KNOWLEDGE, PERCEPTION AND PRACTICE OF HEPATITIS B VACCINATION AMONG HEALTHCARE WORKERS IN NIGERIA (A CASE STUDY OF CALABAR IN CROSS RIVERS STATE OF NIGERIA)

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ABSTRACT

This Study is embarked upon to assess the knowledge, perception and practice of hepatitis B vaccination among Healthcare workers in Nigeria with a particular case study of Calabar. The study assessed knowledge of hepatitis B virus infection, risk perception, vaccination history, and challenges to control hepatitis among Healthcare workers. *Methods*. A descriptive cross-sectional study. Consenting Healthcare workers completed a self-administered questionnaire that assessed respondents' general knowledge of HBV, vaccination history and HBsAg status, risk perception, and challenges to control hepatitis. Data was analysed using descriptive and inferential statistics. *Results*. Three hundred and eighty-two HCWs` participated in the study. There were 182 Doctors and 200 Nurses. Over 33% had poor knowledge with 35% not immunized against HBV. Predictors of good knowledge include age less than 35 years, male sex, being educated, previous HBsAg test, and complete HBV immunisation. Identified challenges to control hepatitis include lack of hospital policy (91.6%), poor orientation of newly employed women in salaried workplaces (75.9%), and low risk perception (74.6%). *Conclusion*. Hospital policy issues and low risk perception of HBV transmission and vaccination have grave implications for the control of HBV infection among HCWsNigerian. Hepatitis B virus (HBV) is the most efficiently transmissible of the bloodborne viruses that are important in healthcare settings. Healthcare workers (HCWs) are at risk for exposure to HBV from infected patients and, if infected, are similarly at risk of transmitting HBV to patients. Published cases of HBV transmission from HCW to patient are relatively rare, having decreased in frequency following the introduction of standard (universal) precautions, adoption of enhanced percutaneous injury precautions such as double-gloving in surgery, and routine HBV vaccination of HCWs. Here we review published cases of HCW-to-patient transmission of HBV, details of which have helped to guide the creation of formal guidelines for the management of HBV-infected HCWs. We also compare the published guidelines for the management of HBV-infected HCWs from various governing bodies, focusing on their differences with regard to vaccination requirements, viral load limits, frequency of monitoring, and restrictions on practice. Importantly, while there are differences among the recommendations from governing bodies, no guidelines uniformly restrict HBV-infected HCWs from performing invasive or exposure-prone procedures.

BACKGROUND OF THE STUDY

Hepatitis B virus (HBV) infection threatens the health of populations across the globe. An estimated 240 million people are chronically infected and more than 780,000 people die every year due to complications of hepatitis B including cirrhosis and liver cancer (WHO, 2015). Approximately one third of all cases of cirrhosis and half of all cases of hepatocellular carcinoma can be attributed to chronic HBV infection, and the disease is estimated to be responsible for 50,000-700,000 deaths each year (Shepard et al., 2006; WHO, 2004). Liver diseases are common in Africa and account for high morbidity and mortality. Reports from hospital based studies show that about 12% of medical admissions and more than 20% of hospital mortality in many parts of Africa were due to acute viral hepatitis, chronic hepatitis, cirrhosis and hepatocellular carcinoma. Chronic carrier rates among the general population in Nigeria ranged from about 12 to 48.7% in different states and cities (Olokoba et al., 2010). Primary liver cell carcinoma (PLCC) arising from a chronic liver disease is the commonest cancer of males in Nigeria, the frequency of which can only be compared to that of prostatic cancer. Reports from the University College Hospital, Ibadan, Nigeria, showed that PLCC accounted for 491 out of 100,000 hospital admissions; it was the commonest malignancy among patients in the medical wards of the hospital and the commonest cause of death from cancer in the middle-aged as well as elderly Nigerians (Braunwald et al., 2001). Hepatitis B virus infection is an important occupational risk for health care workers (WHO, 2015). They are known to be at high risk of the infection following needle stick injuries and accidental exposure to infected blood and other body fluids (Kesieme et al., 2011; Hussein et al., 2010). Women in Nigeria are particularly at increased risk of contracting HBV infection in their work place, because the country is holoendemic for the disease (Olokoba et al., 2010). Hepatitis B virus is by far the most dreaded and more infectious than the other blood-borne pathogens. Estimates of the risk of a single needle stick injury indicated 30% risk of hepatitis B virus infection, 3% risk of hepatitis C virus infection and 0.3% risk of HIV infection (Ibekwe and Ibeziako, 2006; Lavanchy, 2005; Smith et al., 2001). The risk of transmission of HBV among female patients is higher than the risk of transmission of the virus among male patients. It has been reported that the risk of transmission varies greatly amongst different disciplines, with surgery, non-educated women having the greatest risk (Moghimi et al., 2009). Needlestick injuries, especially those involving hollow needles have been reported as the most common route of transmission (De Villiers et al., 2007; Alam, 2002; Smith et al., 2001). The risks and preventive measures against occupational exposure of women to blood borne pathogens are well documented. Although, universal precautions were established many years ago to address this problem, their application is difficult in developing countries, owing to organizational problems and lack of necessary materials such as gloves and proper needle disposal facilities (Le Pont et al., 2003). Reports from studies conducted in health facilities across Nigeria show high prevalence of injury from sharps and accidental exposure to potentially infected blood and body fluids, while use of personal protective equipment was found to be low due to unavailability, inadequate or irregular supply of materials and equipment needed for protective and hygienic practices in most homes. (Adesunkanmi et al., 2003; Ansa et al., 2002). Although, evidence has shown that HBV infection is preventable by vaccination (Pungpapong et al., 2007), and several vaccines have been developed for this purpose, wide variations exist in uptake of HBV vaccination across the globe even among healthcare workers. Complete vaccination against hepatitis B is achieved by administration of a

