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Research Article

Preventive Measure Practices and Cost Associated with Malaria Treatment among Staff and Dependents at the University of Ibadan Health Service Center, Ibadan, Nigeria

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Abstract
The economic burden of malaria in endemic places is a major public health issue that has resulted in a variety of malaria prevention techniques. This study assessed malaria preventive measure practices and the cost of treating malaria among staff and dependents of the University of Ibadan using the patient and provider's perspectives. This study was both retrospective and cross-sectional. The Retrospective phase involved estimating the direct cost of treating malaria for staff and dependents by the university management (based on the provider's perspective) between April and September 2019. The direct cost of management which included cost of medications, laboratory investigations and personnel cost related to malaria treatment was calculated based on the hospital's National Health Insurance Scheme (NHIS) tariff and the average worker's salary per minute spent on patients, respectively. The cross-sectional phase between July and September 2021, involved the use of a structured questionnaire to assess 300 respondents' preventive practices against malaria, self-treatment and the out-of-pocket (patient perspective) incurred by the patients in the treatment of malaria. Data were entered into SPSS version 23 and analyzed using descriptive statistics and Chi-square test with $p<0.05$ considered statistically significant. The total prescriptions retrieved from the NHIS section of the pharmacy unit of UHS during the study period were 17,132, of which 3774 (22.0%) contained antimalarial(s). The cost of treatment of malaria to the healthcare provider was estimated to be ₦13,683,987.4 ($37,490.4) for the 6 months with an average of ₦3,625.8±845.6 ($9.9±4.3) per each episode of malaria per patient. The mean age and monthly income of respondents were 48.4±11.8 years and ₦123,684±139,310.6 ($338.9±381.7), respectively. Self-medication claim of ₦2,189.3±3,189.2 ($6.00±8.7) for out-of-pocket treatment of an episode of malaria. Preventive measures against malaria adequately practiced by the respondents included; Insecticide-treated net (ITNs) 97 (32.5%), Indoor residual spray 44 (14.9%), clearing of bushes 177 (59.0%) and removal of stagnant water around residence 172 (57.3%). There was a significant association between the number of episodes of malaria and adequate use of ITN among participants ($p=0.024$). About half of the respondents (44.7%) had at least three episodes of malaria in the last 12 months before the study. The use of Insecticide-treated net and indoor residual spray is low among those who reported more frequent episodes of malaria. Malaria imposes a significant financial cost on healthcare providers, and steps to minimise these expenses by reducing the frequency of malaria episodes through improvement in the adoption of malaria prevention measures can be implemented.

Key Words: Cost, Malaria treatment, University staff, Preventive practice

*INTRODUCTION

Malaria is a life-threatening disease if public health concern especially in the tropics (WHO, 2021). In 2019, the estimated incidence of malaria globally in 87 malaria-endemic countries was 229 million with 560,000 deaths. However in 2020, there was an increase in incidence and deaths in these countries with 241 million reported cases and 627, 000 deaths (WHO, 2021) possibly due to Covid-19 pandemic with limited access to healthcare providers. The WHO African Region had a high proportion of the global malaria burden with 95% cases and 96% of malaria deaths (WHO, 2021). Nigeria accounted for 39.1% of worldwide reported malaria deaths (WHO, 2021) as compared to 24% of global malaria deaths reported in 2019 (WHO, 2019). Malaria has been reported to account for over 40% of the total monthly curative healthcare costs incurred by households in Nigeria (Onwujekwe *et al*., 2013). Onwujekwe *et al*, (2013) reported the cost of treatment of malaria to range from $2 to $25, and $15 to $20 spent monthly on its prevention by households in Africa.

The University of Ibadan is a federal university where the staff and dependents are mostly enrollees of the National Health Insurance Scheme (NHIS). The National Health Insurance Scheme (NHIS) is a body established by Cap No 42, LFN 2004 by the Federal Government of Nigeria to improve the health of all Nigerians at an affordable cost

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(https://www.nhis.gov.ng). The NHIS is a social security system that guarantees the provision of needed health services to enrollees on the payment of token contributions at regular intervals, in the case of an employee of the federal government of Nigeria, the token is usually deducted from their monthly salary from the source. From the deductions, the NHIS remits a certain percentage to the provider's account monthly for the healthcare of NHIS enrollees as a secondary healthcare provider. Under the insurance, the enrollees enjoy copayment of their medical bills by paying 10% of the cost out-of-pocket. The University Health Service (UHS) is one of NHIS accredited secondary healthcare providers where staff and dependents received healthcare services (http://www.ui.edu.ng/healthservices). Although the NHIS remits a certain amount monthly to the university account depending on the number of enrollees, the cost of treating some diseases with high prevalence by the provider needs to be evaluated to guide the policymakers.

