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Factors Associated with Malaria Prevalence Among Lira University Students at Lira University Hospital, 2022. A Cross-Sectional Study

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Research Article

Keywords: Malaria Prevalence, University Students, Lira University

Posted Date: March 29th, 2024

DOI: https://doi.org/10.21203/rs.3.rs-4145813/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Malaria is a leading cause of death and disease in many developing countries. Lira district remains an endemic area for malaria in Uganda, East Africa, greatly impacting and affecting the lives of many individuals who live and travel to the place.

Objective

The study investigated the factors associated with Malaria prevalence among Lira University students.

Methodology:

A cross-sectional study using both quantitative and qualitative data collection methods was used involving 340 participants between March and April 2023. Quantitative data was obtained from 324 participants through a systematic random sampling technique using interviewer-administered questionnaire. Data was entered and analyzed in SPSS version 26 at univariate, bivariate and multivariate levels. Chi-square tests were used for bivariate analysis and binary logistic regression for multivariate analysis. Qualitative data was collected from 16 participants using a Key Informant interview guide and data was analyzed manually through thematic content analysis of major themes that emerged from the participants' responses.

Results

The prevalence of malaria among the students was 13.3% (95% CI = 9.6–16.99). The major factors that were associated with the malaria prevalence were staying around bushy areas (p-value = 0.035) and use of mosquito nets (p-value = 0.028).

Conclusion

The prevalence of malaria among Lira University students was 13.3%. Factors associated with the prevalence of malaria were staying around busy areas and use of mosquito nets. Interventions such as increasing awareness about malaria prevention and encouraging slashing bushes around hostels should be done.

Background

Malaria is the disease caused by 5 species (*Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae and Plasmodium knowlesi)* of the intracellular parasite of the genus plasmodium (1). Malaria is one of the most severe public health problems worldwide. It is a leading cause of death and disease in many developing countries(2).

Globally, according to the World Malaria Report 2020, there were 241 million cases of malaria in 2020 (uncertainty range 218–269 million) and 627,000 malaria deaths (uncertainty range 583–765 thousand). Malaria case incidence reduced from 81 in 2000 to 59 in 2015 and 56 in 2019, before increasing again to 59 in 2020. In Africa, four African countries accounted for just over half of all malaria deaths worldwide: Nigeria (31.9%), the Democratic Republic of the Congo (13.2%), United Republic of Tanzania (4.1%) and Mozambique (3.8%). According to the World malaria report 2019, sub-Saharan Africa accounted for approximately 93% of all malaria cases and 94% of deaths in 2018. More than two-thirds of deaths were among children under the age of five(3). The East African community has the 3rd highest proportion of malaria cases (5%) and the 8th highest level of deaths (3%) with the highest proportion of malaria cases (23.7%) in East and Southern Africa. In 2012, malaria prevalence stood at 38% in Lira city. It reduced to 13.6% in the 2016/2017 financial year and 8.4% in the 2017/2018 financial year(4). Malaria remains Uganda's leading cause of death, especially in children(5). There has generally been a gradual increase in the number of confirmed cases, incidence, and the number of upsurge districts with a total of 221,271 malaria confirmed cases according to the Uganda Ministry of Health Weekly malaria report(6).

The government of Uganda through the MOH, in response to malaria prevention and control has put in place a number of interventions to ensure malaria is addressed at all levels, on all fronts for maximum impact on the disease focusing on the integration of the most effective prevention and treatment tools. Both indoor residual spraying of insecticides (IRS) and large-scale use of long lasting insecticide treated nets were promoted to have the most rapid and sizable impact on the transmission of this disease. Management of malaria at the community level was attached to availability of the most effective medicines at all levels and use of the newest diagnostic tools including rapid diagnostic tests, to ensure proper diagnosis at lower health facilities.

