

Coverage and use of long-lasting insecticide treated nets in Kpone-on-Sea Township, Accra, Ghana: A cross-sectional study

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Abstract

Background: Long lasting insecticide-treated mosquito nets (LLINs) are currently one of the most viable options to prevent malaria transmission in Africa. In Ghana, the National Malaria Control Programme (NMCP) has embarked on a universal coverage strategy to ensure that all members of the population sleep under an LLIN regardless of age or sex.

Objective: This study assessed the NMCP's LLINs distribution and hanging campaign in Kpone-on-Sea Township. It sought to establish the coverage of LLINs in the community and its usage by children < 5 yr. old and in pregnant women.

Methods: The cross-sectional study involved 400 households with heads of the households or their representatives as respondents. Data was collected through questionnaire interviews and observational checklists. Frequency tables were used to indicate proportions and Chi Square test for associations.

Results: Of the 400 households (represented by a head of the household or an adult representative), 93.30% owned any type of mosquito net and 83.75% owned LLINs and 74.92% used it. Households with children less than 5 yr. old accounted for 69.25% regarding ownership and 69.40% regarding usage. LLINs possession by pregnant women was 84.80% while usage was 72.30%. The study also indicated that 73.70% of respondents had good knowledge of malaria, 21.30% had very good knowledge and 5.01% had low knowledge. Furthermore, 89.50% of the respondents had knowledge of LLINs.

Conclusion: The general coverage of LLINs in the community was 83.75% and usage was 74.92% 7 mos after a free distribution and hanging campaign. This provides a useful assessment of NMCP's LLINs campaign in this community and suggests ways for improvement.

Keywords: Ghana, long-lasting insecticide-treated nets, malaria

INTRODUCTION

Insecticide treated mosquito nets are currently one of the most viable options to prevent malaria transmission in large parts of Africa. Looking for practical solutions, the World Health Organization stimulated industry to produce long lasting insecticide-treated nets (LLINs) using new bioactive fabric technologies. Long-lasting nets are treated only once at factory level. The insecticide can resist multiple washes and is released over time to the surface of the netting fibres. The efficacy of the net could last as long as the average lifespan of the net (4–5 yr.) [1]. The insecticide on the LLINs has a repellent effect on mosquitoes and most commonly kills them or has a knock-down effect so that the malaria parasite can no longer be transmitted

even to those not covered by mosquito nets. When used correctly, LLINs have been shown to reduce malaria cases by approximately 50%, effectively reducing all causes of child mortality by 20% [2]. The Ministry of Health, Ghana and its agent, the Ghana Health Service (GHS), has mandated the National Malaria Control Programme (NMCP) to lead in the national effort of reducing the malaria burden in Ghana. The NMCP together with its multi and inter-sectoral partners are making prevention and treatment strategies widely available in every part of the country.

In an effort to quickly boost LLINs coverage and utilization to a much higher level, the NMCP in 2010 switched to mass distribution. This strategy began in May 2010, with a distribution to pregnant women and children less than 5 yr. old in the Northern Region of Ghana. With support from various local and international partners, the NMCP distributed over half a million LLINs. During this campaign, paid volunteers distributed nets

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door-to-door and hung them in recipient households immediately. The effect of immediate hang-up on use is still under study, but it is hoped that the strategy will lead to significantly higher utilization. With increased availability of LLINs, the NMCP switched its strategy to universal coverage; defined as one LLIN for every two people in every household. The objective of universal coverage is to ensure that all members of the population sleep under a LLIN regardless of age or sex. Universal coverage is consistent with the goal of malaria eradication: rather than decreasing morbidity and mortality by protecting only those most vulnerable, universal coverage aims to interrupt transmission by eliminating the human reservoir of parasites [3]. Coverage of entire populations will be required to accomplish large reductions of the malaria burden in Africa. While coverage of vulnerable groups (children < 5 yr. of age and pregnant women) should still be prioritized, the equitable and communal benefits of wide-scale insecticide treated nets (ITN) use by older children and adults should be explicitly promoted and evaluated by NMCP. ITN use by the majority of entire

populations could protect all children in such communities, even those not actually covered by achieving existing personal protection targets of the Millennium Development Goal (MDG), Roll Back Malaria (RBM) Partnership, or the United States of America President's Malaria Initiative [4]. As Ghana strives toward the target of universal coverage, the NMCP has refocused and streamlined their distribution approach to emphasize free mass distribution and hanging campaigns. The Kpone-on-Sea Township has been one of the latest beneficiary communities [5]. It is therefore necessary that, after every free distribution campaign of ITNs, an assessment is done especially regarding coverage, access in remote areas and equity to develop targeted strategies to fill the remaining gaps. There is limited information regarding LLINs ownership and use in Ghana. This therefore presents the need for research to obtain accurate, up-to-date, reliable and valid data on the coverage and consistent use of LLINs in the community especially among pregnant women and children and also to assess how effective the LLINs distribution programme has been.

