Malaria Control & Elimination
ISSN: 2470-6965

Inungu et al., Malaria Contr Elimination 2018, 7:1
DOI: 10.4172/2470-6965.1000158

Research Article Open Access

School-based Distribution of Long-Lasting Insecticide-Treated Bed Nets in the Democratic Republic of the Congo

Joseph N Inungu[1*], Nestor Ankiba[2], Jonas M Ndeke[1], Willy Onema[2], Dido Bolekela[1] and Bienvenu Mukoso[1]

[1]*African Center for Research and Development, Kinshasa, Democratic Republic of the Congo*
[2]*Family Health Association, Democratic Republic of the Congo*

[*]**Corresponding author:** Joseph N Inungu, African Center for Research and Development, Quartier Limete, Kinshasa, Democratic Republic of the Congo, Tel: 4704399020; E-mail: otilonken@gmail.com

Received date: November 1, 2018; **Accepted date:** November 19, 2018; **Published date:** November 28, 2018

Abstract

Introduction: The use of long-lasting insecticide treated nets (LLINs) has become the core malaria prevention strategy worldwide.

Methods: The Family Health Association and the National Malaria Control Program (NMCP) in the Democratic Republic of the Congo (DRC) carried out an operation research in the Kasai Central province in 2017. Twelve (n=12) health zones were randomly selected in the province. LLINs and health education about the benefit of LLINs were provided to children enrolled in the 1st, 3rd, and 5th grades (n=782) in 1094 primary schools in 6 health zones (intervention zone); whereas no intervention took place in the remaining 6 health zones (control zone). The purpose of the study was to assess the difference in the ownership and utilization of LLIN between the two zones.

Results: In 2017, 750 (50.9%) households were visited in the intervention zone compared to 749 in the control zone. The ownership was higher in the intervention zone (78.2%) compared to the control zone (56.7%), p<0.0001. The utilization rate was higher in the intervention zone (73.4%) compared to the control zone (44.1%), p<0.001. Parents in the intervention zone reported that 64.2% of children under five slept under a net compared to 47.9% in the control, p<0.000. The proportion of pregnant women who slept under a net was 72.4% in the intervention zone versus 60.2% in the control zone, p<0.000.

Conclusion: School-based distribution program in the DRC increased both the ownership and the utilization of LLIN in the intervention zone. It is an effective distribution channel that should be integrated into the national malaria control strategies.

Keywords: Malaria; School-based distribution; LLIN ownership; LLIN use; Delivery strategy; Democratic Republic of the Congo

Introduction

The use of insecticide treated nets (ITNs), and subsequently the long-lasting insecticide treated nets (LLINs), has been the core malaria prevention strategy for more than two decades in many African countries [1]. In May 2015, the World Health Assembly approved a 15-year strategy to reduce malaria incidence and death rates by at least 90%, eliminate malaria in at least 35 countries, and prevent the reintroduction of malaria in all countries that were malaria free [2]. This strategy required the scale-up of existing effective malaria interventions, including early treatment of malaria cases with artemisinin-based combination therapies (ACTs), intermittent preventive treatment for pregnant women (IPTp), and interventions that reduce human–vector contact, such as indoor residual spraying (IRS) and use of long-lasting insecticide-treated bed nets (LLINs) [3].

Mass campaign distribution of LLIN contributed to significant reductions in morbidity and mortality from malaria in sub-Saharan Africa [4,5]. However, maintaining high LLIN coverage rate several years following large-scale campaigns has proven to be a challenge [6,7]. Although repeated campaigns could contribute to maintaining high coverage rate, this approach would be too costly overtime and impractical for several countries. Therefore, the sustained coverage and use of LLINs have become an integral component of national malaria control programs in malaria endemic countries [8]. The World Health Organization (WHO) [9] now recommends that each household owns one LLIN for every two people living there [10]. However, ownership rates of LLINs decline in the years following large-scale distribution campaigns, due to "loss", itself due to various factors, such as wear and tear [11]. It is estimated that 8%, 20% and 50% of LLINs are lost in the first, second and third year, respectively, after large-scale distribution. To maintain high coverage rate, a mix of approaches, including mass campaigns coupled with routine distribution of LLIN to pregnant women and infants in antenatal and child health immunization clinics should be considered [12-14]. Studies conducted in Kenya [15] and Ghana, Nigeria, Senegal, and Tanzania [16] identified school-based bed nets distribution program as an effective strategy for maintaining LLIN coverage after a nationwide mass campaign.