Recently, there has been an increase in attention, funding and political will to improve malaria control and prevention and the process is complemented by the National Malaria Control Strategic Plan. Within the MOH, the National Malaria Control Program (NMCP) has the mandate to reduce malaria morbidity, prevent mortality, and minimize the social effects and economic losses attributable to malaria in Uganda. The success of this policy will require continued close linkages and coordination between all partners to ensure we meet the common goal of malaria control and eventual elimination from Uganda and attain the vision of a "Malaria Free Uganda"(7).

In 2014, the Government of Uganda introduced IRS in the fight against malaria following an upsurge of malaria prevalence in Lira district. IRS is the application of long-lasting insecticides in residences to either kill or repel the malaria transmitting mosquito species. It is believed to be suitable for Uganda because mosquitoes that spread malaria parasites feed and rest indoors. IRS was conducted in Lira District

between July and August 2016. Malaria morbidity records from four health facilities were reviewed, focusing on 6 months before and after the IRS intervention and results showed that the proportion of outpatient attendance due to malaria dropped from 18.7% before spraying to 15.1% after IRS. The proportion of outpatient attendance due to confirmed malaria also dropped from 5.1% before spraying to 4.0% after the IRS intervention. There was a decreasing trend in malaria test positivity rate (TPR) for every unit increase in months after spraying. The decreasing trend in TPR was more prominent 5–6 months after the IRS intervention (8). Lira district has registered a 15% reduction in Malaria prevalence which gives appreciation to the IRS program. However, of recent, the IRS exercise in April 2022 was not effective in killing mosquitoes. *"Of every 100 people at the outpatient department in any health facility in Lira District that we test, at least 54 of them have malaria parasite,"* Dr. Ocen explained. He however, said they would use 20 drones that have been procured by the Ministry of Health to destroy mosquito' breeding sites(9). This indicates that whereas the government has put in place interventions to reduce malaria prevalence in Lira district, there seems to exist a gap and many limitations within the control measures. Several factors are known to be associated with prevalence of malaria in Lira district e.g. Socio-demographic, Environmental, the methods and practices used in prevention and control but the exact factors influencing prevalence of malaria among Lira University students is not known. Given the fact that malaria continues to be the major cause of mortality and morbidity in Uganda, yet IRS was done in the community, the prevalence of malaria is expected to decline but has not yet been fully realized. It is upon this background that this study explored factors associated with malaria prevalence among Lira University students at Lira University Hospital, 2022.

Lira district has a total land area of 1,368.9 km^2 and a total population of 478,500 with 230,400 males and 248,100 females(10). The district has 31 government health facilities: 1 regional referral hospital, 1 teaching hospital, 3 health center fours, 17 health centers threes, 10 health center twos, ….. Private Not for Profit Health facilities, and several private health practitioners' health facilities through which malaria services are offered. The major economic activities of people in Lira district include agricultural produce sale, food vending, animal and poultry trade in addition to nonagricultural production activities(11). Uganda's doctor-patient and nurse-patient ratio is approximately 1:25 000 and 1:11 000 respectively. This is way below the WHO recommended doctor-patient ratio of 1:1000 and however much there is no official WHO recommended nurse-patient ratio, 1:11 000 is still inappropriate considering that most developed health care systems have a doctor: nurse ratio of 1:2–5(12).

Materials and methods

Study Design

This was a cross-sectional study that employed explanatory quantitative and qualitative methods of data collection.

Study Site and Setting

This study was conducted at Lira University located in Ayere Ward, Lira City West Division. Lira University is located on approximately 500 acres of land, off Lira Kamdini road, about 11 kilometers by road, northwest of the Lira city. The coordinates of the University campus are $2^0$15'04.0N,$32^0$49'16.0"E (Latitude: 2.25111; Longitude:32.821111).

Study Population

The target population were Lira University students and the study population were Lira University students who receive care and treatment at Lira University Hospital.

Sample Size Determination

The sample size was determined using the Yamane (1967) formula of sample size determination as follows:

n = N / (1 + Ne^2)

Where: n = the sample size (respondents to be interviewed), e = the precision of the study (5%), N = population size = 1,104 enrolled undergraduate students (statistics from Academic registrar) from a total of 1,285 students enrolled.

