

## Aftermath of ICT Literacy on Prevalence of Malaria Parasite among HIV/AIDS Patients

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### ABSTRACT

The role of ICT in the prevention and mitigation efforts for HIV/AIDS cannot be over emphasized. The greatest advantage of ICTs is that they can reach out to remotest areas. So through the innovative use of ICTs youths and even adults can have access to HIV/AIDS programmes that can meet their needs. The paper focuses on the aftermath of ICT literacy on malaria parasite among HIV/AIDS patients. Therefore, to achieve positive results in the fight against HIV/AIDS ICTs should be taken on board. HIV/AIDS information should be found everywhere i.e. radio, cell phone, TV and internet. ICTs make HIV/AIDS information easily accessible, confidential and user friendly. The study has shown the possibility of co-infection of HIV positive or negative patients with malaria and HBsAg. This phenomenon could increase the severity of HIV infection and facilitate the progression of HIV to AIDS. The practices of universal screening of blood should be implemented to improve the safety of blood supply so as to reduce the risk of Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV). More malaria enlightenment programmes by the Local Community, the government and nongovernmental organization should be implemented.

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## 1. INTRODUCTION

ICT literacy otherwise known as technological literacy can be considered as the ability to know and to use technology adequately. ICT literacy refers to the application of technology effectively as a tool to research, organize, evaluate and communicate information. This also includes the use of digital technologies (computers, PDAs, media players, GPS, etc), communication/networking tools and social networks appropriately to access, manage, integrate, evaluate and create information to successful function in a knowledge economy. The ETS defines ICT literacy as using digital technology, communication tools, and or network to access, manage, integrate, evaluate, and create information ((ETS), 2004). ICT literacy includes general literacy skills, critical thinking skills and problem solving skills ((ETS), 2002). The ETS concluded that ICT literacy should include both cognitive skills and the application of technical skills and knowledge. Educators use ICT to refer to the convergence between information and communication technologies. ICT competence and literacy are used somewhat interchangeably in this study, assuming that both entail functional and critical, feelings and thoughts. ICT literacy may be grouped into three classes: class one pertains to knowledge of technology, the second class, to skills relevant to using the technology, and the third to attitudes accruing from critical reflection of technology use. This paper will focus more on the behavioral

attitude of use and acceptance of ICT by the university academicians. The 21<sup>st</sup> century, also called (ICT) literacy or new literacy, includes not only the traditional concept of literacy, being able to read and write fluently, but also includes the ability to judiciously utilize and incorporate the new technologies that abound in order to communicate with others (21<sup>st</sup> Century Skills, 2006).

In order to successfully contain the spread of HIV/AIDS, which has such profound socio-economic implications; it is vital that preventive interventions be more effectively targeted. There is now widespread recognition that HIV/AIDS is a development problem that has profound implications not just for public health, but also for the economy and society. As a result, there is strong support at the very top of the current political leadership for greater interministerial and inter-sectoral collaboration in the fight against HIV/AIDS and the mainstreaming of HIV/AIDS into development programmes. Innovative use of information and communications technology (ICT) for wider outreach, networking, advocacy and bridging the digital divide in HIV/AIDS has been an integral part of the UNDP HIV development programme.

### **ICT and Targeting Interventions**

ICT can play a pivotal role in the identification of vulnerability zones for focusing HIV/AIDS intervention programmes, but this has not received much operational focus in the Nigerian context. The ICT with the help of GIS tools, can be used as an effective means of not only identifying vulnerable populations and regions, but also tracking and monitoring the vulnerability profiles of the target regions. The best way to reduce the vulnerability to HIV would be to strike at the very roots of the causes that lead people to migrate out, leaving their families and dependants behind. This would include a direct action against poverty, low productivity, lack of livelihoods and social infrastructure in these regions. The key role of ICT in the prevention and mitigation efforts for HIV/AIDS in Nigeria is generating awareness and providing practical information to people to deal with such problems through the audio-visual and electronic media and also it is helping in capacity building of health functionaries towards counseling and treatment with regard to HIV/AIDS

### **Demography Variables in Nigeria Literacy Level and HIV/AIDS**

Demographic variables in Nigeria such as the literacy level and HIV/ AIDS have so many roles to play in the economy. They affect the economy both positively and negatively. Nigerian society varies greatly between urban and rural areas, across ethnic and religious borders, and with levels of education. Still, most Nigerians share a strong attachment to family and especially to children, to clearly differentiated roles for men and women, to a hierarchical social structure, and to the dominance of religion in shaping community values. A combination of new diseases and reemerging old ones is putting the lives of millions of Nigerians in serious jeopardy. At the top of the list is HIV/AIDS, which is devastating much of sub-Saharan Africa. National health services are under serious stress as more and more funds and personnel have to be devoted to treating and caring for AIDS victims. This has drawn attention and resources away from other health problems, such as malaria and other infectious diseases. While various environmental and social issues can be identified as the cause of these afflictions, the real culprit is poverty. Until poverty is controlled, Nigerian's health situation will remain precarious, and doubly so for the most vulnerable: children.