Mass distribution of bednets is usually done every three years. Because bednets are lost or wear out between campaigns, people have to wait until the next cycle to get a new one, exposing household members to the risk of developing malaria. School-based distribution of bednets has proven to be an innovation that makes nets accessible to more people in a cost-effective way. This approach allows school-aged children to receive nets that can be given to family members and friends who may need them.

A free LLIN distribution campaign took place in all HZ of Kasaï Occidental province in 2014. The details about the mass distribution campaign is provided elsewhere [17]. Briefly, around 3.5 million LLINs were distributed free of charge in the Kasaï Occidental province in the Democratic Republic of Congo (DRC) in September–October 2014, using two different approaches, a fixed delivery strategy and a door-to-door strategy including hang-up activities. The fixed approached was used to distribute nets in 35 of the 44 HZ in Kasaï Occidental province, whereas the door-to door (hang up) was used to distribute nets in 9 of the 44 HZ in Kasaï Occidental province. Household ownership of at least one LLIN increased from 39.4% pre-campaign to 91.4% post-campaign. To assess the effectiveness of school-based LLIN distribution as viable malaria prevention option, the National Malaria Control Program (NMCP) in the Democratic Republic of the Congo in collaboration with the Family Health Association conducted an operation research in the Kasai Central province in 2017.

To assess the effectiveness of school-based LLIN distribution as viable malaria prevention option, the National Malaria Control Program (NMCP) in the Democratic Republic of the Congo in collaboration with the Family Health Association conducted an operation research in the Kasai Central province in 2017, in the aftermath of a large-scale LLIN distribution campaign conducted in 2014.

This study describes the pilot intervention conducted in the Democratic Republic of the Congo and examines the effectiveness of the school-based distribution approach on household bed net ownership and utilization.

Materials and Method

Study site

The site of the 2014 mass distribution of the LLIN in the Kasaï Occidental province was described elsewhere. Briefly, the Kasaï Occidental province, one of the 11 old provinces of the DRC. Kasaï Occidental province, located at the center of the country, has a total area of 170,000 km2 with an estimated 7.3 million inhabitants. The population is rural, except for those living in the town of Kananga, the provincial capital. The population is poor and grows subsistence crops for home consumption. The province is divided into 44 Health Zones (HZ) grouped into five Health Districts. The HZ is the primary operational unit of the health system in DRC. It covers a population of 100,000–150,000 in rural areas and 200,000–250,000 in urban areas. (Ref) The HZ includes a referral hospital, few health centres, and about a dozen lower level health facilities. Each HZ is further divided into 15 health areas (HAs) on average, which usually has 10,000–15,000 inhabitants. In Kasaï Occidental Province, malaria is endemic with stable transmission throughout the year.

Intervention

With the Department for International Development (DFID) financial support, ASF in partnership with the National Malaria Control Program (NMCP) carried out an operation research in the Kasai Province. They randomly selected 20 HZ out 44 and equally assigned 10 HZ to the intervention and control zones. The intervention consisted of distributing LLIN to children enrolled in the 1st, 3rd, and 5th grades. Concomitantly, community health workers carried out community mobilization to educate the population about the benefits of LLIN. In the remaining 10 HZ (control zones), neither LLIN were distributed nor community mobilization activities took place.

Household survey sampling approach

Three weeks following the distribution of LLIN in the different schools, ASF conducted a population-based household cross-sectional survey in 6 health zones randomly selected in both the intervention and the control zone.

Considering an estimated LLIN ownership rate of 30%, a 95% confidence interval, and 10% margin of error, a sample of 1500 households was required to conduct a community-based survey. Multi-stage cluster sampling design was used to select a representative sample of households. First, each health zone was divided into health areas (HA). Five HA were selected in each Health Zone (n=60). Three villages were selected in each health area (n=180). From each village, 8 households with at least one member aged 18 years or older at the time of the study were selected. The village selected was mapped, and a house-to-house survey was conducted until 8 households were completed. Only one adult per household was interviewed. Households were revisited if no one was available for interview on the first attempt; if no one was available after three attempts, the interviewer continued to the next randomly selected household on the list until the desired number of households was obtained. Households where eligible participants refused to be interviewed were excluded.

