Economic burden of malaria infection on households: A survey of various households in Port Harcourt, Rivers State, Nigeria

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Abstract

Purpose: This study is aimed at evaluating the economic burden of malaria treatment among households in Port Harcourt, Rivers State Nigeria.

Methodology: A correlation survey research design was adopted for this study and a sample size of 338 was determined from a target population of 2,200 using Yamane formula.

Findings: There are significant positive relationships between economic burden (direct and indirect costs) of treating malaria infection and the disposable income as well as high rate of poverty of the sampled households in Rivers State, Nigeria**.**

Recommendations: The study identifies and recommends the need for government to intensify efforts in malaria elimination through effective eradication programme, universal health coverage, national health insurance scheme and free malaria treatment. In addition, government is called upon to strengthen the health system in Nigeria and provide effective leadership as avenue to mitigate the huge economic burden of malaria treatment in the country.

Originality/value: This study contributes to malarial infection research by providing empirical evidences of the relationships that exist between the direct and the indirect costs of treating the disease and its effects on the disposable income and the living standard of the people.

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Keywords: Malaria, infection, economic, burden, households, direct costs, indirect costs

1. Introduction

Malaria remains one of the most devastating parasitic diseases in the world. It contributes considerably to the poor health situation in Africa. The global incidence of the disease is estimated to 350 to 500 million clinical cases annually, resulting in 1.5 to 2.7 million deaths each year in sub-saharan Africa and parts of Asia (WHO, 1997, 1999, 2000, Kioko, 2007) [19]. About 90% of these deaths occur in young children below the age of five years, who have not yet acquired clinical immunity, and pregnant women, whose immunity to malaria is temporarily impaired. It accounts for an estimated 25% of all childhood mortality below the age of five years, excluding neonatal mortality (WHO, 1997). In 2018 an estimated 228 million cases of malaria occurred worldwide (95% confidence interval/CI; 206 – 258 million). Compared with 251 million cases in 2010 (95% CI: 231 – 278 million) and 231 million cases in 2017 (95% CI: 211-259 million). Most malaria cases in 2018 were in the World Health Organization (WHO) African Region (213 million or 93%) followed by WHO South-East Asia Region with 3.4% of the cases and the WHO Eastern Mediterranean Region with 2.1% (WMR, 2019). This report also showed that in 2018, there were an estimated 405,000 deaths from malaria globally, compared with 416,000 estimated death in 2017 and 585,000 in 2010. Children accounted for 67% (272,000) of all malaria deaths worldwide while about 11 million pregnancies in moderate and high transmission Sub-Sahara Africa (SSA) have been exposed to malaria infection. In Sub Saharan Africa (SSA) Malaria is responsible for, between 30 to 50% of outpatient visits and between 10 and 15% of hospital admissions (WHO 2015). In addition, the disease exerts enormous pressure on scarce health resources in SSA countries. In general, it is estimated that malaria account for an average of 3% of the total global disease burden. More evidence points to significantly increasing malaria morbidity and mortality in SSA due to non-adherence to full treatment courses (protocol) namely combination therapy, early diagnosis and prompt effective treatment (WHO 2015).

WHO and World Bank report shows malaria is responsible for an estimated annual loss of 45 million disability adjusted life years (DALYs) worldwide. This was higher than the loss of 39 million DALYs reported in 1998 and more than 36 DALYs in 1999 (WHO, 1998, 1999, 2002, World Bank 1993). In SSA, more than 10% of all disability adjusted life years were lost to malaria in 2000 (WHO, 2002). It has furthermore being estimated that among the ten leading causes of loss in DALYs in the world in 2000 malaria is ranked eighth with a share of 2.8% of the global disease burden (WHO, 2002, Kioka, 2007). Recent estimates shows economic losses due to malaria in sub-sahara Africa to over, US dollars 12 billion annually (Gallup an Sachs, 1998, WHO, 2000). Here malaria exerts a devastating effect on the development potential of SSA countries and mostly affects the disadvantaged and economically susceptible households, who constitute the bulk of economic labourers. Available data indicates that malaria imposes high and regressive cost burden on household that have a sick family member, with poor household spending, a higher proportion of their income on healthcare than the better-off households (Russell, 2004; Goodman et al 2000), Kioko, 2007) [29, 40]. Further to this expenditure on insecticides, drugs, and equipment, large numbers of malaria patients make health personnel get stretched beyond capacity, thus affecting the standard of care they give to patients. From the above, malaria is a serious problem affecting many sectors of a country economy.

Malaria is ranked first, accounting to 10% of the disease burden (WHO, 2002). In addition, to the disease burden, it is estimated that the total cost of malaria to Africa increased from US dollars 1.8 in 1995 to US dollars 2 billion in 1997 (WHO, 1997).

