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Parasitological assessment of presumptive diagnosis and treatment of Malaria in some health facilities in Jos

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Abstract

According to World Health Organization estimates released in 2021, there were 241 million cases of malaria and 627,000 deaths worldwide in 2020. Sub – Saharan Africa and India carried almost 85% of the global burden. Nigeria is among the six countries which accounted for more than half of all malaria cases worldwide, mostly consisting of pregnant women and children under 5years. Nearly 110million clinical cases of malaria are diagnosed each year, and malaria contributes up to 60% of out – patients' visits and 30% of hospital admissions. This study sought to establish the accuracy with which malaria is presumptively diagnosed and treated based on clinical presentations only and the cost estimates on the patient in the study facilities. A prospective study was carried out between October, 2018 to June 2019 using 356 participants who came to the health facilities to access treatment with suspected cases of malaria and were presumptively diagnosed and treated for malaria. Demographics and blood samples were collected from eligible and consented patients and screened for plasmodium parasite by microscopy. The results obtained showed 88% of the patients tested negative for plasmodium parasite while 12% tested positive. The cost of anti-malarial ranged from 500 – 1000 naira (using the median score). Authors concluded that only 12% of those treated for malaria actually needed such treatments. This underscores the need to test for malaria before treatment.

Keywords: Parasitological Assessment; Presumptive Diagnosis; Malaria; Jos

1. Introduction

Malaria is a febrile illness which is characterized by fever, rigors, chills, and other related symptoms such as stomach ache, vomiting, malaise, headache and sometimes drowsiness especially in cerebral malaria. Malaria has been known to mankind for a very long time, as mentions of it are found in ancient Egyptian, Chinese and Indian manuscripts. Its clinical symptoms were fully described by Hippocrates where it was initially thought that 'miasma' (bad air or gas from swamps 'malaria') was responsible for the disease [1]. It remains an important cause of illness and deaths in children and adults especially pregnant women, patients with HIV/AIDS in countries in which it is endemic as well as non-immune immigrants, mobile populations and travelers [2].

Malaria is caused by protozoa from the genus *Plasmodium* and is transmitted to humans through a bite from one of 40 species of female Anopheles mosquitoes. Infection may also occur through exposure to infected blood or blood products. Five Plasmodium species cause human disease: *P. falciparum*, *P. vivax*, *P. ovale*, *P. malariae*, and *P. knowlesi*. The majority of infections is caused by *P. falciparum* and *P vivax*, and are responsible for the most severe disease.

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It is a disease that can be treated in just 48 hours, yet it can cause fatal complications if the diagnosis and treatment are delayed. Despite centuries of efforts, malaria continues to infect millions and kill thousands annually. More than a century after identification of the causative parasites, and more than half a century after finding effective drugs and insecticides, it continues to wreak havoc on millions, particularly in the poorest parts of our world. The dreaded disease is difficult to eradicate and its control is possible only with coordinated efforts of the general public, healthcare personnel and government agencies. With global warming threatening to increase the mosquito density and the spread of other mosquito borne infections like Dengue fever, time has come for concerted effort to curb this menace.

According to World Health Organization estimates release in 2021, there were 241 million cases of malaria and 627,000 deaths worldwide in 2020 [3]. Delay in diagnosis and treatment is a leading cause of death in malaria patients. The spread of Covid-19 to malaria endemic countries leading to restriction of movements caused major disruptions in treatment seeking for febrile diseases such as malaria [3]. This must have accounted for the surge in clinical cases and deaths recorded in 2020.

Sub – Saharan Africa continue to carry a higher menace globally. In areas with high transmission of malaria, children under 5 years of age are particularly susceptible to infection. More than 70% of all malaria deaths occur in this age group. Furthermore, in sub – Saharan Africa, over 50million pregnancies are threatened by falciparum malaria each year.

Nigeria bears up to 25% of the malaria disease burden in Africa, contributing to about one million lives lost per year in the region. This mostly consist of children under 5years and pregnant women [4]. This tends to overburden the already weakened health system.

The commonest drugs used for presumptive treatment of fever cases as malaria in the past 50 years of malaria control are chloroquine (CQ) and sulphadoxine-pyrimethamine (SP). Both these drugs have a long half-life and their efficacy and effectiveness for prophylaxis have been clearly documented [5]. Thus, treating most febrile illness with antimalarials, practiced widely in sub-Saharan Africa has led to a mass and frequently applied treatment against malaria that not only cleared parasitaemia in true cases of malaria but also provided chemoprophylaxis for three weeks in the case of CQ and four weeks in the case of SP.

