

ASSESSING THE EFFECTIVENESS OF SCHOOL-BASED INSECTICIDES TREATED NETS DISTRIBUTION IN KONO DISTRICT

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Abstract

Background: Malaria remains a critical public health issue in Sierra Leone, disproportionately affecting children under five. Despite wide-scale insecticide-treated net (ITN) distribution, usage and access remains suboptimal in household. To address this, the National Malaria Control Program piloted a school-based ITN distribution initiative in Kono District to increase the channel of distribution to school-age children who constitute a significant reservoir for malaria transmission.

Aim/Objectives: The study aimed to evaluate the effectiveness of the school-based ITN distribution program in Kono District by assessing ITN distribution coverage, pupils' knowledge of malaria prevention, and identifying factors influencing ITN use and challenges in the distribution process.

Methods: A descriptive cross-sectional study employing a mixed-methods approach was conducted. Quantitative data were collected from 228 pupils through surveys to assess ITN coverage and knowledge about malaria and ITN care. Qualitative data were gathered through interviews with 20 stakeholders to identify challenges faced during the distribution.

Findings: The study revealed distribution coverage of 69.1%, falling short of the target 85%. Although 78.1% of pupils correctly identified mosquitoes as the cause of malaria, knowledge gaps persisted regarding symptoms and prevention. Stakeholders identified logistical challenges, poor planning, limited community engagement, and insufficient training as major barriers to effective distribution.

Conclusion/Recommendations: The study concludes that school-based ITN distribution can enhance access to malaria prevention tools among children but emphasizes the need for improved educational outreach on malaria awareness and net care. Recommendations include developing targeted educational programs for pupils and families, enhancing stakeholder involvement in future distributions, and addressing logistical barriers to ensure sustained ITN usage.

Keywords: Insecticide-Treated Net, Malaria, distribution, knowledge of malaria prevention

INTRODUCTION

In sub-Saharan Africa, malaria is one of the leading causes of morbidity and mortality among school-age children (SAC). SAC make up more than 60% of the malaria transmission reservoir, yet malaria prevention measures do not prioritize them as much (Nankabirwa et al., 2014). Malaria is a disease that can be avoided and treated and is spread by Anopheles mosquitoes. Despite advances in malaria treatment and prevention, Africa still has 93% of the world's malaria cases (WHO, 2024), even though the UN's Millennium Development Goal 6C, sought to reverse the incidence of malaria by 2015 (Teklehaimanot et al., 2007).

Despite the enormous progress made in ITN distribution, malaria is still a public health concern and an endemic disease (Walldorf et al., 2015). To control malaria in Sierra Leone, the National Malaria Control Program (NMCP) developed a strategic plan to find evidence-based solutions (NMCP, 2020). In 2019, United States President

Malaria Initiative (USPMI) reported that NMCP distributed 3,264,927 and 3,523,873 ITNs in 2010 and 2014 to households throughout the country.

ITNs limit the transmission of malaria because they serve as a physical barrier between people and mosquitoes (WHO, 2020). The mosquito species that transmit malaria bites between dusk and sunrise, according to the WHO. Sierra Leone has a tropical environment, which allows malaria transmission all year round (Malaria Indicator Survey [MIS], 2016). However, weather can have an impact on the lifetime and mobility of mosquitos. Therefore, the use of ITNs when sleeping is crucial (Ahorlu et al., 2019)

The best available malaria prevention method is still ITNs. The success of ITNs depends on ensuring widespread access to and use of them (Ahorlu et al., 2019). General household features are thought to be a concern with ITN usage, along with public health outbreaks. According to data from the 2016 Sierra Leone Malaria Indicator Survey (SLMIS), 60% of households in Sierra Leone own at least one ITN. One ITN could serve two people in a single family, according to the SLMIS. Studies show that just 16% of households follow this (NMCP, 2016). Despite ITNs being accessible, studies have shown that the population as a whole use them infrequently (Konlan et al., 2017; MoHS, 2016, 2017; Ranasinghe et al., 2015; Vincent, 2020). There is a glaring behavioural gap in how families use ITNs that need to be researched and addressed. As a result, this study examines survey data to examine the effectiveness of the pilot distribution of ITNs in Kono district among school-age children.

Problem Statement

In the Kono area, ITN coverage and use are still not at their best despite the employment of a variety of distribution tactics, including mass distribution campaigns and focused delivery to pregnant women and school-based children. ITN use and coverage determine how well they work to reduce malaria transmission and morbidity. Campaigns to distribute ITNs in schools have been launched in several African nations, and they appear to be having a positive impact on ITN use and coverage. Since school based ITN distribution initiatives are being undertaken for the first time in Kono district, Sierra Leone, there is, however, no data on their efficacy. As a result, it's important to evaluate the success of the ITN distribution campaign in schools, as well as to recognize the obstacles and lessons learned.

In Sierra Leone, preventing malaria continues to be a top issue. In children under the age of five, the disease is currently the main cause of morbidity and mortality. 95% of the population is thought to be at risk (MoHS, 2016; WHO, 2019). The socioeconomic growth of Sierra Leone is likewise thought to be significantly hampered by malaria (USGMC, 2019).

The NMCP was established in 2006 to provide ITN to control and eradicate malaria in Sierra Leone. For instance, the MoHS distributed 3,264,927 and 3,523,873 ITNs to families across the nation in 2010 and 2014, respectively (USGMC, 2019).

Malaria continues to impact the general population and is an endemic disease, despite the enormous strides that have been made in ITN distribution. Malaria has a case fatality rate of 17.6%, accounts for 38% of hospital admissions and 47% of outpatient morbidity for children under five (MoHS, 2017a). ITNs are readily available, however studies show that overall population use of ITNs is still low (Konlan et al., 2017; MoHS, 2016, 2017; Ranasinghe et al., 2015; Vincent, 2020). According to a USGMC research from 2019, just 44% of homes in Sierra Leone had ITNs for children under the age of five on average.

ITNs have a wide free distribution, low health hazards, and a demonstrated capacity to reduce malaria in children under five, but there is a gap in the literature regarding why they are not utilized frequently. According to the CDC, one factor in ITN usage among children under five years old may be their "lack of understanding of its (ITNs) importance" (CDC, 2019). Therefore, this will explore the knowledge of pupils about malaria and care of ITN and the distribution coverage.

Aim:

To assess the effectiveness of the school-Based Insecticide treated nets Distribution Pilot in Kono district.

Objectives:

The specific objectives of this study are to:

- To determine the distribution coverage of the ITN among pupils in Kono district
- To assess the knowledge of pupils on Malaria cause, prevention, and care of ITN in Kono district.

- To assess the perspective of key stakeholders about the net distribution
- To examine the challenges faced in the distribution process

Research Questions

This study will answer the following questions:

- What is the percentage coverage of ITN distribution among pupils in Kono District?
- What is the knowledge of pupils on Malaria cause, prevention, and care of ITN in Kono district?
- What are the perspectives of key stakeholders about net distribution?
- What are the challenges faced in the distribution process?

