SEROPREVALENCE OF HEPATITIS B AND HUMAN IMMUNODEFICIENCY VIRUS AMONG ONCOLOGY PATIENTS IN A SECONDARY AND TERTIARY HEALTH FACILITY, BENIN CITY, EDO STATE, NIGERIA.

BY

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SCHOOL OF BASIC MEDICAL SCIENCES,
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OCTOBER, 2025.

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A PROJECT SUBMITTED TO THE DEPARTMENT OF MEDICAL LABORATORY SCIENCE, UNIVERSITY OF BENIN, IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF THE AWARD OF BACHELOR OF MEDICAL LABORATORY SCIENCE (BMLS) DEGREE.

SUPERVISED BY

DR. MRS. S. A. AIGBODION

OCTOBER, 2025.

CERTIFICATION

This is to certify that this research work was satisfactorily carried out by ENEGBUMA ANGELICA ONAGIEKHUEMHE with matriculation number BMS2101494 of the Department of medical Laboratory science, School of Basic Medical Sciences, College of Medical Sciences, University of Benin, in partial fulfillment of the requirement for the award of the Bachelor of Medical Laboratory Science (BMLS).

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EXTERNAL EXAMINER **DATE**

DEDICATION

I dedicate this research project to God Almighty, my greatest provider, my supporter, my strength and source of inspiration in my journey till competition.

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ABSTRACT

Hepatitis B virus (HBV) and Human Immunodeficiency Virus (HIV) are major global health concerns, particularly in sub-Saharan Africa. Nigeria accounts for a substantial burden, with millions affected by both viruses. HBV and HIV share common transmission routes and pose serious health risks, especially among immunocompromised individuals such as oncology patients. The aim of this study is to determine the seroprevalence of HBV and HIV among oncology patients attending secondary and tertiary health facilities in Benin City, Edo State, Nigeria. A cross-sectional study was conducted among oncology patients at the University Of Benin Teaching Hospital. A total of 150 consenting patients were recruited for the study. Data were collected using structured questionnaires. Venous blood samples (3ml) were collected, and analyzed for Hepatitis B surface antigen (HBsAg) and HIV antibodies using rapid diagnostic test kits following standard procedures and manufacturer's instructions. Females constituted the majority of the study population. The results in this study showed total seroprevalence of HIV was 4% (3 males and 3 females) , while HBV was 2% (1 male and 2 females) . Infections were only recorded among patients with carcinoma-type cancers with a prevalence of 4.8% and 2.4% for HIV and HBV respectively. Age-specific analysis showed that HIV infection was most prevalent in age groups 51-60 (7.4%) and 41–50 (6.7%). HBV prevalence was highest among patients ages 51–60 (7.4%). Age and sex showed not statistical significant in influencing infection. Awareness level revealed that although all participants had heard of HIV, only a small portion was aware of HBV. In conclusion, these findings observed a measurable prevalence of HIV and HBV among oncology patients in Benin City. Increased awareness of viral infections, particularly among high-risk groups should be implemented to improve early detection, prevent reactivation (HBV) during immunosuppressive therapy, and reduce complications related to co-infection.

CHAPTER ONE

INTRODUCTION

1.1 Background of Study

Hepatitis B virus (HBV) and human immunodeficiency virus (HIV) are significant public health concerns, with disproportionate impacts in sub-Saharan Africa. The World Health Organization (WHO) estimates that 254 million people live with chronic HBV worldwide in 2022, while 39.9 million people globally were living with HIV in 2023 (WHO, 2024; UNAIDS, 2024). An estimated 1% of persons living with HBV infection are also infected with HIV (WHO, 2024). Africa bears the greater burden, accounting for about 60 million individuals with chronic HBV (WHO, 2017). As of 2024, an estimated 5.1 million people are living with HIV in Western and Central Africa, Nigeria included (UNAIDS, 2024). Federal Ministry of Health, UNAIDS, and National Agency For the Control of AIDS (NACA) (2019) reported that in Nigeria about 1.9 million people are living with HIV in Nigeria and the South-South zone of the country having the highest HIV prevalence, at 3.1% among adults aged 15–49 years.

HBV is a partially double-stranded DNA virus from the Hepadnaviridae family, primarily targeting hepatocytes. It replicates via reverse transcription (Inoue and Tanaka, 2016). HIV, a single-stranded RNA retrovirus, attacks CD4+ T-cells, compromising immunity and progressing to AIDS if untreated. Both viruses evade immune responses (Van Heuvel *et al.*, 2022).

Both viruses have shared transmission routes such as blood transfusion, unsafe sex, needle sharing, and mother-to-child transmission (Ranjbar *et al.*, 2011). Both infections contribute significantly to morbidity and mortality, with HBV causing liver cirrhosis and hepatocellular carcinoma (HCC) and HIV leading to AIDS-related complications. However, HBV is 100 times

more infectious than HIV but preventable via vaccination, unlike HIV, which has no cure (Ranjbar *et al.,* 2011).

Oncology patients (cancer patients) face high infection risk due to chemotherapy-induced immunosuppression, which depletes lymphocytes and weaken defenses (Harris *et al.,* 1976). Malignancies such as lymphomas and leukemia further impair immunity, increasing susceptibility to HBV and HIV. Chemotherapy drugs like rituximab and doxorubicin can reactivate HBV in carriers, causing fulminant hepatitis (Seto *et al.,* 2014). Concurrently, HIV may increase cancer progression by reducing immune surveillance (e.g., higher Kaposi's sarcoma incidence) (Mbulaiteye *et al.,* 2011). HIV alone in cancer patients complicates treatment, reducing chemotherapy tolerance and slightly increase mortality rate (Rozemeijer *et al.,* 2025). HBV mono-infection raises risks of drug-induced hepatotoxicity and liver failure during chemotherapy (Juan and Feld, 2014) . Co-infection, however, presents synergistic challenges as HIV accelerates HBV replication while, HBV worsens HIV-related liver damage (Thio *et al.,* 2002). Co-infected oncology patients face higher mortality rates, ART-drug interactions, and limited treatment options; however, undiagnosed HBV-HIV co-infection could further diminish survival rates (Cooper *et al.,* 2009).

1.2 Justification of Study

Although public health awareness has increased, a significant proportion of the population are yet to know their Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV) status, primarily due to social stigma, fear of discrimination, and limited healthcare access (Adesina *et al.,* 2021). Early diagnosis of these viral infections enables prompt medical intervention, which can slow disease progression, minimize transmission risks, and enhance treatment efficacy.

Percentage data on infection rate of HBV, HIV and co-infection among cancer patients in Benin City is currently lacking. This information gap is particularly concerning given that oncology patients undergoing immunosuppressive therapies face an increased risks of viral infection and/or reactivation HBV, thus necessitating this study.

1.3 Aim of Study

To determine the seroprevalence of HIV and HBV among oncology patients attending a secondary and tertiary health facility in Benin city, Edo state, Nigeria.

1.4 Specific Objectives

The specific objectives of this study are:

i. To determine the seroprevalence of HIV among oncology patients attending a secondary and tertiary health facility in Benin City, Edo state, Nigeria.
ii. To determine the seroprevalence of HBV among oncology patients attending a secondary and tertiary health facility in Benin City, Edo state, Nigeria.
iii. To determine the prevalence of HIV and HBV co infection among the oncology patients.
iv. To examine the relationship between selected socio-demographic factors and presence of HIV, HBV, or co-infection.
v. To assess the awareness level of HIV and HBV among oncology patients.

1.5 Research Hypothesis

Ho: There is no prevalence of HIV and HBV infection among oncology patients attending a secondary and tertiary health institution in Benin City, Edo State, Nigeria

H1: There is prevalence of HIV and HBV infection among oncology patients attending a secondary and tertiary health institution in Benin city, Edo state, Nigeria

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of Viral Infections

Viral Infections are caused when viruses invade host cells and undergo replication resulting in interactions that present as host immune response (Whitley, 2023). Viruses have been classified based on several criteria, including genetic material (DNA or RNA): structure, replication mechanisms, and host specificity.

The Baltimore classification system categorizes viruses into seven groups (I–VII) based on their genome type and replication strategy (Baltimore, 1971). Meanwhile, the International Committee on Taxonomy of Viruses (ICTV) classifies viruses into a hierarchical taxonomy (order, family, genus, species) based on genetic, structural, and biological properties. Species are differentiated based on genomic sequence divergence, host range, and pathogenicity (Lefkowitz *et al.*, 2018).

Viral pathogenesis involves virus entry, replication, immune evasion, and host cell damage. To succeed, a virus must enter in sufficient numbers, reach cells that are both susceptible and permissive, and overcome barriers such as epithelial surfaces, immune responses, and other host defenses. This relationship between virus and host tissues is described as tropism. Entry typically occurs through mucosal epithelium of the respiratory, gastrointestinal, or genital tracts, but viruses may also bypass barriers through skin penetration, transplantation, or vertical transmission across the placenta or during birth (Louten, 2016).

2.2 Hepatitis B Virus (HBV)

The World Health Organization describes hepatitis as the inflammation of the liver which may be due to a viral infection or non-infectious agent and can give rise to variety of health problems (WHO, 2025). Hepatitis B virus (HBV) first discovered mid-1960s, can cause short term or long term hepatitis that can lead to severe liver damage and result in cirrhosis and liver cancer (Seeger and Mason, 2015) .

According to the ICTV classification, HBV is of the genus *Orthohepadnavirus* and belongs to the family Hepadnavirus (Norder *et al.,* 2004). Baltimore classification groups HBV to class VII possessing a circular, partially double stranded DNA genome that replicates through and RNA intermediate using reverse transcriptase unlike other double stranded DNA viruses (Koonin *et al.,* 2021).

