

Research Article

Replacement Campaign of Long Lasting Insecticide Treated Nets in Ondo State, Southwest Nigeria, Heartland of Africa's Most Efficient Vector Species

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ABSTRACT

Background: Ondo State in Southwest Nigeria, heartland of Africa's most efficient malaria vector, conducted a Long-Lasting Insecticidal Nets (LLINs) replacement campaign at the last quarter of 2017 with the aim of achieving the recommended coverage of one LLIN per two persons, in line with the National Malaria Elimination Program (NMEP) strategy. The LLIN replacement campaign planned to reach 4,757,725 populations to achieve universal coverage, a proven intervention aimed at reducing malaria morbidity by increasing access to, as well as ownership and utilization of LLINs. The processes to achieve this goal are described in this paper.

Methodology: This paper describes the modalities and scheme for LLIN distribution in one of the states in Southern Nigeria. The campaign took place in all the 18 Local Government Areas (LGAs) of the state between September 17 and November 15, 2017. Implementation trainings were held and advocacies were conducted at state level and to traditional and religious leaders followed by community mobilization in all the Local Government Authorities. Intense logistic activities included transportation and positioning of LLINs. The implementation was endorsed by LLIN Ambassadors. End process evaluation and reverse logistics were carried out. The LLIN replacement was carried out at a time of high malaria transmission during the second rainy season of the year. Excel spreadsheet was used in data analysis.

Outcome: The LLIN replacement campaign involved the training of 11,695 personnel in different cadres including teams, supervisors and monitors at state and at LGA levels, independent monitors, ward monitors and town announcers. Distribution point supervisors, health educators and crowd controllers as well as store keepers were also trained. In all 2,734,500 net cards were issued to LGAs of which 2,674,172 (98.0%) net cards were issued to beneficiaries to collect LLINs. In all, 2,444,036 (91.4%) LLINs were redeemed. Reasons for non-use of LLIN ranged from adverse reaction (11.0%) to "no mosquitoes" (1.0%). Majority (82.0%) of people heard about the LLIN campaign from town announcers and none was unaware of the campaign. Hanging rate was low at 55.0% while utilization by under-fives and by pregnant women was 67.0% and 76.0%, respectively.

Conclusion: Despite the fact that replacement of LLINs in Ondo state of southwest Nigeria took place on a large scale, its utilization, especially among the at-risk groups, was still low. Aggressive follow-up campaigns to increase utilization should include more purposeful social and health advocacies to community and religious leaders. Use of local drama groups for behavioral change could be an advantage. Distribution of LLINs to school children should also be considered.

Keywords: Ondo state; Heartland; Malaria vectors; Net cards; LLIN; Replacement campaign; Utilization; Southwest Nigeria

Background

Malaria, a public health concern, poses a substantial global threat and had reaffirmed itself in a more overwhelming form in the sense that it is resistant to erstwhile effective, readily available and cheap medications and to the new artemisinin combination therapies, especially in the Thai-Cambodia border [1]. Probably, the extensive dispersal of antimalarial resistance and low adherence to malaria prophylaxis in pregnancy brought about the emphasis of using Long Lasting Insecticide Treated nets (LLINs) to prevent human-mosquito contact as much as possible and thus avoid introduction of malaria parasites into the human blood stream.

Despite the fact that millions of US dollars have been pumped into curbing the scourge of malaria, through the support of donors such as Global Fund for Aids, Tuberculosis and Malaria (GFATM), malaria is still a public health burden. For example, an approximate 212 million cases of malaria occurred globally in just one year, 2015, predominantly (90%) in sub-Saharan Africa, resulting in 42,900 deaths, mostly (92%) in the same sub-Saharan Africa [2,3].

Malaria burden is devastating in sub-Saharan Africa where an approximate 550 million people are still at risk of the disease, especially where the transmission is stable, there is constant and perennial attack [1]. Various studies have shown how