Malaria is the main cause of anaemia among pregnant women and can lead to miscarriage, still-birth, underweight – low birth weight (LBW) babies and maternal mortality. It has also been shown that frequent malaria can lead to disabling neurological sequalae. Further, the disease is the major cause of school absenteeism among school children slowing intellectual development of children in malaria endemic area (Lucas 2005) [23] with about 2% of children who suffer from cerebral malaria experience brain damage including epilepsy (WHO, 2003).

Malaria affects labour supply of household, increase income shocks, household production, gross domestic product (GDP) substantially imposing substantial social and economic costs impeding economic development through human capital, premature deaths, medical costs and reduction of savings and investments (Lucas 2005, Laxminarayan, 2004, Goodman et al 2000, Sachs and Malaney, 2002) [20, 23]. Total household malaria burdens amounted to 9-18% of annual income for small farmers in Kenya and 77-13% in Nigeria, with total annual value of production loss due to malaria estimated to be 2-6% and 1-5% of GDP in Kenya and Nigeria respectively. Aggregate cost of malaria to be US dollars 3.15 per capital /equivalent to 0.6% GDP) following from the above, a larger proportion of the health sector budgets, are spent on malaria control and treatment, studies show 40% of the public health expenditure 30-50% of hospital admissions and up to 50% of outpatient visits in countries with high malaria transmissions. Researchers have placed the economic burden on households due to malaria prevention measures to between US dollars 0.23 and US dollars 15 each month, and between US dollars 1.79 and US dollars 25 due to treatment measures (Leighton and Foster 1993, Kirigia et al 1998, WHO 2002, Kioko, 2007) [21, 29, 18].

1.1. Statement of the problem

Emerging evidence from macro-economic studies indicate that malaria endemic countries stand to lose billions of dollars in national income due to the impacts of morbidity and mortality from the disease on labour supply. In Nigeria, malaria has been shown to account for over 40% of the total monthly curative healthcare costs incurred by households compared to a combination of other illnesses, the cost oftreating malaria and other illnesses depicted 7.03% of the monthly average household income, and treatment of malaria cases alone contributed 2.91% of these costs (Onwujekwu et al 2000). Households spending on malaria can be classified into expenditure on prevention and expenditure on treatment. Individual or household direct cost of malaria treatment include direct payment for drugs, consultation, laboratory tests, transportation fees to and from the facility (Asenso-Okyere et al, (1997) [3] while the indirect cost is the productive time lost due to malaria. Despite its devastating health effects, empirical evidence of the economic impact of the disease on households in Port Harcourt South South Nigeria, remain largely unknown aware that presently vaccine management is not in sight, prevention and treatment remain the only way of malaria control. Effective control programme requires a clear understanding of the economic burden of the disease to guide resource allocation across the various activities of the programme. This study fills the knowledge gap that exists concerning the economic burden of malaria at the household and individual level in Port Harcourt, Rivers State, Nigeria. Thus, the main objective of the study is to investigate how direct and indirect cost of malaria treatment affects the economy of households and individuals in Port Harcourt, Rivers State, Nigeria. Specific objectives include to:

1. Evaluate the relationship between direct costs of treating malaria and the disposable income of households in Port Harcourt, Rivers State, Nigeria.
2. Evaluate the relationship between direct costs of treating malaria and the high rate of poverty among households in Port Harcourt, Rivers State, Nigeria.
3. Investigate the relationship between indirect costs of treating malaria and the disposable income of households in Port Harcourt, Rivers State, Nigeria.
4. Investigate the relationship between indirect costs of treating malaria and the high rate of poverty among households in Port Harcourt, Rivers State, Nigeria.

1.2. Statement of hypotheses

To meet the general as well as the specific objectives set for the study, the following hypotheses are thus formulated in a null form (Ho):

H_0: There is no significant relationship between direct costs of treating malaria infection and the disposable income of households.

H_0: There is no significant relationship between direct costs of treating malaria infection and high rate of poverty among households.

H_0: There is no significant relationship between indirect costs of treating malaria infection and the disposable income of households.

H_0: There is no significant relationship between indirect costs of treating malaria infection and the high rate of poverty among households.

2. Literature Review

Individual and Household

2.1. Conceptual Framework and Review

Figure 1. Represents the conceptual framework for the review that was derived from studies that have investigated the household costs of illness, coping strategies and their economic consequences at household levels (Sauerborn et al, 1996; Russell, 2001) [38, 43]. The household is the preferred unit of analysis for assessing the cost of illness because decisions about treatment and coping are based on negotiations within the household (but not necessarily from an equal bargaining position), illness cost are incurred by caregivers as well as the sick and costs fall on the household budget.

