FACTORS AFFECTING THE PREVALENCE OF MALARIA AMONG UNDER-FIVE IN RUMUIGBO TOWN, OBIO-AKPOR L.G.A, RIVERS STATE

BY

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER IN PUBLIC HEALTH

DECEMBER, 2016

CERTIFICATION PAGE

This is to certify that this thesis on " Factors Affecting the Prevalence of Malaria in Under-Five Children in Rumuigbo town Obio/kpor Local Government Area, Rivers State" was conducted by Amadi Dorathy (20085655229) of the Department of Public Health under the supervision of Dr (Mrs) E. A. Nwoke and had been read and approved as meeting the requirement for the award of masters degree in Public Health.

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DEDICATION

This piece of research work is solely dedicated to God the infinite for his sufficient Grace in my weakness, mercies and abundant love beyond human comprehension.

ACKNOWLEDGEMENTS

This work would have not been successful without the vehement contribution of the people around me worthy of commendation.

My profound gratitude goes to my supervisor, Dr. (Mrs) E. A. Nwoke for her understanding and patience in correcting this work from the beginning to the final stage. I also express my appreciation to the Head of Department, Rev. Sr. Prof. E. T. Oparaocha for her criticism, advice and direction before and during the course of this research work. Thanks to the lecturers in the Department who taught me in the course of this program and other staff members of this venerable Department in order of Rank for their moral, intellectual and general support.

Worthy of mention is my husband, my children and my course mates for their patience, tolerance and understanding, throughout the period of this research work.

Above all, I owe all to God 'ELOHIN' for his sustenance and enablement in this journey so far.

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ABSTRACT

The factors affecting the prevalence of malaria among the under-five children in Rumuigbo town, Obio-Akpor L.G.A of Rivers State was studied. Three objectives that guided the study include; determining if parents' income, mothers literacy level and occupation affects the sustenance of malaria in Rumuigbo. To determine if the use of insecticide treated nets is a determinant in the sustenance of malaria among under-five in the area and finally to ascertain if environmental factors (living close to stagnant water, blocked drains and water retaining plants) are determinants in the prevalence of malaria in Rumuigbo town. A descriptive research design was adopted. Structured and standardized questionnaire was administered to 480 care givers of under-fives selected systematically from 3 hospitals in the area. The result indicated that 42 percent were males while 58 percent were females. The prevalence of malaria was 62 percent in Rumuigbo. The Chi-square result revealed that average monthly income of parents (p-value < 0.001), mothers' occupation (p-value < 0.001), the non-use of ITNs ($p < 0.001$) are factors associated with the sustenance of malaria in the area. There is also association between some environmental factors such as living close to blocked drains (p-value < 0.001) and water retaining plants (p-value < 0.001) with malaria prevalence. Mothers should be enlightened on the risk factors of malaria. There should also be enlightenment campaign on the use of ITNs to reduce the prevalence of malaria among under-five.

Keywords: Prevalence, Malaria, Under-five, Rumuigbo, Obio-Akpor L.G.A, and Rivers State

CHAPTER ONE

INTRODUCTION

Background to the study

According to World Health Organization (2000), malaria affects 3.3 billion people, or half of the world's population, in 106 countries and territories. It estimates that 216 million cases of malaria occurred in 2010, 81% in the African region and that there were 655,000 malaria deaths in 2010, 91% in the African Region, and 86% were children under 5 years of age (WHO, 2010).

Malaria is the third leading cause of death for children under five years worldwide, after pneumonia and diarrheal disease and the 2nd leading cause of death from infectious diseases in Africa, after HIV/AIDS (Williem, 2002). Thirty countries in Sub-Saharan Africa account for 90% of global malaria deaths. Nigeria, Democratic Republic of Congo (DRC), Ethiopia, and Uganda account for nearly 50% of the global malaria deaths (Whitty and Rowland, 2002).

Almost one out of five deaths of children under 5 in Africa is due to malaria (WHO, 2008). There are four main types of malaria parasite which are the Plasmodium vivax, Plasmodium malaria Plasmodium ovale, and Plasmodium falciparum.

Although malaria is transmitted exclusively by anophelines, only certain species are important vectors of the disease. Several factors determine both the importance of each specie as a vector of malaria (or other diseases) and the options for control. A good understanding of the biology and ecology of the principal vectors is essential to the development of an integrated vector control approach. These factors include the following:

- Time of biting (evening, dawn, night)
- Flight range of the vector (usually 3 kilometers [km])
- Feeding preferences of adult female mosquitoes (humans or animals)
- Adult behavior—particularly, preference for biting and resting indoors (endophagic, endophilic) or outdoors (exophagic, exophilic)
- Larval habitat preferences (e.g., pools vs. containers, brackish vs. fresh water, full sun vs. shade)
- Resistance to insecticides

The malaria parasite enters the human host when an infected Anopheles mosquito takes a blood meal. First, sporozoites enter the blood stream and migrate to the liver. They infect liver cells called hepatocytes, where they multiply into merozoites, rupture deliver cells and escape back into the blood stream (World Malaria Report, 2011). Then the merozoites infect red blood cells where they develop into ring forms, trophozoites and schizonts which in turn produce further merozoites. Sexual forms (gametocytes) are also produced which if taken up by a mosquito will infect the insect and continue the life cycle (World Malaria Report, 2008).

Household level factors associated with adult malaria risk are low vegetation level in compound, distance to the vector-breeding site, income, education, pregnancy and occupation.

Statement of problem

Despite progress in fighting malaria worldwide, the parasitic disease kills close to 800,000 persons annually (WHO, 2002). Children less than five years of age living in sub-Saharan Africa are mainly affected. Malaria exerts a significant health and economic burden on Nigeria. According to the statistics of the Nigerian National Malaria Control Program, it is responsible for 60% of out-patient visits to health facilities, 30% of childhood deaths, 25% of infant deaths and 11% of maternal deaths; and an estimated loss of 132 billion Naira in the form of treatment and prevention cost, and loss of man-hour, amongst others (RBM, 2005).

The high rate of hospital visits by mothers due to cases of malaria has prompted the researcher to investigate the factors that are affecting the prevalence of malaria among under-five in the area.

Purpose of the study

The study aims at ascertaining the factors affecting the prevalence of malaria among under-five in Rumuigbo, Obio-Akpor Local Government Area of Rivers State.

Specific Objectives

1. To determine if socio-demographic characteristics (parents' income, mothers literacy level and occupation) affect the sustenance of malaria in Rumuigbo.
2. To determine if the non use of insecticide treated nets is a determinant in the sustenance of malaria among under-five in the area.
3. To ascertain if environmental factors (living close to stagnant water, blocked drains and water retaining plants) are determinants in the prevalence of malaria in Rumuigbo town.

Research questions

The following research questions guided the conduct of the study:

1. Does parent's socio-demographic variables (income, literacy level and occupation) affect the sustenance of malaria in Rumuigbo?

2. Does the use of insecticide treated nets determine the prevalence of malaria among under-five in the area?

3. Do environmental factors (living close to stagnant water, blocked drains and water retaining plants) determine the prevalence of malaria in Rumuigbo town?

Research hypotheses

The following null hypotheses were formulated for the study:

Hypothesis 1: Parents' income does not significantly affect the sustenance of malaria in Rumuigbo

Hypothesis 2: Mothers' literacy level is not a significant determinant in the sustenance of malaria in Rumuigbo.

Hypothesis 3: Mothers' occupation does not significantly influence the sustenance of malaria in the area.

Hypothesis 4: The use of insecticide treated nets (ITNs) is not a significant determinant in the sustenance of malaria among under-five in the area.

Hypothesis 5: Environmental factors (living close to stagnant water, blocked drains and water retaining plants) are not significantly determinants in the prevalence of malaria in Rumuigbo town.

Significance of study

This study shall be relevant in its potential to contribute to the reduction in the prevalence of malaria among the under five children by improving the hygiene and sanitary condition and also provision of basic amenities. The result of the study shall be beneficial to researchers, health planners, government agencies, non-governmental agencies, and parents.

The study may open up more areas of research and program development that may also lead to the improvement of the general health of the under five children and also reduce the morbidity and mortality rate of under five children.

Scope of the study

The study focused on the factors affecting the prevalence of malaria among under-five in Rumuigbo, Obio-Akpor L.G.A., Rivers State. It was delimited to parents' income, occupation, level of education and environmental factors such as living close to stagnant water or pools, blocked drains and water retaining plants. The study was delimited to children below five years in Rumuigbo town, Obio-Akpor L.G.A. of Rivers State.

CHAPTER TWO

LITERATURE REVIEW

Malaria is one of the commonest tropical diseases plaguing the African continent and the ruler areas of the continent in particular (WHO, 2008). Among the major diseases that are common in Africa, malaria is one of the greatest threats facing development in Africa today (Alaba, 2002). Malaria is characterized by cycle of chills, fever, pain and sweating. Historical records suggest malaria as infected human since the beginning of mankind. The name "malaria" (meaning "bad air" in Italian") was first used in English in 1740 by H. Walpole when describing the disease. The term was shortened to "malaria" in the 20^{th} century. C. Laveran in 1880 was the first to identify the parasites in human blood. In 1889 R. Ross discovered that mosquito transmitted malaria (Bogitish, 1990). The parasite is constrained only by the expanse of it anopheles vector and social and climatological condition of the area it finds itself. The tropical band in which the parasite is found contains countries that present.

Very little defense against the spread of malaria, consisting predominantely of Third World Countries who lack surplus economic recourses to enact legitimate and effective antimalaria programmes (WHO, 2000). Condition of poverty, low standard of living in which health and educational services are underdeveloped and poorly funded, mainutritio, illiteracy and ignorance all serve to create an environment that enables plasmodium to thrive (Prothero, 1998). Not only the majority of affected countries lack significant education or monetary resources to combat the spread of malaria, but many of them exacerbate the problem. Poorly fed irrigation system and unmonitored borrow-pit for housing construction encourage the growth of anopheles populations (Bruce-Chwatt, 2000). The nomadic pastoral culture of North and Northeastern Africa and Mesopotamian regions encourages the spread of the parasite through infected individual into uninfected areas (Prothero, 1998). A great number of human factors contribute to the already volatile natural state of malaria transmission and frustrate what effort are made today to control the diseases (Prothero, 1998).