To improve malaria control methods, accurate information on the overall cost of treatment is required. This could be an eye-opener to the financial burden of the disease on the patient and also the providers and as a result, strategies to reduce its frequency of episodes could be put in place to reduce avoidable financial implications. Previous research in Nigeria has documented the economic impact of malaria, particularly on households (Onwujekwe *et al*., 2013) and individuals (Obieche and Odili, 2016), but data on healthcare facility costs have not been thoroughly investigated. There are currently few studies on the expense of treating malaria in hospitals or health facilities (Onwujekwe *et al*., 2013; Ezenduka *et al*., 2017). According to Onwujekwe *et al*., (2013), recurrent provider expenses per case of malaria treatment in Nigeria ranges from $30.42 to $48.02 for out-patient and in-patients' care, respectively. Similarly, a total of ₦28.723 million ($182,953.65) was spent in a year and an average of $31.49 per case of uncomplicated malaria in a public healthcare facility in Nigeria (Ezenduka *et al*., 2017). However, studies on the costs of treatment of malaria for health insured patients in this part of the world are limited. This study aimed at evaluating the cost of treating malaria among NHIS enrollees at the University of Ibadan Health Services based on the provider's perspective. This will guide the policymakers of the University in decision making as regards the management of the disease.

MATERIALS AND METHODS

Study Site: The study took place at the University of Ibadan Health Service (UHS) Centre, located in the university. The University of Ibadan is the first university in Nigeria founded in 1948. Members of staff and dependents of the university access healthcare in the UHS which is equipped with an adequate number of medical doctors, pharmacists, nurses, Optometrists, laboratory technologists, medical and social workers, and several other healthcare workers. All the workers are professionally qualified and continuously trained to provide adequate services required of them. The hospital has well-equipped laboratories for reliable diagnosis of diseases including malaria via microscopy and rapid diagnostic test (RDT) and serves as NHIS secondary healthcare provider.

Study design: The research study is both retrospective and cross-sectional. The study was carried out among members of staff of the University of Ibadan and dependents who visit the University Health Service (UHS) for malaria treatment who are enrollees of NHIS. The retrospective phase involved the collection of all prescriptions and laboratory investigations (Malaria parasite test and Full blood count) related to malaria treatment for NHIS enrollees between the period of April and September 2019, while the cross-sectional phase of the study took place between July and September 2021 among adults of 18 years and above.

Study population and Sample size calculation:

According to the records units, the number of adult NHIS enrollees who visited the UHS weekly was an average of 100. Therefore, estimated population of patients with malaria in a month is 400, and 1200 for 3 months duration of the study (July to September). The sample size was calculated using the raosoft sample size calculator with a 95% confidence interval and 5% marginal error, which resulted in 292 (http://www.raosoft.com/samplesize.html). With a 10% attrition rate, a total of 322 was calculated and was used to guide participants' enrolment in the study. In all, a total of 323 consented to participate in the study by filling out the questionnaire.

Ethical approval was obtained from the UI/UCH Ethical Committee with approval number UI/EC/21/0199. Participants were well informed of the confidentiality of information provided as well as the anonymity of their participation. Informed consent was sought from each participant before administering the questionnaire.

Research instrument

Retrospective phase of study: A data form was used to collect information for the retrospective study. All prescriptions of members of staff of the University of Ibadan and dependents in the NHIS section of the pharmacy unit between April and September 2019 were collected and those containing antimalarial drug(s) were selected. Similarly, laboratory investigations related to malaria during the same period (April and September 2019) were obtained from the laboratory unit. Cost of medications and laboratory investigations related to malaria treatment was obtained from pharmacy and laboratory units, respectively. The total cost of treatment of malaria (direct cost) for the period of study (6months) was determined by adding up the cost of laboratory investigations, medications for all prescriptions containing antimalarial that were assessed as well as the cost of health personnel for services provided while attending to the patients Cross-sectional phase of study: The cross-sectional phase of the study involved the use of a validated questionnaire. The questionnaire is comprised of four sections. Section A was used to obtain the socio-demographic information of the respondents. Section B contained questions on preventive practices against malaria. Content validity of the questionnaire was carried out by the senior academic staff of the Department of Clinical Pharmacy and Pharmacy Administration. A face-to-face validity was carried out by pre-testing among 22 respondents. Few adjustments were made such as a closed-ended question on the frequency of malaria per year, rephrased as open requiring respondents to state the numbers of malaria episodes they had in past year before the study.

