RESEARCH ARTICLE

Assessment of the Knowledge, Attitude, Practices and Malaria Prevalence among Undergraduates

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Abstract

Background: This study assessed the prevalence of malaria infection, associated risk factors, knowledge and practices about malaria among selected students in Lagos state, Nigeria.

Methods: The study employed quantitative descriptive cross-sectional design, using pre-tested questionnaires and rapid diagnostic test kits to collect data from 172 University students in Lagos state. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 25.

Results: Out of the 172 students examined for malaria parasite, 70 (40.7%) tested positive to the parasite. The overall mean (SD) knowledge score was 23 (± 7.25). The results of the chi-square tests showed that there was a significant association between the knowledge level and faculty among the students (p = 0.04). However other variables such as gender, age and academic level had no significant association with knowledge level. P < 0.05 at 95% confidence interval.

There is a Significant Negative Relationship (At 0.05 CL) between the Attitude of the Students and the Prevalence of Malaria (R = -0.16, P < 0.05). This implies that, as the attitude of the student improves, the prevalence of malaria among them reduced. However, knowledge does not have a significant relationship with prevalence and with attitude (p > 0.05).

Conclusion: This study revealed relatively moderate prevalence of malaria among the study population. **Participants generally had good knowledge, attitudes, and practices about prevention and control of malaria.** The university management therefore should implement malaria control strategies among young people in tertiary institutions.

Introduction

Malaria is a preventable and curable life threatening disease, caused by parasites that transmitted through infected female Anopheles mosquitoes [1]. It is the most important parasitic disease of man and remains a peculiar health problem particularly in tropical countries [2]. It has persisted as a global threat causing hundreds of millions of illnesses and hundreds of thousands of deaths each year. Globally, about 228 million cases of malaria were reported in 2018, with estimated death cases of 405,000 people. African region shared 93% of the global prevalence and 94% death occurrences [3]. According to the 2020 World Malaria report, Nigeria suffers the world's greatest malaria burden, with approximately 51 million cases and 207,000 deaths reported annually (27% of the total malaria cases and 23% of global malaria deaths), while 76% of the population live in high transmission areas [4].

Malaria is a vector-borne endemic disease caused by parasitic protozoa of the genus *Plasmodium*. There are various species of *Plasmodium* causing malaria in humans including *Plasmodium malariae, P. ovale, P. vivax, P. falciparu*m, and *P. knowlesi* [5]. Most serious illnesses, deaths from malaria and also most drug-resistant infections are due to infection with *Plasmodium falciparum*, the most virulent human malaria parasite.

Malaria is transmitted to humans through the bite of female *Anopheles* mosquito (*Anopheles gambiae*), which require a high temperature climate to thrive. Thus, malaria is commonly found in warm regions of the world that are closer to the equator, including tropical and subtropical countries [6].

In 2020, there were an estimated 241 million cases of malaria worldwide, while the estimated number of malaria deaths stood at 627,000. In addition, it has been reported that, the African Region carries a disproportionately high share of the global malaria burden. In 2020, the region was home to 95% of malaria cases and 96% of malaria deaths. Children under 5 accounted for about 80% of all malaria deaths in the Africa [1].

The control and eventual eradication of malaria depend on a small set of tools. For control of anopheline mosquito vectors the values of insecticide-treated bednets and indoor residual spraying of insecticides have been clearly demonstrated. Thus, appropriate use of antimalarial drugs remains a cornerstone of malaria control. The two main pillars for malaria control and beyond remain targeting the anopheline mosquito vector and effective case management, which is crucially dependent on the efficacy of the deployed antimalarial drug [7].

