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COST OF MALARIA TREATMENT, KNOWLEDGE AND PREVENTIVE MEASURE PRACTICES AMONG UNDERGRADUATE STUDENTS IN THE UNIVERSITY OF IBADAN, NIGERIA

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ABSTRACT

Malaria is a disease with public health concern and high economic burden in endemic areas. This study assessed the cost of malaria treatment for undergraduate students and university management as well as knowledge of malaria and preventive measures adopted by the students. This study was both retrospective and prospective. Retrospective involved estimating cost of treating malaria for undergraduate students by the university management (provider's perspective) between May and October 2017. The prospective phase involved use of pre-test structured questionnaire to assess respondents' frequency of malaria infection, knowledge on malaria and preventive measures. Data was entered into SPSS version 20 and analysed. The total prescriptions retrieved was 15,931 of which 22.7% contained antimalarial. The cost of malaria treatment to the university management was estimated to be ₦9,224,900/USD28,827.80 (mean = ₦2,553.20 ± 1,894.60/USD7.98 ± 5.92) for the 6 months studied. A total of 487 respondents were involved in the prospective study. Mean age of respondents was 20.8 ± 2.5 years old. An average of ₦2,209.10 ± 2,436.90 (USD73.60 ± 7.6) was spent by the students for treatment of malaria out-of-pocket (OOP) by those who sought treatment outside the University Health Service (UHS) centre. The use of insecticide treated net (ITN) was significantly common among females who also had lower incidence of malaria compared to males. Majority (68.9%) of participants had at least one episode of malaria in the last 6 months before the study. The economic burden of malaria to the university and the students is huge and this can be reduced if the students improved on the use of preventive measures against malaria.

Keywords: Cost, Malaria, Undergraduates, University, Treatment

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INTRODUCTION

Malaria is a life-threatening disease with high economic burden to the endemic society. In 2018, about 228 million cases of malaria and 405,000 malaria deaths were reported worldwide (World Health Organization [WHO] 2020). The WHO African Region accounted for 93% of malaria cases and 94% of malaria deaths (WHO 2020) with children as the most affected population (Liu, Isiguzo and Sieverding 2015). Nigeria is one of the top 10 highest burden countries in Africa accounting for one quarter of the continent's cases (WHO 2020), also reported resumed and confirmed cases of malaria increased from 16,740,50 in 2016 to 18,690,954 in 2017 (WHO 2018).

Globally, the total funding for malaria control and elimination in year 2018 was estimated to be USD2.7 billion, 30% of which was contributed by the governments of the endemic countries (WHO 2020). The economic burden of malaria to the developing countries is overwhelming. Malaria has been shown to be responsible for up to 1.3% decrease in the economic growth of most Africa countries. Thus, since there are no proper measures taken over the years, malaria has pull back the economy of many countries (Roll Back Malaria 2010). In the year 2017, about USD3.1 billion was invested in malaria control and elimination efforts by the governments of countries where malaria is endemic and their international partners (WHO 2018). In Africa, the cost of malaria to the continent was estimated to be between USD10 billion and USD12 billion annual loss of gross domestic product leading to a huge negative effect on the economic growth and increasing poverty (Marvis and Humphrey 2015). The WHO recommended different measures such as vector control, chemoprevention, diagnostic testing and treatment have proven to be both cost-effective and efficient with 47% reduction in mortality of malaria between 2000 and 2013 (WHO 2015). In spite of these measures, millions of people are still affected by malaria due to inappropriate utilisation of the measures put in place or unwillingness on the part of individual towards recommended preventive measures (Aribodor, Ugwuanyi and Aribodor 2016).

Many studies have been conducted in different parts of Nigeria in relation to burden of malaria to the populace. A study in the Eastern part of Nigeria evaluated the economic burden of malaria on households to be 40% of the total monthly healthcare budget (Onwujekwe *et al*. 2013). The direct and indirect cost of malaria burden in Yenagoa metropolis, Nigeria was reported to be approximately ₦594,973,953 (USD184,774.50) with an average of ₦42,319.50 (USD132.20) per household, whereas in some other places' households spent about ₦667.9–19,759.10 (USD2.10–61.70) on treatment of malaria each month (Ebenezer and Dorothy 2017). In a study in Benin City Nigeria, USD18.51 was estimated as average cost of medications and laboratory investigation related to malaria treatment per an individual (Obieche and Odili 2016). The direct costs of malaria to households in some African countries were estimated to be USD6.87 in Ghana, USD11.84 in Nigeria and USD17.50 in Mali (Okorosobo *et al*. 2011).

