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Malaria infection and socioeconomic status of some residents of Port Harcourt metropolis, Rivers State, Nigeria

[*1]ABAH, AE; AWI-WAADU, G.DB; NDUKA, FO; RICHARD, A

Department of Animal and Environmental Biology,
University of Port Harcourt PMB 5323 Port Harcourt 50001,
Rivers State, Nigeria.
[*]Corresponding author Email, austin.abah@uniport.edu.ng

ABSTRACT: The study investigated the prevalence of malaria and socioeconomic status of subjects in part of Port Harcourt metropolis. Following ethical clearance which was obtained from the University of Port Harcourt and the parents of the subjects who gave their written consents, blood samples were collected and analysed following standard parasitological method from 200 subjects within the age bracket of 0-17years. The demographic characteristics of 200 subjects showed that more males, 105 (52.5%), were examined compared with females, 94 (47.5%). The socioeconomic status of subjects were grouped into higher class with 144 (72.0%), middle class with 22 (11.0%) and lower class with 34 (17.0%). Overall prevalence of 71 (35.5%) was recorded. Sex related prevalence showed that more males were infected with 42 (40.0%) and parasite density of 91120 μl than females with 29 (30.5%) and parasite density of 62480 μl. The differences in prevalence between males and females was not significant (P>0.05).The prevalence of malaria infections based on socioeconomic status showed that greater percentage of infection of 55 (38.2%) was recorded among the higher class with parasite density of 112880 µl followed by infection of 12 (35.3%) and parasite density of 29120 µl in the lower class with the least percentage of 4 (18.2%) and parasite density of 11600 µl recorded in the middle class. There was no significant difference (P>0.05) in infection rate on the basis of socioeconomic status. In Conclusion, malaria infection does not respect individual's socioeconomic status. There is need to sustain the current intervention measures and awareness campaign among Port Harcourt residents for prevalence rate to be reduced to the desired zero level. ©JASEM
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Malaria is one of the most severe public health problems worldwide. Globally, 3.3 billion people in 97 countries and territories are at risk of being infected with malaria and developing disease (WHO, 2014). It is estimated that 840 million people are at risk of malaria in Sub-Saharan Africa. In Nigeria, Malaria remains a major public health challenge where it accounts for more cases and death than any other country in the world (CDC, 2012). Malaria is caused by five species of the parasite belonging to the genus *Plasmodium* namely; *P. faciparum. P. vivax , P. ovale, P. malariae* and *P. knowlesi.* However, *P. falciparum* and *P. vivax* malaria pose the greatest public health challenge and *P.falciparum* is the most prevalent in African continent, and is responsible for most deaths from malaria (WHO, 2014)

Malaria brings to bear substantial costs to both individuals and governments. To individuals and their families the costs may include procurement of drugs for treatment of malaria at home; Travel expenses to and fro clinics, dispensaries and hospitals; loss of man hour; absenteeism in school; expenses for preventive measures; burial expenses in case of deaths (CDC, 2016). Costs to governments on the other hand include maintenance, supply and staffing of health facilities; purchase and supplies of drugs; public health interventions against malaria, such as insecticide spraying or distribution of insecticide-treated bed nets; loss of man hour with resulting loss of income; and lost opportunities for joint economic ventures and tourism. Direct costs (for example, illness, treatment, premature death) have been estimated to be at least US$ 12 billion per year. The cost in lost economic growth is many times more than that (CDC, 2016).

There is reported change in epidemiology of malaria (Cotter *et al*., 2013; WHO,2015),which requires adaptation of interventions to address shifts in geographical, behavioural and demographic risk characteristics, especially as transmission declines and becomes more clustered (Cotter *et al*., 2013). There is a need to understand possible determinants of this change. Local knowledge of the burden of the disease will be important to adapt interventions and maintain cost-effectiveness and equity. Among other parameters such as : changes in vector habits and insecticide resistance, drug resistance and climatic change, there is need to establish parasite infection patterns, socio-economic and demographic changes for effective and relevant control strategies to achieve

[*]Corresponding author Email, austin.abah@uniport.edu.ng

the WHO vision of "A world free of malaria". The aim of this study is to determine the status of malaria infections and socioeconomic level of some Port Harcourt residents.