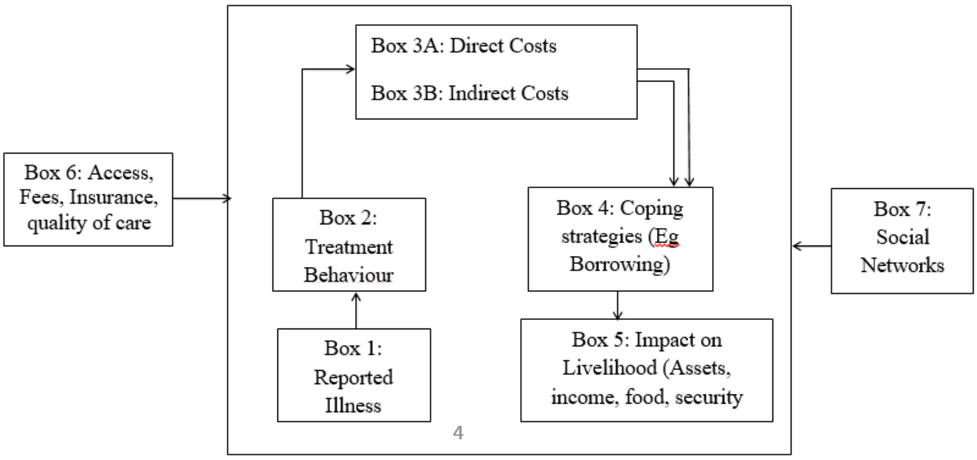

Fig 1: Conceptual Framework for Economic Burden of Illness for Households (Adapted from Russell 2004 [40]; Berman *et al*, 1994, Sauerborn, 1995) [43]

In response to perceived illness (fig 1, Box 1) decisions are made about whether to seek treatment and from which source (fig 1, Box 2). The health system is shown as a resource outside the household on which members can draw (fig 1, Box 6). Illness costs are broken down into direct (fig 1, Box 3A) and indirect costs (fig 1, Box 3B). Direct costs refer to household expenditure linked with seeking treatment, including non-medical expenses such as transport or special foods. Indirect costs refer to the loss of household productive labour time for patients and caregivers. The term cost burden refers to direct or indirect costs expressed as a percentage of household income.

Analyst assume that a cost burden greater than 10 percent is likely to be catastrophic for the household economy (Prescott, 1999; Ranson, 2002) [32, 34], meaning that it is likely to force household members to cut their consumption of other minimum needs, trigger productive asset sales or high levels of debt, and lead to impoverishment. However, this 10 percent figure is somewhat arbitrary because it may not be catastrophic for high income household as that can cut back on luxuries or for resilient households that can mobilize asset to pay for treatment (Russell, 1996) [39].

Direct and indirect costs will be influenced by type and severity of illness (fig 1, Box 1) and health service characteristics (fig 1, Box 6) that influence access and choice of provider illness costs going beyond the households daily or monthly budget may trigger coping strategies such as borrowing or asset sales (fig 1, Box 4).

In situations of poverty, where households struggle to meet daily food and fuel needs, the loss of a daily wage due to illness or a relatively small treatment expense is likely to trigger such strategies (Russell 1996, Russell, 2001, Pryer, 1989) [38, 39] including claims on resources outside the household such as social network or local organizations that offer credit (fig 1, Box 7) illness costs and coping organizations that offer credit (fig 1, Box 7). Illness costs and coping strategies then have implications for household asset portfolios and processes of impoverishment (fig 1, Box 5). The highlighted boxes in figure 1, illustrate this research focus on illness costs, coping strategies, and more limited evidence on links between illness and impoverishment.

Comparing cost of illness studies is different because of the different definitions and methods used to measure and quantify cost (Chima *et al*, 2003; McIntyre et al, 2003; Worral *et al*, 2003) [8, 69] with respect to direct costs, all studies measure medical cost but some ignore non-medical costs such as transport. The scope of indirect cost measurement varies considerably across studies. Some only include economically active individuals, but others include children and the elderly; most measure the time spent seeking treatment by the patient and care giver and their loss of productive labour time due to illness. A few studies extend measurement to the cost of mortality in terms of lifetime income forgone. Perhaps the greatest variation arises from the different methods used to place a value on productive time lost, for example, an average wage rate, average daily output per adult, or the actual output and income lost for each respondent. Studies also varies in their units of analyses, for example, costs were expressed per episodes, per month on per year, and by per capital household spending or total household spending. No studies included the less quantifiable loss associated with suffering, grief or social exclusion arising from illness. (McIntyre et al, 2003).

2.1.1. Geography and malaria prevalence

Malaria remains a public health concern in sub-saharan Africa especially in pregnant women because of the potential risk to the life of the mother and risk of transmission to the foetus. In 2017, an estimated 219 million cases of malaria occurred across the world and 25% of the cases were in Nigeria (WHO 2018). The ailment is caused by a parasite that is transmitted by anopheles mosquitoes. According to Jimoh et al, (2007) [17], the most dominant species of anopheles mosquitoe instrumental for transferring the parasite in Nigeria are anopheles funestus, anopheles gambiae complex anopheles arabiensis and anopheles melas. Nigeria can be grouped into three malaria epidemiological zones namely, forest, savannah and grassland. The study is focused in Rivers State, in the forest zone. The forest zone covers mainly the southern states in Nigeria, including the south-west, south-east and the south-south (Jimoh 2007) [17], Chima *et al* (2003) [8], Ukpai and Ajoku 2010. Rivers State very rich in oil resources is located in the Niger Delta Region, the largest wetland in Africa (WHO 2008) annual rainfall averages more than 2550mm with the third largest mangrove forest in the world, where transmission of malaria is allyear round (Uluocha et al (2004), Umoh (2008) Chijioke- Nwauche (2020), PMI (2011).