### **HIV/AIDS**

Human Immunodeficiency Virus (HIV) is a lentivirus that can lead to Acquired Immunodeficiency Syndrome (AIDS), a condition in humans whereby the immune system and the body defense against infection is been gradually attacked and destroyed, threatening the existence of the infected individual. AIDS was first reported in 1981 by investigators in New York and California. The disease was yet to be known, some linked it to its initial occurrence in gaymen calling it gay compromise syndrome. Others called it Gay-Related Immune Deficiency (GRID), Acquired Immunodeficiency Disease (AID), gay cancer or community Acquire Immune Dysfunction (Altman, 1982).

In 1983, French and American researchers isolated the causative agent, HIV, and by 1985 serological test to detect the virus had been developed. HIV/AIDS spread to epidemic proportions in the 1980s particularly Africa, where the disease may have originated. It was thought to have originated in non-human primates in Sub-Sahara Africa and transferred to humans early in the 20<sup>th</sup> century. Two strains of HIV (HIV-1 and HIV-2) have been shown to be pathogenic in humans; both strains must have originated in west-central Africa from a non-human primate to humans (Zoonosis). HIV-1 is thought to have originated in Southern Cameroon after jumping from chimpanzees (*Pan troglodytes*) to humans during the twentieth century (Gao *et al*, 1999), it came from a simian Immunodeficiency virus (SIVCPZ). HIV-2 on the other hand, many have originated from the sooty managabey (*Cercocebus atys*), an old world monkey of Guinea-Bissau, Gabon and Cameroon (Reeves, *et al*, 2002).

The spread was facilitated likely by several factors including increasing urbanization and long distance travel in Africa, international travel, changing sexual mores and intravenous drug users. HIV is transmitted through blood, semen, vaginal fluid or breast milk. It can also be transmitted by the use of sharp objects such as razor blade and needles. The virus cannot multiply on its own but can only do so by using cytoplasm or the machinery of the host cell. Transmission of the virus depends on some factors such as trauma, secondary infections, efficiency of epithelial barriers, and the presence of the receptors cell for HIV and immune status of the exposed persons. There are two main stages of the disease in an infected person. Acute infection stages are the first stage, at this stage there is rapid viral replication. Immediately, this follows the individual's exposure to HIV leading to an abundance of virus in the peripheral blood approaching several million viruses per ml. There is a drop in the numbers of circulating CD4<sup>+</sup> T cells. CD8<sup>+</sup> T cell response has been linked to slower disease progression and a better prognosis, though it does not eliminate the virus. The most common symptoms of which include fever, rash, lymphadenopathy, pharyngitis, myalgia, malaise, mouth and esophageal sores and may also include less common symptoms of which include headache, nausea and vomiting etc. It may last for 28 days and usually lasting at least a week (Kahn *et al.*, 1998).

The second is the latency stage. A strong immune defense reduces the number of viral particles in the blood stream, marking the start of the infections clinical latency stage. It can vary between two weeks and 20 years. During this early phase of infection, HIV is active within lymphoid organs, where large amounts of viruses become trapped in the Follicular Dendritic Cell (FDC) Network (Burton *et al.*, 2002). HIV enters macrophages and CD4<sup>+</sup> T cells by the adsorption of glycoprotein's on its surface to the receptors on the target cell followed by fusion of the viral envelope with the cell membrane releasing viral RNA into the cytoplasm. Once HIV has bound to the target cell the HIV RNA and various enzyme including reverse transcriptase, integrase, ribonuclease and protease are injected into the cell. During microtubule based transport to the nucleus, the viral single strand RNA genome is transcribed into double stranded DNA, which is then integrated into a host chromosome. The virus uses the host enzyme to transcript the interpreted provirus DNA to RNA which is subsequently translated into viral proteins. The viral proteins are first synthesized from precursor in a required cleavage by HIV protease into functional viral proteins. This is then assembled and bud from the host cell.

As the viral proteins are released they cause damages by:

- Weakening the CD<sup>4</sup> or T4 cell response by invading the dendrite cells that stimulate the CD<sup>4</sup> cells to respond to foreign organisms.
- Entering CD<sup>4</sup> cells and joining the cell reproductive material, by this numerous copies of viruses produced which eventually breakout of the cells, killing them and looking for other CD<sup>4</sup> cells to invade, the process start again causing the uninfected ones to clump around the CD<sup>4</sup> cells thus immobilizing them, leading other cells dependent on CD<sup>4</sup> cells to malfunction as CD<sup>4</sup> cell resulting in depletion, attacking other cells

When so many damages are been caused by the relentless replication of HIV, the immune systems can no longer fight infections, this then gives way for other opportunistic infection such as malaria and hepatitis to infect the body, since the immune system of the body is been suppressed.