MATERIALS AND METHODS

Ethical clearance: Ethical clearance was obtained from the research and development unit of University of Port Harcourt and the parents of the subjects gave their written consents

Study Area. Port Harcourt is the capital city of Rivers State, Nigeria. Rivers State lies on the recent coastal plain of the eastern Niger Delta. It has much surface water and high rainfall of between 3420mm and 7300 mm per year. The land surface can be grouped into three main divisions: the fresh water, the mangrove swamp and the coastal sand ridges. Rainfall is seasonal, variable and heavy, generally Port Harcourt is at south of latitude 05^{o} N, so rain occurs on the average every month of the year but with varying duration. The mean annual temperature is in the range of 25^{o}C to 28^{o}C and relative humidity is high throughout the year. Port Harcourt has a population of 1.5 million (Nig.1991). Local weather conditions often allow transmission of malaria to occur year round.

Sample Collection. Blood samples were collected through the vein puncture from 200 subjects within the ages of 0-17years between July 2014-February 2015. Structured questionnaires were administered and parents provided answers for younger children. Two millilitres of blood was collected and gently dispensed into Ethylene Diamine Tetra-Acetic acid (EDTA) bottle and thoroughly mixed. Collected samples were transported to the laboratory.

Sample Preparation. Thick and Thin films were prepared, air dried, stained and examined microscopically using oil immersion objective. The thin films were fixed with methanol and all films were stained with 10% Giemsa stain diluted with 7.2 buffer water for 10 minutes following standard procedure described by Cheesbrough (2005).

The number of parasites per μl of blood was calculated using the relative value method (WHO standard) as

$$\frac{\text{parasite count x 8000}}{\text{set range of WBC}} = \text{Parasites/µl}$$

Statistical analysis: The data collected were analysed using descriptive statistics (Tables and Charts) and Chi square (X^2) analysis at 5% significant level. SPSS package was used.

RESULTS AND DISCUSSIONS

The demographic characteristics of 200 subjects in Port Harcourt metropolis is presented in Table 1. It showed that more males with 105 (52.5 %) were examined compared to females with 94 (47.5 %). The age groups were stratified into six classes with subjects in ages 0-3yrs having the highest percentage of 71 (35.5 %) , followed by subjects within 4-6yrs and subjects within the ages 16-18 yrs with the least 2(1.0%) .The socioeconomic status of subjects were grouped into Higher class with 144 (72.0 %), Middle class with 22 (11.0 %) and lower class with 34 (17.0 %). Preventive measures used by the subjects against malaria were treated nets with 134 (67.0%), untreated nets with 16 (8.0 %), non- net users with 47 (23.5 %), others include environmental sanitation with 3 (1.5 %) and prayers 1(0.5 %).

The overall prevalence of 71 (35.5%) was recorded in the studied population of 200 subjects (Table 2). *Plasmodium falciparum* was the only *Plasmodium* species encountered in present study. Sex related prevalence showed that more males were infected with 42 (40.0%) and parasite density of 91120 μl than females with 29 (30.5%) and parasite density of 62480 μl (Table3). The differences in prevalence between males and females was not significant (P>0.05).

Table 1: Demograhic characteristics of the study population in Port Harcourt metropolis

Characteristics	No. and(%) of infection
Sex	
Female	95(47.5)
Male	105(52.5)
Age group in years	
0-3	71(35.5)
4-6yrs	50(25)
7-9yrs	40(20)
10-12yrs	25(12.5)
13-15yrs	12(6)
16-18yrs	2(1)
Socio Economic status	
Higher class	144(72)
Middle class	22(11)
Lower class	34(17)
Preventive Measures	
Net	
Treated net	134(67)
Untreated net	16(8)
Non net users	47(23.5)
Others	
Environmental sanitation	**3(1.5)**
Prayers	1(0.5)
No. number, N=200	

Table 2: Malaria infection and plasmodium species in Port Harcourt metropolis

Prevalence	No.Examined	No.Positive%	Plasmodium spp.
Port Harcourt	200	71(35.5)	*Plasmodium falciparum*

Table 3: Sex related prevalence of malaria parasitaemia in Port Harcourt metropolis.

Study Areas	No. Examined		No. Positive (%)		Parasite Density(μl)		X^2	P-Value
	F	M	F	M	F	M		
Port Harcourt	95	105	29(30.5)	42(40.0)	62480	91120	1.96	0.162

X^2=Chi-square

Prevalence of malaria infection by age (Table 4), showed that the highest percentage of 1(50.0%) was recorded among the age 16-18 years followed by those within the ages 4-6years with 23 (46.0%) while those within the ages 14 -15 years had the lowest percentage of infections of 4 (33.3%). However, the highest parasite density of 58080 µl was recorded among those in ages 0-3years followed by those in ages 4-6years with 46000 μl and the least parasite density of 1280 µl was recorded among age group 16-18years. The differences in prevalence of infection by age was not significant (P>0.05).