Of the four common species that causes malaria, the most serious type is plasmodium falciparum malaria. It can be life threatening. However, another relatively new species, plasmodium knowlesi, is also a dangerous species that is typical found only in long-tailed and pigtail macaque monkeys (Holder, 1999). Like P. Falciparum, P.knowlesi may be deadly to any one infected. The other three common species of malaria (P. Viax, P. Malariae and P. Ovale) are generally less serious and are usually not life threatening. It is possible to be infected with more than one species of plasmodium at the same time.

Malaria is a disease caused by plasmodium spp. Parasite that infect about 400 million people by year with about 2 million deaths. Symptoms include the recurrent cycle (every one to three days) of fever chills muscle aches, headaches; nausea, vomiting, and jaundice also may occur (World Malaria Report, 2011). Anopheles mosquitoes transmit the parasite when they bite. The parasite undergoes a complicated life cycle in both mosquitoes and human; the cycle begins again when the mosquitoes take a blood meal from a human that is contaminated with mature parasites. According to Colluzi (1999), African, Asia and central and South America are the area with high numbers of malaria infections. The incubation period of malaria symptoms is about one to three weeks but may be extended to eight to ten months after the initial infected mosquito bite occurs. Some people may have dormant parasites that may get reactivated years after the initial infection.

Malaria is diagnosed by the patient's history of recurrent symptoms and the identification of the parasite in the parent's blood, usually by a Giemsa blood smear. Malaria is usually treated by using combination of two or more anti-parasite drugs incorporated into pills that are taken before exposure (prophylactic or preventative therapy) or during infection. More serious infection are treated IV anti-parasitic drugs in the hospital. Infants, children, and pregnant females, along with immune depressed patients are at higher risk for worse outcomes when the infected with malaria parasites to reduce the chance of getting malaria, people should avoid Malaria-endemic areas of the world, use mosquito repellents, cover exposed skin, and use mosquito netting covered areas when sleeping. Burton et al, (2000) suggested that the prognosis for the majority of malaria patients is good; most recover with no problems, unless infected with p. falciparum or p. knowlesi, which may have fair to poor outcome unless treated immediately. Infants, children under five years of age, pregnant female and those with depressed immune systems frequently have a fair to poor prognosis unless effectively treated early in the infection.

Currently, about 2 million deaths per year worldwide are due to plasmodium infections (World Malaria Report 2011). The majority occur in children under five years of age in sub-saharan Africa countries. There are about 400 million new cases per year worldwide (World Malaria Report, 20011). Most people diagnosed in the U.S obtained their infection outside the country, usually while living or traveling through an area where malaria is endemic (Clyde, 2000).

Prevalence of malaria in Africa

Malaria is world most widespread infection. According to the world malaria report 2011, malaria is prevalent in 106 countries of the tropical and semitropical world, with 35 countries in central Africa bearing the highest burden of cases and deaths. It maintained that in 2007, 2.37 billion people were estimated as being at risk of p. falciparum malaria worldwide with 26% located in the WHO AFRO regions compared to 62% in the combined SEARO-WPRO region. Of this total population at risk, about 42% or almost 1 billion people lived under extremely low malaria risk.

According to wang et al, (2008), the five plasmodium species that infect human beings (p. Falciparum, p. Vivax, p. Malariae, p, ovale and p. knowlesi), p. Falciparum and p. vivax cause the significant majority of malaria infections. P. falciparus, which causes most of the severe cases of deaths, is generally found in tropic regions, such as sub-saharan Africa and southeast Asia, as well as in the western pacific and in countries sharing the amazon rainforest. P. vivax is common in most of Asia (especially southeast Asia) and the eastern Mediterranean, and in most endemic countries of the Americas.

Estimates of the annual incident of malaria vary widely. According to the estimates of the World Malaria Report, 2011, there were 216 million episodes of malaria in 2010, of which approximately 18%, or 174 million cases, were in the Africa region about 91% being due to p. falciparum. But the actual number of cases may be much more and the number of confirmed cases reported by national malaria control programme was only 11% of the estimate number of cases. Hay et al have estimated the number of clinical cases of p. falciparum malaria in 2007 at 451 million. According to the estimate of the World Malaria Report, 2011, the vast majority of cases (81%) where in the African region followed by the South-East Asia (13%) and Eastern Mediterranean Region (5%). Nineteen Countries in Africa – Rwanda, Angola, Zambia, Guinea, Chad, Mali, Malawi, Cameroon, Niger, Burkina Faso, Cote d'Ivoire, Ghana, Mozambique, Uganda, Kenya, United Republic of Tanzania, Ethiopia, Democratic Republic of Congo and Nigeria – accounted for 90% of all WHO estimate causes in 2006. Hay et al reported that more than half of all estimated P. falciparum clinical cases occurred in Nigeria, the DRC, Myanmar (Burma) and India.

WHO (2006) suggested P, vivax is transmitted in 95 countries in tropical, sub-tropical and temperate regions except where there is a natural absence of anopheline mosquitoes (East of Vanuatu in the south pacific) or among population lacking the Duffy receptor on red cells (in much of Africa). It is only P. vivax malaria that occur in the temperate latitudes – up to the Korean peninsula and across the southern temperate latitudes of Asia to the Mediterranean Sea. Approximately 2.6 billion people are at risk of infection with P. vivax malaria, and the ten countries with the highest estimated population at risk, in descending order, are India, China, Indonesia, Pakistan, Viet Nam, Philippines, Brazil, Myanmar, Thailand and Ethiopia. Estimates of annual infections range from 70 to 390 million, with about 80% occurring in South and South East Asia. Approximately 10-20% of the World's cases of P. Vivax infection occur in Africa, South of the Sahara. In Eastern and Southern Africa, 10% of malaria case are due to P. vivax whereas it occur for <1% of cases in Western and Central Africa. Outside of Africa, P. vivax accounts for >50% of all malaria and about 80-90% of P. vivax outside of Africa occurs in the mid East, Asia and the Western pacific and 10-15% in central and South America.

According to the World Malaria Report, 2011 there were 655000 malaria deaths worldwide in 2010, compared to 81,000 in 2009. It has been estimated that 91% of deaths in 2010 where in the Africa Region followed by the South-East Asia (6%) and Eastern Mediterranean Regions (3%). About 86% of deaths globally where in children under five years of age.

Symptoms of malaria

The symptom of malaria include flu-like illness with fever, chills, muscle aches, and headache. Some patients develop nausea, vomiting, cough diarrhea. Cycles of chills, fever and sweating that repeat every one, two, or three days are typical. There can sometimes be vomiting, diarrhea, coughing and yellowing (Jaundice) of the skin and whites of the eye due to the destruction of red blood cells and liver cells.

People with severe P. Falciparum malaria can developed bleeding problem, coma and can die from the infection or its complication. Cerebral malaria (Coma, or altered, mental status or seizures) can occur with severe P. falciparum infection. It is lethal if not treated quickly; even with treatment about 15%-20% die.

Method of malaria transmission

The life cycle of malaria parasites (plasmodium) is complicated and involves two hosts, humans and Anopheles mosquitoes. The disease is transmitted to human when an infected Anopheles mosquitoes bites a person and inject the malaria parasites (sporozoites) into the blood (coluzzi, 1999)

Sporozoites traveled through bloodstream to the liver, mature, and eventually infect the human red blood cells. While in red blood cells the parasite again develop until a mosquitoes take a blood meal from an infected human and ingest human red blood cells containing the parasites. Then the parasites reach the anopheles mosquitoe's stomach and eventually invades the mosquitoes salivary glands. When anopheles mosquitoes bite a human, these sporozoites complete and repeat the complex plasmodium life cycle. P. ovale and P. vivax can further complete their cycle by producing dormant stages (hypnozoites) that may not develop for weeks to years.

Incubation period of malaria

The period between the mosquitoes bite and the onset of the malaria illness is usually one to three weeks (7 to 21 days). This initial time period is highly variable as report suggest that the range of incubation period may be four days too one year. The usually incubation period may be increase when a person has taken an inadequate course of malaria prevention medication. Certain types of malaria (P. vivax and P. ovale) parasites can also take much longer, as long as eight to 10 months, to cause symptoms. These parasites remain dormant (inactive of hibernating) in the liver cells during this time. Unfortunately, some of these dormant parasites can remain even after patience recovers from malaria, so the patience can get sick again. This situation is termed relapsing malaria.

Diagnosis of malaria

Clinical symptoms associated with travel to countries that have identified malaria risk (listed above) suggest malaria diagnosis. Malaria test are not routinely ordered by most physicians so recognition of travel history is essential. Unfortunately, many disease can mimic symptoms of malaria (for example, yellow fever, dengue fever, typhoid fever, cholera, filariasis, and even measles and tuberculosis). Consequently, physicians need to order the correct special test to diagnose malaria, especially in industrialized countries where malaria is seldom seen. Without the travel history, it is likely that other tests will be ordered initially. In addition, the long incubation period to tend to allow people to forget the initial exposure to infected mosquitoes.

The classic and most used diagnostic test for malaria is the blood smear on a microscope slide that is stained (Giemsa stain) to show the parasite inside the red blood cell.

Treatment of malaria

Three main factors determine treatment: the infecting species of plasmodium parasite, the clinical situation of patient (for example, adult, child, or pregnant female with either mild or severe malaria), and the drug susceptibility of the infecting parasite (Slater et al, 2002). Drug susceptibility is determined by the geographic area where the infection was acquired. Different area of the world have malaria types that are resistance to certain medications.

Anti-malaria therapy should ideally destroy all sexual forms of the parasite in order to cure the clinical illness, eliminating sporozoites and exo-erythrocytic forms to relapses and kill gametocytes to block transmission from the vector (mosquito). Effective, affordable and safe treatment of malaria particularly falciparum malaria is becoming increasingly difficult as resistance to chloroquine and other anti-malaria drugs continue to spread through the tropics. Drug treatment of malaria is not always easy. Chloroquine phosphate (Aralen) is the drug of choice for all malaria Parasites except for chloroquine-resistant plasmodium strains (Alaba, 2002). Although almost all strains of P. malariae are susceptible to chloroquine, p. vivax, and even some P. ovale strains have been reported as resistant to chloroquine. Unfortunately, resistant is usually noted by drug treatment failure in the individual patient. The WHO's treatment policy, recently established in 2006, is to treat all cases of complicated P.faciparum malaria with artemisininderived combination therapy (ACTs). ACTs are drug combinations (for example, artesunate-amodiaquine, artesunate-mefloquine, artesunate-pyronaridine, dihydroartemisinin-piperaquine and chlorproguanil-dapsonearteunate) used to treat drug-resistance P. faciparum (World Malaria Report, 2011).