According to the Nigeria population census data, Rivers State has a population size of 5,198,716 making it the sixth most populous state in the country. The workforce in Rivers Consists mainly of men with many of the women being housewives, traders, with a few as public civil servants. According to the National Bureau of Statistics 2018, Rivers State has an unemployment rate of 41.82% of the third quarter of 2017 implying that 4 out of every 10 persons in the state were not doing anything, though the state is seemingly a major contributor to the National wealth of the country and housing all the major oil companies. Generally, cost of living in the state is high (Abah *et al* 2017, Chijioke-Nwuche 2020).

A similar phenomenon plays out in other parts of Africa like Kenya where the endemicity or distribution of malaria is not uniform and varies from region to region, mainly due to geographical differences in altitude, rainfall and humidity. These geographical factors influence the remission patterns as they determine the vector densities. The higher the ambience temperature, the shorter the sporogenic cycle of the parasite in the mosquito, hence the shorter the duration of the life cycle of the parasite (Republic of Kenya 2006). Most areas of the country are, prone to malaria, the country can be divided into four malaria eco-zones. These eco-zones are described as stable malaria. It is said to stable if it is transmitted throughout the year, albeit with the potential of wide seasonal variations in transmission intensity and disease incidence. The transmission can lost up to 6 months depending on the prevailing climatic conditions. Annual transmission is particularly important in the case of malaria caused by plasmodium falciparum because infected house members tend to become non-infectious within two months after infection. Areas described as unstable experience sporadic malaria transmission and frequently appear in epidemic form in areas previously free of infection. In such area, mortality is not limited to children under five years but the whole population is at risk of infection because of lower immunity (Kiszewski, *et al*, 2004, Goodman et al, 2000).

2.1.2. Cost of illness concepts

A cost of illness study (COI) or a cost of disease study involves the determination of the total economic impact (cost of a disease or health condition on society through the identification, measurement and valuation of all direct and indirect costs. This form of study focuses on costs and does not address questions relating to treatment efficiency (Drummond 1992). Performing a COI study means adopting one of two main approaches to costing. The prevalence approach (the most commonly used) provides an estimate of the total annual cost associated with disease. The approach provides an estimate of the life time costs of incident cases diagnosed in a given year. Within these overarching frameworks, individual component costs (direct, indirect) are addressed in different wages. Direct costs are calculated using either the top-down or 'bottom-up' costing techniques or both. Indirect costs associated with lost economic activity (the value of the output that is lost to an economy because people are too ill to work ror die prematurely) are calculated using the human capital method (most common method) or the friction cost method. The choice of any specific methodology used is often determined by the data available to the investigator (Rice 1994). cost of illness studies communicates to the reader a measure of the total expenditure (s well as the relative weighting of direct and indirect cost) spend on a particular disease (eg the use of health and social care services) in comparison to the scope of the health problem (ie epidemiological estimate of the mortality and morbidity of the disease) comparisons can theoretically be made across diseases within a particular council, or region or between countries. COI studies have been controversial with respect to their use in resources prioritizing decisions.

In addition, COI provide a market measure for the pharmaceutical industry with respect to assessing market volume potential (low to high) and treatment patterns of specific health problems and disease (Drummon, 1992, Rice, 1994, Smith et al 2003) COI studies certainly raise the cost consciousness of policy makers and provided a simple, single index of the burden of illness (total direct and indirect costs versus the scope of the health problem). Indirect costs often represent large proportion of reported total costs in COI studies, COI studies can provide baseline against which new interventions can be assessed. For what health gains attainable from specific treatment intervention and prevention program for a given level of expenditure or all work while financially cost – effectiveness, cost utility, and cost benefit analysis are required so to do (Smith 2003).

2.1.3 Economic burden (Direct and Indirect Costs)

Economic burden is defined as expenditure on seeking treatment (direct cost) production and income losses (indirect cost) related to copying strategies and their consequences for household livelihood in terms of indicator such as the number of workers and working days, levels of asset portfolio, income and food consumption levels (Scoones *et al*, 1998). The burden of malaria is in three dimensions: the health, economic and social burden. The health burden of malaria is the ill-health and premature mortality associated with malaria. The social burden includes loss in social capital resulting from restriction in movement and networking of people due to fear of contacting malaria. The economic burden is the total loss in output or income that is associated with malaria morbidity and mortality (WHO/AFRO, 2001, Kioko, 2007) [29].