### **Malaria among HIV Infected Patients**

Acute malaria infection increases viral load, and one study showed that increased viral load was reversed by effective malaria treatment. This malaria associated increase in viral load could lead to increase in transmission of HIV and more rapid disease progression, with substantial public health implications. (UNICEF 2003), HIV infection has been found to roughly double the risk of malaria parasitemia and clinical malaria. The effects of HIV infection multiply with increasing immunosuppression (Corbelt *et al.*, 2002). The interactions of both disease has major health implication (WHO, 2004). The immune system of an individual becomes suppressed as a result of been infected with HIV, because of this, it's own clinical course can be altered by other infections like malaria and hepatitis B virus. In cases of treatment, co-infections can complicate treatment. Drugs used in treating HIV, malaria and hepatitis B virus can interact (when a patient happens to be infected with the three diseases and then takes drugs for the diseases at once) and side effects may be exacerbated (Chung 2002). Malaria and Hepatitis B virus are co-infections among HIV infected patients, serious considerations should be placed on this two diseases so as to give HIV infected persons a chance to live.

## 2. REVIEW OF LITERATURE

Human malaria is caused by sporozoa of the germ plasmodium. It is found in regions lying roughly between altitudes 60°N and 40°S. There are four species of the parasite that infect man, *P. falciparum*, *P. vivax*, *P. malariae* and *P. ovale*. The differentiation of the species depends on the morphology and staining of the parasite and associated changes in the containing cells. The most common and important ones are those caused by *P. falciparum* and *P. vivax*. Malaria parasite is of four types, one of which is *Plasmodium falciparum*. Malaria view under an electronic microscope using a magnification of X100 is seen on the Erythrocytic cycle. The trophozoite of *Plasmodium falciparum* is in a circulating Erythrocyte, the young trophozoites resemble small rings resting in the erythrocyte cytoplasm. The pathological change caused by malaria involves not only the erythrocytes but also the spleen and other visceral organs. The first classical symptoms develop with the synchronized release of merozoites and erythrocyte malarial paroxysms shaking chills, then burning fever followed by sweating, fever and chills may be caused by malarial toxin that induces macrophages to release INF- $\gamma$  and interleukin -1. Several of these paroxysms constitute an attack. A remission that last from a few weeks to several months is after an attack then a relapse occurs. Between paroxysms, the patient feels normal. The loss of erythrocyte is as a result of anaemia and the spleen and the liver of ten children and non-immune individuals can die of cerebral malaria.

### Prevalence of Malaria Parasite

World Health Organization (WHO) reports that 40% of the world health population is at risk of malaria. Clinical cases every year is between 350 and 500 million. A study carried out shows that 3 million deaths occur each year due to malaria, up to 90% occur in Africa, the 90% are children under age five. Chandramohan, reported that in areas with stable malaria, HIV increase the risk of malaria infection and clinical malaria in adults, especially in those with advanced immunosuppression in settings with unstable malaria (Chandramohan, 1998).

Four species of malaria parasite can infect humans but *Plasmodium falciparum* is important more than the rest in term of mobility and mortality. Malaria causes serious infection in pregnant women from an area of unstable transmission acute malaria, still birth abortion may occur.

Laboratory-based studies have found that some components of human immune response to *P. falciparum* are modified by HIV-1 but that others are unaffected (Xio 1998).

Adult infected with HIV have high rate of ever clinical malaria especially in areas of unstable transmission (Girmwalde, 2004).

In a recent cohort study evaluation in Uganda, rate of parasitemi among older HIV infected children between 0-5 years were 1.7fold greater than those without HIV and they also have greater parasite density (Merwin, 2004). In terms of interaction, older children infected with HIV may be more like adults and may be infected because of HIV induced impairment of acquired immunity to malaria.

In a study from Western Kenya, severe anaemia and hospitalization due to malaria was suggested to be common in HIV infected infants (Van, 2003).

Prevalence of malaria parasite among HIV seropositive patients in Ondo State Nigeria was 33.5% with 26.90 and 38.20% being observed in males and females respectively. The peak of infection was observed among children between ages 0-9 years (66.7%). This strongly agrees with (Joklik *et al*, 1992) who observed and reported in the United State of America that children suffer most from malaria infection (Onifde *et al*, 2007).

Malaria and HIV are co-related in several ways, there may also be drug interaction and convergent toxicity between the drugs used to treat each of the disease.

### Transmission

The parasite enters first, into the bloodstream through the bite of an infected female Anopheles mosquito. The mosquito injects a small amount of saliva containing an anticoagulant along with small haploid sporozoites. The sporozoites in the bloodstream immediately enters the hepatic cells of the liver undergoing multiple asexual fission (Schizogony) in the liver and producing merozoites. The merozoites attach to erythrocytes and penetrate these cells after its release from the liver cells.

In erythrocyte, the plasmodium begins to enlarge as a uninucleate cell termed a trophozoite. The trophozoite nucleus then divided asexually to produce a schizont that has 6 to 24 nuclei. The schizont divides and produces mononucleated merozoites.