Control of the vector

1. Spraying residual insecticide such as DDT
2. Spraying the breeding sites with petroleum oil and Paris green as larvicides
3. Flooding and flushing breeding sites
4. Eliminating breeding places such as lagoon and swamps
5. Prevention of man-mosquito contact through the use of insecticide treated net while sleeping

6. Biological control of larva guppy fish ((poecilia reticulate) and Gambusia affills to control the larvae
7. Avoiding exposure to mosquito bite by wearing long sleeve clothing and trouser after sunset, when the insects are most active.
8. Application of mosquito replant containing diethyltouamide to exposed skin.
9. Early diagnosis and prompt treatment of infected patients.
10. Use of genetic control.

Epidemiology of malaria

The successful eradication of malaria in a region is dependeant not only of the parasite as well. Its application to malaria is an example of a complex biological system that involves the eradication between the mosquito and the human within an intricate environment in which climate, social conditions, and economics conditions all contribute influence (Krier, 2001). The epidemiology of malaria is interested in understanding the interaction between four factors involved in the transmission of the disease- the parasite, the host, the vector, and the environment.

The Parasite

Intense observation and experimentation over the last 150 years have yielded an immense amount of knowledge about the life cycle and transmission of the plasmodium parasites. Integral to the epidemiology study of the parasite is the knowledge of how various species exert extreme longevity in the host, surviving for up to 50 years. The characteristic, in combination with its slow bloodstage cyle and lower metabolic rate, enables it to be more resistant to anti-malaria drugs and, and with recent human technology, be likely to be transmitted through blood transfusion (Clyde, 2000) P. ovale and P. vavax both persist in the liver of their host, releasing parasites periodically to enter the erythrocytic stage.

These strains are thought to posses two types of sporozoites –one that demonstrates normal activity through exo-erythrocytic and erythrocytic stages within a normal time period, and an

Abnormal sporozoite termed a hypnozoite that remains dormant in the hepatocyte indefinitely, released by physiologic changes in the host (Bogitish 1990). Relapse, therefore, is common in P. ovale and P.vivax, which ensures an increased availability of gametocytes for anopheline ingestion.P. faciparum, responsible for high percentage of the malaria fatalities, possesses a rapid reproduction rate and is not preferential for what age erythrocyte it infects, giving it marked advantage in mixed infections (Clyde, 2000).

Many parasitic subspecies possess specific adaptation to increase transmission probability and to prolong host life. Many parasite observe long incubation period to align their highest level of clinical parasitemia with periods of increased Anophelene feeding activity (Clyde, 2000 & Krier,2001).

The Human host

An age-dependant prevalence rate in endemic areas relate to gradual homoral, antibody-dependent acquisition disease out not to parasitemia.

In hyperendemic and holoendemic settings, most clinical disease manifestation presents in individuals before the the age of 5 years, while peak prevalence rates are in individuals aged 10-15 years. Interestingly, the age dependent immunity carries over to the ability to clear chloroquine-resistance parasites when given chloroquine.

Children aged 1-5 years are least able to clear chloroquine resistant parasites, while those over the age of 5 years clear more than 50 of infections with chloroquine-resistance parasites. Whether this presumed humoral ability to make drugs work better can be translated into a vaccine construct is underexposed.

Human factor affecting the epidemiology of malaria are both physiological and behavioural. In western African, most individual lack the duffy surface antigens that that are necessary for P. vivax penetration of the erythrocytic Plasma membrane (Bogish, 1990). People carrying the gene for haemoglobin S, which is phenotypically expressed as sickle-cell anaemia, are unable to support P. falcipaarum growth (Bruce- Chwatt, 2000). There is also recent evidence, although denied by studies done by S.K.Martin, that a deficiency in glucose-6-phos sphate dehydrogenase gives some amount of protective action against thesusceptibility of individuals to infection. Although a limited and short-lived is given passive immunity is given to children by their mothers transplacementally, the lack of adequate immune response to infection is the explanation given to the high mortality rates among infected children (Clyde, 2000). Because of repeated exposure, most individuals in infectious area develop an acquired immunity strong enough to mitigate the symptoms of further attacks and to restrain parasitemia (clyde, 2000). Behavioural, men in malarious areas often work at times of high vector activity and, as a result, display a higher degree of infection than women of the area. Other individuals fail to take necessary precautions, like the use of an insect repellent or protective netting at night, that help prevent a mosquito bite. Mass migrations as a result of war, famine or political distress are also major factors in the epidemiology of malaria.

The Anopheles Vectors

Critical density, a common statistic used to represent the influence of vectors on the endemic status of malaria in a population, is a measure of the number of bites per person per night. This measure is a good indication of the vector influence because it includes climatic changes and the preference of local Anopheles species for humans. Of 400species of Anopheles, only 60 are proven vectors of human malaria (Bruce-Chwat, 2000). Many species prefer animals, rather than humans, for blood meals, a characteristic that limits the spread of malaria in certain areas (Clyde, 2000). The longevity of mosquito is another variable that affects the spread of malaria. While some species lives long enough to allow several generations of sporozoites to develop, obviously a favourable condition for the parasite, other species have life spans of less than 10 days, which is not enough time for any of the species of Plasmodium to complete their vector phase of sporozoite production (Clyde,2000 & Krier, 2001). Mosquitoes also demonstrate a seasonal fluctuation in population and, in a smaller time frame, specific times of climate, which restrains the mosquito not only to specific seasons of transmission, but also to geographic regions.

The environment

The primary influence of the environment of the transmission of malaria is meteorologic. Climatic conditions play a central role in determining the range of the vector, the work and social habits of the host, and certain cycle length constraints on the parasite. Colder temperatures slow down the natural cycle of the parasite, sometimes extending them beyond the longevity of the mosquito, and cease the metabolic activity of the parasite if temperature dips below 16 C(bailey, 2002; Bruce-Chawatt,2000). Rainfall is an important factor in the environment influence, but it is complex in its effects. Although rainfall increases the amount of water available for the female Anopheles breed, often large amount of rain disrupt standing bodies of water, transforming them into moving streams or rivers that will not support larval development. On the converse, the absence of rain for long period of time may increase the chances of a body of water being stagnant, but the total surface area of water is reduced.

Other source of stagnant water surface irrigation ditches, have dangerous effects on malarial transmission rates because they raise water tables and humidity in addition to providing a favourable breeding ground for Anopheles (Krier, 2001). Humidity, as mention before, has a marked effect on the survival rates of mosquitoes, and provides another boundary for the vector (Bruce-Chwatt, 2000; Clyde, 2000). When humidity levels begin to drop below 60%, the mortality rate for Anopheles begins to rise (Krier, 2001).

Strong winds have also been given credit for reducing the life expectancy of mosquitoes and preventing them from Ovipositioning. Gentle winds, however, broaden the flight range of the vector and therefore broaden the range of plasmodium transmission (Krier, 2001). The presence of water-bearing plants that cup small amounts of water, in which the mosquitoes breed, also has a positive effect on the rate of malaria transmission (clyde, 2000).

The Human and Economic Burden of Malaria

The cost of malaria can be measured in lives lost, in time spent ill with fever, and in economic terms. Money spent on preventing and treating malaria, the indirect cost of lost wages, time home from school, and time spent caring for sick children, adds up at the personal level. In the public sector, large fractions of health sector budgets are spent on malaria control and treatment (Poland et al., 2002). Social; and economic consequences are directly related to the severity of the malaria's increased morbidity and mortality. As a result of malaria, children spend days away from school and adults lose workdays. Age distribution of the population also has an effect on the burden of disease. In highly endemic area, the older population develops some collective immunity to malaria so the severity of malaria attacks is less than in children under five (WHO, 2008). Plasmodium ovale is less fatal than plasmodium falciparum. Since plasmodium ovale is less more prevalent in non-endemic area, in these areas the burden of diseases is less than in endemic areas where malaria is due to the fatal plasmodium falciparum. Currently, studies show that any increase in the disease burden of malaria as expressed in terms of DALYS is an unsustainable development (WHO, 2000) the level of socio-economic development in a country usually affects how much is invested in health care, which in turn affect the health outcome and severity of diseases like malaria. Like a vicious cycle, the health outcome affect income and capital which in turn affect the economic development in the country. Studies of Philips (2001) maintained that the effects of malaria have most often been motivated by a desire to understand the cost of the diseases to individual and society and frequently to justify public expenditure to diminish the burden. The burden of malaria is quite high. It is responsible for 300 – 500 clinical cases per year. 80% of these occur in Africa. It is responsible for one million deaths per year or virtually due to P. falciparum; 90% of these are in Africa (Philips 2001). Malaria impedes human development and is both a cause and consequence of under development. Every year Malaria is said to cause Africa and estimated $12 billion in lost productivity (WHO, 2008). Nigeria loses over N132 billion from the cost of treatment and absenteeism from work, school and farm to cost effect drugs and insecticides (World Malaria Report, 2011).

Climate Change and Malaria

The effects of temperature on both the vectors and parasites of malaria are easily seen in the latitudinal and altitudinal boundaries to malaria transmission. However, these boundaries seem to be changing as many highland areas have experienced malaria epidemics in the past few years. It has been hypothesized that increasing temperature could be part of the reason why malaria can now survive at higher altitudes. Many other confounding factors, however, could be causing the increases in malaria in these areas (Philips, 2001). In addition to predictions of the effect of climate change on malaria, studies which identify the factor or factors that are most responsible for any changes in malaria are important in order to understand the complexities of malaria in the actual world. There are many variables that affect malaria transmission in addition to climate changes, such as environmental modification (e.g. deforestation, increases in irrigation, swamp drainage), population growth, limited access to health care systems, and lack of or unsuccessful malaria control measures (Philips 2001). Some studies have been done on the subject, yielding differing result as to which factor or factors are most responsible for the increase in malaria. Most of the studies, however, do not take into account all of the factors that are related to malaria transmission.

