or use ITN. In general it is assumed that coverage of 80% of households with at least one ITN will provide such mass-effects although some data and modelling suggests that the effect could start as early as 50% household coverage. Using a LQAS-based approach to estimate community coverage Figure 12 presents the results for "at least one ITN" and "at least one ITN for every two people" (enough ITN). The proportion of communities with 50% coverage of "at least one ITN" was almost 100% at baseline as well as at the end of the pilot. However, at baseline community coverage dropped sharply after the 60% target point and only 40% of communities had ITN coverage of at least 80% households owning any ITN. In contrast, in 83% of communities coverage of at least 80% of households with any ITN was reached at the endline survey suggesting a dramatic increase of the potential mass-effect. With respect to "one ITN for every two people" only 3% of communities reached the 50% target while at endline in 63% of communities at least half of the households had enough ITN for all members.

Figure 12: Community-level ITN ownership coverage



Equity of net ownership

It was previously already highlighted that households in the poorer wealth quintiles were less likely to request a new ITN through the community-based distribution (Table 7) and that the number of nets received per household was lower for the poor even after adjusting for family size (Figure 7). A closer look at equity of ITN ownership is presented in Figures 13 and 14 and Table 9. While the gradient between wealth quintiles for coverage with at least one ITN remained unchanged between baseline and endline survey, i.e. the curve only shifted upward, equity for enough ITN)at least one ITN for two people) showed a significantly more "pro-rich" distribution which reflects the higher number of ITNs received by wealthier households. However, as shown by the concentration curves (Figure 14) and concentration indices (Table 9) the level of inequity was moderate at best. Comparing the concentration index for requesting a coupon (0.065) and receiving a coupon net (0.082) indicates that the delivery process was not wealth biased but that the "inequity came from poorer people asking less for new nets.

