

**A pilot test a methodology for rapidly assessment of mosquito net use in the
Kassena - Nankana District, Northern Ghana.**

Philip Adongo¹
Catherine Reed²
Fred N. Binka³
Joseph Amankwah⁴
Martin Adjuik¹

1 Navrongo Health Research Centre, 2 PATH Canada, 3 World health Organization (WHO), 4 Ministry of Health. Ghana.

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1 Executive Summary

Malaria is a serious barrier to health and development in Ghana and is the main cause of mortality in young children. Interest in treated nets continues to grow as treated nets have been associated with a 17% reduction in all cause mortality in young children in Ghana. Recent studies in Ghana suggest that household ownership of nets is between 9 - 20%, however, the number of children within these samples that were actually sleeping under nets was approximately 20%.

The purpose of this study was to pilot test a cluster sampling (CS) methodology for rapidly assessing the coverage of mosquito nets for children under 2 years in particular, and the general population in an ongoing program area. As part of the monitoring process, other methods such as Focus Group Discussion (FGDs), promotional campaigns and good record keeping system were also used to shape program activities.

Most community members had knowledge about the net and net treatment service but a few people utilize these services as clearly shown by the focus group discussion and the survey. Community members were expecting free nets and treatment services as it happened during the efficacy trial. Another reason advanced for non-purchase of nets is lack of money.

It was noted that income status of women is low and that men control most of the income in the household and would have to take decisions on how to use scarce resources. Women are therefore constrained by their inability to acquire nets or re-treat services without depending on their husbands.

Personal contact was seen as the best mode of communicating messages about nets and net re-treatment services to the community. Itinerant workers were found to be the most effective way to deliver ITN services to the community.

In the CS (cluster sampling), 71% of households owned one or more nets compared to 68.4% in the Simple Random Survey (SRS). In the SRS, the total number of children living in a net owning household was 63.2%. From the SRS male children of this age group were reported to sleep under nets 98.0% of the time compared to 89.6% female children. In the CS, approximately 62.1% of children living in net owning households were reported to be sleeping under nets. Similar to the SRS, there were more males aged children 0-4 sleeping under nets (97%) than females of the same age category (87.6). With respect to the number of people in the household who were sleeping under a net, the difference in proportions between the two surveys was 2.4%, 95% CI = (-9.8% - 5.0%). The sample was subdivided into groups by age and sex; no significant difference was found between the two surveys in terms of net usage except for the age group of 40+ males.

The results from this study suggest that either of the two methods could be used to assess net coverage since there is no difference between the two samples. CS does not

require a rigorous sampling framework and is easier to adopt by district health managers. The CS provides an additional advantage of offering the opportunity to collect information on Expanded Programme on Immunization such as infant immunization coverage and tetanus toxoid immunization of women at little extra time and effort. However, care should be taken when combining surveys for malaria control and EPI, to ensure that equal attention is paid to both areas when training and during data collection. Subsequent studies should further subdivide the under 5 years old into under 24 months to provide detailed information on coverage of this risk group.

2 INTRODUCTION

Malaria is a serious barrier to health and development in Ghana. It is the main cause of mortality among young children. The increasing resistance of plasmodium falciparum to choroquine (Afari et al., 1992) has prompted interest in treated nets as a part of integrated malaria control activities. Treated nets have been associated with a 17% reduction in all cause mortality in young children (6 months - 4 year old) in Northern Ghana (Binka et al., 1996).

Ghana has little recent tradition of mosquito net use. When nets were introduced into the Kassena-Nankana District in 1992, only 4% of the households owned one or more nets. More recent studies in other areas of Ghana show ownership of between 9 - 20%, but only 20% of children in these households actually slept underneath a net (Adongo 1996). However nets and treated nets have been well accepted when they were introduced during the trial (Binka and Adongo, 1997). When considering promoting the widespread use of ITNs, cost is a primary concern. In Ghana, the lack of a tradition of net use and the poor availability of nets in shops around the country are also important factors.

A recent survey (June 1998) has estimated that 68% of the households in the Kassena-Nankana district own one or more mosquito nets, most of them donated during the bednet trial in 1992. The percentage of children sleeping under a net *in net owning households* is approximated to be less than 30%. A similar study from 1996 showed that 93% of households had one or more nets and approximately 50% of children in *net owning households* slept under them.

The Navrongo Health Research Centre (NHRC) has experience with ITNs from the efficacy trial of 1992 - 1994 as well as community assessment from the work performed on Vitamin A supplementation trial and other interventions. With this experience, the NHRC collaborated with PATH Canada to develop and test a collection of tools that can be used in the Kassena-Nankana district and other districts of Ghana to monitor ITN interventions. Particular emphasis was placed on assessing the number of children under five years old that are sleeping under a mosquito net. This target group is the most vulnerable to mortality and morbidity from malaria and has been chosen by the MOH in Ghana (and other interested organizations) as a key indicator for ITN interventions. As ITN interventions move from the research world into the sphere of child health it is fitting that ITN implementers benefit from the lessons learned from other interventions which have also targeted children under five and developed monitoring tools to assess their interventions.

In this study, a cluster sampling technique was piloted and evaluated against a standard simple random sampling method. Also, Focus Group Discussions (FGD), a survey and careful recording system were used to monitor three distinct activities that have been implemented in the Kassena-Nankana district. These included;

1. Selling of mosquito nets
2. Provision of a net treatment service

3. Promotion of the above activities as well as raising awareness of the benefits of treated nets for health and malaria prevention.

These activities are being supported by WHO/TDR through a project evaluating community's willingness to replace and re-treat nets. Nets and insecticides are being actively marketed through three different channels: itinerant vendors, health centres and shops. The survey methodology discussed in this paper is only one of a complimentary set of tools that has been developed to assess these different activities.

There is a growing commitment by the Ghana Ministry of Health (MOH) to actively promote malaria control. The promotion of insecticide treated mosquito nets (ITNs) are an integral part of this strategy. With the collaboration of the MOH, NGOs and donors, ITN interventions are being planned in Ghana. Since most districts will be implementing ITN programs in the near future, knowledge of coverage will help managers to assess performance and develop strategies to increase coverage. The need for rapid, pragmatic and accurate monitoring and evaluation tools that will assist programme managers to assess baseline coverage, plan their activities, monitor progress towards setting goals and providing information to assist in refining activities during the life of the project cannot be overemphasized.

The optimal research tool will be able to assess reported coverage (children sleeping under a net) of children under five years of age in a given population and monitor change in that population. Other methods will then provide information on the factors that influence this coverage rate.

3 DESIGN AND METHODS

3.1 Study Site:

This study was carried out in the Kassena-Nankana district of northern Ghana where a large-scale trial of permethrin impregnated bednet study was conducted (Binka et al. 1996). In addition, ongoing activities are being implemented at the Navrongo Health Research Centre (NHRC) to evaluate the community's willingness to replace and re-treat nets in the district which will include the sale of nets and insecticide.

The district lies within the Guinea Savannah of northern Ghana and covers an area of about 1675km² with population approximately 140,000 (NDSS, 1993). There are two main seasons, a short wet season with an average annual rainfall of 850-1000mm and a dry season from September to May when little or no rainfall occurs.

The people in this area comprise mainly of the Kassena and Nankana peoples and a minority of Buli speaking people. The population is primarily rural, agrarian and live in dispersed settlements. There are no distinct villages as such because village boundaries overlap. Settlement pattern is characterized by extended family living in dispersed compounds surrounded by farmlands.

The district is divided into ten chiefdoms and each chiefdom is headed by a paramount chief. The chiefdoms are also sub-divided into divisional and sub-

divisional areas, each headed by divisional and sub-divisional chiefs. At the sub-divisional level, there is further division into lineage groups.

The lineage is the smallest corporate group and is usually headed by the oldest male member. Most social and political activities take place at the lineage level.

Net usage was about 4% in the community before the start of the impregnated bednet (Gyapong et al.1996). Usage increased to over 90% during the trial (Binka and Adongo 1997).

3.2 *METHODS*

Two methodological approaches were used to pilot test and validate the cluster sampling methodology: a cluster survey and a simple random sample survey.

3.2.1 **Cluster survey:**

The study adopted the WHO EPI cluster survey method because of its usefulness in measuring other health indicators collected at the district level (WHO 1991). The NHRC runs a Demographic Surveillance System (NDSS) which reports the dynamics of the population every quarter to update demographic events. The district has been divided into 244 clusters, with a cluster containing an average of 65 compounds. An average of 570 people live in a cluster. Using the EPI clustering system, the 244 clusters were regrouped into 30 new clusters. Seven mothers with children who were aged between 12-24 months at the date of visit were interviewed in each cluster. One advantage of selecting this age category is to make it possible for District Health Management Teams to also assess EPI coverage during net coverage. Two field workers working together were expected to conduct 7 interviews in a cluster per day. This was judged to be realistic but not punitive allowing for the distances between compounds. There was supervision by a senior researcher from NHRC and a counterpart from the MOH, experienced in EPI survey methods.

