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Prevalence and preventive measures of malaria among students of Imo State University, Owerri, Nigeria

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ABSTRACT

Introduction

Episodes of malaria attack among students contribute immensely to high economic loss, poor academic performance due to absenteeism, and, occasionally, loss of life due to ignorance and negligence emanating from untreated malaria.

Purpose

The purpose of this study was to determine the prevalence and preventive measures of malaria among students of Imo State University, Owerri, Nigeria, to inform intervention initiatives.

Materials & Methods

A survey on the prevalence and preventive measures of malaria among students of Imo State University living off-campus was conducted between March and September 2019. A total of 618 students made up of 258 males and 360 females within the age range of 18 - 27+, who were randomly selected, participated in the study. Demographic and other information, including preventive measures in use, was obtained through responses to a well-structured questionnaire administered to them. Blood samples were collected by finger-pricking for the direct preparation of thick and thin blood smears. The blood films were prepared and stained with field stain A and B and examined with an x100 objective microscope for malaria parasites.

Results

Results obtained revealed that out of the 618 students examined, 78.3% had malaria parasites. Age group-related results showed that the age group, 23-26 years had the highest prevalence of malaria parasites (82.1%) while the least prevalence was observed among the age group of 27+ years (71.4%). Also, gender-related results revealed that males were more infected (90.00%) than females (69.4%). Data related to the preventive measures taken showed that participants that utilised window and door nets had the highest prevalence (90.6%) while those that utilised insecticide-treated bed nets (ITN) had the least prevalence (64.7%) of the infection. Results also indicated that those that lived close to refuse dumpsites had more infections (96.3%) than those that lived far from refuse dumpsites (58.8%). Further analyses of data revealed that a greater majority of the students were infected with malaria parasites **($p<0.05$)** and the infection was significantly dependent on gender and preventive measures adopted **($p<0.05$)** but independent of age groups **($p>0.05$)**.

Conclusions

There is an urgent need for education and enlightenment of the masses on the dangers of malaria infection and the proper employment of preventive measures. The government, also, needs to encourage general environmental sanitation to forestall further breeding of mosquitoes, while providing essential preventive amenities.

INTRODUCTION

Malaria is a life-threatening disease usually caused by *Plasmodium spp.* and is transmitted through mosquito bites. It is a killer and debilitating disease in the world and remains formidable health and socio-economic problem, not minding the global awareness being given to it (Neb et al., 2007; Nwoke & Ogomaka, 2019). All over the world, about 350 to 500 million cases of malaria episodes occur each year, and over I million people die, most of whom are children and pregnant women of the sub-Saharan nations (World Health Organization [WHO], 2010; Baird, 2013), where malaria is known as the leading cause of morbidity and mortality, especially among pregnant women and children under 5 years of age (United Nations Children's Fund [UNICEF], 2005). Often, malaria transmission occurs as a result of travels by infected individuals to non-endemic areas. When uninfected local mosquitoes bite the infected traveler, they collect malaria parasites and transmit them to the indigenes during their next blood meal (Artzy-Randrup et al., 2010). According to Uganda's Ministry of Health (MOH, 2006), nearly half of the world's population remains at risk of malaria infection.

In Nigeria, malaria accounts for about 25% of all outpatient visits at health care centres while up to 20% of all hospital admissions and 15% of in-patient deaths are due to malaria infection in Uganda (Stephniewska et al., 2006).

Environmental conditions of the tropical and subtropical African countries such as consistent high temperature, humidity with abundant stagnant waters due to poor drainage system encourage the breeding of mosquitoes and transmission of malaria parasites (Stepniewska et al., 2001; Nwoke & Ogomaka, 2019). It is a disease of both urban and rural communities with potential mosquito breeding sites, which put residents at risk of the disease's spread (Etusim, et al., 2013). A high rate of infection, according to Centres for Disease Control and Prevention (CDC, 2004), contributes to a reduction in work capacity and impairs physical, mental, and cognitive development in the affected young ones and also limits their potential in making reasonable contributions to the socio-economic development of the society.