There are many factors contributing to persistence of malaria infection in Nigeria such as wrong drug use patterns by individuals and households, poor education, low socio-economy status, unplanned or improper housing patterns, leadership challenge, infrastructure deficiency, water storage, behavioral challenge and lack of knowledge about causes and control of the disease [8,9]; presumptive diagnosis and treatment of malaria based on symptoms leads to over- diagnosis of malaria and missed diagnosis for patients without malaria [10]. Other factors have been associated with the spread of malaria such as; environmental changes, malaria vector dynamics, host immune status and individual or community factors such as the socio-economic status, knowledge of malaria and the protective behaviors [11]. Microscopy technique, referred to as the gold standard method for laboratory diagnosis of malaria, involves collecting a finger-prick blood sample, preparing a thick and, in some occasions, a thin smear, staining the smear, usually with Giemsa, and examining with a microscope. RDTs are immunochromatographic test methods based on the detection of malaria parasite antigen in lysed blood. It usually involves the use of nitrocellulose test strip bearing monoclonal antibodies directed against a specific parasite antigen - the target antigen. The tests are relatively easy and fast to perform, mostly lasting for 15 min or less. Different antigens are targeted by the various kinds of RDTs available in the market today. Some of these antigens are the histidine-rich protein 2 (HRP-2), parasite lactate dehydrogenase (pLDH), and aldolase.

In spite of efforts made by the government, malaria cases continues to remain high and one of the leading causes of ill-health and deaths in Nigeria. Malaria infection has led to a high number of complications like cerebral malaria, hypoglycemia, jaundice, severe anemia leading to increased number of in-patient admissions and deaths. This same infection has led to malnutrition, growth retardation, reduced school attendances and dropouts among the children, which has also led to low economic growth as a lot is spent on treatment of the disease and this has left the people poor and economically devastated [12]. Inadequate knowledge and misconceptions about the transmission, as well as, the management of malaria, have been reported among various strata of the society especially students, with the notion that these category of people have little or no idea about this subject matter, which thus affect their malaria control measures [13].

Although previous studies have documented a high prevalence of malaria throughout Nigeria, there remains a paucity of research on knowledge, attitude and practices towards malaria in the major part of the federation, particularly among young people. This information is imperative in order to identify and implement effective control measures, and plan for the participation of the targeted communities in the control, which is one of the cardinal tools for the success and sustainability of disease control programs. This study therefore aimed to investigate the level of malaria prevalence, knowledge and practices about malaria among students in Lagos state, Nigeria.

Materials and Methods

Study design

A cross-sectional study was carried out between July and August, 2021 among students of a University in Lagos State, Nigeria. A total of 172 students of the University were sampled for the study. The students reside within the University (on campus) hostels. The study population was of different ages, ethnic groups, faculties and academic levels. To determine the knowledge level and practices related to prevention of malaria among the students, questionnaire were administered containing items on the knowledge, practice and awareness of the disease, including the ability to recognize malaria symptoms, previous malaria infection records and symptoms, source of information, medication, treatment and preventive measures against malaria infection.

Study population

Simple random sampling technique was used for the selection of students. The list of students was obtained from the registration unit of the chosen faculties. The simple random technique was employed to avoid any potential biases. The purpose of the study was explained to the selected students before their class sessions, and

they were encouraged to participate. Those who agreed to participate were asked to give their consent and complete a set of questionnaires. Students who were available and were also willing to fill the questionnaires and donate their blood as samples were included in this study. All staff both the teaching and non-teaching staff was excluded from this study including students that were unwilling to volunteer for this study and students that were also absent during the period of this study. Students on antimalarial drugs or who have completed antimalarial drugs less than two weeks were also excluded from this study.

Sample size

The sample size was obtained according to single population proportion formula: $n = z^2 * P(1-P)/d^2$

Where n = sample size, Z = Standard normal deviation at 95% confidence interval which is 1.96. P = Proportion of the target population, d = Degree of precision (taken as 0.05) [14]. From the formula, n was calculated to be 156. Adding 10% attrition rate to the calculated sample size i.e. 156 + 15.6 = 171.6. Therefore, 172 students were sampled, consisting 72 males and100 females, with age range of < 16-30 years.