devastating malaria is to human life. For example, a high level of phenylalanine in Nigerian children with falciparum malaria and increased plasma histidine and histamine in falciparum malaria in the same country have been demonstrated; that malaria occurs in the first six months of life, contrary to earlier thinking has also been substantiated [4-6]. Malaria has been documented to cause increased risk of adverse pregnancy outcome such as abortion, premature deliver, stillbirths and low birth weight [7]. Earlier studies have reported nearly 60% of miscarriages are due to malaria and that malaria causes sequestration of malaria parasites in the placenta or depression of selected components of the immune system in association with increased production of several hormones or other proteins [8-11]. Further, it has been noted that the disease inhibits the passage of maternal antimalarial immunoglobulins, especially IgG, across the placenta, to the fetus, thereby reducing the protection against malaria to infants during the first month of life [12]. A study also reported the patterns of osmotic fragility and thrombocytopenia in Nigeria children with acute Plasmodium falciparum malaria before and after chemotherapy [13]. However, all is not gloom as there has been drastic reduction in malaria morbidity and mortality. Malaria transmission is influenced by climate, land use and deliberate interventions such as Long Lasting Insecticide Treated Nets (LLINs) [3]. Effective use of LLINs has been found to lower all-cause child mortality by about 20% and also minimize malaria morbidity [14-16].

Further, long-term reduction in malaria transmission has been recorded globally, especially sub-Saharan Africa where the prevalence of Plasmodium falciparum decreased from 40% between 1900-1929 to 24% between 2010-2015 [3]. In Nigeria, malaria is a public health burden, with a prevalence of 40.2% in children between 6 and 59 months of age [3]. A recent malaria survey in Nigeria reported that malaria prevalence in Southwest Nigeria was 17% and specifically it was 21% in Ondo State which lies within the Southwest geo-political zone with a rain-forest ecology where malaria is holoendemic [17]. Ondo State government has put in all its effort to reduce the mortality and morbidity due to malaria among the people in the state. Although

malaria control activities have been conducted in Ondo State for at least 10 years, none has been published. Also, there have been a plethora of studies and publications of scientific papers on malaria in international journals but very few emanated from this part of Nigeria, though a lot of efforts is being made by the State Government, funding agents such as The Global Fund and Partners such as Catholic Relief Services in the State. A disproportionate reduction in malaria transmission intensity between the margins of the historical range of *P. falciparum* transmission compared to the heartland of Africa's most efficient vector species, *Anopheles gambiae sensu stricto* and *Anopheles coluzzii* has been reported [3]. Ondo state in southwest Nigeria falls within this "heartland" which, as observed "forms a densely populated belt from West Africa through Central Africa toward Mozambique and represents the most severely impacted area of the contemporary malaria-endemic world which currently runs the risks of being overlooked today." This paper aims to report the most recent distribution of Long Lasting Insecticide Treated Nets (LLINs) in Ondo State and the challenges faced in distributing the commodity to communities in its riverine, rain-forest, mangrove and hilly locations. The goal is to achieve universal coverage of 1 LLIN per 2 people according WHO's recommendation [18]. Thus, the precise objective of this study is to document systematic replacement of LLINs in Ondo State that achieved universal coverage, according to requirement of the World Health Organization.

Materials and Methods

Design of the replacement campaign

This paper describes the modalities and scheme for LLIN distribution in Ondo State, South-west Nigeria. The replacement campaign was designed along international protocols, adapting and adopting what Roll Back Malaria (RBM)/Alliance for Malaria Prevention developed as tool-kit for that purpose [19]. The strategies on mass campaign were developed jointly by the Ondo State Ministries of Health and of Finance as well as Partners, including the WHO, Global Fund for Aids,

Table 1: Implementation strategies for 2017 LLIN replacement campaign in Ondo state.

	Activity
1.	Meetings on logistics and finance management with State Ministry of Finance
2.	Implementation training were held in September 2017 at State, LGA and Ward levels
3.	Advocacies conducted at State level
4.	Community mobilization carried out in all 18 LGAs
5.	Sensitization of press/media conducted
6.	Advocacy to traditional/religious community leaders at LGAs
7.	Household mobilization
8.	Transportation of LLINs to LGA stores
9.	Positioning of LLINs at DP
10.	Endorsement of LLIN use by LLIN Ambassador
11.	Coordination and Review Meetings
12.	State and LGA flag offs
13.	Net distribution
14.	End process
15.	LLIN reverse logistics

Tuberculosis and Malaria (GFATM), Society for Family Health (SFH), Catholic Relief Services (CRS) and Association of Civil Society Organizations for Malaria, Immunization and Nutrition (ACOMIN). The key elements of the strategies are as illustrated in Table 1. To summarize, the replacement campaign activities were hinged on (i) involvement of community gate-keepers (ii) sensitizing and mobilizing the communities (iii) training various cadres of staff, including supervisors, registration of households (iv) issuance of net cards (v) logistics, including finance and transportation (vi) registration of all households by village health teams (VHTs).

