Use of Insecticide-Treated Mosquito Net among Pregnant Women and Guardians of Children under Five in the Democratic Republic of the Congo

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1. Background

Malaria is a major cause of mortality and morbidity in the world, accounting for 148–304 million cases and an estimated 235,000–639,000 deaths globally. Most deaths occurred in the World Health Organization (WHO) African Region (92%), followed by the WHO South-East Asia Region (6%) and the WHO Eastern Mediterranean Region (2%). Between 165,000 and 450,000 deaths are estimated to have occurred in children aged under 5 years, which is equivalent to 70% of the global total [1].

Malaria is caused by an intraerythrocytic protozoa of the genus Plasmodium transmitted by the bite of an infective female Anopheles mosquito. Of the four Plasmodium species that infect humans, P. falciparum is common in sub-Saharan Africa and causes severe and potentially fatal malaria [1]. The other 3 species include P. vivax, P. ovale, and P. malariae. P. vivax is common in Asia and Latin America [2]. Malaria can also be transmitted through transfusion of contaminated blood or during child birth [3].

The signs and symptoms of malaria illness vary widely. Symptoms of uncomplicated malaria episode include fever, chills, sweats, headache, nausea, vomiting, body ache, and malaise, whereas symptoms of severe clinical episode are organ dependent. Abnormal behavior, seizures, coma, or impairment of consciousness is observed in cerebral malaria. Anemia, jaundice, and hemoglobinuria result from massive destruction of red blood cells. Other severe symptoms
include acute respiratory distress, low blood pressure, acute kidney failure, metabolic acidosis, and hypoglycemia [4]. Conventional diagnosis is based on examination of thin and thick blood films stained with Giemsa’s or Field’s stain. The antigen-based dipstick tests known as “Rapid Diagnostic Tests” (RDTs) offer a useful alternative to microscopy in situations where reliable microscopic diagnosis is not available [4]. PCR-based diagnostic tests for human malarialias are more applicable to large-scale surveys than to clinical diagnosis [5].

In addition to the human cost, the economic burden of malaria is vast. It is estimated that malaria costs African countries more than US $12 billion every year in direct losses [6]. This figure includes the costs of healthcare, absenteeism, days lost in education, decreased productivity due to brain damage from cerebral malaria, and loss of investment and tourism. Certain countries that managed to completely eliminate malaria in recent times have had more rapid economic growth than their neighbors [7].

The Government of the Democratic Republic of Congo (DRC), through the National Malaria Control Program (NMCP), has, with the support of its partners (including the World Bank, USAID, UNICEF, Association for Family Health (ASF) and the Global Fund), relied on the use of insecticide-treated mosquito nets (ITNs), together with treatment of malaria with artemisinin-based combination therapy (ACT) to control malaria in the country. However, access to ACT is difficult in the DR Congo. Due to high cost, ACT is not readily available in the private sector [8]. Counterfeiting of ACT is a growing global challenge [9]. In addition, report of the emergence of artemisinin-resistant *P. falciparum* in Africa is very disturbing [10]. Efforts by the government of the Congo to scale up free distribution of ITNs during the last 10 years contributed to increase household ITNs ownership rates to 72% although ITNs utilization remains low (52%) [11]. Modern mosquito nets lack physical durability, and household nets can accrue an average of 12–20 holes during 1-2 years of use [12]. Net replacement schemes struggle to meet demand at this level of deterioration and attrition [13]. The objective of this study was to examine knowledge, attitude, and practice about the use of insecticide-treated mosquito nets (ITNs) in the prevention of malaria among pregnant women and guardians of children under 5 years living in these households.

First, 177 health areas (HA) were selected out of 5624 using a probability proportional to size (PPS) sampling method, so that more populated HAS had a higher probability of being selected. In each HA, households with at least one child aged 6–59 months or a pregnant woman were listed by community health workers (CHW). From the list of households, 35 eligible households were randomly selected, yielding a total of 5748 households. One guardian or pregnant woman was interviewed in each household.

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.