The Hepatitis B viral particles (Virion) are known as Dane particles about 42m in size and enveloped by a lipoprotein coat. The viral particle consists of a nucleocapsid core, three primary structural antigens; the core (HBcAg): the surface (HBsAg) and e (HBeAg): a partially double stranded relaxed circular DNA genome (Lamontagne *et al.,* 2016). Its genome is made up of about 3200 nucleotides and four open reading frame (ORFs) partially overlapped : polymerase, X, preS/S and preCore/Core. The preS/S ORF encodes three viral envelope proteins; the large (L): middle (M): and small (S, similar to HBsAg) surface proteins sharing identical C-terminal sequence but differ at the N-terminal region (Pollicino *et al.,* 2014).

The polymerase (Pol) ORF encodes viral polymerase , the X ORF encodes small regulatory X protein needed for regulating host and viral genome expression during viral replication and the PreCore/Core ORF encodes the structural protein of the nucleocapsid; HBcAg and HBeAg. Once

the virus infect liver cells, the relaxed circular genome converts into a covalently closed circular DNA (cccDNA) by host enzymes within the nucleus (Pollicino *et al.,* 2014).

Hepatitis B virus can be further divided into distinct genotypes (A-J) and 40 sub-genotypes which play a role in transmission, infection and treatment. Genotype E with no sub genotype is common in west and central Africa (Kafeero *et al.,* 2023). A 97.1 % predominance of HBV genotype E, of five genotypes identified in a study Zaria emphasizes HBV/E prevalence (Ahmad *et al.,* 2019).

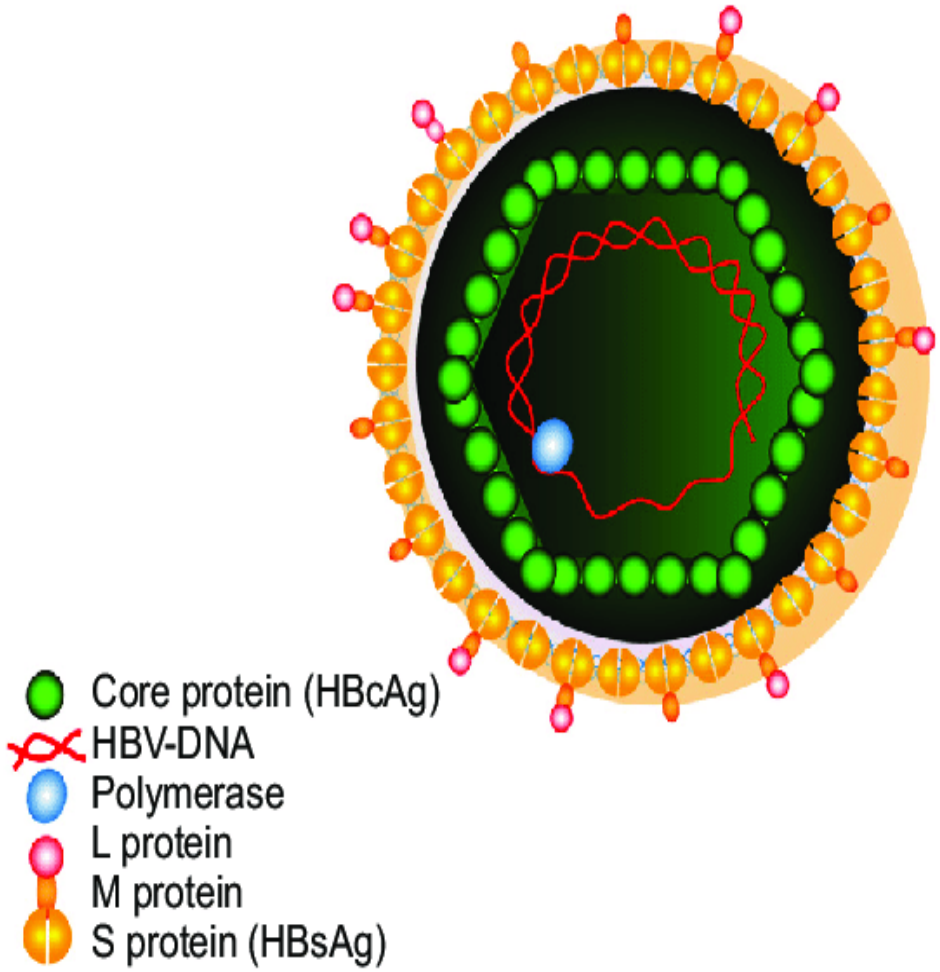

Fig 2.2: A schematic representation of hepatitis B virus highlighting envelope proteins, core antigen, polymerase and viral genome (Pollicino *et al.*, 2014)

2.2.1 Epidemiology of HBV

Hepatitis B viral infection is a major global health issue. The World Health Organization (WHO) estimates an approximate 254 million people living with chronic HBV infection and 1.1 million deaths attributed to cirrhosis and primary liver cancer due to Hepatitis B viral infection (WHO, 2025).

Africa bears the highest burden of HBV infection and the risk of contracting the disease is on a high side (greater than that of malaria, tuberculosis and even human immunodeficiency virus). Sub Saharan Africa currently faces a 6.1% prevalence of HBsAg (60 million persons with chronic hepatitis B) of which 4.5 million are children under the age of five, representing 70% of global childhood infections (Faniyi *et al.,* 2024). More than 8% of the general population in Sub-Saharan nations like Nigeria, Gabon, Namibia , Cameroon and Burkina Faso is hyper endemic for chronic HBV infection (Katamba and Onaluwa Philippe, 2022) .

A systematic review and meta-analysis of 47 studies attributed a prevalence of 9.5% of HBV in Nigeria, with a sub group analysis of 10.7% prevalence in rural communities. Regional distribution revealed major geographical disparities estimating the highest prevalence of 12.1% to the North West geopolitical zone (Ajuwon *et al.,* 2021)

2.2.2 Mode of Transmission

Hepatitis B virus is transmitted mainly via vertical transmission, sexual transmission and parenteral contact with blood or blood products. Vertical transmission involves mother to child transmission of HBV which may be intrauterine, during delivery (most common method) or postpartum (Borgia and Gentile, 2014). Intimate sexual activities especially promiscuous

individuals, homosexual men have very high chances of acquiring HBV infection (Katamba and Onaluwa Philippe, 2022).

Less commonly and efficient, the virus may also be transmitted in the absence of the above routes through horizontal transmission (Sabeena and Ravishankar, 2022). HBV can be detected from other body fluids than blood such as saliva, sweat, tears, semen, and vaginal secretions of infected persons as well as reuse of infected syringes, piercing needles, unsafe drug injections, unsterilized equipment. Contact with these fluids, objects or surfaces even in small quantities can cause infection and disease spread (Bahrami *et al.*, 2022).

In addition, HBV infection may occur during medical operations such as surgery, blood transfusion, phlebotomy and dental procedures (Janahi, 2014).

2.2.3 Pathogenesis and Clinical Manifestation

The severity of hepatitis caused by HBV varies, with many HBV carriers appearing asymptomatic with minimal liver damage, others showing acute or chronic HBV infection. The virus causes liver injury primarily via immune mediated mechanisms, as it has no direct cytopathic effect on liver cells. Inflammation and damage to the liver occur mainly from adaptive immune response, where HBV-specific CD8+T Cells and CD4+ T Cells target infected hepatocytes (Busca and Kumar, 2014).

In acute hepatitis B viral infections, patients present with several flu like symptoms, nausea, loss of appetite, fatigue abdominal pain later followed by jaundice, dark-colored urine and light stools (in severe case). Incubation period of acute infection is about six weeks to six months with approximately 25% to 40% of adults appearing symptomatic. However, infants, toddlers

and immunocompromised individuals may not show obvious signs and symptoms such as jaundice (Krajden *et al.,* 2005).

In chronic hepatitis B viral infections, the virus persists in liver cells because of its seroconversion into covalently closed circular DNA (cccDNA): which allows it to keep multiplying in the nucleus. The virus enters liver cells using the large hepatitis B surface antigen and replication occurs. Viral proteins like hepatitis B core antigen (HBcAg) and hepatitis B e antigen (HBeAg) trigger the body's immune system, which attacks infected liver cells and causes long-term inflammation. This chronic inflammation can slowly damage the liver, leading to scarring (fibrosis): cirrhosis, and even liver cancer (Li *et al.,* 2024).

2.2.4 Laboratory Diagnosis

Blood is the specimen of choice for the laboratory diagnosis of HBV (Krajden *et al.,* 2005) . The presence of Hepatitis B virus in man can be accurately identified using laboratory techniques such as serological tests and molecular assays to detect and monitor antiviral treatment. Serological assays include: enzyme immunoassays which is able to test for serological markers such as surface antigen (HBsAg) , core antigens (HBcAg) and their antibodies (anti-HBs, anti-HBc, anti- HBc IgM and IgG) (Song and Kim, 2016).

HBsAg serves as the hallmark serological marker of HBV infection. It can be detected in the blood within 10 weeks post exposure (acute infection). Presence in the blood for more than six months is indicative of chronic Hepatitis B infection (Song and Kim, 2016). After diagnosis with chronic HBV, alanine aminotransferase (ALT) test is carried out. Constant elevated levels of ALT indicates liver cell inflammation (Krajden *et al.,* 2005)

Molecular methods include the use of real-time polymerase chain reaction (PCR) which can be considered gold standard for detecting and quantifying HBV DNA. It is a highly sensitive technique and measures a wide range of viral load (Riaz *et al.*, 2016).