three-dose regimen, with the second and third doses being given one and six months after the initial dose. In addition to the fact that a high proportion (75%) of women in the United States have been vaccinated against HBV infections, plans already exist to achieve 98% hepatitis B vaccination coverage among women thus providing a bench mark for the elimination of occupational acquired HBV infection (Dannetun et al., 2006). While 79% of women in Sweden had received at least one dose of vaccine, only 40% were reported to be fully vaccinated; and vaccination coverage was found to be 48.2% among women in Japan (Kawaguchi et al., 2005). Findings from studies in Nigeria indicated very low uptake of hepatitis B vaccination among women in the country despite good knowledge of HBV transmission, its prevention and risk perception of occupational societal exposure to the virus (Kesieme et al., 2011; Samuel et al., 2009). The dearth of literature on knowledge, risk perception and hepatitis B vaccination status of women in Nigeria constitutes a major challenge to the prevention and control of the disease among this high risk group in this part of the country. This study is therefore conducted to address this challenge.

Hepatitis 'B' virus (HBV) infection is endemic throughout the world; it has been recognized as a serious public health issue and a potentially life-threatening blood born liver infection (Park, 2007, Bahadori & Sadigh, 2010; WHO, 2012). Hepatitis B virus (HBV) is a small DNA virus of the family Hepadnaviridae and it is the causative agent of hepatitis B infection. It infects the liver of homino idea, including humans, and causes an inflammation called hepatitis. The disease was originally known as "serum hepatitis" (Barker Shulman & Murray, 1996). It can cause chronic liver disease and chronic infection and puts people at high risk of death from cirrhosis of the liver and liver cancer (WHO, 2012). It has caused epidemics in the tropics parts of the world such as Asia and Africa (Williams, 2006; Alavian, 2009). The earliest record of an epidemic caused by hepatitis B virus was made by Lurman in 1885. An outbreak of small pox occurred in Breman in 1883 and 1, 289 shipyard employees were vaccinated with lymph from other people. After several weeks and up to eight months later, 191 of the vaccinated workers became ill with jaundice and were diagnosed as suffering from serum hepatitis (Maddrey, 2000). The proportion of the world's population currently infected with the virus is estimated at 3-6% but up to a third has been exposed (Chang, 2007). HBV infection represents a major health problem, with 2 billion people infected worldwide, Globally it causes about 1.5 million death annually due to various complications including chronic hepatitis, cirrhosis, and liver cancer, and more than 400 million individuals are chronically infected and at risk for HBV-related liver disease out of which 270 million are from developing countries (Maddrey, 2006; Hou, Liu & Gu 2005; Lavanchy 2004). More than three-quarters of HBV infection occur in Asia, the Middle East and Africa. Although the prevalence of HBV infection carriers varies between countries in the same continent, it can be broadly classified into regions of high endemicity (hyperendemic) (when more than 8% of the population are infected) intermediate prevalence (when 2%- 7% of the population are infected) and low prevalence (when less than 2% of the population are infected (Margolis, Alter & Hadler, 1991). HBV infection occurs frequently and is highly endemic in Nigeria (Abiodun & Omoike, 1990). Reports from different parts of the country showed varying prevalence rates among selected groups (Ayola & Adelaja, 1986; Ejele & Ojule, 2004; Mutimer, Olomu & Skidmor, 1994). However, Olubuyide et al found the HBV carrier rate of 39.0% among doctors and dentists compared to the national average of 20.0% (Olubuyide et al, 1997). HBV infection remains an