Furthermore, some studies have been carried out on knowledge and prevention of malaria among people who live in malaria endemic countries especially in Africa (Munisi, Nyundo and Mpondo 2019; Jumbam *et al*. 2020). Some studies reported participants had good knowledge on causes of malaria, its transmission as well as symptoms but participants' attitude to use of preventive measures especially insecticides treated net (ITN) was poor as reported by Jumbam *et al*. (2020) in a study among rural population in Zambia, while Munisi, Nyundo and Mpondo (2019) reported majority of the study's participants in Tanzania use ITN in prevention of malaria. However, some studies have reported poor knowledge of causes and preventive practices among some categories of women; rural women as compared to urban in Burkina Faso (Yaya *et al*. 2017) and

women in the south-central district of Ethiopia (Deressa and Ali 2009). A study among non-medical higher institution students on their knowledge and perception of malaria prevention at Ondo state, Nigeria reported that 33.4% of the students had an insecticide treated net, however, only 21.1% reported sleeping under the net (Usman *et al*. 2015). A similar research in South Africa, indicated that 95% of the participants indicated that malaria can be prevented and 49% reported to be using preventive measures (Manana *et al.* 2015). However, studies on assessment of knowledge of malaria, prevention measures and cost of treatment among students in higher institution are rare.

With the present burden of malaria, estimating the economic implication would provide needed information for planning and evolving strategies to reduce the burden of malaria. To achieved this, this study evaluated the direct costs of treating uncomplicated malaria (cost-of-illness) in an adult at a public health facility in order to generate relevant information that is needed for planning and effective implementation of malaria case management among students' population. In addition, the study evaluated participants' knowledge on causes, treatment and practices of preventive measure against malaria and their treatment seeking attitude.

METHODS

Study Design

The study had both retrospective and prospective phases. The retrospective phase used pharmacy and laboratory units' records to estimate the cost of treating malaria from the school management perspective as a healthcare provider (provider's perspective), who pays for the treatment of students received at the University Health Service (UHS) centre after each student had paid a sum of ₦1500 (USD4.70) per session for medical services (Jo 2014). The prospective phase is a descriptive cross-sectional study that assessed the knowledge of malaria and preventive measures taken by undergraduate students of university of Ibadan, Nigeria. The cost of malaria treatment from the students' perspective/patient's perspective (Jo 2014) for those who paid out-of-pocket (OOP) when they assess healthcare outside the UHS centre was also estimated.

Study Site

University of Ibadan was founded in 1948 and has a total of 13 faculties. It has an undergraduate population of about 29,000 for 2017/2018 academic session based on the school management system records of registered students.

The retrospective phase of the study was carried out in the pharmacy and laboratory units of the UHS centre. The University of Ibadan Health Services is a National Health Insurance Scheme (NHIS) accredited primary care provider. UHS provides healthcare services to the university community namely students, staff, their dependents, visitors and retirees. The staff and dependents are NHIS enrollees while the students' health is funded from medical fees (capitation) paid by students at the beginning of each session. The University vote to the UHS makes up for short-falls from the students' fees including among others payment for emergency referrals to University College Hospital, Ibadan. The UHS is equipped with adequate number of medical doctors, 4 pharmacists, 25 nurses, 2 optometrists, 6 laboratory technologists, 2 medical and social workers and several other healthcare workers. All the workers are qualified and further trained to provide

relevant services required of them. The laboratory is well equipped for reliable diagnosis of malaria via microscopy and rapid diagnostic test (RDT).

Study Population

All the available records of undergraduate students in the laboratory and pharmacy units between May and October 2017 were used for the retrospective phase of the study. While the prospective phase was carried out in February, 2018, only consenting full-time undergraduate students were included in the survey or study from randomly selected faculties. According to the University management system 4,331 undergraduate students were registered for the academic session in the named faculties as at the time of the study.

Sample Size Determination

The retrospective phase involved the evaluation of prescriptions containing antimalaria. Similarly, all records of malaria parasite test and other related investigations such as full blood count were evaluated and used for the cost estimation in the study. For the prospective phase, the population of registered students in the selected faculties for the 2017/2018 academic session according to the information given by the university management information system was 4,331. The sample size was calculated using the Raosoft sample size calculator. The confidence level was set at 95% and the margin of error was 5%, sample size of approximately 353 undergraduate students in selected faculties was calculated. However, the inclusion of a 10% non-response rate gave a target sample size of approximately 390. In all 500 questionnaires were administered of which 485 were retrieved.

