Assessment of Knowledge and Practice on Hepatitis B Virus Infection Prevention Among Students of Univeristy in Ikere Ekiti, Ekiti State

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Certification

This is to certify that Mary Alaba ADERIBIGBE with matriculation number LCU/PG/001869 carried out this research work titled "Assessment of Knowledge and Practice on Hepatitis B Virus Infection Prevention among Students of Bamidele Olumilua University of Education Science and Technology Ikere Ekiti Ekiti State" in the Department of Public Health, Faculty of Basic Medical and Applied Science, Lead City University, Ibadan, Oyo State, for the award of Master Degree (MPH) in Public Health and that this has not been previously submitted.

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Dedication

This research work is dedicated to the Almighty God, the giver of all things

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Abstract

Hepatitis B virus is more infectious than HIV, and the virus is endemic in Nigeria. The study was carried out among the students of Bamidele Olumilua University Education Sciences and Technology Ikere Ekiti aimed at investigating the knowledge and practice on Hepatitis B virus infection prevention. The objective of the study was to assess the knowledge and practice of the students regarding HBV infection prevention. The design was cross sectional study where data was collected using self-administered questionnaires given to about 400 students using and analysis was carried out by using Statistical Package for Social Sciences version 20. The results showed that 52% of the respondents have knowledge of HBV while 40% have not heard of HBV. 13.6% have undergone screening for HBV and only 14,6% had received vaccination. Minority demonstrated good practice towards prevention of HBV infection. It was concluded that low screening rates, lack of HBV vaccine uptake and poor practice towards infection prevention heightened the vulnerability of the students to HBV infection. Recommendation was made that adequate educational campaign to create awareness and prevention of the infection should be regularly done. Access to screening and vaccination should be made available to the students.

Keywords: Hepatitis B Virus, Knowledge, Practice, Infection, Prevention, Vaccination.

Word Count: 252 words

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List of Acronyms

Abbreviations	Meaning
HB	Hepatitis B
HCC	Hepato-cellular Carcinoma
HBV	Hepatitis B Virus
SSA	Sub Saharan Africa
HBsAg	Hepatitis B Surface Antigen
BOUESTI	Bamidele Olumilua University of Education, Science and Technology, Ikere Ekiti.
STDs	Sexually Transmitted Diseases
HIV/AIDS	Human Immunodeficiency Virus/Acquired ImmunodeficiencySyndrome
HCV	Hepatitis C Virus
WHO	World Health Organization
ART	Antiretroviral Therapy
EPI	Extended Programme for Immunisation
DNA	Deoxyribonucleic Acid
RNA	Ribonucleic Acid

HBeAg	Hepatitis B e Antigen
PEP	Post-Exposure Prophylaxis
HBIG	Hepatitis B Immune Globin
COVID-19	Coronavirus Disease-1
TPB	Theory of Planned Behavior
SCT	Social Cognitive Theory
HBM	Health Belief Model
TTM	Trans Theoretical Model
TRA	Theory of Reason Action
RDT	Rapid Diagnostic Test
ELISA	Enzyme Linked Immunosorbent Assay
RAPD	Random Amplified Polymorphic DNA
FCE	Federal College of Education
UNEC	University of Enugu Campus
MTCT	Mother to Child Transmission
KAP	Knowledge, Attitudes, Practices

SVP	Sub Viral Particles
ORF	Open Reading Flame
cccDNA	Covalently Closed Circular DNA
RT	Reverse Transcriptase
pgRNA	pregenomic RNA
SPSS	Statistical Package for Social Sciences
APOBEC3	apolipoprotein B editing complex 3
CBP	CREB-binding protein
cccDNA	covalently closed circular DNA,
C/EBP	CCAAT-enhancer-binding protein,
CREB	cAMP response element binding protein,
DHBV	duck hepatitis B virus,
eTIF	eukaryotic translation initiation factor,
FEN1	flap structure-specific endonuclease 1

Chapter One

Introduction

1.1 Background to the Study

Hepatitis B (HB) is a major public health problem, as one-third of the world population is infected with the virus[1]. It is a life-threatening viral infection that causes acute and chronic diseases of the liver[2]. Globally, about 360 million people are chronic carriers and are at risk of developing liver diseases likecirrhosis and hepatocellular carcinoma (HCC)[3]. Hepatitis B virus (HBV) is a DNA virus that is 100 times more infectious than the human immunodeficiency virus[3]. HBV is very contagious and easy to be transmitted from one infected individual to another through blood or other body fluids during sexual and non - sexual contacts, mother -to -child transmission, and unsterilized equipment[4].

The prevalence of HBV infection varies across regions of the world as a result of the differences in social, cultural factors and different modes of transmission of the virus[5]. It ranges between 2% and 7% in developed countries of America and Europe and between 5% and 20% in Asia, Africa, and the Middle East [6,7].

The burden of HBV infection is lowest in America with 5 million people chronically ill, 14 million in European Region, 18 million in South-East Asia Region while 60 million people are infected in the Eastern Mediterranean Region. It is highest in Western Pacific Region and the African Region with about 116 million and 81 million people are chronically infected[8].

InSub-Saharan Africa (SSA) has one of the highest burdens of HBV with approximately one in every 15 people infected with HBV [9]

Pooling the prevalence of HBV by country, Kenya had the highest prevalence rate of 8.54%, followed by Uganda (8.454%) and Tanzania (5.16%), and finally Rwanda with the lowest prevalence (4.1%)[10]

However, Nigeria is one of the countries with greatest burden of HBV accounting for 8.3%. One in every 12 persons in the country is estimated to be living with the infection[11]. This placed Nigeria in the hyper-endemic region of HBV infection.Studies from Nigeria on the prevalence of hepatitis B among subgroups showed the prevalence of 12.2% among the general population, 16% among adults, 14% among blood donors, 14.1% among pregnant women attending antenatal clinic, 13.7% among traders, 13% among healthcare workers, and 11.5% among children[12,13]. Various studies have reported different prevalence of 9.7% and23.1% among youths and students[14,15]. As a result, Nigeria has one of the highest rates of HBV-attributable cancer in West Africa, with an age-standardized incidence estimate of 2.6 to < 5.1 cases per 100,000 person-years[16,17,18]

Knowledge is very important in preventing many contagious diseases. Poor knowledge can place people life in the danger of severe and fatal health complications. Many individuals who have been infected with HBV do not know that they are infected as the disease silently damage the liver function which may take up to 30 years to develop without any sign or symptom[19]. Although several studies have reported low knowledge of Hepatitis B Virus among undergraduates in Nigeria,[20,21]however, knowledge about preventive measure have not been well documented among Nigerians students. Despite the high prevalence of HBV in Nigeria, about nine in ten Nigerians who live with chronic HBV are unaware of their infection status, and are missing from the global public health statistics due to a lack of resources, awareness, and political will for addressing Nigeria's HBV plight.[22,23,24]

While safe practices are important, the prevention of HBV infection is effective through immunization [25]. Immunization was introduced against HBV about two decades ago in Nigeria, and it was included in the routine immunization schedule for children[26].

However, other protective measures include condom use during sexual intercourse, handwashing, avoiding sharing of needles and personal care items like toothbrush and razor, using protective barriers such as gloves, and avoiding tattooing as much as possible, especially when the sterility of the tattooing equipment is not guaranteed, appropriate sterilization of medical equipment, and a suitable hospital waste management. Due to the latest trends in fashions, such as body piercing and explosives makeups through the use of sharp objects, students are at high risks of contracting and spreading the disease [27].

Undergraduate students are majorly youths who are sexually active and are usually required when there is need for blood donation which make them at high risk of the infection[14]. Though, there are several studies that have been carried out among medical and health sciences students but there is a gap in knowledge, prevention and practice of Hepatitis B virus infection among undergraduates in Nigeria especially in Ekiti State. This study is aimed to assess the knowledge and practice on HBV infection among students of Bamidele Olumilua University of Education, Science and Technology, Ikere Ekiti. (BOUESTI)

Statement of the Problem

HBV remains the major cause of liver -related morbidity and mortality across the globe particularly in SSA[2]. Globally more than 600,000 die of HBV- related liver diseases every year.[3]

About 120,000 of Nigeria's population are affected with Hepatitis B, more than 50,000 suffered from lifelong chronic infection, and more than 12,000 individuals die due to HBV - induced infections[2].

Approximately, 95% of new HBV infections occur among young adults, who have been unvaccinated exposing their household contacts and sex partners at the risk of getting infected[5]

Lack of knowledge of hepatitis B among university students seems alarming, especially when the virus is highly infectious and hyper endemic in Nigeria [28]. University Students are at high-risk of contacting and spreading Hepatitis B virus infection because it is at this stage that they initiate interest in sexual relationships and tend to explore and experiment with sex, which is a risk factor of contraction and transmission of hepatitis B[35]. Young adults between 15–24 years old represent 25% of the sexually active population and almost half of all newly acquired STDs is majorly caused by sexual ignorance, sexual abuse, nonuse of condoms, high number of relationships between young persons and older partners, use of hard drugs, and poor attitude in making use of hospitals [9].

To reduce the rate of infection among students, it is important for them to have adequate knowledge of HBV infection and appropriate measures to prevent.

In Nigeria, the vaccination of young adults does not have the same implementation success as compared to infant vaccinations. Much emphasis has been laid by the national policy for

the control of viral hepatitis in Nigeria on the need for public enlightenment on the transmission of viral hepatitis and vaccination, especially among health-care workers, mothers of infants, and sex workers, but there is no information provided that focuses on high-risk group like university students and young adults.

Justification of the Study

Good knowledge and practice of Hepatitis B virus prevention are essential for infection control among the students. There is limited evidence concerning knowledge and practice of Hepatitis B infection preventive measure among this study population. Understanding the level of knowledge preventive and preventive measure is essential to designing programme for behavior among HBV high-risk groups especially students. Efforts aimed at understanding the level of awareness and knowledge of HBV transmission and prevention is important, especially among young adults.

The results of this study will be of help at increasing the level of knowledge and awareness of HBV infection and its prevention among the study population. It will be of great help and eye opener for policy makers and government officials in implementation of various health programs like sensitization, health educational talks, screening, vaccination as efforts in prevention of HBV infection among the students this area.

Aim and Objectives of the Study

This study investigated the knowledge and practice on Hepatitis B virus infection prevention among students of Bamidele Olumilua University of Education, Science and Technology Ikere-Ekiti.

The specific objectives of this study are to:

i. assess the knowledge of Hepatitis B virus infection among students of Bamidele Olumilua University of Education, Science and Technology Ikere-Ekiti.
ii. examine the practice of HBV infection prevention among students of Bamidele Olumilua University of Education, Science and Technology Ikere-Ekiti.
iii. identify the factors influencing the practice of Hepatitis B virus infection prevention among students of Bamidele Olumilua University of Education, Science and Technology Ikere-Ekiti.

Research Questions

1. What is the knowledge of Hepatitis B virus infection among the study population?
2. What is the practice of Hepatitis B virus infection prevention among the study population?
3. What are the factors influencing the practice of HBV infection prevention among the study population?

Significance of the Study

In Nigeria, many people especially the youth and students are ignorant about the hepatitis B infection and its prevention. It has become very difficult to control and prevent the

transmission of this disease because of the poor knowledge among the populace. It is of great importance to create awareness among the youth and students about the knowledge, practice and factors that influence HBV infection prevention. The results from this study would be an opener to how knowledgeable the students of BOUESTI are about HBV Infection and their practice on the prevention of the disease. It would be of great help to the state ministry of health, health educators and the school authority to have programs like sensitization, health education talks, screening and vaccination that would be of help in curtailing the spread of this infectious disease among the students.

The study would provide useful information for policy makers to find solution to the challenges of scarcity HBV vaccines for youth and students.

Scope of the Study

The research centers on the assessment of knowledge of HBV infection on prevention among one of the universities in South West Nigeria. It also examined the practice of the infection prevention to mitigate the transmission of the virus. The factors influencing the practice of the prevention were also identified through the review of some past journals.

Limitation of the Study

Participants may have been biased in responding to some items (such as prevention practices) since the data collected was based on self-reported information. Further studies can be conducted on the prevalence of the infection among the study populace.

Operational Definition of Terms

Good knowledge: Study participants who answer more than half of the knowledge questionscorrectly.

Poor knowledge: Study participants who answer less or equal to half of the knowledgequestions correctly.

Good practice: Study participants who were able to answer more than half of practice itemquestions correctly.

Poor practice: Participants who were unable to answer less or equal to half of the practiceitem questions correctly

Endnotes

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Chapter Two

Literature Review

Conceptual Review

Hepatitis B Virus Infection

Hepatitis B virus (HBV) infection is a serious global health challenge that impacts millions of individuals across the world[1]. As a member of the Hepadnaviridae family, HBV is a hepatotropic DNA virus, meaning it specifically targets and infects liver cells, leading to various degrees of liver damage. This viral infection is a major cause of viral hepatitis, contributing to a significant burden on public health systems and posing a substantial threat to global well-being[2].

The progression of hepatitis B varies from individual to individual[2]. The initial phase of Hepatitis B infection, referred to as acute hepatitis B infection, is a critical stage that spans the first six months after an individual becomes exposed to the virus[3]. During this period, a substantial proportion of those infected may not exhibit any noticeable symptoms, making it challenging to identify the infection promptly[3]. This asymptomatic presentation poses a significant public health concern, as individuals may unknowingly transmit the virus to others, perpetuating the spread of the disease within communities[3].

Among those who do develop symptoms during the acute phase, the manifestations typically remain mild and non-specific[3]. Such vague symptoms may include fatigue, loss of appetite, mild fever, and general malaise[3]. The mild nature of these symptoms often leads affected individuals to dismiss them as a passing flu or common viral illness, not realizing the underlying involvement of their liver[3]. Consequently, the acute phase of hepatitis B

frequently goes unnoticed or is misdiagnosed, contributing to delayed recognition and management of the infection[4].

According to Tripathi and Mousa, (2023) the challenge of detecting acute hepatitis B infection is compounded by the fact that in some cases, symptoms may not manifest until later stages of the acute phase or may not appear at all[5]. This further hinders early diagnosis and underscores the importance of raising awareness among healthcare professionals and the general public about the asymptomatic and mild nature of the initial infection[5].

During this phase, the immune system is actively responding to the viral invasion, attempting to clear the virus from the body[5]. However, in some instances, the immune response may not effectively control the infection, leading to viral persistence and progression to chronic hepatitis B, a condition characterized by prolonged viral presence and potential long-term liver complications[5].

Approximately 90% of individuals who contract hepatitis B as adults experience a favorable outcome during the acute phase, as their robust immune system effectively combats the infection[6]. Within six months, the virus is successfully cleared from their body, leading to complete healing of the liver, and they acquire lifelong immunity against hepatitis B infection[6]. This achievement is pivotal in preventing future reinfection and providing long-term protection to the individual.

However, in the remaining 10% of cases, the immune system's response is unable to clear the virus during the acute phase, resulting in the virus persisting beyond the six-month mark[6]. This enduring state is commonly referred to as chronic hepatitis B infection[6]. Unlike the acute phase, where the immune system is typically successful in controlling the virus,

individuals with chronic hepatitis B continue to carry the virus in their body for an extended period, often lasting for the rest of their life[7].

The persistence of the virus in chronic hepatitis B raises concerns about potential long-term consequences on liver health[1]. Over time, chronic infection may lead to inflammation and scarring of the liver, a condition known as liver fibrosis[8]. In some cases, this progression may further advance to cirrhosis, where extensive scarring disrupts liver function[8]. Moreover, individuals with chronic hepatitis B are at a heightened risk of developing hepatocellular carcinoma (HCC), a primary form of liver cancer[8] Conversely, where babies contract hepatitis B infection at birth or during infancy, the dynamics of the disease take on a distinct pattern compared to that observed in adult infections[9]. While in adult cases, the majority clear the infection during the acute phase, the situation reverses when it comes to infants[9].

Startlingly, only a mere 10% of these young patients manage to successfully clear the infection during the initial stages of the disease[10]. This relatively low clearance rate indicates that the immune response in infants may not be as effective in eliminating the virus compared to adults[10]. As a consequence, a significant majority of 90% of these babies progress to develop chronic hepatitis B infection, signifying that the virus persists in their bodies beyond the acute phase[10].

The development of chronic hepatitis B in such a high proportion of infants is a matter of concern for healthcare professionals and caregivers[11]. Chronic infection poses unique challenges for these young patients, as it may lead to persistent liver inflammation, scarring, and an increased risk of liver-related complications later in life[8]. Therefore, the potential

long-term consequences of chronic hepatitis B underscore the critical need for close monitoring and appropriate medical management from an early age[12].

Careful and regular monitoring of these infants' liver function and viral load becomes essential to assess disease progression and initiate timely interventions when required[10]. Early detection and management are crucial in preventing severe liver-related complications, such as cirrhosis and hepatocellular carcinoma (HCC), which may develop in later years if the infection is left untreated[9].

Furthermore, in cases of chronic hepatitis B infection, the liver undergoes a prolonged state of inflammation, leading to progressive scarring over the course of several years[13]. However, the rate at which this inflammation and scarring develop varies significantly from person to person. For some individuals, the disease progression is notably aggressive, resulting in severe liver scarring known as cirrhosis within a relatively short span of around 20 years[8]. On the other hand, there are instances where the liver disease advances at a much slower pace, not posing a major health concern during the affected individual's lifetime[14]. This wide spectrum of disease progression highlights the diverse nature of chronic hepatitis B and emphasizes the importance of closely monitoring and managing each patient's condition based on their specific circumstances and risk factors[1]. Hence, early detection, regular liver function assessment, and appropriate medical intervention are vital in identifying those at higher risk of rapid liver scarring and implementing measures to minimize potential complications[15].

Epidemiology of Hepatitis B Virus Globally

According to the Centers for Disease Control and Prevention about 1.34 million deaths cause by viral hepatitis annually which is similar to annual number of deaths caused by HIV/AIDS (1.3 million), malaria (0.9 million) and tuberculosis (1.3 million)[16,17].

Mortality due to viral hepatitis has increased by 63% since 1990 and is now ranked the seventh leading cause of mortality worldwide; however, global recognition of the severity of the problem has not been achieved, and a global commitment to combat the disease is still needed[18].

Viral hepatitis, including hepatitis B virus (HBV) and hepatitis C virus (HCV) infections, accounts for the majority of morbidity and mortality, contributing to 96% of global hepatitis-related deaths (with a 95% uncertainty interval of 94-97) and 91% of disability-adjusted life-years in 2013 (with a 95% uncertainty interval of 88-93)[19].

Hepatitis B is a global health problem, with an estimated 257 million people chronically hepatitis B surface antigen (HBsAg) positive[11]. The burden of chronic hepatitis B is increasing in spite of the fact that it can be prevented by vaccine and availability of the effective vaccine since 1992[20].Globally, hepatitis B mortality is increasing, with 500 000 to 1.2 million deaths occurring annually, whereas mortality due to HIV/AIDS is decreasing with the advent of effective antiretroviral therapy (ART)[21]. The number of HBsAg-positive individuals was highest in the WHO Western Pacific region (115 million, prevalence estimated as 6.2%; 95% UI 5.1–7.6) and African region (60 million, prevalence estimate 6.1%; 4.6–8.5), which together accounted for 68% of the global burden according to the 2017 WHO Global Hepatitis Report[22]. Seroprevalence differs depending on sex and

ethnicity, and between rural and urban areas, with the highest prevalence of HBsAg infection found to be in black men and boys born in rural areas, putting further economic hardship on under-resourced rural health-care services[23]. When there is no effective prevention, endemic and chronic HBV infection is established in early childhood with studies on HBsAg seroprevalence showing no difference between children aged 5-9 years and adults[24].

The risk of chronic HBV infection is inversely related to the age of infection. For instance, neonatal infection (in children born to mothers who are HBeAg positive or highly viremic) leads to chronic infection in approximately 90% of cases, while childhood infection (aged <5 years) results in chronic infection in 20–50% of cases, and adults infected after age 20 years have a risk of less than 5%[25]. Hepatitis B imposes a significant burden of clinical disease, with people having chronic HBV infection facing a 15–40% risk of developing cirrhosis, liver failure, or hepatocellular carcinoma, and a 15–25% risk of dying from HBV-related liver diseases[11].

In sub-Saharan Africa, Hepatitis B is estimated to cause approximately 87,890 deaths annually[26]. However, obtaining accurate longitudinal data on the incidence of cirrhosis in this region has proven challenging due to the lack of routine liver biopsy and limited accessibility to non-invasive imaging tests for liver fibrosis, like transient elastography[27]. The high incidence of hepatocellular carcinoma in sub-Saharan Africa, with 80% of cases attributed to HBV infection, has been reported in several studies[28]. The age-standardized incidence of hepatocellular carcinoma in this region can be as high as 41.2 per 100,000 people per year, with Mozambique recording the highest incidence rate (101 per 100,000 male individuals per year[29].

Several risk factors for hepatocellular carcinoma have been identified in sub-Saharan Africa, including a family history of hepatocellular carcinoma, male gender, cirrhosis, high HBsAg concentration, high HBV DNA concentration, HBV genotypes A and C, basal core-promoter mutations, and aflatoxin exposure[28]. Unfortunately, the prognosis for patients with hepatocellular carcinoma in under-resourced regions of sub-Saharan Africa is poor, with 92% of individuals dying within one year of symptom onset due to the absence of surveillance programs for early tumor detection[28].

The WHO region of the Americas has the lowest number of individuals living with HBsAg, which is more than 7 million people[11]. Within this region, countries like the USA, Mexico, and Guatemala have a low endemic level (<2%), except for Haiti, where the level of HBsAg prevalence is high[26]. In contrast, the Eastern Mediterranean WHO Region is home to over 17.4 million individuals with HBsAg. It generally experiences a lower intermediate level of endemicity (2–4.99%), but some countries like Somalia, Sudan, and Djibouti have a higher prevalence of HBsAg compared to others in this region[30]. Moving to the European WHO Region, there are a little less than 18.5 million individuals with HBsAg, and it generally shows a lower intermediate level of prevalence[19]. However, the endemicity significantly increases from west to east within this region, with Western European countries like the UK having low levels (lowest at 0.01%) and the republics of Central Asia, such as Kyrgyzstan and Uzbekistan, reporting much higher rates (10.32% and 13%, respectively)[31].