Study area

A private University located in Lagos Mainland, Lagos State, Nigeria, having distinct dry and wet seasons.

Ethical considerations

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of Nigerian Institute of Medical Research (NIMR), Lagos State. The Medical Director of the University health center was also duly informed of the ongoing research. The study protocol was approved before data collection commenced among the students. The aim of the study was also clearly explained to the students in order to get their informed consent while students who do not give their consent were excluded from the study. The students were also reminded of their right to decline to take part in the study as well as to withdraw any time without consequences. Confidentiality was assured and maintained throughout the study. Thus, written and signed or thumb-printed informed consents were obtained from all respondents before starting the survey; the ethics committees approved these procedures as well. All malaria positive individuals were referred to the university's medical center for appropriate and standard medication according to national malaria drug policy.

Study instrument

The study instrument was a self-administered questionnaire that was modified from relevant KAP studies on Malaria. The content validity of the study instrument was done by cross-checking and authentication from experts in the field of study.

Afterwards, modifications were made according to the recommendations and counsel. (Accordingly, the questionnaire was pre-tested on 8 students of 15-25 years-old as part of a pilot study, and a few adjustments were made by changing the question wording).

In order to ensure validity and reliability, the questionnaire was pre-tested among 8 students, 15-25 years-old, of Faculty of Science and Science Education in Department of Biological Sciences, Anchor University through a focus group study before the actual data collection. Validated and well-structured questionnaires were administered to 172 consenting students at the time of blood sampling in order to obtain information by probing into their knowledge of the cause of malaria, ability to recognize malaria symptoms, treatment seeking behavior and preventive measures used.

Data analysis

Datasets were analyzed and interpreted using Statistical Package for Social Sciences SPSS Version 25. Descriptive statistics were used to determine the socio-demographic data, general knowledge about malaria, knowledge about individual's status, the signs and symptoms and practices related to malaria prevention.

Pearson's Product Moment Correlation was used to test relationship between variables (using p-value < 0.05 as statistical variable of relevance).

Blood sample collection

To determine the prevalence of malaria among the students of the university, blood samples were collected from students from July to August 2021 by finger prick using the SD Bioline Ag Pf/Pan malaria kit (Abbott, India) and Nantong Voyage malaria Pan/Pf test kits (Nantong Start Medical Device Co. Ltd., China) to diagnose malaria following the manufacturer's instructions. This RDT is a qualitative immunochromatographic test that detects *Plasmodium falciparum* HRP-II and *Plasmodium* lactate dehydrogenase, which is a glycolytic enzyme common to *Plasmodium falciparum*, *Plasmodium ovale*, *Plasmodium vivax* and *Plasmodium malariae* asexual stage parasites. A sample was tested in the university health center as a quality control to check the effectiveness of the RDT kit. Students that tested positive for the malaria parasite were referred to the university health center to be administered antimalarial drugs.

Results

Socio-demographic characteristics of the respondents

A total of 172 students participated in this study. The majority was female (58.1%) while the remaining was male (41.9%). Out of the 172 students who took part in the survey, eighty five (49.4%) were from the Faculty of Science and Science Education (Table 1).

The respondents within the age group of 16-20 years had the highest population (60.5%, n = 104). Of the respondents, 40.1% were year 4 students, while the remaining (59.9%) were from other academic levels. Eighty three (48.3%) of the students surveyed were from Yoruba ethnic group, (25.6%) were Igbos (Table 1).

Prevalence and distribution of malaria according to gender, age and faculty, academic level (n = 172)

Out of the 172 respondents, a total number of 70 (40.7%) students tested positive for malaria. Of these, 27.3% females were positive with malaria parasite while 13.4% males were positive. Majority of the positive cases was found among the age group of 16-20 years (22.7%). The results of the chi-square test showed that the prevalence of malaria was significantly associated with gender (p = 0.04). But there was no significant association between age, faculty, academic group and ethnicity. However, among the age groups, 16-20 years had the highest prevalence of 22.7%.