Figure 13: ITN ownership coverage by wealth quintiles

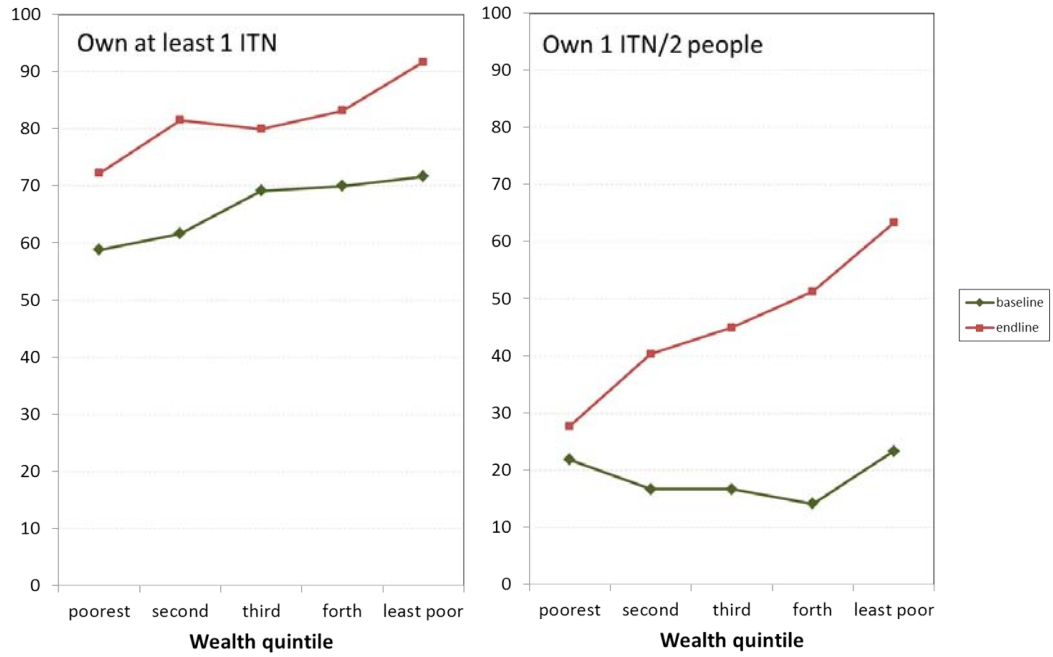


Figure 14: Equity of net and ITN ownership expressed as concentration curves

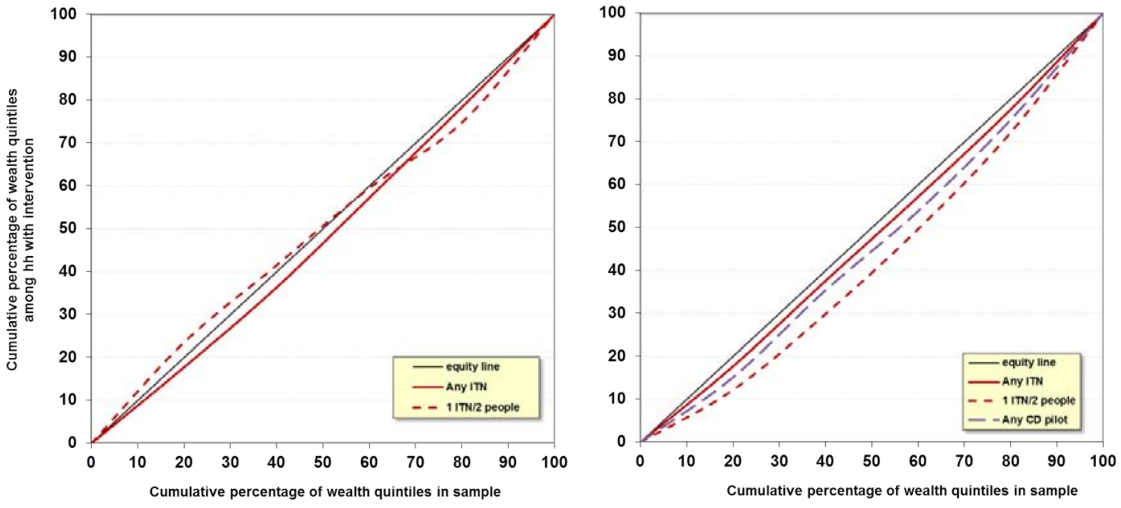


Table 9: Concentration Indices of ITN ownership indicators

Indicator	Baseline		Endline	
	Concentration Index	95%-CI	Concentration Index	95%-CI
At least one ITN owned	0.041	0.009, 0.074	0.040	0.018, 0.061
At least 1 ITN for every 2 people owned	0.002	-0.098, 0.108	0.144	0.096, 0.193
At least one ITN from private sector	0.237	0.119, 0.355	-0.075	-0.205, 0.056
At least one ITN from public sector	-0.036	-0.055, -0.017	0.044	0.021, 0.067
At least one ITN from community pilot			0.082	0.051, 0.112
Requested net from CD pilot			0.065	0.038, 0.091

Utilization of nets

Hanging and use

For the assessment of hanging and use of nets it should be kept in mind that both surveys were done at the same time of the year, namely at the beginning of the rains implying that the comparison between surveys mainly reflects change in attitudes and behaviours rather than the seasonal influence.

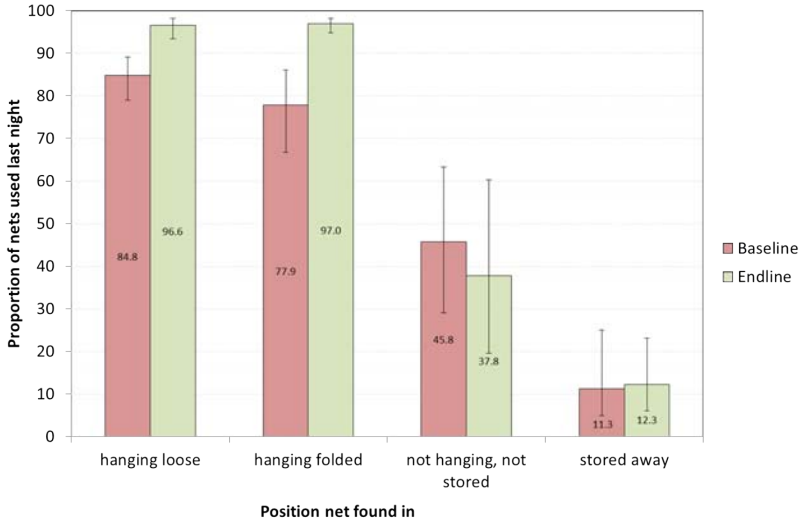
Table 10: Hanging of nets

Background characteristic	Among households with any nets			Among all sampled nets	
	None hanging	Some hanging	All hanging	Found hanging	Used last night
Baseline					
Estimate	22.5%	6.3%	71.2%	77.4%	71.9%
95% CI	17.8, 28.0	4.0, 9.8	64.8, 76.9	71.8, 82.1	65.3, 77.7
Endline					
Estimate	4.7%	16.7%	78.7%	85.4%	85.6%
95% CI	2.9, 7.5	12.9, 21.2	73.6, 83.0	81.7, 88.4	81.2, 89.1

Observed at household level the proportion of households that had hung any of their nets increased from 78% at baseline to 95% ($p<0.05$) and hanging all available nets from 71% to 79% (Table 10). With respect to the nets found in the households, the proportion hanging increased from 77% of the nets to 85% ($p<0.05$). Similar positive changes were also seen for use of nets which went from 72% to 86% ($p<0.05$). As shown in Figure 15 this was mainly due to an almost perfect use of those nets hanging over sleeping places open or folded. The likelihood of a net being used was closely associated with whether or not it was hanging. It must be kept in mind, however, that this only shows an association and does not necessarily imply a causal relationship between hanging and use (i.e. if they are hung, they are used) but that this causal relation could be the opposite as well (i.e. if they are used, they are left hanging).

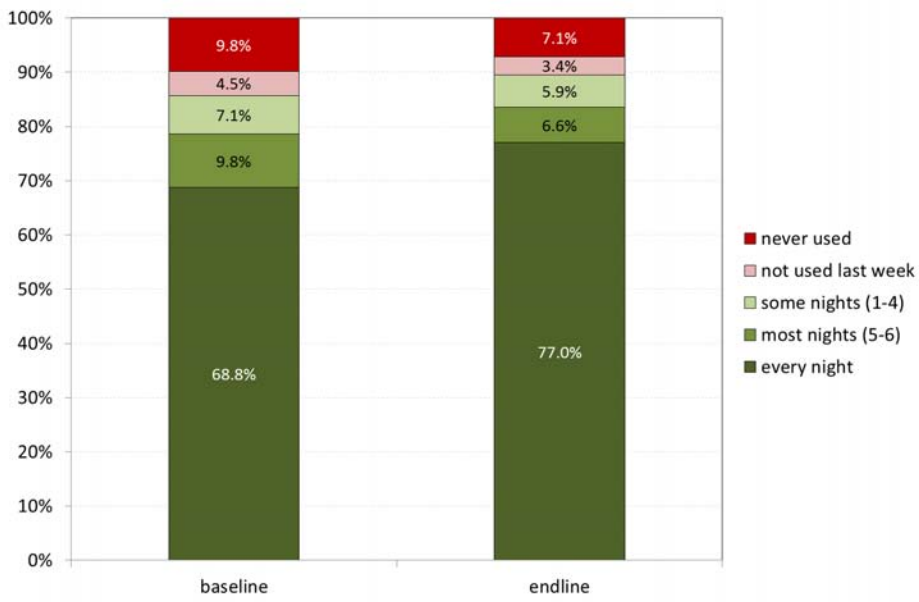
The average number of net users for used nets was 1.77 (1.64, 1.90) at baseline and 1.59 (1.55, 1.63) at endline. However, when stratified whether the household had enough ITN for all members or not, the mean users were 1.86 (1.73, 2.00) and 1.77 (1.68, 1.85) respectively if there were not enough ITN for all and 1.62 (1.41, 1.82) and 1.51 (1.47, 1.55) respectively with enough ITN. This shows that the difference in mean users was mainly due to the increase in households with enough ITN where single net users are more common that in households with insufficient ITN.