2.2 Theoretical Review

Health Belief Model (HBM)

This work is anchored on the Health Belief Model (HBM) which was developed in the 1950s by social psychologist, Hochbaum, Kegel, and Roseustock to study why people fail to participate in health intervention programmes such as malaria screening, and free health programmes including – tuberculosis andhuman immunodeficiency virus, acquired immunodeficiency syndrome HIV/AID. The HBM is guided by six constructs:

a. Perceived susceptibility to particular disease
b. Perceived seriousness of disease.
c. Perceived benefit to taking health action, (d) Perceived barrier to taking action
d. Cues to action (readiness to take action) and (f) Self-efficacy (Glanz, Rimer, and Viswauth, (2008).

HBM originated from the United State public health services, it was included in the study of peoples response to symptoms and adherence of treatment (Glanz *et al* 2008) many disciplines showed that influencing behavioural change is difficult as a result, programmes such as health promotion, improve the environment where people live to help enable behavioural changes at an individual level. HBM is widely used by different professions e.g (Nurses, dentists, public health) to study behavioural changes and maintenance of behaviour(*Shumaker*, *Ockene*, & *Riekert* (*Eds*.). (*2009*). (3rd *ed*.). HBM is based on the belief that people are more likely and willing to avoid illness if they believe their specific action will prevent illness. HBM becomes imperative to this study as it allows us to observe the behavior change of households towards malaria infections and other diseases.

Health Belief Model

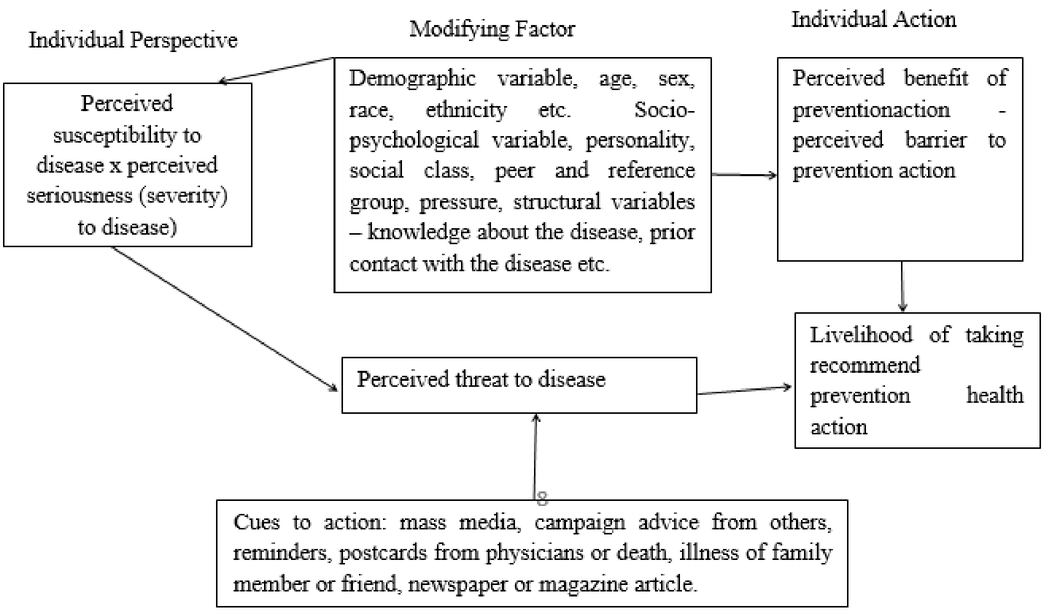

Fig 2: Adapted from the health belief model (from Becker, Hacfner & Kaslsv*)* selected psychosocial models and correlates of individual health related behaviours Medicare 1997, 15: 27-46

Explanation of the Health Belief Model: Social strata are associated with different values that shape a wide range of people's response to health and illness, behaviour. Social stratification of a society can also be of importance in understanding their pattern of health and illness behaviour (Abanobi, 2010)). This is explained clearly in the figure above.

2.3 Empirical Review

Studies on high prevalence of malaria have been reported in various parts of Nigeria and other parts of the world. In a survey of the prevalence of plasmodium species and common clinical symptoms in a rural community in Imo State, Chukwuocha *et al*, 2008, found 68% prevalence of malaria in the study community. They reported that P. falciparum (67.8%) was the dominant parasite while P. malariae occurred in mixed infection with both parasites at a 0.9%. Ukpai and Ajoku (2001) in a hospital based study of the prevalence of malaria in Okigwe and Owerri areas of Imo State, reported a prevalence of 321 (80.25%) out of 400 individuals examined. Okigwe had a higher prevalence rate (85.5%) than Owerri (75.00%). Matur *et al* (2001), in a study of prevalence of malaria amongst the undergraduates of University of Abuja reported a prevalence rate of 121(61%), out of 200 blood samples examined. Similarly,Mbanugo and Ejims (2000) reported a prevalence of 233 (53.3%) out of 400 children examined for malaria parasites in Awka metropolis, Anambra State. All positive cases were infections of plasmodium falciparum (Eleanya 2015, Abah 2017)