Sampling Technique

All prescriptions for undergraduate students within the study period were assessed for antimalaria medications and related adjunct medicines. All laboratory investigations related to malaria treatment for period of study was also assessed for the retrospective phase of the study. Five faculties were randomly selected through balloting. These faculties are: (1) Social Sciences, (2) Arts, (3) Pharmacy, (4) Veterinary Medicine and (5) Law. The number of participants for each faculty was determined using ratio of the student population per faculty. This was also done for each course and level of study. For the Faculty of Arts and Social Sciences, two departments were randomly selected for the study using balloting, while the Faculty of Pharmacy, Law and Veterinary Medicine are one set of students in each of the faculty, hence there was no need to select department. Students were approached in their respective lecture classes. One in every five students was approached for the study. If the student decline to participate, the next student is enrolled upon consenting to participate.

Inclusion/Exclusion Criteria

The retrospective phase of the study included all prescriptions and laboratory records in the undergraduate students' section of the UHS between May and October 2017. All other records within the UHS were excluded from the study. The prospective phase included only registered and consented undergraduate students of University of Ibadan. All postgraduate

students, diploma or any other students for any form of degree awards programmes, staff and visitors of the university community were excluded from the study.

Data Collection Instrument

The data form used for the retrospective phase and the questionnaires for the prospective phase of the study were developed by the authors in line with the objectives of the study after extensive review of relevant studies and also utilising practice experiences. The instrument has not been previously published elsewhere.

The data form consists of the name of the medication(s), route of administration, the quantity of the medication prescribed, the unit price of the medication, the total cost of treatment for each prescription, laboratory investigation and the associated cost. The questionnaire for the prospective phase of the study involving the undergraduate students consisted of four sections: (1) the sociodemographic characteristics of the participants; (2) knowledge of malaria among the participants, preventive measures against malaria; (3) frequency of malaria episode and (4) cost implications of malaria treatment among the participants.

Pre-Test and Validation of the Instrument

The questionnaires were assessed for content validity by three academic scholars who were expertise in the field of health economics and public health. This is to ascertain that the item-statements in the questionnaires is comprehensive and in line with stated study objectives, and also ensure simplicity in the questions or statements. Afterwards, the questionnaire was pre-tested/validated among 40 students from two departments of the Faculty of Arts and Social Sciences, which were excluded from the research. Minor adjustments were made on the questionnaire from the pre-test feedback in line with the pre-test questionnaire. Two opened questions were modified to closed ended with a Yes/No answer to make the questions definite for the respondent to pick an appropriate answer. In addition, the pre-test guided the appropriateness of the recruitment of participants and sampling procedure of the study.

Data Collection Procedure

A data collection form designed by the authors was used to collect information retrospectively from the pharmacy and laboratory unit of UHS. All prescriptions of undergraduate students presenting at the pharmacy unit and the laboratory investigations records that were related to malaria management obtained from the laboratory unit between May and October 2017 were assessed. Cost of all medications on the prescription and laboratory investigations related to malaria treatment were determined using the pharmacy and laboratory units tariff of the UHS centre used for visitor who accesses healthcare service at UHS. The direct cost of malaria treatment to the management was estimated using costs of medications and laboratory investigations. This study does not include cost of medical staff and other related cost such as indirect cost of malaria.

For the prospective phase of the study, participants were informed on the objectives of the study and their identities kept anonymous. Informed consent of all participants was sought to achieve their optimum and genuine participation. The informed consent form in the approved protocol of University of Ibadan/University College Hospital (UI/UCH) Health Research and Ethics Committee with approval number UI/EC/16/0106 captured the consent information which includes; objectives and procedure of the study, the risks and

benefits of participation, expected duration of involvement among others. This was read and explained to individual participant before the administration of the questionnaire. Thereafter, verbal informed consent was also obtained from each participant to signify their intention to participate in the study.

Cost Data Identification, Collection and Calculations

The study employed cost-of-illness study by estimating the financial burden of treating malaria using the provider perspective (university management) and also the patient's perspective (undergraduate students who pays OOP when they sought for treatment outside the UHS facility) (White *et al*. 2011). The overall costs of medications (which included the type, amount, duration, frequency and route of administration), supplies and laboratory tests carried out for each student at each visit related to malaria treatment was retrieved from the records made available. Pharmacy and laboratory prices were based on current prices (as at the time of the study) in the health centre used for patients that are not NHIS enrollee (mainly visitor). Medication costs per patient were calculated by multiplying the quantities of medications prescribed and dispensed by the prices obtained from the pharmacy department. Similarly, the cost of laboratory investigations per patient was obtained based on test carried out and price obtained from the laboratory department.