Figure 15: Relationship between hanging and use of nets



Based on the responses regarding the frequency of net use in the past week (Figure 16) the vast majority of nets were used very regularly either every or most nights and this rate increased from 79% at baseline to 84% at endline. The proportion of nets not used, either not last week or not at all decreased accordingly from 14% to 10%.

Figure 16: Reported frequency of net use last week



Net access and use coverage

There are two critical indicators to describe the net use situation and to distinguish the "ownership gap" (not enough nets to be used) from the "use gap" (existing nets not being used): the proportion of the population with access to an ITN within the household (assuming each ITN is shared by two people) and the proportion of the population actually using an ITN the previous night. Results are shown in Table 11 and demonstrate that not only was there a significant increase of the proportion of the population with access to an ITN from 38% to 66% but also an improvement of use among those with ITN access which increased from 60% to 82%.

ITN use was above average for heads of households, women in reproductive age and children under five showing some preferential use which, interestingly, was highest for the heads of household, but did not differ between male and female heads. Also, this use pattern did not change from baseline to endline survey.

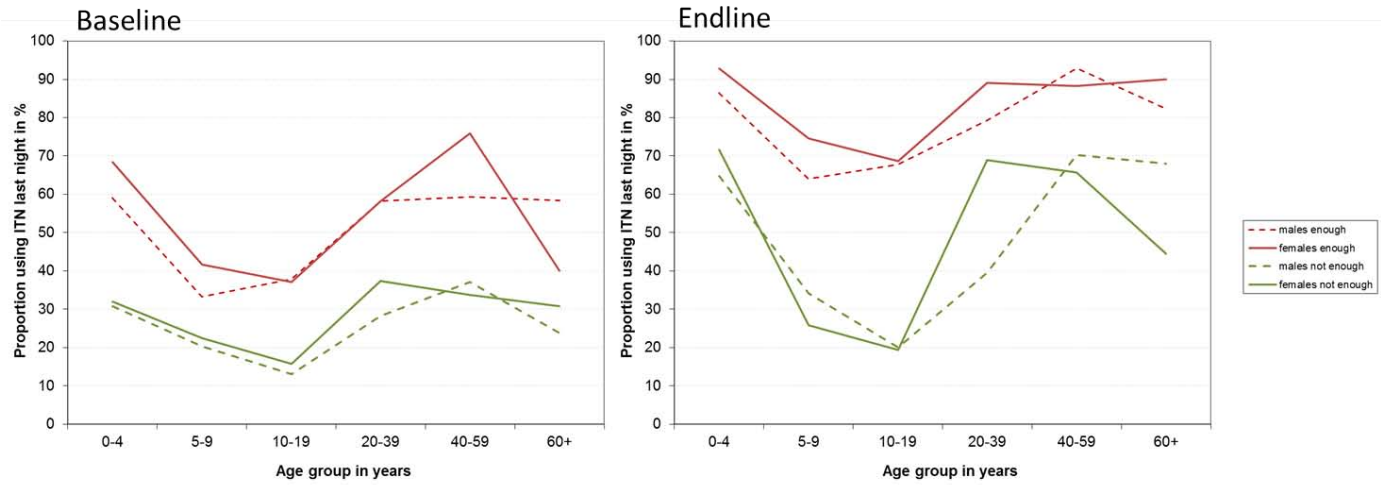
Table 11: ITN access and use by population

Background characteristic	Among all usual members			Among sub-groups		
	With access to ITN*	Used ITN	Using if access	Head	Woman 15-49 years	Child 0-4 years
Baseline						
Estimate	37.9%	22.7%	60.1%	33.3%	28.2%	27.0%
95% CI	33.3, 42.7	18.0, 28.3	55.3, 64.9	26.9, 40.3	22.5, 34.8	19.0, 36.9
Endline						
Estimate	66.2%	53.9%	81.5%	67.7%	62.7%	66.1%
95% CI	61.2, 70.9	49.6, 58.2	76.4, 86.1	62.0, 72.8	57.9, 67.2	60.2, 71.5

* Assuming each ITN used by 2 people

An analysis of ITN use by age, gender and the households ITN supply situation is shown in Figure 17. It confirms that young children and women in reproductive age were prioritized ITN users and also shows for those households with insufficient ITN a “dip” in ITN use for ages 10-19 years. However, at baseline even the use rates for people living in households with enough ITN, which should be above 70% at least, is varying between 40% and 75% and the particularly low use at ages 5-19 years. This clearly changes in the endline survey where for households with enough ITN varied, indeed, between 80% and 90% with only the older children and adolescents showing a slightly lower use but which still was around the 70% mark. Considering only people from households with enough ITN the overall ITN use rate increased from 54.1% (43.3, 64.6) at baseline to 79.7% (76.7, 82.5). Use in households with insufficient ITN was similar to baseline for the 5-19 year age groups but showed marked increases for children under five and persons over 20 (females) or 40 years of age (males) resulting in an overall ITN use increase from 17.0% (13.3, 21.5) at baseline to 32.7% (28.7, 37.1) at endline.