Temperature affect many parts of the malaria life cycle. The duration of the extrinsic phase depends on temperature and on the species of the parasite the mosquito carrying. The extrinsic cycle normally lasts nine or ten days, but sometimes can be as short as five days (Bailey et al., 2002). As the temperature decreases, the number of days necessary to complete the extrinsic cycle increases for a given plasmodium species. P. vivax and P. falciparum have the shortest extrinsic incubation times and therefore are more common than P. ovale and P malariae (slater et al., 2002). The extrinsic phase takes the least amount of time when the temperature is 27^{o} C. below 20^{o} C, the life cycle of P. falciparum is limited. Malaria transmission the areas colder than 20^{o} C can still occur because Anophelines often live in houses, which tend to be warmer than external temperatures. Larval development of the mosquito also depends on temperature. Higher temperatures increase the number of blood meals taken and the number of times eggs are laid by the mosquitoes (Wang et al., 2008).

The intersections of the ranges of minimum and maximum temperature for parasite and vector development determine the impact of changes in temperature on malaria transmission. The minimum temperature for mosquito development is between 8-10^{o} C, the minimum temperatures for parasite development and between 14-19^{o} C with P. vivax surviving at lower temperatures than P. falciparum (Philips 2001). The optimum temperature for mosquito is 25-27^{o} C and the maximum temperature for both vectors and parasites is 40^{o} C (Poland et al., 2002). There are some areas where the climate is optimal for malaria and Anopheles mosquitoes are present, but there is no malaria. This is called "Anophelism without malaria" which can be due to the fact Anopheles mosquitoes present do not feed primarily on humans or because malaria control technique have elimininated the parasite (Philips 2001). If any changes, whether or otherwise,where to occur to bring another species to the area that does act as a vector for human malaria, then the potential for outbreaks for malaria is very high since there is no immunity in the human population there.

Anopheline mosquitoes breed in water habitats, thus requiring just amount of precipitation in order for mosquito breeding to occur (Holder et al., 1999). However it is know that different Anopheline mosquitoes prefer different types of water bodies in which to breed (Krishna, 1997). Too much rainfall, or rainfall accompanied by storm conditions can flush away breeding larvae. Not only the amount and intensity of precipitation, but also the time in the year, whether in wet or dry season, affects malaria survival. Rainfall also affects malaria transmission because it increases relative humility and modifies temperature, and it also affects where and how much mosquito breeding can take place. Some contend that the amount of rainfall may be secondary in its effects on malaria to number of rainy days or the degree of witness that exist after a rain event. Relative humidity also affect malaria transmission. Plasmodium parasites are not affected by relative humidity, but the activity and survival of Anopheline mosquitoes are (Philips 2001). If the average monthly relative humidity is below 60, it is believed that the life of the mosquito is also shortened that there is no malaria transmission.

Risk Factors of Malaria

Household level factors associated with adult malaria risk are low vegetation level in compound, distance to the vector-breeding site, income, education, pregnancy and occupation.

Occupation and Malaria

Certain occupations place individuals at greater risk for malaria infection than others (mills, 1998). Agricultural labourers, for instance, may not only place themselves at risk through increased contact with the malaria vector but also, through their migration, place others at greater risk by contributing to the spread of the disease (Okorosobo,2000). Consequently, occupation may reflect both soco-economic status and differential risk of exposure aoccupational attributes. Whtty et al, (2000) reviewed the relationships between irrigation (for rice, wheat, cotton, sugar cane, dams) and malaria in a variety of African countries, finding that rice irrigation does not increase malaria in local communities and may actually reduce it. The authors cite evidence from other studies to suggest this may be due to wealth creation in local communities that allows farmers to use disposable income to protect themselves from the mosquito vector (Audibert et al., 1990 & Boudin et al., 1992).

Location and housing type

Rural location can be associated with increased malaria risk for both epidemiological and socio-economic reasons. Similarly, rural residence can be accompanied by 22 potentially protective socio- economic factors against malaria risk such as education and income (Poland et al., 2002). A number of recent studies have used urban and rural varieties in their analysis of risk factors and transmission rate.

Gender and Malaria

While women are frequently disadvantage in socio-economic terms, the evidence of this translating into an increased risk for malaria infection is mixed. An additional factor is the ability of women to seek and receive prompt and proper care once infectected. Snow et al, (1997) argue that: the combination of epidemiological, social economical risk differentials means that children and women in areas of high transmission are inevitably the most disadvantaged population sector. In addition, pregnancy is an important risk factor for malaria infection, due to depressed immune status (WHO, 2006).

Poverty and Malaria

Most of the studies are limited to determining the mathematical significant of malaria. The links between malaria and poverty are multiple and complex (Alaba, 2002). Therefore a better understanding of the direction and magnitude of the causal relationship is needed, along with better understanding of the nature of poverty that is related to malaria. For example, understanding whether the relationship between malaria and poverty is related to household factors, community, or larger regional factors would help to identify whether further investigation and action is needed at one or more of these levels (Poland et al., 2002). Poverty sustains the conditions where malaria thrives, and malaria impedes economic growth and keeps communities in poverty. With a potential dual relationship between malaria and poverty, where poor household experience high malaria prevalence that maintains them in poverty, these household are trapped in reinforcing cyles (Poland et al., 2002). A research by Colluzi (1999) showed that malaria is higher in rural than urban areas. He maintained that this maybe associated with the high level of poverty because poor people live in dwelling prone to mosquito profanations. He also said that urban mothers responses to fever seen to be better than that of rural mothers.

This might explain or corroborated the high prevalence of fever in the rural areas reported in the analysis.

Other factor suggested by these researchers include the possession of bed nets, sleeping under bed net and type of bed Net child slept under. Another study conducted by Wang et al (2008) showed that childhood mortality due to malaria reduced significantly in areas where high prevalence of children slept under bed nets. In another study on bed net use and malaria, those who used bed nets had better knowledge of malaria than non-users; however, this usage did not influence malaria morbidity at the household level (Poland et al.,2002). The low rate of the possession of bed nets(which might be as a result of inability to afford them) might have accounted for the high prevalence of fever especially in rural areas in particular, and in villages where poverty is more pronounced. Preventive measures such as insecticide-treated bed nets are unaffordable to the poor if they pay for them.

Ecology of Mosquito Breeding Side

Each environmental changes in the mosquito habit, whether occurring as the result of a natural process or through human intervention, rearranges the ecological landscape in which these vector breed. Every Anopheles spp. Occupies a particular ecological niche that is genetically determined, challenges in temperature, humidity, attitude, population density of humans, and deforestation are just a few ecological factors that each plays essential parts in the transmission of malaria (WHO, 1999).

Temperature and humidity have a direct effect on the longevity of the mosquito. Each species can thrive at an optimal level a result of ecological adaptation. The spread of malaria requires that conditions are favourable for the survival of both the mosquito and the parasite. Temperatures from approximately 21-32 C and a relative humidity of at least 60 are most conductive for maintenance of transmission.

Mosquito density is conveniently measured in terms of the number of female mosquito per human inhabitant of the area. Thus, malaria transmission is proportional to mosquito density. Mosquito longevity affects malaria transmission, because takes time (approximately 1 week) for the parasite to develop. Altitude is significant in determining in determining the distribution of malaria and its seasonal impact on many regions of the world(WHO,2000). In Africa, for example, altitudes above 1,000-1,500 m are considered safe from malaria. However, it must be cautioned that with continuing global climate change, these figures may change, extending the range of mosquitoes well above those altitudes as ambient temperatures rises (WHO, 2000).

One of the most disruptive changes affecting mosquito populations is deforestation. When forest is cleared, erosion of the soil occur, stripping away nutrients. It may take up to 50 years or more before a deforested area in the tropical forest is typically converted into grazing pastures, agricultural plots, and human settlements. These ecological disturbances allow for the proliferation of mosquitoes that prefer human habitation to natural settings (Poland et al., 2002).

The breeding sites of infected mosquitoes vary greatly with regards to species. Some prefer clear water, inhabiting the edges of streams, while others thrive in irrigation ditches and reservoirs. Some species require extensive vegetative cover, preferring swamps and other permanent bodies of water laden with dissolved organic matter, mosquito breeding site are found anywhere fresh water collects. In fact, there is a direct correlation between the availability of water and the frequency in which mosquitoes feed on humans (Poland et al., 2002), permanent natural bodies of water, such as swamps, serves as unique breeding grounds. In the topics, as mentioned, mosquito breeding sites have emerged due to constructions of dams and canals. Many of these sites develop into zones of transmission due to concomitant increase of human populations moving to these areas. The number of possible breeding sites is extensive, and describing a few more of them will help to illustrate the difficulty in finding a common solution to control of malaria transmission by limiting mosquito populations.

Ecological disturbance as a direct result of human activity may also increase the number of breeding sites. Road building and maintenance projects often impede drainage of runoff from rainfall. Clogged drainage ditches along road left by logging and construction activities are ideal places for flood water mosquitoes (Alaba, 2002). Around the house, object such as empty cans, discarded tires, potted plants, and similar objects collect water and allow rainwater and allow mosquitoes to breed within the limits of human habitation.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter deals with the research design study area, population for the study, sample size, sampling techniques, instrument for data collection, validity and reliability of the instrument, method of data collection and methods of data analysis.

Research Design

A Descriptive survey design was adopted for the study. A survey design according to Gay (1976) is an attempt to collect data from members of the population with respect to one or more variables. Babbie (1975) confirms that survey research affords a researcher the opportunity to collect original data in a natural setting for the purpose of giving them a detailed description.

Study Area

Rumuigbo is a town in obio-akpor local government area of Rivers State. It lays at 4.75^{o}N 7^{o}E: 4.75^{o}N 7^{o}E, 41 miles (66 km) upstream from the Gulf of Guinea. It is inhabited by the Ikwerre people and Igbo subgroup.

Rumuigbo features a tropical climate with lengthy and heavy rainy seasons and very short dry seasons. The month of December and January truly qualifies as dry season, mostly in the city. The harmattan, is less pronounced in the area. Rumuigbo's heaviest precipitation occurs during September with average of 370 mm of rain. December on average is the driest month of the year; with an average rainfall of 20 mm. Temperatures throughout the year in the city is relatively constant (between 25^{o}C-28^{o}C), this shows little variation throughout the course of the year.

Population for the Study

The population for the study consisted of all the care givers of the under-five children in the 8 hospitals in Rumuigbo town, Obio-Akpor L.G.A., Rivers State, Nigeria. Through the register about a total of 4, 796 caregivers visited the hospitals with their under-five children during the study period.