Similarly, amount spent by student for treatment of an episode of malaria when they sought for treatment outside the UHS was obtained from the students in the prospective phase of the study and accounted for out-of-pocket expenditure on malaria treatment on the part of the students. In addition, we estimated cost-benefit analysis of visiting of UHS for malaria treatment for the students who accessed the centre for malaria treatment. This was estimated by deducting the amount those students paid as capitation for the session from total amount that would have been spent in treating malaria outside the UHS facility using the average amount spent by those who accessed treatment outside UHS facility.

All costs were measured at their market values in local Nigerian currency, Naira (₦) and converted to USD at the 2017 exchange rate which was ₦320 = USD1 (Oando. com n.d.). This rate reflected the period of study. It is important to state that any update to current values may not reflect the true costs due to the current challenges of the Nigerian economy, unstable prices and exchange rates. For the purpose of this study, 2017 exchange rate was adopted.

Data Analysis

Data was entered into and analysed using SPSS version 20. Descriptive statistics such as frequency counts and percentages, mean and standard deviation were used to summarise the results. Pearson's Chi-squared (χ^2) test was used to test for association between gender, residence and practice of preventive measures against malaria. Similarly, χ^2 test was used to test for association between gender and residence. The level of statistics significance was set at $p < 0.05$.

RESULTS

All prescriptions of undergraduate students presenting at the pharmacy unit and the laboratory investigations records related to malaria management obtained from the laboratory unit within the period of May and October 2017 were assessed. A total of 15,931 undergraduate students presented at the pharmacy unit of UHS with prescriptions for their medications supply of which 3,613 (22.7%) patients reported with a prescription for malaria within the study period at the UHS centre as shown in Table 1**.** The highest percentage of reporting undergraduate students was in July with 31.3% of that presented prescription with antimalaria. There were more males treated for malaria in this health facility. The total cost of antimalarial and other adjunct medications, and laboratory cost related to malaria treatment dispensed at the UHS center was ₦9,224,900 (USD28,827.80) for a 6-month period. If extrapolated for a year period, the cost would be ₦18,449,800.00 (USD57,655.60). The average cost of medications per patient (undergraduate student) per episode was ₦2,067.10 ± 1,800.20 (USD6.50 ± 5.6). With a capitation of ₦1,500 (USD4.70) paid by each student at the beginning of session, a total of ₦43,500,000 (USD135,937.50) from 29,000 students in the session was an amount generated for medical fee by the university management. This implies that 42.4% of amount generated was spent on malaria treatment alone aside other ailments which accounted for 77.3% of visit to UCH that session. The most common artemether combination therapy (ACT) prescribed was artemether-lumefantrine (Table 2).

Table 1: Gender distribution of patient and associated cost of malaria treatment at the UHS centre, University of Ibadan, Nigeria.

Month	Gender	Number of patients (%)	Total (%)	Cost incurred related to malaria treatment		
				Medications ₦ (USD)	Laboratory investigations ₦ (USD)	Total cost for each month ₦ (USD)
May	Male	594 (62.3)	954 (26.4)	3,904,400 (12,201.20)	477,000 (1,490.60)	4,381,400 (13,691.90)
	Female	360 (37.7)				
June	Male	210 (59.8)	351 (9.7)	434,800 (1,358.80)	125,500 (392.20)	560,300 (1,750.90)
	Female	141 (40.2)				
July	Male	705 (62.2)	1133 (31.3)	1,531,200 (4,785.00)	566,500 (177.00)	2,097,700 (6,555.30)
	Female	428 (37.8)				
August	Male	327 (65.4)	500 (13.8)	682,000 (2,131.20)	250,000 (781.20)	932,000 (2,912.50)
	Female	173 (34.6)				
September	Male	91 (66.9)	136 (3.7)	183,600 (573.80)	68,000 (212.50)	251,600 (786.20)
	Female	45 (33.1)				

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Table 1: (*continued*)

Month	Gender	Number of patients (%)	Total (%)	Cost incurred related to malaria treatment		
				Medications ₦ (USD)	Laboratory investigations ₦ (USD)	Total cost for each month ₦ (USD)
October	Male	372 (69.0)	539 (14.9)	732,400 (2,288.80)	269,500 (842.20)	1,001,900 (3,130.90)
	Female	167 (31.0)				
Total	Male	2299 (63.6)	3,613			
	Female	1314 (36.35)		7,468,400 (23,338.80)	1,756,500 (5,459.10)	9,224,900 (28,827.80)
Average cost per case of malaria				2,067.10 ± 1,846.10 (6.5 ± 5.8)	785 ± 256.40 (2.5 ± 0.8)	2,553.20 ± 1,894.60 (7.8 ± 5.9)

Table 2: Cost of co-medications prescribed for malaria treatment at the UHS centre within the period of May to October 2017.