The prevalence of malaria infections according to socioeconomic status in Port Harcourt metropolis (Table 5) showed that greater percentage of infection of 55 (38.2%) was recorded among the higher class with parasite density of 112880 µl followed by infection of 12 (35.3%) and parasite density of 29120 µl in the lower class with the least percentage of 4 (18.2%) and parasite density of 11600 µl recorded in the middle class. There was no significant difference (P>0.05) in infection rate on the basis of socioeconomic status.

Prevalence of malaria in relation to preventive measures (Table 6) shows that those who believe in the efficacy of environmental sanitations had the highest percentage of infection at 3 (100.0%) followed by non-net users at 31 (66.0%) and the least infection was recorded among the treated net users at 32 (23.9%). However, the parasite density was higher among the non-net users at 84260 μl followed by the treated net users at 51360 µl and the least parasite density of 2940 µl was recorded among those that implore environmental sanitation. There was significant difference (P<0.05) in prevalence of malaria in relation to preventive measures.

The treatment seeking behaviour in relation to education (Table.7) Showed that more subjects (115) had formal education compared to those with informal education (18) and subjects without education at all (4). More of those with formal

education at 64 (55.7 %) sought treatment with hospitals which is greater than 48 (41.7 %) that sought in the clinics and none of the subjects with formal education sought treatment with patent drug sellers. Among the subjects with informal education (18), greater number of 10 (55.6 %) sought treatment with patent drug sellers and none of the subjects in this category was involved in self-medication. There was significant difference (P<0.05) in treatment seeking behaviour in relation to education

Table 4; Prevalence of malaria infection by age in Port Harcourt metropolis

Age group(yrs)	No.Examined	No. +ve(%)	parasite density(μl)	X2	P-value
0-3yrs	**71**	20(28.2)	58080		
4-6yrs	**50**	23(46.0)	46000		
7-9yrs	**40**	13(32.5)	15520		
10-12yrs	**25**	10(40.0)	28560	4.66	0.459
13-15yrs	**12**	4(33.3)	4160		
16-18 yrs	**2**	1(50.0)	1280		
Total	**200**	71(35.5)	153600		

Table 5: Prevalence of malaria infection according to socio-economic status in Port Harcourt metropolis

S.E Class	No.Examined	No.+ve(%)	P.D(μl)	X^2	P-value
Higher Class	**144**	55(38.2)	112880		
Middle Class	**22**	4(18.2)	11600	3.34	0.188
Lower Class	**34**	12(35.3)	29120		
Total	**200**	71(35.5)	153600		

No=Number,S.E=Socioeconomic, +ve=Positive, P.D=ParasiteDensity, X^2=Chi-Square

Table 6: Prevalence of malaria infection in relation to preventive measures in Port Harcourt metropolis

Prevention No.Examined		No.+ve(%)	Parasite density(μl)	X^2	P-value
Net.					
Treated Net users.	**134**	32(23.9)	51360		
Untreated Net users.	**16**	5(31.3)	15040		
Non Net users.	**47**	31(66)	84260	32.5	0.000
Others					
Environmental Sanitation	**3**	3(100)	2940		
Prayers	**0**	0	0		
Total	**200**	71(35.5)	153600		

No=Number, +ve =Positive, X^2 = Chi- square

Table 7. Treatment seeking behaviour in relation to Education among respondents in Port Harcourt metropolis.

		Treatment seeking behaviour.							
Study Area.	Education	Hospital	Clinic	Dispensary	Sm	PDS	Total	X2	P-Value
Port Harcourt	Formal	64(55.7)	48(41.7)	1(0.9)	2(1.7)	0	115		
	Informal	3(16.7)	4(22.2)	1(5.5)	0	10(55.6)	18	32.52	0.000
	None	0	1(25)	2(50.0)	0	1(25.0)	4		
	Total	67(48.9)	53(38.7)	4(2.9)	2(1.5)	11(8.0)	137		

PDS=patent drug sellers, SM= Self-medication, X2= Chi-Square.