Epidemiology of Hepatitis B Virus in Africa

In the African region, the prevalence of HBsAg is significant, with over 75 million individuals estimated to be affected[32]. The highest HBsAg prevalence in the general

population is observed in Sub-Saharan Africa, reaching 8.8% according to a meta-analysis. This high prevalence is primarily attributed to vertical transmission from mother to fetus and infant, limited anti-HBV vaccination routine campaigns (including vaccination of newborns), and unsafe medical procedures and products[33]. With the exception of Algeria, Eritrea, and Seychelles, almost all countries in Africa exhibit higher intermediate or high levels of HBsAg prevalence, ranging from 5% to 7.99% and above 8%[26].

Approximately 60 million people in Africa are living with chronic HBV infection, with an estimated overall prevalence of 6.2%[34]. New infection rates are highest among children, and transmission primarily occurs through perinatal routes[35]. The introduction of vaccination to protect against HBV infection as part of the WHO Extended Programme for Immunisation (EPI) has been progressively implemented across Africa since 1995, alongside enhanced interventions to prevent mother-to-child transmission. While these efforts have been critical in reducing infections in children, the overall population prevalence of HBV infection remains high in many settings in Sub-Saharan Africa, exceeding 8%[36]. Early epidemiological studies suggested significant variations in HBV prevalence between countries and subgroups of the population in Sub-Saharan Africa, which can often be attributed to methodological differences[34].

Epidemiology of Hepatitis B Virus in Nigeria

Nigeria ranks among the hyper-endemic countries for HBV infection in Africa, with a prevalence exceeding 8%[34]. Shockingly, about nine out of ten Nigerians living with chronic HBV are unaware of their infection status, mainly due to resource constraints, lack of awareness, and insufficient political commitment to addressthe country's HBV challenge[34].

Additionally, Nigeria faces a high burden of HBV-attributable cancer in West Africa, with an estimated age-standardized incidence ranging from 2.6 to less than 5.1 cases per 100,000 person-years[34].

The situation is compounded by the aggressive nature of hepatocellular carcinoma (HCC), which presents limited treatment options, particularly in resource-constrained settings[28]. The absence of affordable diagnostics, including specialized immunoassays and nucleic acid tests, and the out-of-pocket costs for vulnerable populations further impede efforts to eliminate viral hepatitis B in Nigeria, posing a significant threat to public health[34]. Moreover, despite some progress in clinical and epidemiological research on HBV infection in Nigeria, inadequate funding and investment have hindered comprehensive advancements in this field[34].

Despite the urgency of the situation, there are no recent country-wide systematic reviews reporting HBV prevalence in Nigeria. The existing systematic review and meta-analysis from 2013 mainly included articles published before 2010, pointing to a need for an up-to-date comprehensive investigation[34].

A significant finding from a 2017 study revealed a rural-urban disparity in HBV prevalence in Nigeria, with a higher prevalence of 10.7% in rural areas compared to 8.2% in urban settings. This indicates that HBV is more prevalent in rural regions, potentially due to lower awareness, inadequate shared care pathways for HBV management, and high-risk lifestyles common in the countryside[37]. The variations in prevalence across Nigeria also suggest inequities in birth dose vaccination, which is recognized as a crucial factor influencing HBV prevalence[38]. Immunization coverage of birth dose varied widely across the country, with

the highest coverage of 64.9% in the South East and the lowest coverage of 14.1% in the North West[38]. Barriers like geographical isolation, religious beliefs, limited antenatal screening, and lack of qualified medical staff have contributed to low birth dose uptake in the North West region[38].

HBV Biology and Life Cycle

Hepatitis B virus (HBV) is an enveloped DNA virus, classified in the Hepadnaviridae[39]. By the detection of its antigen, currently known as surface antigen and originally called "Australia antigen", HBV was first discovered in an Australian aborigine[40]. An electron microscope was used to see the virus particles in 1970 by Dane and colleagues[41]. Not less than three types of HBV particles are observed in the serum of infected patients: spherical structures of 42 nm in diameter, those with a diameter of 22 nm, and filament structures of variable length that are 22 nm in a diameter (Fig. 2.1).

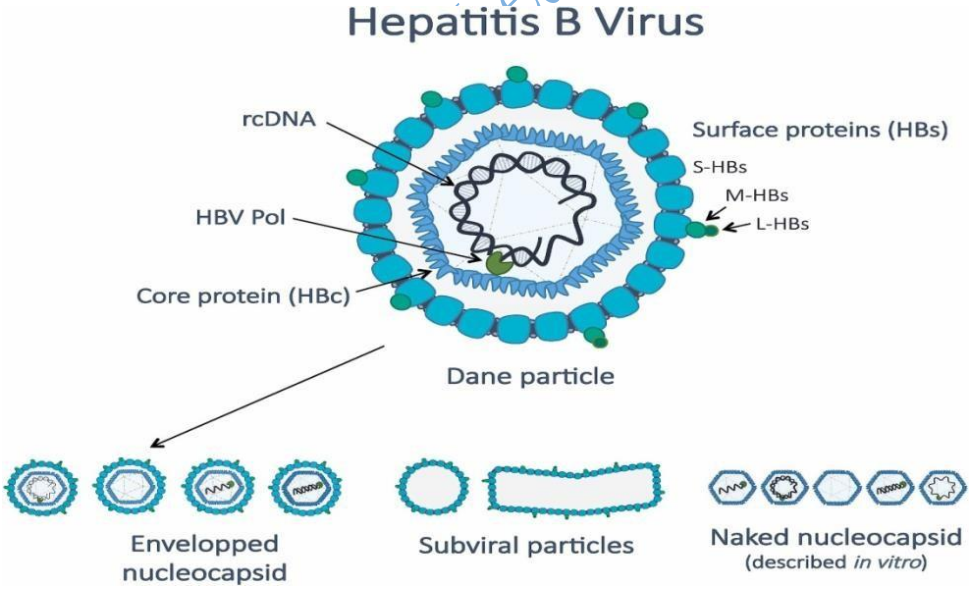


Fig. 2 1. Schematic representation of HBV particles. Infectious HBV virion (Dane particle) (upper) and non-infectious HBV particles, including enveloped capsids containing immature DNA/RNA, subviral particles (sphere and filament), and naked nucleocapsids (lower)[42]

The 42 nm particles, also called Dane particles, are infectious virions consisting of a lipid membrane with three viral surface antigens (HBs), large (L-HBs), middle (M-HBs), and small (S-HBs), that surround a nucleocapsid composed of hepatitis B core protein (HBc), viral polymerase (Pol), and viral genome DNA. The 22 nm particles, which are much more abundant in patient serum, include subviral particles (SVPs) that lack the nucleocapsid and are thus non-infectious. Also, other non-infectious particles are currently known to be produced by infection, including enveloped particles that lack a viral genome, those containing viral RNA, and envelope-less particles (naked nucleocapsids)[43]. The HBV genome DNA is a relaxed-circular DNA (rcDNA) of approximately 3.2 kb in length with a complete minus strand and an incomplete plus strand (Fig. 2.2)[42]

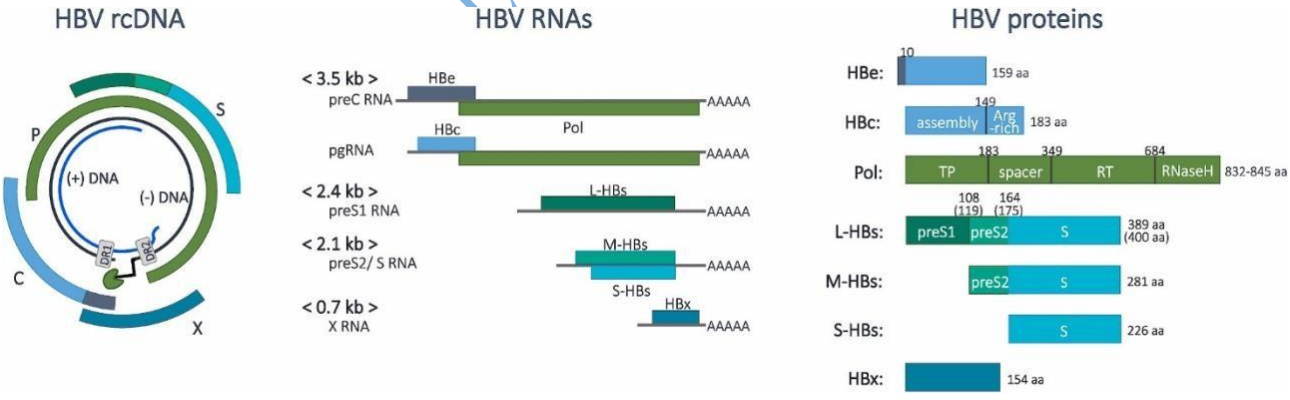


Fig. 2.2 Schematic representation of the structure of HBV genomic DNA, RNAs, and proteins. Left, HBV genomic rcDNA and the encoded ORFs (C, P, S, X). Center, HBV RNAs (gray lines) produced by cccDNA transcription and the proteins (boxes) produced from the RNAs. The RNA lengths, as well as the names of the RNAs, are shown on the left. Right, HBV proteins and the domain structures. Amino acid numbers and the lengths are shown above the box and on the right, respectively.

The viral genome conceals four overlying open reading frames (ORFs), C, P, S, and X, from which functioning viral proteins are made: HBc and its relatives such as E antigen (HBe) and 22-kDa precore protein (p22cr) from C; Pol from P; three types of surface antigens, L-HBs, M-HBs, and S-HBs, from S; and HBV X protein (HBx) from X. rcDNA is transformed into covalently closed circular DNA (cccDNA) in contaminated cells (see below), and cccDNA produces HBV RNAs of divergent lengths (mostly 3.5 Kb, 2.4 Kb, 2.1 Kb, and 0.7 Kb) transcribed from dissimilar promoters in the HBV genome. The protein product from C and P; a 2.4 Kb RNA is produced by 3.5 Kb RNA, and is converted into L-HBs and a 2.1 Kb RNA integrates the other two surface antigens, M-HBs and S-HBs; and a 0.7 Kb RNA produces HBx. The produced HBc protein product links originally to produce a dimer through its N-terminal domain, and then amass itself into an icosahedral capsid made up of 90 or 120 dimers. Thus, it integrates the 3.5 Kb viral pregenomic RNA (pgRNA) associated with Pol.

HBe is created by the translation of 3.5 Kb preC mRNA, having an extended 5' upstream region of the C gene and succeeding separation of the protein product at its C-terminus. Pol is the largest HBV protein, which is made up of four domains with three discrete enzymatic functions:

1) the terminal protein (TP) domain, which is needed for binding to pgRNA. It also serves as a protein primer to start minus strand DNA synthesis;

2) the spacer domain, whose function has not been explicitly stated;

3) the reverse transcriptase (RT) domain, which has DNA elongation activity for both reverse transcription and DNA-dependent DNA polymerization;

4) the ribonuclease H (RNaseH) domain, which breaks down pgRNA after reverse transcription. The common C-terminal S region is shared by the three HBs proteins. Furthermore, M-HBs and L-HBs carry an extended region, called the preS2 region, at the N-terminus of the S region. L-HBs also includes an extension (preS1 region), that is important for receptor binding during virus entry, at the N-terminus of the preS2 and S regions. HBx is a protein that has several functions. It aids viral production at numerous steps, which includes viral transcription and replication. Furthermore, it plays a role in the growth of HBV-related hepatocellular carcinoma. HBV multiplies in host cells Exploiting these viral proteins in concert with host-derived factors, HBV multiplies in host cells. (Fig.2.3)[42].

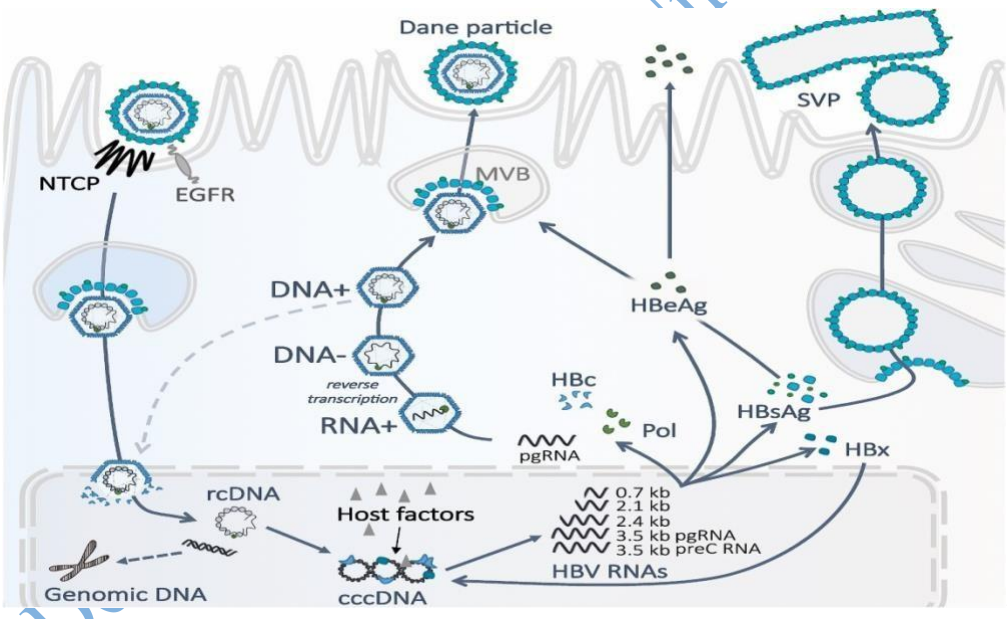


Fig. 2.3. Schematic overview of the HBV life cycle. See the main text for a precise description of the HBV life cycle

HBV entry

It takes numerous steps for HBV to gain entrance into host hepatocytes. At first, the virus joins itself to the host cell surface in a non – specific and low affinity way by binding to factors including heparan sulfate proteoglycans (HSPGs) such as glypican 5, and then interacts with its receptor(s) more specifically and with high affinity[44]. Sodium taurocholate co transporting peptide (NTCP/SLC10A1), and majorly expressed in the liver and uptake bile salts into hepatocytes as it is initial functions, was recognized in 2012 as an HBV and HDV entry receptor.

NTCP was recognised as a factor that bound to aa 2–48 of the preS1 region, which had been already known to be important for receptor binding[45]. It is believed that Virus-receptor interactions trigger virus internalization into cells in an endocytosis-dependent manner [46]. Recently, it was reported that the internalization of HBV/HDV through its direct interaction with NTCP was triggered by a receptor tyrosine kinase, epidermal growth factor receptor (EGFR) [47],[48]. Also, it was documented lately that NTCP can be oligomerized, and the oligomerization status modulates the ability of NTCP to mediate viral internalization [49]. Moreover, it is believed that Internalization in vesicles induces fusion between the viral envelope and the cell-derived vesicular membrane, but its mechanism remains largely unknown.

The incoming nucleocapsid in the cytoplasm is directed to the nucleus along with the microtubules[50] and is imported into the nucleus through the nuclear pore complex in an importin-dependent manner [51,52]

cccDNA formation/maintenance

HBV genomic DNA is modified by cellular factors in the nucleus. The Pol-linked terminal redundant sequence in the 5′ -end of the minus strand DNA and the RNA oligonucleotide attached at the 5′ end of the plus strand DNA are removed from the rcDNA, and the gaps in both strands are filled and joined to generate cccDNA[53]

The process of cccDNA formation involved many factors. It has been shown that a DNA repair enzyme, tyrosyl-DNA phosphodiesterase 2 (TDP2), adhere to the tyrosyl-DNA phosphodiester bond between Pol and rcDNA in an in vitro assay, its importance in cccDNA formation in the cellular context is still controversial [54,55]. Another factor reported to cleave the flap structure at the 5′ -end of the minus strand is Flap structure-specific endonuclease 1 (FEN1), which is implicated in cellular DNA replication and repair[56]. After the removal of the Pol and RNA primers, DNA polymerases and ligases, such as DNA polymerase κ and α (Pol κ and Pol α), DNA ligase 1 and 3 (LIG1 and LIG3), and topoisomerase I and II (TOP1 and TOP2), have been documented to function for filling the gaps in rcDNA [57,58,59,60].

It is still unclear how and where cccDNA is maintained in the nucleus, cccDNA resides episomally but is stable naturally, and this makes it functions as a template for viral replication for a long term. It was observed recently that cccDNA half-life of about 40 days in NTCP-overexpressing HepG2 cells [61.] However, it is likely to be longer in a clinical setting.

A cccDNA half-life in hepatitis B patients has been evaluated to be more than nine months[62]. Major factors that affect cccDNA maintenance are immune responses and cytokine stimulation[63]. The mechanisms for the regulation of cccDNA maintenance/stabilityis still

not understood, but a cytidine deaminase, apolipoprotein B editing complex 3 (APOBEC3), is an example of a protein that regulates cccDNA stability. Upon stimulation by cytokines such as interferon α and γ (IFNα, IFNγ), tumor necrosis factor α (TNFα) as well as lymphotoxin β (LTβ), APOBEC3A and/or APOBEC3B are induced and are reported to destabilize cccDNA [64,65]. An ubiquitin conjugating enzyme E2 L3 (UBE2L3) and male-specific lethal 2 (MSL2) regulate cccDNA stability through degeneration of APOBEC3A and APOBEC3B, respectively [66,67]. During an overexpression experiment, the capacity of APOBEC3G to activate cccDNA hypermutation has also been reported [68]. Furtherance to cccDNA formation and maintenance, a part of the incoming HBV DNA is incorporated into the host genome. Recently, cell culture study showed that the incorporation occurs as fast as within a week after infection[69]. The incorporated HBV DNA is replication-incompetent but can act as a template for the production of HBs, and it is believed to be related to HBV-specific immune tolerance and the development of HBV-related pathogenesis.

HBV transcription

Four different lengths of RNAs (3.5, 2.4, 2.1, and 0.7 kb) are transcribed in using cccDNA as a template. Transcription of viral RNAs is managed by four distinct promoters for preS1, preS2, core, and X, and two enhancers (Enhancer I and Enhancer II), this is moderated by host RNA polymerase II machinery-dependent transcription[70]. The transcription is regulated at multiple levels as shown below (Fig. 2.4).

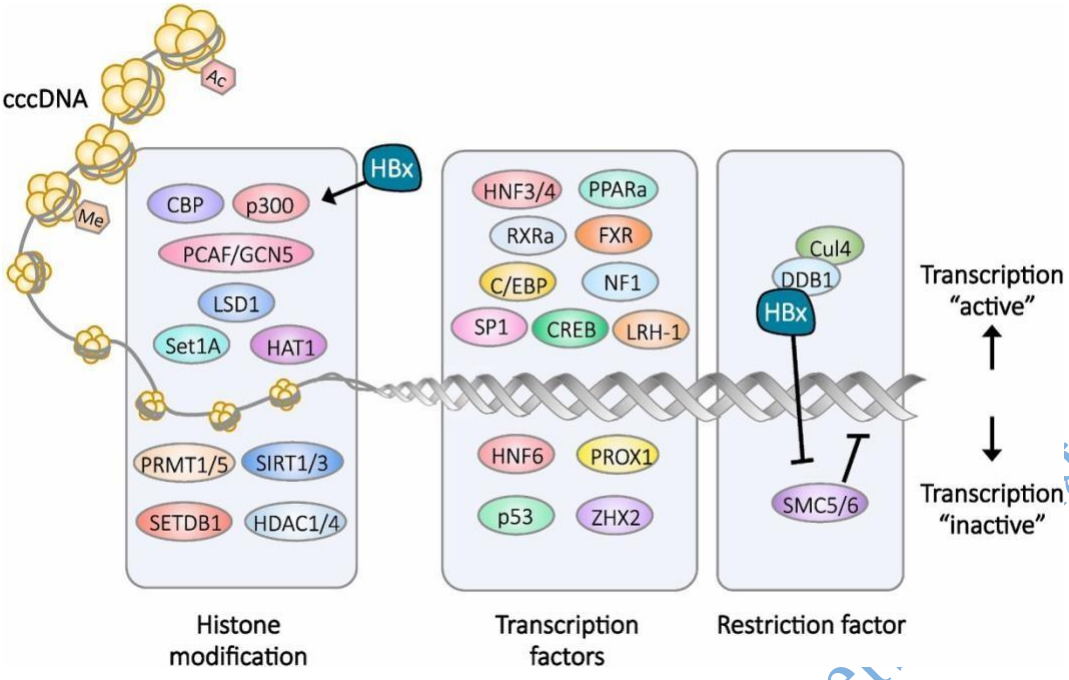


Fig.2.4. Schematic representation of the regulation of HBV transcription. HBV transcription is regulated at the epigenetic (left), transcription factor (center), and the restriction (right) levels. Left, histone modification enzymes that positively (upper) and negatively (lower) regulate transcription are shown. Center, transcription factors positively (upper) and negatively (lower) regulate the transcription of HBV core promoter/enhancer. Right, SMC5/6 suppresses the transcription, and HBx counteracts the SMC5/6 restriction by the recruitment of the DDB1/Cul4 ubiquitin ligase complex for protein degradation

2.1.9. Epigenetic modification

cccDNA exists as a minichromosome that associates with viral proteins and host factors (Fig. 4). As cccDNA is assembled with histones, the post-translational modification status of histones directs the transcriptional activity of cccDNA[70]. Genome-wide ChIP-seq analysis has exposed the post-translational modification of cccDNA-associated histones that show a high level of trimethylation or acetylation of lysine of histone 3 (H3K4me3, H3K27ac, and H3K122ac), active markers of transcription, enhance at specific sites within the HBV genome, and very low levels of transcriptional repression markers (H3K27ac and H3K9me2) even at silent HBV promoters [72]. There are also accumulating reports of histone modification enzymes and other factors directly or indirectly recruited onto the cccDNA minichromosome to regulate viral transcription. Such histone modification enzymes includes histone acetyltransferases [CREB-binding protein (CBP)/p300, CBP-associated factor (PCAF)/CGN5, HAT1], histone deacetylases [histone deacetylase 1 and 4 (HDAC1, HDAC4), sirtuin 1 and 3 (SIRT1, SIRT3)], methyltransferases [SET domain bifurcated histone lysine methyltransferase 1 (SETDB1), protein methyl transferase 1 and 5 (PRMT1, PRMT5), histone methyltransferase 1A (Set1A)], and demethylases [histone lysine demethylase 1 (LSD1)] [73,74,75,76,77,78]. Precisely, mechanisms for cccDNA-associated histone modification and its regulation of viral transcription reported[79]. Mostly, these cccDNA-associated histone modifications have been revealed to be targeted by the antiviral activity of interferon (IFN):

IFNα induces hypoacetylation of cccDNA-bound histones and the recruitment of transcriptional corepressors that result in transcriptional silencing both in cell culture and in chimeric mouse models [80]. Moreover, IFNα alters the acetylation status of H3K9 and H3K27 to suppress transcription of duck hepatitis B virus (DHBV) cccDNA[81].