2.2.5 Treatment and Management

HBV infection causes various degree of damage to the liver, from liver cell inflammation, cell death to life threatening complications. Treatment involves the long term inhibition of HBV replication, preventing liver damage and risk of cirrhosis and cancer . Treatment and management of the disease aims to clinically cure infected individuals, this means that, HBsAg records negative and the DNA of Hepatitis B virus is undetectable. Therapy doesn't completely wipe off the virus as cccDNA survive in the nuclei of hepatocytes leaving patients at risk of reactivation and cancer development (You *et al.*, 2023).

Available therapies include PEGylated interferon (Peg-IFN) and nucleos(t)ide analogues (NUCs). Peg-IFN mode of action is to boost immune response thereby, suppressing HBV DNA but also enhances long term HBsAg seroclearance even after therapy ends unlike the NUCs. However, it requires injection, causes severe side effect and is not suitable for patients in advanced stages of liver disease or in comorbid conditions (Chien and Liaw, 2022).

NUCs (entecavir, tenofovir disoproxil fumarate and tenofovir alafenamide) are usually administered orally and highly effective in suppressing the virus but, their impact on HBsAg clearance is low. These antiviral treatments have a low chance of developing resistance. Entecavir requires long term usage as HBsAg clearance is $\leq 1\%$ in patients after several years. Tenofovir disoproxil fumarate is highly potent but HBsAg clearance is achieved in only a small fraction mostly in patients with prior HBeAg loss and prolonged use may result in renal and bone

complications. Tenofovir alafenamide is similar in potency to the former but safer for the kidneys and bones but requires lifelong therapy (Chien and Liaw, 2022; Easterbrook *et al.,* 2024).

2.2.6 Prevention of HBV

Following the 2024 updated World Health Organization (WHO) guidelines, the prevention of HBV is primarily by vaccination. The administration of HBV vaccines (especially timely birth dose) is recommended for all infants to prevent neonatal infection. Prevention of vertical transmission requires tenofovir prophylaxis for all HBsAg-positive pregnant women. Other preventive measures include safe medical practices such as: safe blood transfusion services, use of sterile medical equipment and adherence to infection control practices. Early diagnosis increases treatment outcomes and sexual health education protects individuals and reduces transmission risks (Wong and Lemoine, 2025).

2.3 Human Immunodeficiency Virus

The Human Immunodeficiency Virus (HIV) is a positive-sense, enveloped retrovirus belonging to the Retroviridae family in the *Lentivirus* genus. It exists in two major forms: HIV-1 and HIV-2. HIV-1 and HIV-2 possess structurally similar genomes but having just 48% identity similarity at the nucleotide level and 60% identity similarity at the amino acid level (Swinkels *et al.,* 2025). HIV-1, which is the most widespread globally, is further classified into groups M, O, N, and P, while HIV-2, predominantly confined to West Africa, comprises groups A and B *(*Masenga *et al.*, 2023).

HIV-1 is an enveloped virus with a diameter of approximately 80–100 nm. Its outer lipid bilayer is derived from the host cell membrane and incorporates viral glycoproteins gp120 and gp41,

which are essential for receptor binding and membrane fusion. The viral core is a conical capsid composed of capsid protein (CA). Within the capsid are two copies of single-stranded positive-sense RNA, which serve as the viral genome. Associated with the genome are nucleocapsid proteins and essential enzymes (reverse transcriptase, integrase, and protease). The HIV-1 genome, approximately 9.7 kb in length, encodes structural genes (gag, pol, env), regulatory genes (tat, rev) and accessory genes (nef, vif, vpr, vpu) (Kalinichenko *et al.,* 2022).

HIV-2 is less common when compared to HIV-1, presents with a much slower disease progressing, and mostly prevalent in West Africa (Williams *et al.,* 2023). HIV-2 contains a lipid bilayer derived from the host cell membrane, into which its envelope glycoproteins gp120 and gp41 are inserted; gp120 binds CD4 and co-receptors, while gp41 helps in fusion. Beneath the envelope lies the matrix protein (MA, p17), which stabilizes the membrane and directs viral assembly. The capsid protein (CA, p24) forms a cone-shaped core enclosing the genome, and in HIV-2 the immature Gag lattice is more complete and uniform than in HIV-1. Inside the capsid are two copies of positive-sense single-stranded RNA coated by nucleocapsid proteins, along with essential enzymes (reverse transcriptase, integrase, and protease) needed for replication and maturation. HIV-2 has reduced infectivity, lower viral loads, and distinct drug susceptibility when compared with HIV-1 (Yang *et al.*, 2022).

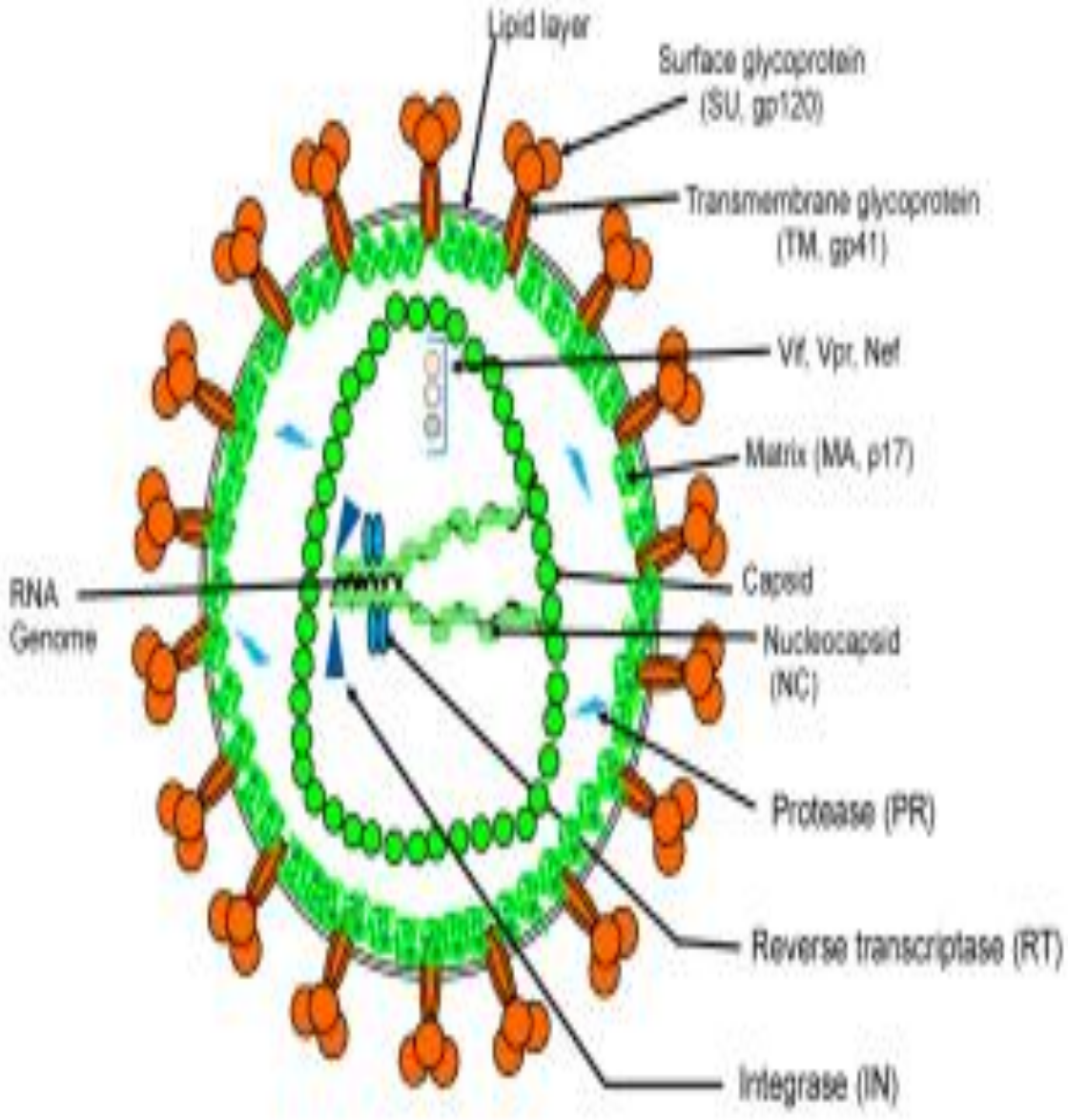

Fig 2.3: Schematic diagram of the HIV-1 viral particle (Eid *et al.*, 2020).

2.3.1 Epidemiology of HIV

The global prevalence of HIV is approximately 37- 45.6 million. An incidence of about 1.3 million people acquired HIV in 2024 and an estimate of 490,000-820,000 people died from causes linked to HIV infection (WHO, 2025). The HIV epidemic is most severe in Sub-Saharan Africa, which accounts for about 70% of global cases and experiences millions of new infections and deaths annually (Emmanuel *et al.,* 2025b).

In West Africa, HIV prevalence ranges across different populations, from as low as 1.4% to as high as 54.9%, with women standing out as the most affected group. Interestingly, even though studies show that women are more likely than men to achieve viral suppression, the fact that their greater numbers are higher, means that more women remain unsuppressed. (Fofana & Mehmet, 2022; Hladik *et al.,* 2023). HIV prevalence is high among key populations, with 28.8% in transgender people, 25.0% in men who have sex with men, 15.5% in female sex workers, and 10.9% in people who inject drugs (Emmanuel *et al.,* 2025a).

Nigeria has a national prevalence of 1.4% , with approximately 1.9 million people living with HIV. About 80% of recent infection are due to unprotected sexual intercourse between heterosexuals, female sex workers and among people who inject drugs (Onovo *et al.,* 2023).