Eventually the erythrocyte lyses, releasing the merozoites into the bloodstream to infect other erythrocytes. This erythrocytic stage is cyclic and repeats itself approximately every 48 to 72 hours or longer, depending on the species of plasmodium involved. The sudden release of merozoites and erythrocyte debris triggers the attack and approximately chills, fever and sweats begins to surface.

Occasionally, merozoites differentiate into macrogametocysts and microgametocytes which do not neptune the erythrocytes. When these are ingested by a mosquito, they develop into female and male gamete respectively. In the mosquito's gut, the infected erythrocytes lyse and the gametes fuse to form a diploid zygote called the ookinete. The ookinete migrates to the mosquitoes gut wall, penetrates and form an oocyst.

In a process called sporogony, the oocyst undergoes meiosis and forms sporozoites which migrate to the salivary glands of the mosquito. The cycle is now complete and when the mosquito bites another human host the cycle begins anew.

### **Prevention and Control**

Malaria can be prevented or controlled through indoor spraying of mosquito with residual spray. Drainage of stagnant water can help control spread of malaria. Administration of chloroquine, amodiaquine or mefloquine suppresses protozoan reproduction and is effective in eradicating erythrocytic asexual stages. Also primaquine is used in eradicating the exo erythrocytic stages. Expensive drug combination are now being used e.g fansidar, combination of pyrimethamine and sulfadoxime. People traveling to endemic areas should receive chemo prophylactic treatment with chloroquine.

### **3. METHODS**

The study was conducted between July 2009 and August 2009 o a total number of 300 patients attending Immunology Department of the University of Maiduguri Teaching Hospital (UMTH) Borno State. Maiduguri is located between latitude  $10^{\circ}2^{\prime}N$  and  $13^{\circ}4^{\prime}N$  and longitude  $11^{\circ}4^{\prime}E$  and  $13^{\circ}5^{\prime}E$ . The state lies in arid and semi arid region and it is characterized by a rainy season of three months (July-September) and a dry season from October to May.

#### **Method of Blood Collection**

The area of the femoral vein was cleansed using 70% alcohol in 1% iodine for atleast one minute and allowed to dry. With precaution to avoid touching and recontamination, the needle was inverted and 5ml of blood was drawn. This was then dispensed into a clean plastic container. The blood of the same individual was drawn for malaria parasite and Packed Cell Volume (PCV).

#### **Sample Collection**

5ml of blood (Venous blood) was collected from three hundred patients consisting of both adults and children. The thumb of a patient is swabbed with 70% alcohol and pricked with a sterile needle. A heparinized capillary tubes end is filled with blood from the finger. The tube can also be filled from venous blood specimen taken into a sequestrane bottle.

#### **Microscopy of The Slide And Identification**

The stained slides were examined using microscope with X100 oil-immersion lens. Malaria parasite are recognized as bodies staining red (Nuclear material and blue cytoplasm) with black or brown pigment granules in later developmental stages, which occur within erythrocytes. The chief diagnostic characters in the blood include:

- i. Occurrence of ring form alone or along with the greenest gametocytes.
- ii. Common occurrence of multiple infection of single with also accole forms and sings with double chromatin dots.
- iii. Presence of enlarged infected erythrocytes and the appearance of granules, called schuffners dots, over the erythrocytes cytoplasm.

#### **HIV Blood Screening Test**

Syringes 5ml, determine HIV 1/2, Unigold HIV/western blot, containers, cotton wool, gloves. The blood (Venous blood) collected from a patients is been put in an EDTA container, after a while the blood in the container separates into serum at the upper layer and red cell at the lower layer. The determine HIV-1/2 protective foil is removed and 50ml of the serum is added to the sample pad. After 15minutes the result is ready.

Determine HIV-1/2 is an immunochromatographic test for test for the qualitative detection of antibodies to HIV-1 and HIV-2.

Sample is added to the sample pad. As the sample migrates through the conjugate pad, it reconstitutes and mixes with the selenium colloid-antigen conjugate. This mixture continues to migrate

through the solid phase to the immobilized recombinant antigens and synthetic peptides at the patient window site.

If antibodies to HIV-1 and /or HIV-2 are present in the sample the antibodies bind to the antigen-selenium colloid and to the antigen at the patient window, forming a red line at the patient window site. If antibodies to HIV-1 and /or HIV-2 are absent, the antigen-selenium colloid flows past the patient window and no red line are formed at the patient window site.

### Interpretation of Results

- i. Red bars appear in both the control window and the patient window of the strip when the patient is positive.
- ii. One red bar appears in the control window of the strip and no red bar appears in the patient window of the strip when the patient is negative.
- iii. If there is no red bar in the control window of the strip and even if a red bar appears in the patient window of the strip, the result is invalid and should be repeated.

### Confirmatory Tests

Confirmatory tests are second line tests which on account of their high sensitivity and specificity give highly reliable results. Confirmatory tests are however, generally expensive requiring much initial capital for procurement of equipment and higher running costs relative to screening tests uniGold HIV and Western blot are used as Confirmatory tests for HIV positive patients.