Medications	Route	Unit dispensed	Total cost ₦ (USD)
Co-medications			
Vitamin B complex	Oral	3073	153,650 (480.20)
	I.M.	460	46,000 (143.80)
Paracetamol	Oral	3011	90,330 (282.30)
	I.M.	602	60,200 (188.10)
Vitamin C	Oral	945	47,250 (147.70)
Ibuprofen	Oral	497	24,850 (77.70)
	I.M.	49	4,900 (15.30)
Diclofenac	Oral	263	31,560 (98.60)
	I.M.	52	20,800 (65.0)
Chloramphenicol	Oral	32	640 (2.0)
Total cost of co-medications			480,180 (1500.60)
Antimalaria			
Artemeter	I.M.	586	175,800 (549.4)
Artemeter/Lumefantrine	Oral	3031	6,346,820 (19,833.8)
Dihyroartemisinin/Piperazine	Oral	582	465,600 (1,455)
Total cost of antimalaria			6,988,220 (21,838.2)
Total cost of all medication			7,468,400 (23,338.8)

In the prospective phase of the study, the total number of questionnaires retrieved was 487 out of 500 administered, which amounted to 97.4% response rate. There were more females 267 (54.8%) than males. The average age of participants was 20.8 ± 2.43 years old, with participants within the age group 20–24 years old being the highest. The average monthly stipend calculated for the respondents was ₦14,980.20 (USD46.80) as shown in Table 3. The respondents' knowledge on causes, management and preventive measures against malaria is represented in Table 4.

Good number of the respondents have good knowledge on causes and preventive measure against malaria infection (Table 4). The preventive measures practiced by participants are presented in Table 5. Majority have insecticide treated and this is more common among the females. Similarly, the females use the ITN more than the males (Table 5).

Table 3: Sociodemographics distribution of participants.

Variables	Frequency	Percentage
Gender distribution		
Male	220	45.2
Female	267	54.8
Age distribution (years old)		
14–19	143	29.4
20–24	307	63.0
25–29	35	7.2
> 30	2	0.4
Mean ± SD (years old)	20.82 ± 2.43	
Faculty of respondents		
Pharmacy	42	8.6
Arts	134	27.6
Social Sciences	139	28.6
Veterinary Medicine	84	17.3
Law	87	17.9
Level of respondents		
100	92	19.3
200	123	25.3
300	158	32.4
400	56	11.5
500	56	11.5
Residence		
Hostel (on-campus)	422	87.0
Off-campus	63	13.0

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Table 3: (*continued*)

Variables	Frequency	Percentage
Monthly allowance (₦)		
< 10,000	106	30.4
10,000–19,000	134	38.4
20,000–29,000	78	22.3
30,000–39,000	12	3.4
40,000–49,000	4	1.1
> 50,000	15	3.2
Mean ± SD	₦14,980.20 ± 12,568.20 (USD46.81 ± 39.30).	

Table 4: Respondents' knowledge on causes, management and preventive measures against malaria.

Items	Frequency of correct answer	Percentage
Causes and management of malaria		
Malaria can be caused by *Plasmodium falciparum*	334	68.6
Only the female anopheles mosquito causes malaria	386	79.3
Malaria is only induced by stress	418	85.8
Malaria can be transmitted from an infected person to another	364	74.7
Malaria occurs frequently in certain seasons of the year	253	52.0
Malaria can cause death if not properly treated	447	91.8
Malaria can be prevented using drugs before an infection	320	65.7
Malaria can be treated with the use of antimalarial	446	91.6
Prevention of malaria		
Malaria can be prevented by keeping the environment clean	469	96.3
Malaria can be prevented by using a mosquito treated net	477	97.7
Malaria can be prevented by spraying of insecticides	469	96.3
Malaria can be prevented by fumigating the environment	456	93.6
Malaria can be prevented by taking paracetamol	418	85.8
Malaria can be prevented by covering my body against mosquito bites	357	73.3
Malaria can be prevented by rubbing mosquito repellant on body	439	90.1

Table 5: Participants practice of preventive measures against malaria.