The most effective means of eliminating malaria is to prevent the transmission of malaria parasites through the adoption of effective preventive measures. The use of insecticide-treated bed nets (ITN) is one of the most effective tools for malaria prevention; thus, consistent or regular use of this measure helps in reducing malaria transmission through mosquito bites (Giming et al., 2003).

In Nigeria and, more especially, Imo state, ITN distribution has received a boost in the past 3 years so that 1 in every 4 households has at least one net, and many own more than one net ("field observation", n.d.).

Globally and, especially, in the tropical African countries, there has been an increase in awareness on the distribution and use of preventive measures against malaria transmission by both governments and individuals. However, the issue remains whether these items are properly used. Hence, the researcher sets out to study the prevalence and preventive measures of malaria among the study participants, to inform intervention initiatives.

MATERIALS AND METHODS

Study Area

Imo State University is a State-owned University that is situated at the heart of the State capital, Owerri, having the geographical coordinates (DMS Lat: 5° 28' 34.7160" N and DMS Long: 7° 1' 33.0708" E) and other geographic features with the State (LatLong, 2020). Being a non-residential institution, students find homes (hostels) wherever it is affordable (especially, Lake Nwaebere, Ikenaegbu, Bishop's Court, and Amakohia where this survey was conducted) and this singular reason expose a great many of them to mosquito breeding sites and malaria transmission. The influx of people into the State as a result of the presence of many institutions of higher learning and being a refuge to many people living outside the State due to the ongoing insecurity in many parts of the country, led to the construction of buildings along waterways, without proper planning. The consequence of this is the blocking of the drainage systems and the creation of stagnant waters, which encourage the rapid breeding of mosquitoes and the transmission of malaria parasites.

Ethical Clearance & Consent

Ethical clearance for this study was obtained from the Imo State University Ethics Committee while informed consent was obtained from the participants during advocacy visits.

Study Population

The study population consisted of all students of Imo State University living at Lake Nwaebere (IMSU back gate), Ikenegbu, Bishop's Court, and Amakohia.

Sample size & Sampling Technique

This study's sample size consisted of 618 students of Imo State University living at the quarters of interest, who

were randomly selected, and consented to participate in the study.

Inclusion & Exclusion Criteria

The researcher made sure that students who participated in the study had not treated malaria for the two weeks preceding the data-gathering exercise and were living within Owerri metropolis.

Study Design

Cross-sectional study design was adopted for the study.

Sample Collection and Analysis

Demographic and other related data were collected using a well-structured questionnaire administered to the participants.

Blood samples were collected, using the finger-pricking method. Both thin and thick smears were made on clean grease-free slides, on the spot, after collection. The slides were air-dried, taken to the diagnostic laboratory, and stained with field stain A and B and examined with an x100 oil immersion objective lens of a microscope for the presence and number of parasites. The parasite density (µl) was determined by counting and multiplying the average number of parasites per high power field (HPF) by 500. Between 10-50 HPF were counted, depending on the parasitaemia. This method was as described by Cheesbrough (2006).

Statistical Analysis

All the data collected were analysed using descriptive and inferential statistics (percentages (%), chi-square (χ^2) and z-test)

RESULTS

The overall result of malaria prevalence among the students revealed that out of the 618 students examined, 78.3% were infected with malaria parasites (*Plasmodium falciparum* species). Thus, a greater majority of the students were infected **(p<0.05)**. Gender-related prevalence revealed that 90.4% of males had malaria parasites infection as opposed to 69.4% of females. The overall parasitaemia/parasite density was 493500/μl, with the males having a higher parasite density (255750/μl) than the females (237750/μl). The infection was significantly dependent on gender **(p<0.05) (Table 1)**.