The most critical issue for the cluster survey is how to select the first compound (or household) where interviewing will commence. With the assistance of geographic maps, schematic maps and people who are knowledgeable about the locality, the field workers identified a central location within the cluster from which to start. They randomly selected a direction by spinning a pencil from the centre of the cluster. After spinning the pencil, all compounds in the direction of the pencil were walked through and marked with chalk until the edge of the cluster was reached. A random number between 1 and the total of compounds was selected to represent the first compound/household. The interviewers then visited every compound from the starting point until they had found 7 children meeting the criteria for the study. For the purpose of collecting household information on ITN use, each mother or guardian of index child (age 12-23 months) was interviewed. No interviews were conducted in compounds where there were no children aged between 12-24 months. Immunization cards and NDSS ID cards were used to ascertain correct ages and children qualified to be interviewed.

3.2.2 **Random sample survey:**

The Navrongo Demographic Surveillance System covers about 13,000 compounds. From the compound data, a random sample of 400 compounds was selected and all households in these compounds were interviewed. Based on 68% (Adongo 1996)

prevalence of net use in the district, 400 compounds were selected. The software program Stata 4.0 was used for all random calculations for the survey.

3.3 Night observational survey:

In order to validate reported usage with actual usage, a night observational survey was carried out. A random sample of 200 compounds (50%) was selected from the random survey sample for this survey. These compounds were visited by senior field supervisors between 03 30 hours to 06 30 hours to observe actual net usage.

3.4 Focus group discussions:

Focus Group Discussions (FGD) were held with a cross section of the community; men and women who are net owners and non-owners. In all, eight FGDs were held with four net owning groups and four non-net owning groups. Discussions centered on knowledge about net promotional activities and malaria education.

4 RESULTS

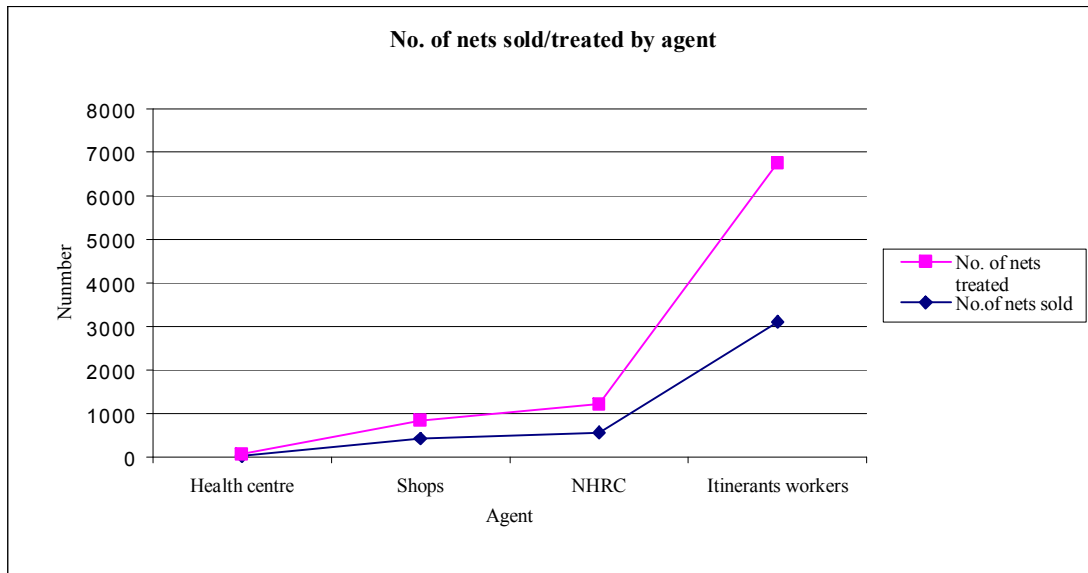
4.1 Monitoring of the Implementation process

The re-treatment and sale of nets started in the first week of July. Thirty Itinerants Workers (IWs), ten shop keepers and three representatives of the health centres have been recruited and trained on how to treat nets and keep good record of nets sold or re-treated. Each person is given 10 nets and 240mls of insecticide to sell at a time (The insecticide is put in small-decanted bottles of 240 mls.) The volunteers are re-supplied after the proceeds from earlier supplies have been paid. Meetings are held with IWs the last Friday of every month to discuss issues arising from the field and the to know the problem they are facing in the field.

There has been a change from permethrin to deltamethrin as the insecticide for net treatment. This change was made for the reason that deltamethrin cuts down the number of treatment in a year from two (with permethrin) to one and also helps solve low re-treatment rate in the dry season when mosquito density is low. Unfortunately, we were unable to buy individual packed insecticide because of availability and cost. The only available individual packed deltamethrin is the tablet and it is sold at 5,000 cedis (\$2.20) which is well beyond the means of most people. We therefore had to buy one litre deltamethrin bottles for the mean time. It is hoped that in the second year of the project, individual doses of insecticide either tablet, sachet or bottle will be used.

For the period under review, a total of 4131 bednets have been sold while 4753 nets have also been treated through the various channels as shown in figure 1 below.

Figure 1:



4.1.1 Health Centres

The three health centres recorded the least sales and treatment of nets. For the entire period under review, about 27 nets were sold and another 41 nets treated as shown in figure 1. Although nets are displayed at the health centres for patients and mothers who are attending antenatal clinic, few nets are sold or treated. The main reason given by the medical assistants for the low patronage of nets at the health centres was that people who come to the health centre for either health care or antenatal reasons usually carry money enough to pay for their medical expenses.

They also do not remember to carry old nets for re-treatment. Despite the recorded low sales and treatment by this outlet, the health centres have been very useful for educating the visiting patients and mothers about net impregnation and net use.

4.1.2 Shops

Compared to the health centres, the ten shops seem to be doing better. The ten shops sold 569 nets and treated 642 (see fig 1). The shops are good channels to get nets to the community since it is easier for them to sell the nets. Discussions with shop owners revealed that it is more profitable selling nets than providing re-treatment services. It was observed that shop owners find selling and treating a net time consuming and the reward from the treatment is so little. The shops are completely not suitable as channels for re-treatment. Just as the health centres, people going to the market are less likely to carry nets for re-treatment. However, the tendency to buy new nets is high because they have enough money to buy nets after the sale of their

products. The shop may be a good avenue to sell individual pre-packed treatment dosage.

4.1.3 Itinerant Workers.

The Itinerant workers so far have proven to be the best mechanism for delivering nets and providing net treatment services to the community. Figure 1 above, clearly demonstrates this as the combined team of 30 volunteers sold 2808 nets and re-treated 3329 nets for the period. Their modus operandi is well suited to what was adopted during the bednet trial that took place in the district five years ago.

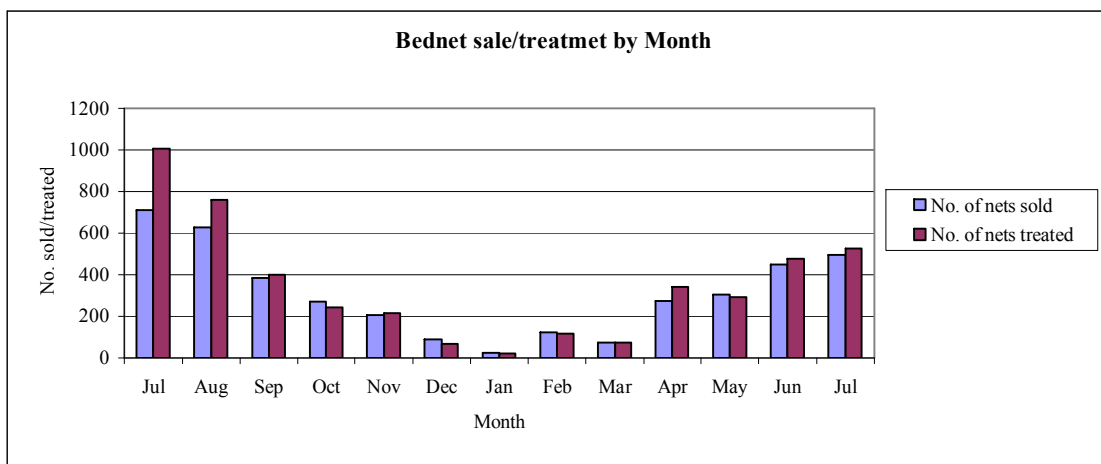
They move either on foot or on bicycle around the compounds in the localities selling and re-treating nets. In addition to moving around compounds, they also visit local markets and sell nets. This system of operation, especially the former, is more suitable to most community members as they are able to re-treat their weak or worn-out nets at their home without showing them to the public. This affords them the opportunity to avoid the embarrassment that would arise if they treat them at the health centre or in the shop.