Sample size

The sample size was determined from the general population using; Nwana's formula.

According to Nwana the following sample size determination technique should be adopted;

Population size	Sample size
Few hundreds	40% of the population
Many hundreds	20% of the population
Few thousands	10% of the population
Several thousands	% or less of the population

Based on the above; 10 % of 4,796 was computed as sample size. This gave a sample size of 480 caregivers

Sample and sampling techniques

Sample of 480 care givers of under five children were selected for the study. Out of the 8 hospitals in Rumuigbo, 3 hospitals were selected for the study using the simple random sampling technique of balloting. The systematic sampling technique was also used to select the mothers for the study. The first mother was selected at random after which every eighth mother that was visiting the paediatric department of the hospitals was sampled.

Instrument for Data Collection

The instrument used for data collection was self developed and open-ended structured questionnaire. The questionnaire had two basic parts; A and B.

Section A is for personal data while B sought information on factors affecting the prevalence of malaria among the under-five in Rumuigbo.

Validity of the Instrument

The questionnaire was presented to experts in the field for both face and content validity. The researcher's supervisor also approved a draft of the self-developed and structured questionnaire after modification.

Reliability of the Instrument

The reliability (consistency or precision) of the instrument was ascertained mathematically through a pilot study, using a randomly selected twenty respondents from different clinics in the neighboring communities of Rumola, Rukpokwu and Rumokoro which were not used in the study. In doing this, the researcher employed test, re-test method of reliability determination. After an interval of two weeks, the researcher re-administered copies of the questionnaire on the same selected patients and retrieved their responses. The reliability of the instrument was established by using the split half method which yielded correlation coefficient of 0.83. The researchers guaranteed that the sampling method could be applied repeatedly to the same respondents and would yield the same results.

Method for Data Collection

The researcher and three other trained research assistants administered the questionnaire to the respondents and ensured on-the-spot collection. The outpatient clinic and antenatal clinic of the three were visited. On the first day 30 caregivers were recruited from each of these sections making a total of 180 respondents. In the second visit after one week, 150 copies of the questionnaires were administered and also 150 was distributed in the third visit. These gave a total of 480. A total of 480 completely filled questionnaire were used for the study.

Method of Data Analysis

Data collected were entered into SPSS for analysis. Simple statistics of percentage and frequency were used to present the data on a frequency distribution table. Pie chart and bar chart were used for graphical illustration of the distribution of frequencies. Test of statistical significance was done using chi-square(X^2) at 0.05 level of significance and p-value less than 0.05 was considered statistically significant.

CHAPTER FOUR

RESULTS

The results of the data analysis are presented in frequency tables and charts. Hypothesis testing was done for relevant variables using Chi-square test statistic.

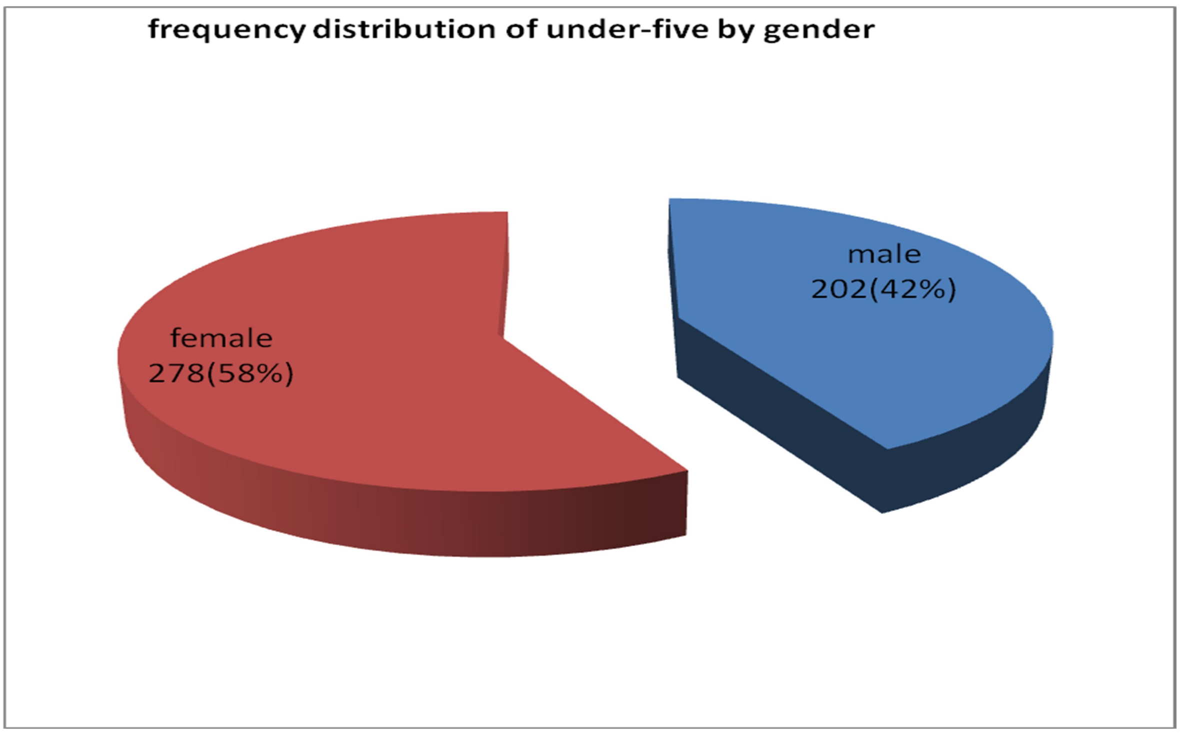

Fig 1: Frequency distribution of under-five babies by gender

This presents the distribution of the under-five babies by gender. It shows that 202 (42%) of the care givers were male while 278 (58%) were females.

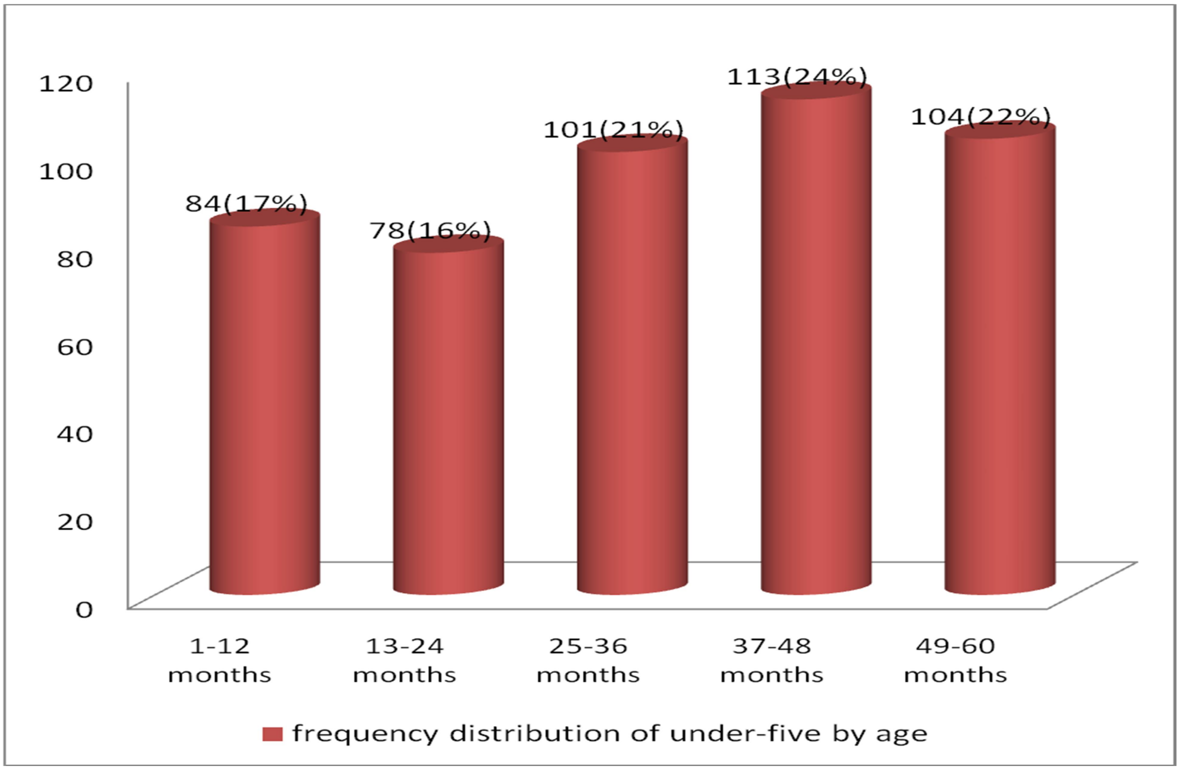

Fig 2: frequency distribution of under-five by age

Age distribution revealed that 84 (17%) of the children were aged between 1 and 12months old. 78(16%), 101 (21%), 113 (24%) and 104 (22%) are between the ages of 13-24 months, 25-36 months, 37-48 months and 49-60 months respectively. This is shown in Figure 2 above.