2.2. Data Collection. Eight teams of 15 enumerators and 3 community liaisons were trained in interviewing techniques and administration of informed consent during simulated interviews sessions. A pretested questionnaire was used to collect information. The questionnaire was developed in French with oral translation into locale languages (Lingala, Kikongo, Swahili, and Tshiluba) and field tested prior to 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, bednet ownership, source of bednets, bednet utilization, history of fever (past 2 weeks), factor of opportunity (perception of the bednet, cost, availability, social norm), factor of ability (knowledge

![Figure 1: Opportunity, motivation, and ability (OMA) framework.](image-url)

**Figure 1:** Opportunity, motivation, and ability (OMA) framework.
about malaria, knowledge about mode of prevention, and self-efficacy), and factor of motivation (perception about severity, usefulness, and attitude towards the brand). 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.

2.3. Data Analysis. Data were entered using the Census Surveys Professional (CSPro) software and were exported to and analyzed using SPSS 22.0. Descriptive statistics were carried out for sociodemographic characteristics, ITN household ownership and utilization of bednets, and knowledge of malaria. Logistic regression analysis was used to assess the independent association between independent variables and the outcome of interest.

2.4. Dependent Variable. The use of bednets 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.

2.5. 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, and attitude towards ITN. 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 [22].

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.”

2.6. 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.

3. Results

3.1. Sociodemographic Characteristics. Table 1 summarizes the sociodemographic characteristics of the participants. Of the 5,138 individuals who participated in the survey, 4,966 (96.6%) were women. Among them, 2,008 were pregnant at the time of the study. The majority of the participants (68.8%) were married and 35.5% of them were housewives. About 74.3% of participants had at least a primary level of education; 54.3% were 15 to 29 years of age. Catholic, protestant, and charismatic churches were the most commonly reported religious affiliations. The majority of participants lived in urban areas (61.6%), and had a low socioeconomic status (42.5%).

3.2. Malaria Knowledge among Participants. Participants in the study had a high level of knowledge about malaria. More than 80% of the participants knew a relative who suffered from malaria in the past 12 months, could name at least one sign or symptom of malaria, or list one method to prevent malaria (Table 2). Although the majority of participants knew that mosquito bites transmit malaria (89%), misconceptions about malaria transmission persist. Some respondents thought that drinking unclean water (19.1%) or being exposed to the sun (3.1%) could cause malaria. Health centers (47.2%), radio stations (24.7%), and community health workers (10.5%) were the most commonly reported sources of information about malaria.

3.3. Bednet Ownership and Utilization. Table 3 summarizes ITN ownership and utilization. ITN ownership rates were high. Eighty-one percent (81.6%) of the participants reported having an ITN in their household. About 75.7% reported having 2 or more bednets. ITN ownership varies among provinces. The Oriental Province (91.9%), Bas Congo (89.2%), and Kasai East (86.2%) reached universal coverage. The lowest coverage rate was reported in Kasai Occidental Province (67.9%) (Table 4).

Regarding the utilization of ITN, 78.4% participants reported having used an ITN the night before the interview. More than 80% of the participants in the Oriental Province, Bas Congo, and Kasai Oriental reported using ITN the night before the interview compared to 69.2 and 72% in the Kasai Occidental and Bandundu province, respectively (Table 4). Among groups most vulnerable to malaria, 71.4% of pregnant women reported having slept under an ITN the night before the survey. The Oriental Province (81.6%) and Maniema (81.4%) reported the highest utilization rate compared to Kasai Occidental (64.5%), Bas Congo (66.4%), and even Kinshasa (67.7%). Guardians of children under five reported that 68.2% of children slept under ITN the night before the interview. The highest utilization rate was reported in Kasai Oriental (74.6%), Bas Congo (74.0%), and the Oriental Province (73.5%) compared to Maniema (59.2%) and Kasai Occidental (62.7%).

When asked if they would purchase a bednet if given money, 65% of participants answered affirmatively. They were further asked which bednet would they use between the one they purchased and the other received free of charge.
The majority of participants (72%) said that the method of acquisition of ITN has no bearing on the decision to use it or not. Examining where people get information about bednets, we noted that the health centers (40%) and radio stations (20%) were the most commonly reported sources of information. Participants were asked to explain the reasons why they did not use an ITN the night before the interview. Lack of money and the unbearable heat were the two main reasons for not using bednets.