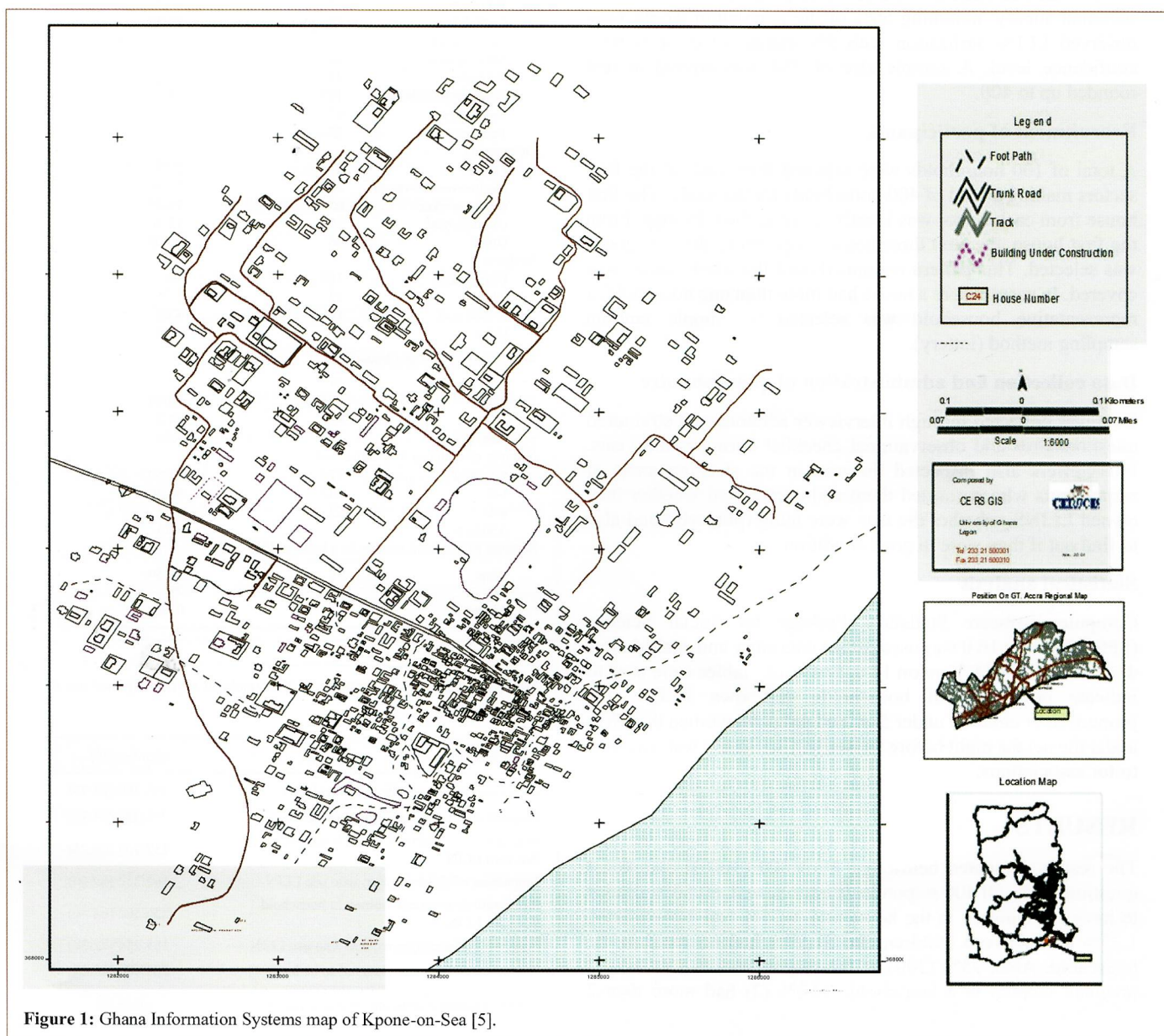


Figure 1: Ghana Information Systems map of Kpone-on-Sea [5].