One major problem we face in dealing with Itinerant workers is the tendency for some to move outside the district to sell nets. A rigorous monitoring system was put in place to check this and four people who were found to be involved in this kind of activity were withdrawn from the study and replaced.

4.1.4 NHRC Premises

Both sale and re-treatment services were also provided at the premises of the Centre. As shown in the figure above, about 437 nets were sold and about 498 nets were treated. The centre's premise is mostly patronized by the staff of the centre, staff of the district hospital and people who come from adjacent districts to buy nets.

Figure 2



4.1.5 Seasonal variation in net sales and treatment

The sale and treatment of nets follow a seasonal pattern. More nets are sold in the rainy season when there is high mosquito nuisance compared to the dry season when mosquito nuisance is low. The rainy season begins in May but nuisance is minimal until from June to September when there are heavy torrential falls and water collects in several bodies ideal for breeding all kinds of mosquitoes. As shown in figure 2 above, sale and treatment picked up in July 1998 when the study was launched to September 1998 where an average of 500 and 700 nets were sold and treated respectively. A similar situation can be observed for June to July 1999. The figure also shows clearly that acquisition and treatment of nets is lowest in the dry season which is from November to April. April seems to be an exceptional month in the dry season.

It coincides with the tomato harvest period and at the same time, it is the period when most rice fields are pounded. People who live around the irrigated areas would therefore buy nets because they have more money.

4.1.6 Problems

1. The main complaint noted is the change from permethrin to deltamethrin. The community has observed that the deltamethrin does not have a strong smell as permethrin. For the community, the smell of the insecticide is associated with its potency and because deltamethrin is odorless, they think it cannot kill the mosquitoes.

2. The volunteers have also complained that work involves moving around compounds and they will need bicycles to do their work effectively. Shortly after sending them to the field, three IWs returned their nets and insecticide because they had no means of transport. The IWs said their work performance will be greatly enhanced if they were mobile.

3. The use of the local FM radio station to create awareness has generated demand across the entire region and people from other districts in the region flock to the Kassena-Nankana district to seek ITNs.

4. Some community members have complained that this is the lean season and they have no money to re-treat or buy nets.

4.2 Promotion

4.2.1 Meeting

Various activities to create awareness about the study started as early as March. First and foremost, six community meetings were held with the chiefs, elders and people of the main study area. During these meetings, the purpose, design and importance of the study were explained to the community leaders. These meetings also gave community members the opportunity to ask questions and seek clarification about the study.

Durbars

The organisation of durbars in the various communities to increase awareness about nets and net re-treatment is ongoing. Four durbars are organized each month in different communities. These durbars are organized with drumming and dancing and

this pulls a large crowd and make them excellent grounds for communicating to the people messages about malaria and net use. During the dubars, a drama on ITNs is enacted and talks on treated nets are given and the community members react to these messages.

4.2.2 Radio announcement

Radio announcements are made three times weekly in two local languages and in English to remind the community of the net sale and treatment services. The announcements also inform community members where they can re-treat their bednets and buy new ones and at what prices the nets are sold and re-treated.

4.3 Impact assessment

4.3.1 Process monitoring

A continuous recording system has been developed at the retailer/outlet level (i.e. with IWs, general shop keepers and health centres) to keep track of nets sold or re-treated and the amount received from the sales. A system has been developed with the accounting office to keep track of all payments and expenses made. Daily log of all sales and any anecdotal evidence regarding the project are also being kept.

4.3.2 Survey

The main study area (for the first year of the study) which forms about a quarter of the Kassena-Nankana district has population of 49,576 with approximately 7,249 households who live in 3,639 compounds. At the beginning of June, preparations were made for the collection of baseline data for the study and this took a period of four weeks.

A total of 300 compounds was randomly selected for the baseline survey and in each compound two households were selected for interviewing. A target of 600 interviews was planned for this survey. Out of this figure, 437 interviews were completed in the 300 compounds. About 27% of the compounds were made up of single households.

Of the 437 households interviewed, 65% (283) had at least one or more nets and the remaining 35% (153) of the households had no nets at all. These two groups are likely to have had nets from the Navrongo Health Research Centre (NHRC) and might not differ from one another in terms of net use. It is also possible that those who do not have nets now were in the treated clusters of the trial and theirs are worn out.

This deduction is based on the fact that over 96% (273) of households with nets reported that they got their nets from the bednet trial carried out by the NHRC, with only 4% buying their nets from other sources. Since these nets have been in existence for the past four years, most of them may either be weak or torn with holes in them due to extensive use over the years and would need to be replaced.

About 12% (33) of households that reported having a net, had purchased at least one net to increase or replace existing nets. For those who did not buy an additional net, 52% said there was no need to buy a net because the net they got from NHRC was still in good condition while 48% mentioned that the price of a net is either too high or they had no money to buy. However, over 92% (255) of respondents who owned a net were willing to replace their nets if it became completely worn out. The main reason given for net ownership was to prevent mosquito bites (94%).

Out of the 283 households that had nets, 32% (95) reported re-treating their nets in the last year and have paid between 600 and 800 cedis (35-40 US cents) for treating a net. Most of these nets were re-treated by Itinerants workers (80%) and the remaining 20% were also treated at the health centre, NHRC and markets within the district. The high re-treatment rate by the itinerant workers may be attributed to the study design of the efficacy trial where a team of workers moved around compounds every six months to re-treat nets. The community is accustomed to this system because they think it saves time.

A total of 181 (66%) did not re-treat their nets during the past year. Of this group of respondents, 118 (64%) reported the insecticide was not available and the remaining 65 (36%) mentioned that they could not afford the cost of re-treatment. Although 98% of this group would like to treat their nets, the amount they offered for one dose of treatment ranged between 200-500 cedis (10-30 US cents) as compared to 1,200 cedis (50 US cents) which is the cost of treating one net currently. This suggests that, although this category of people are willing to re-treat their nets, they are severely constrained by very low income levels. The question that arises from this then is that if they cannot afford the cost of re-treatment, how can they afford the cost of replacing a net? Almost all of these respondents mentioned earlier that they would replace their nets if they became completely worn out.

Of the 153 households that reported that they do not own a net, over 80% reported that they would like to buy a net to prevent mosquito bites (90%). However, about 41% reported that nets were not available and 59% could not afford to buy the nets. Although 80% of the households said they were willing to buy a net, they were prepared to pay an average of 2,000 cedis (under \$1.00) for a net which is far below the current market price of a net which is 12,000 cedis (\$5.00). Again, this shows that nets are desirable in the community but the key issue is the ability to pay for them. People want to use nets but the cost is well beyond their means. A total of 20% of respondents said they would not like to buy a net because the cost of a net was beyond their means.

A total of 28% (123) reported having heard a message about nets and treated nets in the last 6 months. Of this, 37% heard a message from IWS, 21% from health, 12% from friends and 9% from the radio. Another 17% heard a message from other sources.

5 Net use and Coverage Assessment

The surveys all took place during the 1998 rainy season. The Cluster Survey (CS) was conducted between the 4th – 11th of September and the simple random survey (SRS) between the 19th - 30th of September. The SRS questionnaire was longer than the Cluster Survey, however the details of net ownership and net coverage were collected and recorded in the same manner.

In the CS, all 200 interviews were completed out of the expected 210. On some occasions single respondents had to be interviewed for two children either because the children are twins or their mothers were not present at the time of visit.

The information was collected and analyzed by the staff of NHRC and PATH Canada. The data was entered using FOXPRO 2.6 for DOS and analyzed using EPI INFO version 6.0.

The SRS team visited 566 households, in which 35% of the respondents were the head of the household (men) and 46% were women, the remainder were sons, daughters or other family members. In the CS, the 200 interviews were carried out with the child's mother.

In the SRS, 68.4% of the households owned one or more mosquito nets. In the CS 71% of households owned one or more nets. The total number of households visited was 566. From this total, there were 462 children aged 0-4. The percentage of children living in a household with a net was 63.2%. Male children of this age group in net owning households were reported to sleep under nets 98.0% of the time, compared to 89.6% female children from the SRS. In general, with increasing age group, there were fewer people sleeping under nets. For all age groups, 78.1% of females in net owning households slept under nets, compared to 67.5% males.

Out of the 200 households interviewed in the cluster survey, the total number of children aged 0-4 was 248 and 62.1% of the children in all households were reported to be sleeping under nets (Table 2). Similar to the SRS, more males aged 0-4 in net owning households were sleeping under nets (97%) compared to females (87.6). The total percentage of people sleeping under nets in net owning households was 53.9%. Again more females than males were reported to be sleeping under nets (77.4%, 68.4%, respectively).