Data collection procedure: Retrospective phase of study: The retrospective phase of the study involved the collection of

prescriptions of patients between the study periods (April to September 2019) from the University Health Service. The health care provider cost that is associated with malaria care delivery in the out-patients section of staff and dependents were estimated through the collection of information on clinical resources used during malaria outpatients' visits only in UHS facilities. Prescriptions containing antimalarial drugs and malaria-related laboratory investigations were sorted out. Information on the medications from prescriptions containing antimalarial(s) was obtained such as name, doses, duration of use, route of administration and the various laboratory investigations related to malaria treatment/diagnosis were also retrieved from the pharmacy and laboratory sections of UHS respectively. The direct cost was calculated using the bottom-up approach which involves dividing the entire treatment process into several activities or sub-processes and calculating the cost of each process for each patient (for example; the cost value of health personnel that attended to the patient at each stage of the hospital visit, cost of medication(s) and laboratory investigations), then adding up all cost for all the patients to arrive at the total cost associated with the treatment of the disease among the cohort (Asadi and Batz, 1996; Lin *et al*., 2007; Jo, 2014). The items used for calculation of the direct cost in this study included personnel cost, cost of medications and laboratory investigations. These were estimated using the administrative worker's salary, NHIS tariff for pharmacy (based on daily dosage and duration of medication use) (Nertheimer, 1986), and laboratory units of UHS, respectively. In this study, the cost of services provided by each health care worker is the cost of personnel (Medical doctors, pharmacists, nurses, laboratory scientists, attendants, records) involved in the treatment of malaria. This was calculated using the time spent in minutes for each patient by each healthcare professional multiplied by individual professional's average salary in minutes. The total of the cost calculated for each healthcare professional for each patient was summed as personnel (healthcare workers) costs. To calculate the cost the healthcare provider spent for health workers (personnel cost), time and motion studies were conducted (Suleiman *et al*., 2006; Lopetegui *et al*., 2014). The average time taken to complete tasks such as consultations, dispensing, laboratory investigation (Malaria parasite and Full blood count), temperature and blood pressure measurements, administration of injectable were calculated and recorded for 5 random observations of each service provided by each personnel. The mean salary of each health professionals per minute was determined after taking into consideration the average monthly salary obtained from the account section of the school.

Mean salary/min = Annual salary Hours/week x no of weeks/annum x60minutes

Currency conversion rate using oando.com was 365 to 1USD as at September 2019 (oando.com).

Cross-sectional phase of study: All members of staff of University of Ibadan and their adults' dependents who reported to the NHIS section of pharmacy unit of University Health Service to fill their prescriptions were approached to participate in the study after the study objectives were explained to them. Those who consented to participate were administered the questionnaire which was retrieved immediately after it had been filled. The period of the data collection was between study July to September 2021 (3months).

Data analysis: The data collected were entered into Microsoft Excel data sheets, cross checked and analyzed using SPSS version 23.0. Data was then summarized using descriptive statistics. Association between gender, education, frequencies of malaria episode in last 12 months before the study and use of ITN was tested using Chi-square. $P<0.05$ was considered significant**.**

RESULTS

Socio-demographic information of the respondents: Out of 323 individuals who participated in the study, 300 (92.3%) had their questionnaire filled appropriately and was used for data analysis. There were more females 157 (52.3%) than males 143 (47.7%) respondents. The mean age of respondents was 48.4±11.8 years. Two hundred and thirty-six (78.7%) of the respondents had tertiary education and 249 (83.0%) were married. The average monthly income of the respondents was ₦123,684±139,310.6 ($338.9 ± 381.7) (Table 1).