Transcription factors

The recruitment of cellular transcription factors to the viral promoter/enhancer regions in cccDNA governs the activity of transcription as well as the epigenetic control. The viral promoter/enhancer regions contain the binding sites for numerous transcription factors, including the elements for the liver-specific nuclear receptors. For over two decades, the transcription factors involved in HBV transcription have been studied (Fig. 2.4). These include liver-enriched hepatocyte nuclear factor 3 and 4 (HNF3, HNF4), retinoid X receptor alpha (RXRα), peroxisome proliferator-activated receptor alpha (PPARα), and farnesoid X receptor (FXR) as nuclear receptors[82]. Other transcription factors that have been reported to activate transcription to augment pgRNA expression include CCAAT-enhancer-binding protein (C/EBP), nuclear factor 1 (NF1), specificity protein 1 (SP1), cAMP response element binding protein (CREB), and liver receptor homolog-1 (LRH-1), and those that reportedly suppress pgRNA transcription include HNF6, prosperous-related homeobox protein 1 (PROX1), p53, and zinc finger and homeoboxes 2 (ZHX2)[83]

Role of HBx in HBV transcription

For HBV replication after infection, HBx has been indicated to be essential[84]. HBx is a multifunctional protein with many studies showing a wide variety of functions, notwithstanding, the relevance of such functions in physiological settings needs to be further investigated. Association of Hbx with the cccDNA minichromosome in close parallel to the kinetics of cccDNA-bound H3 acetylation has been documented[85]. HBx modulates the recruitment of chromatin-modifying enzymes (p300, HDAC, SIRT1) and controls the epigenetic status of cccDNA-associated histones for active transcription[85]. HBx was found to affect not only acetylation but also methylation and phosphorylation of cccDNA-associated histones in HepG2 cells according to a report[86]. Without the presence of HBx,

cccDNA is transcriptionally silenced by a decrease in H3 acetylation and H3K4me3 and an increase in H3K9me2/3 that results in the recruitment of heterochromatin protein 1 (HP1) and chromatin condensation, while HBx expression relieves this transcriptional silencing by recovering the increased H3K4me3 and dissociating HP1 recruitment on cccDNA). This evidence supports the activity of HBx on the epigenetic profile of cccDNA-associated histones to regulate HBV transcription. Also, a recent finding on HBx action on Smc5/6 has opened a new aspect of its function (Fig. 4).

ATPases that generally regulate higher-order chromosome organization are the structural maintenance of chromosomes (Smc) family[87]. The Smc5/6 complex associates with an episomal HBV DNA reporter and suppresses its transcriptional activity as reported lately[88]. In the presence of HBx, DDB1-containing E3 ubiquitin ligase is recruited to Smc5/6 and induces complex degradation to relieve Smc5/6-mediated transcriptional silencing. Genetic knockdown of Smc5/6 causes the replication of HBx-deficient HBV, suggesting an essential role for Smc5/6 antagonism in HBx's function to support viral replication[89]. This function requires a CCCH motif in the HBx sequence that is highly conserved among strains[90]. A study using clinical samples has shown that the anti-Smc5/6 function can be retained in HBx variants found in HCC patients[91]. Interestingly, nitazoxanide has been found to inhibit HBx-DDB1 binding and restore the expression of Smc5 to suppress HBV replication in HBV-infected cells, proposing that this mechanism can serve as a therapeutic target [92].

HBV RNAs stability

Recent accumulating evidence has focused on the HBV RNA stability as a major step that limits the viral replication level. HBV pgRNA contains a stem loop, called epsilon, at both the 3'and 5′ termini. Epsilon is essential for the RNA packaging into capsids and recent reports have shown a role for these elements in modulating the stability of HBV RNAs. Zinc

finger antiviral protein (ZAP) interacts with HBV RNAs through a region containing the epsilon and promotes its decay mainly in the nucleus, and this mechanism is potentiated upon IFN treatment[93]. An RNA helicase, superkiller viralicidic activity 2-like (SKIV2L: a homolog of the Saccharomyces cerevisiae Ski2), interacts with HBV RNAs, especially X-mRNA (0.7 Kb RNA), and mediates their degradation through a non-stop-mediated RNA decay mechanism[94]. A ribonuclease, IFN-stimulated exoribonuclease gene of 20 kDa (ISG20), aids HBV RNA degradation by binding to the lower stem portion of the epsilon[95,96]. The growing list of other cellular factors that bind to HBV RNAs and promote their degradation includes a cytidine deaminase, AID [97], a splicing factor and a U2 small nuclear ribonucleoprotein auxiliary factor, PUF60 [98], RNA-binding motif protein 24 (RBP24)[99], and peroxiredoxin 1 (Prdx1)[100]. It has been noted that, using a dihydroquinolizinone derivative, RG7834, which is a new drug candidate that suppresses HBV replication and gene expression, the non-canonical poly(A) RNA polymerase associated domain containing proteins 5 and 7 (PAPD5 and PAPD7) has been shown to function in stabilizing HBV RNA, and RG7834 has been verified to target these proteins [101,102]. Recently, there was a report that covalent modifications of viral RNA can regulate the translation and/or stability of RNA in many viruses including HIV-1, influenza virus, enterovirus, and respiratory syncytial virus, which is known as epitranscriptomic regulation[103].

In HBV, it has been documented that the post-transcriptional modification, N6-methyladenosine (m6 A) of HBV RNA at its 3′ epsilon stem loop structure, destabilizes HBV RNAs, even though the m^{6}A at the 5′ epsilon stem loop of pgRNA has another function that experdite the reverse transcription of pgRNA[104]

YTH-domain family 2 (YTHDF2) identifies m6 A-modified HBV RNA at A1907 and an IFN-induced RNase, ISG20, which then processes HBV RNA for degradation[105]. Hence, it

has been made known that HBV RNA stability is strictly regulated by multiple cellular factors.

Encapsidation and DNA synthesis RNA encapsidation requires HBc, Pol, and viral RNA. Initially, synthesized HBc monomers associate to yield a dimer, and then 90 or 120 dimers subsequently self-assemble to constitute an icosahedral capsid Simultaneously, with the encapsidation, Pol at its TP domain interacts with the epsilon stem loop of the pgRNA at the 5' terminus to form a ribonucleoprotein complex, which is then incorporated into the capsid. This process is expedited by host chaperones, heat shock protein 90 (Hsp90), Hsp40, and heat stress cognate 70 (Hsc70), through interactions with Pol and its conformational optimization RNA-binding motif protein 24 (RBM24) interacts with both Pol and epsilon RNA to moderate the encapsidation[106].

The interaction of nucleophosmin B23 with HBc also increases capsid assembly[107]. The reported host factors intergrated into the capsid include eukaryotic translation initiation factor 4E (eIF4E), DEAD-box RNA helicase DDX3, and APOBEC3G [108]

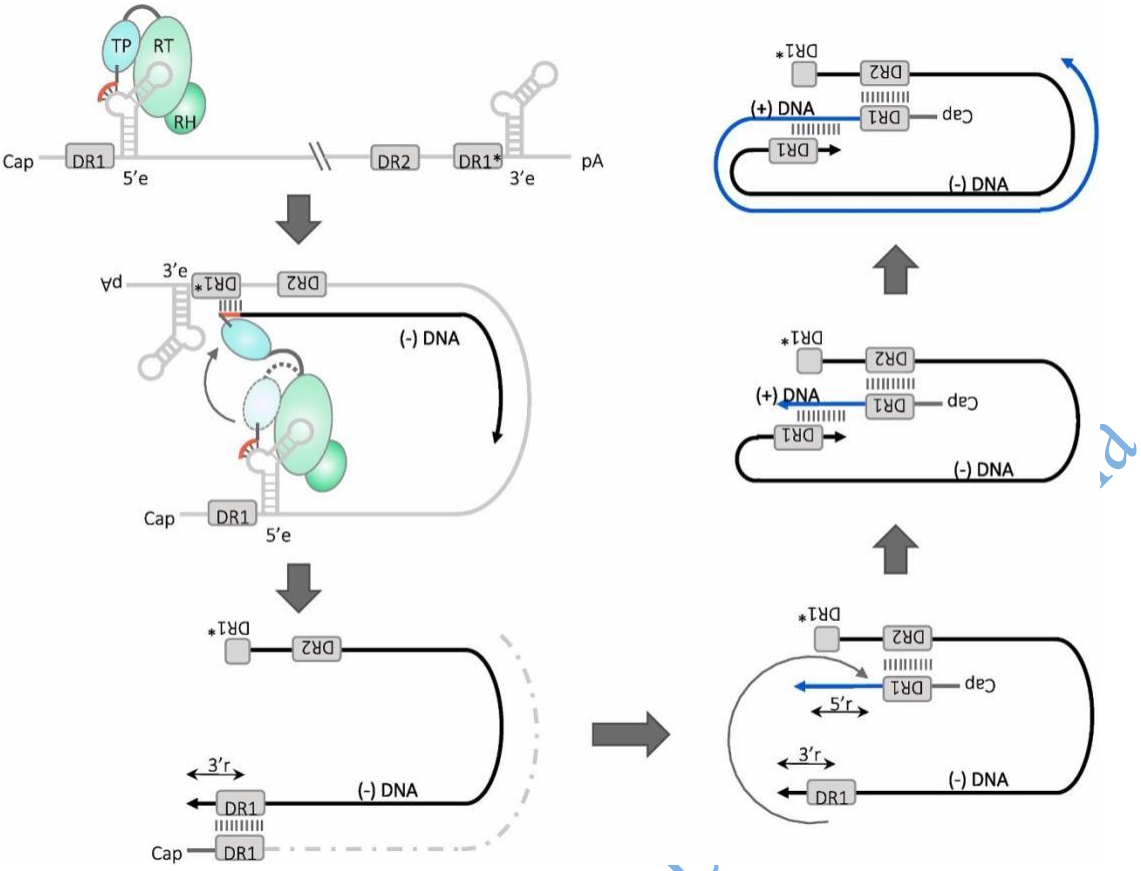


Fig. 2.5. Schematic representation of reverse transcription, RNA degradation, and DNA synthesis in nucleocapsids. Pol (shown by TP, RT, RH) is recruited to the 5′- terminal epsilon and mediates the priming reaction. After translocation to the 3′-terminal DR1, Pol mediates the DNA elongation to synthesize the full-length (−)DNA and simultaneously digests the template RNA. The remaining 5′-terminal RNA fragment containing DR1 is translocated to DR2 on the other terminus and starts the synthesis of (+)DNA.

DDX3 and APOBEC3G have a negative effect on the HBV replication. After RNA incorporation, viral genome synthesis proceeds through several steps inside the nucleocapsid (Fig. 2.5). The epsilon in pgRNA has an internal bulge possessing the sequence 5′ -UUC-3′, which functions as a template for priming. A tyrosine residue at aa 63 in the TP domain of Pol acts as a protein primer: the first dGTP residue is covalently linked to a hydroxyl residue in Y63 (priming initiation), and two further dAMPs are extended to produce 5′ -dGAA-3’ (priming polymerization)[109].

The produced Pol-dGAA complex is then translocated to the complementary direct repeat 1 (DR1) sequence at the 3′ end of pgRNA to allow for minus strand DNA synthesis [110]. This strand is extended to the 3′ end of pgRNA, resulting in a unit length minus strand DNA containing an additional terminal redundancy. The pgRNA template is degraded at the same time during the minus strand DNA synthesis through digestion by the RNase H domain, and finally leaves a short RNA fragment containing the capped 5′ terminal region including 5′ DR1. This RNA fragment is then translocated to DR2 at the 3′ terminus and is stretched to the 5′ terminus of the minus strand DNA. Having a redundant sequence, extending the 3′ end of the plus strand DNA switches to the 3′ redundant sequence on the minus strand DNA, helped to further elongate the plus strand DNA to eventually produce rcDNA.

HBV morphogenesis

The viral genome-containing nucleocapsids are either transported to the nucleus to amplify and maintain the cccDNA pool (recycling) or assembled with mature envelope proteins to be secreted outside of cells (virus egress). Capsids containing the replication intermediates, pgRNA, and those without viral DNA/RNA are also secreted from cells but with different secretion efficiencies. The secretion process for infectious virions depends on multivesicular body (MVB)-associated endosomal sorting complex required for transport (ESCRT) machinery, which involves gamma 2-adaptin, CHMP3/4, Vps4, Nedd4, and α-taxilin[111,112.]

Contrarily, the egress of naked capsids does not require the above ESCRT machinery, but rather involves other factors such as Alix and HGS[113] Subviral particles in the spherical structure that predominantly contain S-HBs are released from the endoplasmic reticulum through the general secretory pathway and filamentous subviral particles that also contain L-HBs share the ESCRT-dependent egress pathway[114]. Therefore, the virus egress pathway is closely associated with the cellular membrane sorting machinery.

2.1.15 Genotype of Hepatitis B Virus

HBV has been classified into 9 genotypes (A to I) and numerous subgenotypes based on its genetic divergence. The genotypes and subgenotypes show different geographical distribution in populations around the globe[115,116]. Genotypes are A and D are the most universal and are predominant in Europe, Africa, and North America. The most frequent in East and South-East Asia are genotypes Band C, and mostly confined to Africa is genotype E. Genotype F is indigenously from the American continent and found in native populations from Alaska, Central, and South America[117,118,119]

Surprisingly, clinical outcomes are influenced by HBV genotypes as shown recently. HBeAg seroconversion rates, severity of liver disease, emergence of mutants, transmission patterns, and response to interferon therapy[120]It has been shown that patients infected with genotype A or B generally respond better to interferon treatment than patients infected with genotypes C and D. Moreover, individuals infected with (sub)genotypes C and F1b showed a delayed HbeAg to anti-Hbe seroconversion than those infected with (sub)genotypes A, B, D, and F4. In addition, it has been confirmed that a close association of (sub)genotypes C and F1b with an early and rapid progression of chronic infection and evolution to HCC[121,122,123].Furthermore, there is a paucity of data regarding their distinctive biological characteristics, in particular for genotype F, mainly due to the limited geographic distributions of the genotypes.The majority of studies comparing HBV genotypes have been restricted between genotypes B and C in Asia and genotypes A and D in Europe. Moreover, due to a lack of appropriate replication models there have been very few *in vitro* studies directly comparing virological parameters across genotypes.[124]. Most studies have used more than unit-length HBV constructs. In these constructs, it has been noted that the complete HBx open reading frame and the enhancer I/II regions are duplicated. Also, more than unit-length HBV built up are directly transcribed in the cell nucleus bypassing the formation of cccDNA

replicative intermediate [125]. Therefore, the utilization of these constructs may not be ideal to study differences in HBV replication and protein expression among genotypes. Due to the absence of duplicated genome regions and the ability of cccDNA formation, the use of unit-length monomeric constructs without heterologous promoters represents a better alternative[124]

Transmission of Hepatitis B Virus

The transmission of the HBV is facilitated through various routes, each contributing to its widespread prevalence.

1. Percutaneous or Mucosal Exposure to Infected Blood

Hepatitis B virus (HBV) transmission occurs primarily through percutaneous (through the skin) or mucosal exposure to infected blood, representing the predominant route of spread[5]. Additionally, various body fluids, including saliva, menstrual, vaginal, and seminal fluids, have been implicated as potential vehicles for human transmission[11].

Sexual transmission of hepatitis B is also a significant concern, especially among unvaccinated individuals, such as men who have sex with men and heterosexual persons with multiple sex partners or contact with sex workers[126]. It is important to note, however, that in less than 5% of cases, infection in adulthood leads to chronic hepatitis [126].

The virus can as well be spread through accidental inoculation of minute amounts of infected blood or fluid during medical, surgical, and dental procedures. Inadequately sterilized syringes and needles, as well as the use of razors and similar objects contaminated with infected blood, can also contribute to transmission[127]. Furthermore,

intravenous and percutaneous drug abuse, tattooing, body piercing, and acupuncture have been identified as potential risk factors for the transmission of the virus[128].

Unsafe medical practices and exposure to contaminated blood or bodily fluids pose an additional significant risk for acquiring HBV[129]. In healthcare settings where injections or medical procedures are performed with improperly sterilized or reused equipment, transmission can inadvertently occur[129]. Similarly, individuals who come into contact with sharp instruments contaminated with infected blood are also susceptible to acquiring the virus[130].

2. Perinatal Transmission

Perinatal transmission stands as one of the most significant modes of Hepatitis B virus (HBV) infection, occurring when an infected mother passes the virus to her child during childbirth and delivery[35]. This particular mode of transmission poses a substantial risk, primarily due to the vulnerability of infants to developing chronic infections, which can have profound and long-term consequences on their liver health[35].

In many parts of the world, especially in regions like China and Southeast Asia, perinatal transmission plays a pivotal role in maintaining the reservoir of HBV infection[131]. Without appropriate prophylaxis measures, a large number of mothers who are carriers of the virus, particularly those who are seropositive for HBeAg (Hepatitis B e antigen), may transmit the infection to their infants at the time of birth or shortly thereafter[132]. Effective prevention strategies and timely treatment are crucial to mitigating the risk of transmission from mother to child[132].

The risk of perinatal infection is further heightened if the mother experiences acute hepatitis B during the second or third trimester of pregnancy or within two months of

delivery[25]. In such cases, the chances of transmitting the virus to the newborn increase significantly[25].

It is noteworthy that HBV infection of the fetus in the uterus appears to be relatively uncommon and is typically associated with conditions like antepartum hemorrhage and placental tears[133]. However, once perinatal infection occurs, the risk of developing chronic HBV infection is alarmingly high, estimated at approximately 90% within the first six months of the infant's life[36]. Nevertheless, this risk gradually reduces to a range of 20% to 60% between the ages of 6 months and 5 years, underscoring the importance of early detection and intervention to prevent chronic infection in infants[11].

3. High Risk Behaviors

The sexual behavior of youth is of significant concern for various public health issues[134]. Among young individuals, engaging in unprotected vaginal sexual intercourse has contributed to unwanted pregnancies, abortions, pregnancy-related complications, and the spread of sexually transmitted infections[135]. Disturbingly, there has been a noticeable increase in the proportion of undergraduate students in Nigeria who report being sexually active while at school. Several studies have highlighted this trend, particularly among adolescents[136].

The surge in sexual behaviors, especially among undergraduate students, is alarming, given the associated short and long-term effects[137]. Risky sexual behaviors in this population expose them to sexually transmitted infections, and these practices include having multiple sex partners, engaging in group sex, having sex without using condoms, and participating in anal and oral sex[134]

In addition to sexual transmission, the Hepatitis B virus can also be spread through high-risk behaviors, such as engaging in sexual activity with an infected partner51[81138]. Unprotected sexual contact, especially with individuals who are unaware of their infection status, significantly increases the likelihood of acquiring the virus[139]. Furthermore, intravenous drug use, particularly when sharing contaminated needles, syringes, or other drug paraphernalia, serves as another prominent route of transmission that contributes to the prevalence of HBV among injection drug users[130].

The prevailing trends in sexual behaviors among youth, especially undergraduate students, raise serious concerns about their vulnerability to sexually transmitted infections, including Hepatitis B[140].

Clinical Manifestation of Hepatitis B Virus

Hepatitis B virus (HBV) infection can lead to a range of clinical manifestations, varying from asymptomatic or mild cases to severe and life-threatening conditions[127]. The clinical presentation of hepatitis B can be categorized into different phases:

1. **Acute Phase:** During the acute phase of HBV infection, some individuals may remain asymptomatic and not exhibit any noticeable symptoms. However, others may experience flu-like symptoms, such as fatigue, loss of appetite, nausea, vomiting, low-grade fever, and muscle and joint pain. Jaundice, a yellowing of the skin and eyes, is a common characteristic of acute hepatitis B, although it may not be present in all cases[5].

2. **Chronic Phase:** In some cases, especially among infants and young children infected with HBV, the infection may progress to a chronic phase[141]. Chronic hepatitis B is characterized by persistent infection lasting more than six months. During this

phase, individuals may experience ongoing fatigue, loss of appetite, and intermittent or continuous episodes of jaundice. The liver may become enlarged and tender, and there may be an increased risk of developing liver cirrhosis and hepatocellular carcinoma (HCC) in the long term[141].

3. **Fulminant Hepatitis**: In rare instances, acute hepatitis B can progress rapidly to a severe form known as fulminant hepatitis[142]. This is a life-threatening condition characterized by sudden and severe liver failure. It requires immediate medical attention and may necessitate liver transplantation[142].

4. **Asymptomatic Carrier State**: Some individuals infected with HBV may become asymptomatic carriers[143]. They show no signs of illness but can still transmit the virus to others56[56]. These carriers have the virus in their blood and are considered potential sources of infection[143].

Prevention and Vaccination Against HBV Infection

The prevalence of Hepatitis B virus (HBV) infection continues to pose a significant public health challenge, with more than 250 million individuals affected worldwide[11]. The consequences of HBV infection, such as liver-related morbidity and mortality, including cirrhosis and hepatocellular carcinoma (HCC), are alarming[1]. Despite these challenges, substantial progress has been made in the prevention of HBV through vaccination57[87144]

1 Vaccination Against HBV Infection

Hepatitis B vaccines containing inactivated HBsAg have been available since the early 1980s and have proven to be safe and effective[6]. Over time, there have been advancements in vaccine production, shifting from plasma-derived vaccines to those manufactured using recombinant DNA technology in yeast or mammalian cells[145]. The standard vaccination

schedule consists of three doses, typically administered at birth or soon after, followed by a second dose after one month, and a third dose at least six months later[6].