The prevalence of 35.5 % recorded in the present study is relatively high and worrisome due to the fact that majority of the subjects in the study area fell within the higher class of socioeconomic stratum and had formal education, Which suggests that awareness and adherence to preventive measures would have been high and hence reduction in prevalence rate. The prevalence in this study is higher than the average

prevalence of 32.2 % among children within the age of 6-59 months in the south-south zone of Nigeria (NMFS, 2011), the zone which Port Harcourt and Rivers state belong. This high prevalence agrees with other earlier researchers (Kalu *et al* ., 2012; Olasehinde *et al* .,2010; Abah and Temple 2015), who had established that there is high prevalence of malaria in Nigeria and which corroborates the fact that malaria is endemic in Nigeria (CDC, 2012).However, the 35.5 % prevalence observed in this study is lower than 80.4 % reported by Kalu *et al*.,(2012) in Aba, Abia state; 80.5 % reported by Olasehinde *et al*., (2010) in Ota, Ogun state; and 63.3 % reported by Abah and Temple (2015) in Angiama community, Bayelsa state all in southern part of Nigeria. And 39.5 % reported by Houmsou *et al.,* (2011) in Gboko, Benue state, North central Nigeria. This high prevalence of malaria in Port Harcourt metropolis may be attributed to the prevailing environmental conditions such as urban slums, high rainfall and relative humidity, much surface water, septic ditches and stagnant pools all of which combine to encourage mosquito (malaria vector) breeding.

Sex related prevalence showed that more males were infected with 40.0% and parasite density of 91120 µl than females with 30.5% and parasite density of 62480 μl. This is in line with the findings of Houmsou *et al.,*(2011), and Abah and Temple (2015). The higher prevalence in males than in females may be due to the fact that the males engage more in outdoor activities like football than females among the higher socioeconomic class neighbourhood.

Prevalence of malaria by age shows that the highest parasite density of 58080 µl was recorded among those in ages 0-3 years followed by those in ages 4-6 years with 46000 μl. This finding is in line with WHO position (WHO, 2014) and explains why more death due to malaria occurs in age less than 5years. WHO's position is that 90% of all death due to malaria occur in Sub-Saharan Africa and children under 5 years account for 78% of all deaths (WHO, 2014). Also children of older age tend to develop immunity due to progressive acquisition of immunity as a result of subsequent exposure to malaria parasite (Bloland *et al*., 1999).

Plasmodium falciparum was the only *Plasmodium* species identified in the present study. This corroborates earlier observations made by previous researchers in the south-south zone of Nigeria (Abah and Temple, 2015; Wogu *et al*., 2013; Pondei *et al*., 2012). More so, WHO had earlier established that *Plasmodium falciparum* remains the most common *Plasmoduim* species across most of Sub-Saharan Africa.

Prevalence of infection on bases of socioeconomic class showed that malaria infection does not respect individual's socioeconomic status as those within the higher class had higher parasite density of 112880 μl and greater percentage of infection. The finding seems to agree with Onwujekwe, *et al*.,(2009) who observed that Malaria occurs more amongst better-off Socioeconomic status groups and urban dwellers in southeast Nigeria, but differed from other studies which showed a higher prevalence of malaria among the poorest population groups (Akazili, 2002 , Bennett and Gilson, 2001). The reason for this finding may be due to the fact that majority of the population sampled were those living within highbrow area and so within the higher socioeconomic class.

Prevalence of infection in relation to preventive measures shows that subjects that are non- net users had higher parasite density 84260/μ*l* compared to other groups. This observation supports the need to use insecticide treated nets (ITNs) which have been shown to reduce severe disease and mortality due to malaria (CDC, 2004). Also the use of insecticide treated net to prevent mosquito bites has become a very important malaria control strategy in the absence of effective vaccine for malaria prevention and development of unacceptable level of resistance to drugs by the malaria parasites (Ter Kuile *et al*.,2003; Lengeler and Snow,2000).

The treatment seeking behaviour in relation to education Shows that more subjects 115 (83.9 %) had formal education compared to other groups and more of those with formal education at 64(55.7 %) sought treatment with hospitals. There was significant difference ($P<0.05$) in treatment seeking behaviour in relation to education. This finding was expected because even common sense can attest to the fact that Standard of living correlates quite well with education.

Conclusion: Prevalence of infection on bases of socioeconomic class showed that malaria infection does not respect individual's socioeconomic status .There is need to sustain the current intervention measures and awareness campaign among Port Harcourt residents for prevalence rate to be reduced to the desired zero level

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