## 4. FINDINGS AND DISCUSSION OF RESULTS

The result of the analysis showed that of the 300 sample screened for HIV, 126 were confirmed positive while 174 were confirmed negative of the 126 HIV positive patients studied, 67(54.0%) were infected with malaria, 21(16.7%) were infected with Hepatitis B virus while 9(7.10%) had both malaria and HBV. On the other hand, of the 174 HIV negative patients, 99(56.9%) were infected with malaria while 24(13.8%) were infected with HBV and 22(7.3%) were infected with both malaria and HBV (Table 1). This shows that HIV negative patients are more infected with malaria, HBV and both than HIV positive patients.

Table 1. Prevalence and Distribution of Malaria and Hepatitis B virus among HIV positive or negative group

Cases	No Examined	Malaria	HBV	Malaria and HBV
HIV positive	126	67(53.2%)	21(16.7%)	9(7.1%)
HIV negative	174	99(56.9%)	24(13.8%)	13(7.5%)
Total	300	166(55.3%)	45(15.09%)	22(7.3%)

Table 2. Age and Sex distribution of malaria among HIV positive or negative patients.

AGE	MALE				FEMALE			
	HIV Positive		HIV Negative		HIV Positive		HIV Negative	
	No Ex	No Inf	No Ex	No Inf	No Ex	No Inf	No Ex	No Inf
0-10	5	4(80)	6	1(17)	2	1(50)	7	7(100)
11-20	1	0(0)	5	2(40)	6	5(88.3)	9	4(44.4)
21-30	16	8(50)	35	17(48.5)	36	17(47.2)	42	26(61.9)
31-40	18	12(66.6)	17	9(52.9)	22	8(36.4)	24	15(62.5)
41-50	10	7(70)	12	7(58.3)	8	4(50)	10	6(60.0)
51-60	0	0(0)	5	4(80)	2	1(50)	0	0(0)
61-70	0	0(0)	1	0(0)	0	0(0)	1	1(100)
Total	50	31(62)	81	39(48.1)	95	36(37.9)	93	60(64.5)

The age and sex distribution of HIV positive or negative patients revealed that males between the age of 31-40 years mostly infected with HIV followed by ages between 21-30 years. Female within 21-30 years are mostly infected with HIV followed by ages between 31-40 years while males between the ages of 21-30 years are not infected with HIV and females between the age of 21-30 years are also not infected with HIV. Prevalence for HIV positive male between 31-40 years is 36% while for HIV negative male between 21-30 years has 21.0%. HIV positive and negative female between 21-31 years has prevalence of 37.9% and

45.2% respectively. This shows that age 21-30 years is mostly infected followed by 31-40 years. Number of females with HIV is 95 while that of male with HIV is 50. In the case of HIV negative females the number is 93 while that of males without HIV is 81. Therefore we conclude that females are mostly infected with HIV than their male counterparts and also HIV negative females are more than HIV negative males (Table 2).

The age and sex distribution of malaria revealed that children who are males between the age of 0-10 years that are HIV positive have malaria with prevalence of 4(80%), while HIV negative males between ages 0-10 years are mostly infected with malaria with prevalence of 1(17%). This shows that HIV positive males have more malaria than their HIV negative male counterparts. Female children between the age of 0-10 years that are HIV negative are mostly infected with malaria with prevalence of 7(100%), while female children that are HIV positive have more malaria with prevalence of 1(50%). This shows that female children that are HIV negative have more malaria than those that are HIV positive. Adults males between the age of 31-40 years that are HIV positive are mostly infected with malaria more than any other age group with prevalence of 12(66.6%), while male (adults) between the age of 21-30 years that are HIV negative are mostly infected with malaria more than any age group with prevalence of 17(48.5%). In the other hand, Adult females between the age of 21-30 years are mostly infected with malaria (those that are HIV positive), with prevalence of 17(47.2%), while those that are HIV negative (females) between the age of 21-30 years are mostly infected with malaria with prevalence of 26(61.9%).

HIV positive males with malaria have a prevalence of 31(62.0%), while HIV negative males with malaria have a prevalence of 36(37.0%). In the case of females that are HIV positive have prevalence of 39(48.1%) and 60(64.5%) among HIV negative females. Hence, males with HIV are more infected with malaria than females with HIV while females without HIV are more infected with malaria than males without HIV.

#### **Age and Sex Distribution of HIV Positive or Negative Patients Based on their Marital Status**

HIV negative male between the ages of 31-40 years have the highest number of married males with prevalence of 13(76.5%). Shows that married females are within 21-30 years, and also within this age group we get the highest number of HIV positive and HIV negative patients. Married males are within 31-40 years and also within this age group we get the highest number of HIV positive and HIV negative patients. Married females with HIV have prevalence of 52(54.7%) while married male with HIV have prevalence of 38(76%), married female without HIV have prevalence of 49(52.7%), while married males without HIV have prevalence of 38(46.9%). This shows that married males have HIV more than married female and married females without HIV are more than married males with HIV.