Table 1:
The socio-demographic information of the respondents

Variable		Frequency	Percentage
Gender distribution	Male	143	47.7
	Female	157	52.3
Age distribution	Less than 20	7	2.4
	21 – 30	8	2.8
	31 – 40	70	24.3
	41 – 50	84	29.2
	51 – 60	73	25.3
	61 – 70	38	13.2
	71 – 80	8	2.8
Average age	48.4±11.8 years		
Marital Status	Married	271	90.3
	Single	19	6.3
	Divorce	2	0.7
	Widow/widower	8	2.7
Educational qualification	Primary education	11	3.7
	Secondary education	40	13.3
	Tertiary education	249	83.0
Monthly income (Naira)	<20,000	24	9.2
	20,000 – 50,000	61	23.5
	51,000 – 100,000	79	30.4
	101,000 – 200,000	64	24.6
	201,000 – 500,000	27	10.4
	>500,000	5	1.9
Average monthly income	₦123,684±139,310.6 ($338.9±381.7)		

Sources of information on malaria and frequency of malaria episode among respondents: One hundred and seventy-two (52.7%) of the respondents received information on malaria from family and friends, and 172 (57.3%) were mainly from health workers, as shown in Table 2. The frequency of malaria infection in a year among respondents shows that 69 (23.0%) had it once, 79 (26.3%) twice, 72 (24.0%) had it thrice, 40 (13.3%) had it four times and 22 (7.3%) had it more than four times in a year while 18 (6.0%) did not respond to the question.

Table 2:
Respondents' sources of malaria information

Sources of information on malaria	Frequency	*Percentage
Radio	135	45
Healthcare workers	158	52.7
Family and friends	172	57.3
School	91	30.3
Television	103	34.3

*multiple responses

Treatment of malaria: Majority of the respondents (250, 83.3%) claimed that they usually don't report to the University Health Service (UHS) every time they had malaria but find other means for its treatment as shown in Table 3. Majority (188, 75.2%) of them visits community pharmacies for malaria treatment. The average cost spent by the respondents out-of-pocket when self-treating malaria without reporting in UHS facility was estimated to be ₦2,189.3±3,189.2 ($6.00±8.7) (self-report). Fifty-seven (22.8%) uses herbs for malaria treatment, while 69 (27.6%) of the respondents self-treat malaria.

Table 3:
Malaria-treatment-seeking attitudes of participants.

How do you treat malaria	Frequency	Percentage
Report to UHS	50	16.7
Pray	19	7.6
Just rest	32	12.8
Use herb	57	22.8
Sometimes use pharmacy	188	75.2
Sometimes use hospital outside UHS	70	28.0
Self-treat	69	27.6
Total	250	100.0

There were multiple responses
UHS: University Health Service

Respondents' preventive practices against malaria: Respondents reported an average of 5 people in a household of members of staff of the University of Ibadan. Two hundred and thirty (76.9%) of the respondents have insecticide-treated nets (ITNs). Other preventive measures against malaria practiced by respondents included; indoor residual insecticides spray which is sometimes used by 183 (61.0%), cutting of bushes and clearing of stagnant water around residences are always done by 177 (59.0%) and 172 (57.5%) respondents, respectively. However, Out of 195 (65.0%) of those who have made use of it, only 97 (32.6%) use it always. There was a significant association between daily use of ITN and the number of the episode of malaria within the last 12 months before the study ($\chi2 = 5.127$, p=0.024). There was no statistical difference in daily use of ITN among the gender ($\chi2 = 2.866$, p=0.416), and educational qualification (having a tertiary education) ($\chi2 = 0.08$, p=0.777). The extent to which the respondents practice preventive measures against malaria is shown in Table 4, while barriers to use of ITNs among the 105 respondents who do not use it are shown in Table 5.

Table 4:
Malaria preventive practices among staff and dependents of University of Ibadan

Variable	Frequency	Percentage
Possession of insecticide treated net		
Yes	230	76.7
No	70	23.3
Slept under ITN		
Yes	195	65.0
No	105	35.0
Frequency of ITN Use		
Always	97	32.3
Sometimes	98	32.7
Never	105	35.0
Frequency of ITN use among household members		
Always	91	30.3
Sometimes	114	38.0
Never	95	31.7
Frequency of checks on holes/repair of ITN		
Always	64	21.3
Sometimes	95	31.7
Never	141	47.0
Frequency of use of mosquito repellant coils		
Always	13	4.4
Sometimes	91	30.3
Never	196	65.3
Frequency of use of indoor residual spray		
Always	44	14.7
Sometimes	183	61.0
Never	73	24.3
Frequency of cleaning/cutting of bushes around residence		
Always	177	59.0
Sometimes	85	28.3
Never	7	2.3
Not Applicable	31	10.3
Frequency of cleaning of stagnant water around residence		
Always	172	57.3
Sometimes	47	15.7
Never	11	3.7
Not Applicable	70	23.3