Data collection

Fieldworkers were trained in interviewing techniques and administration of informed consent. Pre-tested questionnaire was used to collect information. The questionnaire was developed in French, but through simulation sessions, interviewers learned how to translate the questionnaire into the locale language -Tshiluba. The questionnaire was field tested prior to starting the survey. At each household, fieldworkers introduced themselves and explained the purpose of the study. An informed consent was sought from the respondent prior to administering the questionnaire. Participation in the study was entirely voluntary.

The questionnaire was designed to collect information on household characteristics, education status, family size, household amenities and assets, LLIN ownership, source of LLIN, LLIN utilization, history of fever (past 2 weeks), on knowledge and understanding of malaria transmission, on recognition of sign and symptoms, on perception of cause, treatment seeking patterns, preventive measures, and protective patterns. To ensure consistency and integrity of data collected, 20% of the forms were rechecked by team supervisors in the field at the end of each day. Incomplete entries were sent back to be filled the next day. Questionnaires were first checked for completeness, and the information was manually coded.

Dependent variable: The use of LLIN the night before the interview was the dependent variable for this study. All insecticide-treated mosquito nets, whether long lasting insecticide treated nets or retreated nets are referred to as ITNs.

Independent variables: The independent variables included: place of residence (urban or rural), age, education, knowledge of the cause of malaria, social norm, self-efficacy; perception about severity of malaria, attitude towards LLIN. We used the Amenities and Possession Index, a poverty/wealth indicator based on household access to 3 basic amenities (drinking water, toilet, and electricity) and 4 consumer

durable possessions (radio, television, refrigerator, and car). A person was assigned to one of three categories (high, medium and low) according to whether the household in which the person resides has access to different combinations of the following amenities and consumer goods: toilet facilities, drinking and nondrinking water, electricity, radio, television, refrigerator and car. The method to compute the Amenities and Possession Index was described elsewhere [18].

Participants were asked to list all the signs or symptoms of malaria and name all possible methods used to prevent malaria. Based on the correct answers relative to the signs and symptoms of malaria, three groups were created: 0: "listed no correct sign or symptom"; 1-2: "listed 1 to 2 correct signs or symptoms", and 3: "listed 3 or more signs or symptoms of malaria". To assess participants' knowledge about the methods to prevent malaria, we created 3 groups: 0: "named no correct prevention method" 1-2: "named 1 to 2 correct prevention methods", and 3: "named 3 or more prevention methods".

Data analysis

Data were entered using the Census Surveys Professional software (CSPro). Statistical analyses were performed using Stata/SE 13.0 (StataCorp, 2013: Stata Statistical Software, Release 13.0, College Station, TX: StataCorp LP) and a p-value of less than 0.05 was considered significant unless otherwise specified. Descriptive statistics were carried out for socio-demographic characteristics, household ownership and utilization of LLIN, and knowledge of malaria. Logistic regression analysis was used to assess the independent association between independent variables and the outcome of interest.

Ethical consideration

Participants were informed about the purpose of the study. An informed consent was sought out before administering the questionnaire. Participation in this project was voluntary. Ethical clearance was obtained from the Ethics Committee of the School of Public Health in Kinshasa, University of Kinshasa.

Results

Characteristics of households

Demographic characteristics: Fieldworkers visited a total of 1499 households, 750 in the intervention zone and 749 in the control zone. The characteristics of these households are summarized in Table 1. In general, most heads of households were men. The proportion of male-headed households was higher in the control zone (91.4%) compared to the intervention zone (86.9%). Regarding their level of education, 56.3% of heads of households in the intervention zone had a secondary education level compared to 69.6% in the control zone. The difference was statistically significant, $p<0.05$.

In terms of household composition, a significantly higher proportion of households in the control zone (83.4%) reported having a child under five years of age compared to the intervention zone (74.0%); about 69.6% of households in the intervention zone had children 5 to 14 years old versus 72.5% in the control area ($p>0.05$); and 39.8% of households in the intervention zone reported having a pregnant woman versus 30.4% in the control zone ($p<0.05$). Most houses were of modest conditions. Approximately 60% of the houses were covered with metal sheet and the walls were made with mud. About 24.5% of households in the intervention zone and 57.7% in the control zone use Arab pit toilets ($p<0.05$). People rely on wells and rivers as their sources of drinking water.

