Willingness to pay for long lasting insecticidal nets in the Kainji Lake area, Niger State, Nigeria.

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Abstract

Background: There are very few empirical data from studies in north central region of Nigeria on the usage and social marketing of long lasting insecticidal nets (LLINs).

Methods: A controlled experimental study was conducted to evaluate the social marketing, willingness and ability to pay for LLINs pre- and post-intervention in the Kainji lake area of Niger State, North Central region of Nigeria. Semi-structured questionnaires, focus group discussion and in-depth interviews were used to for data collection among adult populations in the communities. A bidding format was used to elicit willingness to pay (WTP) values using 2 different starting bids. The scenario was constructed in a way to reduce the possibility of respondents acting strategically.

Results: A total of 198 household heads of 4 villages were studied. Average monthly income of respondents was N5, 916 (US$13.11) and a median of N5,000 (US$11.08). None of the respondents had ever used LLIN prior to the baseline phase of the study. 98.5% compared to 89.6% of the respondents were willing to pay for LLINs at a cost in the pre and post-intervention period respectively. The mean WTP at ≥ N500.00 (US$1.11) and ≥ N350.00 (US$0.78) were N700.00 (US$1.55) and N383.00 (US$0.85) respectively. The income level of the respondents suggests the need for subsidy to enable ability to buy the LLINs, taking cognizance of their preferred mode of payment.

Conclusion: The elicited mean and median WTP can be used to inform and guide policy decisions on appropriate pricing of LLINs particularly in rural communities for wider use of LLINs to prevent malaria in the country.

Keywords: Malaria, LLINs, Knowledge, Perception, Use, Willingness to Pay, Nigeria.

Introduction

Malaria remains a formidable global health and socio-economic problem in tropical Africa [1-7]. Currently advocated malaria control strategies prioritize prompt diagnosis, early treatment and use of long lasting insecticidal nets (LLINs) [8-11]. Moreover, LLINs are standard for malaria vector control as the use reduces malaria-related illness and deaths [12]. Trials showed a reduction of 20-63% (median 45%) in malaria rates after LLIN use; 17% in Ghana, 33% in Kenya, and over 60% in The Gambia. The rate of actual use of LLINs remains low in the population particularly pregnant women and children less than five years of age. The limitations are mainly inconvenience and affordability rather than lack of knowledge [13-22].

Widespread coverage of vulnerable populations, including pregnant women and children less than five years of age, with LLINs constitutes an important component of the strategy to control malaria in endemic regions including Nigeria [23]. This is hinged on the World Health Organization (WHO) recommendation for free distribution of LLINs which was adopted in the country in 2001, The free LLINs distribution policy is being implemented across Nigeria including Niger State, through the provision of LLINs and intermittent preventive treatment of malaria in pregnancy (IPTp) to pregnant women in attending antenatal clinics and through provision of LLINs to children under five years of age upon completion of immunizations [24-27]. Outside of these, people would have to buy the LLINs as the free nets provided the vulnerable population in a household for example may not be sufficient to provide the necessary protection of the entire household members against mosquito bites. Entirely free programmes are unsustainable due to lack of government funds and time limited donor inputs. Hence, avenues of mobilizing the communities to pay for LLINs need be pursued [28].

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The percentage of the population sleeping under the LLIN globally has increased considerably between 2000 and 2020, for the whole population (from 2% to 43%), for children aged under 5 years (from 3% to 49%) and for pregnant women (from 3% to 49%) [7]. In Nigeria, the national average household ownership of at least one LLIN increased from 42% in 2013 to 69% in 2015 and dropped to 61% in 2018 across the six geo-political zones of the country [29,30]. In contrast, actual personal protection using LLINs remains low [18,19,31,32]. However, the World Malaria Report 2021 showed that since 2017, indicators for LLIN access and use in sub-Saharan Africa including Nigeria have been declining [7].

