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Malaria infection among persons patronizing drugstores for malaria treatment in Port Harcourt and its environs Rivers, State Nigeria

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ABSTRACT

Background: Malaria continues to be of grave concern, despite all efforts geared towards its control and so remains a public health dilemma in Nigeria. Objectives: The aim of this study was to determine the occurrence of malaria among persons patronizing drugstores for malaria treatment in Port Harcourt and its environs, Rivers State, Nigeria. Methods: Ethical clearance was obtained and samples were randomly collected from 24 drug stores in three different locations and analyzed using both microscopy and rapid diagnostic techniques. Results: Out of 663 participants, 151(22.78%) were positive for Plasmodium falciparum. None was positive for P. Vivax. Preponderance by location showed that out of 221 sampled in each location, Mile IV (Rumueme) 68(30.77%), Rumuosi had 51(23.08%) and D/ Line area 32(14.48%). The occurrence of malaria in the study area was significantly different (X2 = 16.69; p = 0.001). Out of the 151 positive cases, 134 (88.0%) had an intensity level of 1,000 parasites/µl, 16 (10.6%) had an intensity level of 1000-9999 parasites/µl and only 1(0.71%) had an intensity level of ≥10,000parasites/µl (0.71%). (X2 = 2.58; P = 0.275). This implies that majority of those patronizing drugstores for malaria treatments do not have severe malaria. In conclusions: The occurrence of malaria among the study group is high. There was a significant difference in the occurrence of malaria across the three study areas. Therefore, the populace should be encouraged to step up their practice on malaria prevention and control.

Keywords: Malaria; Occurrence; drugstores; treatment; patronage.

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Introduction

Malaria is a public health dilemma in Nigeria, where it leads to serious economic loss [1]. It also results in a high mortality rate [2]. Malaria continues to be of grave concern, despite all efforts geared towards its control [3], [4].

World Health Organization [5] reported that malaria affected 214 million persons as well as caused the death of 430,000 persons in 2015. This figure is higher than that of 2013, where 198 million persons were affected [6].The burden of malaria is enormous, perpetuating a never ending circle of poverty [7]. It is a problem that has to be urgently resolved. However, a major impediment to doing this and achieving a world devoid of malaria is drug resistance [8]. This often occurs as a result of overdose of antimalarial, a common habit among those living in malaria endemic areas [9].

In Nigeria, when one has a febrile illness, a visit to the drugstore, commonly known as chemist for malaria treatment without diagnosis is the usual line of action [10]. This habit is not in tandem with the WHO recommended strategy of Test, Treat, and Track (T3). The T3 strategy for malaria control was launched in 2010 [11]. Its primary purpose is to control malaria, by underscoring diagnostic testing of all cases of febrile illness prior to and after treatment with antimalarial. This is where the use of Rapid Diagnostic Test (RDT) comes in, because it is fast to perform. Result can be obtained within 30 minutes [12].

A visit to the drugstore also results in the consumption of all kinds of antimalarial [13]. These drugs might not be the WHO recommended Artemisinin Combination Therapy (ACT). The efficacy of these un-prescribed antimalarials is not known. Even where testing is done and the right drug administered, ACT purchased and consumed, tracking is not done [14]. This is observed even in most public health institutions in Nigeria [15].

Efforts aimed at controlling malaria, have employed an integrated management approach. This approach has yielded some positive result, with global incidence falling by 37 % and death rate by 60 % from the year 2000 figure [16], [17]. In Nigeria, a decrease in the incidence was also observed [18].

Studies on malaria burden and efficacies of antimalarials are key factors in the designing, implementation and monitoring of malaria prevention and control programmes. However in Nigeria, these studies are mostly carried out in the formal health sector [19]. This is forgetting the fact that most Nigerians prefer visiting drugstores for malaria treatment when they come down with any febrile illness [10]. Thus a large proportion of the population do not benefit from these programmes. The aim of this study was to determine the occurrence and severity of malaria among persons patronizing drugstores for malaria treatment in Port Harcourt and its environs Rivers, State Nigeria.

Materials and Methods

Ethical Considerations

The guidelines laid down in the Declaration of Helsinki for procedures involving human subjects were strictly adhered to, the study was approved by the research management and development committee of the University of Port Harcourt. A written consent was obtained from owners of drugstores and oral consent sort from participating individuals.