Across regions in Nigeria, the pattern of the epidemic differs. In some states, it is concentrated in high-risk groups, while in others it spreads more widely through multiple sexual partnerships in the general population. In Lagos, for example, HIV prevalence among sex workers rose sharply from 2% in the late 1980s to 70% by the mid-1990s (Oguh *et al.,* 2021). Risky practices, including low condom use and needle sharing, contribute to the continued spread of HIV

(Emmanuel *et al.,* 2025a). Onovo *et al.* (2023) found that Edo state places fourth in a modelled HIV prevalence estimated at 3.4%(95% CI: 2.9%-4.0%).

2.3.2 Mode of Transmission

Human immunodeficiency virus makes use of two major mechanisms of transmission : the release of free viral particles and direct cell-to-cell transfer (Kalinichenko *et al.,* 2022). The main mode of HIV transmission in children is vertical, occurring in utero, during delivery, or through breastfeeding. Fortunately, global interventions such as antiretroviral therapy have reduced pediatric HIV incidence. Horizontal transmission, though less common, may result from contaminated blood products or reused needles in healthcare settings. Community-acquired infection can occur through surrogate breastfeeding, sexual infection or pre-mastication of food (Myburgh *et al.,* 2020).

In adults, HIV is mainly transmitted through sexual contact, with heterosexual intercourse being the most common route. Among older men, commercial sex with female sex workers, often without condom use, plays a major role in the transmission of HIV. These men may then transmit the virus to their spouses or regular partners. Women are most frequently infected through marital or long-term relationships (Sun *et al.,* 2022).

HIV is also transmitted through body fluids such as blood, plasma, serum, and genital secretions. Few reports exist of transmission through saliva and bite injuries, and open lesions but they may serve as entry points for the virus. Needle-stick injuries can also lead to infection, since even small volumes of blood may be sufficient if viral load is high or if infected cells are present (Akani *et al.,* 2007).

2.3.3 Pathogenesis

The pathogenesis of HIV-1 infection is brought about by several viral and host factors, Human Immunodeficiency Virus weakens the body's defense system mainly by reducing cluster of differentiation 4 positive ($CD4^+$) T cells. This change shifts the balance, between T helper 1 (Th1) and T helper 2 (Th2) responses. Instead of producing protective cytokines such as interleukin-2 (IL-2) and interferon gamma (IFN-γ), the immune system begins releasing more interleukin-4 (IL-4) and interleukin-5 (IL-5). Viral proteins like glycoprotein 120 (gp120) aid in disease progression. HIV destroys active $CD4^+$ cells through apoptosis and inactive ones through pyroptosis, both processes causing inflammation and early symptoms such as fever, fatigue, and weight loss (Wong *et al.,* 2020).

Dendritic cells also play a role by picking up the carrying the virus into lymph nodes, where it spreads further. In addition, HIV infection triggers the build-up of reactive oxygen species, which damage tissues. (Wong *et al.,* 2020).

Generally in HIV infected individuals, disease progression is slow and may take years before significant immunosuppression develops. During this phase, the virus replicates actively in lymphoid tissues and blood, gradually impairing immune function. In advanced stages, patients become highly susceptible to opportunistic infections caused by other microorganisms such as bacteria (tuberculosis), fungi (candidiasis): virus (cytomegalovirus) and parasites (toxoplasmosis. HIV infection subsequently may result in Acquired Immunodeficiency Syndrome (AIDS). An elevated viral load with CD4+ T cell counts below 200 cells/mm^3 is indicative of AIDS (Naif, 2013; Wong *et al., 2*020).

Infections like hepatitis B, hepatitis C, and Monkey pox can become more severe in people with HIV (WHO, 2025).

2.3.4 Laboratory Diagnosis

Early and precise diagnosis of HIV should be prioritized for effective treatment and management of infection, reduction in morbidity and mortality as well as long term financial burden. HIV immunoassays are diagnostic tests that detect HIV infection by targeting either the p24 antigen (a viral protein) or anti-HIV antibodies produced by the immune system (Williams *et al.*, 2023).

Molecular diagnostics for HIV/AIDS improve both detection and patient management. Techniques such as polymerase chain reaction (PCR) and nucleic acid amplification tests (NAATs) detect infection during the window period when antibodies may not yet be present, overcoming the limitations of traditional serologic tests. These techniques are used to monitor viral load, identify drug-resistance mutations, and guide antiretroviral therapy, improving patient outcomes and supporting public health efforts to reduce transmission. Qualitative nucleic acid tests detect acute infections and early infant infection, while genotypic and phenotypic assays assess drug resistance and treatment effectiveness (Tang & Ou, 2012; Bhat & Mehto, 2025).

A high burden of the disease is observed in many developing regions like Africa struggling with several health inequities. The timely development of rapid HIV tests represents a major breakthrough by moving screening directly to patients. A study in China assessed urine HIV-1 antibody rapid test kits among 2,606 participants, including high-risk and general populations. The kits produced on-site results within 15 minutes and showed high diagnostic accuracy, with

Reagent A having 92.16% sensitivity and 99.92% specificity, while Reagent B matched reference methods perfectly (Lu *et al.,* 2023).

2.3.5 Treatment and Management

Treatment and management of HIV is primarily achieved by antiretroviral therapy, with many HIV infected individuals sustaining a normal lifespan. Antiretroviral therapy (ART) is recommended for all HIV patients, ideally starting within 7 days, using bictegravir or dolutegravir-based regimens for high efficacy (Gandhi *et al.,* 2025). The World Health Organization, recommends immediate treatment of HIV after proper diagnosis with ART regardless of symptoms and limitation on CD4 cell counts. Children are advised to take medications daily, suppress the virus and stay healthy (WHO, 2025)

2.3.6 Prevention of HIV

HIV can be prevented through behavioral modifications, adopting safe practices and increased awareness about the infection. In Nigeria, a study among secondary school students showed that peer-led health education significantly improved HIV/AIDS knowledge, indicating that adolescents can be empowered as agents of prevention within schools (Ezelote *et al.,* 2024). Similarly, a systematic review and meta-analysis in Sub-Saharan Africa demonstrated that behavioral interventions increase consistent condom use among HIV-positive individuals, directly lowering the risk of transmission during sexual activity (Endeshaw *et al.,* 2024).

A narrative review across African countries described how peer education, skill-building activities, and community dialogues have been consistently applied to reduce risky behaviors and strengthen prevention (Obeagu & Obeagu, 2025). These findings align with the Nigerian adolescent school program and the condom-use evidence, showing that locally tailored

interventions remain scalable, cost-effective, and essential in resource-limited settings (Ezelote *et al.,* 2024; Endeshaw *et al.,* 2024).

Psychosocial interventions also play a role in reducing HIV transmission through their effect on up to date treatments. The Friendship Bench trial in Zimbabwe, which used lay counsellors to deliver structured problem-solving therapy, improved mental health and supported adherence to antiretroviral therapy (ART). Constant treatment increases viral suppression, and sustained suppression is strongly associated with a lower risk of HIV transmission. (Haas *et al.,* 2023)

2.4 HBV and HIV Co-Infection

HIV and HBV are two major global health concerns causing increased morbidity and mortality of millions worldwide (Payagala and Pozniak, 2024; WHO, 2025). Both virus share similar modes of transmission: sexual intercourse, during pregnancy and delivery, injection drug use (Chen *et al.,* 2022). This explains high possibility of contracting both infections.

Patients infected with HIV have a significant incidence rate of HBV infection. Co-infection rates of HBV and HIV are high especially in areas with high prevalence, including the sub-Saharan Africa, Southeast Asia and Indic subcontinent. In China, Japan and Pakistan, where HBV prevalence is 6.89%, 1% and 3%-5% (10%-20% in high risk population) respectively, HIV-HBV coinfection ranges from 4.4% to 12.5%, 3.2% to 11.9% and 3.4%-10.4% respectively among HIV-positive individuals (Mohd *et al.,* 2023).

A systematic review and meta-analysis involving studies from Kenya, Ivory Coast, Nigeria, and Gambia estimated the overall HBV-related case fatality rate (CFR) in people living with HIV to be 4.4% (95% CI: 0.7–10.3): and 5.5% HBV case fatality rate in West Africa. Data from 32

African countries revealed an HBV prevalence of 10.5% among HIV-positive individuals (Kenfack-Momo *et al.,* 2022).

A study conducted in Ghana achieved a seroprevalence of HIV-HBV co-infection of 8.4% with more female co-infected patients than males. Seropositivity was highest within the ages 21-60 years old. These patients presented with lower CD4 counts than HIV-infected individuals although, there was no significant difference in viral load (Annison *et al.,* 2022).

2.4.1 Co-management Challenges

The impact of HIV-HBV co-infection compared to HIV infection only and HBV infection only is particularly significant. Co infected patients reported higher level of systemic inflammation, and when combined with the silent progression of liver damage complicates treatment outcomes, increases risk of death and emphasize the challenges of co-management (Copeland *et al.,* 2021). Antiretroviral drugs (emtricitabine, lamivudine, tenofovir disoproxil fumarate and tenofovir alafenamide) (Sun *et al.,* 2021) have proven effective in the treatment of co infection and suppressing viral replication but limited due to late diagnosis and start of treatment, health inequities across the world, adherence challenges and suboptimal treatment administration (Ruta *et al.,* 2023).

2.5 Oncology Patients and Immunosuppression

Cancer has a tightly knitted relationship with the immune system and is responsible for approximately 10 million deaths as of 2020 (Kamal *et al.,* 2022). The body often tries to eliminate these uncontrolled proliferating cells (cancer cells) but evade the immune system by creating an immunosuppressive environment that allows tumor growth and survival (Yürekli *et al.,* 2021).