Knowledge and practices related to malaria

Sources of information on sexually transmitted

Table 1: Socio-demographic characteristics of the respondents (n = 172).

Variable	N	%
Gender		
Female	100	58.1
Male	72	41.9
Age group (years)		
< 16	6	3.5
16-20	104	60.5
21-25	58	33.7
26-30	4	2.3
Ethnicity		
Yoruba	83	48.3
Igbo	44	25.6
Hausa	7	4.1
Others	38	22.1
Academic Level		
Year 1	28	16.3
Year 2	29	16.9
Year 3	25	14.5
Year 4	69	40.1
Others	21	1.2
Faculty		
FSSE	85	49.4
FSMS	75	43.6
FHUM	12	7.0

FSSE: Faculty of Science and Science Education; FSMS: Faculty of Social and Management Science; FHUM: Faculty of Humanities

diseases (STDs): Pertaining to the sources of information, 47.1% of the students got their knowledge from home. Another source of information was school (33.7%) of the respondents while a very small proportion had obtained their knowledge from hospital (18.0%) and internet (1.2%).

Knowledge on malaria

The mean knowledge score was 23 (± 7.25). All (100%) participants had heard about malaria. Most (82.0%) of the respondents knew that *Plasmodium falciparum* is the causative agent of malaria, while the remaining (18.0%) chose *Staphylococcus aureus.* The result showed that 94.8% of the respondents knew that the female *Anopheles* mosquito transmits malaria, about 15.7% said that malaria is caused by extended duration under the sun while others mentioned alcohol (18.0%) and stress (15.7%). Majority (97.1%) of the respondents knew that mosquito bites causes malaria, 87.8% of the respondents knew that malaria is not contagious while the remaining 12.2% of the respondents knew that malaria was contagious. A large proportion (97.1%) knew that malaria can be prevented by using mosquito nets (87.2%). Majority (89.5%) of the respondents knew that malaria can be treated in hospitals/clinics (90.1%), pharmacist/chemist (54.7%), while the remaining respondents thoughts that self-medication (16.9%), local herbs (29.7%) and prayers (19.8%) can treat malaria. Out of the population 95.3% of the respondents have heard of antimalarial drugs, having the knowledge that chloroquine (49.4%), coartem (66.9%) are examples of antimalarial drugs (Table 2). Out of 172 respondents, 132 (76.7%) and 136 (79.1%) knew that strepsils and flagyl, respectively, were not examples of antimalarial drugs, the remaining respondent thoughts that strepsils 40 (23.3%) and flagyl 36 (20.9%) were examples of antimalarial drugs. Majority (79.7%) of the respondents knew that malaria can kill. Probing further on their ability to recognize symptoms, the findings revealed that fever (86.0%) were the most recognized symptom of malaria. Out of the 172 respondents, (64.5%) knew that hair loss is not a symptom of malaria.

Practices related to malaria prevention

The mean practice score was 11 (± 3.2). There were 7 items in this section. More than half 65.7% of the respondents claimed to use Long Lasting Insecticide

Table 2: Knowledge on treatment of malaria.

Treatment practices	Yes	%	No	%
Chloroquine	85	49.4	87	50.6
Coartem	115	66.9	57	33.1
Amatem	103	59.9	69	40.1
Flagyl	36	20.9	136	79.1
Strepsils	40	23.3	132	76.7
Antibiotics	57	33.1	115	66.9

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(LLIN), Thirty-six (20.9%) uses Treated Bed Nets while the remaining 79.1% don't use treated bed nets because it is not comfortable (42.4%) or due to heat (23.8%), sixty-seven (39.0%) use various kinds of topical mosquito repellents creams, while seventy-eight (45.3%) try to keep their various rooms clean as a way of preventing the breeding of mosquito (Table 3). Out of the percentage, 49.4% respondents take antimalarial prevention drugs.

Respondents who had scores above the mean was classified as having good preventive practices while those with lower scores were categorized as having bad preventive practices. Only 64% of the respondents demonstrated good preventive practices towards malaria.