MATERIALS AND METHODS

Study site and design

This study was conducted at Kpone-on-Sea, a study site developed by the School of Public Health, University of Ghana and mapped by Geographical Information System (GIS) into 4 sectors A, B, C, and D as shown in Figure 1 [5]. This household survey was conducted between May and June 2012 approximately, 7 mos after NMCP's free distribution and hanging campaign. Kpone-on-Sea (pronounced "Pone") is a well-demarcated fishing village situated in Kpone-Katamasno Municipality in the Greater Accra Region.

Study population and sample size

The study population included heads of households in selected communities in Kpone-on-Sea. Data collected prior to the distribution campaign indicated that Kpone Township had a population of 13,097 and 5,931 households (source: focal person of LLIN distribution campaign in Kpone-on-Sea). The required sample size was calculated based on simple proportion for cross-sectional survey: assuming 50% of the population would have observed LLINs utilization with 5% margin of error at 95% confidence level. A sample size of 384 was arrived at and rounded up to 400.

Recruitment of participants

A total of 100 households were selected from each of the four sectors making a total of 400 households for the study. The first house from each sector was identified using the GIS map. From the first house, the next three houses adjacent to the first house was selected. This pattern continued until the whole sector was covered. In cases where a house had more than one household, a representative household was selected by simple random sampling method (lottery).

Data collection and administration of questionnaire

Data was collected through interviewer administered structured questionnaires and observational checklist during home visits. Interviewers also inspected the nets in the sleeping areas of respondents who permitted them and ascertained whether they owned LLINs, whether the nets were hung (properly) and also to find out if they were in good condition.

Statistical analysis

Computer software Statistical Package for Social Science (SPSS) Version 16.0 was used for the data entry and analysis was done using STATA Version 11.0. Frequency tables were used to indicate proportion of households that own LLINs, the proportion of children under 5 yr. and pregnant women that slept under the net the night before the study. Chi Square test was used to for associations.

RESULTS

The results presented below are from 400 (100%) completed questionnaires. Of 400 respondents interviewed, 60.50% alluded to have 1-3 children in the household, 6.75% had 4-6 children, 1.25% had above 6 children and 31.50% had no child in the household. Also, 75% (300) of the respondents had at most 2 pregnant women in a household, 0.50% (2) had more than 2

pregnant women and 24.50% (98) had none as shown in Table 1. As many as 93.30% (373) possessed any type of bed net whilst about 6.70% (27) did not. Also, out of the 373 respondents that own any type of bed nets, 89.80% (335) had at least one LLIN, 7.80% (29) had re-treatable insecticide net, and 2.40% (9) own untreated nets. Upon inspection, 72.25% (289) of ITNs were hung (Table 2).

Table1: Demographic characteristics of respondents

Characteristic	Number (total = 400)	Percentage
Age (yr.)		
< 25	66	16.50
26-35	156	39
36-45	101	25.20
> 45	77	19.25
Sex		
Male	117	29.25
Female	283	70.75
Marital Status		
Single	76	19.00
Married	241	60.25
Divorced	24	6.00
Widowed	17	4.25
Co-habiting	42	10.55
Level of education		
No education	48	12
Primary	49	12.2
JHS/middle school	153	38.2
Secondary	97	24.2
Tertiary	53	13.2
Occupation		
Farmer	9	2.25
Businessman/woman	208	52.05
Public worker	65	16.25
Unemployed	50	12.50
Other	68	17.00
Religion		
Christianity	360	90
Islam	23	5.75
Traditional	16	4.00
Other	1	0.25
Number of people in a household		
1	44	11
2-4	236	59.00
5-7	97	24.25
Above 7	23	5.75
Number of children in a household		
No child	126	31.50
1-3	242	60.50
4-6	27	6.75
Above 6	5	1.25
Number of pregnant women in a household		
None	98	24.50
1-2	300	75
Above 2	2	0.50