### 3.4. Determinants of ITN Utilization

Only independent variables found to be associated with the independent variable in the bivariate analysis were included in the Logistic Regression Model (Table 5). Of all the factors included in the model, age, marital status, and perception of severity were not significantly associated with the use of ITNs. Perception about ITN, self-efficacy, social norm, and attitude towards ITN had a relatively strong association with ITN utilization. Women who believe that it is normal to use ITNs were 1.9 times more likely to use ITN than those who did not (OR: 1.930; 95% CI: 1.645–2.265). Women who were confident in their abilities to use ITNs were 1.9 times more likely than those who do not to use ITNs (OR: 1.915, 95% CI: 1.489–2.464). Women who had a good attitude towards ITNs were more likely to use ITNs compared to those who do not (OR: 1.529, 95% CI: 1.258–1.858).

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| Characteristics | Description | Total | Percentage (%) |
|-----------------|-------------|-------|----------------|
| Education level | No education | 1040  | 20.2           |
|                 | Primary school level | 1215  | 23.6           |
|                 | Secondary school+ | 2552  | 49.7           |
|                 | College       | 331   | 6.4            |
| Age             | 15–19         | 472   | 9.3            |
|                 | 20–24         | 1055  | 20.8           |
|                 | 25–29         | 1227  | 24.2           |
|                 | 30–34         | 984   | 19.4           |
|                 | 35–39         | 691   | 13.6           |
|                 | 40–44         | 325   | 6.4            |
|                 | 45+           | 313   | 6.2            |
| Marital status  | Single        | 417   | 8.1            |
|                 | Married       | 3502  | 68.8           |
|                 | Married poly  | 378   | 7.4            |
|                 | Divorced/widowed | 148  | 2.9            |
|                 | Widows        | 138   | 2.7            |
|                 | Free union    | 509   | 10.0           |
| Residence-urban| No            | 1971  | 38.4           |
|                 | Yes           | 3167  | 61.6           |
| Occupation      | Housewife     | 1804  | 35.5           |
|                 | No job        | 522   | 10.3           |
|                 | Employees     | 415   | 8.2            |
|                 | Farmer        | 1005  | 19.8           |
|                 | Small business| 669   | 13.2           |
|                 | Others        | 660   | 13.0           |
| Religion        | Islam         | 159   | 3.1            |
|                 | Catholic      | 1556  | 30.6           |
|                 | Protestant    | 1064  | 20.9           |
|                 | New movement  | 1795  | 35.3           |
|                 | Kimbanguists  | 227   | 4.5            |
|                 | Black Church  | 55    | 1.1            |
|                 | Animists      | 8     | 0.2            |
|                 | Others        | 221   | 4.3            |
| Socioeconomic status* | Low | 2184  | 42.5           |
|                 | Average       | 1479  | 28.8           |
|                 | High          | 1475  | 28.7           |

*Based on the Amenities and Possession Index.
Table 2: Malaria knowledge among participants.

| Characteristics                                      | Description | Frequency | Percentage |
|------------------------------------------------------|-------------|-----------|------------|
| History of malaria in your family in the past 12 months | No          | 771       | 18.8       |
|                                                      | Yes         | 3321      | 81.2       |
| Number sign/symptoms of malaria known                | 0           | 87        | 1.9        |
|                                                      | 1-2         | 1101      | 23.5       |
|                                                      | 3 and more  | 3500      | 74.7       |
| Number of methods to prevent malaria known           | 0           | 168       | 3.3        |
|                                                      | 1-2         | 470       | 9.1        |
|                                                      | 3 and more  | 4079      | 79.4       |
| Knowledge of the cause of malaria                    | No          | 508       | 10.8       |
|                                                      | Yes         | 4205      | 89.2       |
| Best ways to protect against malaria                 | Keep house clean | 1386   | 27.7       |
|                                                      | Insecticide treated bednets | 982 | 19.6 |
|                                                      | Drink clean water/avoid drinking dirty water | 980 | 19.1 |
|                                                      | Spray insecticide | 507 | 10.1 |
|                                                      | Take medicine | 390 | 7.8 |
|                                                      | Avoid exposure to the sun | 153 | 3.1 |
|                                                      | Others       | 316       | 6.3        |
| Sources of information                                | Health centers | 1277 | 47.2 |
|                                                      | Radio        | 669       | 24.7       |
|                                                      | Health workers | 284 | 10.5 |
|                                                      | Television   | 221       | 8.2        |
|                                                      | Posters      | 50        | 1.8        |
|                                                      | Billboards   | 48        | 1.8        |
|                                                      | Others       | 86        | 3.2        |