There is dearth of evidence-based information relating to people's willingness to pay for LLINs as well as their acceptability of the LLINs given the very few evidence from studies on the social marketing of LLINs to support their extensive use in the study communities in Niger State in the North Central region of Nigeria. Though this approach of malaria control is attracting enormous attention following the massive LLIN rolling out campaign (National Population Commission geared towards achieving the pre-elimination targets of reducing malaria-related deaths to zero in Nigeria [33,34]. We believe our results will be of importance to the health authorities and non-governmental organisations involved in malaria control particularly in Niger State and Nigeria in general. This is important if the 2030 targets of both the Global Technical Strategy for Malaria (2016-2030) of eliminating malaria in at least 35 countries and the Sustainable Development Goal (SDG) 3 (on ensuring healthy lives and promote well-being for all at all ages) respectively are to be realized in every part of Nigeria by 2030 and beyond [35-37]. Their study on which this paper is hinged examined the people's willingness and ability to pay for LLINs in under-studied rural communities of Borgu local government area (LGA) of Niger State, North Central Nigeria.

Methods

Study design

The approach to data collection in the study area provided some element of a controlled experimental research design [38].

Study area

The study was conducted in two test communities (Monai and Tamanai) and two control communities (Popo/Kere and Koro) all situated around New Bussa town, the headquarters of Borgu local government area (LGA) which is located in Niger State, North Central Nigeria. It is in this LGA that the Kainji lake dam and the main hydroelectric power station for the country is situated. It is a very poor and rural area, economically dependent on the production of millet, groundnuts and fishing. Major ethnic groups in the area are Bissans, Bokkos, Laru, Gungawa, Lupawa, Kambari, Fulani and Nupe, each with their own distinct language/dialect. However, Hausa is the language spoken by most of the people, while the predominant religion is Islam. The LGA lies between latitude 9°53′N and longitude 4°31′E covering an area of 11,580 square kilometres with a 2022 projected population of 256,575 people based on the 2006 National Population Census at 2.5% growth rate [39]. It falls within the savannah zone, with annual rainfall of 1,000-1,200mm. According to primary health care (PHC) records, Kainji is holo-endemic for malaria with both Plasmodium falciparum and P. vivax infections. Although DDT had previously (over four decades ago) been used for the control of Simulium (vector of onchocerciasis), which must have had some impact on the mosquito fauna in the Kainji area at the time.

The four communities selected for the study were of comparable socio-economic characteristics. Population of the communities ranged from 1,470 for Popo/Kere, 2,003 Monai, 2,980 in Tamanai, and 3,115 in Koro, with 91, 112, 132 and 115 households respectively.

Data collection procedures

The study design necessitated the use of two test and two control communities with similar characteristics. The study was carried out in accordance with universal ethical principles. The informed consent of all the research participants was sought and obtained before recruiting them for the study.

Pre-intervention

Both qualitative and quantitative procedures were used to collect baseline data before intervention. The qualitative data were collected using focus group discussions (FGDs) and in-depth interviews (IDIs). A total of 6 FGD sessions were held among four groups of people (adult males and females and adolescent males and females) in Monai and Koro communities and an in-depth interview was held with the Koro village leader. The quantitative data were collected through household survey using semi-structured questionnaires that were administered by trained research assistants. The questionnaire was used to probe the social background of the respondents, their knowledge of cause of malaria and preventive measures for malaria and use of treated nets, household sleeping pattern with number of persons per room and willingness to pay for the treated nets. A total of 200 household heads were interviewed in the household survey.

Sampling procedures

The village leaders using purposive sampling selected homogeneous representatives from each of the different units in the villages to participate in the FGD sessions. Simple random and systematic sampling techniques were used in the selection of 50 households from each of the study communities for the household survey [38]. The first step involved a random selection of two riverine (Monai and Popo/Kere) and inland (Tamanai and Koro) communities from the list of communities around New Bussa. Secondly, the household heads were chosen from the community-directed treatment for household listing records of the respective communities using systematic sampling.

Intervention

Distribution of long lasting insecticide treated nets in the communities

Following the baseline data collection, 200 LLINs were distributed, two LLINs to each of the 100 household heads

initially interviewed during the baseline phase of the study in the two test communities, Monai and Tamanai. The intervention activities included health education on malaria: cause, sign and symptoms, control measures with emphasis on benefits of use of LLINs was carried out in both the test and control communities while the treated nets were freely distributed to household heads only in the two test communities.