Table 1
Overall and gender-related prevalence of malaria in the study population

Gender	No. Examined	No. infected (%)	No. uninfected (%)	Parasite Density/μl
Male	258	234(90.7)	24(13.9)	255750
Female	360	250(69.4)	110(17.8)	237750
Total	**618**	**484(78.8)**	**134(21.7)**	**493500**

z=32.96, p<0.00001 (significant at p<0.05); **χ^2(1, N=618) = 39.88, p<0.00001** (significant at *P*<0.05)

Table 1 revealed that males had 90.4 % of the infection while females had 69.4%. The overall parasitaemia/parasite density was 493500/ (μl), with the males having a higher parasite density (255750/μl) than the females (237750/μl). The infection was significantly dependent on gender (p<0.05).

Age group-related result showed age group, 23 -26 years having the highest infection prevalence (82.1%) while the least infected group was 27+ years (71.4%). Also, age group-related parasite density revealed that those within the age group of 19-22 years had the highest parasite density (165,500/μl) while the least parasite density was recorded in the age group, 27+ years (35500/ μl). The infection/prevalence is independent of the age groups **(p>0.05) (Table 2)**.

Table 2
Age-related prevalence of malaria

Age group (in years)	No. Examined	No. infected (%)	No. uninfected (%)	Parasite Density/μl
>18	124	100 (80.6)	24 (19.7)	135500
19-22	256	196 (76.6)	60 (23.4)	165500
23-26	168	138(82.1)	30 (17.9)	107000
27+	70	50 (71.4)	20(28.6)	85500
Total	**618**	**484(78.8)**	**134(21.7)**	**493500**

χ^2(3, N=618) = 4.24, p=0.2367 (not significant at p>0.05)

Table 2 shows that the age group, 23-26 years had the highest prevalence of malaria parasites (82.1%) while the least infection was observed among participants within the age group of 27+ years (71.4%). The infection/prevalence is independent of the age groups (p>0.05).

Results of the malaria preventive measures adopted by the students revealed that those who used insecticide-treated bed nets had the least infection (64.75%) while the highest infection rate was revealed among those that used door and window nets only (90.5%) **(Table 3)**.

Table 3
Malaria prevalence in relation to the preventive measures adopted

Preventive measures	No Examined	No Infected (%)	No. uninfected(%)
Window and door nets	232	210(90.5)	11(9.5)
ITN	136	88(64.7)	24(35.3)
Indoor spraying	156	104(66.7)	26(33.3)
Use of mosquito coil	94	82(87.2)	6(13.0)
Total	**618**	**484(78.8)**	**134(21.7)**

χ^2(3, N=618) = 52.07, p<0.00001 (significant at p<0.05)

Table 3 revealed that those who used window and door nets had the highest prevalence of infection (90.5%) while the least infected group was those that made use of ITNs (64.7%). Participants within the age group of 19-22 years had the highest parasite density (165,500/µl) while the least parasite density was recorded in the age group, 27+ years (35500/ µl). Thus infection depends on the preventive measure adopted (p<0.05).

Residence near to refuse dump results showed that those that resided very close to a refuse dump had more infections (96.3%) than those who resided far off a dump site (58.8%) **(Table 4)**. Statistically, infection is significantly dependent on a residence near a refuse dump site **($p<0.05$)**.

Table 4
Prevalence of malaria in relation to living near a refuse dump

Residence	No examined	No infected (%)	No. uninfected (%)
Near refuse dump site	322	310(96.3)	12(3.7)
Far from the refuse dump site	296	174(58.8)	122(41.2)
Total	**618**	**484(78.8)**	**134(21.7)**

$\chi^2(1, N=618) = 127.56, p<0.00001$ (significant at $p<0.05$)

Table 4 shows that those students that lived near a refuse dumpsite had more malaria prevalence (96.3%) than those that lived away from a refuse dumpsite (58.8%). Thus, infection is significantly dependent on residence near a refuse dump site ($p<0.05$).