The efficacy of the HBV vaccine is highest in infants, children, and young adults, with around 95% of those vaccinated achieving protective antibody levels (defined as anti-HBs concentration of ≥10 mIU/ml)[146]. However, the proportion of individuals with a protective antibody response decline to 90% in those vaccinated over the age of 60 years[146]. Certain factors, such as immunosuppression, liver disease, renal failure, smoking, and obesity, are associated with a reduced response to vaccination[146].

Despite the decline in anti-HBs concentrations over time, the protection conferred by hepatitis B vaccination has been shown to be long-lasting[147]. This vaccine remains a crucial tool in significantly reducing the risk of HBV infection, even when antibody levels decline to below 10 mIU/ml[146]

In addition to the standard vaccination schedule, catch-up vaccination is recommended for vulnerable individuals who were not vaccinated during infancy[125]. This includes high-risk groups such as healthcare workers, those with multiple sexual partners, and injection drug users. Furthermore, post-exposure prophylaxis (PEP) using hepatitis B immune globulin (HBIG) and the HBV vaccine is crucial in preventing infection for individuals who may have been exposed to the virus, particularly healthcare workers facing needlestick injuries or other occupational hazards[128]. These preventive measures play a vital role in protecting individuals and controlling the spread of HBV infection.

1. Prevention of Mother-to-Child HBV Transmission;

Preventing mother-to-child transmission of HBV is a crucial element in the efforts to control the spread of the virus. A key approach involves timely administration of the HBV vaccine and hepatitis B immune globulin (HBIG) to infants born to HBV-positive mothers, providing passive immunity and reducing the risk of perinatal transmission[148]. Additionally, the administration of oral nucleus(t)ide analogues to HBV-infected pregnant mothers in the third trimester (from 28 weeks upwards) of pregnancy until delivery is currently recommended[25].

For all exposed babies born to HBsAg-positive mothers, the guidelines suggest administering hepatitis B immune globulin (HBIG) intramuscularly in addition to the HBV vaccine as a preventive measure[149]. This HBIG dose must be administered within 24 hours of birth, alongside the first dose of the HBV vaccine, with the two injections given at different sites. Furthermore, pregnant women infected with HBV and positive for HBeAg should undergo treatment with nucleos(t)ide analogues. Similarly, pregnant women infected with HBV but negative for HBeAg and with high viraemia (≥ 200,000 IU/ml) should also receive treatment with nucleos(t)ide analogues to reduce transmission risk[149].

2. Prevention of Hepatitis B Transmission in Older Children, Adolescents, and Adults:

However, for unvaccinated older children (aged from 1 to 11 years), the recommended vaccination schedule involves administering the monovalent HBV vaccine at 0, 1, and 6 months, with a dose of 10µg/0.5ml intramuscularly[145]. Similarly, for previously unvaccinated adolescents and adults, the monovalent HBV vaccine should be

administered at 0, 1, and 6 months, but with a higher dose of 20µg/1 ml intramuscularly[145].

These vaccination strategies for older age groups are essential in preventing HBV transmission and protecting individuals from the adverse effects of the infection[132]. By adhering to these preventive measures and vaccination schedules, we can significantly reduce the burden of HBV infection and work towards controlling its spread in various populations.

Knowledge on Disease Prevention

Disease prevention is a crucial aspect of public health and healthcare systems worldwide[120]. Knowledge plays a fundamental role in disease prevention as it empowers individuals and communities to make informed decisions and take proactive measures to protect their health[151]. Knowledge disease prevention involves understanding the causes, risk factors, and preventive measures for various diseases, which can range from infectious diseases like hepatitis B, HIV/AIDS, and COVID-19 to chronic conditions such as heart disease, diabetes, and cancer[152].

1. **Health Education and Awareness**: Knowledge disease prevention begins with health education and raising awareness about various diseases and their prevention. Health authorities, healthcare providers, and public health organizations play a pivotal role in disseminating accurate and evidence-based information to the public[153]. Educational campaigns, workshops, seminars, and community outreach programs can be effective strategies to increase knowledge about disease prevention.

2. **Understanding Risk Factors:** Knowledge of disease prevention involves identifying and understanding the risk factors associated with specific diseases. For

example, in the case of hepatitis B, individuals need to be aware of the modes of transmission, such as unprotected sex, sharing of needles, and perinatal transmission[140]. By knowing these risk factors, individuals can take steps to avoid high-risk behaviors and protect themselves from infection.

3. **Screening and Early Detection:** Knowledge about the importance of screening and early detection is crucial in disease prevention. Regular screenings, such as mammograms for breast cancer, Pap smears for cervical cancer, and blood tests for diabetes, can help identify diseases at an early stage when treatment is more effective[12]. Knowledge of recommended screening guidelines empowers individuals to prioritize their health and seek appropriate healthcare services.

4. **Vaccination:** Vaccination is one of the most effective strategies in disease prevention. Vaccines have played a significant role in eradicating or controlling many infectious diseases. Knowledge about the availability and benefits of vaccines, like the hepatitis B vaccine, can encourage individuals to get vaccinated and protect themselves from preventable illnesses[147].

5. **Lifestyle Modification:** Knowledge disease prevention also includes understanding the impact of lifestyle choices on health. Healthy lifestyle behaviors, such as regular exercise, balanced nutrition, avoiding tobacco and excessive alcohol consumption, and managing stress, can significantly reduce the risk of chronic diseases like heart disease and diabetes[154].

6. **Empowering Patients and Communities:** Knowledge disease prevention goes beyond individual actions; it also involves empowering patients and communities to advocate for their health. Informed patients are more likely to actively participate in their healthcare decisions and adhere to preventive measures[155]. Community

engagement and involvement can foster a culture of health where disease prevention is a shared responsibility.

7. **Health Literacy**: Health literacy plays a critical role in knowledge disease prevention. It refers to individuals' ability to understand and use health information effectively to make informed decisions[151]. Enhancing health literacy through clear communication, simplified health materials, and patient education programs can improve disease prevention efforts.

2.2 Theoretical Review

Health Communication Theories

Health communication theory is a multidisciplinary field that examines how communication influences health-related behaviors, attitudes, beliefs, and outcomes among individuals and communities[156]. It encompasses a range of theories and models that help researchers and health practitioners understand the process of communication in the context of health promotion, disease prevention, and healthcare interventions[156].

Adesina et al., (2020) conducted a study applying health communication theory to explore its influence on health behaviors in low-income populations. The researchers focused on the role of communication in promoting preventive behaviors related to cancer and other chronic diseases[157]. They found that effective health communication strategies can significantly impact behavior change, improve health literacy, and increase the adoption of preventive practices in underserved communities[157]. This study highlights the importance of understanding communication processes in addressing health disparities.

The main goal of health communication theory is to develop effective communication strategies that can improve health outcomes by facilitating behavior change, promoting health literacy, and fostering positive interactions between individuals and healthcare systems[158].

Harrington, (2016) utilized health communication theory to design a comprehensive health education program targeting adolescents' risky sexual behaviors and HIV prevention. The researchers tailored messages based on the Theory of Planned Behavior (TPB) and Social Cognitive Theory (SCT) to address individual beliefs, normative influences, and self-efficacy related to sexual health72[102159]. The results showed that the tailored messages had a significant impact on adolescents' intentions to engage in safer sexual practices. This study emphasizes the value of tailoring health messages to specific audiences to achieve behavior change objectives[159].

According to Brashers (2019) who explored the role of communication in patient-provider interactions and its impact on healthcare outcomes. The review emphasized that effective communication between patients and healthcare providers can lead to better treatment adherence, patient satisfaction, and overall health outcomes.

Conversely, Al Shamsi et al., (2020) investigated the barriers to health communication in a multicultural setting. The researchers found that cultural beliefs, language barriers, and lack of culturally appropriate health information can impede effective communication between healthcare providers and patients[160]. Addressing these barriers is essential to ensure equitable access to healthcare information and services[103]. Therefore, Balmumcu and Ünsal Atan, (2021) applied message tailoring to promote smoking cessation among pregnant women. The tailored messages based on the Health Belief Model (HBM) and Trans Theoretical Model (TTM) resulted in higher quit rates compared to generic messages. This study demonstrates the effectiveness of tailored messages in promoting behavior change[161]

According Korsah et al., (2017) 97% of students engaged on social is high[153]. Unarguably, the impact of social media in promoting vaccination awareness among college students was

showed that social media campaigns can effectively reach young adults and influence their health-related attitudes and behaviors[162].

Furthermore, the Theory of Reasoned Action (TRA) was used to predict HIV risk behaviors among men who have sex with men[163]. The researchers found that TRA constructs, such as attitudes and subjective norms, were significant predictors of HIV risk behaviors. This study highlights the relevance of behavior change theories in understanding and promoting health-related behaviors[163].

A study evaluated the health communication interventions strategies that targeted various health behaviors findings indicated that well-designed and theory-based communication interventions had significant effects on behavior change outcomes[164]. This study underscores the importance of evidence-based health communication strategies.

Behavioral Theory

Hepatitis B (HBV) prevention among students is a critical public health concern, as this population is often at risk due to various behavioral factors and social interactions[152]. Behavioral theory offers a valuable framework to comprehend and promote preventive behaviors related to HBV among students.

Incorporating behavioral theory principles into a health campaign targeting HBV prevention among students can yield significant positive outcomes[165]. Behavioral theory provides a valuable framework for understanding how individuals' behaviors are influenced by their environment, perceptions, and experiences[166]. By applying these principles, the health campaign can be designed in a way that aligns with students' attitudes, beliefs, and social norms, making it more effective in promoting preventive behaviors[167].

One way to leverage behavioral theory in the campaign is through classical conditioning. By associating positive images with HBV prevention messages, the campaign can create a lasting impact on students' attitudes toward prevention. Positive imagery featuring healthy and active individuals engaging in preventive behaviors can evoke positive emotions and perceptions[168]. Over time, this positive association can contribute to students viewing HBV prevention as a desirable and beneficial action, increasing their motivation to engage in preventive behaviors[169].

Furthermore, applying operant conditioning in the health campaign can be an effective strategy to motivate students to adopt preventive behaviors. Operant conditioning involves providing rewards and incentives to reinforce desired behaviors[170]. The campaign can offer tangible rewards or incentives to students who consistently engage in preventive actions, such as getting vaccinated or practicing safe sexual practices. The rewards act as positive reinforcement, increasing the likelihood of students repeating the desired behaviors to receive the incentives.

By employing both classical and operant conditioning principles, the health campaign can create a synergistic effect on students' attitudes and behaviors toward HBV prevention[171].

In a study conducted by Zacharias et al., (2015) to assess the impact of a health campaign utilizing to encourage hepatitis B vaccination among Asian. The campaign strategically paired messages related to HBV prevention with positive imagery featuring healthy and active individuals[172]. The aim was to create positive associations between the preventive behavior of HBV vaccination and the desirable attributes portrayed in the imagery[172].

Through the study's investigation, the researchers found compelling evidence supporting the effectiveness of this approach. People who were exposed to the health campaign's positive associations demonstrated notable changes in their attitudes toward HBV vaccination. They

exhibited more favorable perceptions of the vaccine's benefits and its potential to protect their health against HBV infection. This shift in attitude is crucial, as positive attitudes are often a significant predictor of individuals' willingness to adopt preventive behaviors.

Furthermore, the study observed a noteworthy impact on students' intentions to get vaccinated against HBV. The people exposed to the health campaign were more likely to express a stronger intention to undergo the vaccination process compared to those who were not exposed. Intentions play a critical role in behavioral decision-making, as they are closely linked to actual behaviors. A higher intention to get vaccinated indicates a greater likelihood of people translating their positive attitudes into concrete action by seeking vaccination services.

These findings highlight the potential in health communication campaigns aimed at promoting preventive behaviors, such as HBV vaccination, among Asian. By pairing messages about HBV prevention with positive imagery of healthy and active individuals, the health campaign successfully created positive associations that influenced Asian' attitudes and intentions. Such a tailored approach can prove instrumental in encouraging people to take proactive steps in protecting their health and preventing HBV infection. The study contributes valuable insights to the field of health communication and behavioral interventions, demonstrating the effectiveness of strategically applying the principles to foster positive health-related attitudes and intentions among Asian[172].

In another study conducted by Nguyen et al., (2021), the researchers aimed to promote HBV preventive actions among students by implementing behavior modification techniques[159]. Recognizing the significance of targeting specific preventive behaviors, such as practicing safe sexual practices and avoiding sharing personal items, the behavioral intervention was designed to address these specific actions[159].

The behavior modification intervention utilized positive reinforcement as a key strategy to motivate and encourage students to engage in preventive behaviors consistently. Positive reinforcement involved the provision of incentives and rewards to students who demonstrated adherence to the recommended preventive actions. These incentives served as tangible rewards that students received when they exhibited the desired behaviors, reinforcing their likelihood of repeating the actions in the future[159].

The researchers carefully examined the impact of the behavior modification intervention through a controlled experimental design. They divided the participants into two groups: the incentivized group, which received the positive reinforcement for their preventive behaviors, and the control group, which did not receive any incentives. By comparing the outcomes between the two groups, the researchers could assess the effectiveness of the behavior modification intervention.

The results of the study demonstrated a significant increase in the adoption of preventive behaviors among the incentivized group compared to the control group. Students who received positive reinforcement in the form of incentives and rewards exhibited higher rates of practicing safe sexual practices and avoiding the sharing of personal items, both essential preventive actions against HBV transmission.

These findings underscore the effectiveness of behavior modification techniques, particularly positive reinforcement, in encouraging students to adopt and sustain preventive behaviors related to HBV. By providing tangible rewards for engaging in these preventive actions, the behavior modification intervention proved to be a powerful motivator for students, leading to a notable increase in their adherence to recommended preventive measures.

The study's emphasis on behavior modification offers valuable insights for public health practitioners and policymakers in designing targeted interventions for HBV prevention

among students. The successful application of positive reinforcement highlights the importance of providing tangible incentives to reinforce desired behaviors, which can be instrumental in promoting long-term behavioral change. Such behavior modification interventions can play a crucial role in curbing HBV transmission among the student population and contribute to improved public health outcomes[159].

In the study conducted by Lin et al., (2019), the researchers delved into the impact of environmental factors on patients' preventive behaviors regarding HBV[173].

In this research, the primary objective is to explore the various factors that patients with chronic hepatitis B encounter while managing their condition on a day-to-day basis[173]. Self-management encompasses the actions, decisions, and behaviors patients undertake to manage their health and well-being. By understanding these factors, researchers aim to gain insights into the challenges, barriers, and facilitators that patients face in managing their chronic condition effectively.

The study also recognizes the crucial influence of social and cultural environments on patients' self-management experiences. Social factors, such as support from family, friends, and healthcare providers, can significantly impact patients' ability to manage their chronic condition. Additionally, cultural norms, beliefs, and practices may influence patients' attitudes towards seeking medical care, adhering to treatment regimens, and engaging in preventive behaviors.

Furthermore, the research aims to investigate how environmental factors can affect patients' preventive behaviors concerning HBV. Environmental factors encompass the broader context in which patients live, including access to healthcare services, community resources, and social norms regarding preventive practices. By exploring these environmental influences,

the study seeks to understand how the surrounding context can either facilitate or hinder patients' engagement in preventive behaviors related to HBV.

The comprehensive investigation of these factors can offer valuable insights to healthcare providers, policymakers, and public health practitioners. Understanding the complexities of patients' self-management experiences within their social and cultural environments can inform the development of patient-centered interventions. Tailored strategies that account for cultural beliefs, social support networks, and environmental contexts can empower patients to better manage their chronic hepatitis B and engage in preventive behaviors effectively86[116173].

According to Davis et al., (2015), the success of incorporating behavioral theory principles in the health campaign lies in its ability to tailor the messaging and interventions to specific behaviors and the factors influencing students' decision-making. By understanding the environmental and social factors that impact students' behaviors, the campaign can effectively address barriers and leverage facilitators to encourage preventive actions.

2.3 Review of Empirical Studies

The World Health Organization (WHO) reported that around 60 million people in Africa have Hepatitis B virus (HBV), which is about 23% of all global Hepatitis cases[126]. Even though there are vaccines to prevent Hepatitis B since the 1980s, the number of cases is still going up[18]. Hepatitis B and C are major causes of sickness and death from hepatitis, but many infected people don't know they have it, so they don't get treatment on time[11]. The lack of good programs to manage hepatitis in sub-Saharan Africa is also making the problem worse[26]. Having the virus for a long time without symptoms, up to 30 years, means people often get tested when it's too late, and their liver is very sick[37].

Studies show that many people in high-risk areas don't know much about Hepatitis B virus and the vaccines that can help[21,22,25]. Some places don't have enough information about the virus, which leads to lower knowledge about the disease in the community[159].

The findings from the study carried out by Eni et al., (2019) to evaluate the knowledge of hepatitis B virus (HBV) infection and vaccination among 758 university students in Nigeria showed that students from the working class demonstrated better knowledge about HBV infection compared to students from other categories[174]. Previous knowledge of HBV infection, prior testing for HBV, and personal acquaintance with someone who had HBV infection were identified as predictors of better HBV infection knowledge. Moreover, the study highlighted the availability of a vaccine for HBV, and previous vaccination was found to be a predictor of good knowledge about the virus[174].

Interestingly, the study revealed that only 31.9% of the participants were aware of the existence of an HBV vaccine. Those with good knowledge of HBV infection were more likely to have received the vaccine. Additionally, individuals who had been previously vaccinated or had personal knowledge of someone infected with HBV had better knowledge of the virus compared to those without such experiences.

Furthermore, the study uncovered that the majority of participants had low levels of knowledge regarding hepatitis B, and those who were knowledgeable about the virus were more likely to have been vaccinated. Surprisingly, despite being aware of the risks associated with certain behaviors, a significant percentage of participants engaged in high-risk activities, such as having multiple sexual partners and not using condoms[174].

In this study, the participants' average knowledge about Hepatitis B virus (HBV) was assessed, and the mean knowledge score was found to be 4.85 ± 2.69 (95% CI 4.66–5.04). The knowledge scores varied significantly across the three major groups, with the working

class (5.59 ± 2.340) demonstrating significantly higher scores than respondents in private (4.91 ± 2.6) and public (4.19 ± 2.9) institutions. Further analysis revealed that respondents from Gateway Polytechnic Igbesa had significantly poorer knowledge compared to respondents from Covenant University, Abia State, and Lagos State ($p < 0.001$).

There were no significant differences in knowledge observed across different age groups ($p = 0.234$) and levels of education ($p = 0.394$). However, certain factors were found to be positively associated with better knowledge about HBV. Individuals who had heard about HBV, previously tested for the virus, or knew someone who had HBV infection showed significantly better knowledge than those who did not have such experiences ($p < 0.001$). Similarly, respondents who had been previously vaccinated or were aware of the HBV vaccine demonstrated significantly higher knowledge levels than those who had not received vaccination or were unaware of the vaccine ($p = 0.01$ and $p < 0.001$, respectively). The analysis also identified a correlation between the school of study and the type of institution, leading to the removal of the school of study variable from the analysis due to multicollinearity concerns.

The independent predictors in the study accounted for 35.2% of the variation in knowledge scores among the participants. Among the independent predictors, having previously heard about HBV had the most significant influence on knowledge, contributing to an increase of knowledge points compared to those who had not heard about HBV ($p < 0.0001$). Additionally, previous knowledge of the HBV vaccine played a crucial role, accounting for up to 1.171 knowledge points ($p < 0.0001$). Not being part of a school, previous testing, and knowing someone with HBV accounted for a cumulative 1.6 knowledge points in individuals belonging to the three categories compared to those who did not belong. These findings highlight the importance of awareness and previous exposure to HBV-related information in improving knowledge levels among the study participants.

Overall, these studies highlight the importance of improving knowledge about HBV infection and the availability of vaccines among university students. Targeted educational campaigns and vaccination programs may be necessary to increase awareness and encourage preventive behaviors among this population.

Deji-Agboola et al., (2019) assessed the knowledge, attitude and detection of HBV among undergraduate students of OOU. The author emphasized that hepatitis B virus is a significant liver disease that often goes undetected, with symptoms only appearing at an advanced stage of the infection. As a result, the study aims to assess the knowledge, attitude, practice, and prevalence of HBV infection among newly enrolled undergraduate students at Olabisi Onabanjo University. The objective was to identify HBV infections early and initiate appropriate treatment. The students' sera were screened for HBV surface antigen (HBsAg) using Rapid Diagnostic Test (RDT) strip, Enzyme Linked Immunosorbent Assay (ELISA), and molecular method employing Random Amplified Polymorphic DNA analysis (RAPD)[175].

To gather relevant information, a structured questionnaire was administered to the students, covering socio-demographic data, risk factors, and their knowledge about Hepatitis. Out of all the participants, 182 (45.5%) were aware of HBV infection. The primary sources of information were electronic media (39%), the internet (35%), and health workers (33%). However, the majority of students, 352 (88%), demonstrated poor knowledge, and 260 (65%) had a negative attitude towards HBV infection.

The prevalence of HBsAg, as determined by both the Rapid Diagnostic Test strip and ELISA methods, was 3% (12 students). Further analysis confirmed the presence of HBV DNA in the HBsAg positive samples, corroborating the existence of Hepatitis B virus. Moreover, the

RAPD technique revealed genetic variation in the HBV DNA, indicating potential differences in the virus strains.

The presence of HBsAg among these students raises concerns, as they could be potential carriers and sources of infection transmission. Education about the risk factors associated with Hepatitis B virus is essential to prevent its spread. Early detection, increased awareness, and appropriate preventive measures are crucial in tackling the burden of HBV infection among the student population. The authors recommended that public health efforts should focus on improving knowledge and promoting positive attitudes towards HBV infection prevention to curb its transmission and protect the well-being of the students and the broader community.