A three year study to investigate the seasonal variations in episodes of malaria among residents in a semi-urban community in South East Nigeria, showed that between January and December 1996, 755 (62.9%) individuals had parasitaemia of either P. falciparum or P. malarae or both. The age – specific prevalence were73.8% for (0-4) years, 76.4% for (5-9) years, 67.2% for (50-59%) years; 43.5% for 60years and above (Ezeanya 1998). Usip and Opara (2008) reported a malaria prevalence of 552 (54.4%) out of 1,012 patients attending St. Luke's General Hospital, Anua, Uyo, Akwa Ibom State between May 2003, and April 2004. All malaria positive cases reported were due to plasmodium falciparum.

Malakooti *et al*, (1998) reported that transmission of all species of malaria parasite depends on the presence of both the suitable species of anopheles mosquitoes and of the (gametocyte bearing) humans and that the suitability of a mosquito as a vector of human malaria disease depends not only on the physiologic adaptation to the infection, but also on such factors as feeding preferences, hour of biting and flight, resting and breeding habits. They also reported that favourable breeding places abound in the tropics, such as old cans, coconut shells, wells, old tyres, poor drainage systems, bushes, and hedges around dwelling houses etc. factors that obviously promote mosquito multiplication (Pondei et al (2012), Ebong et al (2015), Rolle and Omon (2018).

According to the 1992 national plan of action for malaria control, the districts that are located in the Kenya highlands were found to be prone to malaria epidemics. In 1997, approximately 46% of the total population was classified as being at risk of malaria epidemic. In 1995 and 1996, malaria accounted for 42% and 32% of all hospital admissions and death in one district. Malaria epidemic may be caused by climate anomalies (eg excessive or prolonged rainfall) or usual increase in temperatures mainly in arid and semi-aride areas. The remission of the disease could also be seasonal, caused by changes in meteorological conditions such as EL Nino weather conditions (Lindsay & Marteus, 2001).

Malaria as a disease is closely bound to geographical conditions which favour the survival of the anopheles mosquito and the life cycle of the parasite. These conditions are predominantly determined by climate factors, by vegetation coverage and by the vector access to water suffice for breeding requirement (Ghebreyesus *et al* 1996). Human population movements from malaria endemic zones can contribute to malaria transmission.A possible source of variation that is not determined by natural factors such as climate and environmental factors may be differences in socio-economic development, which has played a major role in the control and eradication of malaria in some countries (Mitra & Tren, 2002, Goodman *et al* 2000, Kioko 2007) [29]. Existing evidence shows that socio-economic development could reduce malaria transmission in several ways. For example, increases in household income of women and poverty reducing measures have the potential to reduce exposure to malaria and improve health seeking behaviour and quality of treatment (Packard, 1984). However, socio-economic development could equally increase malaria transmission due to movement of people with little or no immunity into areas of high malaria transmission (Kioko 2007; Pehrson 1984) [29].

3. Methodology

The study is a cross sectional survey. Thus a correlation survey research design was adopted to investigate key aspect of the study. The population of the study comprises male, female, adult and children in household in Port Harcourt City Local Government, Obio/Akpor Local Government and Eleme Local Government. The study locations were purposely and randomly selected to reflect geographical spread of population within Port Harcourt metropolis and surroundings with its hub of activities, environmental peculiarities, and holoendemicity of malaria episodes (WHO 2015).

The field work was carried out intermittently between April 2019 and July 2020. The technique employed involved benchwork, questionnaire, oral interview and participant observation. The questionnaire was produced and distributed during world malaria day in April 25, 2019, at Akpajor, Eleme local government area,world diabetes day 14 November 2019, at Eleparanwa,Obio/Akpor local government area and at various health centres's from December 2019 to June 2020 – Obio/Cottage hospital, RumuokwurishiModel Comprehensive Health Centre, Model Comprehensive Centre Churchill, Town, Agbonchia, Model Comprehensive Health Centre, Eleme.

3.1 Sampling the Population

The sample size of the population was determined using the Taro Yamani formula for sample determination in smaller population.

$$n = \frac{N}{1+N(e)^2}$$

Where n = Sample size
N = Population
I = A constant
e = Margin of error test of significance

$$n = \frac{2,200}{1+2,200(0.05)^2} = 338$$

Target population of patients of 2,200 and the sample size of 338 was used for the study. The sample size represents 15.4% of the target population.

3.2. Validity and reliability of the instrument

The research instruments, the laboratory bench work, the questionnaire and key in-depth interview (KII) guide were subjected to validity by two research supervisor's expertise team and other experts in the department of Zoology and Environmental Biology (ZEB) School of Natural Science Michael Okpara University, Umudike Umuahia, Nigeria. This was to ascertain the appropriateness of the instrument in coverage, scope, clarity, relevance and content, their comments, contributions, corrections and suggestions were used to improve and enhance the validity of the instrument for the study. The study adopted the test and retest method to test the instrument reliability. This involves first administering 20 copies of the questionnaires to 20 patients and others not used in the study. After an interval of two weeks, the researcher re-administered the same instrument to the same 20 patients and others.