Significance of the study

This study will provide valuable insights into the effectiveness of school-based ITN distribution programs in improving ITN ownership and use among school- aged children in the Kono district. Despite the significant investments to control malaria infection rates over the years, infection rates among children under five years remain substantial in sub-Saharan Africa (Afoakwah et al., 2018).

To manage and eliminate malaria in Sierra Leone, the NMCP engaged in distributing free ITN every three years. Although ITN use is considered an effective inhibitor against the transmission of malaria, in Sierra Leone, there the access and use remain sub-optimal (MIS, 2016). Therefore, the NMCP decided to create another distribution channel(School-based ITN distribution) to improve access and use in Households through school children in Sierra Leone. This study is essential to fill the literature gaps relating to school-based distribution coverage of ITN in Kono district and the knowledge of pupil about the importance of Malaria and Mosquito net Care (CDC, 2019). The study will also help to assess the perspectives of key stakeholders involved in the distribution and identify the challenges of the school-based ITN distribution pilot program in Kono district. Provide recommendations, which can inform program improvements and scaling up in other regions in Sierra Leone and beyond.

Theoretical Foundation

To better understand the effects of health behaviour on the usage of ITN to prevent malaria and pinpoint the variables that might affect its effectiveness in Sierra Leonean school-based children, the HBM was used as the theoretical framework for this study. The HBM is a theoretical framework for analyzing individual decisions people make in relation to how they perceive their health. Cultural norms, traditions, societal and religious beliefs, gender roles, institutional and environmental elements all have an impact on the backdrops of behaviour and social change (Diala et al., 2013, Ruyange et al., 2017).

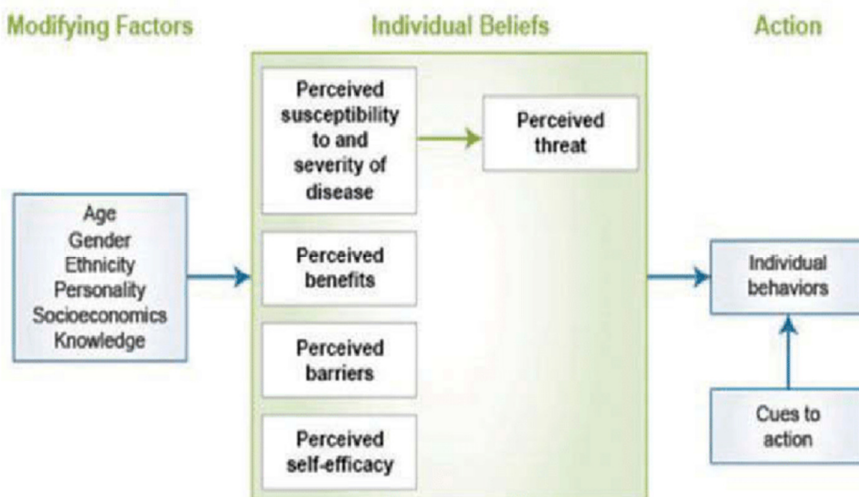


Figure 1. Health belief Model

Source: https://www.researchgate.net/figure/Health-Belief-Model-HBM_fig1_318473387

RESEARCH METHODOLOGY

Research Design and Rationale

This mixed-methods study investigates the effectiveness and challenges of the school-based Insecticide-Treated Net (ITN) distribution program in Kono District, Sierra Leone. The research aims to explore the coverage of ITN distribution, assess pupils' knowledge of malaria causes, prevention, and care of ITNs, and identify the perspectives of key stakeholders and challenges associated with the distribution process. The study also seeks to gather recommendations for improving the effectiveness and sustainability of future school-based ITN distribution initiatives.

The study will use a cross-sectional research design, which allows for the collection of data at a single point in time. This design is appropriate for describing the current state of ITN distribution, knowledge, and perceptions within the population. By collecting both quantitative data (e.g., percentage coverage, knowledge scores) and qualitative data (e.g., stakeholder perspectives, challenges), the study aims to provide a comprehensive understanding of the factors influencing ITN distribution and its impact on malaria prevention among pupils.

The rationale for using a mixed-methods approach is to gain a more complete picture of the distribution campaign's effectiveness, addressing both numerical data on coverage and knowledge, as well as qualitative insights into the barriers and recommendations for future improvement. This approach also ensures the research captures both measurable outcomes and the nuanced experiences of those involved in the distribution process. A quantitative-only approach would be insufficient, as it would overlook the complex human and contextual factors influencing ITN distribution, which are critical for understanding the broader implications of the program (Frankfort-Nachmias & Nachmias, 2008). In a cross-sectional study, the investigator gathers information from the whole study population at a single point in time to investigate the association between the variables of interest and disease (Dubois et al., 2019; Ridder, 2017). The cross-sectional study is like a snapshot of the population and requires a one-time evaluation of the and findings from a cross-sectional study can be generalized to the population. It also has the advantage of being easy to conduct and fast to execute. I used a cross-sectional study to examine factors that influence the use of ITNs to control malaria prevalence, including percentage coverage of ITN distribution, the knowledge of pupils on Malaria cause, prevention, and care of ITN, the challenges associated with the implementation of the school-based ITN distribution campaign, and the evidence-based recommendations for improving the effectiveness and sustainability of future School-Based Distribution campaigns.

Study Area

Sierra Leone has a population of 7,813,215 (Word Bank, 2019). The country is located on the West Coast of Africa, between latitudes 7 and 10 north and longitudes 10.5 and 13 west. (MoHS, 2016, 2020). It is a compact country with a total area of 71,740 km² (27,699 sq. ml) on the great bulge of West Africa's 402 km coastline. The Atlantic Ocean serves as the country's boundary in the west, the north and east by Guinea and south-east by Liberia (Figure 1).

The country has varied terrain, ranging from coastline swamps through inland swamps and rain forest to one of the highest mountains in West Africa, the Bintumani, at 2200m. The country's coastal line has several mangrove swamps, which provide the breeding sites for *Anopheles melas* mosquitoes, one of the primary vectors of malaria besides *Anopheles gambiae*, and *Anopheles funestus*.

The typical climate of Sierra Leone is tropical, with temperatures ranging from 21oC to 32oC and a mean daily temperature of 25oC. The country has two major seasons, including the wet season (May to October) and the dry season (November to April), with heavy rains in July and August. It has an average rainfall of about 320cm yearly. The relative humidity is high, extending from 60 to 90%. (MoHS, 2016, 2017, 2020).



Figure 2. The Geographical Location of Sierra Leone.

Source: <https://www.aardy.com/blog/sierra-leone-country-information/>

According to the MoHS (2017b), the country is subdivided into four administrative regions – the North, East, Southern provinces, and the Western Area, where the capital city (Freetown) is located. Roughly 21% of Sierra Leoneans live in the geographically small Western Area; 35% in the North; 23% in the East; and 20% in the South. These regions are further segmented into 14 districts, as shown in Figure 2. Freetown, the capital, is in the Western Area. The districts are subdivided into 152 chiefdoms.



Figure 3. Map showing the Fourteen Districts of Sierra Leone

Source: Kamara, M. H. (2019). Ebola in rural Sierra Leone: its effect on the childhood malnutrition programme in Tonkolili district.