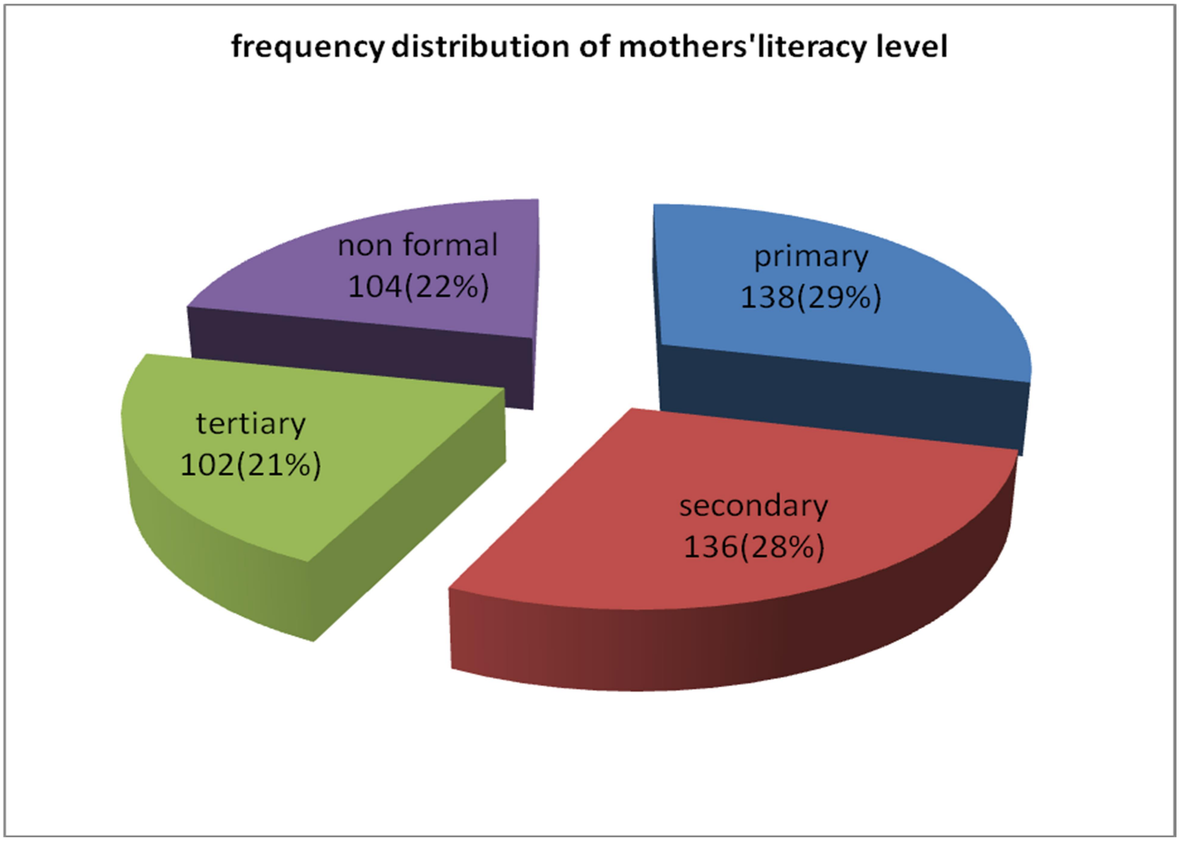

Fig 3; frequency distribution of mothers' literacy level

The result reveals that 138 (29%) of the mothers had primary education, 136 (28%) had secondary education, 102 (21%) had tertiary education and 104 (22%) had non-formal education.

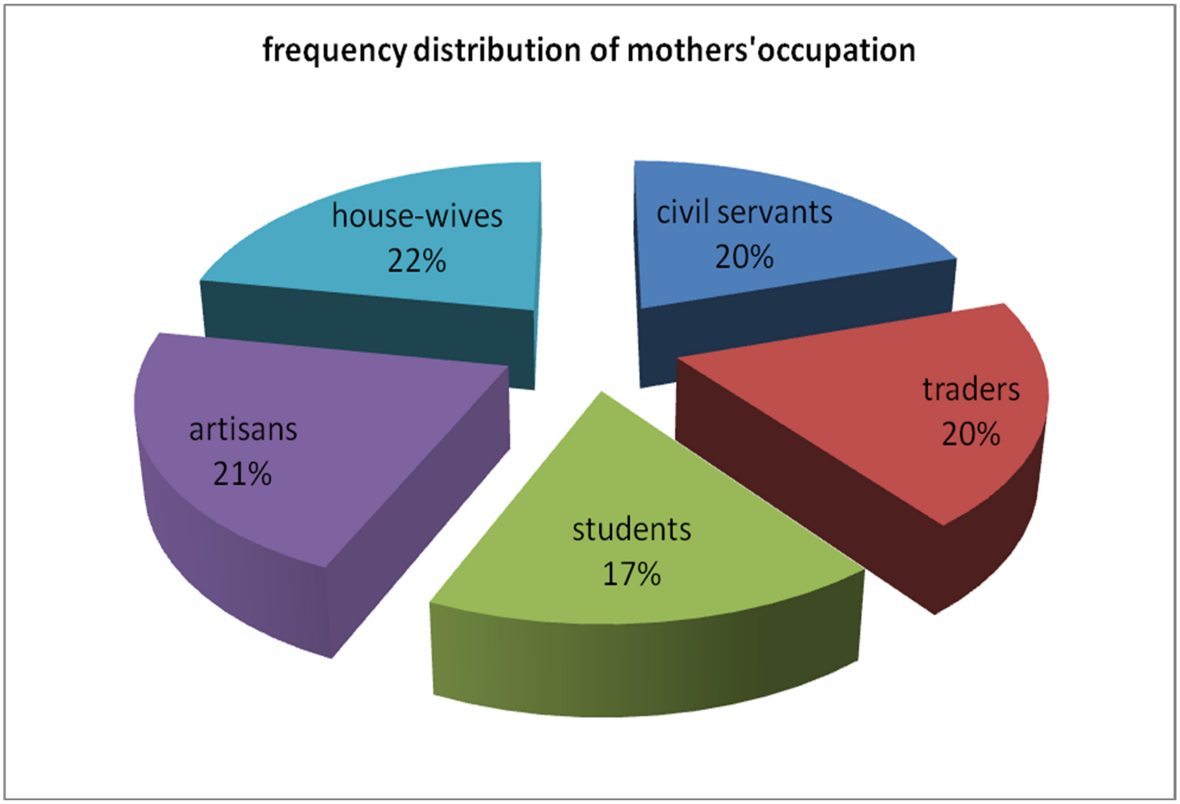

Fig 4; frequency distribution of mother mothers' occupation

The result reveals that 96 (20%) of the mothers' were civil servants, 94 (20%) were traders, 81 (17%) students, 103 (21%) were artisans and 106 were house-wives.

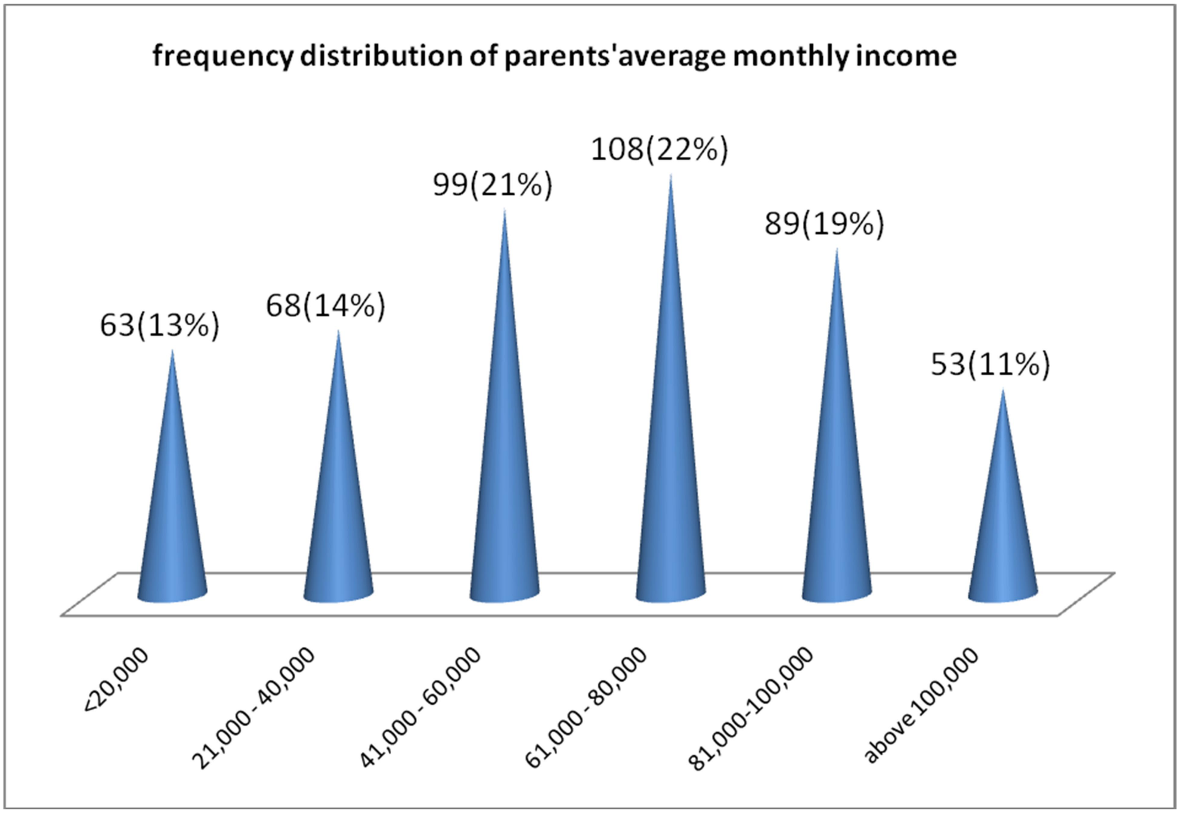

Fig 5: frequency distribution of average monthly income of parents

The result revealed that 63 (13%) of the mothers agreed that their average monthly income is below 20,000 naira, 68 (14%) accepted that they earn between 21,000 and 40,000 naira. 99 (21%), 108 (22%), 89 (19%) and 53 (11%) accepted that their average monthly income is between 41,000-60,000, 61,000-80,000, 81,000-100,000 and above 100,000 Naira respectively.