Cancer causes immunosuppression partly by recruiting tumor-associated macrophages (TAMs): especially the M2-like type (marked by CD163): which promote tumor growth, suppress immune responses and might induce resistance to therapy (Mehta *et al.,* 2021). Although, changes in tumor metabolism, like increased glucose use (the Warburg effect): also support immune evasion (Pan *et al.,* 2025).

Cancer treatments (chemotherapy and radiotherapy) may also weaken patient's immune system in several ways. The most common complication is reduction in the levels of white blood cells (neutropenia and lymphopenia) which opportunistic pathogens take advantage of leading to changes in treatment plan (Kubeš *et al.,* 2023) .

Stress hormones, including glucocorticoids, can further suppress immunity. In people with weakened immune systems, such as transplant patients or those with HIV, virus-related cancers are more common (Yürekli *et al.,* 2021).

2.6 Burden of HBV and HIV among Oncology Patients

Chronic active Hepatitis B virus infection among patients receiving immunosuppressive therapy (chemotherapy or radiotherapy) are more likely to experience an increasingly unfavorable prognosis which may lead to severe liver damage (Ngoato *et al.,* 2023). Nadew et al. (2024) conducted a study on the seroprevalence of HBV infection among cancer patients in Ethiopia and reported a prevalence of 7.6% among sampled patients. Similar study was investigated in Sana'a was 5%with females having higher infection rates (Almohya *et al.,* 2024).

HIV infection brings about immunosuppression which is a risk factor to AIDS-defining cancers (DCs) such as: Kaposi Sarcoma, Non-Hodgkin's Lymphoma, cervical cancer and non AIDS-defining cancer (NADCs). A total prevalence of 23% (HIV Infection) was recorded in a study

carried out in Uganda of patients with cancer with 42% ADCs and 14% NADCs (Bender Ignacio *et al.,* 2018). A prospective cohort study conducted out in 2017 with newly diagnosed cancer patients (3051 patients) with 18.1% of participants being black, an infection rate of 1.1% for HIV was observed with 5.9% of undiagnosed HIV status at the time of study enrollment. The prevalence of previous HBV infection was 6.5% with 5.7% newly diagnosed and 0.6% with chronic HBV infection (Ramsey *et al.,* 2019).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Area of Study

The research was carried out among oncology patients (cancer patients) in Benin City, Edo State. Patents were receiving treatment at the University of Benin Teaching Hospital (UBTH). UBTH is one of the largest referral health facilities in Nigeria. It is located in Ugbowo, Ovia North-East Local Government, Edo State, Nigeria. Edo State is located in the South-South geopolitical zone and is one of the oldest historically significant cities in Nigeria. The state is a major connecting point between the northern, western and eastern regions of the country.

3.2 Study Participants

The sample population consisted of a total of one hundred and fifty cancer patients made up of males and females from various age groups receiving treatment at UBTH.

3.3 Inclusion Criteria

Cancer patients undergoing therapy in a secondary and tertiary health facility in Benin City, Ovia North-East Local Government, Edo State, Nigeria that were willing to participate.

3.4 Exclusion Criteria

Non consenting cancer patients in the health facility in Benin City, Ovia North-East Local Government, Edo State, Nigeria were excluded.

3.5 Ethical Approval

Approval for this research was sought and obtained from the Ethics and Research committee, University of Benin Teaching Hospital. Informed consent was also sought and obtained from all participants and guardians before sample collection. A well-structured questionnaire was administered to collect bio data and socio demographic of each participant

3.6 Data Collection

Socio demographic and other parameters were obtained from participants through the administration of prepared Questionnaires. Each questionnaire had a unique participant identification number (PIDN).

3.7 Sample Size Calculations

The minimum sample size was determined based on the prevalence obtained from previous studies done on transmissible infections among breast cancer patients in Calabar, Nigeria which was 8% (HBV) (Udosen *et al.*, 2023). The sample size for this study was then obtained using the formula described by Daniel *et al.*, (1999).

$n = Z^2 Pq / d^2$

n= sample size

Z= 95%confidence interval equaling to 1.96, and the tolerable sampling error (0.05)

p= Prevalence of the disease in the population

q= 1-p

d=tolerable sampling error (0.05)

$Z^2 = 1.96^2$

P= 0.8

q= 0.98

$d^2 = 0.0025$

(3.8416 × 0.08 (0.98)) / 0.0025

n= 120. 472 minimum sample size

For the present study, a total of 150 samples from oncology patients was collected and screened for HBsAg and HIV.

3.8 Sample Collection

Three (3) liters of blood was collected using venipuncture method, standard operating procedures (SOPs) and dispensed into a plain sample container. Samples were transported to the medical laboratory for analysis.

3.9 Specimen Processing and Analysis

The blood is allowed to stand on the bench to form clot and the serum separated afterwards by centrifugation at 3000 revolution per minute (rpm) for 5 minutes. The serum was screened immediately for Hepatitis B virus using HBsAg Rapid Test Strip (Whole Blood/ Serum/ Plasma) and antibodies to HIV 1and/or HIV 2 using HIV ½ Human Immunodeficiency Virus Rapid Test Strip (Whole Blood/ Serum/ Plasma) (RAPIDLAB Unique Global, China).

3.9.1 Principles of the Procedure

The HBsAg Rapid Test Strip (Whole Blood/ Serum/ Plasma) is a qualitative rapid visual immunoassay for the detection of HBsAg through interpretation of color development in the strip. The membrane within the test strip was immobilized with anti-HBsAg antibodies on the test region. Human Whole Blood, Serum or Plasma is added to the absorbent pad on the test strip and moves on the membrane by capillary action and interacts with the reagents forming a colored and at the test region. The presence of a colored band indicates a positive result, while its absence signifies negative result. The appearance of a colored band also serves as procedural control denoting that proper volume of specimen has been added.

HIV ½ Human Immunodeficiency Virus Rapid Test Strip (Whole Blood/ Serum/ Plasma) is a qualitative visual immunoassay used to detect antibodies to HIV-1 and/or HIV-2 in human whole blood, serum, or plasma. The membrane within the test strip is immobilized with recombinant HIV antigens in the test region. When the specimen is added to the absorbent pad, it migrates along the membrane by capillary action, allowing any HIV antibodies present to bind to the antigens. This binding produces a colored band at the test region, indicating a positive result, while the absence of a band indicates a negative result. The appearance of a colored band at the control region serves as a procedural control, confirming that the correct volume of specimen has been applied and that the test has functioned properly.

3.10 Quality Control

A known positive sample for both HBsAg and HIV was obtained from the Medical Laboratory Science Department at UBTH and used to test the performance of the rapid test kits. The testing

was carried out according to the manufacturer's instructions. The kits were stored as recommended, remaining in their sealed pouches until use.

3.11 Interpretation of Results

HBsAg

Positive: A pink or red colored band appears in the control region (C) and another colored band appears in the test (T) region.

Negative: One colored band appears at the control region and no band appears in the test region.

Invalid: Control band fails to appear during specified result reading time (15 minutes). Insufficient specimen, incorrect procedure and deterioration or expiry of test reagents are the most likely causes or control band failure.

HIV

Positive: A pink or red colored band appears in the control region (C) and another colored band appears in the test (T) region.

Negative: One colored band appears at the control region.

Invalid: Control band fails to appear during specified result reading time (15 minutes). Insufficient specimen, incorrect procedure and deterioration or expiry of test reagents are the most likely causes or control band failure.

3.12 Statistical Analysis

Data collected were analyzed using statistical tools such as SPSS statistics software (Statistical Package for Social Sciences) version 22.0 and relevant information such as prevalence was obtained. The data was analyzed using The Kolmogorov–Smirnov one-sample test. P-values were reported and interpreted against conventional thresholds ($P>0.05$) to determine statistical significance.

CHAPTER FOUR

4.0 RESULTS

Table 4.1a presents the total Seroprevalence of HIV, HBV, and co-infection among oncology patients at UBTH. Out of 150 patients, HIV infection was recorded in 6 (4%) while HBV infection was seen in 3 (2%). No cases of co-infection (0%) were detected.

Table 4.1b further breaks this down by cancer type. Carcinoma patients accounted for the majority of infections, with 4.8% HIV-positive with equal distribution among males (3/57, 5.3%) and females (3/68, 4.4%). 2.4% were HBV-positive affecting one male (1/57, 1.8%) and two females (2/68, 2.9%). The remaining cancer groups (sarcoma, leukemia, lymphoma, and others) showed no seropositivity. Statistical analyses confirmed significant associations between HIV/HBV prevalence and cancer type ($P<0.001$).

Table 4.2 shows prevalence by age group and sex. HIV infections were highest among patients aged 41–60 years, particularly 41–50 years (6.7%) and 51–60 years (7.4%). HBV infections were also detected within this age bracket, though less frequently. Younger and older patients showed no cases. Regardless, neither sex nor age of exposure significantly influenced any of the two viral infections. The P values for sex differences were >0.05, indicating no statistically significant relationship between sex and infection status.