The Government of Sierra Leone (GoSL) has been attempting to devolve many functions to the district and chiefdom levels since the Local Government Act was passed in 2004, with mixed results across its various sectors. The country has roughly fifteen different ethnic groups. The official language is English, and most individuals also speak Krio, the most common local language.

Kono District is a district in the Eastern province of Sierra Leone. Its capital and largest city is Koidu Town. Motema is the second most populous city in the district. The other major towns in the district include Yengema, Tombodu, Jaiama Nimikor and Sewafe. The district is the largest diamond producer in Sierra Leone. The population of Kono District is 505,767 (census, 2015). Kono district borders Kenema District to the southwest, The Republic of Guinea to the east, Koinadugu District to the northeast and Kailahun District to the southeast. Kono District is divided into fourteen chiefdoms (census, 2015). Also, Kono District is one of the most ethnically diverse districts in Sierra Leone and is home to a large population of many of Sierra Leone’s ethnic groups with no single

ethnic group forming majority. Kono District Population is religiously diverse among Muslims and Christians, though Muslims make up majority of the population in Kono District.

Data Collection Method

This study employed primary data collection to gather new insights directly from the study population. The data collection process began with the formulation of research questions to guide the study(Johnston, 2014). A structured questionnaire was developed based on the monitoring and supervision checklist used by the National Malaria Control Program to evaluate the effectiveness of the school-based ITN distribution campaign(See appendix 1). The questionnaire was adapted to fit the research objectives and to capture both quantitative and qualitative data. Also, open-ended questions were prepared to assess perspective of stakeholders and challenges faced in the distribution process The Questionnaire was validated to ensure clarity, relevance, and reliability.

Data was collected using digital tools, specifically an open data kit (Kobo Collect), which facilitated efficient and accurate data collection in the field. The questionnaire was distributed to respondents via a group platform, and completed forms were automatically synced to the Kobocollect cloud. This approach streamlined the data collection process and ensured data integrity. Once the data was collected, it was downloaded into Excel for analysis, using both quantitative and qualitative techniques to address the research questions. The data collection period lasted from November 2023 to December 2023, ensuring a comprehensive dataset for evaluating the ITN distribution campaign.

Study Population

The ownership and use of insecticide-treated nets (ITNs) have been shown in multiple settings across sub-Saharan Africa to reduce clinical episodes of malaria and all-cause mortality (Bennet et al., 2012). The study population consists of pupils and key stakeholders involved in the school-based insecticide-treated net (ITN) distribution program in Kono District, Sierra Leone. The target group includes pupils(in classes 1, 3 and 5) who eligible to receive ITNs, as well as key stakeholders such as school teachers, health workers, DHMT personnel, who are directly involved in or have insights into the distribution process, its effectiveness, and its challenges.

Sample and Sampling Procedures

Sampling is an essential process that enables researchers to make inferences about a population based on a smaller, representative sample. For this study, a stratified random sampling approach will be used to ensure that different subgroups of the population (e.g., pupils from different schools, stakeholders from various districts) are represented. This method is particularly suitable as it ensures the inclusion of a variety of perspectives, enhancing the generalizability and comprehensiveness of the findings.

The study will involve selecting schools across all 14 chiefdoms of Kono District, ensuring coverage of both rural and urban areas. Schools will be randomly selected within each chiefdom to maintain representativeness. This stratified approach will allow for the inclusion of schools with varying levels of exposure to ITN distribution, providing a broader view of its effectiveness.

Sampling Frame

The sampling frame for this study will include the schools and key stakeholders involved in or impacted by the school-based insecticide-treated net (ITN) distribution program in Kono District, Sierra Leone. This will consist of pupils who have received ITNs as part of the program which was determined by archival data obtained from the 2016 SLMIS conducted by the National Malaria Control Programme (NMCP) of the MoHS, collaborating with Catholic Relief Services, College of Medicine and Allied Health Sciences University of Sierra Leone, and Statistics Sierra Leone (MoHS, 2016). Teachers from the selected schools responsible for facilitating the distribution and educating students on the use and care of ITNs, health workers who assist with distribution or provide malaria prevention education, and District Health Management Team (DHMT) staff, including public health officers and other officials overseeing the malaria prevention programs in the district.

Determining sample size

For the sample size, the total number of schools in Kono District will be used to determine an appropriate sample size using Taro Yamane's formula, ensuring a 95% confidence level and a 5% margin of error. Based on the population of approximately 530 schools in Kono District, the sample size for pupils was calculated to be around

228 respondents. This sample size is adequate to draw reliable conclusions and ensure the robustness of the study's findings. Ten teachers were purposively sampled from each selected school will provide insights into the challenges and effectiveness of the program. Five Health workers involved in the distribution process to offer valuable information on the logistical and operational aspects, and 5 DHMT staff who were key in coordinating the distribution efforts, leading to 20 key stakeholders being interviewed.

By selecting a representative sample from the district's schools and stakeholders, the study will provide valuable insights into the ITN distribution program's coverage, challenges, and effectiveness, contributing to future improvements in malaria prevention interventions.

The following is a presentation of Taro Yamane's calculating formula.

$$n = \frac{N}{1 + N(e)^2}$$

Where :

n= sample size required

N = number of people in the population

e = allowable error (%)

Substitute numbers in formula:

$n = \frac{530}{1 + 530 * (0.05)^2}$ <p>n= 228 (rounded)</p>
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After calculating the sample size by substituting the numbers into the Yamane formula, the numbers of sample are 227.95698 persons. To obtain reliable data, the researcher increased sample size to 228 persons.

Data Analysis

The data analysis for this study combined both descriptive statistics for the quantitative data and thematic analysis for the qualitative data. This approach allowed for a comprehensive understanding of the level of knowledge on malaria prevention, the percentage of ITN distribution, and the challenges and recommendations for improving the ITN distribution process.

For the quantitative data, the study focused on summarizing and presenting the results of the knowledge assessment on malaria prevention and the percentage of ITN distribution. Descriptive statistics, such as frequencies and percentages, was calculated to present the responses to knowledge questions and the level of ITN distribution. This was presented in tables and graphs for easy interpretation.

For the qualitative data, thematic analysis was used to explore the challenges in the distribution process and gather recommendations for improving future campaigns. Interviews with stakeholders (such as teachers, health workers, and DHMT staff) was transcribed, and the data will be analysed to identify common themes. Each transcript was reviewed, and key themes related to challenges and recommendations was coded and categorized.

By combining these two methods, the study provided both statistical overviews and in-depth perspectives, allowing for a richer understanding of the effectiveness and challenges of the school-based ITN distribution program in Kono District.

Ethical Procedures

This is anonymous data that did not comprise the study participants' identity. Consent was sought before the data collection commenced. As part of the requirement for conducting biomedical research, my research proposal was sent to Njala University's Institutional Review Board. Further work on my study was based on proper assessment and approval from Njala IRB. I ensured that my data analysis does not in any way bring about the identity of any

participant. I also ensured that the data were securely kept on my computer, only accessible by a passcode. The data will be deleted from my computer after five years.

RESULTS AND DISCUSSIONS

The purpose of this study was to assess the knowledge of pupils regarding malaria prevention and the percentage distribution of insecticide-treated nets (ITNs) in Kono District, as well as to explore the challenges faced in the distribution process and gather recommendations for improving future campaigns.