HIV positive females between the age of 21-30 years have the highest numbers of singles with prevalence of 10(27.8%), while HIV negative females between the age of 21-30 years have the highest numbers of singles with prevalence of 20(47.6%). HIV positive males between the age of 21-30 years have the highest numbers of singles with prevalence of 4(25%), while HIV negative males between the age of 21-30 years have the highest number of singles 27(77.1%). This shows that singles between 21-30 years are infected with HIV mostly females while those that are not infected more are males within that same age group.

Single females with HIV have prevalence of 16(16.8%) while single males with HIV have prevalence of 11(22%). Single females without HIV have prevalence of 42(51.9%) while single males without HIV have prevalence of 21(22.6%). This indicates that males that are singles have HIV more than females that are singles while females that are singles have no HIV more than males that are HIV negative.

We have no record of any widower HIV positive female between the age of 41-50 years have the highest number of widows with prevalence of 3(37.5%), while HIV negative female between the age of 11-20 years and 21-40 years have the highest number of widows with prevalence of 1(11.1) and 1(4.2) respectively. This shows that ages between 41-50 years have high number of widows compared to other age groups.

Female that are HIV positive (widows) have prevalence of 4(4.2%) while HIV negative female that are widows have prevalence of 2(2.2%). Male widowers have none (0) (i.e. we have no widowers). This shows that numbers of male deaths are more than females therefore we have high number of widows than widowers.

HIV positive males that are divorced is 0(0%) while HIV negative males that are divorced between the age of 41-50 years have the highest number of divorced males with prevalence of 1(8.3%). HIV positive female between age 21-30 years have the highest number of divorced females with prevalence of 2(5.6) while HIV negative females between the age of 21-30 years have the highest number of divorced females with prevalence of 2(4.8). This shows that HIV positive females between ages 21-30 years are divorced while HIV negative male between ages 41-50 have the highest number of divorced males compared to female between 21-30 years. Divorced males (HIV positive) have prevalence of 0(0%) while divorced males (HIV negative) have prevalence of 1(1.2%). Divorced females (HIV positive) have prevalence of 4(4.2%) while

divorced females without HIV have prevalence of 3(3.2%). This shows that HIV positive female have a high record of divorced persons (Table 7)

Sex distribution of HIV positive or negative patients based on their occupations revealed that HIV positive males is more among business people with prevalence of 27(62.8%) while HIV negative males are more among business people and student with prevalence of 26(76.5%) and (42.6%) respectively. The highest number of HIV positive female is more among house wives with prevalence of 32(100). The highest number of HIV negative females is more among students with prevalence of 32(57.4%)

Table 3. Sex distribution of HIV positive or negative patients based on their occupations

OCCUPATION	MALE				FEMALE			
	HIV positive		HIV negative		HIV positive		HIV negative	
	NO	NO	NO	NO	NO	NO	NO	NO
	Ex	Inf	Ex	Inf	Ex	Inf	Ex	Inf
Civil servant	19	9(47.6)	33	23(69.7)	19	10(52.6)	33	10(30.3)
Business people	43	27(62.8)	34	26(76.5)	43	16(37.2)	34	8(23.5)
House wife	32	0(0)	29	0(0)	32	32(100)	29	29(100)
Student	22	10(45.5)	61	26(42.6)	22	12(54.5)	61	35(57.4)
Farmer	3	1(33.3)	4	3(75)	3	2(66.7)	4	1(25)
Unemployed	4	2(50)	11	0(0)	4	2(50)	11	11(100)
Total	123	49(39.8)	172	78(45.3)	123	74(60.2)	172	94(54.7)

Male workers that are HIV positive have prevalence of 49(39.8%). Female workers that have HIV positive have prevalence of 74(60.2%). Male workers that are HIV negative have prevalence of 94(54.7%). This shows that housewives are more infected with HIV. Female workers are more infected than male workers and also female workers are also not infected with HIV more than male workers (Table 3).

Table 4. Sex distribution of HIV positive or negative patients based on their PCV (Packed Cell Volume)

PCV	Male HIV positive	Male HIV negative
<40	30(60%)	26(32%)
>54	0(0%)	4(4.9%)
Normal range (40-54)	21(42%)	61(75.3%)
Total	50(100%)	81(100%)

  

PCV	Female HIV positive	Female HIV negative
<36	36(37.9%)	26(28%)
>46	10(10.5%)	11(11.8%)
Normal range (36-46)	49(51.6%)	56(60.2%)
Total	95(100%)	93(100%)

Sex distribution of HIV positive or negative patients base on their PCV. It shows the relative PCV among HIV positive males that have the highest number of PCV is <40 with prevalence of 30(60%). PCV among HIV negative males, those that has the highest number of PCV is at the normal range (40-54) with prevalence of 61(75.3%). HIV positive females that have the highest number of PCV is at the normal range (36-46) with prevalence of 49(51.6%). HIV negative females with the highest number of PCV are at the normal range (36-46) with prevalence of 56(60.2%). This indicates that HIV positive males have low PCV level than HIV positive females and HIV negative males have low PCV level than HIV negative females (Table 4).