Table 2 show the likely medications recognized by the participants as effective for the treatment of malaria. Majority 115 (66.9%) agree that coartem is good for treating malaria; followed by 103 (59.9%) who

claimed that Amatem is the drug of choice; followed by Chloroquine, 85 (49.4%). The other respondents also indicated drugs like antibiotics, 57 (33.1%); Strepsils 40 (23.3%); flagyl 36 (20.9%).

Table 3 shows the knowledge of the participants about the preventive measures for malaria. The results in the Table shows that, only 36 (20.9%) claim to use mosquito treated nets, however most of the students agreed to using other methods for preventing malaria. For instance, the table shows that, 113 (65.7%) claimed to use insecticides, 67 (39.0%) claimed to use mosquito repellent cream; 85 (49.4%) used antimalarial prevention drugs; while 142 (82.6%) claimed to prevent malaria by maintaining a clean environment.

There is a significant negative relationship (at 0.05 CL) between the attitude of the students and the prevalence of malaria (r = -0.16, p < 0.05). This implies that, as the attitude of the student improves, the prevalence of malaria among them reduced. However, knowledge does not have a significant relationship with prevalence and with attitude (p > 0.05) (Table 4).

There was no significant relationship between the frequency of malaria episodes in a year and the usage of mosquito nets. This probably suggests that the usage of mosquito nets does not significantly reduce the incidence of malaria parasite (Table 5).

Table 3: Preventive practices related to malaria.

Preventive practices	Yes	%	No	%
Use of mosquitoes nets	36	20.9	136	79.1
Use of insecticides	113	65.7	59	34.3
Use of mosquito repellent cream	67	39.0	105	61.0
Use of malarial prevention drugs	85	49.4	87	50.6
Maintaining a clean environment	142	82.6	30	17.4

Table 4: Relationship among knowledge, attitude and prevalence of malaria.

		Gender	Knowledge	Attitude	Prevalence
Gender	R	1	-0.049	-0.199**	0.151*
	P		0.523	0.009	0.048
	N	172	172	172	172
Knowledge	R	-0.049	1	0.030	-0.017
	P	0.523		0.700	0.822
	N	172	172	172	172
Attitude	R	-0.199**	0.030	1	**-0.162***
	P	0.009	0.700		**0.033**
	N	172	172	172	**172**
Prevalence	R	0.151*	-0.017	**-0.162***	1
	P	0.048	0.822	**0.033**	
	N	172	172	**172**	172

*Significance: p < 0.05

Table 5: Influence of mosquito net usage on the incidence of malaria.

		Frequency of malaria in a year	Do you use mosquito nets
Frequency of malaria in a year	r	1	-0.015
	p		0.844
	n	172	172
Do you use mosquito nets	r	-0.015	1
	p	0.844	
	n	172	172

Discussion

Findings in this study showed that the prevalence of malaria infection among the university students in Lagos was 40.7%. The conduct of the research during rainy season may be attributed this high prevalence, this is similar to a study done by Mature, et al. [15] among University students in Abuja with a prevalence of 61% and was carried out in wet season. More so, a prevalence of 84.2% was recorded among FUTA students by Awosolu, et al. [16] and this was attributed to presence of bushes and stagnant water in the environment thereby providing favorable breeding sites for the mosquito. In this study, about 82.0% students knew the causative agent of malaria. Similarly, findings obtained from studies in Federal university of Technology, Akure and Tanzanian College Students [16,17], where all the respondents in the study knew about malaria. Studies have proved that improved community knowledge of malaria and its source of transmission promote preventive and personal protection practices amongst affected community [18,19].