Table 2: Summary of proportion of household ownership and use of LLIN

Characteristics	Number (%)
Proportion of households that own LLIN	335/400 (83.75)
Proportion of households that use LLIN	251/335 (74.92)
Proportion of children <5yr. in households that own LLIN	232/335 (69.25)
Proportion of children <5yr. who use LLIN	161/232 (69.40)
Proportion of pregnant women in household that own LLIN	256/302 (84.80)
Proportion of pregnant women who use LLIN	185/256 (72.30)
Proportion of bed nets observed to be hung	289/400 (72.25)

*LLIN, Lasting insecticide treated mosquito

Table 3: Household LLIN possession and usage with socio-demographic characteristic

Characters	All respondents (total = 400)	LLIN Possession n (%)	LLIN Usage n (%)
Age (yr.)			
< 25	66	50 (75.80)	41 (82)
26-35	156	126 (80.80)	38 (30.20)
36-45	101	90 (89.11)	47 (52.20)
> 45	77	69 (89.60)	61 (88.41)
Sex			
Male	117	91 (77.80)	63 (69.23)
Female	283	244 (86.20)	188 (77.05)
Marital Status			
Single	76	57 (75.00)	38 (66.70)
Married	241	210 (87.14)	154 (73.33)
Divorced	24	19 (79.20)	18 (94.73)
Widowed	17	14 (82.40)	12 (85.70)
Co-habiting	42	35 (83.33)	29 (82.90)
Level of education			
No education	48	42 (87.50)	31 (73.80)
Primary	49	45 (91.80)	26 (57.80)
JHS/middle school	153	134 (87.60)	105 (77.40)
Secondary	97	73 (75.30)	57 (78.10)
Tertiary	53	41 (77.40)	32 (78.10)
Number of children < 5yrs in a household			
No child	126	103 (81.80)	90 (87.40)
1-3	242	210 (86.80)	145 (69.10)
4-6	27	20 (74.10)	14 (70)
Above 6	5	2 (40)	2 (100)
Number of pregnant women in a household			
None	98	79 (80.60)	66 (83.50)
1-2	300	254 (84.70)	183 (72.00)
Above 2	2	2 (100)	2 (100)

*LLIN, Lasting insecticide treated mosquito

Possession and use of LLINs in relation to some socio-demographic characteristics of respondents

Age. Majority 89.60% (69) of those who reported to have owned LLINs were above 45 yr. and 88.40% (61) were reported to have used the LLINs they owned. Interestingly, respondents aged up to 25 yr. had a relatively lower possession 75.80% (50) of the LLINs but a relatively higher percentage usage 82% (41) as compared to those in the age range of 26-35 yr. who had the lowest 30.20% (38) usage as shown in Table 3.

Sex. Majority of female respondents (86.20%, 244) owned at least one LLIN, while 77.05% (188) alluded to using it. Their male counterparts however had 77.80% (91) owning LLIN while 69.23% (63) of those who possessed used them. As shown in Table 4, there is significant association between sex and possession and use of any type of net respectively ($\chi^2 = 7.15, p = 0.008$; $\chi^2 = 5.01, p = 0.025$ respectively).

Marital status. With reference to marital status, married respondents turned out to possess the highest percentage (87.14%, 210) of LLIN while those single had the least 75.0% (57). In terms of usage, divorced respondents were reported to have had the highest percentage usage (94.73%, 18) while those single still reported the least proportion in terms of LLIN usage. Marital status had an association with the possession of any type of net but not usage as shown in table 4 ($\chi^2 = 11.63, p = 0.020$).

Children less than 5 yr. old in a household. The survey recorded 274 children in the households which represents 68.50% of households. Out of 274 children 84.70% (232) had LLIN while 69.40% (161) of those who had the net used them as shown in Table 3. Households with 1-3 children recorded the highest possession 86.80% (210) of LLIN while those with more than 6 children recorded the least 40% (2). Meanwhile, respondents with more than 6 children recorded an impressive 100% (2) usage. We observed significant association between households that have children < 5 yr. old and possession of any net ($\chi^2 = 13.39, p = 0.004$) as shown in Table 4.

Pregnant women in a household. There was a total of 302 households with pregnant women recorded in the survey which represents 75.50% of the households. Out of these 302 households with pregnant women, 69.40% (256) possessed at least one LLIN while 72.30% (185) of those who owned the net slept under it as detailed in Table 3. There is an association between households that had pregnant women and possession of any bed net but not usage ($\chi^2 = 11.77, p = 0.003$) as indicated in Table 4.