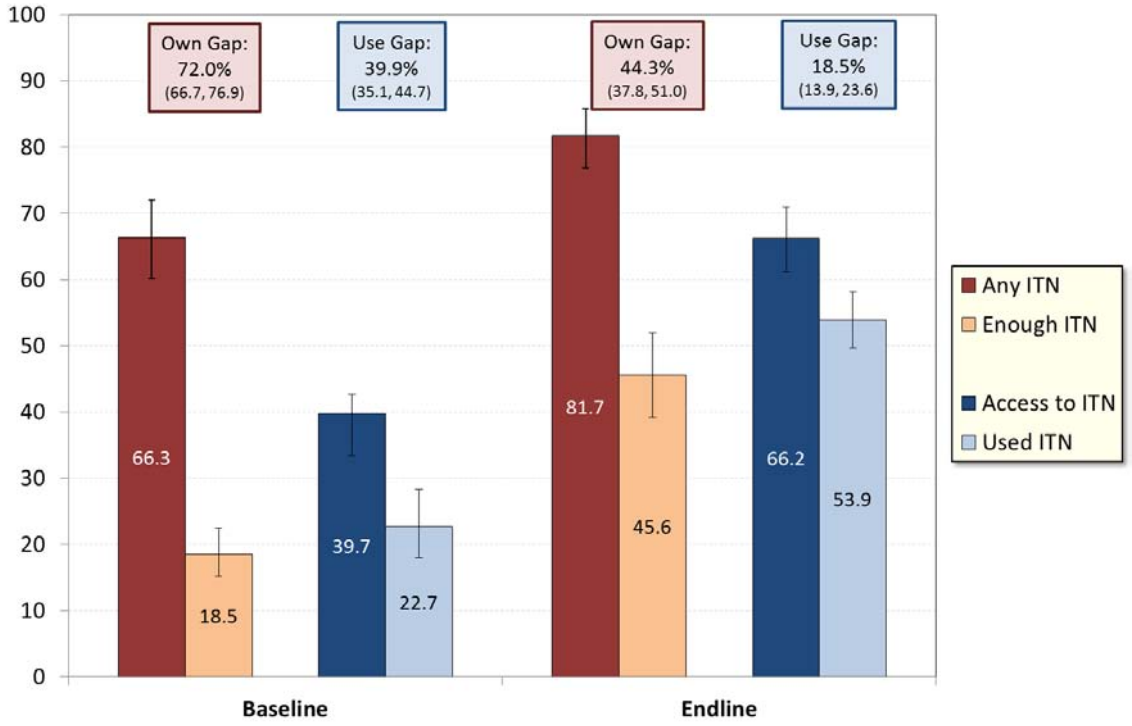
Figure 17: ITN use by age, gender and ITN supply level



Ownership and use gaps

Finally, Figure 18 summarizes the changes between baseline and endline with respect to ITN ownership and use highlighting the two achievements of the pilot: on the one hand a significant reduction of the ownership gap for the minimal coverage gap, i.e. households with no ITN at all (from 34% to 18%) as well as intra-household gap, i.e. households with some but not enough ITN (from 72% to 44%); on the other hand an improvement of the utilization of existing nets reducing the proportion of people with access not using an ITN the previous night from 40% to 19%.

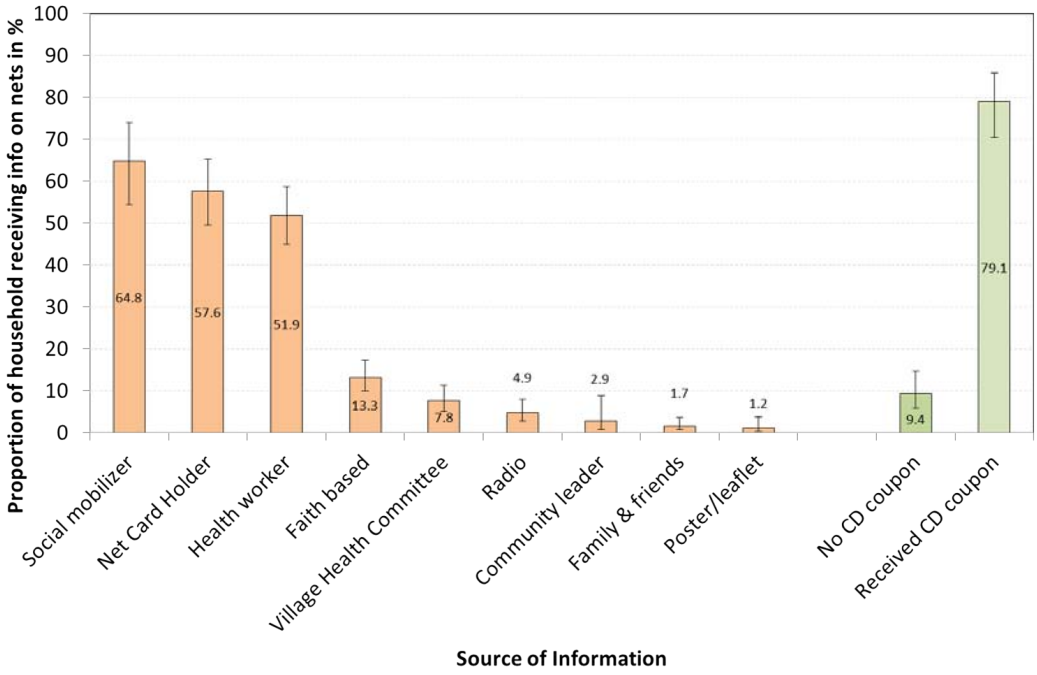
Figure 18: Changes in intra-household ownership and ITN use gaps