About 86.0% students, in this study, admitted that fever was the most recognized symptoms of malaria. This is in contrast to Dejazmach, et al. [20] who reported chills and shivering as most recognized symptoms but is similar to a study by Olusegun-Joseph, et al. [21], who reported that a good knowledge was demonstrated by the respondent in their ability to identify symptoms of malaria, more than half of the participants identify fever, headache and weakness, chills and vomiting as signs and symptoms of malaria;. Definitely this knowledge will aid in prompt treatment of the disease at the appropriate quarters in order to prevent avoidable complications.

The high prevalence of malaria among the student could be attributed to their attitude the use of mosquito nets as about 20.9% of the students use mosquito nets judiciously; others refused to use it due to several reasons such as heat, discomfort etc, thereby exposing a larger percentage to mosquito bites. This is in tandem with Awosolu, et al. [16], who reported that 26.1% of the respondents did not sleep under mosquito net at night. However, 65.7% of the study population used the long lasting insecticides and this is higher when compared with the study of conducted by Olusegun-Joseph, et al. [21], who reported that 16.2% of the respondents use long lasting insecticides.

Although, it is good to know that majority of the students could identify the preventives measures against malaria infection such as the use of long lasting insecticides, mosquito nets, mosquito coil, clean environment etc, it is important to note that the attitude of the not applying this knowledge will in no way reduce the prevalence of malaria among the students [21]. Probing further to know what action is taken as soon as they suspect malaria, majority (89.5%) of the students revealed that going to clinic or hospital is the best action to take in getting treatment against malaria infection, some revealed going to the pharmaceutical outlet, self-medication or use of local herbs (traditional remedy). Misconceptions about malaria were revealed by some of the students that mosquito is not transmittable, *Staphylococcus aureus* is the causative agent of mosquito and wearing black clothes at night is a factor of having malaria. As a result of this, it highly imperative to educate the populace about the epidemiology and pathogenesis of malaria and grave consequence of the ignorance of the killer of mankind, this will definitely aid in reducing and eradicating the menace of malaria in the society.

In this study, the prevalence of malaria was significantly higher (27.3%) in females compared to males (p = 0.04). This may be as a result of more females, close to 60%, participated in the study. More so, the hyper activities of the females along with exposed body part especially in the night, as a result of wearing skirts, to mosquito bites, may be responsible. This is in tandem to a study done by Ezihe, et al. [22] which recorded an alarmingly high (90%) prevalence of malaria among students of Nnamdi Azikiwe University and this was as a result of night activities among the students thereby exposing them to mosquito bites, but this is in contrast to studies carried out in Federal University of Technology, Akure and Nnamdi Azikiwe University [16,23], where the prevalence of malaria among the male gender was higher than that of females due to the fact that the males expose their bodies more than the females when the weather was hot and thus increased the chances of being bitten by the mosquitoes.

Age groups 21-25 and ≥ 30 years were 14.5%, and 1.2% times less prone to malaria when compared to age 16-20 years (22.7%). This suggested that younger ones were at the high risk of malarial infection than older people who have higher body immunity. According to [24], age is a risk factor in asymptomatic in malarial infection.
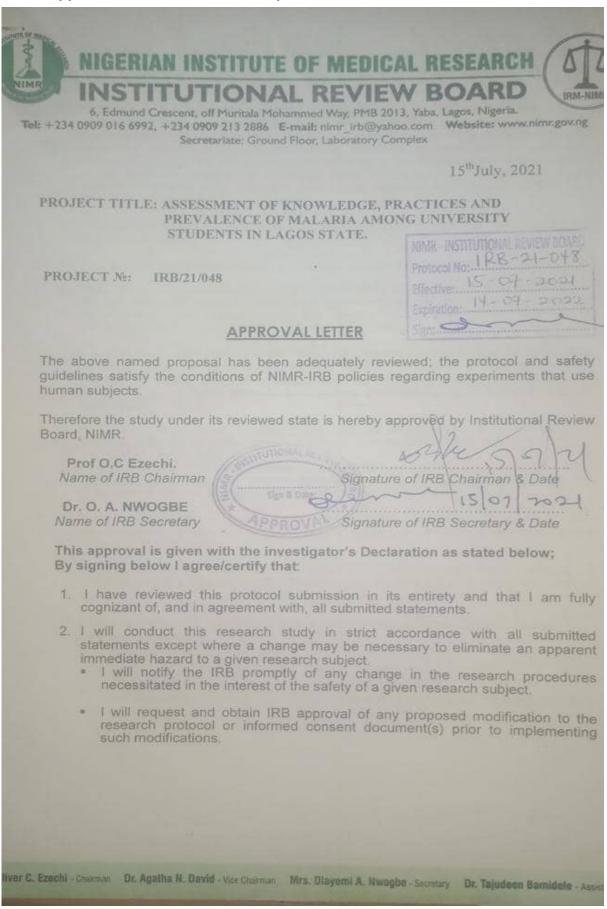
Conclusion