This chapter provides a detailed description of the study sample, including the selection criteria and data collection process. The data analysis for each research objective will be presented using descriptive statistics, such as frequencies and percentages, to summarize the knowledge of pupils regarding malaria prevention and the percentage of ITNs distributed. Additionally, qualitative data from interviews with stakeholders will be analysed thematically to identify common challenges in the distribution process and gather recommendations for improving the program's effectiveness and sustainability.

The statistical analysis for the quantitative data was conducted using Excel software (version 2007). The primary focus was to examine the level of ITN distribution and the knowledge of pupils regarding malaria prevention. The study aimed to identify key gaps in knowledge and distribution and provide a clear picture of the effectiveness of the school-based ITN distribution campaign in Kono District.

Descriptive statistics of Percentage Distribution Coverage

Pie Chart showing the percentage Distribution of pupils.

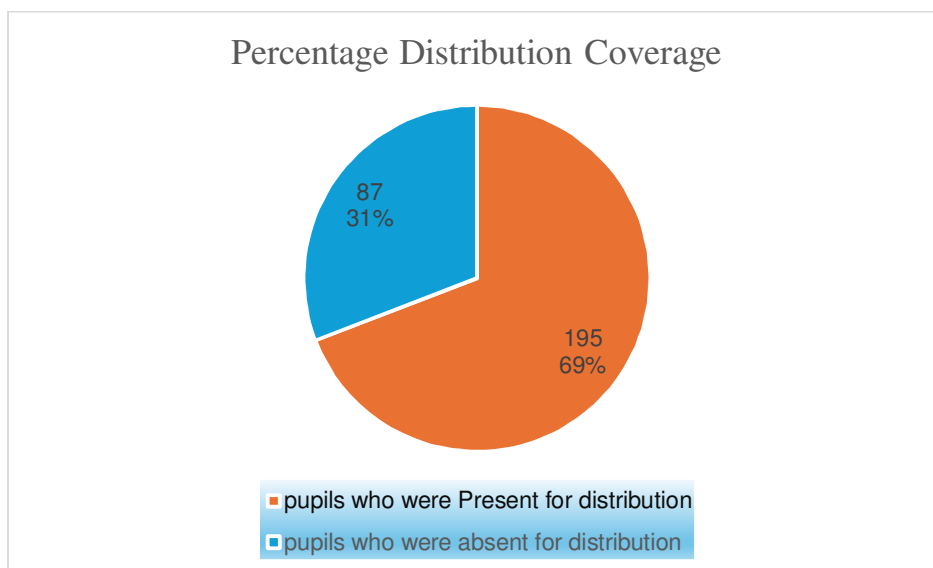


Figure 4. Percentage of pupils present and absent during distribution of School based ITN in Kono district.

Figure 6: Shows pupils who were present and absent in time of ITN distribution campaign, it indicated that 195(69.1%) of respondents received ITN, while 87(30.9%) of them were absent.

A Bar Chart Showing the age categories of Present and Absent pupils at the time of distribution.

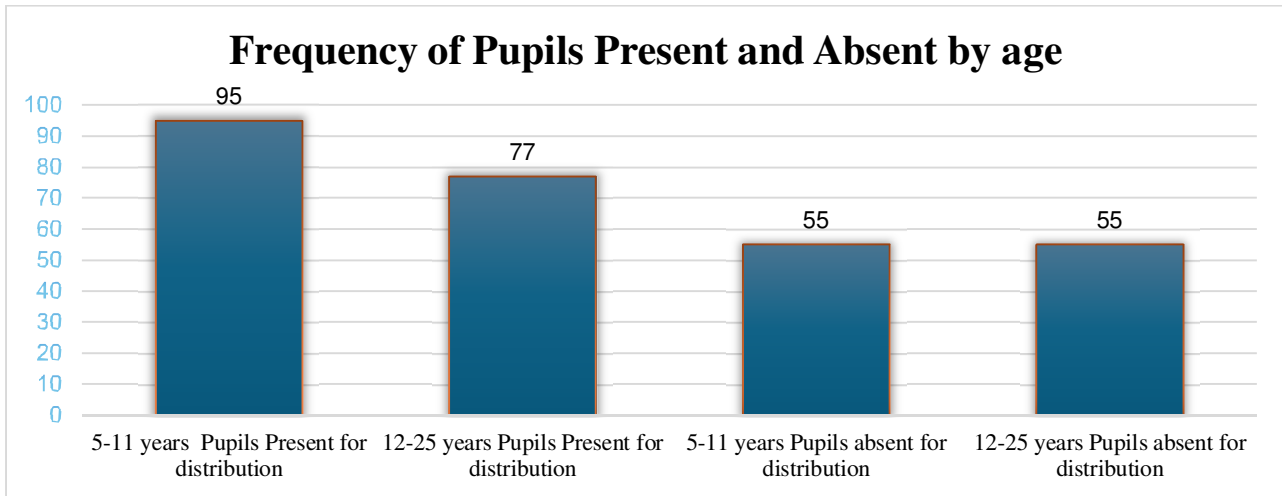


Figure 5. Frequency of pupils by age both present and Absent during distribution of School base ITN in Kono district

Figure 7, Shows the pupils age of respondents, it indicated that 95(67%) of respondents 5-11 years Pupils Present for distribution, 77(4%) of them 12-25 years Pupils Present for distribution, while 55(4%) of them 5-11 years Pupils absent for distribution, 55(8%) of them 12-25 years Pupils absent for distribution.

Knowledge of Malaria Prevention, Causes and Care of ITN

Frequency of Response for Causes of Malaria

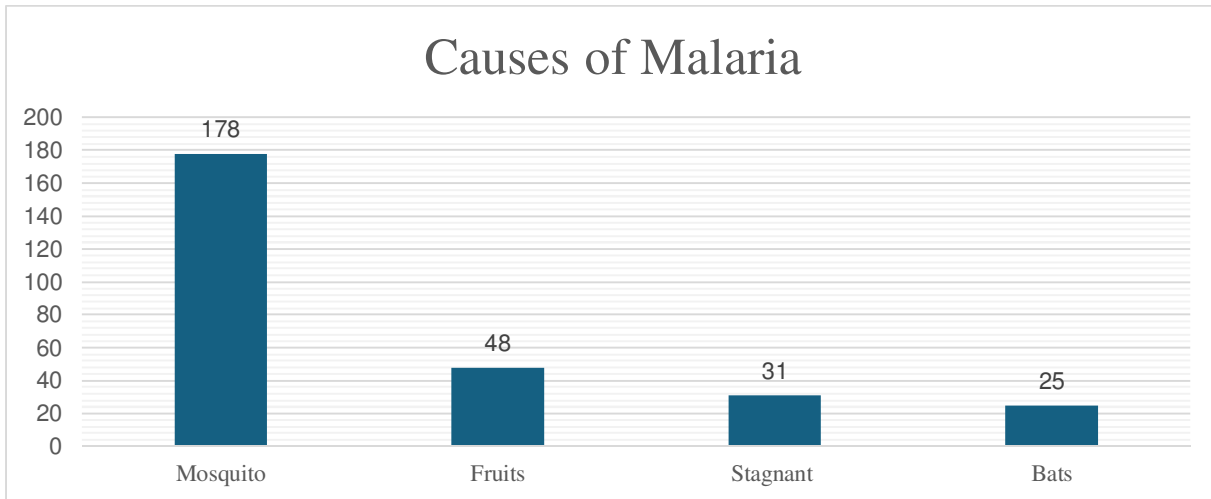


Figure 6. Frequency of causes of malaria during distribution of School base ITN in Kono district