With regard to household assets or possessions, 63.7% of households in the intervention zone and 64.7% in the control zone had a radio ($p>0.05$). In addition, 19.3% of households in the intervention zone compared to 23.8% in the control zone had a motorcycle ($p<0.05$).

During the visits of the 1499 households, the investigators collected information on 9,616 household members. Of these, 2.081 (21.6%) were children under 5 years of age, 2.752 (28.6%) were aged 5-14 years, and 1.014 (10.5%) were pregnant women.

Characteristics		Total	Zones Intervention n=750 (50.9%)	Control n=749 (49.1%)	P value
Sex (heads of household)	Male	1336	651 (86.9)	685 (91.4)	0.004
	Female	163	99 (13.2)	64 (8.5)	
Education Attainment	Primary	181	117 (17.8)	64 (9.3)	≤ 0.001
	Secondary	847	369 (56.3)	478 (69.6)	
	Higher education	301	157 (23.9)	144 (21.0)	
	Don't know	14	13 (2.0)	1 (0.1)	
Composition of household	<5 years	1180	555 (74.0)	625 (83.4)	≤0.001
	5-14 years	1065	522 (69.6)	543(72.5)	0.216
	Pregnant Woman	527	299 (39.8)	228 (30.4)	≤0.001
Material used for the roof	Hays	541	283 (37.7)	258 (34.4)	0.12
	Metal sheets	939	452 (60.3)	487 (65.0)	
	Others	19	15 (2.0)	4 (0.5)	

Sources of water for household	River	238	203 (27.1)	35 (4.7)	≤0.001
	Rain	63	16 (2.1)	47 (6.3)	
	Public well	325	181 (24.1)	144 (19.2)	
	Private well	616	184 (24.5)	432 (51.7)	
	Public faucet	202	134 (17.9)	64 (9.1)	
	Private faucet	55	32 (4.3)	23 (3.1)	
Household Assets	Motorcycle	358	213 (19.3)	145(23.8)	≤0.001
	Bike	442	193 (33.2)	249 (29.4)	≤0.001
	Radio	970	493 (63.7)	477 (64.7)	0.407
	Television	255	142 (15.1)	113 (17.0)	0.047

Table 1: Socio-demographic characteristics of the households.

Knowledge about malaria

The general knowledge level about malaria was very high in the Kasai Central province. All the study participants had heard of malaria and 97% correctly associated malaria with mosquito bite. The majority (75.6%) of the study participants knew two or more symptoms of malaria. Fever was cited by 90% of participants in both intervention and control areas, followed by headaches (over 70%) and fatigue (35%). Despite the high level of knowledge, misconceptions persist among the participants. Some of them stated that malaria can be transmitted by stagnant water (25.4% of respondents in the intervention zone compared to 24.1% in the control zone (p>0.05); the bite of other insects (13.7% in the intervention zone compared to 14.4% in the control zone (p>0.05); drinking water (6.8% in the area of intervention compared to 7.2% in the control zone (p>0.05); or witchcraft (3.7% in the intervention zone versus 3.0% in the control zone (p>0.05).

Access and use of LLIN

LLIN ownership at household level: Among the 1499 households visited in 2017, 67.4% owned LLINs. The ownership was higher in the intervention zone (78.2%) compared to the control zone (56.7%). The difference was statistically significant, p<0.001. The average number of LLIN in each household was 2.57 in the intervention zone compared with 2.03 in the control area.

Use of ITN at individual level: The proportion of people who slept under an LLIN the night before the survey was 53.4%. Specifically, 73.4% slept under a net in the intervention area, compared to 44.1% in the control area.

Use of ITN among children under 5 years of age: Of the 2,081 children under five years of age living in both zones, 1173 (56.4%) children slept under a net the night before the survey. Specifically, the proportion of 5-year-old children who slept under a net was 64.2% in the intervention zone (n=694) versus 47.9% in the control zone (n=479). The difference was statistically significant, p<0.001.