Table 5. Sex distribution of malaria positive and malaria negative patients based of their PCV

PCV MALES		
PCV	Malaria positive	Malaria negative
<40	36(51.4%)	24(41.4%)
>54	1(1.4%)	3(5.2%)
Normal range (40-54)	33(47.1%)	31(53.4%)
Total	70(100%)	58(100%)

  

PCV FEMALES		
PCV	Malaria positive	Malaria negative
<36	30(31.3%)	33(45.2%)
>46	12(12.5%)	12(16.4%)
Normal range (36-46)	54(56.2%)	28(38.4%)
Total	96(100%)	73(100%)



Sex distribution of malaria positive and malaria negative patients based on their PCV. It shows that malaria positive males with the highest number of PCV is at <40 with prevalence 36(51.4%) while males without malaria that have the highest number of PCV is at normal range (40-54) with prevalence of 31(53.4%). This indicates that, malaria positive females have normal PCV level compared to malaria negative males have normal PCV level compared to their female counterparts (Table 5).

Table 6. Sex distribution of HIV positive and malaria positive patients based on their PCV

PCV	Male (HIV positive and malaria positive)	PCV	FEMALE (HIV positive and malaria positive)
<40	15(42.9%)	<36	14(38.9%)
>54	0(0%)	>46	4(11.1%)
Normal range (40-54)	16(45.7%)	Normal range (36-40)	18(50%)
Total	35(100%)	Total	36(100%)

Sex distribution of HIV positive and malaria positive patients based on their PCV revealed malaria positive and HIV positive males that have the highest number of PCV is at normal range with prevalence of 16(45.7%) while malaria positive and HIV positive female that have the highest number of PCV is at normal range with prevalence of 18(50%). This shows that malaria and HIV has no effect on PCV (Table 6).

## Discussion

HIV exposes an infected person to all kind of diseases resulting in Acquired Immune Deficiency Syndrome (AIDS). At this stage the body is exposed to all kinds of infection including malaria and Hepatitis etc. This study evaluates the prevalence of malaria, Hepatitis B surface Antigen (HBsAg) and hematological factor (PCV) in people living with HIV and also those that have no HIV. The result of the study showed that of the 300 patients examined 126 were HIV positive, 67(54.0%) had malaria while out of 174 HIV negative, 99(56.9%) had malaria. The result indicates that children within the age group of 0-10years were infected with malaria irrespective of their HIV status. This strongly agrees with Joklik *et al* ( 1992) who observed and reported in the United State of America that children suffer most from malaria infection. Children susceptibility to malaria infection could be attributed to their low statuesque, which might be due to HIV infection, which has degenerative effect on the immune system. It can also be attributed to the non-challant altitude of their parents towards them, which may be has a result of poverty or inadequate knowledge about the mode of transmission of malaria parasite (Green Berg, 1991). Malaria is highly prevalence among HIV infected patients because both diseases could potentially interact in several ways with effect upon transmission, clinical manifestation etc. Malaria is also very high in endemic areas because HIV disease impairs the acquired immunity to malaria and as a major opportunistic infection, it can transiently increase viral load and therefore could theoretically have an impact on HIV disease progression to AIDS and in transmission.

The result also revealed that case of malaria higher in males (62%) than female (48.1%), it could be because of their higher activity schedule and thus, more exposure time to mosquito bites and parasite load, that the cases among males was more prevalent. The low infection rate of malaria among age group 51-60years could be attributed to an updated knowledge about the mode of transmission of malaria parasite or due to preventive measures among this age group. The high rate of malaria infection in Maiduguri could be attributed to water lodge around resident houses, poor drainage system, bushes around houses which are good breeding grounds for mosquitoes. Inadequate preventive and control measures also contribute to high rate of malaria infection in these areas. Duly resistant malaria parasite could also contribute to the high infection rate since most of the patients in this area cannot afford hospital bills thereby resorting to inadequate medication.

In respect to HIV infection the cases were higher in adults 21-30years. This result corroborates the report of Chandramohan (Chandramohan, 1998; WHO, 2004), who observed high cases of HIV among teenagers and adults. The result revealed that female had higher HIV (37.9%) than male (36.0%), it may be because of their social disposition that's why the are more prone to HIV infection than male. An association between HIV and marital status was evaluated and it shows that married males have HIV more than married females, it might be because of their social lifestyle. Most married males are within 31-40years while most married females are within 21-30years. Single males have HIV more than single females which are within 21-30years. It might be because of the kind of activities the engage themselves in. Male mortality is more female mortality that is why we have more widows than widowers mostly at ages between 41-50years. We have more divorced females at an early age of between 21-30years than males between 41-50years. HIV positive females have high number of divorced females. It might be because they were infected with the virus.