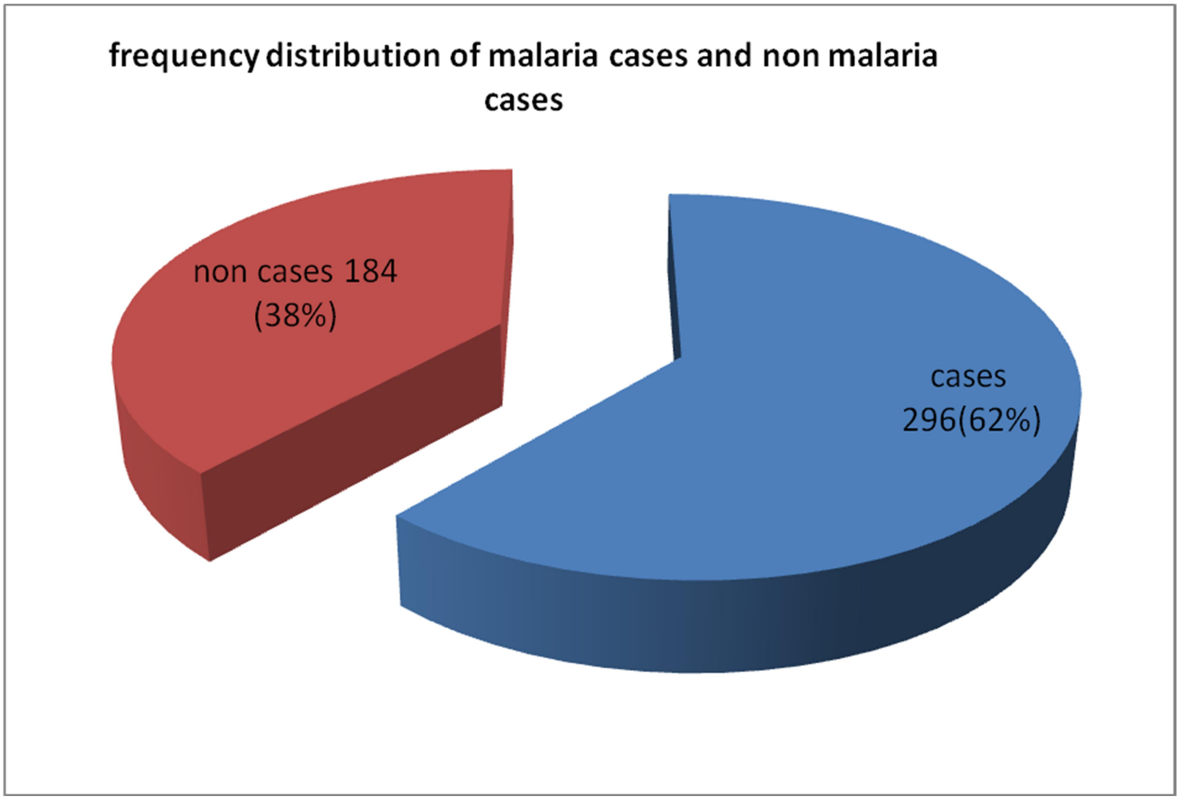

Fig 6: frequency distribution of malaria cases and non malaria cases

The result revealed that 296 (62%) under five children were diagnosed of malaria within the period of this research, while 184 (38%) of the children were non-cases of malaria.

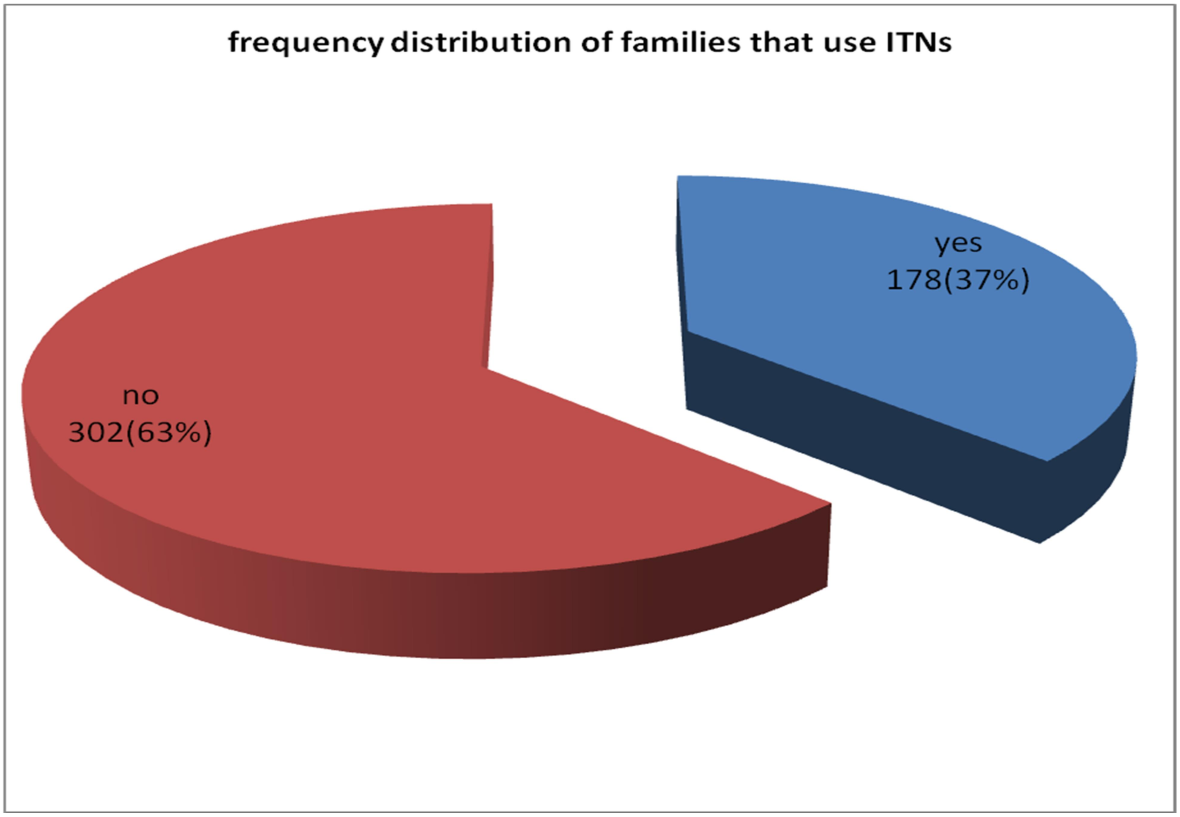

Fig 7: Frequency distribution of families that use ITN

Insecticide Treated Net Use among the respondents shows that 178 (37%) mothers accepted that their children sleep under ITNs, while 302 (63%) said that their children do not sleep under ITNs.

Test of association between demographic characteristics and malaria incidence among the participants

Table 1: Association between socio-demographic characteristics and malaria occurrence

	Malaria Cases (%)	**Non cases (%)**	**Chi- square value**	**P-value**
Mother educational level	78 (26.4)	60 (32.6)		
Primary	82 (27.7)	54 (29.3)		
Secondary	62 (20.9)	40 (21.7)	5.647	0.130
Tertiary	74 (25.0)	30 (16.3)		
No formal				
Occupation of mothers				
Civil servants	42 (14.2)	32 (17.4)		
Traders	62 (20.9)	21 (11.4)		
Students	60 (20.3)	35 (19.0)		
Artisans	68 (23.0)	42 (22.8)	25.086	< 0.001*
Housewives	64 (21.6)	7 (3.8)		
Average monthly income of care givers	56 (18.9)	7 (3.8)		
< 20,000	47 (15.9)	21 (11.4)		
21,000 – 40,000	53 (17.9)	46 (25.0)		
41,000 – 60,000	61 (20.6)	47 (25.5)		
61,000 – 80,000	48 (16.2)	41 (22.3)	27.822	< 0.001*
81,000 – 100,000	31 (10.5)	22 (12.0)		
Above 100,000				

Key: * means statistically significant

The Chi-square statistic revealed that the association between mothers' occupation and average monthly income of the family were statistically significant at the 0.05 level, while that of mothers' literacy level was not statistically significant at 0.05 level.

Table 2: Association between environment factors and malaria occurrence

	Malaria Cases (%)	Non cases (%)	Chi-square value	P-value
Use of ITN				
Yes	83(28.0)	95 (51.6)	27.063	< 0.001*
No	213 (72.0)	89 (48.4)		
Living around stagnant water				
Yes	163 (55.1)	114 (62.0)	2.206	0.137
No	133 (44.9)	70 (38.0)		
Living close to blocked drains				
Yes	189 (63.9)	80 (43.5)	19.117	< 0.001*
No	107 (36.1)	104 (56.5)		
Water retaining plants around the household				
Yes	119 (40.2)	104 (56.5)	12.148	< 0.001*
No	177 (59.8)	80 (43.5)		

Key: * means statistically significant

The Chi-square statistic revealed that the association between use of ITNs, living close to blocked drains and water- retaining plants were significantly associated with malaria occurrence at the 0.05 level, while that of living close to stagnant water or pools was not significant at 0.05 level.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

DISCUSSION

Findings at the end of the analyses of the responses to the various questions posed to test each of the research hypotheses are discussed here.

The result revealed that out of the 480 under-five children, 296 (62%) were diagnosed of malaria while 184 (38%) were not diagnosed of malaria. This was in line with colluzi (1999), who showed that malaria prevalence is highly in rural than urban areas. He maintained that this may be associated with the high level of poverty because poor people live in dwelling prone to mosquito proliferation. He also said that urban mother`s response to fever seem to be better than that of rural mothers.

In the same way, the speculation that mothers' literacy level does not affect the prevalence of malaria among under-five in Rumuigbo town was subjected to test. The data collected revealed that 138 (29%) of the mothers had primary education, 136 (28%) had secondary education, 102(21%) had tertiary education and 104 (22%) had non-formal education. However, the literacy level was not statistically associated with malaria prevalence.

Mothers occupation was statistically associated with malaria prevalence. Certain occupation place individuals at greater risk for malaria infection than others (Mills, 1998). Agricultural laborers, for instance, may not only place themselves at risk through increased contact with the malaria vector but also, through their migration, place others at greater risk by contributing to the spread of the disease (Okorosobo, 2000). Consequently, occupation may reflect both socio-economic status and differential risk of exposure through occupational attribute. Similar results for occupation related malaria prevalence has been reported in similar studies Ukpai and Ajoku (2001) and Martin and Lefebvre (1995). The high rates of infection among farmers in the two areas could be attributed to the nature of their job which exposes them to the bites of exophagous malaria vectors while in their farms in addition to their contacts with endophagous nocturnal vector bites while asleep after farm work. The farmers are usually fatigued at nights resulting in deep sleep at night the condition of which encourages the uninterrupted bloodsucking tendency of the nocturnal and endophagous vectors of malaria.

The frequency analyses revealed that that 178 (37%) mothers accepted that their children sleep under ITNs, while 302 (63%) said that their children does not sleep under ITNs. This was supported by the study conducted by Wang et al (2008) which showed that childhood mortality due to malaria reduced significantly in areas where high percentage of children slept under bed nets and that the low rate of the possession of bed nets (which might be as a result of inability to afford them) might have accounted for the high prevalence of fever especially in rural areas in particular, and in villages where poverty is more pronounced.