Table 4.1a: Seroprevalence of HIV, HBV and co- infection among oncology patients (cancer patients) at UBTH, Edo State (N= 150)

Variable	No Positive	% Positive	P value	Odds ratio
HBV	3	2	>0.05	0.49
HIV	6	4		
HBV-HIV co-infection	0	0		
Total	**9**			

P> 0.05 = no significant difference

Table 4.1b: Seroprevalence of HIV and HBV among cancer patients in relation to types of cancer

	No. Examined			HIV % No. Infected			HBV % No. Infected		
Cancer Types	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**
Carcinoma	125	57	68	6 (4.8)	3 (5.3)	3 (4.4)	3 (2.4)	1 (1.8)	2 (2.9)
Sarcoma	5	1	4	0	0	0	0	0	0
Leukemia	4	3	1	0	0	0	0	0	0
Non-Hodgkin lymphoma	1	1	0	0	0	0	0	0	0
Others	15	9	6	0	0	0	0	0	0
Total	**150**	**71**	**79**	**6**	**3**	**3**	**3**	**1**	**2**
X2		117.34	157.81						
DF		3	3						
P-Value		0.000	0.000						
***Sig**		**P<0.001**	**P<0.001**						

*** P< 0.001 = very high significant difference,**

P> 0.05 = no significant difference

Table 4.2: Seroprevalence of HIV and HBV among cancer patients attending health facility In Benin City, Edo State in relation to Age

	No. Examined			HIV % No. Infected			HBV % No. Infected		
Age	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**
0-10	5	4	1	0	0	0	0	0	0
11-20	4	1	3	0	0	0	0	0	0
21-30	12	5	7	0	0	0	0	0	0
31-40	20	11	9	1(0.5)	0	1(11.1)	0	0	0
41-50	45	18	27	3(6.7)	2(11.1)	1(3.7)	0	0	0
51-60	27	8	19	2(7.4)	1(12.5)	1(5.3)	2(7.4)	1(12.5)	1(5.3)
61-70	21	13	8	0	0	0	1(4.8)	0	1(12.5)
71-80	12	8	4	0	0	0	0	0	0
81-90	4	3	1	0	0	0	0	0	0
Total	**150**	**71**	**79**	**6**	**3**	**3**	**3**	**1**	**2**
X2		32.775	53.962	4.800	0.167	4.300	3.556		
DF		7	7	2	1	2	1		
P-Value		0.000	0.000	0.091	0.683	0.116	0.059		
***Sig**		**P<0.001**	**P<0.001**	P>0.05	P>0.05	P>0.05	P>0.05		

*** P< 0.001 = very high significant difference,**

P> 0.05 = no significant difference

Table 4.3 shows the Risk factors and awareness levels among HIV-infected cancer patients can be observed in All six HIV-positive patients (100%) had prior knowledge of HIV, and two-thirds had undergone HIV testing. However, risky behaviors such as sharing personal items (16.7%) and lack of consistent testing highlight ongoing vulnerability.

Table 4.4 presents similar findings for HBV-infected patients. All three HBV-positive patients were aware of HIV, but only one-third had awareness of HBV itself or had been tested. This indicates a knowledge gap, where patients are more informed about HIV than HBV. The statistical test showed significance ($p < 0.05$): suggesting the difference in awareness and risk behaviors among HBV patients is meaningful.

Table 4.5 addresses the general awareness and knowledge of HIV and HBV among cancer patients (children enrolled for the study did not fill any questionnaire). Almost all respondents had heard of HIV, compared to the few who had heard of HBV. Similarly, HIV testing was far more common than HBV and vaccination against HBV was extremely low.

Table 4.3: Risk factors and Awareness level of cancer patients infected with HIV in relation to cancer types

		% Number of positive response to question on HIV												
Cancer Types	**Total No Infected**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**X2**	**DF**	**P-Value**	***Sig**
Carcinoma	6	4(66.7)[b]	0	0	1(16.7)[c]	1(16.7)[c]	6(100)[a]	0	3(50)[b]	1(16.7)[c]	24.388	3	0.000	**P<0.001**
Sarcoma	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Leukemia	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Non-Hodgkin lymphoma	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Others	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Total	**6**	**4**	**0**	**0**	**1**	**1**	**6**	**0**	**3**	**1**				

*** P< 0.001 = very high significant difference,**
P> 0.05 = no significant difference

KEYS:

1	Have you had blood transfusion in the past?
2	Are you sexually active?
3	Do you practice unprotected sex?
4	Do you share personal items like clippers, razorblade etc.?
5	Have you heard of hepatitis B Virus?
6	Have you heard of HIV?
7	Have you been vaccinated for hepatitis B Virus?
8	Have you ever been tested for HIV?
9	Have you ever been tested for Hepatitis B Virus?

Table 4.4: Risk factors and Awareness level of cancer patients infected with HBV in relation to cancer types

		% Number of positive response to question on HBV												
Cancer Types	**Total No Infected**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**X2**	**DF**	**P-Value**	***Sig**
Carcinoma	3	2	1	0	1(33.3)[c]	0	3(100)[a]	0	2(66.7)[b]	1(33.3)[c]	7.153	2	0.028	**P<0.05**
Sarcoma	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Leukemia	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Non-Hodgkin lymphoma	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Others	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Total	**3**	**2**	**1**	**0**	**1**	**0**	**3**	**0**	**2**	**1**				

*** P< 0.001 = very high significant difference,**

P> 0.05 = no significant difference

KEYS:

1	Have you had blood transfusion in the past?
2	Are you sexually active?
3	Do you practice unprotected sex?
4	Do you share personal items like clippers, razorblade etc.?
5	Have you heard of hepatitis B Virus?
6	Have you heard of HIV?
7	Have you been vaccinated for hepatitis B Virus?
8	Have you ever been tested for HIV?
9	Have you ever been tested for Hepatitis B Virus?

Table 4.5: Awareness and knowledge of HIV and Hepatitis B Virus among cancer patients of 11 – 90 years old

	No Positive Response (%)		
Question	**Total**	**Male**	**Female**
Have you heard of hepatitis B Virus?	10	4(40.0)	6(60.0)
Have you heard of HIV?	145	67(46.2)	78(53.8)
Have you been vaccinated for hepatitis B Virus?	6	1(16.7)	5(83.3)
Have you ever been tested for HIV?	125	56(44.8)	69(55.2)
Have you ever been tested for Hepatitis B Virus?	10	4(40.0)	6(60.0)
X2	327.074	158.075	169.597
DF	4	4	4
P-Value	0.000	0.000	0.000
***Sig**	**P<0.001**	**P<0.001**	**P<0.001**

*** P< 0.001 = very high significant difference,**
P> 0.05 = no significant difference

CHAPTER FIVE

5.0 Discussion

Globally, infectious agents serve as major contributors to cancer burden, especially in Africa. In Nigeria, a study carried out in Abuja and Enugu highlighted common infectious agents in the cancer population, namely human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), human papillomavirus (HPV), and Epstein–Barr virus (EBV) (Odutola *et al.,* 2016).. This research investigated the Seroprevalence of Hepatitis B virus (HBV) and Human immunodeficiency virus (HIV) among oncology patients (cancer patients) presenting for various cancer types attending the University Of Benin Teaching Hospital (UBTH).

Although the initial scope included patients attending both secondary and tertiary health facility, it was observed during the course of study that UBTH serves as a major referral center for cancer (Jaquet *et al.,* 2015) care in Benin City and even Edo state as a whole, with patients also receiving therapy from Delta state and other neighboring states. A total of 150 patients were enrolled, with 71 males (47.3%) and 79 females (52.7%), among various cancer types including carcinoma, sarcoma, leukemia, Non-Hodgkin lymphoma, and others.

The study recorded seroprevalence rates of 4% for HIV (6/150), 2% for HBV (3/150), and no cases (0%) of HBV-HIV co-infection. Infection rates were similar between males and females with HIV positive cases reporting 4.2% in males and 3.8% in females, while HBV positivity was 1.4% in males and 2.5% in females. These frequencies are lower than those reported in the Johannesburg Cancer Case–Control Study, which found a 33.7% HIV prevalence among 5,436 cancer patients (Sengayi *et al.,* 2015). Similarly in south African oncology patients, Malowane *et al.,* (2023) reported higher HBV prevalence. Udosen *et al.,* (2023) in a study among breast

cancer patients in Calabar found a prevalence of 6% and 8% for HIV and HBV respectively. These differences may result from variations in sample size as well as regional distribution of infection. Also most HBV infection in adults are self-liming however, HIV infection is lifelong

Among cancer types, carcinoma predominated (125/150, 83.3%). Seroprevalence of HIV Infected carcinoma patients reported 4.8%. HBV positivity was also limited to carcinoma patients (3/125, 2.4%). Adenocarcinomas, including breast, prostate, colon, and bronchogenic cancers, accounted for most infections. This is in line with findings observed that breast cancer was frequently associated with HIV (Traore *et al.,* 2015). The remaining cancer types recorded no HIV or HBV cases.

Infection was recorded among age group, 31-40, 41-50, 51-60 and 61-70. Pediatric patients, adolescents, young adults (18-30) and patients above 70 years had no case of infections. HIV infection was most common among patients aged 41–50 years (3/45, 6.7%) and 51–60 years (2/27, 7.4%), while HBV was observed in the 51–60-year (2/27, 7.4%) and 61–70-year (1/21, 4.8%) age groups. These patterns are consistent with data from South African cancer cohorts, where middle-aged adults showed higher HIV prevalence and age was a key factor influencing prior testing and awareness (Sengayi *et al.,* 2015). Jaquet *et al.,* (2015) reported a median age of 9 years among west African cancer patients with confirmed HIV status.

Risk behaviors and awareness levels among HIV-positive and HBV-positive patients (though less informed about their infection) found that all (100%) had prior knowledge of HIV. Risky practices were observed in smaller percentages with such as sharing personal items like clippers or razors, engaging in unprotected sex. A encouraging percentage had knowledge of history of

blood transfusion. In Calabar and South Africa, similarly low awareness of HBV among cancer patients was observed (Malowane *et al.,* 2023; Udosen *et al.,* 2023).