Thus: n = 1,104/ (1+ (1,104(0.05^2))

n = 293.6 ≈ 294

Considering an estimated 10% non-response rate (0.1 × 294) = 29.4 ≈ 30

Therefore, the total sample size = 294 + 30 = 324.

For qualitative data, sample size was 5% of overall sample size, therefore = 0.05*324 = 16.2 ≈ 17. The total sample size was then 341.

Sampling Procedures

A systematic random sampling technique was used to select the respondents using a sampling interval of 4. A random number 3 was selected as the starting point. Thereafter, the respondents were sampled, then interviewed.

The researcher purposively sampled some health workers (Laboratory technician, nurses and clinicians at the hospital and student leaders from the hostels as key informants).

Eligibility Criteria

Inclusion criteria.

Those who were included in the study, were current Lira University Students who were seeking healthcare at Lira University hospital.

Exclusion criteria

Those who were too sick to give information, and those who were not willing to give information freely were excluded from the study.

Data Management

Data collection method and instrument

Quantitative data was collected from participants using a pre-tested, semi-structured, interviewer-administered questionnaire, from Lira University hospital when the students go for medical checkups and treatment.

Qualitative data was collected by interviewing some key informants including student leaders from the hostels, Nurses, Lab technicians and Clinicians from the hospital.

Malaria prevalence among the Lira University Students was determined by testing the students who go for treatment at Lira University Hospital using the Malaria rapid diagnostic tests, CareStart™ Malaria PAN (Pldh) Ag RDT (Access Bio, Inc.) .

Data entry and cleaning

Data from the questionnaires was entered manually into the Statistical Package for the Social Sciences (SPSS) version 26 software with the variables in the Variable View and their values in the Data View. After entering the data, the statistical command (list) under the analyze data by the SPSS software was used to identify the missing data at entry. Mistakes at the entry were identified through validation and corrected by recalling the questionnaire using its unique identifier. However, if the item was left blank or answered incorrectly, the Replace Missing Values functional SPSS under the Transform option were used to obtain a value to replace the missing data point though this was much avoided as the questionnaire was interviewer-administered.

Data analysis

Data exploration was first done in order to visualize the general features of the data to be analyzed. At univariate level, analysis of descriptive statistics was carried out to obtain percentages, frequency, mean and median to describe the study participants by socio-demographic, and behavioral factors. At bivariate level, associations between malaria prevalence and the independent variables were determined through univariate logistic regression and results presented in a table with odds ratios, corresponding 95% confidence intervals and p-values. Variables found to have association ($p < 0.2$) were further assessed by using binary logistic regression analysis after careful examination of underlying assumptions. The backward elimination method was used to build the final model with only variables with statistically significant associations ($p < 0.05$). Odds ratios, corresponding 95% confidence intervals and p-values were reported.

Qualitative data was analyzed manually using thematic analysis after coding and summarizing the data which involved interpretation of non-numerical data like audio, or images. In the analysis, 8 codes, 4 sub themes and 2 themes were generated. Data was presented using explanatory sequential method.

Measurement of variables

The main outcome variable (dependant variable) was malaria prevalence. Main explanatory variable (independent variables) were factors associated with the malaria prevalence. Respondents were interviewed to assess the factors then analyzed them (Bivariate analysis). Students who go seeking healthcare at Lira University Hospital were tested to determine prevalence of malaria.

Results

Data was obtained from 340 students at Lira University Hospital, Lira City, Northern Uganda. In this study, all the 340 participants were recruited with a 100% response rate.

Quantitative results

Sociodemographic Characteristics of Respondents

The participants were 18 years and above and the majority (76.5%) were in the 18–24 age group. The proportion of the male 50.9% and female (49.1%) respondents were almost half-half. See Table 1 below.