Knowledge of LLIN. Interviewees responded to questions on whether they had heard about LLINs, through which medium they heard of it, what it is used for and where one can purchase it. Out of 400 respondents, majority 89.50% (358) had heard about LLINs whilst 10.50% (42) had not heard about it. Table 4 indicates a strong association between household heads that have heard about LLIN and possession and usage respectively ($\chi^2 = 4.22, p = 0.040$; $\chi^2 = 18.65, p = 0.001$).

DISCUSSION

The government and other partners including RBM, MDGs for health and United States President's Malaria Initiative goal is to increase ITN coverage and use to 80% in children under five and pregnant women to ultimately achieve universal coverage [4]. In Ghana, for instance, the objective of the NMCP, and its allies is to scale up the distribution of bed nets such that 100% of all households will own at least one treated mosquito net by 2015 [7]. This goal is still far off to be reached in most of the African countries south of the Sahara. This influenced the objectives of this study. We aimed to assess the coverage and use of LLINs in Kpone-on-Sea community.

The findings of the study showed that coverage of LLINs in the community, 7 mos after the free mass distribution exercise was about 84% (335) whilst usage was about 75% (251) in households. Ownership of any type of bed nets among households was an impressive 93.30% (373) while only 6.70% (27) did not possess any net. Among those who owned any type of bed nets 89.80% (335) had at least one LLIN, 7.80% (29) had re-treatable insecticide net and 2.40% (9) owned untreated nets. Household heads that were above 45 yr. had the highest 89.60% (69) possession of the LLIN while households having more than 6 children recorded the least possession (40%, 2). Considering that the level of knowledge or awareness of LLIN was 89.50% (358), it is not surprising that the level of ownership of bed nets is high. This far exceeds the Abuja target of 60% coverage by 2010 and the RBM partnership's Global Strategy Plan to ensuring 80% coverage of people at risk of malaria are protected by the year 2015 [8,9].

Table 4: Association between some factors that influence ownership and use of any bed net

Variable	All respondents (total = 400)	Net possession, n = 373 (93.3%)			Net usage, n = 275 (68.8%)		
		Percentage	Chi Square	p value	Percentage	Chi Square	p value
Age in yr.			5.87	0.118		4.77	0.189
< 25	16.50	87.90			65.20		
26-35	39.00	92.80			64.10		
36-45	25.20	91.80			72.30		
> 45	19.30	96.10			76.60		
Sex			7.15	0.008		5.01	0.025
Male	29.20	88.00			60.70		
Female	70.80	95.40			72.10		
Marital Status			11.63	0.020		7.26	0.123
Single	19.00	85.50			57.90		
Married	60.20	95.90			69.70		
Divorced	6.00	91.70			83.30		
Widowed	4.20	100			76.50		
Co-habiting	10.50	90.50			71.40		
Level of education			5.14	0.273		5.38	0.251
No education	12.00	97.90			68.80		
Primary	12.20	95.90			55.10		
JHS/middle school	38.20	94.10			72.60		
Secondary	24.20	90.70			70.10		
Tertiary	13.20	88.70			67.90		
Number of children in a household			13.39	0.004		5.63	0.131
No child	31.50	86.50			75.40		
1-3	60.50	96.30			66.50		
4-6	6.80	96.30			55.70		
Above 6	1.20	100			80		
Number of pregnant Women in a household			11.77	0.003		1.81	0.404
None	24.50	85.70			72.50		
1-2	75.00	95.70			67.30		
Above 2	0.50	100			100		
Period of net use			9.87	0.020		27.77	< 0.001
All year	52.30	96.70			79.60		
Rainy season	46.00	89.70			57.60		
Dry season	1.70	80			20		
Heard of LLINs			4.22	0.040		18.65	< 0.001
Yes	89.50	94.10			72.90		
No	10.50	85.70			40.50		
Knowledge of malaria			1.75	0.418		2.24	0.326
Low knowledge	5.00	100			70		
Good knowledge	73.70	93.20			66.80		
Very good knowledge	21.30	91.80			75.30		

*LLIN, lasting insecticide treated mosquito.

Generally, it was found that the proportion of households that had pregnant women that owned LLINs was 84.70% (256) which was more than that of children less than 5 yr. old (69.25%, 232) and also a little higher than the general household ownership (83.90%, 335).