The prevalence of malaria infection among the students examined was high (40.7%). This reveals that the students living in the hostels were highly exposed to malarial infection and also indicated that most of the students were potential reservoir for the transmission of the infection, as majority of the students were asymptomatic, showing no signs and symptoms of malaria infection. The abundance of malaria causative agents in the university environment and the high prevalence rate of malaria is an indication of continuous transmission in the area.

From this study, it can be deduced that the students possess average knowledge in aspects of malaria, the knowledge they have is rather insufficient and a lot of misconceptions still exists.

The practices on malarial prevention are relatively satisfactory. This is evidenced by majority of the respondents who agreed that the best way to prevent malaria is to protect themselves from mosquito bites. However the knowledge level does not reflect in the students' practices.

Ethics Approval and Consent to Participate

3. I will ensure that all co-investigators and other personnel assisting in the conduct of this research study have been provided a copy of the entire current version of the research protocol and are fully informed of the current (a) study procedures (including procedure modifications); (b) informed consent requirements and process; (c) potential risks associated with the study participation and the steps to be taken to prevent or minimize these potential risks; (d) adverse event reporting requirements; (e) data and record-keeping; and (f) the current IRB approval status of the research study.

4. I will respond promptly to all requests for information or materials solicited by the IRB or IRB Office.

5. I will submit the research study in a timely manner for IRB renewal approval.

6. I will not enrol any individual into this research study until such time that I obtain his/her written informed consent, or, if applicable, the written informed consent of his /her authorized representative (i.e., unless the IRB has granted a waiver of the requirement to obtain written informed consent).

7. I will employ and oversee an informed consent process that ensures that potential research subjects understand fully the purpose of the research study, the nature of the research procedures they are being asked to undergo, the potential risks of these research procedures, and their rights as a research study volunteer.

8. I will ensure that research subjects are kept fully informed of any new information that may affect their willingness to continue to participate in the research study.

9. I will maintain adequate, current, and accurate records of research data, outcomes, and adverse events to permit an on-going assessment of the risks/benefit ratio of research study participation.

10. I am cognizant of, and will comply with, current federal regulations and IRB requirements governing human subject research including adverse event reporting requirements.

11. I will make a reasonable effort to ensure that subjects who have suffered an adverse event associated with research participation receive adequate care to correct or alleviate the consequences of the adverse event to the extent possible.

12. I will ensure that the conduct of this research study adheres to Good Clinical Practice guidelines.

Miss Hulda Oduwa
Principal Investigator's Name

....
Principal Investigator's Signature and Date

Consent for Publication

All authors have given their consent for the publication of this article in your journal.

Availability of Data and Materials

The authors consent that the data used in this study are available and will be provided if requested by the editor.

Competing Interests

All authors declare that there is no area competing interest as regards this study.

Authors' Contributions

Temiloluwa Afolayan: Wrote the main manuscript and analyzed some data; Williams Omotola Tanimowo: Analyzed some data, prepared and interpreted the tables; Azeeze Godsgift Ibrahim: Corrected the articles and suggested tables and patterns; Huldah Oduwa: Collected the data. All authors reviewed the manuscript.

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