Majority of the respondents were Single (81.2%) and most of them were un employed (64.2%). The biggest proportion (36.7%) were Anglicans, and the least (5.9%) were SDA. The majority (37.3%) were from the faculty of Nursing and Midwifery and the least (8.6%) from Faculty of Education.

Table 1
Socio-demographic characteristics of the respondents

Variable	Frequency(N)	Percent (%)
18–24	248	76.5
25–34	50	15.4
35 and above	26	8.0
Sex		
Male	165	50.9
Female	159	49.1
Marital status		
Single	263	81.2
Married	61	18.8
Employment status		
Formal employment	69	21.3
Self-employed	47	14.5
Un-employed	208	64.2
Religion		
Muslim	27	8.3
Anglican	119	36.7
Catholic	103	31.8
SDA	19	5.9
Born again	56	17.3
Faculty of Study		
Public Health	60	18.5
Nursing and Midwifery	121	37.3
Management sciences	40	12.3
Education	28	8.6
Medicine	29	9.0
Computing and Technology	46	14.2

Prevalence of malaria

Forty three out of 324 (13.3%) participants tested positive for malaria using the rapid diagnostic test (RDT).

Factors associated with malaria prevalence among Lira University students.

Malaria practices

At Bivariate level, the practice that was significantly associated with malaria prevalence was ‘use of mosquito repellants (p-value = 0.02)’. See Table 2 below.

Table 2
Showing the relationship between malaria practices and malaria prevalence among Lira University students

Variable	Malaria status		Total	OR (95% CI)	P-value
	Positive n (%)	Negative n (%)			
Do you own an ITN					
Yes	37(86.0)	254(90.4)	291(89.8)	1.53(0.59–3.94)	0.383
No	6(14.0)	27(9.6)	33(10.2)	Ref	
Insecticide Treated mosquito net use					
Yes	20(54.1)	133(51.6)	153(51.9)	1.74(0.63–4.78)	0.287
No	17(45.9)	125(48.4)	142(48.1)	Ref	
Current situation of the available ITN					
In good order	25(59.5)	192(70.3)	217(68.9)	2.00(0.74–5.39)	0.169
Torne	17(40.5)	81(29.7)	98(31.1)	Ref	
Is the ITN currently being used					
Yes	36(97.3)	255(98.8)	291(98.6)	2.36(0.24–23.31)	0.462
No	1(2.7)	3(1.2)	4(1.4)	Ref	
Did you use it last night?					
Yes	31(83.8)	226(87.3)	257(86.8)	1.33(0.51–3.42)	0.560
No	6(16.2)	33(12.7)	39(13.2)	Ref	
Frequency of mosquito net use					
Always	27(73.0)	205(79.2)	232(78.4)	1.41(0.64–3.08)	0.395
Not always	10(27.0)	54(20.8)	64(21.6)	Ref	
Can you afford an ITN					
Yes	35(81.4)	200(71.2)	235(72.5)	0.56(0.25–1.27)	0.166
No	8(18.6)	81(28.8)	89(27.5)	Ref	
Often slash tall grass from the compound					
Yes	33(76.6)	210(74.7)	243(75.0)	0.90(0.42–1.91)	0.777
No	10(23.3)	71(25.3)	81(25.0)	Ref	

Variable	Malaria status		Total	OR (95% CI)	P-value
Use mosquito repellents					
Yes	21(48.8)	189(67.3)	210(64.8)	2.15(1.13–4.11)	0.020*
No	22(51.2)	92(32.7)	114(35.2)	Ref	
Close windows at night					
Yes	43(100)	270(96.1)	313(96.6)	0.000	0.999
No	0(0.0)	11(3.9)	11(3.4)	Ref	
Room sprayed during IRS					
Yes	20(46.5)	131(46.6)	151(46.6)	1.00(0.53–1.91)	0.989
No	23(53.5)	150(53.4)	173(53.4)	Ref	

*Statistically significant

Environmental factors

The environment factor that was significantly associated with malaria prevalence was staying around bushy environment (p-value = 0.026) and the rest were not significantly associated with malaria prevalence (Table 3 below).