Study area

Situated in Southwest Nigeria, Ondo State, with coordinates of 7°10'N 5°05'E, covers a land area of 14,793 km² with its administrative capital at Akure. The population of the state as revealed by the year 2006 population is 3,460,877 [20]. The state is bounded by Ogun and Osun States in the west, Ekiti and Kogi States in the North, Edo and Delta States in the East and Atlantic Ocean in the south (Figures 1 and 2).

Study population

Within the state, there are 18 Local Government Areas (LGAs) consisting of a rich ethnic composition largely from the Yoruba subgroups of the Akoko, Akure, Ikafe, Ilaje, Ondo and Owo peoples. Ijaw minority (such as Apoi and Arogb) and Ilaje populations inhabit the coastal areas; while a sizable number of Ondo State people who speak a variant of the Yoruba

language similar to Ife dialect reside in Oke-Igbo. It has 203 political wards and 3,528 settlements out of which 773 (22%) are hard to reach in riverine and hilly areas.

Main occupations depend on geographic location. In the south, occupational activities include fishing, canoe making, lumbering net making, mat making, building, farming and trading. In the middle, people are engaged in trading and farming where cocoa, yams, cassava, corn and tobacco are grown. Cloth weaving is also prominent because of cotton production while the northern part of the state is mainly involved in cocoa production. The state has a very large deposit of bitumen.

Infrastructure

The state has the largest number of public schools in Nigeria - over 880 primary schools and 190 secondary schools - and 13 tertiary institutions including: Adekunle Ajasin University, Akungba-Akoko; Ondo State University of Science and Technology, Okitipupa and Federal University of Technology Akure. The state is supplied by social amenities such as tarred roads, electricity and water by public and private primary, secondary and tertiary health facilities at local and state levels. However, sewage system still needs improvement and housing, though mostly made of cement blocks is still a major concern for the government. The state also has local television and radio stations. The market system is cash-and-carry in a slow economy. The deep-sea coastline lacks a seaport, though the state has an airport that carries medium size airplanes to and from Abuja, the nation's political capital and Lagos, the economic capital

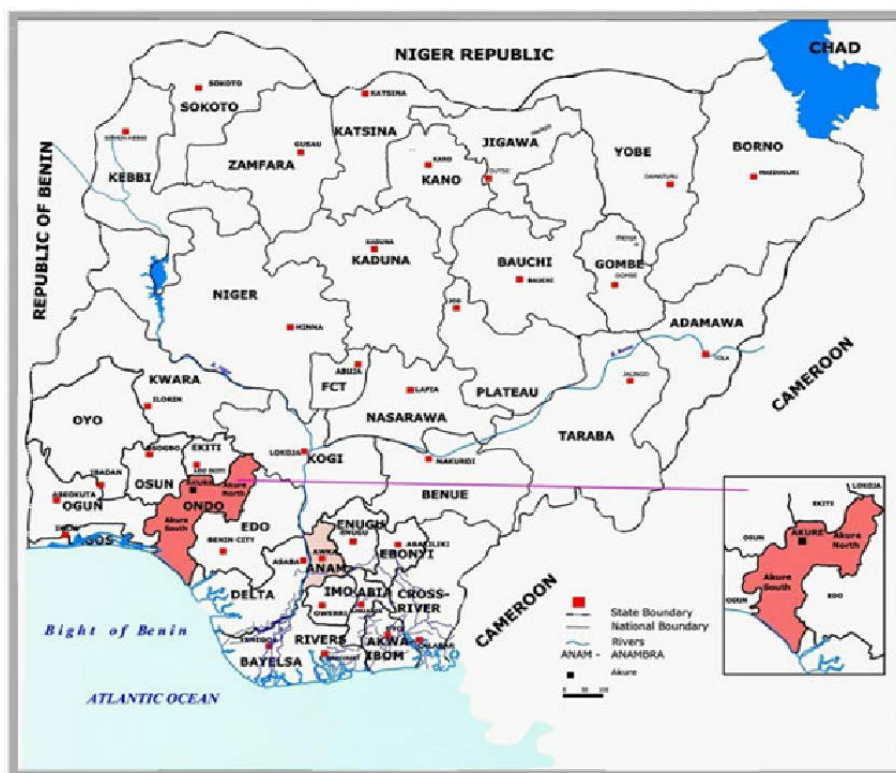


Figure 1: Composite map of Ondo state within Nigeria.