Environmental factors such as living close to stagnant water, blocked drains and water retaining plants do not encourage the prevalence of malaria in the area, $P>0.005$. This was supported by Poland et al., (2002), who suggested that permanent natural bodies of water, such as swamps, serve as unique breeding grounds. In the tropic, as mentioned, mosquito breeding sites have emerged due to construction of dams and canals. Many of these sites develop into zones of transmission due to the concomitant increase of human populations moving to these areas. The number of possible breeding site is extensive, and describing a few more of them will help to illustrate the difficulty in finding a common solution to control of malaria transmission by limiting mosquito populations.

CONCLUSION

The study revealed that average monthly income of parents, mothers' occupation and the use of ITNs are some of the factors affecting the prevalence of malaria among under-five children in Rumuigbo town, Obio Akpor L.G.A., Rivers State. Environmental factors such as blocked drains and water-retaining plants are other factors. Mothers' literacy level and living close to stagnant water were seen to have no association with malaria prevalence.

RECOMMENDATIONS

Based on the research, the following recommendations were made.

Mothers should be enlightened on the risk factors of malaria. They should also be enlightened on the use and importance of ITNs.

There should be a collaborative work between ministry of Health and Ministry of Environment to improve the sanitary level of the area by cleaning up the blocked drains and water-retaining plants around resident areas.

Mass communication program should be readdressed vigorously. Women should be encouraged to bring forth their children regularly for routine diagnosis of malaria and prophylaxis.

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APPENDIX 1

DEPARTMENT OF PUBLIC HEALTH

SCHOOL OF HEALTH TECHNOLOGY,

FEDERAL UNIVERSITY OF TECHNOLOGY, P.M.B. 1526,

OWERRI.

Dear Respondent,

I am a student of the above institution conducting a research on the factors affecting the prevalence of malaria among under-five in Rumuigbo town, Obio-Akpor local government Area, Rivers State.

I will be glad if you can help by answering the questions. Information given will be used purely for academic purposes and treated in strict confidence.

SECTION A: PERSONAL DATA

1. What is the sex of your child?

a) Male ☐

b) Female ☐

2. which of these represent your child's age bracket?

(a) 0-12months ☐ (b) 13-24 months ☐) 25-36 months ☐

(d) 37-48months ☐ (e) 49-60 months ☐

4. What is your highest level of education?

(a) Non formal ☐ (b) Primary education ☐

(c) Secondary ☐ (d) Tertiary ☐

5. What is your occupation?

(a) Civil Servant ☐ (b) Trader ☐ (c) Farmer ☐

(d) Artisan ☐ (e) House Wife ☐ (f) others.....(Please specify)

6. Which of the following represent your average monthly income?

Below 20,000 ☐ 21,000-40,000 ☐ 1,000-60.000 ☐

61,000-80,000 ☐ 31,000-100,000 ☐ ɔove 100,000

SECTION B

INSTRUCTION: This section contains different statement in relation to the factors affecting the prevalence of malaria in Rumuigbo, Obio- Akpor L.G.A, of Rivers State. Please tick as it implies to you. ☑

7. Have your child been diagnosed or told by a doctor or nurse that he/she had malaria?

Yes ☐ No 8. ☐

Do you have insecticide treated nets?

Yes ☐ No ☐

9. How many insecticide treated bed nets do you have in your family?

One ☐ Two ☐ Three ☐

10. Are your children currently sleeping under ITN?

Yes ☐ No ☐

11. Do you live closed to blocked drains?

Yes ☐ No ☐

12. Do you have stagnant water or pool around your house?

Yes ☐ No ☐

13. Do you have water retaining plants around your house?

Yes ☐ No ☐

APPENDIX II

		Malaria cases		Total
		cases	non cases	
mother`s literacy level	primary Count	78	60	138
	Expected Count	85.1	52.9	138.0
	% of total	16.3%	12.5%	28.8%
	Secondary Count	82	54	136
	Expected Count	83.9	52.1	136.0
	% of total	17.1%	11.3%	28.3%
	Tertiary Count	62	40	102
	Expected Count	62.9	39.1	102.0
	% of total	12.9%	8.3%	21.3%
	Non formal Count	74	30	104
	Expected Count	64.1	39.9	104.0
	% of total	15.4%	6.3%	21.7%
Total	Count	296	184	480
	Expected Count	296.0	184.0	480.0
	% of total	61.7%	38.3%	100.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.647[a]	3	.130
Likelihood Ratio	5.782	3	.123
Linear-By-Linear Association	4.777	1	.029
N of Valid Cases	480		

a. 0 cells (0%) have expected countless than 5.

The minimum expected count is 39.10.

APPENDIX III

Occupation of mothers * malaria cases

Crosstabulation

			Malaria cases		
			cases	non cases	Total
Occupation of mothers	civil Servant	Count	42	54	96
		Expected Count	59.2	36.8	96.0
		% of Total	8.8%	11.3%	20.0%
	Trader	Count	62	32	94
		Expected Count	58.0	36.0	94.0
		%of Total	12.9%	6.7%	19.6%
	Student	Count	60	21	81
		Expected Count	50.0	31.1	81.0
		% of Total	12.5%	4.4%	16.9%
	Artisan	Count	68	35	103
		Expected Count	63.5	39.5	103.0
		% of Total	14.2%	7.3%	21.5%
	House wife	Count	64	42	106
		Expected Count	65.4	40.6	106.0
		% of Total	13.3%	8.8%	22.1%
Total		Count	296	184	480
		Expected Count	296.0	184.0	480.0
		% of Total	61.7%	38.3%	100.0%

Chi-Square Tests

	Value	Df	Assymp. Sig. (2-sided
Pearson Chi –Square	19.944a	4	.001
Likelihood Ratio	19.813	4	.001
Linear-by-Linear Associated	4.340	1	.037
N of Valid Cases	480		

a. o cells (.0%) have expected count has than 5. The minimum expected count is 31.05.

APPENDIX IV

AVERAGE MONTHLY INCOME OF THE FAMILY * MALARIA CASES Crosstabulation

			Malaria cases		
			cases	non cases	Total
Average monthly Income of the family	<20,000	Count	56	7	63
		Expected Count	38.9	24.2	63.0
		% of Total	11.7%	1.5%	13.1%
	21,000-40,000	Count	62	32	94
		Expected Count	41.9	26.1	68.0
		% of Total	9.8%	4.4%	14.2%
	41,000-60,000	Count	53	46	99
		Expected Count	61.1	38.0	99.0
		% of Total	11.0%	9.6%	20.6%
	61,000-80,000	Count	61	47	108
		Expected Count	66.6	41.4	108.0
		% of Total	12.7%	9.8%	22.5%
	81,000-100,000	Count	48	41	89
		Expected Count	54.9	34.1	89.0
		% of Total	10.0%	8.5%	18.5%
	above 100,000	Count	31	22	53
		Expected Count	32.7	20.3	53.0
		% of Total	6.5%	4.6%	11.0%

Total	Count	296	184	480
	Expected	296.0	184.0	480.0
	Count			
	% of Total	61.7%	38.3%	100.0%

Chi-Square Tests

	Value	Df	Assymp. Sig. (2-sided
Pearson Chi –Square	27.822a	5	.000
Likelihood Ratio	31.609	5	.000
Linear-by-Linear Associated	15.202	1	.000
N of Valid Cases	480		

a. o cells (.0%) have expected count has than 5. The minimum expected count is 20.32.

APPENDIX V

Those that use any type of ITN * malaria cases Crosstabulation

			Malaria cases		
			cases	non cases	Total
Those that use any type of ITN	yes	Count	83	95	178
		Expected Count	109.8	68.2	178.0
		% of Total	17.3%	19.8%	37.1%
	no	Count	213	89	302
		Expected Count	186.2	115.8	302.0
		% of Total	44.4%	18.5%	62.9%
Total		Count	296	184	480
		Expected Count	296.0	184.0	480.0
		% of Total	61.7%	38.3%	100.0%

Risk Estimate

		95% Confidence Intererval	
	Value	Lower	upper
Odds Ratio for those that use any	.365	.249	.536
type of ITN (yes / no)			
For cohort malaria cases = cases	.661	.556	.786
For cohort malaria cases = non cases	1.811	1.450	2.261
N of Valid Cases	480		

APPEN DIX VI

Those living close to stagnant water

Cases Crosstabulation

			Malaria cases		
			cases	non cases	Total
Those living close To stagnant Water	Yes	Count	163	114	227
		Expected Count	170.8	106.2	277.0
		% of total	34.0%	23.8%	57.7%
	No	Count	114	70	203
		Expected Count	106.2	77.8	203.0
		% of Total	23.8%	14.6%	42.3%

Risk Estimate

		95% Conference Interval	
	Value	**lower**	**upper**
Odds Ratio for those living close to stagnant water (yes no)	.753	.517	1.096
N of valid Cases	480		

APPENDIX VII

Those living close to blocked drains * malaria cases Crosstabulation

			malaria cases		Total
			cases	non cases	
those living close to blocked drains	Yes	Count	189	80	269
		Expected Count	165.9	103.1	269.0
		% of Total	39.4%	16.7%	56.0%
	No	Count	107	104	211
		Expected Count	130.1	80.9	211.0
		% of Total	22.3%	21.7%	44.0%
Total		Count	296	184	480
		Expected Count	296.0	184.0	480.0
		% of Total	61.7%	38.3%	100.0%

Risk Estimate

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Those living close to blocked drains (Yes / no)	2.296	1.577	3.344
N of valid Cases	480		

APPENDIX VIII

Those that have water retaining plants around their houses * malaria cases Crosstabulation

			Malaria cases		
			cases	non cases	Total
those that have water retaining plants around their houses	Yes	Count	119	104	223
		Expected Count	137.5	85.5	223.0
		% of Total	24.8%	21.7%	46.5%
	No	Count	177	80	257
		Expected Count	158.5	98.5	257.0
		% of Total	36.9%	16.7%	53.5%
Total		Count	296	184	480
		Expected Count	296.0	184.0	480.0
		% of Total	61.7%	38.3%	100.0%

Risk Estimate

	Value	95% Confidence interval	
		Lower	upper
Odds Ratio for those that have water retaining plants around their houses (Yes / no)	.517	.356	.751
For cohort malaria cases = cases	.775	.668	.898
For cohort malaria cases = non cases	1.498	1.191	1.885
N of Valid Cases	480		