The overall awareness and knowledge among cancer patients (145 individuals that filled the questionnaire) recorded that all patients had heard of HIV (100%) which may be due to longstanding global and national focus on HIV awareness and prevention, whereas only (6.9%) were aware of HBV. HIV testing was reported in 125 patients (86.2%), compared to only 10 patients (6.9%) tested for HBV. Vaccination against HBV was extremely low. Similarly, Timbiri (2024) reported that 67.9% of respondents had poor knowledge of HBV, highlighting low awareness levels even in the general population.

The research findings contribute to evidence relating to the infection rate of HIV and HBV among cancer patients in Nigeria and helpful in strategizing and implementing public health measures for control of HIV and HBV**.** Oncology patients are immunocompromised due to cancer or therapy, making viral infection particularly concerning. Routine HBV screening, education, and vaccination should be integrated into oncology care. The age and cancer-type patterns also suggest that targeted interventions, rather than generalized approaches.

5.1 Limitations

The study had a small sample size, especially for less common cancer types, which may limit how well the results apply to the wider population. For HBV and HIV, a rapid strip test was used instead of more sensitive methods like other serological methods such as Enzyme Immunoassay (ELISA) or molecular methods such as polymerase chain reaction (PCR), which might have affected accuracy. The cross-sectional design means we cannot draw conclusions about cause and effect. Finally, self-reported information on risk behaviors and awareness could be

influenced by recall or social pressure. Data on HIV, HBV and co-infection prevalence n Nigeria across various cancer types remains limited.

5.2 Conclusion

The outcome of this study shows a notable prevalence of HBV and HIV among cancer patients, particularly among certain age groups. Infection rates were similar between males and females and concentrated among carcinoma patients. The fact that some patients have cancer yet are unaware of their viral status suggests recent infections. Seronegative HBV cancer patients should be vaccinated. Generally, while awareness of HIV was high, awareness about HBV was greatly lacking and vaccination extremely poor.

5.3 Recommendations

1. It is recommended that all oncology patients be routinely screened for Hepatitis B and HIV before commencing chemotherapy or any immunosuppressive treatment to enable early detection and appropriate clinical management.

2. Health institutions should incorporate HBV and HIV screening into standard cancer care protocols to ensure consistent monitoring and reduce the risk of complications from undiagnosed infections.

3. Public health awareness campaigns and Evidence based community engagement should be p to improve knowledge about HBV, reduce transmission especially among cancer patients and other immunocompromised individuals.

4. Patients who test negative for HBV should be offered vaccination as part of their standard care, to prevent infection and reduce the risk of reactivation during immunosuppressive therapy.

5. Further research involving larger sample sizes and multiple centers is recommended to better understand the prevalence and impact of HBV and HIV co-infections among cancer patients in Edo State, and even across Nigeria.

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APPENDIX

QUESTIONNAIRE

QUESTIONNAIRE ON SEROPREVALENCE OF HEPATITIS B AND HUMAN IMMUNODEFICIENCY VIRUS AMONG ONCOLOGY PATIENTS IN A SECONDARY AND TERTIARY HEALTH FACILITY, BENIN CITY, EDO STATE, NIGERIA

Dear Respondent,

I am a final year student of the above-named institution conducting a research project titled "Seroprevalence of Hepatitis B and Human Immunodeficiency Virus (HIV) among Oncology Patients in a secondary and tertiary health facility in Benin City, Edo State, Nigeria."

This questionnaire is intended to collect useful data for academic purposes only. All responses will be treated with strict confidentiality, and no identifying information will be disclosed. Your participation is voluntary.

Please answer honestly. Tick (✓) the most appropriate box or fill in the space provided.

Thank you for your time and cooperation.

ENEGBUMA ANGELICA ONAGIEKHUWEMHE
Researcher

ID NUMBER: C____

SECTION A: SOCIO-DEMOGRAPHIC DATA

1. Age: _____
2. Sex: ☐ Male ☐ Female
3. Type of cancer: _____

SECTION B: HISTORY OF RISK EXPOSURE

4. Have you ever received a blood transfusion? ☐ Yes ☐ No

5 Are you sexually active? ☐ Yes ☐ No

6 Do you practice unprotected sex? ☐ Yes ☐ No

7 Do you share personal items like clippers, razorblade etc.? ☐ Yes ☐ No

SECTION C: KNOWLEDGE OF HBV AND HIV

8. Have you heard of hepatitis B Virus? ☐ Yes ☐ No

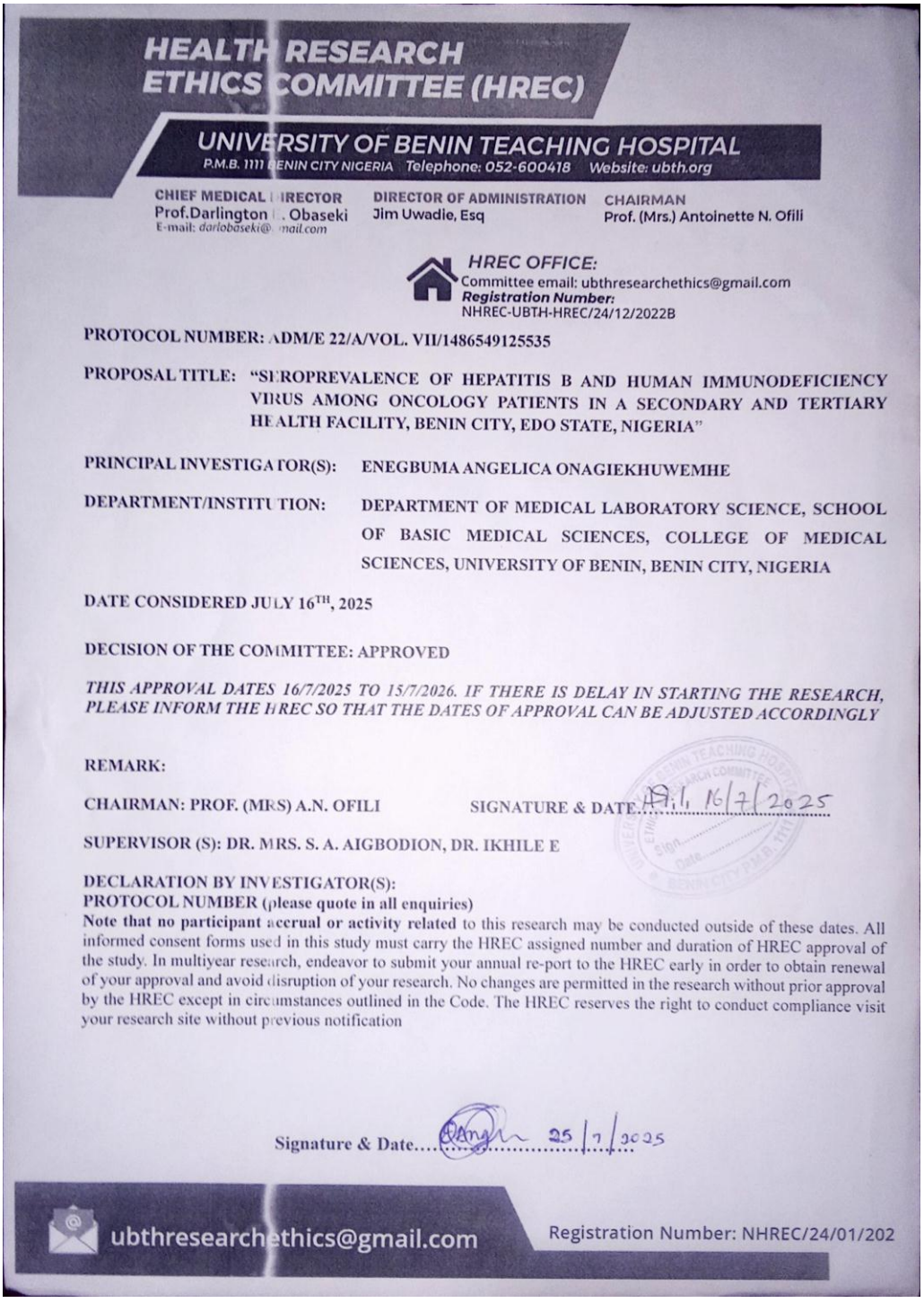
9. Have you heard of HIV? ☐ Yes ☐ No

10. Have you been vaccinated for hepatitis B Virus? ☐ Yes ☐ No

11. Have you ever been tested for HIV? ☐ Yes ☐ No

12. Have you ever been tested for Hepatitis B Virus? ☐ Yes ☐ No

ETHICAL APPROVAL



HEALTH RESEARCH ETHICS COMMITTEE (HREC)

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Registration Number:
NHREC-UBTH-HREC/24/12/2022B

PROTOCOL NUMBER: ADM/E 22/A/VOL. VII/1486549125535

PROPOSAL TITLE: "SEROPREVALENCE OF HEPATITIS B AND HUMAN IMMUNODEFICIENCY VIRUS AMONG ONCOLOGY PATIENTS IN A SECONDARY AND TERTIARY HEALTH FACILITY, BENIN CITY, EDO STATE, NIGERIA"

PRINCIPAL INVESTIGATOR(S): ENEGBUMA ANGELICA ONAGIEKHUWEMHE

DEPARTMENT/INSTITUTION: DEPARTMENT OF MEDICAL LABORATORY SCIENCE, SCHOOL OF BASIC MEDICAL SCIENCES, COLLEGE OF MEDICAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY, NIGERIA

DATE CONSIDERED JULY 16TH, 2025

DECISION OF THE COMMITTEE: APPROVED

THIS APPROVAL DATES 16/7/2025 TO 15/7/2026. IF THERE IS DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY

REMARK:

CHAIRMAN: PROF. (MRS) A.N. OFILI SIGNATURE & DATE A.N.O. 16/7/2025

SUPERVISOR (S): DR. MRS. S. A. AIGBODION, DR. IKHILE E

DECLARATION BY INVESTIGATOR(S):
PROTOCOL NUMBER (please quote in all enquiries)
Note that no participant accrual or activity related to this research may be conducted outside of these dates. All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study. In multiyear research, endeavor to submit your annual re-port to the HREC early in order to obtain renewal of your approval and avoid disruption of your research. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the Code. The HREC reserves the right to conduct compliance visit your research site without previous notification

Signature & Date.... 25/7/2025

ubthresearchethics@gmail.com Registration Number: NHREC/24/01/202

INFORMED CONSENT FORM

Study Title: Seroprevalence of Hepatitis B and Human Immunodeficiency Virus (HIV) among Oncology Patients in a Secondary and Tertiary Health Facility in Benin City, Edo State, Nigeria.