Table 1. Cluster Survey (CS)

Agegp	Total pop N(%)	Female		Male			
		Net owning pop N(%)	Net Users N	Total pop N(%)	Net Owning Pop N(%)	Net Users N	Total N(%)
0 – 4	128 (60.9)	89 (87.6)	78	120(63.3)	78 (97.0)	76	248 (62.1)
5 – 15	143 (58.0)	111 (74.7)	83	133 (57.8)	107 (71.9)	77	276 (58.0)
16 – 39	203 (54.6)	145 (76.0)	110	122(28.6)	82 (42.6)	35	325 (44.6)
40+	58 (53.4)	46 (67.3)	31	74 (51.3)	63 (60.3)	38	132 (52.3)
Sub total	532 (56.9)	391(77.4)	303	449(50.3)	330 (68.4)	226	981 (53.9)

Table.2 Simple random survey (SRS)

	Female	Male
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Agegp	Total pop N(%)	Net owning pop N(%)	Net Users N	Total pop N(%)	Net Owning Pop N(%)	Net Users N	Total N(%)
0 – 4	227 (60.8)	154 (89.6%)	138	235 (65.9)	158 (98)	155	462 (63.2)
5 – 15	369 (50.4)	247 (75.3%)	186	362 (51.3)	244 (76)	186	731 (50.8)
16 – 39	520 (54.0)	350 (80.3%)	281	317 (34.3)	213 (51)	109	837 (46.5)
40+	230 (49.6)	170 (67.1%)	114	260 (33.8)	182 (48)	88	490 (41.2)
Sub total	1346 (53.4)	921 (78.1%)	719	1174(67.8)	797(67.5)	538	2520 (60.6)

The NS visited 192 households all known from the SRS. These compounds were visited between 3.45 am and 6.30 am and the mean time of visits was 5. 00 am. During the visits, 72% of households were seen to have used their nets.

The SRS in particular collected other data which are very relevant to the interpretation of the ownership and usage of treated nets as shown in table 3.1 below.

Table 3.1 Occupation of respondents

Occupation	General population n = 566	'New net purchasers' n = 16
Farmers only	68%	25%
Trader artisan (usually supplementing arming)	23%	63%

Table 3.2 Wealth indicators

Ownership within the household	General population n = 566	'New net purchasers' n= 16
Bicycle	59%	100%
Radio	43%	93%
Coal pot	40%	81%

The SRS also asked two questions to assess the coverage of the promotional activities. When asked if the respondent had heard or seen any message about nets or net treatment in the past 6 months, 51.4% (n = 291) they stated their sources as being a shown in the table;

Table 4: Sources of information about treated nets

Source	Frequency	Percentage
Health Center	138	48%
Radio	64	22%
Friend	38	13%
Health worker	23	8%
Visiting NHRC	15	5%

5.1 Results of the random sample survey versus the cluster survey

From table 1 and table 2, net usage is given as a proportion of net-owning population. To assess whether the two surveys give different results, we calculated the differences in proportion by survey and included the confidence intervals of these differences for the stratified and overall results (Kirkwood, 1990). The results from the surveys will be different if the 95% confidence interval do not include zero. If 95% interval includes zero, then it implies that the results of the two surveys are comparable at the 95% confidence level.

Table 5. Comparison between the results of the simple random survey and the cluster survey on usage

Agegrp	Female		Male	
	Diff (%)	C. I.	Diff (%)	C.I.
0 - 4	2.0	(-4.8, 8.8)	1.0	(-2.1,4.1)
5 - 15	0.6	(-7.0, 8.2)	4.1	(-3.5,11.7)
16 - 39	4.2	(-1.7,10.1)	8.4	(-1.1,17.9)
40+	-0.3	(-10.3,9.7)	-12.3	(-22.6,-2.0)
Overall	0.7	(-3.1,4.5)	-0.9	(-5.5,3.7)

5.2 Net use and factors that affect net use

Users of insecticide treated nets said they are desirable to use both in the dry and rainy seasons. The use of nets was associated with a reduction of mosquito nuisance and provision of good night sleep. The most important issue is that ITNs are seen as a means to good health as frequent use leads to less or no malaria attacks. Although users of the nets recommended the repelling power of insecticide, they complained about its smell and the irritation that it causes. As one discussant claimed, nets can cause catarrh:

“I have realized that those who are sleeping under treated nets have not had malaria attack this year, meanwhile, I had three attacks because I am not sleeping under a net.”

“Treated nets are more effective in malaria prevention. The insecticide repels the mosquitoes and also stays longer in the net. The scent of the insecticide is not good, it can even give you catarrh. Those who have sense of smell can not sleep under the net for the very first few days after treatment.”

On the other hand, non-users had little to say because of their limited experience with nets during the efficacy trial. The non-users have not bought new nets since the nets they received during the trial. Although these people are not using nets, they are aware of the protective nature of ITNs against mosquito nuisance and prevention of illness and malaria in particular. Most non-users would have wished to own a treated but the main reason given for the non-use in the community is lack of resources to buy a net.

In rural communities where income levels are very low, people prefer to spend their little income on food. People complain that the cost of the net is high and even *second hand nets* are far cheaper than the nets NHRC sells. The lack of income to purchase a net is not limited to only non-users but extends to even users. Some users have fewer nets than their family size require but they are unable to acquire more nets because of low levels of income. For this reason, people resort to other alternatives such as mosquito coil and aerosols. A discussant captures this vividly:

“Others prefer the insecticide (aerosol) to the net because they cannot buy nets for the whole family. But when you spray a room many people can sleep in it but a net only one or two people. Besides that, the insecticide spray is cheaper.”

Discussants acknowledged the importance of providing nets for all children to sleep under but also remarked that it is necessary for everybody to sleep under a net because of its protective ability. However, low income and poverty do not allow everyone to be covered.

5.3 Malaria education:

As part of the ongoing evaluation of community willingness to replace and retreat ITNs, various IE&C activities have been put in place to educate and increase community awareness about malaria and 'where and when' to obtain net re-treatment and new nets. These activities include the use of local FM radio station to make spot announcements, drama performances during durbars in the community and door-to-door canvassing by itinerant workers in the communities.

One of the most popular means of passing information to the community about ITNs was by personal contact through the itinerant worker. Communities are generally pleased with the work of the volunteers and their frequent visits prompt the re-treatment of their nets. However, their visits were not always recalled as occasions where information on malaria prevention was passed on. Dramas performed locally were also rated very high though only two out of the eight focus groups sessions were in an area where a drama had taken place. There was considerable recall of the messages given during the performances and even the name of one of the main characters. A number of respondents talked about 'seeing' evidence of the use of ITNs and expressed that they considered live drama better than radio drama that lacks visual images. However, one respondent mentioned that the time of the year would determine whether a community was free to spend time watching dramas as pointed out below;

“We all saw how Abachegetam (character in drama) used his money on drink and the whole of his family was sick with malaria. The lesson is simply prevention is better than cure. Protecting yourself against malaria is better than going to hospital and paying heavily for drugs.”

“The play is more effective. In the radio programs you don't see how people behave, but in the play you can relate it to real life, especially the fun that accompanies the irresponsible behaviour of characters like Abachegetam, who refused to buy nets. What we saw in the play is better than the radio.”

A few people had also heard something on the radio and could recall with some detail information given; for example that NHRC would no longer be giving away nets.

Many people heard that there was something on the radio but that either they did not own a radio (a common response) or that they did not hear everything that was broadcast. Only one respondent mentioned hearing 'messages concerning malaria from a health centre'. A number of respondents acknowledged that they had learned new things but...

"The play has opened our eyes. We have heard about this, but the poverty does not make us act as we have heard the message."

5.4 Net treatment:

Most net owners knew that they could have their nets treated by community sales agents. The male respondents demonstrated some knowledge about net treatment whereas the female respondents (even net owners) were far more vague. The female respondents did not seem to associate someone coming to their door to treat their net with a 'sales agent'. The men linked the sales agents with NHRC and stated that this gave them a degree of credibility.

"Your workers came round here with the chemical and impregnated the nets for us. You gave us the nets and we impregnate them only with your workers. If a different person comes with his / her chemical we will not impregnate our nets from them, because we do not know the source of the chemical."

However many respondents stated that though sales agents came offering net treatment, often they left not having treated any nets. The cost of treatment was the most common reason given for failure to treat. No one mentioned the logistical difficulties of treating a net (i.e. getting it down, washing and drying it etc).

"It is good that they used to come and treat our nets but because we don't have money, they don't come and treat for us again."

Non net owners frequently stated that as they had no net, 'why would they be interested in net treatment'.