Source: https://www.google.com/search?q=map+of+ondo+state&client=firefox&dc=0&tbm=isch&source=iu&ictx=1&fir=M03isJizX2JeM%253A%252Cg1tFP9cZa7J7zM%252C_&usg=__w1NV5hO22D4xcTI2mwNtmiWA1bo%3D&sa=X&ved=0ahUKEwjbOmWa75rYAhXRqQKHxYpB_4Q9QEIMTAE&biw=1366&bih=656#img=7bP-poHVT5rcWM

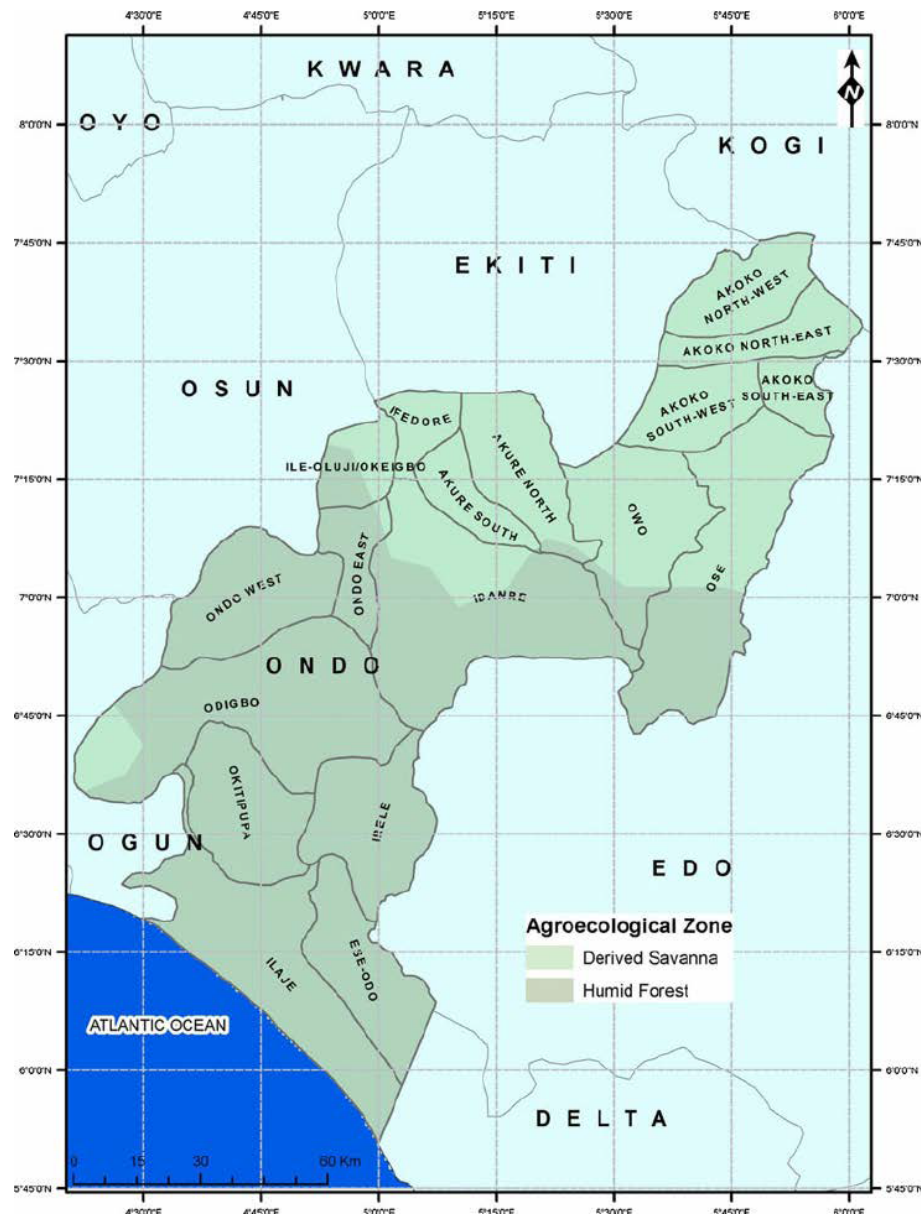


Figure 2: Map of Ondo state (study area) showing the two eco-climatic zones and local government areas (LGAs). Source: Omonijo et al. [30].

which are almost equidistant from Akure, the state capital. Incidentally, rock engravings dating back the Mesolithic period, have been discovered on the outskirts of Akure, as has the oldest Homo Sapiens fossil to have been found in the West Africa thus far (in a burial site at Iwo Eleru near to Akure), dating back to around 11, 000 years ago [21,22]. Two of the most important and biggest projects in West Africa - Bitumen and LNG production are taking place in the state [23].