Table 3
Showing the relationship between Environmental factors and malaria prevalence among Lira University students

Variable	Malaria status		Total	OR(CI-95%)	P-value
	Positive n (%)	Negative n (%)			
Stay around bushy environment					
Yes	21(48.8)	187(66.5)	208(64.2)	2.08(1.09–3.98)	0.026*
No	22(51.2)	94(33.5)	116(35.8)	Ref	
Proximal to breeding sites: old tires, containers and ponds					
Yes	20(46.5)	119(42.3)	139(42.9)	0.85(0.44–1.61)	0.608
No	23(53.5)	162(57.7)	185(57.1)	Ref	
Clean environment					
Yes	17(39.5)	105(37.4)	122(37.7)	0.91(0.47–1.76)	0.785
No	26(60.5)	176(62.6)	202(62.3)	Ref	
Farming activities					
Yes	8(18.6)	89(31.7)	97(29.9)	2.03(0.90–4.55)	0.086
No	35(81.4)	192(68.3)	227(70.1)	Ref	
Windows screened					
Yes	10(23.3)	53(18.9)	63(19.4)	0.77(0.36–1.65)	0.499
No	33(76.7)	228(81.1)	261(80.6)	Ref	
What is the structure of the room					
Bottoms can be put up for hanging the nets	34(79.1)	246(87.5)	280(86.4)	1.86(0.82–4.21)	0.136
Rooms are so small there is hardly any space	9(20.9)	35(12.5)	44(13.6)	Ref	

***Statistically significant**

Multivariable Results

Factors Independently Associated with Malaria Prevalence among Lira University Students

From multivariable analysis, two variables were significantly associated with malaria prevalence: use of mosquito repellants COR, 2.15(1.13–4.11), AOR, 2.09(1.09–4.04) and p-value = 0.028; staying around bushy areas COR, 2.08(1.09–3.98), AOR, 2.03(1.05–3.92) and p-value = 0.035 (Table 4 below).

Table 4
Showing the relationship between independent variables and the dependent variable

Variable	Malaria status		COR (95%CI)	AOR (95%CI)	P-value
	Positive n (%)	Negative n (%)			
Marital status					
Single	31(72.1)	232(82.6)	0.11(0.88–3.82)	1.40(0.51–3.82)	0.515
Married	12(27.9)	49(17.4)	Ref	Ref	
Employment status					
Formal	13(30.2)	56(19.9)	0.48(0.23–1.03)	0.56(0.20–1.56)	0.269
Self-	9(20.9)	38(13.5)	0.47(0.20–1.12)	0.54(0.21–1.36)	0.190
Un employed	21(48.8)	187(66.5)	Ref	Ref	
Current situation of the available ITN					
In good order	25(59.5)	192(70.3)	2.00(0.74–5.39)	0.39(0.03–5.01)	0.466
Torne	17(40.5)	81(29.7)	Ref	Ref	
Can afford an ITN					
Yes	35(81.4)	200(71.2)	0.56(0.25–1.27)	0.53(0.22–1.31)	0.168
No	8(18.6)	81(28.8)	Ref	Ref	
Use mosquito repellents					
Yes	21(48.8)	189(67.3)	2.15(1.13–4.11)	2.09(1.09–4.04)	0.028*
No	22(51.2)	92(32.7)	Ref	Ref	
Stay around bushy environment					
Yes	21(48.8)	187(66.5)	2.08(1.09–3.98)	2.03(1.05–3.92)	0.035*
No	22(51.2)	94(33.5)	Ref	Ref	
Farming activities					
Yes	8(18.6)	89(31.7)	2.028(0.904–4.550)	1.86(0.81–4.31)	0.146
No	35(81.4)	192(68.3)	Ref	Ref	

*Statistically significant

Qualitative Results

Qualitative data was analyzed manually using thematic analysis after coding and summarizing the data which involved interpretation of non-numerical data like audio, or images. In the analysis, 8 codes, 4 sub themes and 2 themes were generated.