Preventive measures		Resident				Sex		
		Halls on campus (%)	Off campus (%)	Total (%)	*p*-value	Male (%)	Female (%)	*p*-value
I have an insecticide treated net		259 (61.5)	38 (60.3)	297 (61.0)	0.855	113 (51.4)	184 (68.9)	0.00*
I use an insecticide treated net		154 (36.5)	20 (32.3)	174 (35.7)	0.727	66 (30.0)	107 (40.1)	0.036*
My room windows netted to prevent mosquito		285 (67.5)	42 (67.7)	327 (67.1)	0.974	134 (60.9)	193 (72.3)	0.006*
My environment predisposes me to malaria		290 (68.7)	40 (63.5)	330 (67.8)	0.230	146 (66.4)	184 (68.9)	0.252
I use a special cream against malaria		84 (20.0)	15 (24.2)	99 (20.3)	0.44	41 (18.6)	58 (21.7)	0.404
How often do you spray insecticide?	Daily	24 (6.0)	2 (5.2)	26 (5.3)		12 (5.4)	36 (13.5)	
	Weekly	70 (17.4)	9 (15.5)	79 (16.2)		36 (16.4)	43 (16.1)	
	Monthly	61 (15.2)	11 (19.0)	72 (14.8)		28 (12.7)	44 (16.5)	
	Almost never	230 (57.2)	33 (56.9)	263 (54.0)		126 (57.3)	137 (51.3)	
	Never	17 (4.2)	2 (3.2)	19 (3.9)		5 (2.3)	14 (5.2)	
	No response	12 (2.8)	6 (9.5)	18 (3.7)		13 (5.9)	14 (5.2)	

χ^2 Test Statistically Significant at $p < 0.05$

Majority of the respondents had malaria at least once in 4 months with 49.4% of them had malaria in the last 4 months before the data collection (Table 6). Considering gender difference in the incidence of malaria among the participants, 71.6% of males and 68.9% of females had at least one malaria episode in the last 6 months prior to the study.

Table 6: Frequency of malaria occurrence among the respondents.

Variable		Male (%) (*n* = 218)	Female (%) (*n* = 261)	Total Frequency (*n* = 478)
How often do you come down with malaria?	Never	25 (11.5)	14 (5.3)	39 (8.1)
	Every month	14 (6.4)	11 (4.2)	25 (5.2)
	Twice/twice in a month	8 (3.7)	14 (5.4)	22 (4.6)
	Quarterly	76 (34.9)	105 (40.2)	181 (37.9)
	Yearly	78 (35.8)	86 (33.0)	164 (34.3)
	Less often in years	18 (8.3)	27 (10.3)	45 (9.4)
When last did you come down with malaria?	1–2 months ago	41 (18.8)	62 (23.8)	103 (21.5)
	3–4 months ago	66 (30.3)	67 (25.6)	133 (27.8)
	5–6 months ago	49 (22.5)	51 (19.5)	100 (20.9)
	7–12 months ago	38 (17.4)	57 (21.8)	95 (19.9)
	More than a year ago	24 (11.0)	24 (9.2)	48 (10.0)

Two hundred and fifty-four (52.2%) of the participants indicated that they have never reported to the UHS centre for the treatment of malaria and they spent between ₦500 and ₦20,000/USD1.60–62.50 (an average of ₦2,209.10 ± 2,436.90/USD6.90 ± 7.60) for treatment of malaria at each episode. This set of students sought for treatment by self-medicating, visiting a community pharmacy or visiting a hospital outside the university community for their treatment (Table 7). Another 233 (47.8%) participants who access UHS for their malaria treatment had benefited from the healthcare medical saving cost by not paying out of pocket for malaria treatment. The cost-benefit of treating an episode of malaria at UHS for these students can be calculated as:

> Total capitation was ₦1500 (USD4.70) (for individual) multiply by 233 = ₦349,500 (USD1,095.10).

An average of ₦2,209.1 (USD6.90) was spent by students outside the UHS facility to treat one episode of malaria.

Total amount that would have been spent out of pockets by 233 students who accessed UHS facility per each episode of malaria treatment = ₦2,209.10 (USD6.90) multiply by 233 = ₦514,720.30 (USD1,607.70).