Behaviour Change Communication

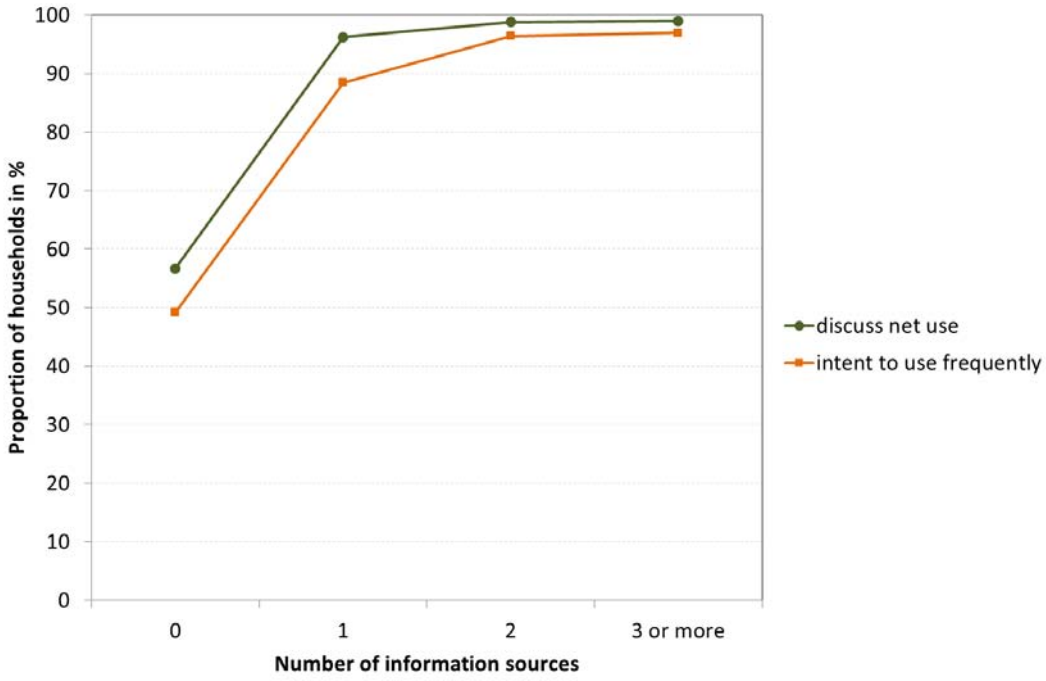
The proportion of households that had received any information on nets and net use in the three months preceding the survey increased from 44.2% (39.5, 49.0) at baseline to 58.1% (49.4, 66.4) at the endline survey. At baseline health workers (33%) and radio (28%) were the most common sources of information followed by community leaders (13%) and family (6%). As shown in Figure 19 this had changed by the end of the pilot period when sources directly or indirectly linked to the community-based programme were the dominant sources of information on nets and net use, particularly the social mobilizers and net card holders. Among the households that received a new net from the community scheme 76% recalled having heard information on net use from one of the volunteers.

Figure 19: Exposure to message on nets by source



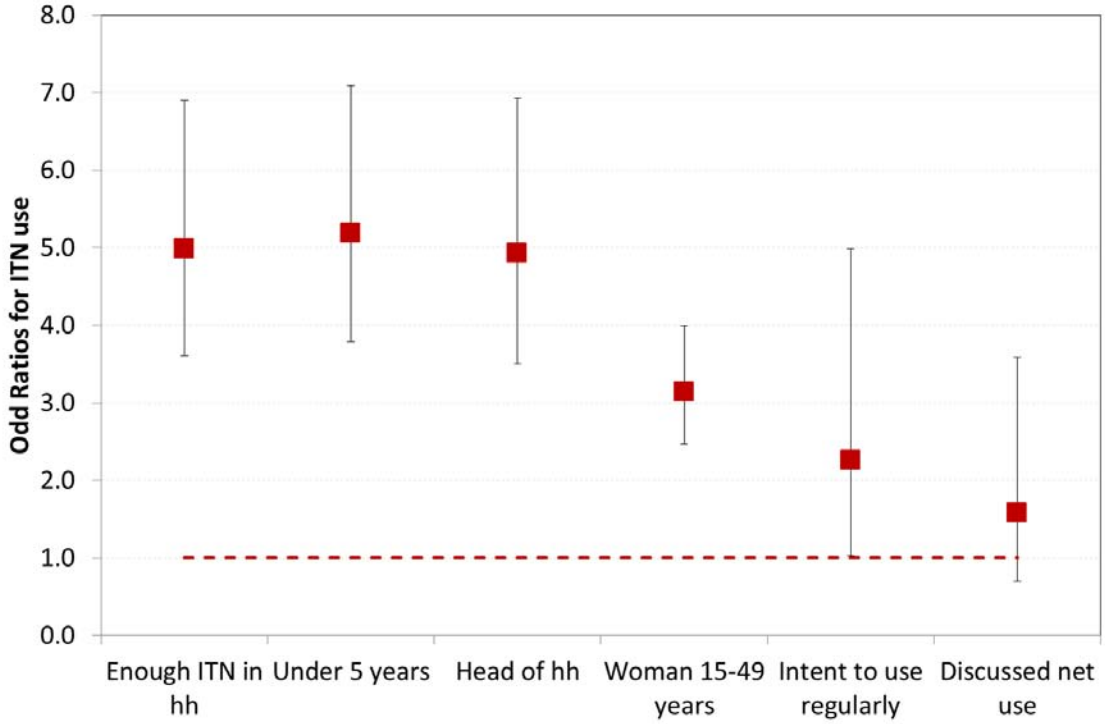
Having heard information on net use was directly associated with reports from respondents that they had discussed net use in their family and their expressed intention to use nets all or most nights (Figure 20). Overall 96% said they had discussed net use in the family and 90% said they intended to use their nets every or most nights. Considering only households with any ITN the difference whether or not respondents had been exposed to any messages or not was 90% vs. 99% for discussing net use ($p<0.0001$) and 78% vs. 94% for intention to use regularly ($p<0.0001$).