Socio-demographics of the respondents

All the respondents were aged between 25–38 years of age, out of the 16 participants, 2 were laboratory technicians, 8 were nurses, 2 were clinicians and 4 were student leaders.

Theme 1: Malaria practices

From the qualitative data, majority of the participants said that the prevalence of malaria is high among students because many students stay outside for so long while reading books yet some may or may not use mosquito repellants. A Majority also said that many students still attribute the cause of malaria to eating raw mangoes and also walking in drizzles of rain. Some of them reported that:

"……. staying outside for long during evening hours because we even used to see students reading from Out Patient Department up to morning not until we started locking the place……..". Male, Lab technician, R08, 36 years.

"Yah, some people tell you that they got malaria when they moved under rain, some when they eat mangoes and one said that he got malaria after being burnt by a flat iron". Female, Nurse, R10, 37 years.

Theme 2: Environmental factors

The majority of the participants said that the prevalence of malaria is high among students because most student hostels are next to bushes which harbor mosquitoes and thereby provide breeding grounds for them.

Others said that there is a lot of stagnant water in the areas where students live mostly in the rainy season and also many agreed that some of the barriers students face is that many of them are un employed and therefore lack resources in form of money to always go for check-ups and treatment in line with limited awareness about many prevention measures of malaria.

Lastly many complained about shortage of drugs most times at the hospital.

This is backed up by some of the participants' views as quoted below:

"……. staying around bushes, bushy areas, you know it favors infestation of mosquitoes, and then also aaaahhh, leaving stagnant water around the compound that is also what facilitates the spread of malaria". Male, Student leader, R01, 23 years.

"The factors are diverse and can be many bushes around hostels where students live, presence of stagnant water, and many tall grasses around that harbor mosquitoes". Female, Nurse, R13, 37 years.

“Aaaahh in this community, I always see bushes around the places of residence which provide breeding areas for mosquitoes and then also see a lot of stagnant water. I think some of it comes as result of poor draining systems from the bathrooms”. Female, Student leader, R03, 24 years.

“Students face very many barriers, because for the students themselves, they lack resources in terms of money to go for health care, there are delays at the hospital which demoralizes someone from going there, then after the check-up and they prescribe a drug for them they don’t have money to go and buy and so end up going to buy a pain killer yet they have malaria which worsens the situation”. Female, Lab technician, R07, 32 years.

“Uhmm, not that am aware of, but I think the biggest challenge is health education and awareness creation that are provided at the hospital is not done well to the students and also re-educating them always. Then also shortage of drugs sometimes at the facility”. Male, Clinician, R09, 28years

Discussion

The period prevalence of malaria from March to April, 2023 among Lira University students was obtained from respondents who went to receive care and treatment at Lira University Hospital and were tested, results showed that 43 (13.3%) of them had malaria infection and tested positive. This gives the overall prevalence of 13.3% which is less than the 63.1% at Lira University Hospital in 2022, probably due to the fact that this study was involving only students as participants and excluding community members. This prevalence could be attributed to a number of factors such as not using mosquito repellants, students staying around bushy environments, and not using mosquito nets. However in the research done among University communities in Eastern Uganda, the prevalence was 12.9%, which is similar to the one of this study (13).

In this study, use of mosquito repellants (p-value = 0.028) was identified as the major factor contributing to malaria prevalence among the students. Students who used mosquito repellents had significantly higher odds of having malaria compared to those who did not use them (p = 0.028). This association remained significant even after adjusting for other factors (AOR = 2.09, 95% CI = 1.09–4.04). This finding may be counterintuitive since mosquito repellents are commonly regarded as a preventive measure against mosquito bites and malaria. It is possible that students who use mosquito repellents may engage in riskier behaviors, such as staying outdoors during peak mosquito activity hours or neglecting other preventive measures. Further research (Case-control) is needed to explore the reasons behind this association and to promote appropriate and effective use of mosquito repellents. Many researches have shown the impact of repellants in protection against mosquito bites and hence preventing malaria, for instance the publication made by the National library of Medicine, 2018 where they show the relevance of mosquito repellants for malaria prevention (14).