Figure 8, Shows the causes of malaria by respondents, it indicated that 178(78.1%) of respondents said mosquito causes malaria, 48(13.1%) of them said fruit causes malaria, 31(5.1%) of them said stagnant water causes malaria, 25(3.1%) of them said Bat causes malaria

Symptoms of Malaria

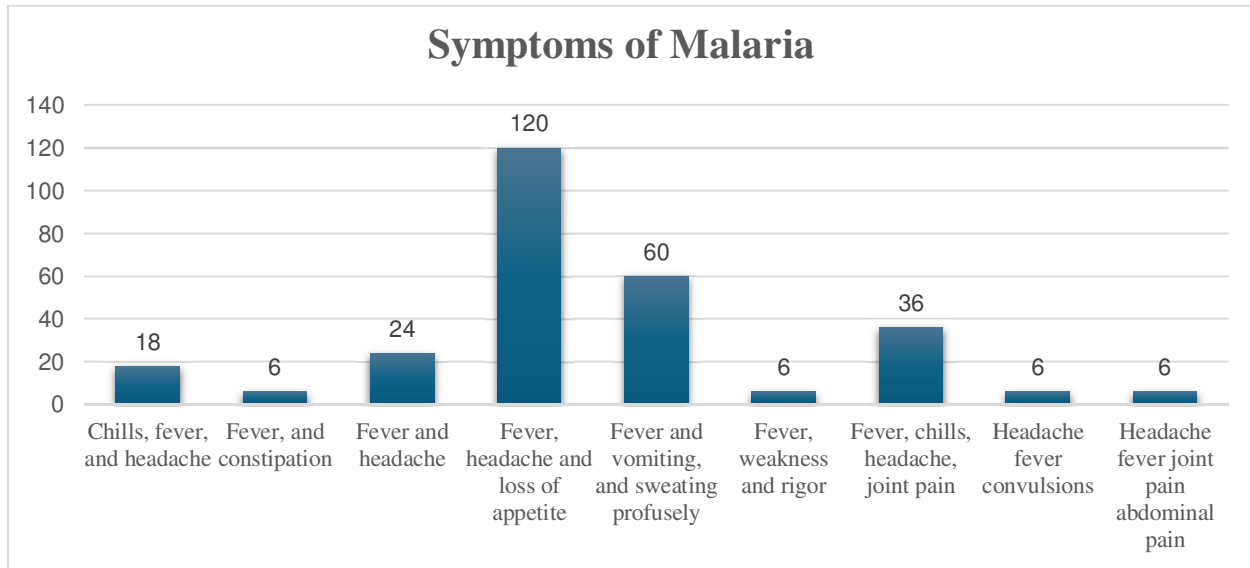


Figure 7. Frequency of symptoms of malaria during the distribution of School base ITN in Kono district.

Figure 9, Shows the symptoms of malaria by respondents, it indicated that 18(6.3%) of respondents said Chills, fever, and headache were the symptoms of malaria, 6(2.1%) of them said Fever, and constipation were the symptoms of malaria, 24(8.5%) of them said Fever and headache were the symptoms of malaria, 120(42.6%) of them said Fever, headache and loss of appetite were the symptoms of malaria, , 60(21.1%) of them said Fever and vomiting, and sweating profusely were the symptoms of malaria, 6(2.1%) of them said Fever, weakness and rigor were the symptoms of malaria, 36(13.2%) of them said Fever, chills, headache, joint pain were the symptoms of malaria, , 6(2.1%) of them said Headache fever convulsions were the symptoms of malaria, , 6(2.1%) of them said Headache fever joint pain abdominal pain were the symptoms of malaria.

Malaria Prevention

Table 1. Frequency and percentage of response for malaria prevention strategies during the distribution of School based ITN in Kono district

Malaria Prevention Strategies	Frequency	Percent
The use of ITN and environmental sanitation	133	47.1
Clean our environment, use of ITNS, Prophylaxes (Fansida)	12	4.2
Cleaning of environment	18	6.3
Sleep inside bed net	107	37.9
Using insect repellent, wearing long-sleeved clothing if out of doors at night	12	4.2
Total	282	100.0

Table 1, Shows the prevention of malaria parasite by respondents, it indicated that 133(47.1%) of respondents said The use of ITN and environmental sanitation could prevent malaria, 12(4.2%) of them said Clean our environment, use of ITNS, Prophylaxes (Fansida) could prevent malaria, 18(6.3%) of them said Cleaning of environment could prevent malaria , 107(37.9%) of them said Sleep inside bed net could prevent malaria, 12(4.2%) of them said Using insect repellent, wearing long-sleeved clothing if out of doors at night could prevent malaria.