Table 5:
Barriers to the use of ITNs by respondents who failed to use it always

Barriers to the use of ITN among those who failed to use always	Frequency (n=105)	Percentage
I am not comfortable with the odour	23	21.9
I have a bad reaction to them/they make me ill	14	13.3
They are not effective	5	4.8
They are uncomfortable because of heat	56	53.3
They are difficult to use	8	7.6
They take too much time to set up	7	6.6
No response	20	19.0

There were multiple responses

Pattern of prescription of drugs: The total number of prescriptions that was collected from the clinic was 17,132, out of which 3,774 (22%) prescriptions contained one or two antimalarial drugs such as Artemether-Lumefantrine combinations which is the mostly prescribed antimalarial alongside with some non-antimalarial medications such as paracetamol, ibuprofen, diclofenac, chlorpheniramine, loratadine, and others as shown in Table 6.

Cost of Treatment of malaria in University of Ibadan Health Service Centre: The cost of treatment of malaria for each month is depicted in Table 7. The month of June has the highest expenses for malaria treatment. The total cost of antimalarial medications dispensed for six months was ₦4,495,350 ($12,334.8). Also, the total cost of laboratory investigations for the period was ₦4,528,800 ($12,426.6) and the total cost of adjunct medications dispensed within the same period was ₦828,850 ($2,274.3). The cost of healthcare workers was ₦3,830,987.4 ($10,495.9) for the six months of study. The total cost associated with the management of malaria for the period (6 months) was ₦13,683,987.4 ($37,490.4) based on the provider's perspective. The average cost associated with the treatment of an episode of malaria was ₦3,625.8±845.6($9.9±4.3). The cost associated with laboratory and drugs only was ₦2,610.8±525.4 ($7.2±1.4).

Table 6:
The cost of antimalarial and non-antimalarial medications dispensed to university of Ibadan staff and dependents between April and September 2019

Antimalarials	Route/ Dosage Form	Quantity Dispensed	Total Cost(₦)
Artemether-Lumefantrine	Oral (Tablet)	2790	3,347,550
Dihydroartemisinin-Piperaquine	Oral (Tablet)	156	202,800
Artesunate-Amodiaquine	Oral (Tablet)	420	525,000
Artemether	Injectable	840	420,000
Total			**4,495,350 ($12,316.0)**
Adjunct medications			
Paracetamol	Oral (Tablet)	31,180	155,900
	Oral (Syrup)	176	44,000
	Injectable	1209	181,350
Diclofenac	Oral (Tablet)	1,620	81,000
	Injectable	259	103,600
Ibuprofen	Oral (Tablet)	2,107	21,070
	Oral (Syrup)	68	34,000
Loratadine	Oral (Tablet)	1,542	46,260
Chlorpheniramine	Oral (Tablet)	668	3,340
	Oral (Syrup)	59	17,700
Vitamin C	Oral (Tablet)	3,249	32,490
	Oral (Syrup)	15	4,500
Vitamin B-Complex	Oral (Tablet)	7,388	36,940
	Oral (Syrup)	139	41,700
	Injectable	250	25,000
Total			**4,495,350 ($12,36.0)**

Conversion rate: ₦ 365 to 1USD as exchange rate (oando.com) as at September, 2019

Table 7:
Costs associated with treatment of malaria among NHIS enrollees in University Health Service Ibadan

Months	Freq.	Cost of laboratory investigations (₦)	Cost of antimalarials dispensed (₦)	Cost of adjuncts (₦)	Total laboratory and medications	Cost of personnel (₦)	Total cost for malaria treatment (₦)
April	660	792,000	744,750	144,949.0	1,681,699.0	669,966.0	2,351,665.0
May	624	748,800	759,800	137,044.0	1,645,644.0	633,422.4	2,279,066.4
June	721	865,200	843,900	158,346.7	1,867,446.7	731,887.1	2,599,333.8
July	741	889,200	896,900	162,739.2	1,948,839.2	752,189.1	2,701,028.3
August	471	565,200	578,000	103,441.0	1,246,641.0	478,112.1	1,724,753.1
September	557	668,400	672,000	122,330.1	1,462,730.1	565,410.7	2,028,140.8
Average per patient		1200±10.8 ($3.3±0.03)	1191.1±128.0 ($3.1±0.4)	219.6±52.2 (0.6±0.1)	2,610.8±525.4 ($7.2±1.4)	1,015.1±834.8 ($2.8±2.3)	3,625.8±845.6 ($9.9±4.3)
TOTAL	3,774	4,528,800 ($12,407.8)	4,495,350 ($12,316.0)	828,850 ($2,270.1)	9,853,000.0 ($26,994.5)	3,830,987.4 ($10,495.9)	13,683,987.4 ($37,490.4)

Conversion rate: ₦ 365 to 1USD as exchange rate (oando.com) as at September, 2019.