Study Area

The study was conducted in three areas of Port Harcourt and its environs, Rivers State, Nigeria. These were D/line, a major business and medium densely populated residential area, Mile IV (Rumueme), a highly densely populated residential area and Rumuosi, a farming community, in a semi-urban setting.

Port Harcourt is a metropolitan city. It is the capital of Rivers State in the south-south geopolitical zone of Nigeria. It lies along the Bonny River and has many creeks. It is host to many major companies, and is the centre of

Nigerian economy. Port Harcourt is one of the largest cities in Nigeria with an estimated population of 1, 865, 000 inhabitants [20]. It is found in the forest bet of Nigeria with a lengthy and heavy wet climate. It has a very short dry season and the average temperature is between 25^0C and 28^0C. (Fig.1)

Study Design

The design was a clustered randomized one

Study Population

The participants were consenting individuals reporting to participating drugstores and requesting for antimalarial for treatment of perceived malaria for themselves.

Eligibility Criteria

Eligibility for the study was based on both inclusion and Exclusion criteria

Inclusion Criteria: Persons who purchased antimalarial to treat perceived malaria for themselves from participating drugstores in the study area and who give inform consent to participate in the study.

Exclusion Criteria

Persons who purchased antimalarial for malaria treatment for others not present. Persons who purchased antimalarial for malaria treatment for themselves from participating drugstores, but not resident in the study area. Persons who purchased antimalarial from participating drugstores but not willing to give consent.

Sample Size Determination

The sample size was 663 with 221 per cluster. It was determined using the formula by Gaur [21].

n×D + 5%(n)

Where n = the minimum sample size

$n = Z^zPQ / e^2$

z = the standard normal deviation corresponding to the level of significance =1.96

p = estimated prevalence = 30%

q = (1-p)

e = level of precision of error estimated at 95% confidence level = 0.05.

D = designed effect = 2

5% (n) = for reliability or non-response (attrition rate)

$$n = \frac{(1.96)^2 (0.3) (1- 0.3)}{(0.05)^2}$$

$$n = \frac{1.96^2 \times 0.3 \times 0.7}{0.0025}$$

$$n = \frac{0.806736 \times 2 + 5\% (n)}{0.0025}$$

$$= 322.69 \times 2 + 16.1345$$

$$= 645.38 + 16.1345 = 662.52 = 663$$

Thus, sample size = 663

Number of cluster = 3

Therefore, number of sample per cluster = 663/3 = 221

Sampling Method

A total of 24 drugstores whose owners gave written consent were randomly enrolled for the study. There were 8 drugstores per cluster. Clients patronizing participating drugstores for antimalarial to treat perceived malaria were approached for oral consent to participate in the study. They were informed that they would be offered a free malaria test before drug administration.

Sample Collection

Whole blood samples were collected from participants by venipuncture, using established practice. The samples were put in a clean well labeled container, containing anticoagulant (EDTA). RDT was conducted immediately. The samples were then put into a box and transported to the laboratory. Thick and thin blood film preparation for Giemsa staining technique was performed on all samples for parasite identification and quantification.

Rapid Diagnostic Test (RDT)

RDT was performed on the samples immediately after collection using a standard RDT kit (Aria, manufactured by CTK Biotech, Inc.,San Diego, CA 92121, USA).

Table 1: Occurrence of Malaria among Persons Patronizing Drugstores for Malaria Treatment in Port Harcourt and its Environs ,Rivers State.

STUDY AREA	TOTAL NO. TESTED	NUMBER POSITIVE	PERCENTAGE (%) POSITIVE	P. falciparium	P. vivax	Chi-square (χ2) (p-value)
D LINE	221	32	14.48	32	0	
MILE IV	221	68	30.77	68	0	16.69 (0.001)*
RUMUOSI	221	51	23.08	51	0	
TOTAL	663	151	22.78	151	0	

**Statistically significant (p<0.05)*

Table 2 . Malaria Parasitaemia among Persons Patronizing Drugstores for Malaria Treatment in Port Harcourt and Its Environs, Rivers State.