Cost benefit of accessing UHS for treatment of an episode of malaria for the students = ₦514,720.30–₦349,500 (USD1,607.70–USD1,095.10) = ₦165,220.30 (USD512.60) for all the 233 students and ₦709.10 (USD2.20) per student per episode of malaria treatment.

Table 7: Malaria treatment seeking attitudes of participants.

Variable	Sex			Residence			
Treatment seeking attitude	**Male (%)**	**Female (%)**	***p*-value**	**Hall (campus)**	**Off-campus**	**Total (%)**	***p*-value**
How do you treat your malaria?							
I report to the UHS centre	90 (41.7)	109 (42.1)		178 (43.1)	21 (33.9)	199 (41.9)	
I self-medicate	50 (23.1)	54 (20.8)		88 (21.3)	16 (25.8)	104 (21.9)	
I report to another hospital, outside school	24 (11.1)	47 (18.1)		60 (14.5)	11 (17.9)	71 (15.0)	
I use local herbs	4 (1.9)	5 (1.9)		8 (1.9)	1 (1.6)	9 (1.9)	
I visit a community pharmacy	42 (19.4)	37 (14.3)		67 (16.2)	12 (19.4)	79 (16.7)	
I say prayers	6 (2.8)	7 (2.7)		12 (2.9)	1 (1.6)	13 (2.7)	
No response	4 (0.2)	8 (3.0)		11 (2.6)	1 (3.2)	12 (2.5)	
I do not have confidence in the service render on malaria treatment in UHS							
Yes	120 (54.5)	110 (41.2)		207 (48.8)	23 (36.5)	230 (47.2)	
No	37 (16.8)	67 (25.1)		87 (20.5)	17 (27.0)	104 (21.3)	
Do not know	63 (28.7)	88 (33.0)		128 (30.2)	23 (36.5)	151 (31.0)	
No response		2 (0.7)		2 (0.5)		2 (0.4)	
Total	**220**	**267**		**424**	**63**	**487**	

DISCUSSION

Malaria cases accounted for more than 20% of undergraduate students visit to the UHS which signifies its huge economic burden on the university management. An average of ₦2,553.20 ± 1,894.60 (USD7.90 ± 5.92) was spent by the management for treatment of malaria episode per student which was doubled the amount (₦906.00/USD2.83) reported in a study in university medical centre in eastern part of Nigeria (Ezenduka, Falleiros and Godman 2017). Furthermore, the average amount spent by the university management for treating one case of malaria is more than the medical capitation fee (₦1,500/USD4.70) paid by each the student at the beginning of the session. It is of note that the total amount spent by the university management for treating reported malaria for the session was more than one third of the capitation fee paid by the students. The university management had to make up for the short fall in medical treatment of students in UHS

which could not be covered by the capitation fee. This report revealed the magnitude of financial burden of malaria on the school management. It is important to know that other cost items such as personnel and use of resources available in the healthcare facility were not included in this study. The direct medical cost calculated would have been more than estimated if such cost items were included in the study.

The average cost of treating one episode of malaria by students who sought for treatment of malaria outside UHS facility and made out-of-pocket payment was ₦2,200 (USD6.90) which was lower than USD8.00 reported in previous study in Nigeria among households (Okorosobo *et al*. 2011). Less than half of the participants in the prospective phase claimed they visits UHS for malaria treatment while majority do not because they believe malaria cannot be effectively managed at the centre, despite the cost benefit of accessing malaria treatment in UHS, hence they access healthcare provider outside the campus or self-medicate, while some resorted to use of herbs and prayers. Similar behaviours have also reported in previous study among undergraduate students in Lagos Nigeria (Omolade, Bello and Simbiat 2011) and Eastern part of Nigeria (Adeyemo *et al*. 2014). Similarly, Okwa, Bello and Olundegun (2011) also reported similar treatment seeking behaviour among undergraduate students in their study in Lagos in which majority self-medicate or visit health care facilities outside of their campuses for malaria treatment. These findings call for evaluation of the services provided for the students in general at the UHS. For a student whose average monthly income is about ₦14,160 (USD46.81 ± 39.30) and willing to spent an average of ₦2,209.10 (USD6.90) (about 15.6% of their income) for treatment of one episode of malaria OOP when they knew they will receive free treatment at UHS having paid the medical fee at the beginning of the season calls for concern. Moreover, the cost of malaria treatment alone which is about 15.6% of their income is more or less a healthcare catastrophe spending on the part of the students which was defined as OOP spending more than 10%–25% of income (WHO 2019). The WHO has raised concern on increase in OOP health expenditure globally and more especially in low and lower-middle-income countries where OOP is still the largest source of funding of healthcare despite funds received from donors across the world (WHO 2019). OOP treatment of malaria among the students can be limited if the students' confidence in the services provided by the UHS can be improved. However, the assessed records in the UHS centre showed that students were tested for malaria parasite before they were prescribed artemisinin combination therapy in accordance to the WHO guideline for the treatment of malaria.