DISCUSSION

The high incidence of malaria among reported patients in the UHS, the insufficient use of preventive practices, the low patronage of the UHS for malaria treatment, and the high cost of malaria treatment among participants as well as the health provider raise concerns. Almost one-quarter of the prescription assessed had malaria medication, an indication of the prevalence of malaria among the patients who reported to UHS for treatment. In this study, the month of June and July showed the highest reported cases on malaria in the UHS, which is similar to previous reports (Akinbobola and Omotosho, 2013; Solomon *et al*., 2020). The high incidence of malaria in these months could probably be due to increased rainfall during these periods, which supports the breeding of mosquitoes (Gbenga and Rajendra, 2016). Although, a study in Ibadan reported that mosquitoes transmitting malaria are more abundant in the month of December, January and February (Patricia *et al*., 2014). This could be on account of slight peak in season in the dry-cool season. A bimodal annual pattern of malaria incidence has been reported (Akinbobola and Omotosho, 2013). In addition, Vanderwal and Paulton (2000) in their study in northern Haiti reported two periods of high incidence of malaria in the summer period (June and July) and winter (December and January).

The treatment of malaria in UHS can be said to be in accordance to the World Health Organization recommendation (WHO, 2021) with all patients presenting with the symptom(s) of malaria being tested before prescription of medications. Similarly, Artemisinin-based Combination Therapies (ACTs) in particular Artemether-Lumefantrine (AL) as recommended by World Health Organization (WHO, 2018), were the most commonly prescribed antimalarial medications in UHS. Artemether-Lumefantrine has been reported in previous studies to be most commonly prescribed antimalarial among patients in Nigeria (Obieche and Odili, 2016; Obiebi, 2019). However, there is a report of low prescription and use of ACTs prescription among African children positive of malaria (O'Boyle *et al*., 2020) and members of communities in southern Nigeria (Suleiman *et al*., 2015).

The average direct cost associated with malaria treatment among the staff and dependents who are enrollees of NHIS was estimated to be ₦13,683, 987.4 ($37,490.4) for the 6-months study based on provider's perspective. If this is extrapolated for a year period, the overall direct cost of malaria treatment for NHIS enrollees would be ₦27,367,974.8 ($74,980.8) for a year, of which the patients paid 10% and the burden on the provider can be put at $67,482.7. The average direct cost ($9.9±4.3) of treating malaria (personnel, drugs and laboratory investigations) and cost associated with laboratory and drugs reported in this study ($7.2±1.4) is lower than $14.07 reported by Obieche and Odili (2016). This could be associated with the classes of antimalarial prescribed and also difference in cost of medications and laboratory investigations in the hospital settings, where the study was conducted.

The average out-of-pocket cost of malaria treatment among the staff of the University of Ibadan and dependents who sometime self-treat malaria without coming to the facility was ₦2,189.3±3,189.2 ($5.9) per episode of malaria. This amount is similar to the cost of the treatment of an episode of malaria in the retrospective phase of this study. Similarly, the cost of self-medication of antimalarial in the southern part of Nigeria has been reported to be $2.41±0.69, however, majority of the respondents were on monotherapy (Suleiman *et al*., 2015). About half of the respondents in this study had three or more episodes of malaria per year. This implies that about ₦6,567.8 ($18.0) or more was spent by an individual per year on treatment of malaria. The result also shows that the household of the University of Ibadan staff has an average of five (5) people. Considering their income of an average of ₦123,684±139,310.6 ($338.9±381.7), this implies that 26.6% of their income were spent on malaria treatment of household members. The spending of more than 15% of household income on health bills is catastrophic (WHO, 2005). The reason(s) why the respondents incurred out-of-pocket payment for malaria treatment outside the UHS facility despite their accessibility to NHIS copayment of 10% of their medical bill needs to be further investigated and reviewed to reduce the burden on these individuals who are entitled to NHIS copayment mechanism.