Level of education, place of residence, and knowledge of the cause of malaria were associated with the use of ITNs, but the association was borderline. Women with high school education or higher were 1.3 times more likely than those with up to primary school level of education to use ITNs (OR = 1.3, 95% CI: 1.085–1.611). Women who knew that mosquito bites transmit the agent that causes malaria were significantly more likely those who did not know to use ITNs (OR: 1.378; 95% CI: 1.09–1.742). Women living in urban areas were more likely to use ITNs than those in rural areas (OR = 1.236; 95% CI: 1.049–1.458).

4. Discussion

This study was undertaken to examine knowledge, attitude, and practice on the use of insecticide-treated mosquito nets in the prevention of malaria among pregnant women and guardian of children under five in the Democratic Republic of the Congo. Considering that two-thirds of the population in the Democratic Republic of the Congo live in malaria endemic areas and ITN use is widely recognized as an effective intervention to prevent malaria, the National Malaria Control Program (PNLP), in partnership with international aid agencies, has been organizing mass distribution of ITNs across the country to increase ownership and promote utilization of ITNs. Ownership of at least one bednet per household is the targeted outcome of the campaign.

Our study showed rapid attainment of high ITN coverage through free bed net distribution in impoverished communities. A coverage rate of 81.6% was achieved in the 8 provinces of the DR Congo following free bed net distribution. High ITN coverage rates following free bed nets distribution were previously reported in the Congo [23] and elsewhere in sub-Saharan Africa including Sierra Leone (87.6%) [24], Ethiopia (91.0%) [24], and Togo (96.7%) [25]. However, the size of the DR Congo, being as large as the size of the United State West of Mississippi River, presents a daunting challenge for the NMCP to organize mass distribution of ITNs across the country. As a result, ITN coverage rates vary widely across the provinces. ITN ownership rate of 91.9% was reported in the Oriental Province compared 67.9% in the Kasai Occidental Province. More investments are needed to assist the National Malaria Control Program to scale up ITN distribution in selected provinces where the coverage remains low (e.g., Kasai Occidental Province).

This study also showed that high ITN coverage did not translate into concomitant high ITN utilization. Although the percentage of households that own at least one ITN was quite high (81.6%), the utilization of ITN on the other hand remained low among children under five (68.2%) and moderate among pregnant women (71.4%). While low utilization of bed nets among children under five were reported in previous studies [5, 16], the reasons behind that observation
### Table 3: Bednet ownership and utilization.

| Characteristics                          | Description | Frequency | Percentage |
|------------------------------------------|-------------|-----------|------------|
| Do you have a bed in your household?     | No          | 896       | 18.4       |
|                                          | Yes         | 3985      | 81.6       |
| How many bednet do you have in the household? | 1           | 953       | 24.3       |
|                                          | 2           | 1231      | 31.4       |
|                                          | 3           | 1018      | 25.9       |
|                                          | 4+          | 721       | 18.4       |
| Did you use the bednet last night?       | No          | 1023      | 21.6       |
|                                          | Yes         | 3710      | 78.4       |
| How often do you use it a week?          | Everyday    | 3722      | 73.7       |
|                                          | 2           | 181       | 3.6        |
|                                          | 3           | 282       | 5.6        |
|                                          | Never       | 862       | 17.1       |
| Have you ever bought a bednet            | No          | 4468      | 88.3       |
|                                          | Yes         | 590       | 11.7       |
| How much it cost you the last time you bought one? | $2.0 (sd: 720) |           |            |
| Would you prefer the bednet you bought over the one you received for free | No          | 3638      | 72.1       |
|                                          | Yes         | 1406      | 27.9       |
| If you had money, will you buy a bednet?  | No          | 1793      | 35.4       |
|                                          | Yes         | 3278      | 64.6       |
| Being counseled about bednet             | No          | 1117      | 22.4       |
|                                          | Yes         | 3871      | 77.6       |