After the free LLIN distribution to 100 household heads in the intervention communities, 500 LLINs were deposited with two popular and trusted people nominated based on consensus of the communities. They were to sell the LLINs at a predetermined price of ₦500.00 (US$1.11) each in the test communities for over a period of six months.

Post-intervention

The evaluation included household survey of heads of household (or their representatives where the household head was unavailable) using questionnaire that probed into: the social background of the respondents, their knowledge and perception of use of LLINs in malaria prevention and their willingness to pay for the treated net materials in both the test and control communities. Three categories of household heads were sampled for interview in the household survey at this phase: 51 of 100 household heads who received treated nets and 95 who were not given treated nets in the test communities and 49 household heads from the control communities where treated nets were not given at all. Systematic random sampling was used in selecting these households for the household survey. Similarly, focus group discussions (FGDs) were repeated among the same four different groups: adult males and females and adolescent males and females. A net inventory was also undertaken with in-depth interviews with the village heads and the LLIN distributors.

Data management and analysis

Sequel to the baseline data collection from the field, 198 of the 200 questionnaires administered in the household survey were found complete and useful for analysis during data cleaning. The questionnaires were subsequently coded preparatory for entry into the computer for analysis using the EpiInfo 6.04a software developed by the Centers for Disease Control, United States of America in collaboration with the WHO [40]. The two sets of qualitative data were analysed using the Text base Beta software developed by Bo Summerlund and distributed by Qualitative Research Management of Desert Hot Springs, California [41,42].

Results

Pre-Intervention

Background of respondents

Of the 200 questionnaires administered, 198 were later found useful for analysis. Almost all (99.5%) the respondents were males of age range 18 to 90 years with an average age of 42 years and median of 40 years. There was a high level of literacy among the respondents: 42.9% had formal education and 27.3% had quoranic education. The respondents were predominantly Muslim (93.4%) with only 0.5% Christians. Most (96.5%), of them were married, 3.0% were single and 0.5% divorced. Majority (59.6%) of the respondents were farmers, 22.2% were civil servants, and 5.5% were fishermen. The income distribution of the respondents showed that majority (61.3%) earned less than ₦7,500 (US$16.62), 3.6% earned ₦7,500 (US$16.62), 24.1% earned more than ₦7,500 (US$16.62) and 11.1% did not respond. The average monthly income was ₦5,916 (US$13.11) with a median of ₦5,000 (US$11.08). The average supplementary income of other members of the household such as the wife was ₦1,055 (US2.34) with a median of ₦500 (US$1,11). The average number of rooms and persons per household were 5 and 8 with a median of 4 and 6 respectively. Similarly, of an average of 5 children with a median of 4 children per household reported by the respondents, each household had an average of 2 under-five children with a median of 2.

Knowledge and sources of information about LLIN

Majority (70.2%) of the respondents indicated their awareness of the availability of LLINs with more awareness being reported in the control communities than in the test communities as illustrated in Table 1. The respondents' major sources of information about LLIN were: friends/neighbours (36.0%), relations (23.0%), market (17.3%), radio (5.8%), television (2.2%), pharmacy shop (2.2%), clinic (1.4%), posters (0.7%) and others (3.6%). 7.9% could not recall their source of information.

LLIN utilisation among respondents

The extent of untreated net use among the respondents showed that only 66 (33.3%) had it being used in their household. In contrast to 24.8% and 45.1% using untreated nets in test and control communities, 72.4% and 53.8% were not. Reasons for non-use of any treated or untreated net by majority of the respondents included: can't afford to buy (53.9%), didn't know about net (9.2%), not interested in nets (8.6%), prefer chemical spraying (7.2%), don't know where to buy (2.6%), and net causes heat (2.5%). While 8.6% gave no reason, 3.3% were indifferent on why they were not using any treated or untreated net. None of the 198 respondents in the study communities had ever used a treated net prior to the study. Alternative preventive measures taken against malaria by respondents included: chemical spraying (29.6%), use of local repellents (17.6%) and cleaning of environment (0.5%).