As an important part of World Health Organization (WHO)) recommendation for the treatment of malaria, all cases of suspected malaria should have a parasitological test to confirm the diagnosis before treatment. Treatment without the benefit of laboratory confirmation should be reserved for extreme cases (strong clinical suspicion, severe disease, impossibility of obtaining prompt laboratory diagnosis [6]. This is against the backdrop of the fact that the clinical symptoms upon which presumptive diagnosis are made are often not specific, therefore resulting in over- diagnosis of malaria.

Traditionally, in poor-resource countries especially in Sub -Saharan Africa, the approach to the diagnosis of malaria is presumptively done upon fever presentation. However, because of non-specific clinical presentations most cases of treatment are not actually malaria, resulting in drug wastages, economic burden, and drug resistance. This research is aimed at assessing parasitologically, the treatment of malaria based on clinical presentation only.

2. Methods

2.1. Study setting/design

The study was conducted at the General Out Patient Department of Jos University Teaching Hospital Lamingo, Primary Healthcare (PHC) Center, Bukuru express and Primary Healthcare Center, Bukuru town in Jos South Local Government Area, Plateau State, Nigeria.

The cross-sectional prospective design was adopted and study population comprised of all categories of patients who came to the Pharmacy units of the facilities with prescription containing drugs for the treatment of malaria but for whom malaria test was not done. A population of 354 patients determined from the Fischer's formula [7] with an estimated prevalence of malaria in children in Nigeria to be 36% [8].

2.2. Ethical issues

Ethical clearance was obtained from the research ethics committee of the Jos University Teaching Hospital with reference number JUTH/DCS/ADM/127/XXVII/820. Participants signed the consent form before their recruitment into the study.

2.3. Data collection/analysis

A total of 356 patients were recruited opportunistically. Copies of questionnaires were administered to the recruited patients. A small prick was made on their fingers using a sterile lancet to collect blood sample. The blood sample was smeared on a slide to make a thick film. Giemsa stain was added to the film and the slide was read under the microscope.

Data collected from the study were entered into Microsoft excel spreadsheet, cleaned and transferred into the Statistical Package for Social Science (SPSS) software version 20.0 and analyzed descriptively.

3. Results

3.1. Participants' demographics

A larger proportion (88.2%) of the participants were recruited from the primary healthcare centres. The sociodemographic profile of respondents showed that 71.1% were older than 15years, 19.4% were 5-15years old while 9.6% were less than 5years old. Gender classification revealed that 52.8% were females and 47,2% were males. Thirty-seven percent were students, 27% were employed while 7.6% were artisans. The highest educational qualification of participants were primary (18%), secondary (41.6%) and 32% had tertiary education (Table 1).

Table 1 Demographic characteristics of participants (N=356)

Variable	Frequency	Percentage
Study sites		
JUTH	42	11.8
PHCs	314	88.2
Age (years)		
< 5	34	9.6
5 - 15	69	19.4
15+	253	71.1
Gender		
Female	188	52.8
Male	168	47.2
Occupation		
Child	39	11
Student	132	37.1
Civil servant	97	27.2
Unemployed	61	17.1
Artisan	27	7.6
Education level		
Pre-primary	14	3.9
Primary	64	18
Secondary	164	46.1
Tertiary	106	29.8
Postgraduate	8	2.2

3.2. Household living condition of participants

Based on the living condition of participants, about 42% live in flats, 45% in room and parlor while 14% live in single rooms. About 60% sleep under mosquito net while 39% do not. The reasons for not sleeping under mosquito nets include lack of access to mosquito net (24.6%), inability to afford it (16%) and 49.3% are simply not comfortable sleeping under the net (Table 2).

Table 2 Living Condition of Study Participants (n=356)

Variable	Attribute	Frequency	Percentage
What is the nature of your accommodation?	Flat	147	41.6
	Room and parlor	158	44.7
	Single room	50	14
Is the apartment well netted	No	75	21.7
	Yes	280	78.7
	Missing	1	0.3
Do you sleep under mosquito net?	No	138	38.9
	Yes	214	60.1
	None response	4	1.1
If no, why?	No access to net	26	34.6
	cannot afford	12	16
	cannot sleep under net	37	49.3

3.3. Pattern of Case Presentation

Three hundred and five (85.7%) participants complained of fever on presentation in the hospitals, 14% did not while 3 persons did not respond to that inquiry. Fifty-five percent had their temperature taken during examination while 44% did not. About 42% have had symptoms of their illness for 2days, 32.9% for 3-5days while 13.8% have had it for more than 5days prior to presentation in the hospital (Table 3).