Another factor that was found to be significantly associated with malaria prevalence was staying around bushy environment. Students who stayed around bushy environments had significantly higher odds of having malaria compared to those who did not (p = 0.035). This association remained significant even

after adjusting for other factors (AOR = 2.03, 95% CI = 1.05–3.92). This is because mosquitoes tend to thrive in bushy environments thus increasing the risk of malaria transmission. This result confirms a study done in Nkongho mbeng, a typical rural setting in the equatorial rain forest of the South West Region of Cameroon where the most significantly associated factor was staying around bushy areas and presence of stagnant water and this provides more evidence that bushy areas and stagnant water provide breeding grounds for mosquitoes(15).

Conclusion and Recommendations

Conclusion

The prevalence of malaria among Lira University students was 13.3% which was higher than the total prevalence in 2022 at Lira University Hospital.

Staying around bushy areas (p = 0.035) and use of mosquito repellants (p = 0.028) were significantly associated with malaria prevalence among Lira University students.

Recommendations

To the University:

The University should establish a partnership with local healthcare providers, such as hospitals, clinics, or public health agencies, to seek their expertise in managing and combating malaria.

The university should offer health education on malaria prevention to the hostel owners, surrounding community and the students.

The University should emphasize the importance of preventive measures, such as the use of bed nets, mosquito repellents, environmental control of larvae and adult mosquitoes and appropriate clothing.

To the University Hospital:

The health workers from the University hospital should carry out sensitizations about the relevance of using Insecticide Treated Mosquito Nets and clarify on all the surrounding beliefs and fears the members of the community and some students have about the ITNs.

The Hospital should strengthen diagnostic capabilities by ensuring that proper diagnostic tools and facilities to accurately and promptly diagnose malaria cases such as microscopy, rapid diagnostic tests (RDTs), or molecular diagnostic techniques are always in place.

Abbreviations

AOR
Adjusted Odds Ratio
CDC
Center of disease control
COR
Crude Odds Ratio
IRS
Indoor residual spraying
ITNs
Insecticide Treated Nets
LLINs
Long Lasting Insecticide Treated Nets
MCP
Malaria control program
MOH
Ministry of Health
NMCS
National malaria control strategy
NPHC
National Plan and Housing Census
PMC
Project Monitoring and Control
RDT
Rapid Diagnostic Tests
SPSS
Statistical Package for the Social Sciences
UNICEF
United Nations Integrated Children Fund
WHO
World Health Organization

Declarations

The authors declare that they have no conflict of interest.

Ethical Approval and Consent to Participate

The study was conducted in compliance with the Helsinki declaration. Ethical approval was obtained from Uganda National Council of Science and Technology through Lira University Research and Ethics Committee (LU-REC), LUREC-2022-6; the Dean of students, Lira University and the Director, Lira University Hospital granted permission to conduct the study. Written informed consent was sought from every

participant. Confidentiality was observed throughout the study and thereafter. The participant's time was compensated at UGX 5000= (USD 1.35) after the interview.

Consent for Publication:

Not Applicable

Author Contribution

NA, MSO, conceptualized and drafted the protocol. NA, AJM, FL, participated in data collection, cleaning and entry. NA, MSO, AJM and EK analyzed and interpreted the data. NA, and MSO drafted the manuscript. MSO, FA, MM, and ARA proof read and made final edits in the manuscript. All authors agreed and endorsed the manuscript for publication.

Acknowledgment

The authors acknowledge the study participants who gave in their time to provide valuable information for this research. In addition, we acknowledge our research assistants for their tireless efforts to collect the data.

Availability of Data and Materials

All the datasets used and/or analysed during this study used in this study are available from the corresponding author on reasonable request.