4.1 Analysis and Results

Table 1: Correlations between household disposable income and malaria direct cost of treatment

	HDI	MDC
Pearson Correlation HDI Correlation Coefficient	1.000	.732**
Sig. (2 tailed)	.	0.000
N	338	338

MDC Correlation Coefficient	.732**	1.000
Sig. (2 tailed)	0.001	.
N	338	338

** Correlation is significant at the 0.05 level (2-tailed)

Hypothesis 1 (Ho_1) shows a correlation coefficient r = .732 which suggests a strong inverse relationship. Also since the p-value is (0.000) which is less than the alpha value for a the 2 tailed test (0.05), the null hypothesis was rejected. This implies that higher rate of occurrence of malaria treatment by way of direct costs incurred in treating the infection, will reduce disposable income of households.

Table 2: Correlations between household high rate of poverty and malaria direct cost of treatment

	HRP	MDC
Pearson Correlation HDI Correlation Coefficient	1.000	.742**
Sig. (2 tailed)	.	0.000
N	338	338
MDC Correlation Coefficient	.942**	1.000
Sig. (2 tailed)	0.001	.
N	338	338

** Correlation is significant at the 0.05 level (2-tailed)

Hypothesis 2 (Ho_2) shows a correlation coefficient r = .742 which suggest a strong inverse relationship. Also since the p-value is (0.000) which is less than the alpha value for the 2 tailed tests (0.05), the null hypothesis was rejected. This implies that material direct cost of treatment affects the poverty level of the people.

Table 3: Correlations between household disposable income and malaria indirect cost of treatment

	HDI	MIC
Pearson Correlation HDI Correlation Coefficient	1.000	.811**
Sig. (2 tailed)	.	0.000
N	338	338
MDC Correlation Coefficient	.811**	1.000
Sig. (2 tailed)	0.001	.
N	338	338

** Correlation is significant at the 0.05 level (2-tailed)

Hypothesis 3 (Ho_3) shows a correlation coefficient r = .811 which suggests a strong inverse relationship. Also since the p-value is (0.01) which is less than the alpha value for a 2 tailed test (0.05), the null hypothesis was rejected. This implies that indirect cost of treating malaria reduces household dispensable income.

Table 4: Correlations between household high rate of poverty and malaria indirect cost of treatment

	HRP	MIC
Pearson Correlation HDI Correlation Coefficient	1.000	.664**
Sig. (2 tailed)	.	0.000
N	338	338
MDC Correlation Coefficient	.664**	1.000
Sig. (2 tailed)	0.001	.
N	338	338

** Correlation is significant at the 0.05 level (2-tailed)

Hypothesis 4 (Ho_4) shows a correlation coefficient r = . 664 which suggest a positive and strong association. Also since the p value is (0.000) which is less than the alpha value for the 2 tailed tests (0.05), the null hypothesis was rejected. This implies that indirect cost of treatment malaria affects the poverty level of the people.

Table 5

Correlations					
Model	**Unstandatdized Coefficients**		**Standatdized Coefficients**	**t**	**Sig.**
	B	Standard Error	Beta		
Constant HDI	14447.628	40498.7		3.27	0.002
MDC	0.604	0.1	0.732	6.078	0.000

a. Dependent variable: HDI
b. Direct cost (of treating malaria)

Table 5 shows that the direct cost of treating malarial infection (MDC) has a calculated t – value of 6.078 with a corresponding significant value of 0.000. This p-value is less than 0.05 level of significance hence the findings lead to the rejection of the null hypothesis with the conclusion that the direct cost of treating malarial infection has a significant effect on the disposable income of households in Port Harcourt, Rivers State.

Table 6

Correlations					
Model	**Unstandatdized Coefficients**		**Standatdized Coefficients**	**t**	**Sig.**
	B	Standard Error	Beta		
Constant HRP	77.03	274.283		.347	.720
MIC	0.007	0.001	.742	7.331	0.000

a. Dependent variable: HDI
b. Indirect cost (of treating malaria)

Table shows that the direct cost of treating malarial infection (MDC) has a calculated t – value of 7.331 with a corresponding significant value of 0.000. This p-value is less than 0.05 level of significance hence the findings lead to the rejection of the null hypothesis with the conclusion that the direct cost of treating malarial infection has a significant effect on the rate of poverty affecting among households in Port Harcourt, Rivers State.