Perception of and willingness to pay for LLIN

Following health education on the benefits of using LLIN and the display of the net, over 90.0% of the respondents had positive perception about the use of LLIN as shown in Table 1. 70.9% said the net would be more effective in preventing mosquito bite, and others considered it relatively more cost-effective than other means of preventing mosquito bites (6.0%), more durable (4.5%) and others such as "the net is good but expensive" (1.0%). 4.5% were indifferent to express their perception, while 13.1% perceived the treated nets as good and opined that government should ensure its availability.

A larger proportion (98.5%) of the respondents were willing to pay for LLIN at a cost and 1.5% were unwilling as presented in

Table 1. *Knowledge and perceived effectiveness of net use and willingness to pay for treated nets among respondents.*

Knowledge of net use	Test		Control		Total	
	Pre (n=105)	Post (n=95)	Pre (n=93)	Post (n=49)	Pre (n=198)	Post (n=144)
Yes	63.8	87.4	77.4	89.8	70.2	88.2
No	36.2	10.5	20.4	10.2	28.8	10.4
No response	0.0	2.1	2.2	0.0	1.0	1.4
Total	100.0	100.0	100.0	100.0	100.0	100.0
Perceived effectiveness of treated Nets						
Yes	95.2	98.9	96.8	98.0	96.0	98.6
No	2.8	1.1	1.0	2.0	2.0	1.4
No response	0.0	0.0	2.2	0.0	2.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Willingness to pay for treated nets						
Yes	98.1	90.5	98.9	97.9	98.5	89.6
No	1.9	3.2	1.1	2.1	1.5	2.1
No response	0.0	6.3	0.0	0.0	0.0	8.3
Total	100.0	100.0	100.0	100.0	100.0	100.0
Price Bidding						
≥ ₦500 (US$1.11)	79.0	41.1	48.4	42.9	64.6	41.7
₦351 (US$0.78) - ₦499 (US$1.11)	4.9	3.2	25.8	14.2	14.6	6.9
≤ ₦350 (US$0.78)	5.7	55.7	22.6	4.2	13.6	51.4
No response	10.5	0.0	3.2	0.0	7.1	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 1. These respondents were willing to buy an average of 3 treated nets at ₦500.00 (US$1.11) each for their households with a range of ₦100.00 (US$0.22) to ₦1,400.00 (US$3.10). Test for statistical significance showed that the respondents' level of education affected their willingness to pay ($p < 0.05$). Sixty-four (32.3%) of those who wished to pay expressed willingness to pay on installment basis. Majority (87.9%) said they preferred buying the nets from the government clinics in contrast to private clinics (0.5%), pharmacy/chemist shop (1.0%), others such as trusted community member(s) (3.0%) and market vendors (3.5%). A very few (4.0%) respondents did not respond.

Perceived fair price for LLIN by respondents

The cost of untreated nets in the study communities according to 66.7% of those that had knowledge of the cost ranged from ₦150 (US$0.33) to ₦850 (US$1.88). The average cost of untreated net in the study area was ₦477 (US$1.06) with a median of ₦400 (US$0.89). Table 1 further shows the bidded prices the respondents were willing to pay for a treated net. On the one hand, the mean WTP at≥₦500.00 (US$1.11) was ₦700.00 (US$1.55) with a median of ₦500.00 (US$1.11). On the other hand, the mean WTP at ≥ ₦350.00 (US$0.78) was ₦383.00 (US$0.85) with a median of ₦300 (US$0.66).

Post-Intervention

Changes in knowledge about LLIN and utilisation among respondents

The level of knowledge of LLIN use among people in the study communities as presented in Table 1 increased from 63.8% and 77.4% to 87.4% and 89.8% in the test and control communities. The level of LLIN use among households not given free treated nets during the intervention in test communities increased from zero to 5.3% and 14.3% in the control communities.