DISCUSSIONS

The results of this study not only gave insight into the malaria prevalence and level of the influence of environmental decay on malaria transmission within the State but also 'x-rayed' the level of effectiveness of different preventive measures available to people in the study population. This assertion is in line with the findings of Omolade et al. (2010), and according to Fernado, et al. (2003), repeated malaria attacks have a great influence on school children's academic performance. Interestingly, a greater majority of the students examined were infected with malaria parasites (78.3%). This result agrees with the work of Akogun (1991) and Adesina (2013) who also observed a high prevalence of malaria parasites in the same region and Eze et al. (2014) who obtained similar results in Rivers State, Nigeria. However, considering the poor environmental conditions within the study area due to massive indiscriminate refuse dump sites and poor drainage systems, which encourage mosquito breeding and transmission of malaria parasites, the high prevalence of malaria among the students is not out of place.

Although the prevalence rate was high in this study, the parasite density of 237750 and 255750 for male and female participants, respectively, do not seem to be a problem judging from the World Health Organization (WHO)'s classification of moderate and at high risk of malaria infection calibration (as cited in Cheesbruogh, 006). Hence, the students could not be said to be at very high risk for malaria infection despite the high prevalence of the infection indicated (78.3%) since infection risk depends on the level of parasitaemia (number of cells infected).

The dependence of infection on gender **($p<0.05$)** is justifiable. Males are usually more exposed to malaria parasites due to their lifestyle *(such as going topless outdoors, staying outdoors late in the evenings, and heavy alcohol consumption, which lowers their immunity)* than most of their female counterparts. This result agrees with the work of Contamin et al. (1995).

Although participants within the age group, 23-26 had the highest prevalence of infection, the relationship between infection with malaria parasites and age was not statistically significant **($p>0.05$)**. This result is also in line with the work of Ntomi et al. (1995) and Richard et al. (2019). Richard et al. study unanimously inferred that prevalence is an issue of exposure rather than age-dependent. Hence, the variations in parasite density observed among the age groups may be linked to the level of immunity that fluctuates with age and lifestyle of individuals.

The result of malaria prevalence in relation to preventive measures in use revealed the least prevalence of infection among ITN users. However, it is surprising that those who used door- and window-nets had the highest prevalence of malaria infection. This shows that there is a massive abuse of the door- and window-net system among the study participants - in terms of opening and shutting of doors and windows. On the other hand, the abuses in the use of the ITNs seems to be connected to the chronic absence of constant electricity and other social amenities, which makes the study participants abuse the door- and window-net system by keeping doors and windows with nets open to access fresh air in the evenings, consequently forfeiting the benefits. This is also real since most mosquitoes hang on the door- and window-nets, waiting for any openings and once they are opened, the mosquitoes enter the house before the occupants! Some mosquitoes even craw under the net or through any space between the window and the walls to access the rooms ("field observation", n.d.).

CONCLUSIONS

Malaria is a major life-threatening disease to which many are at risk, even though some infected individuals seem to be asymptomatic most times. A high rate of infection contributes to a reduction in work capacity and impairs physical and mental development in the affected young ones. It also limits their potentials in making a reasonable contribution to the socio-economic development of society. Malaria affects all ages and gender, influenced by intricate human behaviour, exposure rate, and nearness to

mosquito breeding sites. There is, therefore, the urgent need for education and enlightenment of the masses on the dangers of malaria infection and the proper employment of preventive measures. The government, also, needs to encourage general environmental sanitation to forestall further breeding of mosquitoes, while providing essential malaria preventive amenities.

RECOMMENDATIONS

1. There is a need for urgent and proper environmental sanitation through the provision of appropriate drainage systems to reduce the collection of stagnant water and littering of the environment with plastic containers.
2. Education and awareness campaign on the proper and timely use of ITNs should be emphasized among the populace.
3. Mass administration of anti-malaria drugs should be carried out by the government and non-governmental organizations to help reduce malaria episodes among students, thereby reducing the number of times they miss lectures due to ill-health.
4. New and improved protective tools (such as those that will be directed towards eliminating the eggs and larvae of mosquitoes) should be devised since the vectors have developed resistance to the available ones.
5. The government should engage special measures to protect vulnerable groups that are at risk of malaria by taking into consideration their specific circumstances and needs and planning preventive strategies for them.

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