Figure 20: Association of number of information sources and intent to use nets



Finally, the impact of BCC and other factors on ITN use by the population was explored in a logistic regression model that controlled for location (Payams) and wealth quintiles and the main determinants are shown in Figure 21. The strongest association with population ITN use the previous night was "being a child of less than 5 years of age" with an adjusted Odds Ratio of 5.2 (3.8, 7.1), "having enough ITN for all" with OR5.0 (3.6, 6.9) and "being head of household" with OR 4.9 (3.5, 6.9). A positive and statistically significant association was also found for "being a women age 15-49" with OR 3.1 (2.5, 4.0) and expression the "intention to use nets regularly" with OR 2.3 (1.0, 5.0). Discussion net use had a positive but weaker association which did not quite reach statistical significance (OR 1.6, p=0.2).

Figure 21: Determinants of population ITN use from regression model



Cost and cost-effectiveness

Total costs of the project were GBP 417,062 or USD 667, 299 of which 73% were provided by DFID and 27% by USAID. These costs include the procurement of LLIN through the project, but not the LLIN that were donated by UNICEF and GFATM. The two evaluation surveys had a total cost of GBP 72,488 or USD 115,981 which represents 17% of overall cost. The total of direct and indirect cost without LLIN procurement was GBP 269,207 or USD 473,931 which corresponds to a cost per LLIN delivered of GBP 10.32 and USD 16.52. However, as shown in the detailed breakdown of cost in Table 12, this includes all international backstopping cost by Malaria Consortium and also the detailed design and planning stage in the seven months preceding the actual project start in January 2012. If only direct costs are considered without the LLIN procurement and without the design phase, cost per LLIN delivered come down to GBP 4.30 and USD 6.87.

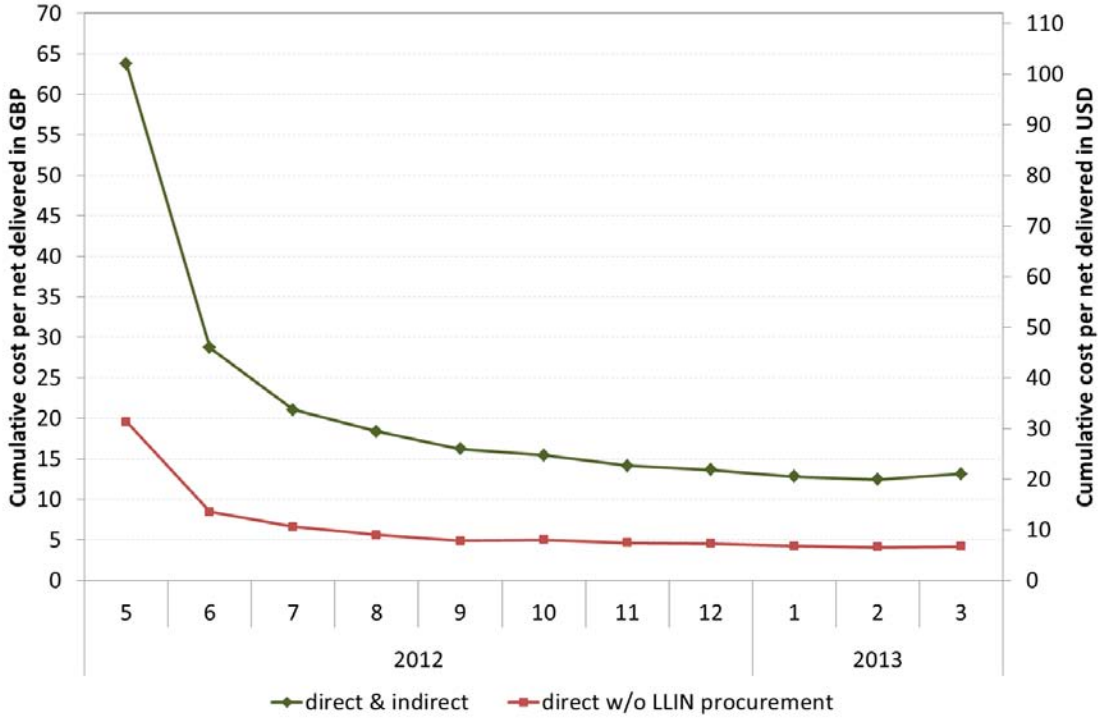
Table 12: Direct and indirect cost of net delivery