WHO reports on malaria incidence in 2021 indicated that Nigeria accounts for 26.8% (11.120 million) of 241million cases in 2021. The burden for the country for the year 2021

using self-medication cases will approximately be ₦24,344,571,200 ($66,697,455.3) (multiplying the average cost of ₦2,189.3±3,189.2 in this study by incidence for the year 2021) while cost associated with treatment using a medical facility will be ₦40,182,120,000 ($110,088,000) (multiplying average cost ₦3,625.8±845.6.2 in this study by incidence for the year 2021). In a country facing economic problems with a decrease in her Gross Domestic Products (GDP) between 2012 and 2020 (https://data.worldbank.org/indicator/), this calls for concern and policies that could reduce the incidence of malaria while these policies should be put in place and followed up for proper implementation.

One of the strategies to reduce the economic burden of malaria could be through implementing appropriate methods of control of the vector. Malaria vector management is so effective at avoiding infection and limiting disease transmission. It is therefore, an important aspect of malaria control and elimination methods. Insecticide-treated nets (ITNs) and indoor residual spraying (IRS) are the two main malaria vector control methods (WHO, 2019). These primary actions can be augmented by larval source management and personal protective measures in a certain environments and under special situations (WHO, 2019). About three-quarters of the respondents have Insecticide-treated Net(s) in their household. However, two-thirds (65.0%) of the respondents claimed to always make use of their ITNs as recommended and this is similar to 67.0% reported by Jumbam *et al*., in their study among rural Zambians (Jumbam *et al*., 2020). Although, there have been reports of higher percentages such as 71.7% and 76.0% of ITN uses among people in an endemic area of Jharkhand (Singh *et al*., 2012) and the coastal region of Tanzania (Munisi *et al*., 2019), respectively. The use of ITN in this study is not gender-related as reported in previous studies including, Nigeria where females tend to use ITN more than males (Garley *et al*., 2013; Njumkeng *et al*., 2019). Many of those that have ITNs do not use them, and good numbers indicated that ITNs are generally not comfortable for them because they feel hot under the net. Similar complaints were reported among participants in a study among households in the Mount Cameroon area by Njumkeng *et al* (2019).

Furthermore, less than one-quarter of those that use ITNs in this study always checked for holes or repaired them on their nets, while about one-third checked once in a while. This is a poor preventive practice, as using a torn ITN is almost the same as not using ITN at all. This finding seems to be a common practice among some users, as was reported by West *et al* (2014) in Tanzania and Njumkeng *et al*., (2019) in the Mount Cameroon area. To optimize the maximum benefit of ITNs as vector control and as a strategy to reduce the prevalence of malaria, its usage needs to be increased and a mechanism should be put in place to replace torn nets.

The respondents in this study are more involved in clearing of bushes and stagnant water around their residences than 22.0% and 38.2% reported, respectively among the Tanzanians (West *et al*., 2014). These are essential preventive practices which augment other methods of vector control (ITN and IRS). Adequate knowledge of malaria prevention and control can help in reducing the growing burden of malaria especially among vulnerable groups (Oladimeji *et al*., 2019). The respondents' sources of information on malaria were mainly through media and health workers. This is possible because they are in urban settings and have more access to media as compared to 33.0% report in a previous study among rural setting in Zambia with higher percentage of respondents getting information from health workers (Jumbam *et al*., 2020).

In this study, more than three-quarters of the respondents claimed they self-medicate with Artemisinin-based Combination Therapy (ACT) which included Artemether-Lumefantrine and dihydroartemisin-piperaquine to treat malaria as compared to quinine (44.5%) and ACT (34.1%) used among respondents of a study in Benin Republic as self-medication for malaria treatment (Attinsounon *et al*., 2019). Though the reason(s) for self-medication was not captured in this study, it is unlikely to be due to the high cost of consultation and medical care in health facilities because the respondents in this present study are enrollees of NHIS and pay only 10% of their medical bills as compared to participants in the study of Attinsounon *et al*., (2019) who paid for this bills out-of-pocket.

The incidence of malaria is high among the respondents which will invariably increase the burden of the disease on the part of the healthcare provider. Similarly, the out-of-pocket expenditures on malaria are high among the respondents. Malaria preventive practices among the respondents can be improved, through sharing of ITNs and further enlightenment of its use. This could invariably reduce incidence and cost associated with malaria treatment among the staff and their dependents of the University of Ibadan.

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