5.5 Community perception about net treatment, sale and promotional activities

Men appeared to be more aware of where nets are sold and at what price. Male net owners were more informed than non-net owners. Those that knew where nets were on sale named sales agents, NHRC, the market and specific shops as places to purchase nets. Female respondents tended not to know details and appear to have very little interest, though this was stated as being because they could not afford to buy them as observed by one female respondent;

"We don't know where they sell them. They say there are some in the market, but we don't have money so we don't go there."

The prices given were largely correct, at 12,000 cedis (about \$5), however it should be noted that in one community a number of respondents had some grievances against nets being sold in local shops.

“It is because they have given nets to the shop owners to sell, that is why they shoot up the price... we appeal to them to limit the sales to only their community agents, and reduce the price so more people can buy.”

“The Store inflates the price to 20,000 cedis. Today some nets in stores are selling for about 20,000 cedis. We don't know where they get the nets.”

5.6 Benefits and side effects of net treatment

There were interesting results from questions asked to net owning groups about their perceptions of net treatment. The male groups more often mentioned that treated nets prevented 'malaria' than female groups. Only one female group mentioned net treatment prevented 'sickness' and improved health and that treated nets were especially beneficial to children.

“When they soak the net it brings health. We ourselves don't get sick and the children too don't fall sick.”

“We like it because we can cover the children with it, it prevents mosquitoes from biting so we will not get the sickness they call malaria.”

A number of participants from three out of four groups mentioned that use of nets could be produce warmth however a number of respondents gave very rational explanations for their comments and few said that feeling warm in a would stop them from using nets.

“When the weather is warm it is uncomfortable to be in it. But when the weather is cold you don't need a cloth any longer.”

One respondent mentioned that the use of four Milo tins and sticks enabled him to easily move his net to sleep outside, or onto the roof. The small size of nets was mentioned a number of times as a factor contributing to the discomfort of sleeping under a treated net. This is said to lead to more wear and tear. One man also suggested that a net hindered other nocturnal pursuits.

6 DISCUSSION

Coverage is seen as one of the most important means of monitoring net use. Whereas this is relatively easy to achieve in trial situations (NIBP 1993), it is sometimes difficult for program managers at the district level to monitor coverage. The issue of selecting accurate samples for conducting surveys has been a problem in most districts because of non-existing good sampling frames. The NHRC provides an ideal situation where a simple random survey could be compared to a cluster survey because of NDSS data source. In addition to this, the cluster survey provides a rapid and accurate knowledge of net use and coverage by households and by age group

especially the 0-4 year group considered most vulnerable to malaria. It also helps program managers to set realistic target for sales and re-treatment for subsequent years and estimating coverage of net use on the most vulnerable groups.

The results from the surveys suggest that there was no difference between the proportion of households owning one or more nets as presented in the SRS and CS respectively. The difference between the two proportions is 2.4%, 95% CI = (-9.8% to 5.0%).

It will be noticed from table 4 that the stratified analysis of the difference between proportions of the two surveys, except for the age group 40+ for the males, show that there is no significant difference between the methods in terms of estimated prevalence of net usage. One method could be used instead of both. If logistically one survey is more superior, then there is good reason to carry out that type of survey rather than the other.

Conducting a CS does not require a rigorous sampling framework and it is easier to be adopted and used by district health managers. The CS will provide district managers an added opportunity of collecting information on Expanded Programme on Immunization (EPI) such as infant immunization coverage and tetanus toxoid immunization of women. Although the CS data were processed and analysed by using computer packages (FOXPRO 2.6 for DOS and EPI INFO version 6.0.), this can be done manually. It is quite possible to tabulate the population and coverage figures by hand. It is anticipated that the CS can be used with a sample size of 210 for communities with a high or low net use. On the other hand, when conducting a SRS the sample drawn must be according to the approximate percentage of existing net use.

However, care should be taken when combining surveys for malaria control and EPI. Programme managers must ensure that equal attention is paid to both areas during training and at the stage of data collection. Although this survey did group children under 5 years of age together, it would be important that subsequent studies subdivide the under 5's into under 24 months as well as the under five's in order to provide detailed information on coverage of risk group. It is important to note that using the cluster survey technique to collect data on ITN coverage may result in getting less than the expected 210 interviews. This could occur if several mothers have twins or other household members have to stand in for children whose mothers are not at home at the time of interview. To overcome this issue, it may be necessary to over-sample in order to obtain the required 210 interviews for the ITN coverage analysis. The minimum number of clusters required for the cluster survey is thirty, this could be increased in areas of low net usage to minimize bias.

In communities where baseline socio-demographic information does not exist, it will be essential that the opportunity be used to get quantitative data on the characteristics of different strata of the population. A baseline approval may be designed to identify current net users, or in the case of areas where net programme exist, new net purchasers and the evaluation of the scale IEC promotion campaign and details of coverage would be useful information to collect.

Although most FGD participants had some knowledge about where to get nets and net treatment service, a clear message that came out of the FGDs was that men are more informed about net treatment and sale services than women. The same can be said for net owning households as against non-net owning households. The probable reason for this could be that women income status are low and that men control most of the income in the household and would have to take decisions on how to use scarce resources. Women are therefore constrained their inability to acquire nets or re-treat services without depending on their husbands. Personal contact was seen as the best mode of communicating messages about nets and net re-treatment services to the community.

Most community members are aware of the sale and treatment of nets in the community but a few people utilize these services as clearly shown by the focus group discussion and the survey. The main reason advanced for this, is that, during the efficacy trial, nets were given free to both the treated group and later to the control group and therefore people still expect to receive them free.

Another reason given for non-purchase of nets is lack of money. For rural African communities where resources are limited, buying a net over \$5.00 is a very big investment and drain on the family income and to overcome this, alternative net production mechanisms such as locally made and sewn nets should be considered in order to make prices cheaper and affordable to all.

The rigorous monitoring processes of going activities led to new ideas that helped the program to refine and redefine its strategies. The focus group discussions and other monitoring activities suggested that people need to be reminded at regular intervals about net and net treatment services which is well done by the itinerant workers. The shops were noted not to good avenues to do re-treatment as compared to itinerant workers as the shops are more profit oriented. Meetings were held with shop owners to discussion these issues. They were encouraged to talk to people about the services they provide. Information gathered from the various monitoring processes indicate that the itinerant workers are the most efficient and desirable channels of providing ITN services to the community. This is an important information to program planners and implementers. However, it also important for further studies to be done on the cost of providing this service by itinerant workers.

The confidence interval for the difference between two proportions is given by

$$c.i. = (p_1 - p_2) \pm 1.96 * \sqrt{((p_1(1-p_1)/n_1) + (p_2(1-p_2)/n_2))}$$

where

p_1, p_2 are the two proportions

n_1, n_2 the sample populations of the two proportions

1.96 is the 5% point of the standard normal distribution. The table below shows the results;

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8 Appendix A - SURVEY INDIVIDUAL QUESTIONNAIRE

NAVRONGO HEALTH RESEARCH CENTRE
BEDNET SURVEY INDIVIDUAL QUESTIONNAIRE

Name of interviewee _____

CPD NAME/ID										COMP-ID
PERMANENT ID OF INTERVIEWEE										PERM-ID
DATE OF INTERVIEW										DINT
FIELD WORKER CODE										FW
NO	QUESTIONS	ANSWER OPTIONS		CODE						
1	Are you the head of the household? IF YES GO TO QUESTION 3.	Yes.....1	No.....2	HHOUSE						
2	What is your relationship with the head of the household?	Spouse.....1	Son.....2	Daughter.....3	Other.....4					
		NA.....8	RHOUSE							
3	What is your occupation?	Farmer.....1	Trader/artisan.....2	Civil servant.....3	Other.....4					
		OCCUP								
4	Does any one in this household own a bicycle?	Yes.....1	No.....2	BICY						
5	Does any one in this household own a radio?	Yes.....1	No.....2	RADIO						
6	Does any one in this household own a coal pot?	Yes.....1	No.....2	POT						
7	Have you heard or seen a message about nets and net dipping in the last 6 months?	Yes.....1	No.....2	MESS						
8	From what sources did you hear or see this message	Radio.....01	Posters.....02	Drama.....03	Durbars.....04					
		Health Centers.....05	Health Worker.....06	Friend.....07	Visiting net treating person.....08					
		Other.....09	NA.....88	SOUR						

9	Do you know where you can re-treat and buy nets from in your area?	Yes.....1 No.....2	NET
10	For how much does it cost for dipping a net?	_____	DCOST
11	For how much does a net cost?	_____	NCOST

Now I would to find out about our family?