A study conducted in Enugu also assess the knowledge, attitudes, and practices of undergraduate students at the University of Nigeria Enugu Campus (UNEC) regarding Hepatitis B infection (HBV)[176]. The research was conducted as a cross-sectional and descriptive survey during April to May 2014, involving 360 undergraduate students from various disciplines at UNEC. A structured questionnaire with 33 items was used to collect data on their knowledge base of HBV, attitudes, and practices towards Hepatitis B89[176].

The results indicated that a majority of the students had heard of hepatitis (93.0%) and specifically hepatitis B (89.9%). However, only 35.9% of the participants believed they could contract Hepatitis B. Furthermore, a low percentage (25.6%) had undergone Hepatitis B screening, and even fewer (33.0%) had received vaccination against HBV.

When evaluating the overall knowledge, attitudes, and practices of the participants, the study found that 97.2% had good knowledge, 10% had positive attitudes, and 24.4% exhibited good practices related to HBV. Interestingly, the students studying health sciences demonstrated significantly better practices concerning Hepatitis B compared to those studying business

administration. Despite the good knowledge levels, the study revealed that the knowledge did not necessarily translate into favorable attitudes or good practices among the undergraduate students. This disconnects between knowledge and behavior highlights the need for targeted educational interventions to bridge the gap and encourage students to adopt preventive measures and healthier practices regarding HBV[176].

Overall, the findings reported that the importance of improving students' attitudes and practices related to Hepatitis B, as enhancing knowledge alone may not be sufficient to promote proactive prevention and control strategies[176]. Implementing comprehensive awareness campaigns, promoting regular screenings, and offering accessible vaccination programs could be effective strategies to foster positive attitudes and practices towards HBV among undergraduate students at UNEC. Such interventions are essential in safeguarding the health and well-being of the students and reducing the transmission of HBV within the campus community.

In Malasia, Ahmad et al., (2016) assessed the factors associated with knowledge, attitude and practice related to hepatitis B among international students[120]. The research conducted on international students revealed that their knowledge about hepatitis was relatively low. The study employed a cluster sampling method to collect data from the participants, and various statistical tests, including Spearman's correlation and Chi-square tests, were used to explore the relationships between different variables. The findings indicated positive correlations between knowledge of hepatitis B and C, as well as positive correlations between knowledge of hepatitis B and attitudes and practices related to hepatitis B and C. Moreover, the study identified specific socio-demographic factors and a history of hepatitis that were associated with the participants' knowledge, attitudes, and practices regarding hepatitis B and C.

Globally, hepatitis B and C infections are significant public health issues, with approximately one in twelve people worldwide being chronically infected with either virus, leading to approximately 1 million deaths annually. These viruses are major contributors to primary liver cell carcinoma cases and liver cirrhosis. The global prevalence of hepatitis B infection is estimated at about 5%, varying across different regions, while hepatitis C infection has a global prevalence of approximately 3%.

In Malaysia, the prevalence of hepatitis B has declined to below 2% among the young age group entering university, which suggests successful efforts in prevention and control of the disease in that population[177].

The study found that a low percentage of international students at UPM had good knowledge of hepatitis B and C. Similarly, the prevalence of a positive attitude towards the diseases was relatively low, although about 80% of the participants exhibited safe practices. The study also revealed correlations between levels of knowledge, attitudes, and practices related to hepatitis B and C. Additionally, certain factors were found to be associated with the participants' knowledge, attitudes, and practices regarding hepatitis.

The study concluded that despite ongoing global campaigns on HIV, more than half of the respondents still had a positive attitude towards hepatitis B and C. The majority of participants also exhibited safer practices towards hepatitis B and C, which may be attributed to increased knowledge gained through seminars and other educational initiatives[147]. However, the study highlights the need for further educational efforts to improve knowledge and attitudes regarding hepatitis B and C among international students, in order to promote better preventive practices and reduce the burden of these diseases.

A study conducted at Woldia University aimed to evaluate the knowledge and preventive practices of health science students in relation to hepatitis B virus (HBV) infection[121]. The

research involved 200 participants, and the findings indicated that 48% of the students had limited knowledge about HBV, while 52% demonstrated good knowledge. Regarding preventive practices, 39.5% of the students had good practices for preventing HBV infection, while 59.5% exhibited poor practices.

The study employed a cross-sectional design and focused on health science students at Woldia University in Ethiopia[178]. The sample size was determined based on the proportions of knowledge and practice from a previous study conducted among students at Wollo University Medical College. To ensure data quality, the researchers provided training to data collectors and supervisors, pretested the questionnaire, and obtained necessary permissions and ethical clearance from the relevant university authorities.

The study also explored the associations between participants' knowledge and preventive practices with their academic year and field of study. It was found that being in the 4th or 3rd year was associated with significantly higher knowledge compared to being in the 2nd year. Moreover, students pursuing nursing were less likely to be knowledgeable about infection prevention and transmission of HBV compared to medical laboratory students. Similarly, health officer and midwifery students were also less likely to have sufficient knowledge about HBV infection prevention compared to medical laboratory students.

In conclusion, the study revealed that while a substantial number of students had good knowledge about HBV infection prevention, their actual preventive practices were inadequate[148]. The findings emphasized the importance of addressing misconceptions and enhancing preventive practices among health science students to reduce the risk of HBV transmission. Furthermore, the study shed light on the role of academic year and field of study in influencing students' knowledge, underscoring the need for targeted educational interventions to improve awareness and practices regarding HBV prevention among future

healthcare professionals. The article also discussed additional aspects, such as safety measures for healthcare personnel to avoid needlestick injuries and the prevalence of hepatitis B and C in various populations, along with healthcare personnel's knowledge, attitude, and practice regarding these diseases

Another study conducted among in-school adolescents in Ogun State, certain practices expose them to potential risks of HBV infection. However, their cognitive factors and preventive practices concerning HBV have not been thoroughly examined in a systematic manner.

The study employed a descriptive cross-sectional survey involving 300 students selected through a multistage sampling process[179]. The participants were from junior and senior arms in four public secondary schools in Ogun State. A pre-tested self-administered questionnaire was used to collect data on socio-demographic characteristics, HBV-related knowledge, and prevention practices. Descriptive statistics were applied to analyze the data, including the participants' knowledge level and preventive practices related to Hepatitis B. The Pearson correlation coefficient was used to assess the relationship between knowledge of HBV and adoption of prevention practices.

The findings showed that the mean knowledge score of the participants was 16.4±4.4, indicating that 79.3% (238) had fair knowledge of HBV infection. However, a concerning 94.7% (284) demonstrated inappropriate HBV preventive practices. Only a small percentage of 6.7% (20.1) had received vaccination against HBV. Surprisingly, there was no significant relationship between knowledge of HBV and the adoption of preventive practices among the participants ($r=0.06$; $p=0.30$).

The study's results indicate that while some students possess fair knowledge about HBV infection, there are still knowledge gaps relating to Hepatitis B. Furthermore, a considerable

portion of the respondents remain vulnerable to HBV due to low uptake of the HBV vaccine and engagement in practices that could expose them to the infection. Addressing these concerns calls for educational interventions and advocacy efforts to raise awareness and promote appropriate preventive practices among in-school adolescents in Ogun State[179].

In conclusion, this study sheds light on the importance of focusing on preventive education and health promotion among students to mitigate the risks of HBV infection. Targeted interventions can help bridge the knowledge gaps and encourage the adoption of preventive practices, such as vaccination and behavior changes, to safeguard the health of in-school adolescents in the region. By implementing these measures, public health authorities can work toward reducing the burden of HBV infection and its associated consequences in Ogun State, Nigeria[179].

Kumah et al., (2021) study carried out in Ghana aimed to assess the knowledge, attitude, and practices of students towards Hepatitis B infection and vaccination at the University of Health and Allied Sciences in Ghana[180]. The researchers conducted a cross-sectional quantitative descriptive survey among 262 Public Health students using a multi-stage sampling technique for participant selection.

The study found that the majority of the respondents were male, comprising 69.8% of the participants, while females accounted for 30.2%. All 262 respondents had knowledge about Hepatitis B infection and were aware of the availability of a vaccine for prevention. However, despite this knowledge, a significant proportion (56.9%) of the respondents believed they did not need protection from Hepatitis B infection.

Regarding vaccination, the majority (58.8%) of the total respondents had been vaccinated against Hepatitis B infection. The study identified the cost of vaccines as a major hindrance to non-vaccination. Interestingly, among the 41.2% of respondents who were not vaccinated,

the majority (50.9%) expressed an unwillingness to be vaccinated even if it was offered to them at no cost.

In conclusion, the study revealed a high level of knowledge among students about Hepatitis B infection and the availability of the vaccine. However, a considerable number of respondents did not perceive the need for protection from Hepatitis B infection, highlighting the importance of raising awareness about the significance of vaccination as an effective measure for controlling Hepatitis infection. Education campaigns are crucial to address misconceptions and promote the importance of vaccination in preventing Hepatitis B infection among students and the broader population[123180]. With regard of HBV vaccine uptake, Chingle et al., (2017) conducted a study among the tertiary institutions. The study reported that healthcare students are at higher risk of exposure to Hepatitis B virus (HBV) due to their direct contact with patients' body fluids and blood94[124]. However, their awareness of the risks associated with HBV infection and their uptake of the HBV vaccine are relatively poor. This study aimed to compare the level of risk perception regarding hepatitis B infection and the uptake of the HBV vaccine between medical students and students from other departments at the University of Jos[181].

To achieve this, a comparative cross-sectional study was conducted among 1,200 students, including 400 each from the departments of Medicine, Nursing Sciences, and Public Administration. Data was collected using a pretested self-administered questionnaire, and risk perception was assessed using a five-point Likert scoring system. The collected data were analyzed using SPSS version 20, with a significance level set at $P < 0.05$.

The results of the study revealed that the awareness of HBV vaccine prevention was generally high among University of Jos students, with 88.4% of the participants being aware of the vaccine. However, awareness levels varied among the different departments, with medical

and nursing students showing similar levels of awareness (36.2% and 36.0%, respectively), while public administration students had a lower awareness (27.8%). The overall risk perception of HBV infection was found to be 76.8%, with medical and nursing students exhibiting similar percentages (40.7% and 40.1%, respectively), and lower risk perception among public administration students (9.1%). Notably, medical students displayed a risk perception that was five times higher than that of public administration students (OR = 5.22, 95% CI = 2.19 - 12.93; P < 0.001). Regarding HBV vaccine uptake, the study revealed that only 60.2% of medical students had received the full dose, compared to 20.6% of nursing students and 15.1% of public administration students. Medical students were found to be four times more likely to receive the HBV vaccine compared to public administration students (OR = 3.62; 95% CI = 2.39 - 5.48; P < 0.001)[94].

In conclusion, the study underscores the importance of increasing awareness and risk perception of HBV infection and promoting higher uptake of the HBV vaccine among University of Jos students, especially those in non-health related disciplines. Targeted educational interventions and awareness campaigns are essential to protect the broader student population from HBV infection and ensure a healthier campus community.

The primary objective of Damien et al., (2021) study was to determine the prevalence of hepatitis B infection and identify associated factors among adolescents and youth attending secondary school in the urban area of Covè, Benin95[125182]. The researchers conducted a cross-sectional survey from 4th to 10th February 2018, and a total of 200 adolescents and youth aged 15 to 24 years were randomly selected as subjects for the study. Hepatitis B surface antigenaemia (HBsAg) was tested in their blood using rapid enzyme-linked immunosorbent assay kits. Univariate and multivariate analyses were performed to identify factors associated with hepatitis B infection[182].

The findings revealed a seroprevalence of hepatitis B virus infection at 18.50% among the selected adolescents and youth. The researchers conducted a multivariate logistic regression analysis to identify factors associated with the infection. They found that individuals in the age group of 15-19 years were 4.32 times more likely to be infected with hepatitis B compared to those in the age group of 20-24 years (PR = 4.32; 95% CI [1.51 - 12.34], p = 0.0063). Additionally, students who were not aware of hepatitis B had a higher likelihood of being infected compared to those who had been sensitized about the infection (PR = 14.60; 95% CI [4.98 - 4.27], p = 0.0001). Furthermore, individuals with tattoos or piercings had an 8.60 times higher risk of hepatitis B infection compared to those without such body modifications (PR = 8.60; 95% CI [3.41 - 21.70], p < 0.0001)95[125,182]

Based on these findings, the study concludes that the seroprevalence of hepatitis B among adolescents and youth in secondary schools is considerably high in the Covè urban area of Benin. The researchers recommend the inclusion of regular screening for hepatitis B infection in school health services in Benin. Moreover, they emphasize the need for awareness campaigns and health education programs to increase knowledge about hepatitis B transmission and prevention among adolescents and youth. By addressing these factors and promoting preventive measures, it is hoped that the burden of hepatitis B infection can be reduced among this vulnerable population in the region[182]

2.4 Theoretical Framework

Health Belief Model

The Health Belief Model (HBM) is a psychological model that attempts to explain and predict health behaviors by examining an individual's beliefs and attitudes towards health-related issues including hepatitis B, which can be crucial in designing effective prevention

programs[183]. Developed in the 1950s by social psychologists Irwin M. Rosenstock and colleagues, the HBM is widely used in health promotion and behavior change interventions.

The Health Belief Model (HBM) is a vital theoretical framework that underscores the significance of individual-level factors in shaping health-related behaviors. It acknowledges the diverse nature of people and recognizes that their perceptions, beliefs, and attitudes significantly influence how they approach health-related decisions[184]. In the core principles of the HBM, highlighting the impact of intrapersonal factors on health behavior choices[185.] By understanding the individuality of each person and catering interventions accordingly, health promotion efforts can effectively inspire positive changes and preventive actions.

Evidently, understanding the individual perspectives to make decisions about their health, they draw upon a complex interplay of internal thought processes, past experiences, and their knowledge of health risks[185]. These intrapersonal factors contribute to their perception of potential threats, such as those posed by hepatitis B, and their understanding of the severity of such diseases. It is essential to recognize that individuals with the same health risk may respond differently based on their unique perspectives and beliefs99[129186]. The HBM acknowledges this diversity, emphasizing the significance of individual-level factors in driving health behaviors[187].

However, considering the diversity of individuals, the HBM places strong emphasis on the need for tailored interventions that address specific beliefs and motivations. By targeting these intrapersonal factors, health promotion initiatives can better resonate with individuals, leading to a higher likelihood of adopting healthier choices and preventive actions.

For instance, when applying the HBM to prevent hepatitis B, healthcare providers and public health professionals can create messaging that aligns with the unique perceptions and experiences of the target population[188]. Addressing specific barriers that individuals may

perceive, such as concerns about vaccine safety or accessibility, can empower them with accurate information and foster a sense of self-efficacy. This, in turn, encourages individuals to take proactive steps in safeguarding themselves from hepatitis B.

Furthermore, the HBM also recognizes the role of external cues to action, which can act as triggers for individuals to engage in health behaviors. These cues can originate from various sources, such as educational campaigns, healthcare providers, or the personal experiences of friends or family members dealing with hepatitis B. Interventions can effectively leverage these cues to prompt individuals to seek vaccination and adopt other preventive measures.

Construct of HBM

Perceived Susceptibility

Perceived Susceptibility is a critical construct in the Health Belief Model (HBM) that relates to an individual's belief about their personal risk or vulnerability to a particular health condition or disease[189]. It reflects the subjective perception of the likelihood of experiencing the health threat based on various factors, including personal characteristics, behaviors, and environmental exposures. In essence, it addresses the question of "How likely am I to get this disease?"[189].

The perception of susceptibility is influenced by various factors, such as an individual's knowledge about the disease, their understanding of risk factors, past experiences, and exposure to information or personal stories about others affected by the condition. For example, if someone is aware that Hepatitis B is primarily transmitted through exposure to infected blood or body fluids and engages in behaviors that may put them at risk, they are more likely to perceive themselves as susceptible to the virus.

In cases where the perceived susceptibility is high, individuals may feel a sense of urgency and concern about the health threat, which can motivate them to take preventive actions. On the other hand, if someone believes that their chances of contracting the disease are low, they may not prioritize preventive measures, leading to potential health risks[184].

In health promotion and disease prevention programs, understanding an individual's perceived susceptibility is crucial for developing effective interventions. If individuals underestimate their susceptibility to a health condition, messages may need to be tailored to provide accurate information about the actual risk and potential consequences[190.] For instance, educational campaigns might highlight the prevalence of Hepatitis B, its modes of transmission, and the potential health impact to raise awareness and enhance perceived susceptibility.

Furthermore, interventions can be designed to address misconceptions or barriers that hinder individuals from recognizing their vulnerability. This can be achieved by sharing real-life stories or testimonials from people who have experienced the disease, which can resonate emotionally and enhance the perception of susceptibility.

Conversely, in situations where individuals perceive themselves to be at high risk, interventions may focus on enhancing self-efficacy (belief in one's ability to take preventive actions) and providing accessible and feasible strategies for adopting preventive behaviors. This might include promoting regular health screenings, vaccination, or lifestyle modifications.

Overall, the perceived susceptibility construct of the Health Belief Model plays a crucial role in understanding how individuals assess their own risk for health conditions and how this perception influences their motivation to engage in preventive behaviors[166]. By addressing perceived susceptibility in health promotion efforts, public health initiatives can effectively

engage individuals and foster a sense of personal responsibility towards their health, ultimately leading to improved health outcomes.

Perceived Severity

Perceived Severity is another essential construct in the Health Belief Model (HBM) that focuses on an individual's perception of the seriousness or potential impact of a health condition or disease[184]. It addresses the question of "How serious would the consequences be if I were to contract this disease?"

Perceived Severity is shaped by an individual's understanding of the potential physical, emotional, and social consequences of the health threat. It involves assessing the severity of symptoms, the potential for long-term complications, and the overall impact on one's quality of life[184]. For example, in the context of Hepatitis B, individuals might consider the possibility of chronic liver disease, liver cancer, or the need for lifelong medical management if they were to become infected.

The perception of severity is influenced by various factors, including personal experiences with the disease, exposure to information, media coverage, and interactions with others who have been affected by the condition. Additionally, cultural beliefs, social norms, and individual beliefs about health and illness can also influence perceived severity[191].

When individuals perceive a health condition as highly severe, they are more likely to take it seriously and be motivated to engage in preventive behaviors. This is because the perceived severity can create a sense of fear or concern, prompting individuals to take action to avoid the potential negative consequences. In the context of Hepatitis B prevention, individuals who perceive the virus as a serious threat to their health may be more inclined to seek vaccination, practice safer behaviors, and undergo regular health screenings.

On the other hand, if individuals perceive the severity of the health condition as low, they may not prioritize preventive measures, potentially putting themselves at greater risk. In such cases, health promotion efforts may need to address misconceptions about the disease's impact and provide accurate information to increase the perception of severity.

Effective health communication can play a significant role in influencing perceived severity. Educational campaigns that emphasize the potential consequences of Hepatitis B infection, such as the risk of liver damage or transmission to others, can help individuals understand the seriousness of the disease and motivate them to take preventive actions.

Perceived Benefits

Perceived Benefits is a significant construct in the Health Belief Model (HBM) that focuses on an individual's belief in the effectiveness and advantages of taking recommended health actions or preventive measures[184]. It addresses the question of "Will adopting this preventive behavior or action be beneficial to me?"

In the context of health behaviors, individuals weigh the potential positive outcomes or benefits of engaging in a particular preventive action against the perceived costs or efforts required to do so. If individuals believe that the benefits of the preventive action outweigh the potential risks or inconveniences, they are more likely to be motivated to take action[187].

When it comes to Hepatitis B prevention, perceived benefits might include the belief that getting vaccinated against Hepatitis B will effectively protect them from the virus and significantly reduce their risk of infection. They may also consider the potential benefits of avoiding the physical and emotional consequences of the disease, such as liver damage, chronic illness, or the risk of transmitting the virus to others.

Perceived Benefits are influenced by various factors, including past experiences, knowledge, cultural beliefs, and the influence of social networks and healthcare providers[135]. For instance, individuals who have seen positive outcomes in others who have received the Hepatitis B vaccine may be more likely to perceive the benefits of vaccination.

To enhance perceived benefits and encourage preventive behaviors, health promotion efforts must focus on providing clear and accurate information about the effectiveness of preventive measures, such as vaccination. Education campaigns can highlight the proven benefits of Hepatitis B vaccination in preventing infection and reducing the risk of serious health complications.

Moreover, addressing misconceptions or myths about the preventive measures is essential. For instance, some individuals may have heard unfounded concerns about vaccine safety, and addressing these concerns with evidence-based information can help improve perceived benefits.

It is crucial for public health initiatives to tailor their messaging to resonate with the target population and emphasize the immediate and long-term benefits of adopting preventive measures[177]. By understanding and addressing perceived benefits, health promotion programs can foster a positive attitude towards preventive actions and motivate individuals to take steps to protect their health.

Perceived Barriers

Perceived Barriers is an essential construct within the Health Belief Model (HBM) that examines the individual's subjective assessment of the obstacles, challenges, or negative aspects that may hinder them from adopting a recommended health behavior or preventive

action[191]. In other words, it explores the factors that may prevent individuals from taking action to protect their health.

When it comes to health behaviors, individuals consider not only the potential benefits but also the perceived barriers associated with adopting a particular preventive measure. These barriers can be diverse and can vary from person to person based on their unique circumstances, experiences, and beliefs[184].

In the context of Hepatitis B prevention, perceived barriers may include concerns about the safety or side effects of the Hepatitis B vaccine. Some individuals might fear pain or discomfort associated with the vaccination process. Other barriers could be related to access and cost, such as limited availability of the vaccine, financial constraints, or difficulties in reaching healthcare facilities for vaccination.

Cultural or religious beliefs can also play a role in perceived barriers. For instance, some individuals might hold beliefs that prevent them from seeking medical interventions, including vaccination, or they may rely on traditional practices for health protection[193].

Perceived barriers can be influenced by external factors, such as societal norms and peer influences. If an individual perceives that their social circle does not support or encourage vaccination, they may be less likely to take action themselves.

To address perceived barriers effectively, public health interventions need to identify and understand the specific barriers that are most relevant to the target population. Tailoring communication and educational campaigns to address these barriers can help individuals overcome their concerns and increase the likelihood of adopting preventive measures.