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Introduction

Your child is being invited to take part in this research. This form explains the purpose, procedures, and your rights as a parent/guardian. Please read carefully and ask any questions before deciding.

Purpose of the Study

The aim of this study is to find out how common Hepatitis B and Human Immunodeficiency Virus (HIV) infections are among patients receiving cancer (oncology) care in secondary and tertiary health facilities in Benin City. The results will help improve prevention and care strategies for children and adults in our community.

If you agree, your child will:

Provide a small blood sample (about 1-3ml) for testing of Hepatitis B and HIV.

Allow access to basic medical records relevant to the study.

The procedure is similar to routine hospital blood tests and will take only a few minutes.

Risks and Discomforts

The risks are minimal. Your child may feel brief discomfort or bruising at the blood collection site. No other risks are expected.

Benefits

Your child may not directly benefit, but the results of this research will provide valuable information that can improve the management of infections in oncology patients. If results suggest any health concern, you will be informed and referred for appropriate care.

Confidentiality

All information about your child will be kept strictly confidential. Names will not appear in any report or publication. Data will be coded and stored securely, accessible only to the research team.

VOLUNTARY PARTICIPATION

Your child's participation is completely voluntary. You may refuse, or withdraw your child at any time without affecting their care at the hospital. If you have questions, please contact: Enegbuma Angelica Onagiekhuwemhe (phone number: 08066402299)

Consent

By signing below, you confirm that:

You have read and understood this information.

Your questions have been answered.

You agree for your child to participate.

Child’s ID Number: _____

Parent/Guardian Signature: _____

Date: _____

TABLES

Table A: Seroprevalence Of HIV And HBV Among Male And Female Oncology Patients (N= 150)

Infection	**Total no Male examined(%)**	**Total no Female examined(%)**	**No Positive Male (%)**	**No Positive Female (%)**	**P value**
HIV	71(47.3)	79(52.6)	3(4.2)	3(3.8)	P>0.05
HBV	71(47.3)	79(52.6)	1(1.4)	2(2.5)	P>0.05

P>0.05 =no significant difference

Table B: Distribution of HIV And HBV Among Male and Female In Relation to Specific Carcinoma Types

Carcinoma type	**Specific cancer**	**HIV Positive Male**	**HIV Positive Female**	**HBV Positive Male**	**HBV Positive Female**
Adenocarcinoma	Breast Cancer	0	2	0	1
	Prostate Cancer	1	0	1	0
	Colon Cancer	1	0	0	0
	Bronchogenic Cancer	0	1	0	0
Squamous Cell Carcinoma	Conjunctiva Cancer	1	0	0	0
Advanced Stage Carcinoma	Stage 4 Breast Cancer	0	0	0	1
Total		**3**	**3**	**1**	**2**

FIGURES

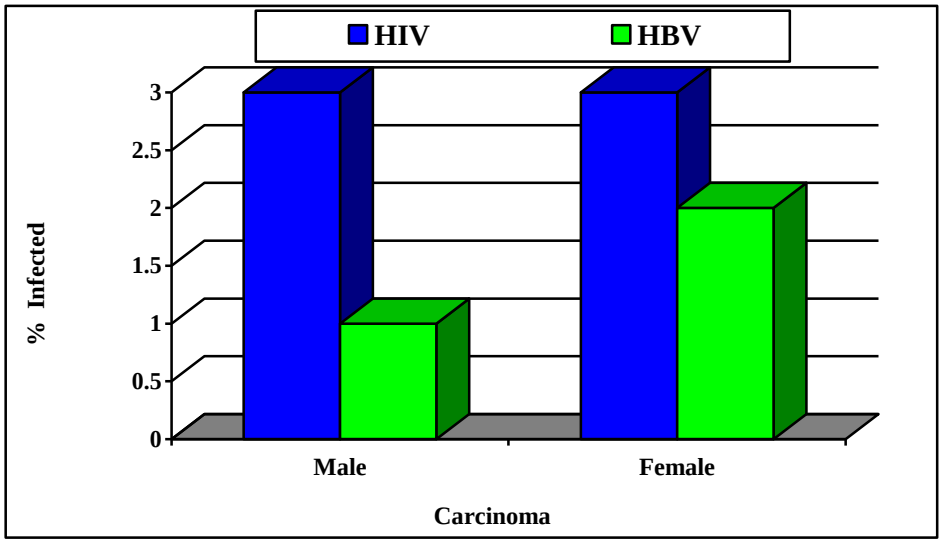

Fig A: Bar Chart showing seroprevalence of HIV and HBV among Male and Female carcinoma patients

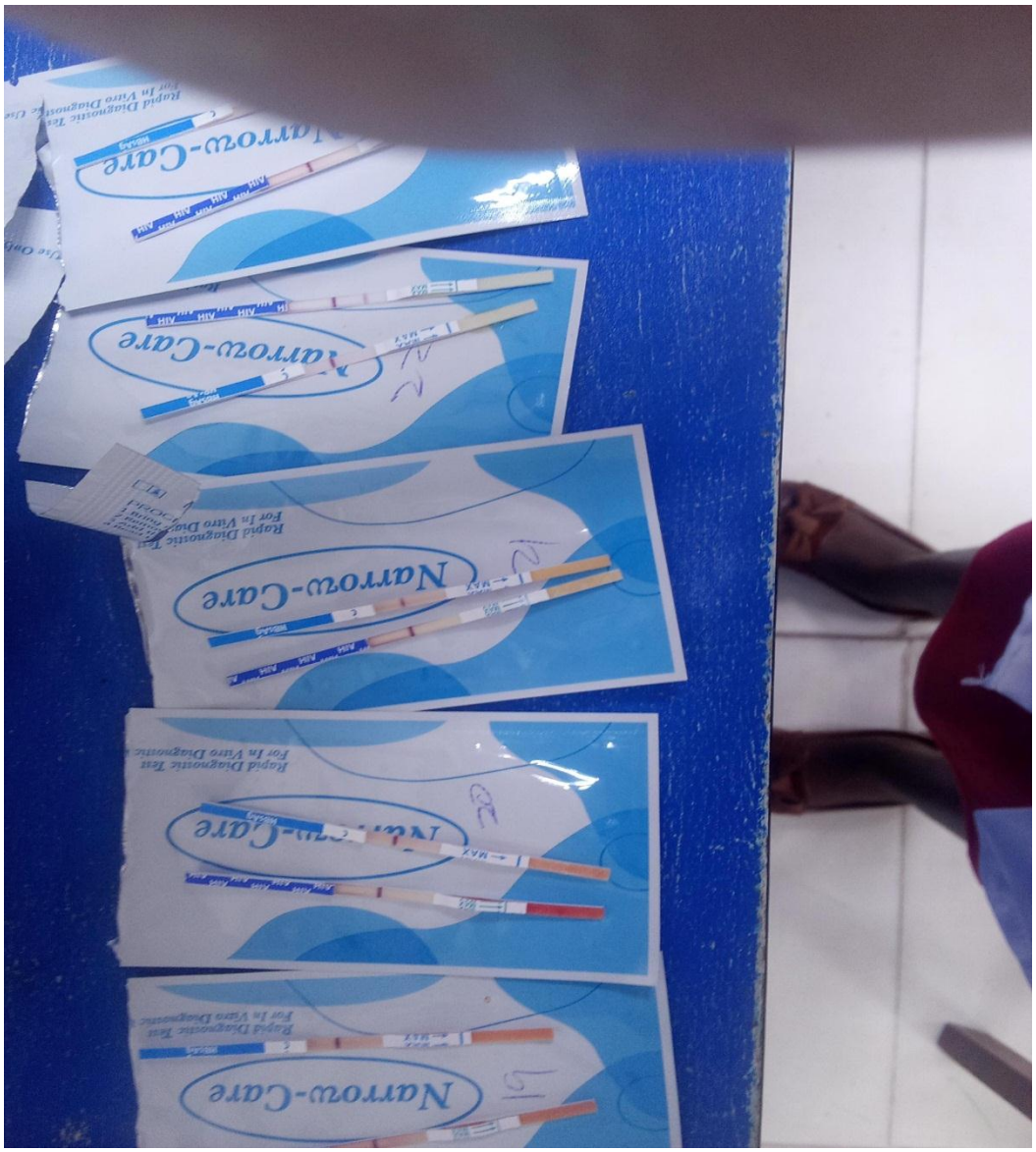

Fig B: A picture of Rapid Diagnostics Test of HIV and HBV

Fig C: A picture of Researcher carrying out Diagnostics Test of HIV and HBV