An association between HIV and occupation was evaluated, we have high risk occupation based on the exposure to association risk factor (students, civil servants, unemployed and business men) while low risk occupation (House wives and farmers). House wives are more infected with HIV more than other occupation. From our earlier study which shows that married men are more infected with HIV than married females. This shows that married men are unfaithful to their wives and it might also be because of polygamous marriage practiced in this part of the country, for instance if a man marries three wives and later happens to get infected he will automatically transfer it to his innocent wives who happens to be Housewives. From our study female workers are infected with HIV more than their male counterparts as discussed earlier on. The number of student with HIV is not much because of the awareness and enlightenment going on and also because of the use of condoms to prevent contact with the disease.

HIV and malaria has no effect on PCV and also HIV, together with malaria has no effect on PCV. Out of 126 confirmed HIV positive patients tested, 21 tested positive to Hepatitis B Surface Antigen (HBsAg) with prevalence of (16.7%) while out of 174 HIV negative patients 24 tested positive to Hepatitis B Surface Antigen (HBsAg) with prevalence of 13.8% this shows that Hepatitis B infection common among HIV positive and negative patients. This shows that Hepatitis B- infection is independent on HIV. Since HBV and HIV share the same mode of transmission, co- infected patients are relatively common. It is generally believed that those who are actively involved in alcoholic consumption and sexually active are at high risk of HIV and HBV infections Ages between 21-30years are mostly infected with HBV. Malaria and HBV in HIV infected patients accelerates the status of the patients from HIV to AIDS in less than no time especially if inadequate love, care and treatment is not given.

Table 7 Age and Sex distribution of HIV positive or negative patients based on their marital status.

AGE	MARRIED		SINGLE		WIDOW		DIVORCED									
	Female +ve HIV	Female -ve HIV	Male +HIV	Male -HIV	Male +ve HI	Female -ve HIV	Female +HIV	Female -HIV	Male +ve	Female -ve	Male +ve	Female -ve				
0-10	0(0)	0(0)	0(0)	0(0)	5(100)	6(100)	2(100)	7(100)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)		
11-20	2(33.3)	1(11.1)	0(0)	0(0)	0(0)	5(100)	3(50)	7(77.8)	0(0)	0(0)	0(0)	1(11.1)	0(0)	0(0)	1(16.7)	0(0)
21-30	23(63.9)	20(47.6)	12(75)	8(22.9)	4(25)	27(77.1)	10(27.8)	0(47.6)	0(0)	0(0)	1(2.8)	0(0)	0(0)	0(0)	2(5.6)	2(4.8)
31-40	20(90.9)	18(75)	17(94.4)	13(76.5)	1(5.6)	4(23.5)	1(4.5)	4(16.7)	0(0)	0(0)	0(0)	1(4.2)	0(0)	0(0)	1(4.5)	1(4.2)
41-50	5(62.5)	9(90)	9(90)	11(91.7)	1(10)	0(0)	0(0)	1(10)	0(0)	0(0)	3(37.5)	0(0)	0(0)	1(8.3)	0(0)	0(0)
51-60	2(100)	0(0)	0(0)	5(100)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
61-70	0(0)	1(100)	0(0)	1(100)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
<b>Total</b>	<b>52(54.7)</b>	<b>49(52.7)</b>	<b>38(76)</b>	<b>38(46.9)</b>	<b>11(22)</b>	<b>42(51.9)</b>	<b>16(16.8)</b>	<b>1(22.6)</b>	<b>0(0)</b>	<b>0(0)</b>	<b>4(4.2)</b>	<b>2(2.2)</b>	<b>0(0)</b>	<b>1(1.2)</b>	<b>4(4.2)</b>	<b>3(3.2)</b>

## 5. CONCLUSION AND RECOMMENDATION

The greatest advantage of ICTs is that they can reach out to remotest areas. So through the innovative use of ICTs youths and even adults can have access to HIV/AIDS programmes that can meet their needs. Therefore, to achieve positive results in the fight against HIV/AIDS ICTs should be taken on board. HIV/AIDS information should be found everywhere i.e. radio, cell phone, TV and internet. ICTs make HIV/AIDS information easily accessible, confidential and user friendly. The study has shown the possibility of co-infection of HIV positive or negative patients with malaria and HBsAg. This phenomenon could increase the severity of HIV infection and facilitate the progression of HIV to AIDS.

Government and other stakeholders should embark on more enlightenment campaign most especially in the rural areas to educate them on those diseases. The practices of universal screening of blood should be implemented to improve the safety of blood supply so as to reduce the risk of Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV). More malaria enlightenment programmes by the Local Community, the government and nongovernmental organization should be implemented. It should include indoor residual spraying of insecticides, clearing up of stagnant water around our environment and voluntary donations of treated mosquitos' nets should be provided to those in the rural areas that cannot afford it. HIV patients should be advised to take adequate measures to protect themselves from co-infections like malaria and hepatitis.

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