Providing accurate information about the safety and efficacy of preventive measures is essential in mitigating perceived barriers. Highlighting the accessibility of vaccination

services and potential cost-saving measures can also help individuals overcome practical obstacles. Moreover, engaging healthcare providers to address and clarify misconceptions about preventive measures can build trust and confidence in the recommended actions[194].

Cues to Action

Cues to Action is a significant construct within the Health Belief Model (HBM) that emphasizes the role of external factors or triggers that prompt individuals to take action and engage in health-related behaviors[184]. These cues serve as stimuli or reminders that encourage people to adopt preventive measures or engage in specific health behaviors[154].

In the context of the HBM, Cues to Action are essential in moving individuals from the stage of being aware of a health threat to actually taking action to address that threat. While individuals may have knowledge about a health issue, such as the risks associated with Hepatitis B infection, they may not feel compelled to act on that knowledge without external prompts.

Cues to Action can come from various sources and take different forms. Some common examples include:

1. Educational Campaigns: Public health initiatives often use educational campaigns to raise awareness about health issues and the importance of preventive behaviors. These campaigns may use various media channels, as television, radio, posters, social media, and online platforms, to provide information and motivate individuals to take action.

2. Healthcare Providers: Recommendations and advice from healthcare professionals can serve as powerful cues to action. When healthcare providers communicate the importance of preventive measures like getting vaccinated against

Hepatitis B, patients are more likely to consider and follow through with the recommendation.

3. Personal Experiences: Personal experiences, either one's own or that of friends or family members, can act as strong cues to action. For instance, witnessing someone close suffering from Hepatitis B can motivate an individual to take proactive steps to protect themselves from the infection.

4. Policy Changes: Implementation of policies or regulations related to health behaviors can serve as cues to action. For example, if there are policies that require vaccination for certain activities or travel, individuals may be prompted to get vaccinated.

5. Reminder Systems: Systems such as vaccination reminder letters, text messages, or emails from healthcare facilities can act as effective cues to action. These reminders prompt individuals to schedule appointments for vaccinations or health check-ups.

6. Social Norms: Perceptions of social norms can influence behavior. If an individual believes that the majority of their peers or community members are engaging in preventive behaviors, they may be more inclined to do the same.

Effective use of Cues to Action in health promotion interventions can significantly enhance the likelihood of individuals adopting preventive measures. By providing timely and relevant prompts that align with an individual's knowledge, beliefs, and motivations, public health efforts can encourage positive health behaviors and ultimately contribute to better overall health outcomes.

2.4.2. 6 Self-efficacy

Self-efficacy is a crucial construct within the Health Belief Model (HBM) that refers to an individual's belief in their ability to successfully perform a specific health-related behavior to achieve a desired outcome[184]. It is a concept rooted in social cognitive theory and plays a central role in influencing health behaviors and decision-making.

In the context of the HBM, self-efficacy is a determining factor in whether individuals will take action to prevent or manage health issues like Hepatitis B. It reflects a person's confidence in their capacity to execute the necessary actions and overcome potential challenges or barriers to achieve a positive health outcome.

High self-efficacy is associated with a greater likelihood of engaging in health-promoting behaviors. When individuals believe they have the skills, knowledge, and resources needed to carry out a specific health action, they are more motivated and determined to take the necessary steps[195].

For example, regarding Hepatitis B prevention, a person with high self-efficacy might feel confident in their ability to seek vaccination, practice safe sex, or adopt other preventive measures. They are more likely to take personal responsibility for their health and make informed decisions to protect themselves from the virus.

Conversely, low self-efficacy can act as a significant barrier to health behavior change. Individuals with low self-efficacy may doubt their ability to follow through with preventive actions, leading to hesitancy or avoidance of the recommended health behaviors[196].

Healthcare providers and public health professionals play a vital role in promoting self-efficacy. By providing clear and accurate information, offering support, and encouraging a positive outlook, they can help individuals build self-efficacy. Additionally, success in taking

small steps towards behavior change can enhance self-efficacy, as achieving even minor health-related goals can boost confidence in one's abilities.

Interventions based on the HBM should address self-efficacy to effectively motivate individuals towards healthier behaviors. Strategies to enhance self-efficacy may include skills training, setting achievable goals, role modeling, and providing positive reinforcement for efforts made towards behavior change.

Strength of HBM

One of the strengths of the HBM regarding hepatitis B prevention is its emphasis on individual perceptions of the disease. By assessing perceived susceptibility to hepatitis B and the perceived severity of its consequences, prevention programs can target individuals who may feel more vulnerable and at higher risk. This tailored approach can lead to better engagement and participation in preventive measures[197]

Additionally, the HBM highlights the significance of perceived benefits and barriers to adopting preventive actions. In the context of hepatitis B, understanding what individuals perceive as potential benefits of vaccination and the obstacles they may face in accessing vaccination services can inform targeted interventions to address these specific concerns. By addressing perceived barriers, such as cost or accessibility, prevention programs can increase the likelihood of vaccine uptake.

The inclusion of cues to action is another positive aspect of the HBM for hepatitis B prevention. By providing clear and compelling prompts, such as educational campaigns or reminders, individuals are more likely to take action towards prevention. These cues can play a vital role in encouraging individuals to seek vaccination and adopt preventive practices.

Moreover, the HBM recognizes the importance of self-efficacy in behavior change[198]. For hepatitis B prevention, empowering individuals to feel confident in their ability to protect themselves, whether through vaccination or adopting safer practices, is critical. By incorporating self-efficacy measures in prevention programs, individuals can be better equipped to take ownership of their health and make informed decisions.

Application of HBM to Hepatitis B Prevention

The Health Belief Model (HBM) can be effectively applied to hepatitis B prevention strategies, as it provides a framework to understand and address the factors that influence individuals' decisions and behaviors related to this infectious disease. Here are some key ways in which the HBM can be applied to hepatitis B prevention:

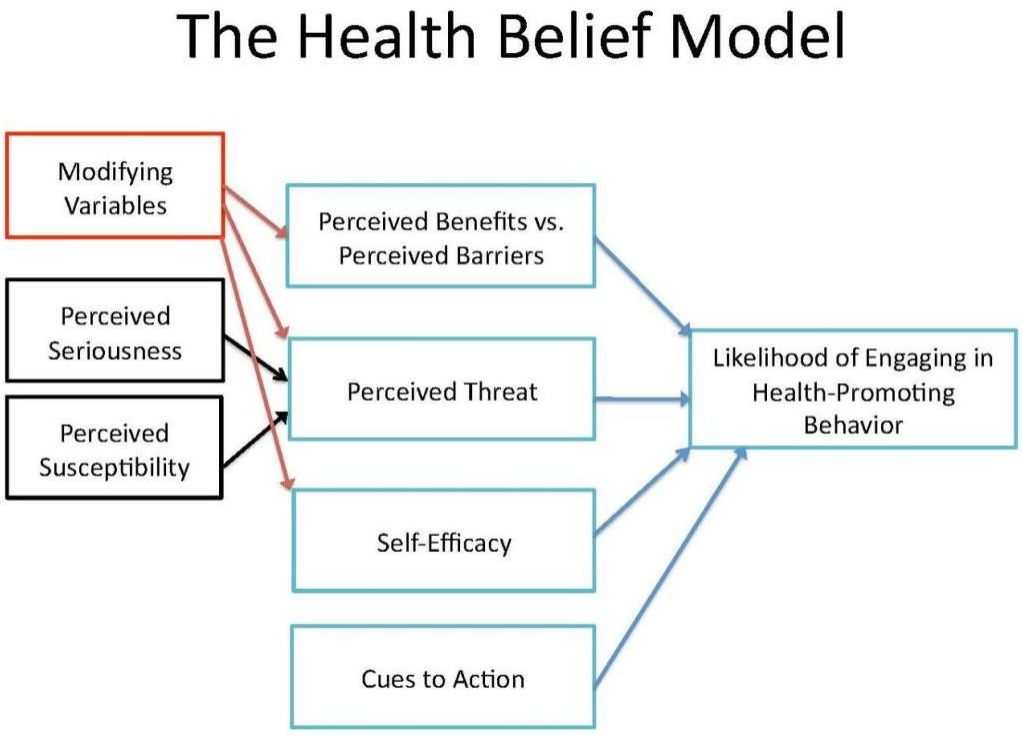
1. Perceived Susceptibility: The HBM emphasizes the importance of individuals' perceptions of their susceptibility to a health condition. In the context of hepatitis B, interventions can focus on raising awareness about the risk factors for transmission and the prevalence of the virus, particularly among high-risk populations. By highlighting the potential for hepatitis B infection and its consequences, individuals may recognize the need to take preventive measures.
2. Perceived Severity: It is crucial to communicate the severity of hepatitis B infection to individuals. This can be achieved by providing information about the potential long-term effects of the disease, such as liver cirrhosis and liver cancer. By understanding the seriousness of the illness, individuals may be motivated to adopt preventive behaviors to protect themselves from infection.

3. Perceived Benefits: Interventions should emphasize the benefits of preventive actions, such as vaccination against hepatitis B. Communicating that vaccination is highly effective in preventing infection and its complications can encourage individuals to seek vaccination as a protective measure.

4 Perceived Barriers: The HBM recognizes that perceived barriers can hinder individuals from engaging in preventive behaviors. For hepatitis B prevention, barriers may include concerns about vaccine safety, lack of access to vaccination services, or cultural beliefs. Interventions can address these barriers through targeted education, addressing misconceptions, and increasing accessibility to vaccination services.

5. Cues to Action: The HBM suggests that individuals may require cues or triggers to initiate preventive actions. Healthcare providers can play a crucial role by recommending and offering hepatitis B vaccination during routine medical check-ups. Educational campaigns and media messages can also serve as cues to action, encouraging individuals to seek information about hepatitis B and its prevention.

6. Self-Efficacy: Building individuals' confidence in their ability to take preventive action is essential. Healthcare providers can empower individuals by providing clear instructions on how to access and receive the hepatitis B vaccine. Peer support and testimonials from vaccinated individuals can also enhance self-efficacy and motivate others to follow suit.



Health Belief Model[199]

Summary of Gaps in Literature

The existing literature on the assessment of knowledge and practice on Hepatitis B virus infection prevention among students highlights several gaps that warrant further investigation. One prominent gap pertains to the need for more research to explore effective strategies aimed at overcoming screening barriers and improving vaccination rates among students[199]. While previous studies have provided valuable insights into students' knowledge and practices related to HBV infection prevention, they often fall short of offering comprehensive solutions to address the complex challenges associated with increasing screening and vaccination rates in this population.

A key limitation in the current literature lies in the lack of in-depth exploration into the specific reasons behind existing screening barriers and low vaccination rates among students. Understanding the underlying factors that contribute to these barriers is critical for developing tailored interventions that resonate with students' needs and circumstances. Future research could benefit from conducting qualitative studies to gather rich insights from students, healthcare providers, and other stakeholders involved in HBV prevention and management.

Another significant gap is the limited exploration of the potential impact of cultural, social, and economic factors on screening and vaccination rates among students. These factors can significantly influence health-seeking behaviors and the acceptability of preventive measures. Investigating the role of cultural beliefs, social norms, and financial considerations in students' decision-making processes can inform the design of context-specific interventions that are culturally sensitive and address the unique challenges faced by students in accessing preventive services.

Furthermore, the existing literature lacks sufficient research on the cost-effectiveness and feasibility of different health care delivery models to reduce the burden of HBV-related disease among students. Evaluating the cost-effectiveness of various strategies, such as community-based outreach programs or integration of preventive services into existing healthcare settings, is essential for making informed policy decisions and allocating resources effectively.

The existing literature of Dagnew et al., (2020) indicates a significant gap regarding the promotion of health education through mass media channels, such as television, radio, and other technologies, specifically focusing on hepatitis B virus transmission and prevention strategies in pregnant women and their infants[200]. Currently, there is limited research exploring the effectiveness of utilizing mass media platforms to disseminate targeted information about HBV to this vulnerable population.

In Ethiopia, public health interventions that encompass routine screening for HBV, timely treatment, and implementation of birth dose vaccines for infants are crucially needed to address the prevention of mother-to-child transmission (MTCT) and contribute to the overall elimination efforts. However, the literature lacks comprehensive studies that assess the impact and feasibility of these interventions in the Ethiopian context.

Further research is warranted to examine the effectiveness of health education campaigns through mass media in reaching pregnant women and their families, considering cultural and socioeconomic factors that may influence information uptake and behavior change. Assessing the knowledge and attitudes of pregnant women towards HBV, as well as their awareness of available prevention strategies, can help tailor communication messages to better meet their needs.

Additionally, evaluating the implementation of routine screening for HBV and the accessibility of treatment and vaccines for infants in various healthcare settings across Ethiopia is crucial. Understanding potential barriers to the adoption and adherence to these interventions can inform the design of targeted strategies to improve the overall effectiveness and reach of prevention efforts. According to Nguyen et al., (2020) it is essential to acknowledge that the study specifically focused on medical students, who possess a unique educational background and broader knowledge of basic medical skills compared to other populations[4]. Consequently, the results obtained from the survey, which assessed the levels of knowledge, attitudes, and practices (KAP) while identifying specific gaps, may not be fully representative of other demographic groups.

Given the particularities of medical students, the KAP gaps identified present an opportunity for improvement and intervention. Therefore, the proposal for a recommendation directed towards medical universities in Vietnam to develop a competency-based medical training program. Such a program would be tailored to meet the specific needs of medical students, equipping them with essential medical skills.

By adopting a competency-based approach, medical universities can address the gaps identified in the KAP assessment and tailor the training to align with the current challenges and demands of the medical field. This training program would aim to bridge the identified gaps in knowledge, attitudes, and practices, ensuring that medical students possess the necessary skills to excel in their future medical practice.

Moreover, the competency-based training program would not only enhance the theoretical knowledge but also emphasize the practical application of medical skills. This approach

would empower medical students to apply their knowledge effectively in real-world scenarios, ultimately contributing to improved healthcare outcomes and patient care.

Endnotes

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Chapter Three

Methodology

Research Design

This study adopted a cross sectional study design

Population of the study

The study population was the students of Bamidele Olumilua University of Education, Science and Technology Ikere Ekiti.

Description of study location

Bamidele Olumilua University of Education, Science and Technology Ikere offers degree programs across Education, Science and Technology. The university was formerly College of Education, located in Apata Hill, in Ikere Ekiti, Ekiti State of Nigeria. Ikere is the second largest city in Ekiti State. The town lies between latitudes 70 30' North of the equator and longitudes 50 14' East of the Greenwich meridian The city has an area of 262km^2, of which 52.2% of the population are females.

Sample and Sampling Techniques

The study participants were selected using convenience sampling techniques.

Sampling Size Estimation

The sample size was calculated using formula

$$n = \frac{Z^2 P(1 - P)}{d^2}$$

n-- minimum sample size required

d– margin of error 3% z—

Confidence level of 95%

p– prevalence of 9.7%.[1]

$$n = \frac{(1.96)^2 \times 0.097(1-0.097)}{0.03^2}$$

$$n = \frac{3.8416*0.097*0.903}{0.0009}$$

$$= 373.877$$

To compensate for non- response[2]

$$\frac{n}{1 - f}$$

n = calculated sample size

f = assuming a 10% proportion of non – response

$$n = \frac{373}{1 - 0.1} = \frac{373}{0.9} = 414$$

Description of the Research Instrument

The research was carried out using well-structured self-administered questionnaires to get the quantitative data. The instrument contained closed ended questions that the participants filled. The questionnaire included four sessions:

Section A: Background Characteristic of the Respondents

Section B: Knowledge on HBV Infection Prevention

Section C: Practice on HBV Infection Prevention

Section D: Life Style and Drivers of HBV Infection

Validity and Reliability of Research Instrument

A questionnaire was adopted from other study to ensure the validity and reliability of this study.[3]

Variables

3.7. 1 Dependent Variable

Practice of Hepatitis B Infection Prevention

In this study the practice of hepatitis B infection prevention was captured based on 6 questions and was categorized as 0 = No, 1 = Yes, 2 = I don't know. It was then re-categorized as 70% in to two, 0 as poor practice and 1 good practice.

Knowledge of HBV

In this study the knowledge of HBV was captured based on 14 questions and was categorized as 0= No, 1= Yes, 2= I don't know, It was measured based on 14 questions, which are: Hepatitis B virus infection is caused by virus?, Hepatitis B virus infections have five sub-types?, Hepatitis B virus infection can affect liver?, Hepatitis B virus infection can cause liver cancer?, Hepatitis B virus infection can affect any particular age group?, Hepatitis B virus infection is the most common of hepatitis infections?, The early symptoms of hepatitis B virus infection are same for cold and flu (fever, running nose, cough)? Jaundice is one of the major symptoms of hepatitis B?, Hepatitis B can be transmitted by handshaking?, Hepatitis B can be transmitted by contact with open wounds?, Hepatitis B is curable/treatable?, Hepatitis B can be self-cured by the body?. It was then re categorized into to, 0 as poor knowledge of HBV and 1 as Good knowledge of HBV.

Knowledge of HBV Infection Prevention

In this study the knowledge of HBV infection prevention was captured by testing the knowledge of student based on 12 questions and was categorized as 0= No, 1= Yes, 2= I

don’t know, It was measured based on 12 questions, which are: Nausea, vomiting and loss of appetite are common symptoms of hepatitis B virus infection?, All hepatitis B virus infection patients experience symptoms at the early stage of the disease?, Hepatitis B virus can be transmitted from unsterilized sharp objects, surgical instruments?, Hepatitis B virus can be .transmitted from unsterilized barber's clipper?, Hepatitis B virus can be transmitted from contaminated blood and blood products?, Hepatitis B virus can be transmitted from unsafe sex?, Hepatitis B virus can be transmitted from mother to child?, Hepatitis B virus can be transmitted by sharing eating utensils?, Hepatitis B virus can be transmitted by sharing clothes and bed sheets?, Hepatitis B virus can be transmitted by living and sleeping in a congested apartments?, Hepatitis B virus can be transmitted from contaminated water/food prepared by a person suffering from the infection?, Hepatitis B virus can be transmitted by mother to child?. It was then re categorized into to, 0 as poor knowledge of HBV infection prevention and 1 as good knowledge of HBV infection prevention.

3.6.2 Independent Variables

Age

This is the age of the students stated in the number of years that have passed as of the ate of the interview. In this study, age was broken into the following categories:

0 = below 16 years, 1=16-20 years, 2= 21-25 years, 3=26-30 years

Sex

This represent the gender of the respondents and it falls into this categories:

0= Male, 1= Female

Marital Status

This shows whether the respondents are married or not at the time of the investigation. It is represented in this work as:

0= Married, 1= Unmarried, 2=unmarried but co-habiting

Study Level

The definition of this variable is the level the student was in the university as at the time of the investigation. It is categorized as 0=100 L, 1=200 L

Religion

This is a reference to the particular religious practice that the student believes and belongs to. It has been placed as: 0= Other religion, 1= Christianity

Tribe

This is to know the particular area of the country where the respondent came from so as know the diversity of culture, language and tradition. The classification in this study is as follows: 0= Yoruba, 1= Non – Yoruba

Ever had Sexual Intercourse

This is to have the knowledge of their exposure sexual relationship with opposite gender and how vulnerable they are to contacting sexual transmitted diseases.

Operational Definitions

The following operational definitions were used in this study:

Good knowledge: was defined when participants' scored >70% of knowledge items correctly.

Poor knowledge: was defined when participants scored ≤70% of practice items correctly.

3.8 Data Collection

Data for the study were collected by using a self-administered questionnaire on the school premises. The questionnaire contained: written consents, socio-demographic variables, knowledge, and practice questions towards hepatitis B infection prevention which were developed by adapting from different peer-reviewed literature.[2]

Data Analysis

Data was collated, entered, cleansed and analyzed using SPSS (Statistical Package for Social Sciences) version 20. Data was presented in tables. The data obtained was analyzed using descriptive statistics such as frequency distribution, percentages and means.

Ethical Approval

Ethical clearance was obtained from Centre for Research and Development, BOUESTI. The aim and objectives of the study were explained to the participants. Consent was taken from each person after clearly explaining the purpose of the research. They were told that confidentiality of information, privacy would be maintained throughout the period of the research. Numbers were used to identify the participants instead of their names. They were to withdraw from answering the questions if not interested.

Endnotes

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3. Gebremeskel T, Beshah T, Tesfaye M, Beletew B, Mengesha A, & Getie. A *''Assessment of Knowledge and Practice on Hepatitis B Infection Prevention and Associated Factors among Health Science Students in Woldia University, Northeast Ethiopia''* **Advances in Preventive Medicine,** 2020, 9421964.