| Health centers          | 1520 | 40.4 |
|-------------------------|------|------|
| Radio                   | 779  | 20.7 |
| Church                  | 458  | 12.2 |
| CHW                     | 301  | 8.0  |
| TV                      | 225  | 6.3  |
| Neighbors               | 193  | 5.1  |
| Family                  | 54   | 1.4  |
| Sellers                 | 79   | 2.1  |
| Others                  | 153  | 4.1  |

have not been elucidated. We posit that the difference in the sleeping arrangements of children under five could, in part, explain this result [26]. Baume and Marin reported that parents consider children under 2 years of age to be more vulnerable to malaria and tend to place them in priority under bed nets [27]. They are inclined to remove their 3-year-old child from the parents’ bedroom to join their older siblings who often times spend the night in the living room or in the hall ways. Unlike the 2-year-old children, the older children are not protected and therefore more exposed to malaria. More studies are needed to conform this assertion.

Finally, this study examined the factors associated with ITN utilization and found that social norm, self-efficacy, women's perception about ITN, and factors of motivation (such as attitude towards bednet) were significantly associated with ITN utilization. These findings underscore the need for designing new, effective, and evidence-based behavior change interventions to enhance ITN utilization in the Congo. To improve the utilization rate of ITNs in the Congo, policy makers should consider using a multifaceted intervention addressing people's self-efficacy in placing bed nets in the bedrooms, the prevailing social norm in the community, and their attitude and acceptability of bed nets. Increasing people's ownership of bed nets alone does not always translate into action. Furthermore, existing misconceptions about the cause of malaria may prevent community members from taking the right course of action to prevent malaria. For example, the belief that drinking uncleaned water or being exposed to the sun causes malaria can prevent people from using ITNs to protect themselves.

Considering the proven effectiveness of ITNs in reducing malaria morbidity and mortality, it is imperative for the NMCP to remain focused in promoting both ITN ownership and utilization since access to bed nets does not guarantee their utilization. Public debate has largely focused upon the comparative merits of free and market-based strategies for deploying ITNs [28–30]. While mass distribution has been shown to be the best approach to achieve rapid scale, it requires huge capital to organize and carry out the campaign. In addition, loss of physical integrity of ITNs and inaccessibility due to geographic barriers constitute major hindrances to maintaining universal coverage [31].
Table 4: ITN ownership and utilization among groups vulnerable in the different provinces.

| Province          | Total ITN ownership | All participants | ITN utilization | Under five |
|-------------------|---------------------|------------------|----------------|-----------|
|                   | No (18.4%)          | Yes (81.6%)      | No (28.6%)     | Yes (71.4%)|
|                   | 896                 | 3985             | 574            | 2130      |
| Kinshasa          | 70 (16.2%)          | 365 (83.9%)      | 40 (32.3%)     | 169 (29.1%)|
| Bas Congo         | 34 (10.9%)          | 281 (89.2%)      | 40 (33.6%)     | 80 (26.0%)|
| Bandundu          | 243 (24.6%)         | 749 (75.5%)      | 104 (29.8%)    | 476 (37.8%)|
| Equateur          | 187 (19.7%)         | 761 (80.2%)      | 98 (27.3%)     | 406 (33.1%)|
| Province Orientale| 58 (8.1%)           | 657 (91.9%)      | 51 (18.4%)     | 293 (26.5%)|
| Maniema           | 37 (21.9%)          | 132 (78.1%)      | 13 (18.6%)     | 113 (40.8%)|
| Kasai Oriental    | 115 (13.8%)         | 720 (86.2%)      | 91 (28.1%)     | 281 (25.4%)|
| Kasai Occidental  | 151 (32.1%)         | 320 (67.9%)      | 137 (35.3%)    | 312 (37.3%)|
Table 5: Logistic Regression Model for ITN utilization.