Table 7

Correlations					
Model	**Unstandatdized Coefficients**		**Standatdized Coefficients**	**t**	**Sig.**
	B	Standard Error	Beta		
Constant HRP	221434.214	17301.98		12.782	0.002
MIC	1.1777	0.074	0.811	18.434	0.000

a. Dependent variable: HDI
b. Indirect cost (of treating malaria)

Table 7 shows that the indirect cost of treating malarial infection (MIC) has a calculated t – value of 18.434 with a corresponding significant value of 0.000. This p-value is less than 0.05 level of significance hence the findings lead to the rejection of the null hypothesis with the conclusion that the indirect cost of treating malarial infection has a significant effect on the disposable income of households in Port Harcourt, Rivers State.

Table 8

Correlations					
Model	**Unstandatdized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Standard Error	Beta		
Constant HRP	68.286	261.167		.3783	0.002
MIC	.018	0.003	.664	6.438	0.000

a. Dependent variable: HRP
b. Indirect cost (of treating malaria)

Table 8 shows that the indirect cost of treating malarial infection (MIC) has a calculated t – value of 6.438 with a corresponding significant value of 0.000. This p-value is less than 0.05 level of significance hence the findings lead to the rejection of the null hypothesis with the conclusion that the indirect cost of treating malarial infection has a significant effect on the rate of poverty affecting households in Port Harcourt, Rivers State.

5.1 Summary of Findings and Conclusion

Table 5 shows the correlation between the direct cost of treating malaria and the disposable income of households. A correlation of 0.732 (73 percent) implies that a strong association exists between the explanatory variable (direct cost of treating malaria) and the criterion variable (disposable income of households). Direct cost of treatment has a calculated t-values of 6.078 with a corresponding p-value of 0.000 < 0.05 (level of significance). Hence the findings lead to the non-acceptance of the null hypothesis with the conclusion that direct cost of treating malaria has a significant effect on the disposable income of households.

Table 6 shows the correlation between the direct cost of treating malaria and high rate of poverty among households. A correlation of 0.742 (74 percent) implies that a strong association exists between the explanatory variable (direct cost of treating malaria) and the criterion variable (high rate of poverty among households). Direct cost of malaria treatment has a calculated t-values of 7.331 with a corresponding p-value of 0.000 < 0.05 (level of significance). Hence the findings lead to the non-acceptance of the null hypothesis with the conclusion that direct cost of treating malaria has a significant effect on high rate of poverty among house households.

Table 7 shows the correlation between the indirect cost of treating malaria and the disposable income of households. A correlation of 0.811 (81 percent) implies that a strong association exists between the explanatory variable (indirect cost of treating malaria) and the criterion variable (disposable income of households). Indirect cost of malaria treatment has a calculated t-values of 18.434 with a corresponding p-value of 0.000 < 0.05 (level of significance). Hence the finding is not in support of the stated null hypothesis; it is thus concluded that indirect cost of treating malaria has a significant effect on the disposable income of households.

Table 8 shows the correlation between the indirect cost of treating malaria and high rate of poverty among households. A correlation of 0.664 (66 percent) implies that a strong association exists between the explanatory variable (indirect cost of treating malaria) and the criterion variable (high rate of poverty among households). Direct cost of malaria treatment has a calculated t-values of 6.438 with a corresponding p-value of 0.000 < 0.05 (level of significance). Hence the finding is not in support of the stated null hypothesis; it is thus concluded that indirect cost of treating malaria has a significant effect on high rate of poverty among households.

This study confirms that the treatment of malaria infection will not only affect the disposable (spending income) of households but it could equally increase their rate of impoverishment. This outcomes corroborates the assertion of Russel, 2004 and 2005 that ill-health can cause household impoverishment through income losses and medical expenses that trigger a spiral of asset depletion, indebtedness and cuts to essential consumption It also supports Russel 2001 work which shows that when the cost of treating illness is high, households are sent to poverty and are kept there. The poor are likely to be sick and when sick, less likely to access health promptly. Increase in poverty level will therefore mean increase in number of sick people and lack of personal resources means they would only seek treatment when condition have become catastrophic, creating desperation. Households from the poorest income quartile experience higher cost burdens than better off groups (Russel 2001). The implication of these results is that the country's goal of eliminating the incidence of poverty will not be achieved unless effective malaria control programmes are put in place.

5.2. Recommendations

The study identifies and recommends based on our findings the need for government to intensify efforts in malaria elimination through eradication programme, universal health coverage, national health insurance and free malaria treatment. In addition, government is called upon to strengthen the health system in Nigeria and provide effective leadership as avenue to mitigate the huge economic burden of malaria treatment in the country.

It is clear that investment in malaria control and education could mitigate the economic burden imposed by malaria. Hence it is imperative that government intensifies public education awareness about the disease transmission and on prevention measures. A higher level of public awareness or education on malaria in general is positively related to the presence of malaria at the household level. Incidence of malaria is higher for less educated households and in regions with poorer preventive health services. Hence, public health interventions which decrease the households' risk of contacting malaria will improve labour productivity and result in higher output levels as well as improve the disposable income of households and by extension, their quality of living.

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