Chapter Four

Results and Discussion of Findings

Demographic Data Analysis

Section A of the questionnaire contained data on socio-demographic variables which was analyzed using descriptive statistics (Frequency, percentages, mean and standard deviation). Table 4.1 shows the background characteristics of the respondents. The majority of the respondents are below 18 years. The result shows that only 27.1% of the respondents are male while others are female, it is also shown that 82.2% of the respondents are not living with partners. The findings show that the majority of the respondent are 100L students. However, 84.4% of the respondents are practicing Christianity and 89.2% of the respondents are Yorubas, and others are non-Yorubas

Table 4.1: Background Characteristics of the Respondent

Variables	Frequency	Percent (%)
Age of respondent		
Below 18 years	330	82.9
18 years and above	68	17.1
Sex		
Male	108	27.1
Female	290	72.9
Marital Status		
Living with partner	71	17.8
Not living with a partner	327	82.2
Study Level		
100L	274	68.8
200L	124	31.2
Religion		

Other religion	62	15.6
Christianity	336	84.4
Tribe		
Yoruba	355	89.2
Non-Yoruba	43	10.8
Ever had Sexual Intercourse		
No	61	15.3
Yes	337	84.7

Presentation of Data

Knowledge of HBV

Section B of the questionnaire assessed knowledge of HBV. Table 4.2 shows the percentage distribution of knowledge of HBV. The majority of the respondent answered correctly that Hepatitis B virus infection is caused by a virus while others answered incorrectly. Only 40.2% of the respondents said Hepatitis B virus infections have five sub-types while others answered the question incorrectly. 51.8% of the respondents answered correctly that Hepatitis B can affect the liver, while others said it can't affect the liver. 47.7% of the respondents said Hepatitis B virus infection can cause liver cancer, while 52.3% answered the same question incorrectly. The result shows that 46.2% said Hepatitis B virus infection can affect any particular age group, while others answered incorrectly. It is shown from the result that the majority of the respondents answered correctly that Hepatitis B virus infection is the most common hepatitis infection, while others answered incorrectly. Only 46% answered correctly that the early symptoms of hepatitis B virus infection are the same for cold and flu, while others answered incorrectly. The result shows that only 14.3% of the respondents said jaundice is one of the major symptoms of Hepatitis B, while others answered incorrectly. 50.5% of the respondents answered correctly that Nausea, Vomiting and loss of appetite are common symptoms of hepatitis B virus infection while others answered incorrectly. 39.7% of respondents answered correctly that all hepatitis B virus infection patients experience symptoms at the early stage of the disease while others answered

incorrectly. 12.6% of the respondents answered correctly that Hepatitis B is curable and treatable, while others answered incorrectly. 26.6% of the respondents answered correctly that Hepatitis B can be self-cured by the body, while others answered incorrectly. 48% of the respondents answered correctly that Hepatitis B can be transmitted by handshaking, while others answered incorrectly. 16.6% of the respondents answered correctly that Hepatitis B can be transmitted by contact with open wounds, while others answered incorrectly. However, 89.7% of the respondents answered correctly that a specific diet is required for the treatment of Hepatitis B while 10.3% answered the same question incorrectly.

Table 4.2: Percentage Distribution of Knowledge on HBV

Variables	Correct %	Incorrect %
Hepatitis B virus infection is caused by a virus?	59(235)	41.0(163)
Hepatitis B virus infections have five sub-types.	40.2(160)	59.8(238)
Hepatitis B virus infection can affect the liver.	51.8(206)	48.2(192)
Hepatitis B virus infection can cause liver cancer.	47.7(190)	52.3(208)
Hepatitis B virus infection can affect any particular age group.	46.2(184)	53.8(214)
Hepatitis B virus infection is the most common of hepatitis infections.	53(211)	47(187)
The early symptoms of hepatitis B virus infection are the same for cold and flu (fever, running nose, and cough).	46(183)	54(215)
Jaundice is one of the major symptoms of hepatitis B.	14.3(57)	85.7(341
Nausea, vomiting and loss of appetite are common symptoms of hepatitis B virus infection.	50.5(201)	49.5(197)
All hepatitis B virus infection patients experience symptoms at the early stage of the disease.	39.7(158)	60.3(240)

Hepatitis B can be transmitted by handshaking?	48(191)	52(207)
Hepatitis B can be transmitted by contact with open wounds.	16.6(66)	83.4(332)
Hepatitis B is curable/treatable?	12.6(50)	87.4(348)
Hepatitis B can be self-cured by the body?	26.6(106)	73.4(292)
A specific diet is required for the treatment of Hepatitis B?	89.7(357)	10.3(41)

Table 4.3 shows the percentage distribution of knowledge of HBV infection prevention. 49.5% of the respondents answered correctly that the Hepatitis B virus can be transmitted from unsterilized sharp objects, or surgical instruments while others answered the same question incorrectly. Only 42.5% of the respondents answered correctly that the Hepatitis B virus can be transmitted from an unsterilized barber's clipper, while others answered the same question incorrectly. The majority of the respondents answered correctly that the Hepatitis B virus can be transmitted from contaminated blood and blood products while others answered incorrectly. It is shown from the result that 52.5% of the respondents answered correctly that the Hepatitis B virus can be transmitted from unsafe sex, while others answered incorrectly. 45.5% of the respondents answered correctly that Hepatitis B virus can be transmitted from mother to child, while 54.5% answered incorrectly. 23.9% of the respondent answered correctly that it can be transmitted by sharing eating utensils while others answered incorrectly. 42.5% of the respondent answered correctly that the Hepatitis B virus can be transmitted by sharing clothes and bed sheets, while others answered incorrectly. 32.7% of the respondents answered correctly that Hepatitis B can be transmitted by living and sleeping in a congested apartment while 67.3% answered incorrectly. Only 28.1% of the respondents answered correctly that the Hepatitis B virus can be transmitted from contaminated water and food prepared by a person suffering from the infection, while others answered the same question incorrectly. 14.3% of the respondent answered correctly that Hepatitis B can be transmitted from mother to child while 85.7% answered the same question incorrectly. Only 15.6% of the respondent answered correctly that Carrier can transmit hepatitis B, while 84.4% answered incorrectly. The majority of the respondent answered correctly that Vaccination is available for Hepatitis B infection, while others answered incorrectly.

Table 4.3: Percentage Distribution of Knowledge on HBV Prevention

Variables	Correct %	Incorrect %
Hepatitis B virus can be transmitted from unsterilized sharp objects, surgical instruments.	49.5(197)	50.5(201)
Hepatitis B virus can be transmitted from an unsterilized barber's clipper?	42.5(169)	57.5(229)
Hepatitis B virus can be transmitted from contaminated blood and blood products?	56.3(224)	43.7(174)
Hepatitis B virus can be transmitted from unsafe sex?	52.5(209)	47.5(189)
Hepatitis B virus can be transmitted from mother to child?	45.5(181)	54.5(217)
Hepatitis B virus can be transmitted by sharing, eating utensils?	23.9(95)	76.1(303)
Hepatitis B virus can be transmitted by sharing clothes and bed sheets?	42.5(169)	57.5(229)
Hepatitis B virus can be transmitted by living and sleeping in a congested apartment?	32.7(130)	67.3(268)
Hepatitis B virus can be transmitted from contaminated water/food prepared by a person suffering from the infection?	28.1(112)	71.9(286)

Hepatitis B can be transmitted by mother to child?	14.3(57)	85.7(341)
Carriers can transmit hepatitis B?	15.6(62)	84.4(336)
Vaccination is available for Hepatitis B infection?	91.7(365)	8.3(33)

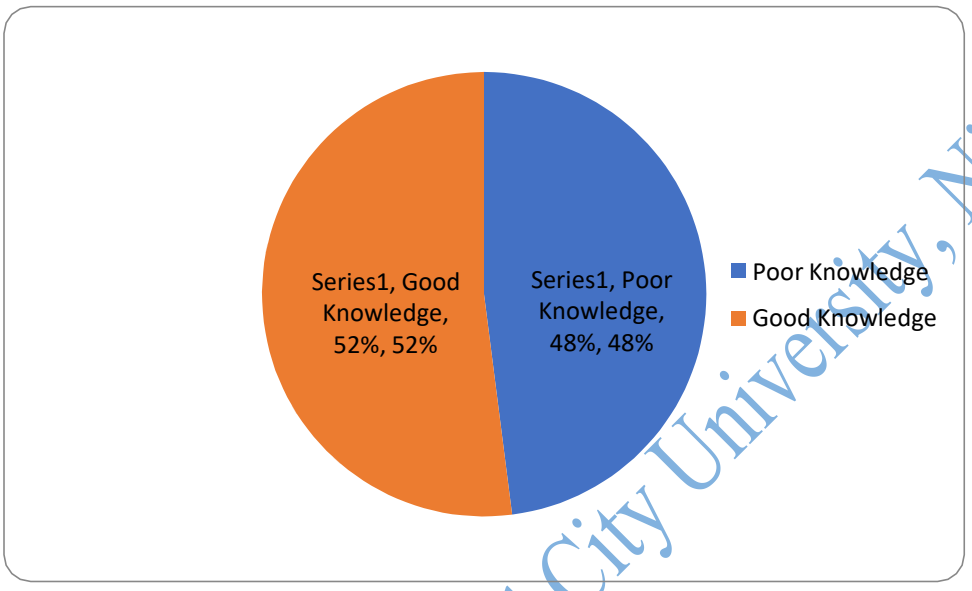

Figure 4.1: Percentage Distribution of Knowledge on HBV

The result from the findings shows that 48% of the respondents have poor knowledge while 52% have good knowledge of the Hepatitis B Virus.

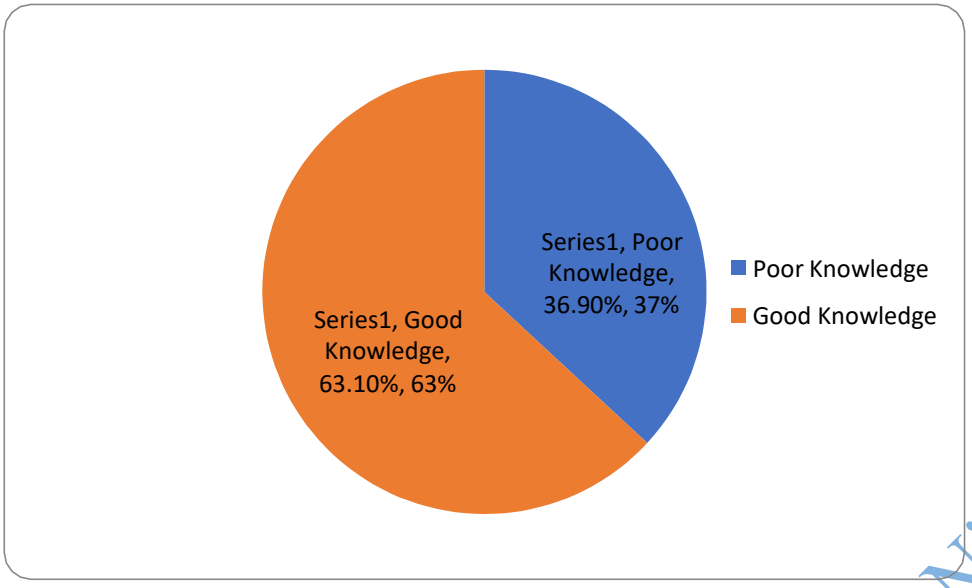

Figure 4.2: Knowledge of HBV Infection Prevention

Figure 4.2 shows that only 36.9% of the respondents has poor knowledge of HBV infection prevention.

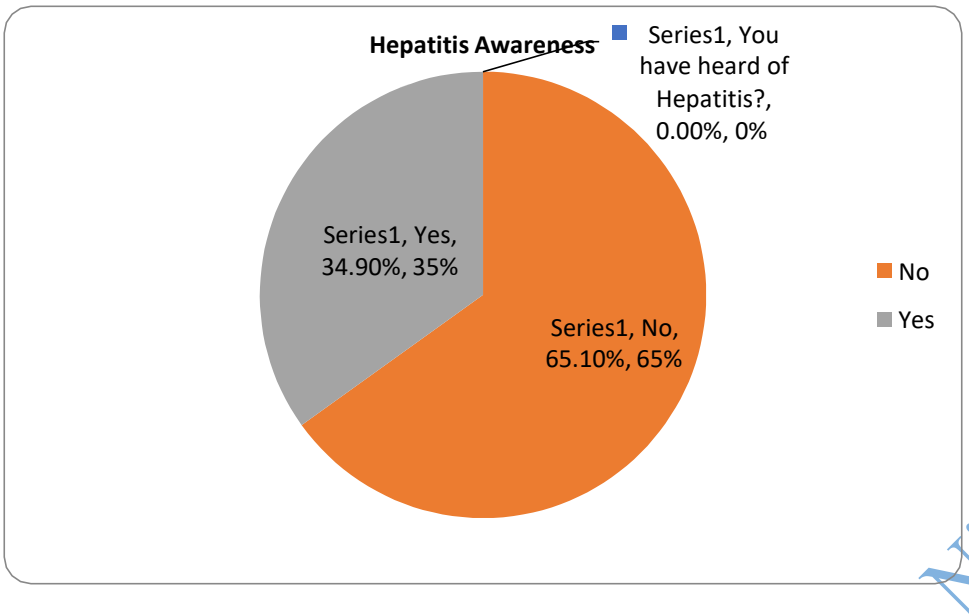

Figure 4.3: Percentage Distribution of those that heard of hepatitis

Fig 4.3 shows that the majority of the respondents have not heard of hepatitis

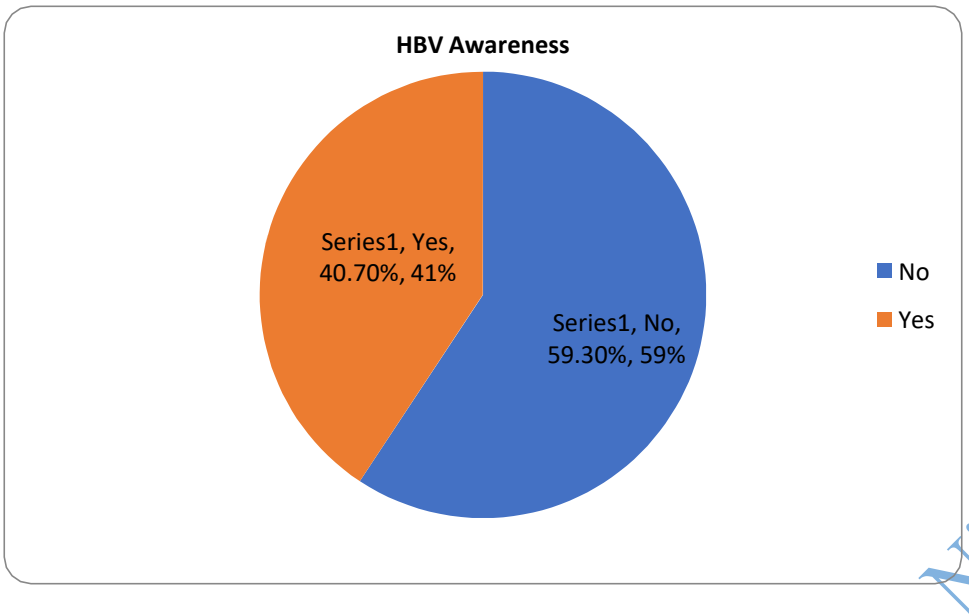

Figure 4.4: Percentage Distribution of those that heard of the hepatitis B virus

The result shows that only 40.70% of the respondents have heard of hepatitis B

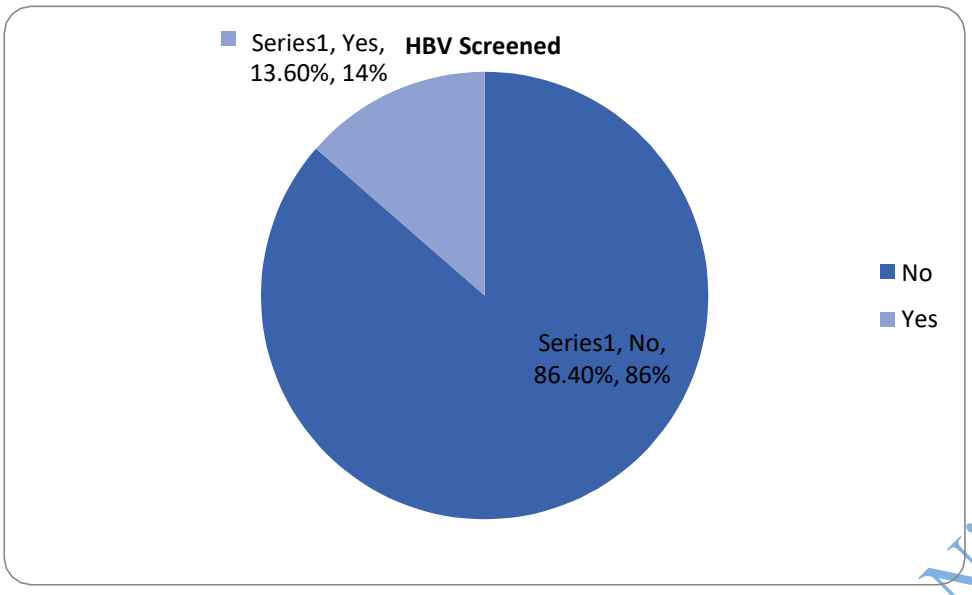

Figure 4.5: Percentage Distribution of those that have been screened for hepatitis B virus

The result shows that only 13.60% of the respondent has been screened for hepatitis B virus

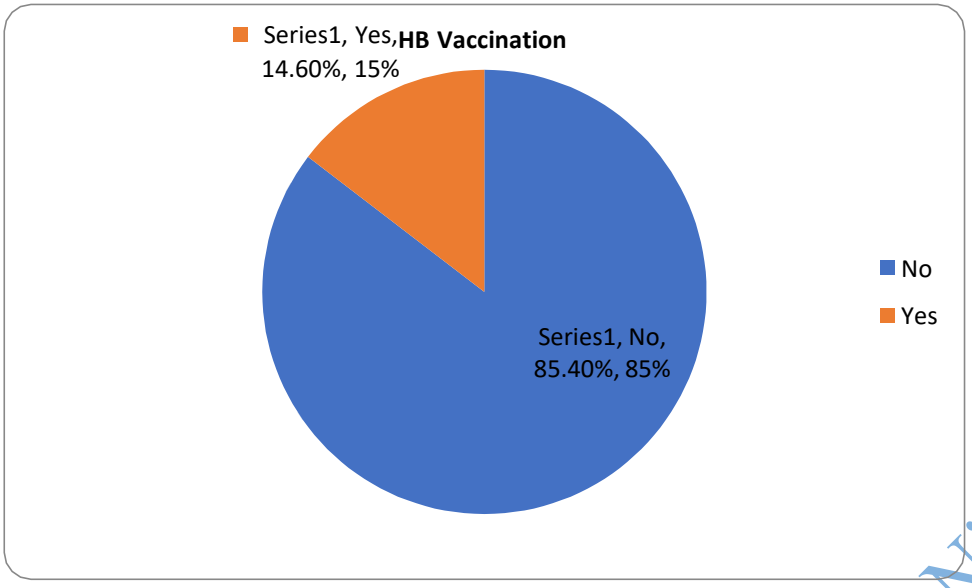

Figure 4.6: Percentage Distribution of those that have been vaccinated for hepatitis B

The result shows that only 14.60% of the respondent has been vaccinated for hepatitis B

Table 4.4 shows that 42.20% of the respondent said they do not always wear condoms during sexual intercourse, while 57.80% said they wear condoms. 86.4% of the respondents said they have not been screened for Hepatitis B, while 13.60 said they have been screened. The result shows that the majority of the respondent have not been vaccinated, while only 14.60% said they have been vaccinated. 38.90% of the respondent said they have not asked for a new syringe before use, while 61.10% said they asked for a new syringe before use. It shows that only 29.90% of the respondent said they would not go for further investigation and treatment, while the majority said they would go for further investigation and treatment. However, 34.20% said they have not participated in health education, while 65.80% said they have participated in health education.

Table 4.4: Percentage Distribution of Practice in Hepatitis B Infection Prevention

Variables	Frequency	Percent (%)
Do you always wear a condom during sexual intercourse?		
No	168	42.20%
Yes	230	57.80%
You have been screened for Hepatitis B?		
No	344	86.40%
Yes	53	13.60%
You have been vaccinated for hepatitis B?		
No	340	85.40%
Yes	58	14.60%
Did you ask for a new syringe before use?		
No	155	38.90%
Yes	243	61.10%
In case you are diagnosed with hepatitis B, would you go for further investigation and treatment?		
No	119	29.90%
Yes	279	70.10%
Have you participated in health education?		
No	136	34.20%
Yes	262	65.80%

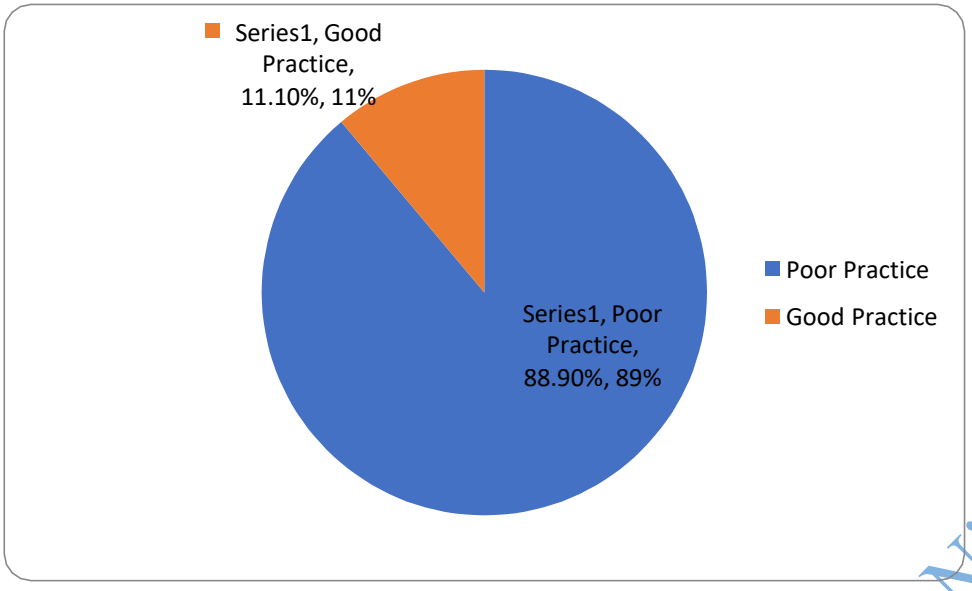

Figure 4.7: Practice of Hepatitis B Infection Prevention

The result shows that only 11.10% of the respondent has good practice towards Hepatitis B Infection Prevention.

Table 4.5 shows that the majority of the respondent have not been transfused with blood before, while 16.3% said they have been transfused with blood. 83.7% of the respondents said they do not have any tattoos or other marks on their bodies, while 16.3% said they have tattoos or other marks. 72.4% of the respondents said they have never shared any sharp objects including needles/syringes with anyone, while others said they have shared. The majority of the respondents said they have shared or have shared toothbrushes, while 29.6% said they have shared tooth brush. Only 33.4% of the respondents have not shared bed sheets with their peers, while 66.6% said they have shared. 87.7% of the respondents said no one in their family has ever been diagnosed of HBV infection before, while only 12.3% said someone in their family has been diagnosed with HBV infection before. Majority of the respondent said you they have not engage or have engaged in unprotected sexual intercourse with a partner. 28.2% of the respondents said they have engaged in unprotected sexual intercourse with a partner, 29.1% of the respondents said they have engage or have engaged in unprotected sexual intercourse with 2 partners, 6.8% of the respondents said they have engage or have engaged in unprotected sexual intercourse with 3 partners, 2.9% said they have engage or have engaged in unprotected sexual intercourse with 4 partners, while 33% has engage or have engaged in unprotected sexual intercourse with more than 4 partners.