| Variables                        | Bednets utilization | OR      | (95% CI)     | P value |
|----------------------------------|--------------------|---------|--------------|---------|
|                                  | No N = 1024        | Yes N = 3720 |              |         |
| Age                              |                    |          |              |         |
| 15–29 years                      | 595 (58.1)         | 1988 (53.4) | 1            |         |
| 30+                              | 429 (41.9)         | 1732 (46.6) | 0.874        | 0.746–1.025 | >.05   |
| Attended school                  |                    |          |              |         |
| No                               | 278 (27.1)         | 662 (17.8) | 1            |         |
| Yes                              | 746 (72.9)         | 3058 (82.2) | 1.322        | 1.085–1.611 | <.05   |
| Urban                            |                    |          |              |         |
| No                               | 385 (37.6)         | 1327 (35.7) | 1            |         |
| Yes                              | 639 (62.4)         | 2393 (64.3) | 1.236        | 1.049–1.458 | <.05   |
| Marital status-live in union     |                    |          |              |         |
| No                               | 159 (15.5)         | 512 (13.8) | 1            |         |
| Yes                              | 865 (84.5)         | 3208 (86.2) | 1.019        | 0.815–1.274 | >.05   |
| Knowledge cause of malaria       |                    |          |              |         |
| No                               | 139 (16.2)         | 334 (9.5)  | 1            |         |
| Yes                              | 720 (83.8)         | 3166 (90.5) | 1.378        | 1.09–1.742 | <.05   |
| Perception severity              |                    |          |              |         |
| Low                              | 167 (39.6)         | 413 (11.9) | 1            |         |
| High                             | 685 (80.4)         | 3069 (118.1) | 1.189       | 0.949–1.489 | >.05   |
| Perception of the ITN*           |                    |          |              |         |
| Low                              | 257 (30.0)         | 762 (21.9) | 1            |         |
| High                             | 597 (69.9)         | 2725 (78.1) | 1.521       | 1.270–1.821 | <.05   |
| Self-efficacy                    |                    |          |              |         |
| Low                              | 154 (18.1)         | 252 (72.0) | 1            |         |
| High                             | 698 (81.9)         | 3242 (92.8) | 1.915       | 1.489–2.464 | <.05   |
| Norm social                      |                    |          |              |         |
| No                               | 480 (55.9)         | 1356 (38.6) | 1            |         |
| Yes                              | 378 (44.1)         | 2156 (61.4) | 1.930        | 1.645–2.265 | <.05   |
| Attitude: bednets are useful     |                    |          |              |         |
| No                               | 257 (30.0)         | 579 (16.5)  | 1            |         |
| Yes                              | 600 (70.0)         | 2929 (83.5) | 1.529        | 1.258–1.858 | <.05   |

*Containing missing values.
Considering that funding from donors will likely decrease over time, the commercial sector’s ability to sell ITNs in retail markets appears to be a viable option. But experiences in many different countries show that only around 20% of the population is willing and able to pay for the nets. This coverage is not high enough for protecting vulnerable groups nor for achieving the “mass effect.” In a study conducted in Tanzania, Magesa et al. [32] achieved rapid attainment of high net coverage for the vulnerable population through the combined contributions of the product provision campaign and voucher subsidy while broad coverage for the rest of the community resulted largely from nets purchased on the open market at full price. The lesson learned from this study is to apply diverse approaches to deliver ITNs simultaneously in an imperfect but constructive and complementary manner.

5. Limitations

The first limitation of this study is the lack of baseline data to assess the extent to which free bed net distribution improved ITN coverage in the 8 provinces surveyed. The use of self-reported information on ownership and utilization of ITNs without verification is prone to recall and information biases. Respondents could have reported ITN ownership and utilization due to social desirability. The strength of this study is its large sample size and the collection of data in several provinces of the Democratic Republic of the Congo.

6. Conclusion

Although mass distribution of ITNs contributed to high level of knowledge about malaria and attainment of rapid high ITN coverage rates in the 8 provinces studied, the utilization of ITNs among pregnant women and children under five remained low. The NMCP should take into account the factors associated with the use of ITNs in designing evidence-based behavior change interventions to improve the utilization of ITNs in the Democratic Republic of the Congo.

Conflicts of Interest

The authors declare that they have no significant competing financial, professional, or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

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