Chronology of events

The Ondo state LLIN replacement campaign had planned to distribute a total of 2,780,710 LLINs across the 18 LGAs in the state. Operationally, LLINs were allocated to households at 1 net for every 2 persons, or 1 net to a single adult in a household, with a maximum of 4 nets per household. One of the Partners, Catholic Relief Service (CRS), was given the task of implementing this replacement campaign in the state with the National Malaria Elimination Program coordinating and playing oversight function.

Chemonics, another partner, got the grant from the Global Fund to transport all nets from State to distribution points (DPs) through the LGAs. The campaign involved a sequence of activities namely (i) engagement with the State (ii) microplanning, (iii) budget and timeline development (iv) training (v) household mobilization (vi) LLIN distribution and (vii) rapid assessment.

Implementation trainings were held in September 2017 at State, LGA and Ward levels followed by advocacies which were conducted at State level to key stakeholders. In the same vein, sensitization meetings were held with traditional leaders, community leaders and clerics to gain their support for the campaign. To buttress demand creation, town announcers, totaling 406, were thereafter engaged to carry out community sensitization prior to community mobilization in all the 18 LGAs. The press and electronic media were equally sensitized to be part of the campaign. In all, 5,286 household mobilizers were trained and deployed to all the 18 LGAs for household mobilization. In the same period, LLINs were transported

from State Central Medical Store to LGA stores awaiting final distribution. Frequent coordination and review meetings were held to ensure smooth operation. The First Lady of the State gave an endorsement speech which was recorded and aired on radio and television and Investiture of Net Ambassador and Advocates was carried out. Throughout the state, flag-off ceremonies were held for further awareness creation. In all 11, 695 personnel were engaged and trained for the campaign. The largest number of personnel trained were household mobilizers (5,286, 45.20%) followed by net distributors (1,468, 12.55%) and distribution points crowd controllers (1,468, 12.55%) (Table 2).

Logistics

Prior to eventual distribution of the LLINs, effective training of logisticians at LGA level on logistic processes and strategies were carried out. Each LGA store was assessed for its maximum capacity for LLIN storage and for other deficiencies such as leaking roofs and security. The logistic process also included recruitment and orientation of LGA conveyors for timely delivery of LLINs to the depot in each LGA, positioning of LLINs in all 734 distribution points throughout the state and proper reconciliation of LLINs.

Use of limited cash and asset transfer (CAT) strategy

The practice of limited Cash Asset Transfer (CAT) involved use of Samsung Android Devices (SAD) and peripherals to carry out Biometric time attendance tracking during campaign trainings and also to capture the biometric details of each individual campaign personnel to be trained, the distribution of badges to campaign personnel, bank account details validation and updates of replaced campaign personnel during trainings. Thus, with this device, the campaign tracked over 8,500 personnel's attendance and validated their phone numbers and bank details across 162 training venues across the various

levels of training throughout the state. Further, with the aid of CAT using SAD, participation was encouraged as biometric data capture limited participants missing trainings as they had to clock in and out. Thus, the device ensured availability of participants for all training days and increased overall quality of implementation since they employed the knowledge gained to the advantage of the program. After clocking in on the first day, the device would not allow any other person apart from the one who logged in on that first day thereby avoiding impersonation. Participants were either available or not available and therefore replaced. The device also facilitated correct banking details into verifiable accounts of participants, thus avoiding double payment or non-payment or payment into wrong account. Lastly, the system ensured verifiable training sessions in that GPS coordinates and time stamps were taken per training site hence eliminating any fake training sessions.

Results and Discussion

A total population of 4,635,789 was reached with net cards as against expected 4,757,726 obtained during micro-plan meeting, representing 98%. However, 2,734,500 nets cards were allocated to all 18 LGAs based on micro-plan estimates and 2,674,172 net cards were distributed to beneficiaries, representing 98% net card update. Redemption of 2,444,036 nets as against the 2,674,172 net cards issued to households during the household mobilization represents 91.1% net redemption rate. Data was reconciled and collated during the different phases of the campaign by the mobilization and distribution teams as well as by independent monitors. Daily review meetings were held in all LGAs and at State level.