Category	Item	GBP		USD		% of direct/ indirect	% of total
		cost	cost/net	cost	cost/net		
Direct cost							
commodity	coupon booklets	4,510.63	0.16	7,217.01	0.25	2.6%	1.3%
	Printer	368.76	0.01	590.02	0.02	0.2%	0.1%
	metal boxes and locks	404.61	0.01	647.38	0.02	0.2%	0.1%
	registry books	2,354.45	0.08	3,767.12	0.13	1.3%	0.7%
	Sub-Total	***7,638.45***	***0.27***	***12,221.52***	***0.43***	***4.3%***	***2.2%***
	LLIN procurement	48,367.22	1.69	77,387.55	2.70	27.5%	14.0%
	Sub-Total	***56,005.67***	***1.95***	***89,609.07***	***3.12***	***31.9%***	***16.3%***
operation	Design and planning	2,293.76	0.08	3,670.02	0.13	1.3%	0.7%
	LLIN storage and transport	16,329.86	0.57	26,127.78	0.91	9.3%	4.7%
	Training, mobilization & BCC	21,315.54	0.74	34,104.86	1.19	12.1%	6.2%
	Supervision	13,617.87	0.47	21,788.59	0.76	7.8%	4.0%
	Stationary & telephone etc	1,042.15	0.04	1,667.44	0.06	0.6%	0.3%
	Sub-Total	***54,599.18***	***1.90***	***87,358.69***	***3.04***	***31.1%***	***15.8%***
	Transport (fuel, car hire etc)	48,444.51	1.69	77,511.22	2.70	27.6%	14.1%
	Sub-Total	***103,043.69***	***3.59***	***164,869.90***	***5.75***	***58.7%***	***29.9%***
NCH & storekeepers	Incentives	13,443.00	0.47	21,508.80	0.75	7.7%	3.9%
	support (airtime stationary etc)	3,116.38	0.11	4,986.21	0.17	1.8%	0.9%
	Sub-Total	***16,559.38***	***0.58***	***26,495.01***	***0.92***	***9.4%***	***4.8%***
	Total w/o LLIN purchase	**127,241.52**	**4.43**	**203,586.43**	**7.09**	**72.5%**	**36.9%**
	Total Direct	**175,608.74**	**6.12**	**280,973.98**	**9.79**	**100.0%**	**51.0%**
Indirect cost							
	Staff	70,510.23	2.46	112,816.37	3.93	41.7%	20.5%
	benefits and per diem	49,618.26	1.73	79,389.22	2.77	29.4%	14.4%
	office cost	22,968.86	0.80	36,750.18	1.28	13.6%	6.7%
	Travel	17,404.16	0.61	27,846.66	0.97	10.3%	5.1%
	management	8,463.67	0.29	13,541.87	0.47	5.0%	2.5%
	Total Indirect	**168,965.18**	**5.89**	**270,344.29**	**9.42**	**100.0%**	**49.0%**
	Total w/o LLIN procurement	**296,206.70**	**10.32**	**473,930.72**	**16.52**	**175.3%**	**86.0%**
	Overall Total	**344,573.92**	**12.01**	**551,318.27**	**19.21**		**100.0%**

Figure 22 presents the cumulative total and direct costs per LLIN delivered highlighting the high start-up cost and decreasing cost per LLIN delivered with the length of the distribution. This suggests that a routine programme at steady-state could be implemented at much lower costs per LLIN delivered. Since this was a “proof of principle” approach cost for BCC and supervision was higher than would be expected in a government run routine implementation over a longer period of time. In addition, external vehicles had to be hired for the supervision activities which caused transport cost to go up to 38% of the direct cost (not including LLIN procurement) equivalent to GBP 1.69 per LLIN delivered or USD 2.70.

The essential cost of coupons, registry books and LLIN transport/storage alone cost GBP 0.84 or USD 1.34 per LLIN delivered and if one assumes that in routine circumstances the cost for training, supervision, and BCC would be 50% of what was incurred in the pilot and would further assume that no incentive would be paid to the store keepers, the operation cost over the nine months of distribution can be estimated at GBP 1.44 or USD 2.31 per LLIN distributed. This suggests that operating cost of less than GBP 1.20 or USD 2.00 could be achieved in a routine implementation setting.

Figure 22: Cumulative cost per net delivered over project duration



Summary of Key Findings and Conclusions

The purpose of this evaluation of the continuous distribution pilot was to describe the feasibility, acceptance and effectiveness of the community-based, demand-driven approach and assess to what extent it contributed to reaching and sustaining universal coverage with ITN. In addition, the effects on net utilization and cost of implementation were also assessed.

The results of the evaluation can be summarized as follows:

1. The implementation of the pilot was smooth with a continuous supply of coupons and LLIN resulting in steady distribution of on average 3,188 LLIN per months over a 10 months period. A total of 30,530 coupons and 28,696 LLIN were issued representing a redemption rate of 94%. Approximately half of the nets were issued because households owned less than one ITN per two people, one third was given to replace torn or lost nets and about 10% were issued to pregnant women who delivered in the village and had not attended ante-natal care services. The LLIN channelled through the community-based distribution channel were equivalent to 11.2 nets per 100 population which corresponds to 13.4 nets per 100 people over a full year which in turn would be sufficient to sustain 80% universal coverage with ITN according to the NetCALC tool based on the estimated population of Lainya County and an assumed median survival of the nets of three years.

2. The two cross-sectional household surveys with a cluster sampling design targeting 600 households each achieved samples of 599 and 597 at baseline and endline respectively. Demographic and socio-economic characteristics of the sampled households and population was very comparable for the two surveys suggesting internal validity and – based on the sampling design – good representativeness for Lainya County. Data also showed a slight decrease in family size from 5.8 to 5.1 persons per household which is thought to be a reflection of a stabilization of the population after an influx of returnees from the North in 2010 and 2011. Some indicators such as access to latrines and mobile phones also showed increasing trends as evidence of progress in the post-conflict consolidation.

3. Generally, the reach and acceptance of the scheme was good with 78% of households confirming they had heard about it. Of these families 96% (or 75% of sampled households) requested a coupon and 96% of them (72% of households) received it. Almost all of those who received a coupon also went to the distribution point to collect an LLIN (99%) and 97% of coupon recipients also received at least one LLIN and on average 2.3 nets per participating family. This represents an overall programme effectiveness of 88% of households aware of the scheme also receiving at least one LLIN. A majority of 88% felt that the eligibility criteria were very fair or fair but some felt that access to the coupon and nets was too far from their homes and this proportion was higher for the distribution of nets (52%) than for access to the Net Coupon Holder (36%).