Table 3 Patient-Health worker interaction (N=356)

Assessment questions	Frequency	Percent
Did you tell the physician about your symptoms		
No	1	0.3
Yes	355	99.7
Did you complaint of fever?		
No	51	14.3
Yes	305	85.7
Were you asked follow- up questions about your complaints?		
No	66	18.5
Yes	279	78.4
No response	11	3.1
Were you examined?		
No	87	24.4

Yes	269	75.5
Was your temperature taken?		
No	157	44.1
Yes	196	55.1
No response	3	0.8
How many days have you been experiencing the symptoms?		
1 day	33	9.3
2 days	148	41.6
3 – 5 days	117	32.9
6 days and above	49	13.8
No response	9	2.5

3.4. Accuracy of presumptive (clinical) diagnosis of malaria

For the participants presumptively treated based on clinical diagnosis only, 12% of those cases tested positive for malaria and 88% tested negative (Fig 1)

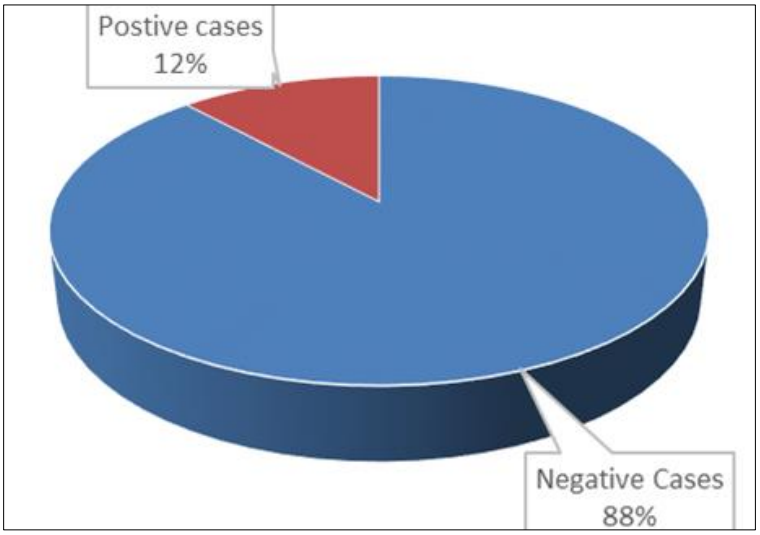

Figure 1 Sensitivity of clinical diagnosis and treatment of malaria

3.5. Pattern and cost of treatment

Fifty-two percent were treated with antimalarials only while 48% were treated with antimalarial in combination with antibiotics and or antipyretics. Prescribed antimalarials were Artemeter-Lumefantrine (34.8%), Artesunate-Amodiaquine (20.5%) and Artesunate-Sulphadoxine/Pyrimethamine (17.4%). Others were Quinine (9.6%), Artemisinin monotherapy (4.5%) and Sulphadoxine/pyrimethamine (3.4%). The cost of the anti-malarial prescribed for the study participants were less than ₦500 (33.4%), 59% had a cost range between ₦500 – ₦1000 while 7.6% had their cost above ₦1000 (Table 4)

Table 4 Pattern and cost of treatment

Treatment variable	Frequency (n)	Percent (%)
Prescription pattern		
Antimalarials alone	185	52
Antimalarial + antibiotic + antpyretic	171	48
Prescribed antimalarials		
Artesunate /Mefloquine	5	1.4
Sulphadoxine/pyrimethamine(SP)	12	3.4
Artemisinin monotherapy	16	4.5
Dihydroarthemisinin/piperaquine	29	8.1
Quinine	35	9.8
Artesunate/SP	62	17.4
Artesunate/amodiaquine	73	20.5
Artemether/Lumefantrine	124	34.8
Cost of treatment		
< ₦500	119	33.4
₦500 - N1000	210	59
> ₦1000	27	7.6

4. Discussion

Most treatment of malaria in Africa especially among poor and low literacy population with inadequate health services are based on clinical diagnosis only. Poor management of other illnesses with symptoms similar to malaria is also a consequence of presumptive diagnosis and treatment of malaria [9], which in some cases could be fatal. This indiscriminate use of antimalarials often contribute to the problem of parasite resistance which has been observed especially in *Plasmodium falciparum* constituting a barrier to successful management of malaria in endemic areas. The possible reason for more females than the males in this study could be attributed to the health seeking behaviour of the females. In some societies, especially in the rural or semi-urban areas, the male folks tend to overlook the importance of seeking medical attention for ailments which they may consider to be less dangerous especially if they are able to carry on with their normal daily routine, believing that the symptoms could resolve with time without seeking for medical assistance. Some even prefer to patronize herbal preparations or even self-medicate. This is contrary to females who easily seek medical attention at the slightest experience of discomfort.