Table 4.5: Percentage Distribution of Lifestyle and Drivers of HBV Infection

Variables	Frequency	Percent
Have you ever been transfused with blood before?		
No	333	83.7
Yes	65	16.3
Do you have any tattoos or other marks on your body?		
No	333	83.7
Yes	65	16.3
Have you shared or do you share any sharp objects including needles/syringes with anyone?		
No	288	72.4
Yes	110	27.6
Do you share or have you shared tooth brush with anyone before?		
No	280	70.4
Yes	118	29.6
Have you shared or do you share bed sheet with your peers?		
No	133	33.4
Yes	265	66.6
Has anyone in your family been diagnosed of HBV infection before?		
No	349	87.7
Yes	49	12.3
Do you engage or have engaged in unprotected sexual intercourse with a partner?		
No	295	74.1
Yes	103	25.9

If yes, how many partners do you have or have you had sexual intercourse		
1	29	28.2
2	30	29.1
3	7	6.8
4	3	2.9
More than 4	34	33.0

Table 4.6 shows the factors Influencing the Practice of HBV Preventive Measure.

The respondents aged < 18years were 1.69 times more likely to have good practice of HBV prevention compare to those aged ≥18 years, though it is not significant. The odd of good practice of HBV prevention was lesser among male students compared to female students in this study [OR= 0.77, 95% CI 0.366-1.61]. Likewise, the parentage of good practice of HBV prevention was higher among students with good knowledge of HBV than their counterpart with poor knowledge. At unadjusted level, the awareness of HBV was significantly associated with the practice of HBV prevention among the students [UOR= 2.23, 95% CI 1.09-4.56]. Health education [AOR = 0.034, 95% CI 0.005-0.26], family diagnosed [AOR= 0.28, 95% CI 0.12-0.66] and unprotected sexual intercourse [AOR = 0.46, 95% CI 0.23-0.93] were influencing good practice of HBV prevention.

Table 4.6: Factors Influencing the practice of HBV Prevention

Variables	UOR	95% CI	P-value	AOR	95% CI	P-value
Age						
Below 18years	1.689	0.640-4.455	0.290			
18 years and above	1	4.455				
Sex						
Male	0.768	0.366-1.614	0.487			
Female	1					
Marital Status						
Married	1.633	0.782-3.412	0.192			
Unmarried	1					
Study Level						
100L	1.089	0.549-2.162	0.807			
200L						
Awareness of HBV						
No	2.232	1.093-4.558	0.028	1.637	0.768-3.488	0.202
Yes	1					
Health Education						
No	0.038	0.005-0.277	0.001	0.034	0.005-0.260	0.001
Yes	1					

Family Diagnosis						
No	0.311	0.148-0.656	0.002	0.284	0.122-0.663	0.004
Yes	1			1		
Unprotected Sexual Intercourse						
No	0.368	0.193-0.699	0.002	0.463	0.231-0.928	0.030
Yes	1					
Ever Had Sexual Intercourse						
No	1.262	0.556-2.865	0.578			
Yes	1					
Knowledge						
Poor	0.870	0.450-1.682	0.679			
Good	1					

Discussion of Findings

Knowledge of Hepatitis B Virus Infection

The findings from this study provide valuable insights into the level of knowledge pertaining to HBV infection, its prevention, causes, and symptoms. The overall knowledge level was found to be commendable compared to other studies. Specifically, the result revealed that more than half of the participants exhibited a satisfactory knowledge of hepatitis B virus infection. This finding aligns closely with outcomes from a similar study conducted among students at Woldia University in Ethiopia, where it was reported that knowledge level also stood at 52%[1]. Similarly, a study in Sudan demonstrated a comparable knowledge level of 58.2% among its participants[2].

However, the knowledge level identified in this study was lower when compared to the study conducted among medical and health science students in Ethiopia, where an impressive 80% knowledge level regarding hepatitis B virus was observed [3]. Similarly, in Cameroon, the knowledge level among medical students was even higher at 83.2%[4]. The variance in knowledge levels between these studies and the current one may be attributed to a combination of factors. One significant distinction is the participant demographics. The studies reporting higher knowledge levels often involved in-service students who were already engaged in various healthcare settings. This exposure to clinical environments and practical experiences could contribute to a more comprehensive understanding of infectious diseases, including hepatitis B virus infection. In contrast, the present study focused on regular university students who might not have the same level of exposure to healthcare practices. However, efforts should be madeeducate the students about their health especially in regards to preventable infections.

Additionally, the study findings reveal that a relatively small proportion of students, amounting to 13.60%, have undergone screening for HBV. In contrast, a study conducted previously among nursing students in Ghana demonstrated a significantly higher rate of HBV screening at 89.1%[5]. This variance might be attributed to the presence of well-structured intervention programs aimed at enhancing awareness and understanding of HBV infection among nursing students[6]. The wide difference in screening rates could be due to the fact that these nursing students have been exposed to effective educational initiatives specifically designed to enhance their knowledge about HBV infection and the importance of screening. These programs likely emphasized the significance of regular screening as a crucial aspect of proactive healthcare

Furthermore, the result of the study reveals that merely 14.60% of the participants had received vaccinations. Although this percentage signifies a low vaccination rate, it remains higher than the 4.7% reported among undergraduate students in Ghana who had successfully been vaccinated[7]. This underscores the need for comprehensive public health education and awareness programs targeting university students in Ekiti State, Nigeria. Students who have not undergone vaccination are at risk of contracting the disease in the future. It is therefore imperative to actively encourage and provide support for students who have not yet received the Hepatitis B vaccination or have yet to complete the full three-dose regimen[8].

Hepatitis B Infection Prevention Practices

The Hepatitis B infection prevention practices among students at Bamidele Olumilua University of Education, Science and Technology Ikere Ekiti were found to be inadequate. The study's findings indicated that only 11.1% of the students demonstrated good practice towards preventing HBV infection. This outcome aligns with similar research conducted among Clinical medical students in Nepal, where 14.2% of participants exhibited effective

HBV infection prevention practices[9]. It also confirmed of the result from Afihene et al., (2015) in Ghana[10].

However, this study's results indicate a lower percentage of students with good practices in comparison to another study conducted among undergraduate students at Hawassa University College of Medicine in Ethiopia, 50.3% of students exhibited good prevention practices towards HBV infection[11]. Another study conducted at Wollo University's medical and health science college uncovered that a higher percentage, 39%, of students there practiced good HBV infection prevention methods[1].

This discrepancy may also be attributed, in part, to varying levels of health literacy among student population. The variation in hepatitis B infection prevention practices can be attributed to a range of factors, including health literacy levels. Students who possess better health literacy skills are more likely to comprehend the significance of preventive measures and incorporate them into their behaviors. The prevalence of poor hepatitis B infection prevention practices among students suggests a lack of dedication to mitigating the risks of hepatitis B infection. Substandard practices heighten students' susceptibility to the disease and increase the likelihood of its transmission.

Consequently, there is a pressing need for the establishment of institutional policies that prioritize regular hands-on training in hepatitis B infection prevention for students. Moreover, addressing health literacy through educational initiatives can empower students to make informed decisions regarding their health and engage in effective preventive practices.

4.3.3. Factors Influencing the Practice of Hepatitis B Virus Pretention

The study's findings show the respondents aged < 18years were 1.69 times more likely to have good practice of HBV prevention compare to those aged ≥18 years, though it is not significant. This finding can be related to a research carried out among international students in Malaysia where the prevalence of hepatitis was below 2% among the young age group just entering the university[11]. This suggests successful efforts in prevention and control of the disease in that population.

It is also revealed that odd of good practice of HBV prevention was lesser among male students compared to female students in this study. This is supported with a study conducted among newly admitted students of Olabisi Onabanjo University, Ago- Iwoye[12]. This can be linked to fact that male students are more exposed to dangerous lifestyles like taking hard drugs, tattooing.

Likewise, the parentage of good practice of HBV prevention was higher among students with good knowledge of HBV than their counterpart with poor knowledge. At unadjusted level, the awareness of HBV was significantly associated with the practice of HBV prevention among the students. This support what was earlier revealed that the level of knowledge and awareness is high among the students of BOUESTI.

Furthermore, it has shown from the study that Health education, family diagnosisand unprotected sexual intercourse influenced good practice of HBV prevention. It shows that increase awareness and appropriate preventive measures are crucial in tackling the burden of HBV infection among the student population and health education about the risk factors associated with the disease is essential to prevent the spread. Also, heightened awareness translates into a more informed and proactive approach to preventive measures. This supports

the study among Clinical medical students in Nepal where students exhibited good prevention practices.[9]

Endnotes

[1] T. Gebremeskel, T. Beshah, M. Tesfaye, B. Beletew, A. Mengesha, &A.Getie. ''*Assesment of knowledge and Practice on Hepatitis B Infection Prevention and Associated Factors among Health Science Studies Students in Woldia university, Northeast''.***Advances in Preventive Medicine**, 2020, 9421964.

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Chapter Five

Summary of Findings

Hepatitis B (HB) is a major public health problem as one-third of the world population is infected with the virus. It is a life-threatening viral infection that causes acute and chronic diseases of the liver. The result shows both accurate knowledge and misconceptions among the participants. While a notable proportion demonstrated accurate knowledge, such as recognizing HBV's viral source, its liver impact, and potential for liver cancer, gaps and misunderstandings were evident. A considerable number of respondents lacked awareness of jaundice as a significant symptom and held misconceptions about HBV transmission, including beliefs in transmission through handshakes and open wounds. Moreover, a significant subset misunderstood HBV's self-curability and the role of a specific diet in treatment, underscoring the necessity for targeted educational interventions to rectify these knowledge gaps and enhance comprehension of HBV infection and prevention.

Furthermore, respondents demonstrated an understanding of various transmission modes, such as unsterilized instruments, contaminated blood, unsafe sex, and mother-to-child transmission. However, misconceptions surfaced in areas like utensil sharing, living conditions, water and food contamination, and carrier transmission. On a positive note, the majority recognized the availability of vaccination for HBV.

The overall knowledge distribution indicated that 48% of participants held poor knowledge, while 52% exhibited good knowledge regarding the Hepatitis B Virus. The findings highlighted the need for targeted interventions to enhance knowledge, particularly in areas where misconceptions were prevalent.

In addition, the study examined participants' screening practices, safe sexual behaviours, vaccination status, syringe usage, willingness for further medical action, and engagement in health education programs. The results underscored the importance of fostering greater awareness about HBV, promoting responsible practices, improving screening rates, encouraging vaccination, enhancing syringe usage awareness, and boosting participation in health education initiatives.

The analysis of Hepatitis B infection prevention practices revealed that only 11.10% of respondents followed good practices. Most hadn't undergone blood transfusions or acquired tattoos/marks (83.7%). While many avoided sharing needles/syringes or toothbrushes, 29.6% admitted to sharing toothbrushes. Similarly, 66.6% refrained from sharing bed sheets. A significant number (87.7%) reported no family history of HBV infection. In terms of safe sexual practices, the majority hadn't engaged in unprotected intercourse. Some admitted to unprotected intercourse with one (28.2%), two (29.1%), three (6.8%), or four (2.9%) partners. A notable 33% engaged in unprotected intercourse with more than four partners. These findings highlight the importance of enhancing education on preventing Hepatitis B infection.

The study revealed a strong connection between awareness and health education regarding Hepatitis B prevention. These findings underscore the importance of education in influencing people's actions to prevent Hepatitis B infection.

Conclusion

The findings of the study revealed that more than half of the students possess a good knowledge of how to prevent hepatitis B infection. Nevertheless, a substantial majority of the students demonstrated inadequate adherence to infection prevention practices related to HBV. This highlights a concerning disparity between knowledge and practical application among the students of Bamidele Olumilua University of Education, Science and Technology

Ikere Ekiti, placing them at a significant risk of contracting HBV infection. The study also underscored the prevalence of low screening rates and a lack of HBV vaccine uptake, further exacerbating the vulnerability of the student to HBV infection.

Furthermore, the study notably identified awareness and health education as pivotal factors influencing the practices of HBV prevention among students. These factors play a crucial role in shaping students' behaviours and decisions in relation to HBV prevention measures.

Recommendation

1. It is crucial to launch comprehensive educational campaigns that effectively communicate the significance of HBV prevention, transmission modes, and early screening. These campaigns should encompass various mediums, ensuring students receive accurate and practical information.

2. An innovative approach involves integrating HBV awareness and prevention topics into the educational curriculum. By collaborating with educational institutions, these essential subjects can become a consistent part of student's learning experiences, fostering a deeper understanding and encouraging proactive health practices.

3. Increasing accessibility to regular and affordable HBV screening programs within educational institutions is vital. Collaborating with healthcare providers can facilitate early detection, allowing for timely medical intervention if needed.

4. Vaccination is a cornerstone of prevention. Thus, focused campaigns thcat educate students on the importance of HBV vaccination, while dispelling myths surrounding vaccines, should be organized. On-campus vaccination drives, in collaboration with healthcare professionals, can help students access vaccines conveniently.

Contribution to Knowledge

The study enriches the field by providing empirical data on the knowledge-practice gap, misconceptions, and the impact of education on HBV prevention among students. Beyond academic contributions, it guides practical strategies to enhance awareness, promote accurate knowledge, and ultimately reduce HBV transmission risk in this population.

Suggested Areas for Further Research

Research should be done to investigate the correlation between health literacy, the availability of healthcare facilities, and the adoption of HBV prevention practices among students. This inquiry could provide insights into obstacles that impede well-informed decision-making.

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Appendix I

Questionnaire

Appendix II

Ethical Approval

CENTRE FOR RESEARCH AND DEVELOPMENT
BAMIDELE OLUMILUA UNIVERSITY OF EDUCATION, SCIENCE AND TECHNOLOGY, IKERE-EKITI

Office Address:
Room 1-4, Alumni Building,
PMB 250, Igbara Odo Road
Ikere Ekiti, Ekiti State, Nigeria
Our Ref No: CERAD/RDC/RE/STA/032

Email: cerad@bouesti.edu.ng
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obasuyi.tope@bouesti.edu.ng
Tel No: +234-8062439687
Date: 27th October 2022

Aderibigbe Mary Alaba,
Department of Public Health,
Lead City University
Ibadan. Oyo State,
Nigeria

ETHICAL CLEARANCE CERTIFICATE

On behalf of the Bamidele Olumilua University of Education, Science and Technology (BOUESTI)' Research and Development Committee (RDC), where your research ethics' application was considered, issue this **Ethical Clearance Certificate** in respect of the undertakings contained in the below mentioned research project and research instruments:

Title of the Project	Assessment of knowledge and practice on Hepatitis B virus infection among Students of Bamidele Olumilua University of Education, Science and Technology, Ikere Ekiti
Type of Research Project	Thesis Work
Principal Investigator	Aderibigbe Mary Alaba
Co-Researchers	Nil
Area of Study	Ekiti State Nigeria
Target Population	Students in Universities only
Type of Instrument	Questionnaire
Mode of Administration	Hard copy Production
Ethical Clearance Certificate Number	CERAD/RDC/ECC-BOUESTI/STA/07/032
Ethical Clearance Certificate Validity	12 months (7th October 2022 – 6th October 2023)

However, should any other instrument be used, except for the instrument named *Knowledge and Practice on Hepatitis B Virus(HBV) Infection Prevention*, as considered by the Board, would require a separate approval. With this Certificate, the Principal Investigator and his team, therefore, can commence the research as from the date of the Certificate, using the indicated certificate reference number.

Please be informed that RDC through Centre for Research and Development (CERAD) must be informed if:

i. Any Condition changes in the instrument presented to the Board;

ii. Any material breaches ethical undertakings or event that impact on ethical conduct of the research.

Thus, the Principal Investigator should report to the RDC through CERAD in the aforementioned approval, where applicable, annually and at the end of the project, in consonance with ethical compliance.

Finally, the RDC through CERAD has the right to:

a) Withdraw or amend the Ethical Clearance Certificate if:

i. Any unethical practices are revealed or the approved instruments for the study are unused
ii. Regulatory changes of whatsoever nature so require.
iii. Any relevant information has been misinterpreted or withheld
iv. The condition contained in the Certificate has been violated.

b) Request access to any information or data about the study at any time during or after completion of the project.

Please, accept our warm congratulations and wish you successful completion of the research project.

Thank you

Dr. F.O.T. Obasuyi
Chairman, (URTC)

27th October 2022

Appendix III
Bio-data

A. Personal Data

Name:	Mary Alaba Aderibigbe
Email Address:	aderibigbefoluke4@gmail.com
Phone Number:	08066440634
Date of Birth:	November 1st, 1971
Place of Birth:	Ondo-State
Nationality:	Nigerian
Marital Status:	Married
Next of Kin:	Aderibigbe Ebenezer Ayodeji
Address of Next of Kin:	No 18, Boluwaduro Qtrs, Behind De-Link Hotel, Adehun, Ado Ekiti, Ekiti State

B. Educational Background with Dates

Educational Institutions Attended with Dates and Qualifications:

Primary School Leaving Certificate
St. Peter' Anglican Prymary School, Emure, Ekiti State. 1976-1982

West African Senior School Certificate
St. Louis Grammar School, Ikere, Ekiti State. 1983-1988

Associate of Institute of Medical Laboratory Sciences
School of Medical Laboratory Sciences, U C H Ibadan, Oyo State. 1991-1996

Post Graduate Diploma (Biochemistry)
Federal University of Technology, Akure, Ondo State. 2012-2014

Fellowship of Medical Laboratory Sciences Council
U C H Ibadan Oyo State 2017-2021

Masters in Public Health
Lead City University, Ibadan, Oyo State 2021 - Present

C. Work Experience with Dates

Ekiti State University Medical Centre, Laboratory Department 2003 - Present

Chief Medical Laboratory Scientist **October 2015- Present**

- Advising on budgeting and procurement of laboratory equipment, reagents and other laboratory consumables
- Taking charge of administration of a whole medical laboratory specialty
  Advising on policy matters relating to medical laboratory services
- Collating and reviewing annual report on laboratory services and personnel
- Assisting in the general administration of the department

Assistant Chief Medical Laboratory Scientist **January 2011- Sept 2014**

- Supervising subordinate staff
- Teaching of Medical laboratory students on general medical laboratory specialty
- Taking charge of quality control of the lab procedures

Principal Medical Laboratory Scientist **January 2008- Jan. 2011**

- Training of laboratory personnel
- Assisting in quality control of laboratory reagents and procedures
- Supervising the duties of subordinates
-

Medical Laboratory Scientist **January 2003- Sept 2008**

- Carrying out routine diagnostic tests in Hematology, Chemical pathology and Microbiology benches
- Training and supervising of lower cadre (Laboratory Assistant and Medical Laboratory Technicians)
- Preparing and calibrating reagents for diagnostic use
- Assisting in documentation and preparation of periodic reports for supervising officers
- Assisting in basic research, analytical and experimental studies as assigned by supervising officers

State Specialist Hospital, Ado-Ekiti **March 2002-December 2002**

Medical Laboratory Scientist 1

- In charge of Chemical Pathology Laboratory
- Carryout routine diagnostic test in Chemical Pathology Lab like Renal function test, Blood sugar test, Liver function test, Urinalysis, 24hour urinary protein, Lipid profile
- Preparing reagents for diagnostic use

Documentation of and preparation of periodic reports for supervising officer
In charge of purchasing and stock taking of Laboratory consumables and Laboratory reagents.
Training of Industrial Training (IT) students and students from School of Health Science and Technology

Duro Soleye Hospital, Allen Avenue, Ikeja, Lagos State. Oct 1998- Sept 2001
Medical Laboratory Scientist 2

- Working on Chemical Pathology bench, Carrying tests on Renal function tests, Electrolytes and Urea, Creatinine, Liver function tests, Blood Glucose.
- Haematology and Blood Group Serology
- Microbiology
- Preparation and reconstituting of reagents for diagnostic use

D. Fellowships

Fellow of MLSCN

D. Thesis/Papers

- Kidney Injury Molecule 1 and Alpha Glutathione Transferase Among workers of commercial motor park in Ado-Ekiti consuming herbal medicine
- Knowledge, Attitude of Health care workers and Effects on patients seeking Health care services in Ado- Ekiti, Ekiti state during Corona virus Disease 2019 pandemic : A Pilot Cross-sectional Survey
- Lipid Profile and Renal function parameters in patient with DIABETIC Mellitus (Type2) attending teaching Hospital (EKSUTH), Ado- Ekiti, Ekiti State.

E. Membership

- Medical Laboratory Sciences of Nigeria(MLSCN)

F. Thesis/Papers

- Kidney Injury Molecule 1 and Alpha Glutathione Transferase Among workers of commercial motor park in Ado-Ekiti consuming herbal medicine
- Knowledge, Attitude of Health care workers and Effects on patients seeking Health care services in Ado- Ekiti, Ekiti state during Corona virus Disease 2019 pandemic : A Pilot Cross-sectional Survey
- Lipid Profile and Renal function parameters in patient with DIABETIC Mellitus (Type2) attending teaching Hospital (EKSUTH), Ado- Ekiti, Ekiti State.

H. References

Name and Address of Referee:

Prof. A.A Onyeaghala
Chrisland University
Abeokuta, Ogun State

Dr. C. O. Esan
Deputy Director Medical Laboratory Services
Ekiti State University Health Centre
Ado Ekiti, Ekiti State

Dr. D.D. Ajayi
H O D, Medical Laboratory Dept,
Federal Univ. Oye. Ekiti,
Ekiti State

Signature

30/10/23
Date

The University Compliance Certification

This is to certify that this thesis by Mary Alaba ADERIBIGBE with Matric No. LCU/PG/001869 in the Department of Public Health, Faculty of Basic Medical and Applied Sciences, Lead City University, Ibadan is in full compliance with the approved university format.

_____ _____

Signature **Date**