Forty-six (90.2%) of the 51 household heads given LLINs in the two test communities and interviewed during the evaluation phase used one of the two nets given their households, 3 (5.9%) gave the nets to their spouses and young children under five years and 2 (4.0%) gave the nets to only the young children under five years for use.

Changes in perception of and willingness to pay for LLIN

The perception of people in both the test and control communities on the effectiveness of LLINs in protecting against mosquito bites improved following the intervention activities that involved continuous community health education as presented in Table 1.

In contrast to 98.1% (test) and 98.9% (control) that indicated willingness to pay for the treated net materials in the pre-intervention phase as shown in Table 1, 90.5% in the test communities and 97.9% in control communities expressed willingness to pay post-intervention. Statistical test showed that the belief in the effectiveness and benefits of the treated nets had significant influence on the respondents' willingness to pay for the nets in both the test ($\chi^2 = 30.12$, df = 6, $p < 0.05$) and control communities (the chi-square with Yates correction is 11.49 with p-value of less than 0.05). In contrast, respondents' level of education significantly influenced willingness to pay only in the control communities. Other factors including income and number of persons in household had no influence on willingness to pay for the net materials in both the test and control communities ($p > 0.05$).

The percentage of those willing to pay for the materials on installment basis increased during evaluation. Fifty-two (54.7%) of ninety-nine respondents and 28 (57.1%) of 49 respondents in test and control communities expressed willingness to pay on installment basis. The average number of treated nets the respondents was willing to buy at ₦500.00 (US$1.11) varied from one in test communities to two in the control communities.

A very low actual purchase of the net materials was recorded in the test communities. Only 6 of the 500 treated nets

deposited during the intervention at a predetermined price of ₦500.00 (US$1.11) in the test communities were purchased over period of six months.

On where the respondents find more convenient to buy treated nets, majority preferred the government clinics in either the test (71.6%) or control (75.5%) communities. A large number (76.5%) of the household heads that received the free treated nets distributed during the intervention similarly considered it more convenient to make their future purchase of treated nets from the government clinics. The community chief's house was mentioned by 15.7%, pharmacy shop (2.0%), retail/ wholesale shop (2.0%) and 3.9% did not respond.

Changes in perceived fair price for LLIN among respondents

In contrast to the perceived fair price the respondents bidded for in the pre-intervention shown in Table 1, majority (84.3%) of the household heads who were given nets indicated their wish to pay ≥ ₦350.00 (US$0.78) in the post-intervention interview while 9.8% were willing to pay ≥ ₦500.00 (US$1.11). Similarly, majority of respondents who were not given nets in both the test and control communities were willing to pay the minimum bid price ≥ ₦350.00 (US$0.78) in the post-intervention interview as presented in Table 1. The mean WTP at ₦500.00 (US$1.11) was ₦274.00 (US$0.61) and ₦312.00 (US$0.69) in the test and control communities respectively.

Perceived delivery strategies for LLIN by respondents

Despite the indication of finding it more convenient to make future purchase of the treated nets from government clinics as agreed by majority of the respondents, it was a general opinion among a larger proportion (94.1%) of the respondents that the community heads should be involved in the distribution of the net materials in the communities. A very few (2.0%) of the respondents were of the opinion of the need for regular community health education and low pricing to ensure affordability. Only 3.9% were undecided on what to suggest on how to improve the LLIN delivery strategy.

Discussion

The communities studied were poor farming and fishing communities. Majority of the respondents were even unable to purchase untreated nets which are relatively cheaper than LLINs depite their average number of rooms and persons per household that needed protection from sleeping under the net. This perhaps explains why none of them had ever used a treated net before the intervention.Added to this, their income level suggests the need for subsidy to enable their ability to buy the nets, hence the issue of inability to pay needs to be addressed. It is of concern that a few respondents were either not interested in it, perceived it as causing heat or preferred chemical spray.

A large proportion of the respondents were willing to pay for LLIN although largely on the basis of instalment payment and at costs below the factory purchase price. The willingness to pay for LLIN demonstrated in this study was higher than what was found in a household survey in Enugu State, South East Nigeria by Onwujekwe and another similar study that assessed the perceived fair price mothers of children under five years and pregnant women are willing to pay for LLINs in Ogun State, South-West Nigeria by Adeneye [20,28]. This perhaps suggests the need for subsidy by government in the procurement of LLINs in the study area and similar communities across the country in order to ease the price burden of LLIN and make it affordable and accessible for use in protection against malaria.