Care of Insecticide Treated Nets

Frequency of response on how to Care for the ITNS

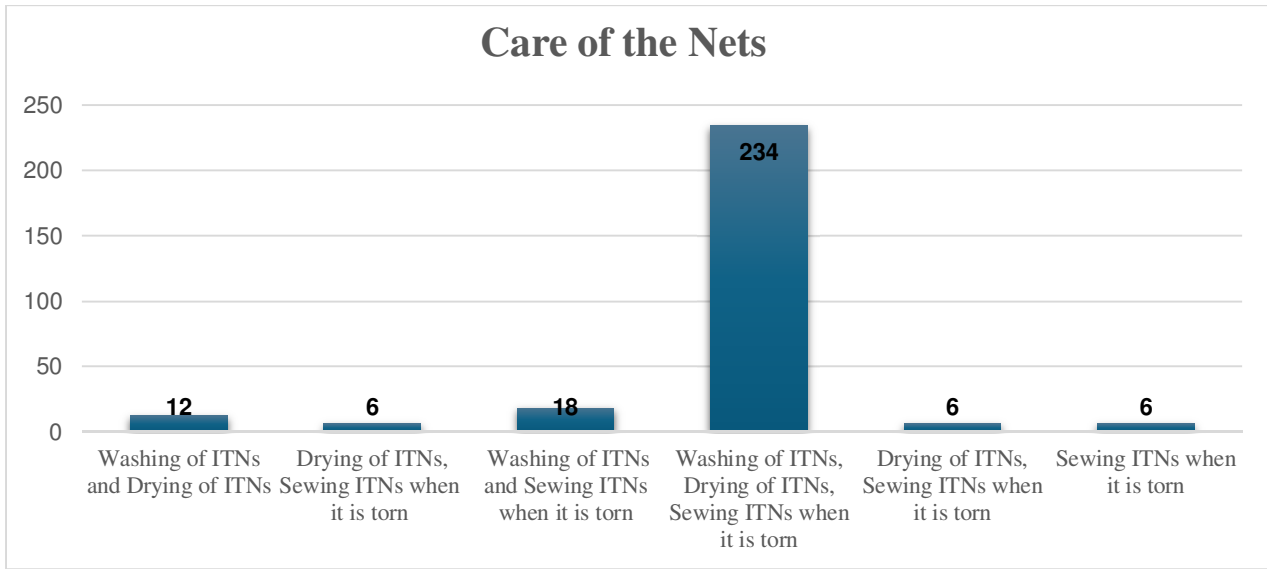


Figure 8. Frequency for response on Caring for the ITNS

Figure 10, Shows caring of the ITNs by respondents, it indicated that 12(4.2%) of respondents said they Washing of ITNs and Drying of ITNs, 6(2.1%) of them said Drying of ITNs, Sewing ITNs when it is torn, 18(6.4%) of them said Washing of ITNs Sewing ITNs when it is torn , 234(83.0%) of them said Washing of ITNs, Drying of ITNs, Sewing ITNs when it is torn, 6(2.1%) of them said Drying of ITNs, Sewing ITNs when it is torn, 6(2.1%) of them said Sewing ITNs when it is torn.

Thematic Analysis of Stakeholder’s Perspectives on the ITN Distribution Program

This section presents the thematic analysis of the responses from key stakeholders involved in the school-based insecticide-treated nets (ITNs) distribution program in Kono District. The analysis focuses on the perspectives of teachers, health workers, and District Health Management Team (DHMT) staff, with a particular emphasis on the effectiveness of the program, community involvement, challenges faced during the distribution process, and suggestions for future improvements.

The results are organized by key themes identified in the responses, with each theme broken down by the percentage of stakeholders who expressed a particular view. This allows for a comprehensive understanding of the strengths and limitations of the program as perceived by these stakeholders.

Effectiveness of The ITN Distribution Program

Firstly, 70% (7 teachers) reported that the nets would have a positive impact on student health, noting a reduction in absenteeism due to malaria. However, 30% (3 teachers) observed that not all students will used the nets consistently, which might affect the overall effectiveness of the program. Furthermore, 60% (3 health workers) felt the program will be effective in reducing malaria cases, expecting a noticeable decline in cases in areas where the nets were distributed. On the other hand, 40% (2 health workers) acknowledged challenges with ensuring consistent usage of the nets, which will limit their full potential. Finally, 80% (4 DHMT staff) confirmed a decline

in malaria cases in areas where nets were distributed during the other existing distribution programs, while 20% (1 DHMT staff) noted that the reduction in malaria cases was modest, and further monitoring was needed to assess the long-term impact.

Community Involvement and Awareness

In the first place, 60% (6 teachers) felt there was limited involvement from parents and teachers in the distribution process, which affected the overall effectiveness of the program. 40% (4 teachers) reported that the time of distribution was wrong due to pupils completing their exams, but communication with the broader community was lacking. Moreover, 80% (4 health workers) emphasized the key role that local community leaders played in mobilizing communities, ensuring that the nets reached the target populations. 20% (1 health worker) noted that in some areas, community engagement was insufficient, which impacted the program's success. Finally, 100% (5 DHMT staff) agreed that the program would have benefitted from better community engagement and involvement from teachers in the planning and execution phases.

Challenges faced during the Distribution Process

The study revealed that 70% (7 teachers) identified logistical challenges, including delays in receiving the nets and inconsistencies in the delivery to schools. 30% (3 teachers) mentioned confusion over the eligibility of classes, leading to an unclear and sometimes unfair distribution process. Furthermore, 60% (3 health workers) reported significant challenges with transportation, particularly in remote areas, which made it difficult to reach all communities with the nets. 40% (2 health workers) pointed out that there was a lack of adequate training and resources for effectively handling the distribution process. It was reported that 80% (4 DHMT staff) highlighted transportation and planning as major obstacles to timely and efficient distribution. 20% (1 DHMT staff) mentioned that poor road network in certain areas hindered the smooth distribution of nets.

DISCUSSION OF FINDINGS

The analysis of data gathered from the study sample revealed several significant findings regarding the effectiveness of the school-Based Insecticide-Treated Nets (ITN) Distribution Pilot in Kono district. These findings encompass various aspects such as the distribution campaign's coverage, knowledge gaps among respondents regarding malaria, challenges faced during implementation, and the impact of household and socioeconomic factors on ITN distribution.

Percentage Distribution Coverage

The study indicated that a considerable proportion of respondents were present during the ITN distribution campaign, with 69.1% of them being present while 30.9% were absent. Among those present, a majority belonged to the age group of 5-11 years, comprising 67% of the respondents, whereas the 12-25 years' age group constituted 4% of the present respondents. This shows that the percentage distribution coverage of ITNs was 69.1%, which is significantly below the 85% target set by the National Malaria Control Program (NMCP) to declare high coverage (NMCP, 2023). This shortfall highlights critical challenges in achieving effective malaria prevention through ITN distribution. The target of 85% is crucial because it is associated with a substantial reduction in malaria transmission and morbidity, especially among vulnerable populations such as children (Scott et al., 2021). The current coverage indicates that while progress has been made, there is still much work to be done to reach this essential threshold.

The reported absenteeism rate of 30.9% during the ITN distribution campaign raises concerns about the effectiveness of outreach strategies. High absenteeism can lead to unequal access to ITNs, resulting in vulnerable populations, particularly children, being left unprotected against malaria (Olafeju et al., 2018b). This is critical given that malaria disproportionately affects younger children, as noted in other studies where households without young children were less likely to possess ITNs (Mbishi et al., 2024). The absence of a substantial portion of the target population during distribution could indicate barriers such as lack of awareness, logistical challenges, or cultural factors that need to be addressed in future campaigns.

Moreover, absenteeism may reflect broader systemic issues such as inadequate communication regarding distribution schedules or locations. For instance, in Sierra Leone, despite high awareness levels about ITNs, only 48.2% of participants found current campaign strategies effective (Babalola et al., 2022). This suggests that simply distributing nets is not sufficient; there must be accompanying educational and logistical efforts to ensure that all

eligible individuals are present to receive their nets. In comparing this percentage distribution coverage to other countries, we see a range of outcomes that reflect different strategies and challenges. For Instance, countries like Mali and Uganda have reported ITN usage rates exceeding 80%, which correlates with effective malaria control measures and strong community engagement strategies(Olapeju et al., 2018a). In contrast, Ghana has faced challenges despite high net distribution, with usage rates stagnating around 61.8%. The disparities in ITN coverage across different countries can often be attributed to various factors(Doe et al., 2024). Countries that employ continuous distribution strategies alongside mass campaigns tend to achieve better coverage(Zegers de Beyl et al., 2016). Angola's approach of combining mass campaigns with ongoing distribution has shown promise in maintaining higher access levels over time(Azevedo, 2017). Moreover, community engagement also plays a significant role; successful programs often involve local communities in planning and executing distribution strategies(De Weger et al., 2018). However, Madagascar serves as a good example of this, where community involvement has led to higher net usage rates compared to access rates(Venart & Reuter, 2014). Logistical challenges further complicate the picture. Countries facing issues like inadequate transportation infrastructure or lack of funding often report lower coverage rates. For instance, studies in Nigeria shows that Nigeria struggled with distribution inefficiencies that hinder access despite substantial net availability(Ayoko et al., 2023).