Use of ITN among children 5-14 years of age: Of the 2,752 children aged 5-14 years residing in both areas, 1,357 (49.3%) children slept under a net the night before the survey. Specifically, the proportion of children aged 5-14 who slept under a net was 58.4% in the intervention zone (n=850) compared to 39.1% in the control zone (n=507). The difference was statistically significant, p<0.001.

Use of ITN among pregnant women: Among the 1,014 pregnant women living in both areas, 677 (66.7%) slept under a mosquito net the night before the survey. Specifically, the proportion of pregnant women who slept under a net was 72.4% in the intervention zone (n=394) versus 60.2% in the control zone (n=283). The difference was statistically significant, p<0.001.

Discussion

This study examined the effectiveness of the school-based distribution on the ownership and utilization of LLIN in the Kasai Central Province. Our results showed a significant difference in LLIN ownership between the two intervention zones. An estimated 77.5% of households in the intervention zone owned LLIN compared to 56.5% in the control zone (p<0.05). The average number of LLIN per household was 2.57 in the intervention zone compared to 2.03 in the control zone. Our findings are consistent with the results of a pilot study conducted in Ghana and Tanzania which showed a significant difference in LLIN ownership among study participants [19].

A significant difference in LLIN utilization was also reported among the different vulnerable groups. About 59.7% of household members in the intervention area reported sleeping under LLIN compared to 45.8% in the control area (p<0.05). The idea that pupils can act as health change agents in the community as part of an action-oriented and participatory health education approach in schools is well documented [20,21]. Previous studies conducted in Kenya, Macedonia and Denmark confirmed it. carried out a 14 month-health communication training about malaria, diarrhea and hygiene among 40 schoolchildren. The impact of the project was reflected in concrete changes in both the school and the home environments. Lisette Borrows [22] found that pupils were key transmitters and translators of school-based health knowledge and were capable of, and responsible for, helping their families eat well and exercise more. However, the positive contribution of the school-based distribution on the utilization and LLIN reported in our study is in vast contrast with the 2017 report from the Bioko Island Malaria Control Project (BIMCP) which failed to show any positive result. This is the only study among

many that did not show any positive results associated with school-based distribution of LLIN in the community.

This study has some limitations. Since the investigators were not always able to verify the information provided, the use of self-reported data may lead to bias, as some heads of household could have reported practices to be in line with the NMCP recommendations in controlling malaria, Our findings may not be generalized to the whole national territory of the Democratic Republic of the Congo (DRC) due to the existence of a wide difference in geography. The collection of data in some health zones experienced serious security difficulties related to the "Kamwina Sapu" phenomenon, a militia supporting a traditional leader in Kasai province. Of the selected health zones, five of the twelve were under militia control. This situation affected the choice of the different intervention and control areas, therefore, the results of this study.

Conclusion

Our findings suggest that school-based distribution is an effective complementary channel for LLIN delivery. It contributed to the increase in both ownership and utilization of LLIN in the intervention zone in the Kasai Central province.

Acknowledgement

The authors are grateful to other members of the African Center for Research and Development for their valuable contributions in reviewing this manuscript and/or collecting data used for this study.

Data Availability Statement

Data used to support the findings of this study may be obtained upon application to Population Services International () and/or the National Malaria Control Program in the Democratic Republic of the Congo.

Funding Source Statement

This evaluation was part of a large project on the Acceptability and use of Rapid Malaria test in private pharmacies in Kinshasa and the evaluation of the School-based Distribution of Long-Lasting Insecticide-Treated Bed Nets in the Kasai Central province in the Democratic Republic of the Congo. Funded by DFID, the project was implemented collaboratively by the National Malaria Control Program, the Family Health Association and Population Services International. These partners contracted the African Center for Research and Development to carry out the evaluation part of the project. Funding to pay for the Open Access publication charges for this article was provided by JNI's professional development funds.

Competing Interests

JNI, DB, BM received honoraria from Family Health Association for conducting this research. NA, JN and WO declare they have no conflicts of interest.