Competing interest

The authors declare that they have no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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Figures

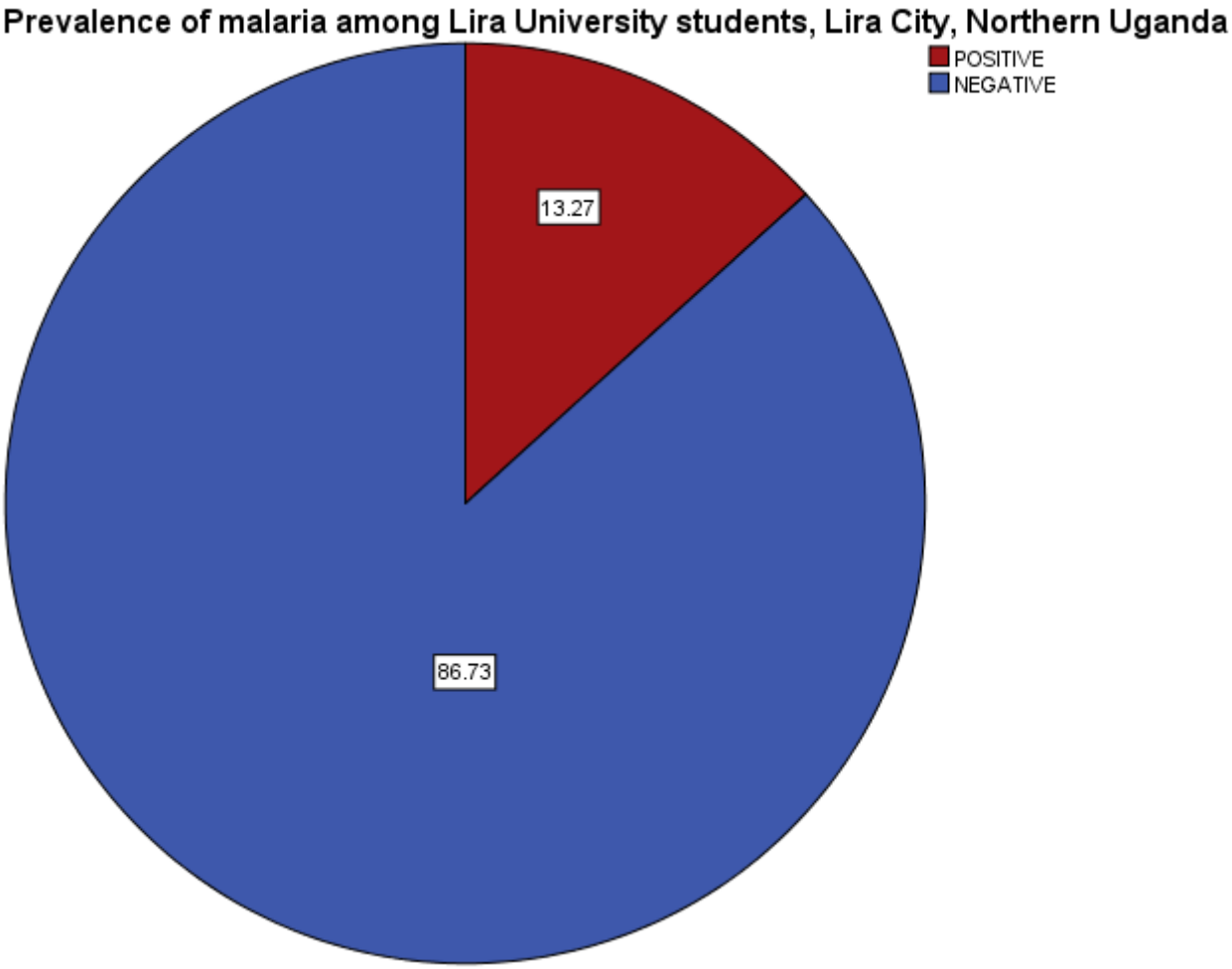


Figure 1

Figure 2: Showing the prevalence of malaria among Lira University students, Lira City.