To address the shortfall in ITN coverage and move toward the NMCP's goal of 85%, it is essential to enhance distribution logistics to ensure timely and efficient delivery of ITNs. Implementing continuous distribution models could also help maintain higher access levels over time, rather than relying solely on periodic mass campaigns(Koenker et al., 2023). Increasing community awareness about the importance of ITNs and involving local leaders in distribution efforts can enhance participation and ensure nets are used effectively(Benito et al., 2024). Finally, establishing robust monitoring systems will help evaluate the effectiveness of distribution campaigns, allowing for adjustments based on identified gaps(Inisha & Elly, 2022).

In summary, while achieving an ITN coverage rate of 69.1% is a step forward, it emphasised the need for enhanced strategies to meet the NMCP's target of 85%. Learning from successful models in other countries and addressing logistical challenges will be crucial in improving malaria prevention efforts through effective ITN distribution.

Knowledge Gaps on Malaria Prevention, causes and Care of ITN

Regarding knowledge gaps, the findings suggested that while a significant portion of respondents correctly identified mosquitoes as the cause of malaria (78.1%), there were misconceptions regarding other causes such as fruits (13.1%), stagnant water (5.1%), and bats (3.1%). Similarly, diverse symptoms of malaria were reported by respondents, with fever, headache, and loss of appetite being the most recognized symptoms (42.6%). While the assessed the knowledge levels of pupils regarding malaria prevention and ITN care the results indicated a significant gaps in knowledge that need to be addressed through targeted educational interventions to enhance overall malaria prevention efforts in Kono District. Notably, while 78.1% of respondents correctly identified mosquitoes as the cause of malaria, misconceptions persist, with some attributing the disease to fruits, stagnant water, and bats. This disparity suggests that existing malaria awareness campaigns have not effectively penetrated all segments of the population. The persistence of these misconceptions can be attributed to various factors, including cultural beliefs, insufficient education, and inadequate communication strategies(Djoufounna et al., 2022). For instance, in other studies conducted in Sierra Leone and Uganda, similar misconceptions were prevalent, indicating that these misunderstandings are not unique to our study area but rather reflect broader challenges in malaria education across endemic regions(Obol et al., 2011).

The implications of these misconceptions on malaria control are profound. If individuals believe that fruits or bats cause malaria, they may prioritize ineffective preventive measures instead of focusing on vector control strategies such as ITN use and eliminating mosquito breeding sites(Onyinyechi et al., 2023). Moreover, a lack of awareness regarding stagnant water as a breeding ground for mosquitoes could hinder community efforts aimed at reducing larval habitats(Agyemang-Badu et al., 2023). This misallocation of focus not only undermines public health initiatives but also perpetuates the cycle of malaria transmission.

Furthermore, the finding that only 42.6% of respondents recognized fever, headache, and loss of appetite as symptoms of malaria indicates a limited understanding of clinical signs associated with the disease. This knowledge gap can delay treatment-seeking behaviour, potentially leading to severe disease outcomes or continued transmission within communities(Stanley et al., 2023). Socio-demographic factors such as age, gender, and education level likely influence symptom recognition; however, our study did not delve deeply into these

correlations(Mocanu et al., 2021). Nevertheless, it is crucial to acknowledge that similar studies have shown disparities in symptom knowledge across different demographic groups, underscoring the need for tailored educational interventions(Williams et al., 2016).

In terms of ITN use and care, inadequate knowledge among pupils about proper usage and maintenance practices significantly reduces the effectiveness of ITNs in preventing malaria(Onyinyechi et al., 2023). Improper washing or hanging practices can compromise the insecticidal properties of these nets. While distributing ITNs is critical for malaria prevention efforts, the sustainability of their impact relies heavily on correct usage and maintenance practices(Msangi et al., 2024). This aligns with findings from sub-Saharan regions where improper net care has been linked to reduced efficacy in preventing malaria(Kumoji et al., 2022), which also revealed both consistencies and differences in knowledge gaps across various contexts. For example, research in Sierra Leone indicated that while a high percentage recognized mosquitoes as vectors for malaria, misconceptions about other causes were also common(Koroma et al., 2022). Similarly, studies from Uganda highlighted that many believed cold weather or poor diet could lead to malaria infection(Semakula et al., 2023). These similarities suggest that misconceptions about malaria causes are widespread and require targeted educational interventions.

To address these knowledge gaps effectively, targeted educational interventions are essential. Evidence-based strategies such as school-based education programs can teach pupils about malaria transmission, symptoms, and prevention methods(Chokkara et al., 2022). Community engagement initiatives like household campaigns can help dispel myths about malaria causes and promote ITN use more effectively. Collaborating with health workers and local leaders to deliver culturally appropriate messages will further enhance the impact of these interventions(Awasthi et al., 2024).

From a policy perspective, it is imperative for the Ministry of Health and other stakeholders to prioritize knowledge dissemination as part of their malaria control strategies. Integrating malaria education into school curricula will equip students with accurate information that they can share with their families and communities.

Stakeholders Perspective and Challenges Faced During the School Based Net Distribution

The effectiveness of the ITN distribution program, as indicated by the responses from teachers, health workers, and District Health Management Team (DHMT) staff, presents a nuanced picture of both potential benefits and challenges. Notably, 70% of teachers reported that the nets would positively impact student health by reducing absenteeism due to malaria. The results from the present study are in line with previous research on the effectiveness of malaria control interventions such as insecticide-treated nets (ITNs) and indoor residual spraying (IRS) (Pryce et al., 2022). Meta-analyses have shown that ITNs can provide a 50% protective effect against malaria incidence in areas of stable malaria, and a 62% protective effect in areas of unstable malaria(Wangdi et al., 2018). Similarly, the protective efficacy of IRS has been found to range between 31-88% in areas of unstable malaria(Loha et al., 2019). Most teachers (70%) and health workers (60%) reported that the ITN distribution program would have a positive impact, leading to a reduction in malaria cases and student absenteeism. However, some teachers (30%) and health workers (40%) acknowledged challenges with ensuring consistent net usage, which could limit the full potential of the program. The DHMT staff also confirmed a decline in malaria cases in areas where nets were distributed, though 20% noted that the reduction was modest and required further monitoring. Community involvement and awareness play a crucial role in the effectiveness of such programs. The study found limited involvement from parents and teachers in the distribution process, which affected the overall effectiveness. However, the key role of local community leaders in mobilizing communities and ensuring net coverage was emphasized by 80% of health workers. Studies have highlighted the importance of engaging all stakeholders, including cultural leaders, community health workers, and the government, to promote the use of ITNs and address disparities in usage (Patil et al., 2021). The study also revealed several logistical challenges in the distribution process, including delays in receiving the nets, inconsistencies in delivery to schools, and difficulties in reaching remote areas due to transportation issues. These findings are consistent with other studies that have identified transportation and planning as major obstacles to the timely and efficient distribution of ITNs (Meriggi et al., 2024). Furthermore, the literature suggests that the effectiveness of ITNs can be influenced by factors such as the quality and maintenance of the nets, as well as the susceptibility of local mosquito populations to the insecticides used(Tassemedo et al., 2021). Proper community engagement and education on net usage and maintenance are crucial to ensure the sustained effectiveness of the intervention(Brunton et al., 2017). In conclusion, the ITN distribution program has the potential to be effective in reducing malaria cases and improving student health, as evidenced by the positive reports from teachers and health workers(Kudom & Mensah, 2010).