The major sources of information on LLINs identified as friends and relations should be taken cognisance of in information, education and communication (IEC) aspects on promoting LLIN use. Enhanced and continuous extensive health education is required in support of LLINs with emphasis on the benefits of the use.

The high knowledge about the availability of LLIN among respondents in the study communities is encouraging. Nevertheless, for the success of social marketing of LLIN, awareness creation about LLIN and its benefits need to be intensified, particularly in the remote parts of the country such as the communities studied where access to information is limited, using the primary healthcare delivery channels which many of the respondents preferred for its delivery and far-reaching media like the radio. We believe that if the materials could continuously be promoted by health workers at antenatal and post-natal clinics for use by expectant and lactating mothers, this would increase the coverage and extensive use of LLINs by many households. This would go a long way in reducing the morbidity and mortality attributable to malaria among the population particularly among pregnant women and children less than five years who are the most vulnerable groups to malaria. This approach will use the existing structure that has a positive spillover effect of low delivery cost and simple logistics with the added benefits of strengthening antenatal service, delivery and use as emphasized by Onwujekwe [28].

Claimed WTP as compared to actual WTP shows the unreliability of the former. It needs to be emphasized that claims on willingness to pay for any health commodities as demonstrated in some similar studies do not always match the reality as evidenced in Onwujekwe and Adeneye [20,28,43]. The fact that most of the respondents considered LLINs to be relatively more cost-effective than other means of preventing mosquito bites and the use of LLINs by all the households given LLINs indicate the willingness of the people to use them. However, intensive and continuous health education needs to be intensified to convince them to find means of paying for them. Furthermore, the wish by many to pay on instalment is a point of note in this respect.

The lack of awareness of the household heads on the need for the provision and use of treated nets by pregnant women and children particularly those under 5 years in the household as demonstrated by most of them being the users of the nets given their respective households exhibits the need for appropriate health education targeting this group. Emphasis need be placed

on re-orientation of the people from the cultural practice of giving preference to the household head in household use of LLIN. On actual use of the nets in the household, health education needs to emphasise the need where it is not possible to purchase for every member of the family, to give preference to pregnant women and children particularly those under five years of age in the provision of LLINs within the household. The health education provided during the intervention phase of the study impacted positively on the community's level of knowledge on LLIN use. It also increased the level of LLIN use among households not given LLINs in the test and control communities. The finding confirmed that health education has a major role to play in the successful implementation of LLIN use in rolling back malaria as emphasised by the Federal Ministry of Health (Nigeria) [12].

Although majority of the respondents expressed the desire to access LLINs from government health facilities, they would also like their village heads to play some role in facilitating the process through which their perceived village's allocation could be accessed and shared through the village head. This was perhaps based on the misconception that the LLINs will always be provided to everyone for free.

Moreover, there is the need for the provision of maximum support for the development of efficient procurement mechanisms and supply management programmes for LLINs. It is essential that standards for quality control of nets are developed and adhered to across the range of activities and services necessary to provide LLIN regardless of location. This we believe will enhance high quality, widespread distribution of and accessibility to the treated materials and eventually facilitate effective delivery and utilization of LLIN in the country without any doubt about the quality of the materials, particularly in the remote areas.

We share the belief that assessing the willingness of people to pay for a product is a step forward towards informing policy-makers about the amounts individual and households are prepared to pay, motivate policy formulation on strategies to address the issue through cost-recovery schemes and the introduction of subsidies for example emphasized by Guyatt [22]. Nonetheless, the elicited mean and median WTP can be used to inform and guide policy decisions on appropriate pricing of LLINs particularly in rural communities in the country.

It is important to emphasise that building on the positive perceptions about LLINs among the respondents with the adopting of a strategy that makes instructions about application and usage more understandable to the average individual in local languages is imperative.

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