4. Household ownership of any mosquito net increased by 8 percentage points from 74% at baseline to 82% at endline. A more significant increase of 16 percentage points was seen for ITN which in 99% were LLIN: from 66% to 82% meaning that the general target of “at least 80% of households with an ITN” was reached. The largest increase, 27 percentage points was seen for the proportion of households with “at least one ITN for every two people” which increased from 19% to 46% with another 17% of households having “one ITN for every three people” resulting in 63% of households having enough or almost enough ITN for all household members. This translated into a population access to ITN within their household of 66% at endline, up from 38%. However, the pilot did not result in dramatic over-supply of households with ITN as the proportion of households with one ITN per person or better only marginally increased from 4% to 8% at endline.

5. Also at community level a significant increase in ITN coverage was observed: the proportion of communities that were estimated to have "at least 80% of households with any ITN" increased from 40% at baseline to 83% at endline suggesting a high level of effective community protection from malaria transmission (mass-effect).

6. The ownership gap was significantly reduced during the one year of the pilot with households owning no ITN at all decreasing from 34% to 18% and the proportion of households with some ITN but insufficient for all family members reducing from 72% to 44%.

7. At the time of the endline survey 68% of households had any ITN from the community-based scheme, 15% owned any ITN they had obtained from ANC services, 12% still had an ITN from the previous campaign and 10% had any nets from the commercial market. The community-based distribution was the single most important source of ITN during the pilot with 53% of households only obtaining nets from this source. The results suggest that distribution channels were largely complementary, i.e. they reached different households as 7% only had nets from ANC and 3% from private sector only while 15% of households had ITN from more than one distribution channel. Households that had not received nets from the previous campaign of from ANC were more likely to request a net through the community-based distribution channel further strengthening the evidence that new nets were requested by those who, indeed, needed them and that a "demand-driven" approach can work.

8. Ownership of any ITN slightly favoured wealthier households at baseline (concentration index 0.041[5]) and this remained unchanged at the endline survey (concentration index 0.044). However, poorer households were less likely to request a new net from the community-scheme and in addition received less nets for the same family size compared to wealthier households. This resulted in a stronger pro-rich bias in the proportion of households with enough ITN (at least one ITN per two people) at the endline survey than had been observed at baseline (concentration index 0.144 vs. 0.002). However, this is still an acceptable level of equity and since the distribution mechanisms itself was very equitable (redemption of nets once request for coupon had been made) this short-coming can be easily addressed by intensifying promotion particularly among the poorest households.

9. Hanging and use of ITN improved significantly from baseline to endline survey with proportion of households with any of their net hanging increasing from 78% to 95% and the proportion of nets being used the previous night from 72% to 86%. The use gap, i.e. the proportion of people with access to an ITN not using it the previous night decreased from 40% to 19%. The overall proportion of the population using an ITN increased from 23% to 54% and for households with enough ITN for all members from 54% to 80%. Since both surveys were done at the beginning of the rains (April) these changes can be attributed to behaviour change rather than the effect of seasonal variations.

10. Although heads of household were the sub-group with the highest ITN use, children under five (Odds Ratio 4.9) and women in reproductive age (Odds-Ratio 3.1) also were clearly prioritized, especially if there were not enough ITN in the household.

11. Volunteers of the community pilot such as the social mobilizers (64%) and the Net Coupon Holders (58%) were the most important source of information and key messages about net use together with health workers (52%). There was evidence that this repeated exposure

[5] A concentration index of 0 represents perfect equity, that of +1.0 maximum pro-rich inequity and -1.0 maximum pro-poor inequity.

significantly contributed to improved use behaviour as households with any ITN that recalled at least one source of information on net use were significantly more likely to discuss net use in their family (99% vs. 90%) and to express the intent to use their nets every or most nights (94% vs. 78%). In turn, intent to use nets regularly was directly associated with increased ITN use the previous night (Odds-Ratio 2.3).

12. Overall costs of the project without the survey costs and LLIN procurement were relatively high with GBP 10.32 or USD 16.52 per LLIN delivered of which the direct cost were GBP 4.30 and USD 6.87 respectively. The most essential delivery cost came to GBP 0.84 or USD 1.34 per LLIN delivered and if one assumes that cost for training, supervision and BCC would be only half of the pilot in a routine programme, the running cost can be estimated at GBP 1.44 or USD 2.31 per LLIN distributed.

Conclusions:

- A demand-driven, community-based continuous distribution scheme in Lainya County, South Sudan was successfully implemented without major stock-outs and with a high level of community acceptance resulting in a high participation and very high redemption rate
- Not only were ownership levels from the previous campaign sustained, but also ownership gaps left by the campaign dramatically reduced reaching national targets for “80% of households with at least one ITN” and doubling the proportion of households with enough ITN for all household members
- Although expressed demand by the poorest households was less than that of wealthier families the requests for additional or new ITN came from those households that indeed were in need of ITN and filled the existing gaps without oversupplying ITN
- The community-based distribution complemented other channels such as ANC or private sector with very limited overlap
- Repeated exposure to net use messages through the community scheme contributed to an improvement of ITN use reaching 80% for households with ITN for all family members. The BCC activities also re-emphasized and increased preferential use by under-fives and women in reproductive age in households with insufficient ITN
- Taking into account that this was a “proof of principle“ approach the medium term running cost of a programme based on this design can be estimated at approximately GBP 1.20 or USD 2.00.

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