Age	Female	male
0-4		
5-15		
15-39		
40+		

13	Does your household own any mosquito net? END INTERVIEW IF HOUSHOLD DOES NOT OWN NET.	Yes.....1 No.....2	OWN
14	How many nets do you have?	One Two Three More than four	MNET

Which members of family sleep under the a mosquito net which was bought the last year?
[Indicate them a circle]

Which members of family sleep under the a mosquito net which you owned for longer than a last year? [Indicate them a triangle]

Age	Female	male
0-4		
5-15		
15-39		
40+		

9 Appendix B – Focus Group Discussion Guidelines

Focus Group Discussion Guidelines - for net owners

We know that all the people here at least one mosquito net in their house. We would like to ask you a few questions about you nets and would appreciate you been open to us.

Net Usage

What are some of the things you like *and* don't like about using a net?

In your homes who usually sleeps under a mosquito nets? (Probe for children, older people and pregnant women).

What time of the year are nets most often used? And why?

Net treatment

How can you get nets treated in your community? [Probe knowledge of IWs/SH/HC].

What did you like about the services of [IW/SH/HC] that you used? Are there any problems with the net treatment services? [Probe about how services could be improved].

When do you think is the best time of the year for net treatment? Why?

What are the things you like *and* don't like about putting insecticide on your net?

Some of you not treated your nets this year, why is it that you have not treated your nets? Is there anything that will make you decide to treat your nets next year?

Promotional

Have you seen any of these posters before? [show sets of posters], if yes where? What did the posters tell you?

Have someone come to your house to tell about malaria and sell treated nets to you?

Have you seen a drama about malaria and treated nets? if yes, what was it about?

Have you heard a radio show about malaria and treated nets? if yes, what was it about?

Have you attended a durbar about malaria and treated nets? if yes, what was it about?

Net replacement

What do you do when your net becomes torn?

Do you know where you can buy nets from? And how much?

What are some of things that stop people from buying new nets?

10 Appendix C - FGD Questions for non-net owners

FGD Questions for non-net owners

1. We know that there are people around here who have mosquito nets but you don't have. Do you know where mosquito nets are sold?
2. What is the reason for people not buying mosquito nets?
3. Have you spoken about the money. Is it because of the money or you don't see it as necessary to have a mosquito net or because they are not available?
4. There are some people around your area who have mosquito nets but you don't have. Can you tell us what the reasons are that you don't have.
5. In this locality who are the people who sleep under the nets. Is it the children, adults or pregnant women?
6. What time in your area do you think many people like to sleep under mosquito net? What time of the year do most people often sleep under mosquito nets?
7. We have heard what you said so far, but why are there so many mosquitoes at the time you have spoken.
8. What do you know about the medicine used to treat the mosquito nets? What help does it give you?
9. Did they tell you it wasn't good?
10. Did someone come to your area to talk about malaria and to sell mosquito nets?
11. Did they come into your houses to speak to you about them?
12. Where do you send your net for treatment?
13. Have you watched or heard of a play that talks about malaria and treated nets?
14. Have you heard in the radio a talk about malaria and treated nets?
15. Some of you said you heard the play on radio and others say it is other people who spoke to you about this. Which of these do you prefer?
16. Is it the play you want or the talk?
17. When did you hear the radio talk?
18. What did they talk about?

11 Appendix D - Draft paper for publication in peer review journal

Draft paper for publication in peer review journal

To develop, pilot test a methodology to rapidly assess the use of mosquito nets in the Kassena - Nankana District, Northern Ghana.

Philip Adongo¹
Catherine Reed²
Fred N. Binka³
Joseph Amankwah⁴
Martin Adjuik¹

1 Navrongo Health Research Centre, 2 PATH Canada, 3 World health Organization (WHO), 4 Ministry of Health. Ghana.

Abstract

Malaria is a serious barrier to health and development in Ghana, and is the main cause of mortality in young children. Interest in treated nets continues to grow as treated nets have been associated with a 17% reduction in all cause mortality in young children in Ghana. Recent studies in Ghana suggest that household ownership of nets is between 9 - 20%, however, the number of children within these samples, actually sleeping under nets was approximately 20%. The purpose of this study was to pilot test a cluster sampling (CS) methodology for rapidly assessing the coverage by mosquito nets of children under 2 years, in particular, and the general population.

In the CS, 71% of households owned one or more nets, compared to 68.4% in the Simple Random Survey (SRS). In the SRS, the total number of children living in a net owning household was 63.2%. From the SRS male children of this age group were reported to sleep under nets 98.0% of the time, compared to 89.6% female children. In the CS approximately 62.1% of children living in net owning households were reported to be sleeping under nets. Similar to the SRS, there were more males aged 0-4 sleeping under nets (97%) than females (87.6). With respect to the number of people in the household who were sleeping under a net, the difference in proportions between the two surveys was 2.4%, 95% CI = (-9.8% - 5.0%). The sample was subdivided into groups by age and sex, no significant difference was found between the two surveys in terms of net usage, except for the age group of 40+ males.

The results from this study suggest that either of the two methods could be used to assess net coverage, since there is no difference between the two samples. CS does not require a rigorous sampling framework, and is easier to adopt by district health managers. The CS provides an additional advantage of offering the opportunity to collect information on Expanded Programme on Immunization, such as infant immunization coverage and tetanus toxoid immunization of women at little extra time and effort. However care should be taken when combining surveys for malaria control and EPI, to ensure that equal attention is paid to both areas when training and data collection. Subsequent studies should further subdivide the under 5 years old into under 24 months to provide detailed information on coverage of this risk group.

Introduction

Malaria is a serious barrier to health and development in Ghana. It is the main cause of mortality among young children. The increasing resistance of plasmodium falciparum to choroquine (Afari et. al., 1992) has prompted interest in treated nets as a part of integrated malaria control activities. Treated nets have been associated with a 17% reduction in all cause mortality in young children (6 months - 4 year old) in Northern Ghana (Binka et al., 1996).

Ghana has little recent tradition of mosquito net use. When nets were introduced into the Kassena-Nankana District in 1992, only 4% of the households owned one or more nets. More recent studies in other areas of Ghana show ownership of between 9 - 20%, but only 20% of children in these households actually slept underneath a net (Adongo 1996). However nets and treated nets have been well accepted when they have been used (Binka and Adongo, 1997). When considering promoting the widespread use of ITN's cost is a primary concern. In Ghana, the lack of tradition and the poor availability of nets in shops around the country are also important factors.

A recent survey (June 1998) has estimated that 68% of the households in the Kassena-Nankana district own one or more mosquito nets, most of them donated during the bednet trial in 1992. The percentage of children sleeping under a net *in net owning households* is approximated to be <30%. A similar study from 1996 showed that 93% of households had one or more nets and approximately 50% of children in *net owning households* sleep underneath them.

The Navrongo Health Research Centre (NHRC) has experiences with ITN's from the efficacy trial of 1992 - 1994 as well as community assessment from the work performed on Vitamin A supplementation trial and other interventions. With this experience, the NHRC collaborated with PATH Canada to develop and test a collection of tools that can be used in the Kassena-Nankana District, and other Districts of Ghana to monitor ITN interventions. Particular emphasis was placed on assessing the numbers of children under five years old that are sleeping under a mosquito net. This target group is the most vulnerable to mortality and morbidity from malaria and has been chosen by the MOH in Ghana (and other interested organizations) as a key indicator for ITN interventions. As ITN interventions move from the research world into the sphere of child health it is fitting that ITN implementers benefit from the lessons learned from other interventions which have also targeted children under five and developed monitoring tools to assess their interventions. In this study, a cluster sampling technique was piloted and evaluated against a standard simple random sampling method.

Since June 1998, three distinct activities have been implemented in the Kassena-Nankana District:

1. Selling of mosquito nets
2. Provision of a net treatment service
3. Promotion of the above activities as well as raising awareness of the benefits of treated nets for health and malaria prevention.

These activities are being supported by WHO/TDR through a project evaluating a community's willingness to replace and re-treat nets. Nets and insecticides are being actively marketed through three different channels: itinerant vendors, Health Centres and shops. The survey methodology discussed in this paper is only one of a complimentary set of tools that has been developed to assess these different activities.

There is a growing commitment by the Ghana Ministry of Health (MOH) to actively promote malaria control. The promotion of insecticide treated mosquito nets (ITN's) are an integral part of that strategy. With the collaboration of the MOH, NGO's and donors, ITN interventions are being planned in Ghana. Since most districts will be implementing ITN programs in the near future, knowledge of coverage will help managers to assess performance and develop strategies to increase coverage. The need for rapid, pragmatic and accurate monitoring and evaluation tools which will assist programme managers to assess a baseline coverage, plan their activities, monitor progress towards setting goals and providing information to assist in refining activities during the life of the project cannot be overemphasized.