Results from this study show a remarkable improvement of ownership of ITN compared to the Ghana Demographic Health Survey's national household ownership of 33%, of which the Upper West Region had the highest 71% while the Greater Accra region had the lowest, 30% [10]. These high ownership proportions particularly for households with children less than 5 yrs and pregnant women are encouraging. This is because these are the most vulnerable groups in a population and must always be protected. In a one-year post-distribution survey to assess the retention and utilization of LLIN in Plateau state of Nigeria, it was reported that ownership coverage with at least one LLIN was 97.90% [11]. This is higher than the results reported in this study and is an indication that ownership of LLIN in our study community could be better. The household possession of any type of bed nets showed a significant association with households that had children less than 5 yr. old ($p = 0.004$). This

finding is consistent with a similar study in Tanzania where it was reported that there was a positive association between children less than five and ITN ownership [12]. An association also exists between possession of any type of bed net and gender ($p = 0.008$). This is similar to results of a study in Nigeria that shows that gender is a predictive factor for ITN ownership [13]. In determining ITN usage, only persons who reported to have slept under a net the night before the survey were considered users of ITNs. Out of 335 heads of households that alluded to possessing at least one LLIN, 74.90% (57) of them slept under it the night before the survey which turned out to be the highest percentage usage. In the study, households that had more than six children and households that had more than two pregnant women recorded 100% usage respectively. Just over two-thirds (69.30%, 232) of households that had children less than 5 yr., who owned at least one LLIN, used it. This is recorded as the lowest in terms of usage in this study. Households that had pregnant women also recorded 72.30% (185) out of 256 that possessed at least one LLIN. Even though the 80% target set by the RBM Programme was not met in this study, there has been a marked improvement in terms of usage when compared to

proportion of usage recorded in the Ghana Demographic Health Survey 2008. In this study just like other surveys conducted elsewhere there is a gap between mosquito net ownership and eventual usage. For example, while ownership of LLIN by households with children less than 5 yr. in this study was 69.25% (232), usage of 69.40% (161) was recorded. A similar nationwide study conducted in Mali reported that at the national level, 81.0% [95% Confidence interval, 78.50-83.50] of households having children less than 5 yr. old had owned at least one LLIN while usage at the national level was 78.50% [14] which is consistent with the trend in this study. Another study conducted in Sierra Leone confirms this assertion where it reports that 6 mos after a free ITN distribution campaign, 87.60% of households own at least one ITN while 76.50% slept under an ITN the night preceding the survey [15]. In search of some reasons for this trend, preliminary studies in a rural area in Burkina Faso revealed that the population used ITNs at high rates for the first few months and then gave it up for non-objective reasons, such as the reduction in the number of mosquitoes and difficulty in fixing the nets [16]. In sharp contrast to the above trend, a study conducted in Bangladesh reported that proportion of households with at least one LLIN increased from between 22-59% to 62-67% over time while they achieved more than 80% coverage in sleeping under an LLIN or ITN in the case of children < 5 yr. old and pregnant women, especially in the high-endemic districts. This goes a long way to confirm that with much effort even more than 80% could be achieved. This study shows an association between whether the respondent had heard about LLIN and usage ($p < 0.001$) which is in line with a study in Zambia [17]. Most of the findings of this study were based on self-reported possession and usage. This is because not all respondents allowed interviewers to enter their sleeping areas to observe if they have the nets and whether they were hung or not. Also, usage was self-reported since most of the interviews were conducted in the evening which was the most convenient time to find household heads or their representatives.

Conclusion

Even though the target of the National Malaria Control Programme of 100% coverage and 80 percent usage of ITN was not met according to the findings of this study, the free LLIN distribution and hanging campaign can be said to be successful. If current coverage and usage levels are maintained and continuous up-scaling and education on the use of LLINs is done, the NMCP's target could be met.

DECLARATIONS

Ethical considerations

Ethical clearance was sought from the Ghana Health Service Ethical Review Committee (GHS-ERC: 53/03/13).

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Competing Interests

No potential conflict of interest was reported by the authors

Author contributions

STD coordinated data collection, analysis and put together this write-up. NC was part of the conceptualization process, assisted

with field data collection, edited, and proofread the manuscript as well. IQ conceptualized and supervised this research.

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Availability of data

Data is available upon request to corresponding author

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