The distribution of LLINs in each LGA (Tables 3 and 4). It is not surprising that the largest percentage of LLIN uptake was at Ese-Odo LGA, a riverine area of the state which merges with the rain forest. It is envisaged that LLINs among people

Table 2: Personnel engaged and trained for the LLIN campaign.

Cadre of personnel	Total trained	Percentage
State team	4	0.03
State supervisor	18	0.15
State monitor	18	0.15
LGA team	72	0.62
Independent monitors	72	0.62
Ward supervisor	406	3.47
Household mobilizers	5,286	45.20
Town announcers	406	3.47
Distribution point (DP) supervisors	734	6.28
Net distributors	1,468	12.55
DP Health Educators	734	6.28
DP Crowd controllers	1,468	12.55
DP Securities/Waste managers	734	6.28
DP conveyors	203	1.74
LGA Conveyors	18	0.15
LGA Store keeper	18	0.15
LGA store securities	36	0.31
Total	11,695	100.0

Table 3: Net card and LLIN analysis.

Local Government Area (LGAs)	Micro plan Actual Net card	Number of Net card issued to LGAs	Actual Net Cards Issued to beneficiaries	Net Cards returned	Percentage coverage	Total Number of LLINs redeemed	LLIN redemption rate (%)
Akoko North East	1,35,700	1,35,700	1,35,699	1	100	1,29,964	95.8
Akoko North West	1,64,700	1,64,700	1,44,019	20,681	87.4	1,36,066	94.5
Akoko South East	59,000	59,000	58,005	995	98.3	55,747	96.1
Akoko South West	1,76,600	1,76,600	1,76,356	244	99.9	1,65,262	90.8
Akure North	1,11,300	1,11,300	1,11,300	0	100	1,01,123	90.9
Akure South	3,56,500	3,56,500	3,47,246	9,224	97.4	3,05,081	87.8
Ese Odo	1,16,900	1,16,900	1,16,900	0	100	113,702	97.3
Idanre	99,000	99,000	99,000	0	100	91,075	91.9
Ifedore	1,35,800	1,35,800	1,08,437	27,363	79.9	97,841	90.2
Ilaje	2,78,300	2,78,300	2,26,936	1,364	81.2	2,10,530	85.1
Ileoluji/Okeigbo	1,32,300	1,32,300	1,32,300	0	100	1,12,103	90.3
Irele	1,10,800	1,10,800	1,10,800	0	100	1,03,357	85.1
Odigbo	1,73,700	1,73,700	1,73,700	0	100	1,57,002	92.3
Okitipupa	1,79,800	1,79,800	1,79,615	185	99.9	1,62,691	90.2
Ondo East	58,400	58,400	58,400	0	100	54,660	93.6
Ondo West	2,17,500	2,17,500	2,17,500	0	100	2,01,470	92.6
Ose	1,11,500	1,11,500	1,11,500	0	100	1,02,190	91.7
Owo	1,66,700	1,66,700	1,66,429	271	99.8	1,47,227	88.5
Total	27,34,500	27,34,500	2,674,172	60,328	98	2,444,036	91.4

Table 4: Summary findings at end process.

Variable	Percentage (%)	Variable		Percentage (%)	Variable	
		Reasons for non-use of campaign net	Percentage (%)		Source of information on LLIN campaign	Percentage (%)
LLIN Redemption rate	91.4	No mosquitoes	1	Town announcers	82	
LLIN Retention rate	100	Difficult to hang	5	Media (Radio, TV, SMS)	44	
LLIN Hanging rate	55	Heat	9	Council of Tradition Rulers	43	
LLIN Utilization rate	65	Don't like the smell	5	Neighbor, Friend	53	
		Adverse reaction	11	Others	17	
		LLIN not enough	1	Not aware		
Net/Person Ratio	01:02	Using existing nets from previous campaign	2		0	
		Using nets from other source	3			

in this coastal community would be used to prevent malaria and not to catch fishes. A constant visit by social workers to communities in this LGA will serve a good purpose to remind the villagers and local people to sleep under the net. They should also be empowered to hang the net immediately they receive it. That LLIN uptake in the adjacent Ilaje LGA, was lower at 85.1% was surprising in that Ilaje is coastal and also riverine with water logged areas. The lower uptake in Ilaje may be due to the perception of malaria being caused by cockroaches and not mosquitoes. The Akokos in the northern

fringe of the state had high LLIN uptake ranging from 90.8% in Akoko Southwest to 96.1% in Akoko Southeast. This area of the state is farthest away from the Atlantic coastline and borders the semi-savannah ecological zone of the country. An entomological study of the various types of mosquitoes in these different eco-zones will be an advantage in planning for in-door residual spraying and for health planners. In the middle part of the state towns surrounded by moderately high rocky hills such as Idanre, Ondo, Okeigbo and Ile-Oluji which are located within the rain forest. It is not surprising that these towns had

Table 5: End-process evaluation.