The optimal research tool will be able to assess reported coverage (children sleeping under a net) of children under five years of age in a given population and monitor change in that population. Other methods will then provide information on the factors, which influence this coverage rate.

Design and Methods

Study Site

This study was carried out in the Kassena-Nankana district of northern Ghana, population approximately 140,000 (NDSS, 1996), where a large scale trial of permethrin impregnated bednet study was conducted (Binka et al. 1996). In addition, ongoing activities are being implemented at the Navrongo Health Research Centre (NHRC) to evaluate the community's willingness to replace and re-treat nets in the district, which will include the sale of nets and insecticides.

The district lies within the Guinea Savannah of northern Ghana and covers an area of about 1675km². There are two main seasons, a short wet season with an average annual rainfall of 850-1000mm and a dry season from September to May when little or no rainfall occurs.

The people in this area comprise mainly of the Kassena and Nankana peoples and a minority of Buli speaking people. The population is primarily rural, agrarian and live in dispersed settlements. There are no distinguished villages as such because villages overlap. Settlement pattern is characterized by extended family living in dispersed compounds surrounded by farmlands.

The district is divided into ten chiefdoms and each chiefdom is headed by a paramount chief. The chiefdoms are also sub-divided into divisional and sub-divisional areas, each headed by divisional and sub-divisional chiefs. At the sub-

divisional level, there is further division into lineage groups. The lineage is the smallest corporate group and is usually headed by the oldest male member. Most social and political activities take place at the lineage level.

Net usage was about 4% in the community before the start of the impregnated bednet (Gyapong et al.1996). Usage increased to over 90% during the trial (Binka and Adongo 1997).

Methods

Two methodological approaches were used to pilot test and validate the cluster sampling methodology: a cluster survey and a simple random sample survey.

Cluster survey

The study adopted the WHO EPI cluster survey method because of its usefulness in measuring other health indicators collected at the district level (WHO 1991). The NHRC runs a Demographic Surveillance System (NDSS) which reports the dynamics of the population every quarter to update demographic events. The district has been divided into 244 clusters, with a cluster containing an average of 65 compounds. An average of 570 people live in a cluster. Using the EPI clustering system, the 244 clusters were regrouped into 30 new clusters. Seven mothers with children who were aged between 12-24 months at the date of visit were interviewed in each cluster. One advantage of selecting this age category is to make it possible for District Health Management Teams to also assess EPI coverage during net coverage. Two field workers working together were expected to conduct 7 interviews in a cluster per day. This was judged to be realistic but not punitive allowing for the distances between compounds. There was supervision by a senior researcher from NHRC and a counterpart from the MOH, experienced in EPI survey methods.

The most critical issue for the cluster survey is how to select the first compound/household to start the interview. With the assistance of geographic maps, schematic maps and people with good local knowledge, the field workers identified a central location within the cluster from which to start. They randomly selected a direction by spinning a pencil from the centre of the cluster. After spinning the pencil, all compounds in the direction of the pencil were walked through and marked with chalk until the edge of the cluster was reached. A random number between 1 and the total of compounds was selected to represent the first compound/household. The interviewers then visited every compound from the starting point until they had found 7 appropriate children. For the purpose of collecting household information on ITN use, the mother or guardian of the index child (12-24 months) was interviewed. No interviews were conducted in compounds that did not have children aged between 12-24 months. Immunization cards and NDSS ID cards were used to ascertain correct ages and children qualified to be interviewed.

Random sample survey

The Navrongo Demographic Surveillance System covers about 13,000 compounds. From the compound data, a random sample of 400 compounds was selected and all households in these compounds were interviewed. Based on 68% (Adongo 1996) prevalence of net use in the district, 400 compounds were selected. The software program Stata 4.0 was used for all random calculations for the survey.

Results

The surveys all took place during the 1998 rainy season. The Cluster Survey (CS) was conducted between the 4th – 11th of September, the simple random survey (SRS) between the 19th - 30th of September. The SRS questionnaire was longer than the Cluster Survey, however the details of net ownership and net coverage were collected and recorded in the same manner.

In the CS, all 200 interviews were completed out of the expected 210. On some occasions single respondents had to be interviewed for two children either because the children are twins or their mothers were not present at the time of visit.

The information was collected and analyzed by the staff of NHRC and PATH Canada. The data was entered using FOXPRO 2.6 for DOS and analyzed using EPI INFO version 6.0.

The SRS team visited 566 households, in which 35% of the respondents were the Head of the household and 46% were a spouse, the remainder were sons, daughters or other. In the CS, all the 200 interviews were carried out with the child's mother.

In the SRS 68.4% of the households owned one or more mosquito net. In the CS 71% of households owned one or more nets.

The total number of households visited was 566. From this total, there were 462 children aged 0-4. The percentage of children living in a net household was 63.2%. Male children of this age group in net owning households were reported to sleep under nets 98.0% of the time, compared to 89.6% female children from the SRS. In general, with increasing age group, there were fewer people sleeping under nets. For all age groups, 78.1% of females in net owning households slept under nets, compared to 67.5% males.

Out of the 200 households interviewed in the cluster survey, the total number of children aged 0-4 was 248, and 62.1% of the children in all households were reported to be sleeping under nets (Table 2). Similar to the SRS, more males aged 0-4 in net owning households were sleeping under nets (97%) compared to females (87.6). The total percentage of people sleeping under nets in net owning households was 53.9%. Again more females than males were reported to be sleeping under nets (77.4%, 68.4%, respectively).

(Table 1 here)

(Table 2 here)

Statistical comparison between the results of the simple random survey and the cluster survey

From table 1 and table 2, net usage is given as a proportion of net-owning population. To assess whether the two surveys give different results is to calculate the differences in proportions by survey and include the confidence intervals of these differences for

the stratified and overall results (Kirkwood, 1990). The results of the surveys will be different if the 95% confidence interval do not include zero. If 95% interval includes zero, then it implies that the results of the two surveys are comparable at the 95% confidence level.

(Table 3 here)

Discussion

Coverage is seen as one of the most important means of monitoring net use. Whereas this is relatively easy to achieve in trial situations (NIBP 1993), it is sometimes difficult for program managers at the district level to monitor coverage. The issue of selecting accurate sample for conducting surveys has been a problem in most districts because of non-existing good sample frames. The NHRC provides an ideal situation where a simple random survey could be compared to a cluster survey because of NDSS data source.

The results from the surveys suggest that there was no difference between the proportion of households owning one or more nets as presented in the SRS and CS respectively. The difference between the two proportions is 2.4%, 95% CI = (-9.8% to 5.0%).

It will be noticed from table 4 that the stratified analysis of the difference between proportions of the two surveys, except for the age group 40+ for the males, show that there is no significant difference between the methods in terms of net usage. One method could be used instead of both. If logistically one survey is more superior, then there is good reason to carry out that type of survey rather than the other. Conducting a CS does not require a rigorous sampling framework and it is easier to be adopted and used by district health managers. The CS will provide district managers an added opportunity of collecting information on Expanded Programme on Immunization (EPI) such as infant immunization coverage and tetanus toxoid immunization of women. Although the CS data were processed and analysed by using computer packages (FOXPRO 2.6 for DOS and EPI INFO version 6.0.), this can be done manually. It is quite possible to tabulate the population and coverage figures by hand. It is anticipated that the CS can be used with a sample size of 210 for communities with a high or low net use. On the other hand, when conducting a SRS the sample drawn must be according to the approximate percentage of existing net use.

However, care should be taken when combining surveys for malaria control and EPI. Programme managers must ensure that equal attention is paid to both areas when training and at the stage of data collection. Although this survey did group children under 5 years of age together, it would be important that subsequent studies subdivide the under 5's into under 24 months as well as the under five's in order to provide detailed information on coverage of risk group. It is important to note that using the cluster survey technique to collect data on ITN coverage may result in getting less than the expected 210 interviews. This could occur if several mothers have twins or other household members have to stand in for children whose mothers are not at home

at the time of interview. To overcome this issue, it may be necessary to over-sample in order to obtain the required 210 interviews for the ITN coverage analysis.

In communities where baseline socio-demographic information does not exist, it will be essential that the opportunity be used to get quantitative data on the characteristics of different strata of the population. In a base line you may want to identify current net users, or in the case of areas where net programme exist, new net purchasers and the evaluation of the scale IEC promotion campaign and details of coverage would be useful information to collect.