However, the success of the program is contingent on addressing the challenges related to community involvement, logistics, and net usage and maintenance. Comprehensive strategies that incorporate community engagement, effective distribution, and monitoring of net performance are necessary to maximize the impact of the ITN program (Durrance-Bagale et al., 2022).

Interpretations

The findings of the school-Based Insecticide-Treated Nets (ITN) Distribution Pilot in Kono district reveals both progress and significant challenges in malaria prevention efforts. While 69.1% of pupils received ITN during the distribution campaign, falling short of the 85% target set by the National Malaria Control Program, concerns arise regarding absenteeism and inconsistent net usage, particularly among younger populations. The findings indicate that although a majority correctly identified mosquitoes as the cause of malaria, misconceptions about other causes persist, which could misdirect prevention efforts. Additionally, logistical challenges, such as delays in net delivery and insufficient community involvement, were noted as barriers to effective implementation. Comparatively, successful ITN programs in countries like Mali and Uganda demonstrate the importance of community engagement and continuous distribution strategies. Overall, while there is a foundation for improving malaria prevention through ITNs, targeted educational interventions and enhanced logistical planning are crucial to achieving sustainable outcomes.

New Knowledge and Insight

The new insights added to the existing literature include a focused evaluation of school-based ITN distribution as a strategic intervention for malaria prevention among school-age children, a demographic that has not been adequately prioritized in previous malaria control efforts. This research highlights the significant role that school-age children play in the malaria transmission reservoir, comprising over 60% of cases, yet often being overlooked in preventive measures. The study provides empirical data on the distribution coverage of ITNs among this population in Kono District, revealing critical gaps in both ownership and utilization despite widespread availability. Additionally, it investigates the knowledge levels of pupils regarding malaria prevention and the causes and Care of the ITNs. By identifying the challenges of the school-based distribution pilot program, this study offers evidence-based recommendations for enhancing the effectiveness and sustainability of future ITN distribution campaigns. Overall, this research contributes to a deeper understanding of the barriers to ITN utilization in Sierra Leone and provides a framework for improving malaria prevention strategies tailored to school-age children.

For future research, several recommendations emerge from this study on the effectiveness of school-based insecticide-treated net (ITN) distribution in Kono District. Firstly, conducting longitudinal studies is essential to evaluate the long-term effects of school-based ITN distribution on both malaria prevalence and academic performance among school-age children. Additionally, studies can be done to investigate the effectiveness of various educational and behavioural change interventions aimed at improving ITN usage among school children and their families. Finally, a comprehensive cost-effectiveness analysis study of school-based ITN distribution compared to other distribution methods would provide valuable insights into resource allocation.

Summary

The study aimed to assess the effectiveness of the school-Based Insecticide-treated nets Distribution Pilot in the Kono district. A cross-sectional quantitative survey was used to collect primary data that was derived from a well-structured questionnaire which was used to study the practice and knowledge gap of respondents about the effectiveness of the school-Based Insecticide-treated nets Distribution Pilot in Kono district. A primary analysis of School-Based Insecticide-treated nets Distribution Pilot in Kono district. The questionnaire was administered in order to assess the effectiveness of the school-Based Insecticide-treated nets Distribution. A total of 282 pupils were interviewed through a well-designed questionnaire. All personal identifiers were removed from the questionnaire and data were transferred into an Excel spreadsheet which was coded and uploaded into SPSS version 20, respectively. Multiple logistic regression was used. To assess the variables such as (percentage coverage of ITN distribution, the knowledge of pupils on Malaria cause, prevention, and care of ITN, the limitations and challenges associated with the implementation of the school-based ITN distribution campaign, and the evidence-based recommendations for improving the effectiveness and sustainability of future School-Based Distribution campaigns). In this chapter, the researcher explains and evaluates the results, contrasting their implications with those of other studies from chapter two of this research. Finding the main problems and offering suggestions for proofreader evidence. The study's recommendations, limitations, and conclusion of the study are all

outlined. For policymakers to make cultivated judgments, information must be made available. Only an assessment of the effectiveness of the school-Based Insecticide-treated net Distribution is included in the study.

Conclusion

The school-based ITN distribution program represents a novel and potentially effective approach to addressing the gap in malaria prevention among school-age children, a demographic that has been historically underserved by traditional distribution methods. However, despite the widespread distribution of ITNs, there remains a significant behavioural gap between ownership and actual usage. This highlights the need for targeted educational interventions to improve understanding and compliance among families and school children. The study reveals that knowledge levels among pupils regarding malaria prevention and proper ITN care are inadequate, indicating a critical area for improvement in future campaigns. Socioeconomic factors, including parental education and household characteristics, play a significant role in ITN usage, suggesting the need for tailored interventions that address these underlying determinants. The pilot program in Kono District provides valuable insights into the strengths and weaknesses of school-based distribution, offering a foundation for evidence-based improvements and potential scaling up to other regions. Long-term impact assessment of school-based ITN distribution on both malaria prevalence and academic performance is crucial for understanding the full potential of this intervention. Integration of ITN distribution with other school-based health programs could enhance overall health outcomes and resource utilization efficiency. Gender-specific differences in ITN usage and knowledge among school children warrant further investigation to ensure equitable access and utilization.

In conclusion, while the school-based ITN distribution campaign in Kono District has made impact in increasing access to malaria prevention tools, its effectiveness is limited by low usage rates and knowledge gaps. Future efforts should focus on addressing behavioural barriers, enhancing education, and tailoring interventions to local contexts. The insights gained from this study provide a valuable foundation for refining and expanding school-based ITN distribution strategies, potentially contributing to more effective malaria control efforts in Sierra Leone and similar settings. However, sustained research, monitoring, and evaluation will be essential to maximize the impact of these interventions and progress towards the overarching goal of malaria elimination.

Recommendations

Based on the findings, the following recommendations are proposed:

1. **Enhance Knowledge and Behavioural Change:** Develop targeted educational programs addressing knowledge gaps about malaria causes, prevention, and proper ITN usage. Combine these with behaviour change communication campaigns involving parents, teachers, and community leaders to ensure sustained adoption and proper usage of ITNs.
2. **Strengthen ITN Distribution Systems:** Improve the planning, logistics, and coordination of ITN distribution with schools and health authorities to ensure wider and more effective coverage. Include strategies for timely replacement of worn-out ITNs and explore integration with other school-based health initiatives for greater impact.
3. **Monitor, Evaluate, and Scale:** Implement ongoing monitoring and evaluation systems to measure the effectiveness of ITN distribution programs. Use insights from the Kono District pilot to refine and scale the model to other districts, incorporating research on factors influencing ITN usage and addressing socioeconomic barriers.

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