Activity	Date (2017)	Duration	Number	Percentage
Training of independent monitors on end-process evaluation	November 2	1 day	-	-
End-process evaluation by 72 independent monitors	November 4-5	2 days	-	-
Wards surveyed	-	-	72	-
Communities surveyed	-	-	288	-
Households surveyed	-	-	2,880	-
Percent registration	-	-	-	98.0%
Percent redemption	-	-	-	91.4%
Hanging rate	-	-	-	55.0%
Utilization rate for under-fives	-	-	-	67.0%
Utilization rate for pregnant women	-	-	-	76.0%
Utilization rate for others	-	-	-	52.0%

approximately 90.0% LLIN uptake. The findings at end process indicating that the campaign achieved a net/person ration of 1:2 according to the specification of WHO (Table 5) [18]. It is a cause for concern to notice that the 11% of non-users of LLINs gave “adverse reaction” as reason for non-use of the campaign net. The State Ministry of Health should not turn a blind eye to this data but collaborate with National Agency for Food and Drugs Administration and Control (NAFDAC) that have the oversight for pharmacovigilance not only to consumable drugs but also to insecticides such as permethrin that are on the LLINs. Adverse drug reactions (ADRs) may be dermatological or irritation of the eyes or nostrils. It should also be noted that asthmatic patients are protected from such ADRs. On the contrary, 32% of LLIN recipients in Cross River State located next to Cameroon border reported LLIN non-use due to torn nets or nets being used for other purposes such as door screens or bed sheets [24]. Other reasons for non-use of the net include heat (9.0%), difficult to hang (5.0%) and don't like the smell (5.0%). Though only 1% of the non-users mentioned “no mosquitoes,” this should be further investigated and factors responsible for absence of mosquitoes in such communities be documented. In fact, this is where entomological study should

be conducted to verify presence or absence of plasmodium-carrying mosquitoes.

Majority of the people mentioned “town announcer” as the source of information on LLIN campaign. This is very important in that local communication system might be more effective than print and electronic media. In the first place, people may be in the farm or in the market when LLIN campaign is aired on the radio or on TV. Secondly, town announcers are usually directed by the community gate-keepers such as the traditional ruler and once they speak, it is usually taken that the traditional leader had spoken and given his consent to the exercise. Thirdly, the town announcers speak late in the night, before everybody goes to sleep and to the hearing of everybody. His modus operandi is to firstly ring the gong given by the traditional ruler and once this gong is sounded and heard, the instructions following are taken whole-heartedly. This is one vital community system that, in addition to others such as village theatre and dancing groups, festivals and community-oriented resource persons (CORPS), can be studied, improved upon, compensated and utilized to strengthen community health systems.

All-in-all, 2,880 households in 288 communities in 72 wards of

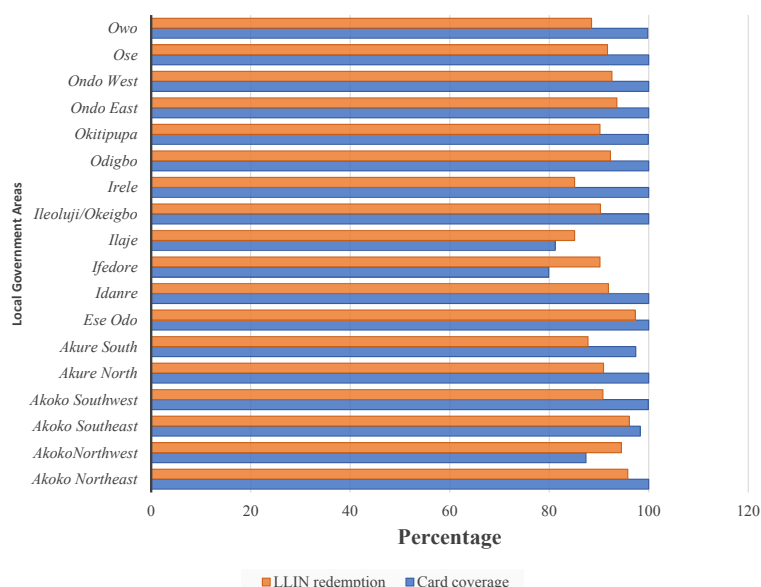


Figure 3: Card coverage and LLIN redemption rate at different local government areas during 2017 LLIN replacement campaign in Ondo state.