Majority of the participants are knowledgeable on the causes of malaria and its preventive measures, two-third claimed they had ITN of which about one-third made use of it and very few used indoor spraying insecticides as preventive measure against mosquito bite. The percentage of participants who claimed they have and made use of their ITN is higher than those reported in some previous studies among undergraduate students in Nsukka Nigeria (Tola *et al*. 2017; Anene-Okeke *et al*. 2018). However, in this study, significant numbers of those that have made use of the ITN were females. The use of ITN seems to be more common among pregnant mothers and their infants/ school children in Nigeria (Orji *et al*. 2018; Onwuka, Akinyemi and Ajayi 2016) than other populations. More than two-third of the participants in this study resides in the university residential halls on campus indicated that their unkept environment predisposes them to malaria infection.

The increase in incidence of malaria report among the male undergraduate students in this study as compared to their female's counterpart could possibly due to low level of malaria preventive measures such as not having ITN or not using it and also not fixing window and door nets as compared to their female counterparts. Previous

report has shown that males tend to exposed themselves to mosquito bites by not using ITN and other measures (UNDP 2015). Similarly, a previous study in Nigeria reported significantly higher prevalence of malaria among male undergraduate students compared to females (Ezenwaka and Ivoh 2018). The WHO recommends protection for all people who are at risk of malaria with effective malaria vector control which includes; ITNs and indoor residual spraying which have been shown to be effective in reducing incidences of malaria (WHO 2020). Effort to reduce the incidence of malaria among the students through preventive practices is highly essential.

The reported malaria infections among the undergraduate students as documented in UHS centre in this study showed that highest number of cases of malaria was in the month of July possibly due to the seasonal increase in the breeding of mosquito parasites. The lower number recorded for the month of August and September was due the industrial strike action by the non-academic staff of the university and few students were on campus during this period. Previous study also revealed higher prevalence of malaria in the raining season (Oluleye and Akinbobola 2010), this shows that more presentations for malaria would have been expected within the industrial strike period. Malaria infection accounted for about one quarter of visit of undergraduate students to the UHS centre during the period of study. An indication of high prevalence of malaria among the students. Furthermore, about 86.5% of the participants will recorded at least one episode of malaria yearly based on their frequencies of malaria infections, with more than two-third reported to have an episode of malaria within the last six months prior to the study and male population having the highest percentage. Uzochukwu *et al*. (2010) reported that 50% of Nigerian population will have at least one episode of malaria in a year. This implies that the incidence of malaria is higher among the undergraduate students and effort to improve on vector's control such use of ITN, fixing of window and door nets, clearing of surrounding especially among the male population in this study with the aim of reducing the incidence of malaria by all stakeholders (both the management and the students) with resultant reduction in financial burden of malaria and improve the quality of life of the sufferer.

CONCLUSION

The burden of malaria on the school authority and the students who also pay OOP whenever they do not use UHS is huge. The prevalence of malaria is higher among male students and this is attributed to their low level of preventive measures adopted against malaria. Treatment seeking attitude of undergraduate students in the UHS centre for malaria treatment need to be improved. Further study can evaluate reasons why students do not visit the UHS for malaria treatment in order to improve on it. Furthermore, it will be beneficial to the school management to see to adequate clearing of bushes and cleaning of the surrounding of the halls of residence of the students. Addressing the preventive measures of malaria among these students will reduced the amount spent by the university management on treatment of malaria yearly. Such funds can be channelled to other things that will be of great benefit to the management.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethics approval for the study was obtained from the University of Ibadan/University College Hospital Ethics Review Committee with approval number UI/EC/16/0106. Permission was also obtained from the director of University of Ibadan Health Service Centre and head of the pharmacy unit. Verbal informed consent in accordance with the approved study protocol by the Ethics committee, was obtained from each undergraduate student who participated after explaining the objectives and procedure of the study to the student individually. The consent information as contained in the informed consent form was read and explained to individual participant before the questionnaire was administered to them. Verbal informed consent was deemed appropriate for our study being a questionnaire-based survey with questions carefully designed without infringement on participants' privacy. Only the consented participants within the study period were enrolled.

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