Note

The confidence interval for the difference between two proportions is given by

$$c.i. = (p_1 - p_2) \pm 1.96 \sqrt{(p_1(1-p_1)/n_1 + (p_2(1-p_2)/n_2))}$$

where

p_1, p_2 are the two proportions

n_1, n_2 the sample populations of the two proportions

1.96 is the 5% point of the standard normal distribution. The table below shows the results;

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Table.1 Simple random survey (SRS)

Agegrp	Total pop N(%)	Female Net owning pop N(%)	Net Users N	Total pop N(%)	Male Net Owning Pop N(%)	Net Users N	Total N(%)
0 – 4	227 (60.8)	154 (89.6%)	138	235 (65.9)	158 (98)	155	462 (63.2)
5 – 15	369 (50.4)	247 (75.3%)	186	362 (51.3)	244 (76)	186	731 (50.8)
16 – 39	520 (54.0)	350 (80.3%)	281	317 (34.3)	213 (51)	109	837 (46.5)
40+	230 (49.6)	170 (67.1%)	114	260 (33.8)	182 (48)	88	490 (41.2)
Sub total	1346 (53.4)	921 (78.1%)	719	1174(67.8)	797(67.5)	538	2520 (60.6)

Table 2. Cluster Survey (CS)

Agegrp	Total pop N(%)	Female Net owning pop N(%)	Net Users N	Total pop N(%)	Male Net Owning Pop N(%)	Net Users N	Total N(%)
0 – 4	128 (60.9)	89 (87.6)	78	120(63.3)	78 (97.0)	76	248 (62.1)
5 – 15	143 (58.0)	111 (74.7)	83	133 (57.8)	107 (71.9)	77	276 (58.0)
16 – 39	203 (54.6)	145 (76.0)	110	122(28.6)	82 (42.6)	35	325 (44.6)
40+	58 (53.4)	46 (67.3)	31	74 (51.3)	63 (60.3)	38	132 (52.3)
Sub total	532 (56.9)	391(77.4)	303	449(50.3)	330 (68.4)	226	981 (53.9)

Table 3. Comparison between the results of the simple random survey and the cluster survey on usage

Agegrp	Female Diff (%) (p_SS-p_CS)	C. I.	Male Diff (%) (p_SS-p_CS)	C. I.
0 - 4	2.0	(-4.8, 8.8)	1.0	(-2.1,4.1)
5 - 15	0.6	(-7.0, 8.2)	4.1	(-3.5,11.7)
16 - 39	4.2	(-1.7,10.1)	8.4	(-1.1,17.9)
40+	-0.3	(-10.3,9.7)	-12.3	(-22.6,-2.0)
Overall	0.7	(-3.1,4.5)	-0.9	(-5.5,3.7)

12 Appendix E - Cluster sampling population data

Cluscod	Popn	Cumm_pop	Cluster_number
EGA	415	415	
EGC	328	743	
EED	297	1040	
EEF	285	1325	
EEG	192	1517	
EGB	459	1976	
EGG	371	2347	
EGE	410	2757	
EGD	414	3171	
EFF	326	3497	
EFG	610	4107	1
EGF	409	4516	
EEA	341	4857	
EAD	338	5197	
EEB	529	5724	
EEE	650	6374	
EEC	667	7041	
EAE	667	7708	
EAF	590	8298	2
EFA	651	8949	
EFD	660	9609	
EFB	605	10214	
EFC	526	10740	
NFF	740	11480	
NFD	673	12153	
NFG	481	12634	3
NFB	599	13233	
NFC	405	13638	
NFE	722	14360	
EAC	367	14727	
EAB	514	15241	
EAA	338	15579	
EAG	465	16044	
EBA	384	16428	
EDC	499	16927	

Cluscod	Popn	Cumm_pop	Cluster_number
EDA	373	17300	4
EBB	506	17806	
EBF	286	18092	
EBH	458	18550	
EDD	415	18965	
EDG	585	19550	
EDH	358	19908	
EFH	411	20319	
SEI	259	20578	
EFE	383	20961	
SEA	531	21492	5
SEB	409	21901	
SEC	452	22353	
ECG	503	22856	
EDF	450	23306	
EDE	440	23746	
EBG	310	24056	
EBE	301	24357	
EBC	321	24678	
ECA	537	25215	
EDB	308	25523	
EBD	336	25859	6
ECB	328	26187	
ECC	617	26804	
ECE	381	27185	
SEE	326	27421	
SEF	556	27977	
SED	464	28441	
SEG	480	28921	
ECF	513	29434	
ECD	496	29930	
SFF	291	30221	
SFA	391	30612	7
SFG	459	31071	
SFE	519	31590	
SFH	379	31969	
SDA	336	32305	
SFC	479	32784	
SFD	298	33082	
SFB	453	33535	
SDC	345	33880	
SDE	542	34422	

Cluscod	Popn	Cumm_pop	Cluster_number
SDD	358	34780	8
NFA	657	35437	
NCG	687	36124	
NCE	711	36835	
NCC	1094	37929	
NCD	525	38454	
NCF	521	38975	
NDF	478	39453	9
NDG	472	39925	
NGB	562	40487	
NCA	705	41192	
NCB	915	42107	
NGC	627	42734	
NGA	844	43578	10
NGG	497	44075	
NAB	501	44576	
NDA	630	45206	
NDB	400	45606	
NDD	741	46347	
NDC	556	46903	
NDE	730	47633	
NAA	601	48234	11
NAC	847	49081	
NAE	780	49861	
NGD	534	50393	
NGE	1134	51529	
NGH	265	51794	
NGF	765	52559	12
WFA	666	53225	
WFB	561	53786	
WFD	622	54408	
WFE	726	55134	
WFC	577	55711	
NAD	479	56190	
NEA	508	56698	
NEB	439	57137	13
NEC	756	57893	
NEF	814	58707	
NEE	651	59358	
NED	540	59898	
NBD	753	60651	

Cluscod	Popn	Cumm_pop	Cluster_number
NBF	479	61130	14
NBG	508	61638	
NBE	439	62077	
SBA	756	62833	
NBC	814	63647	
SBB	561	64208	
SBD	540	64748	
SBF	753	65501	
SCA	430	65931	15
SCC	739	66670	
SCB	448	67118	
SBG	365	67483	
SCF	711	68194	
SCD	449	68643	
SDG	445	69088	
SDF	278	69366	
SDI	290	69656	
SDH	483	70139	16
SCG	562	70701	
SDB	389	71090	
SAK	470	71560	
SCE	692	71252	
SAA	491	72743	
SAC	648	73391	
SAD	358	73749	
SBC	585	74334	
SBE	555	74889	17
SBH	365	75254	
SAB	674	75928	
SAJ	629	76557	
SGS	951	77508	
SGT	404	77912	
SGP	833	78745	
SGR	962	79707	18
SGQ	780	80487	
SGN	811	81298	
SAE	708	82006	
SAF	694	82700	
SAG	660	83360	19
SGM	593	83953	
SGK	588	84541	
SGL	504	85045	
SGJ	724	85769	
SHH	500	86269	
SHJ	56	86325	

Cluscod	Popn	Cumm_pop	Cluster_number
SHG	578	86903	
SHE	669	87572	
SHF	721	88293	20
SHD	775	89068	
SHA	594	89662	
SHB	646	90308	
SHC	611	90919	
SJA	852	91771	
SJC	834	92605	21
SJB	526	93131	
SJD	843	93974	
WEA	639	94613	
WEB	609	95222	
WEC	526	95748	
NAF	642	96390	
NEG	512	96902	22
NBB	674	97576	
NBA	564	98140	
WFF	762	98902	
WEE	523	99425	
WEF	665	100090	
WFG	719	100809	
WED	739	101548	23
TBB	478	102026	
TBD	11	102037	
TBA	918	102955	
TBC	399	103354	
WDF	599	103953	
WDG	609	104562	
WDE	514	105076	
WDA	347	105423	
WDX	182	105605	24
WCE	574	106179	
WDY	710	106889	
WDZ	446	107335	
WDC	425	107760	
WCF	490	108250	
WDB	498	108748	
WCC	516	109264	
WCA	495	106759	

Cluscod	Popn	Cumm_pop	Cluster_number
WBF	344	110103	25
WBD	647	110750	
WBE	557	111307	
WBA	678	111985	
WBB	789	112774	
WBC	451	113225	
WAF	348	113573	
WAE	631	114204	
WAC	550	114754	26
WAD	335	115089	
WAA	543	115635	
WAB	458	116090	
WGA	840	116930	
WGB	1175	118105	
WGC	846	118951	27
WGD	553	119504	
CAA	667	120171	
CAB	845	121016	
CAC	1198	122214	
CAD	624	122838	
CAE	739	123577	28
CAF	906	124483	
CAG	530	125013	
CAH	500	125513	
CAI	623	126136	
CAJ	314	126450	
CAK	455	126905	
CAL	635	127540	
CAM	1162	128702	29
CAN	641	129343	
CAP	733	130076	
CAQ	712	130788	
CAR	233	131021	
CAS	222	131243	
CAT	421	131664	
CAU	579	132243	
CAV	211	132454	
CAW	39	132493	
CBA	158	132651	30