The sociodemographic profiles may play important role in peoples' choice of the type of accommodation they live in. Living area may be determined by family size and income level. Large families and those with appreciable income will normally prefer more room apartments to accommodate their family comfortably or to contain their interior goods while student are comfortable with single rooms and sometimes sharing the single room. It is possible that most of those who reportedly live in single rooms or room and parlour are the student or middle-income workers with smaller family sizes. A sizeable number of participants said they do not sleep under mosquito net. Majority of these (49.3%) complaint of discomfort experienced when sleeping under the net while 16% simply cannot afford to buy the nets.

These findings suggest the need for more public awareness on the importance of sleeping under insecticide treated nets, particularly for those who categorically stated that they cannot sleep under mosquito nets even though in malaria endemic areas. There is also the need to make the nets available free or at a subsidized cost to the general public to ensure affordability.

This study revealed that a large proportion (88%) of patients were misdiagnosed and treated for malaria as only 12% of cases were actually malaria-related. This has grave consequences for the patients who may suffer treatment failures

with attendant increase in needless healthcare cost, morbidity and mortality. This revelation underscores the importance of testing for malaria before treatment.

In a previous study, a lower proportion of febrile children presumptively treated actually had malaria where authors concluded that presumptive malaria diagnosis a lot of times may lead to over diagnosis and therefore mismanagement of other febrile illnesses e.g. pneumonia, meningitis, enteric fever etc [10]. Antimalarial treatment to all that presents with fever without due confirmation means; Waste of resources by the poor, failure to treat/ look for other potential life threatening illnesses, and Increase risk of emergence of resistance to ACT

Another study findings have been reported of presumptively treated children where only 27.9% were found to have malaria while 72.1% tested negative for malaria parasite [11].

There are many other illnesses such as Pneumonia and Typhoid fever that present with such similar malaria-like symptoms as fever, malaise and pyrexia. This invariably means that majority of the study participants could have had diseases other than the presumed malaria fever which was erroneously treated. It can further be deduced that, due to the high variability in the clinical presentation of malaria which often overlaps with other common illnesses, including Pneumonia which is associated with high morbidity and mortality especially in the pediatric group. This means that mortality will be high in children who are erroneously treated presumptively for malaria while the underlying condition remains untreated.

Experience in practice and the higher level of training is supposed to influence adherence to the use of standard treatment guidelines in the management of malaria. A study by Boadu *et al* 2016 reported that nursing officers were 1.68 times more adherent to the use of treatment guidelines than nursing aids [12].

The pattern of anti-malarial prescription in the study facilities revealed that there were more prescriptions for antimalarials alone than in combination with antibiotics and or antipyretics and the most prescribed antimalarial was Artemether/Lumefantrine, followed by Artesunate/Amodiaquine while Sulphadoxine/Pyrimethamine was the least prescribed. It is to be noted that Sulphadoxine/Pyrimethamine is no longer recommended for treatment of confirmed cases of malaria but mainly used for malaria prophylaxis.

The needless treatment for malaria without laboratory confirmation is associated with needless losses in cost of treatment. More than half of the participants put their antimalarial treatment cost at between ₦500 and ₦1000. The economic waste here is enormous and avoidable. Hansen *et al* 2017 reported from a study in Uganda that presumptive treatment of malaria based on clinical signs and symptoms alone resulted in over diagnosis of malaria and consequently, over prescription of anti-malaria with a consequent burden of additional cost the patient has to bear in addition to the possibility of development of resistance to the drug [13].

5. Conclusion

The accuracy of malaria presumptive diagnosis and treatment in the study facilities was found to be 12% while 88% of patients did not require the anti-malarial drugs prescribed for them. The inclusion of the anti-malarial in the prescription was associated with additional needless cost for majority of patients in the study settings. This underscores the need to comply with the WHO guideline for treatment of malaria which is centred on test and treat basis.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors declare no conflict of interest.

Statement of ethical approval

Ethical approval for this study was obtained from the research ethics committee of the Jos University Teaching Hospital with reference number JUTH/DCS/ADM/127/XXVII/820.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study

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