References

1. World Health Organization (1993) WHO study group on the implementation of the global plan of action for malaria control. WHO, Geneva, Switzerland.
2. World Health Organization (2015) Global technical strategy for malaria 2016–2030, Geneva, Switzerland.
3. Hemingway J, Shretta R, Wells TN, Bell D, Djimdé AA, Achee N, et al. (2016) Tools and strategies for malaria control and elimination: what do we need to achieve a grand convergence in malaria?. PLoS Biol 14.
4. Willey BA, Paintain LS, Mangham L, Car J, Schellenberg JA (2012) Strategies for delivering insecticide-treated nets at scale for malaria control: a systematic review. Bull World Health Organ 90: 672-684.
5. Ntuku HM, Ruckstuhl L, Julo-Reminiac JE, Umesumbu SE, Bokota A, et al. (2017) Long-lasting insecticidal net (LLIN) ownership, use and cost of implementation after a mass distribution campaign in Kasai Occidental Province, Democratic Republic of Congo. Malar J 16: 22.
6. Samadoulougou S, Pearcy M, Ye Y, Kirakoya-Samadoulougou F (2017) Progress in coverage of bed net ownership and use in Burkina Faso 2003-2014: evidence from population-based surveys. Malar J 16: 302.
7. Vanden Eng JL, Thwing J, Wolkon A, Kulkarni MA, Manya A, et al. (2010) Assessing bed net use and non-use after long-lasting insecticidal net distribution: a simple framework to guide programmatic strategies. Malar J 9: 133.
8. Yukich JO, Lengeler C, Tediosi F, Brown N, Mulligan JA, et al. (2008) Costs and consequences of large-scale vector control for malaria. Malar J 7: 258.
9. World Health Organization (2007) Global Malaria Programme. Insecticide-Treated Mosquito Nets: a WHO Position Statement. Geneva, Switzerland.
10. World Health Organization (2008) World malaria report 2008: World Health Organization, Geneva, Switzerland.
11. Briët OJT, Hardy D, Smith TA (2012) Importance of factors determining the effective lifetime of a mass, long-lasting, insecticidal net distribution: a sensitivity analysis. Malar J 11: 20.
12. Bennett A, Smith SJ, Yambasu S, Jambai A, Alemu W, et al. (2012) Household possession and use of insecticide-treated mosquito nets in Sierra Leone 6 months after a national mass-distribution campaign. PloS One 7.
13. Grabowsky M, Nobiya T, Selanikio J (2007) Sustained high coverage of insecticide-treated bed nets through combined catch-up and keep-up strategies. Trop Med Int Health 12: 815-822.
14. Kolaczinski JH, Kolaczinski K, Kyabayinze D, Strachan D, Temperley M, et al. (2010) Costs and effects of two public sector delivery channels for long-lasting insecticidal nets in Uganda. Malar J 9: 102.
15. Onyango-Ouma W, Aagaard-Hansen J, Jensen BB (2004) Changing concepts of health and illness among children of primary school age in Western Kenya. Health Educ Res 19: 326-339.
16. Stuck L, Lutambi A, Chacky F, Schaettle P, Kramer K, et al. (2017) Can school-based distribution be used to maintain coverage of long-lasting insecticide treated bed nets: evidence from a large scale programme in southern Tanzania?. Health Policy Plan 32: 980-989.
17. Ntuku HM, Ruckstuhl L, Julo-Réminiac J-E, Umesumbu SE, Bokota A, et al. (2017) Long-lasting insecticidal net (LLIN) ownership, use and cost of implementation after a mass distribution campaign in Kasaï Occidental Province, Democratic Republic of Congo. Malar J 16: 22.
18. Kishor S, Neitzel K (1996) The status of women: indicators for twenty-five countries. Macro International Inc. Calverton, Maryland USA.
19. Lalji S, Ngondi JM, Thawer NG, Tembo A, Mandike R, et al. (2016) School distribution as keep-up strategy to maintain universal coverage of long-lasting insecticidal nets: implementation and results of a program in Southern Tanzania. Glob Health Sci Pract. 4: 251-63.
20. Mwanga J, Jensen B, Magnussen P, Aagaard-Hansen J (2007) School children as health change agents in Magu, Tanzania: a feasibility study. Health Promot Int 23: 16-23.
21. Onyango-Ouma W, Aagaard-Hansen J, Jensen B (2005) The potential of schoolchildren as health change agents in rural western Kenya. Soc Sci Med 61: 1711-22.
22. Burrows L. Children as change agents for family health. Health Edu J 117: 498-510.