STUDY AREA	TOTAL NO. TESTED	INTENSITY OF MALARIA PARASITAEMIA NUMBER (%) <1000 Parasites/µl	<1000-9999 Parasites/µl	≥ 10,000 Parasites/µl	Chi-square (χ2) (*p-value)*
D LINE	32	31 (97.0)	1 (3.0)	NIL	2.58 (*0.275*)
MILE IV	68	60 (88.0)	8 (12.0)	NIL	
RUMUOSI	51	43 (84.0)	7 (14.0)	1	
TOTAL	**151**	**134 (88.0)**	**16 (10.6)**	**1 (0.7)**	

Statistically significant (p<0.05)

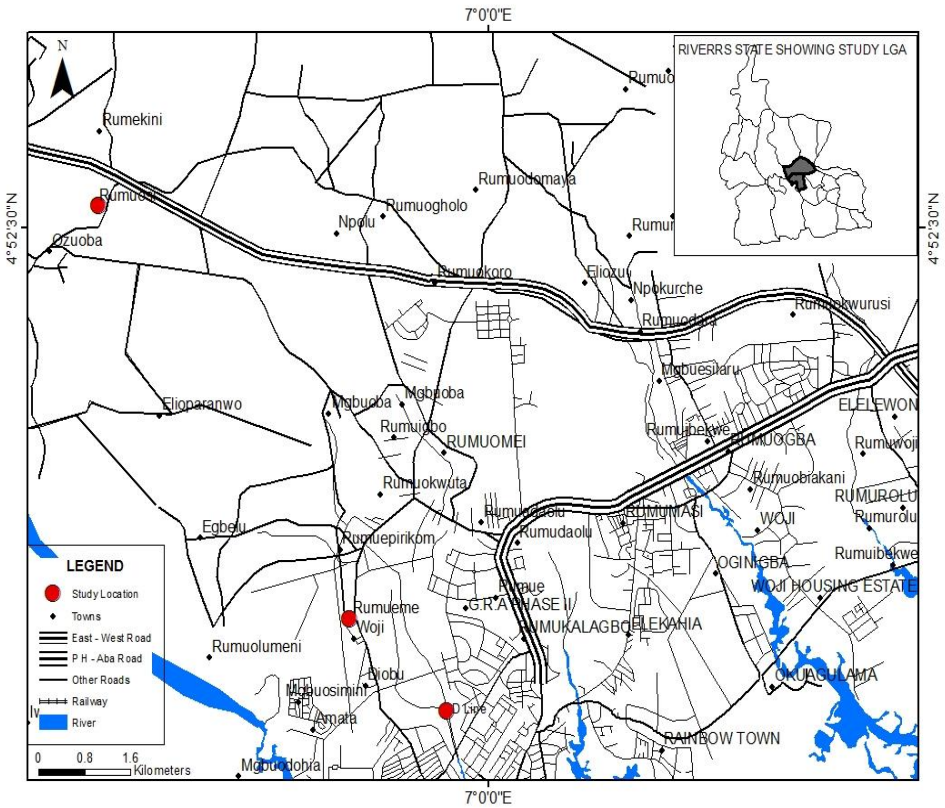

FIGURE 1: MAP OF PORT HARCOURT AND ITS ENVIRONS, RIVERS STATE, NIGERIA SHOWING SAMPLE LOCATIONS.

The kit contains a pouch, which was opened and placed on a clean flat surface. It was labeled with the participants' identification (ID) number. Proper mixing of the sample was then done. With the aid of a mini plastic dropper (blood transfer device) that came with the kit, 5µl of blood was obtained. Holding the device vertically, the blood was transferred into the sample well(s) in the pouch, ensuring that there were no bubbles. Immediately holding the buffer lysis bottle vertically, two drops of lysis buffer was added to the buffer well in the pouch. The pouch was allowed to stand for 20 minutes after which the result was read.

Interpretation of Test

There are three bands on the RDT pouch. These bands are the C (control), P_V (*Plasmodium vivax*), and P_f (*Plasmodium falciparum*). A negative result was indicated by a burgundy colour on the C band and non on the P_V and P_f bands. A burgundy colour on the C band and on the P_V or P_f bands or both indicated a positive result. Absence of a burgundy colour on the C band, irrespective of presence on the P_V and P_f bands, indicates an invalid result.

Microscopy

Thick and thin blood films were prepared, stained using Giesma staining technique and examined following the method described by Cheesbrough [22]. A clean grease- free glass slide was properly labeled with the participants' identification number. To one end of the slide was placed a drop of blood, which was evenly spread to moderate thickness, allowing one to see a print through it. It was then kept horizontally to dry, protected from dust and flies. The thick blood film was allowed to air dry and transferred to a staining rack. It was then flooded with a freshly prepared Giemsa working solution for 30 minutes. The slide was flushed with water allowed to dry, and examined with x100 objective of the microscope for the presence of *Plasmodium* parasite and the estimation of parasite density (parasitaemia). Parasite density was estimated by counting asexual forms of the parasite against 200 WBCs and against 500 WBCs where less than nine (9) parasites were counted. The number of parasite counted divided by the number of WBC's multiplied by 8000 gave the number of parasite per µl of blood.