the 18 LGAs in the State were sampled. The number of household surveyed was higher than the 2,211 surveyed in Madagascar when that country conducted the first two phases of her national free mass distribution campaign of long-lasting insecticidal nets (LLINs) in 2009 [25]. There are a lot of indications that when coverage of LLIN is increased in targeted areas, protection of individuals, vulnerable groups and community members is simultaneously enhanced [26,27] (Figure 3).

Hanging rate of LLIN was observed to be 55% which was far below the 81.7% earlier reported in a nearby geo-political zone, and 67% utilization rates among under-fives was also incomparably lower than the 80% reported from Uganda [28-30]. It should raise an alarm that LLIN utilization rate among pregnant women in the state was 52%. Reasons for this might include unintentional missed opportunity because net was distributed when most of the women in reproductive age were not pregnant, lack of knowledge about the dangers of malaria in pregnancy. Further, women in child bearing age, as a group, are not the specific target of intervention programs such as information, education and communication (IEC) or behavioral change communication (BCC). Future campaigns should specifically consider women in child bearing age group, primary and secondary school children using more decisive social and health education to leverage on the achievements of current LLIN replacement campaign to save lives in the Ondo state. This calls for more work to reach every person in the state and protect them with universal coverage of LLINs, Indoor Residual Spraying (IRS) and other malaria commodities such as Artemisinin-based combination therapies (ACTs), Intermittent Preventive Therapy (IPT) for malaria in pregnancy (MIP) and environmental management.

Challenges

There were some limitations in the campaign that need to be mentioned. First, there was non-adherence to recruitment criteria for household mobilizers which affected the goal of 100% coverage in some LGAs. Secondly, political interference was observed in personnel selection which led to constant replacement. However, this was countered and nipped in the bud early and after training and use of CAT and SAD systems, participants were stable. Some DPs were isolated from the catchment areas they were to serve leading to low redemption. In addition, monitoring was difficult in some LGAs due to difficult terrain and hard-to-reach communities. Finally, micro-positioning of nets commenced late in some DPs in Okitipupa and Odigbo LGA.

There were limitations of study design and analysis in that, unlike in conventional studies; this relied on the outcome of planning such as “sensitizing and mobilizing the communities” and not according to any statistical sample size calculation. According errors may have occurred in our statistical analysis. However, this may be compensated by the outcome and impact of the exercise, from Public Health perspective.

Next steps

- i. The state is to take the lead on the channel of LLIN

continuous distribution to take care of the missed household/communities.

- ii. Chemonics to immediately commence reverse logistics.
- iii. Timely conclusion of personnel payment by Catholic Relief Service.
- iv. State to strengthen post-campaign Social Behavioral Change Communication (SBCC) to sustain and improve on LLIN hanging and use.

Lessons learnt and recommendations

- i. Early engagement of the state before the commencement of the micro-planning process is an advantage.
- ii. Approval of more satellite DPs should be considered in subsequent programs to facilitate net redemption.
- iii. Special consideration should be made for riverine and hard-to-reach areas. This should be clearly detailed during micro-planning.
- iv. Internet-compliant technology for development (ICT4D) should be fully implemented.
- v. Reverse logistics should end at LGA level.

Conclusion

Ondo State in Southwest Nigeria conducted an LLIN replacement campaign in 2017. Although over two million LLINs were redeemed through net cards, thus increasing LLIN ownership, findings suggested low hanging rate and unacceptably low utilization rate, especially among children under the age of five years and among pregnant women. Reasons for non-use of LLIN included adverse reaction to the nets and heat. The state should emphasize a continuous aggressive campaign using local traditional method such as village announcer, supplemented by drama groups, songs, theatres and festivals to drive home the importance of malaria elimination crusade. Health workers should be trained to show evidence of sleeping under nets, such as increased hemoglobin levels in children and in pregnant women. More social, economic, entomological and community studies will be an advantage in this overlooked part of Nigeria.

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