Data Analysis and Presentation

The data was entered on Microsoft excel and spreadsheets, analyzed using the latest version of Statistical Package for the Social Sciences (SPSS version 22). It was presented as tables.

Results:

Out of the 663 participants took part in this study in which there were 221 per cluster, 151(22.78%) tested positive for malaria. *P. falciparum* was found to be responsible for all the positive cases. None tested positive for *P. Vivax.*

Mile IV (Rumueme) had the highest occurrence of positive cases 68(30.77%), Rumuosi had 51(23.08%) and the least occurrence was found in D/Line area 32(14.48%). The occurrence of malaria in the study area was significantly different (X^2 = 16.69; p = 0.001) as shown in Table 1.

There was no significant difference in the intensity of malaria parasite infection in the three study areas. Out of the 151 positive cases, 134 (88.74%) had an intensity level of≤, 1,000 parasites/µl, 16 (10.6%) had an intensity level of 1000-9999 parasites/µl and only 1(0.66%) had an intensity level of ≥ $10,000$parasites/µl (0.71%). (X^2 = 2.58; P = 0.275) as shown on table 2.

Discussion.

Present study showed that out of 663 persons that patronized drugstores for malaria treatment in Port Harcourt and its environs Rivers state, Nigeria, 22.78% (151) had an occurrence of malaria. This figure is higher than the prevalence of 3.9% reported in a similar study in Ibadan Oyo state, Nigeria [10]. It is also higher than the 3.0% prevalence recorded in the study of malaria prevalence among persons attending the University of Port Harcourt Health

Center [23]. However, the figure is closer to the prevalence rate of 26% recorded in the study of malaria parasite infection among pregnant women attending antenatal clinics in Port Harcourt [24] and lower than 35.5% reported in the work on malaria infection and socioeconomic status of some residents of Port Harcourt metropolis, Rivers State, Nigeria [25]. The low prevalence recorded in Ibadan [10] and in Port Harcourt [23] could be location dependent. Ibadan is located in the western part of Nigeria, with an environment that is not as conducive as Port Harcourt for the breeding of mosquitoes. The Port Harcourt study [23] was carried out in the University of Port Harcourt, a community highly enlightened. There, most people would have being practicing malaria preventive and control measures.

In the present study, it was observed that there was a significant difference in the occurrence of malaria across the three study areas. Mile (IV) Rumueme recorded the highest occurrence of 30. 77 %. This was followed by Rumuosi with an occurrence of 23.08 %. The least occurrence was recorded in D/line with an occurrence of 14.88 %. These figures agree with those of Ezenduka [15]. In their study, a prevalence ranging from 10 to35 % was recorded in various locations in Anambra state. However, it was different from the result of the study conducted in eastern Nigeria[2]. He observed no significant difference in prevalence based on location. The significant difference observed in this study based on location could be as a result of various factors, Mile IV (Rumueme), which recorded the highest occurrence, is a densely populated area. In this type of area, there are a lot of environmental factors predisposing to malaria. This includes the presence of stagnant water and persons staying outside late in to the night. Rumuosi which recorded the second highest incidence is a semi-urban area. D/line that recorded the lowest incidence is a low densely populated area. Environment conditions are better in this area than the others. Houses are built with regard to proper planning.

In the present study *P. falciparum* was responsible for all the positive cases of malaria. None was caused by *P. vivax*. Similar observation was earlier reported in Port Harcourt [25]. This collaborate WHO report [6] and that of Amovan [26] that most case of malaria in Nigeria is caused by *P. falciparum*. Nigerians do not possess the Duffy gene, needed by *P. vivax* for the production of the protein needed for it to be able to invade blood cells.

In terms of parasite intensity, present study recorded that 88% of persons who tested positive for malaria had a parasitaemia of <1000 parasites/µl. This agrees with the observation of Okeke [2] and Isiguzo *et al*.,[10] that most of those patronizing drugstores for malaria treatment do not have severe malaria.

In conclusion, the occurrence of 22.78 % observed in this study is high. *P. falciparum* was found to be responsible for all the positive cases. None tested positive for *P. Vivax.* There was a significant difference in the occurrence of malaria across the three study areas.

Conflict of Interest: The authors declare that there is no conflict of interest.

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