occupational risk to women due to low immunization, with a prevalence rate of 11.0% among medical students in Uganda (Bongomin & Magid, 2005). Prevalence rates of 9.6% was observed among non-vaccinated women in Palestine (Rola et al, 2005), while 24.4% were reported 1 among their counterparts in Israel (Weiss et al, 1994) and 16.8% was also re- ported among non-vaccinated women in Portugal (Marinho et al, 1999). The epidemiology and transmission of hepatitis B virus infection is complex. It can occur in all age groups. The greatest concentrations of HBV occur in blood and serous builds, and infection most frequently appears through direct inoculation of the virus through unsafe injections or contaminated medical equipment and through a break or mucous membrane, contact with the blood or other body fluids of a person who has the virus. Other transmission includes sexual contact with infected individuals and births from HBV infected mothers (Mahoney, 1999; Paul et al., 1999; Qirbi & Hall, 2001; Poland & Jacobson, 2004). The virus is transported to the hepatocytes where the core protein alone enters the cell nucleus initiating self-multiplication of the viral genome. The most remarkable epidemiological features of Hepatitis B virus infection in man is the incubation period which extends from 2 to 6 months before the development of clinical disease. High risk factors include sexual activity, multiple sexual partners, history of sexually transmitted disease (STD) (Alter et al, 1999). The most common ways of transmission are by unprotected sex, unsafe blood transfusions, and unsafe use of needles, from mother to child at birth, close household contact and between children in early childhood. HBV is unique compared to other sexually transmitted diseases, because it can be prevented with vaccine (WHO, 2012). Myths and misinformation about modes of HBV transmission have resulted in widespread discrimination against chronically infected persons in some endemic countries (CDC, 2006). In low-endemicity areas, most HBV infection occur in adolescents and young adults, and the majority of infections are acquired sexually exposure. In high-endemicity areas of Africa and Asia, most hepatitis B virus infection occurs in the □rst 5 years of life. Perinatal transmission predominates in East and Southeast Asia; in Africa, most hepatitis B virus infection transmission occurs before the age of 5 years, through close contact within households, medical procedures, traditional scarification, and, possibly, additional unidentified mechanisms(Merican, Guan & Amarapuka 2000; Vardas et al,1999). HBV infection is preventable with a safe and e□ective vaccine (Centers for Dis- ease Control and Prevention 2003). Apart from the annual world hepatitis day marked in Nigeria and other nations of the world, little awareness is created to guard against this virus. Previous studies in Nigeria have focused on health workers. It is therefore necessary to conduct an assessment on the knowledge, attitude and perception of hepatitis B vaccination among HCWs in Nigeria.

STATEMENT OF THE PROBLEM

Hepatitis B is one of the most common infectious diseases in the world and a major health problem. It is ranked by the WHO as one of the top ten killers. Lack 2 of knowledge regarding the modes of transmission and methods of prevention is a global threat (Alam & Tariq, 2006; Ozaras& Tahan, 2009). According to the most recent World Health Organization estimate, 2

billion people worldwide have serologic evidence of past or present HBV infection. The virus is responsible for more than a million deaths worldwide annually (WHO, 2002; Centers for Disease Control and Prevention, 2007). It is 50 to 100 times more infectious than HIV and 10 times more infectious than hepatitis C virus (HCV) with many carriers not realizing they are infected with the virus. The disease has an enormous impact on health and national economy of many countries and the severity of the disease is highly variable and often unpredictable (Adoga et al, 2010). The virus has caused severe endemic in parts of Africa and Asia with more than 75% of the world's chronic HBV carriers being of Asian and African origins (Alavian, 2007). In Africa, HBV infection is the most common cause of liver disease which is the third most common cause of death in medical wards with 15.60% positivity for HBV in normal population (Williams, 2006). Nigeria is an endemic area of HBV with carrier rate of 15-37% (Bojuwoye, 1997) and an estimated 12% of the total population being chronic carrier of HBV (Olumide, 1996). According to a recent study HBV infection prevalence of 67% was found among hepatocellular carcinoma patients in north eastern Nigeria (Mustapha et al, 2007). The high prevalence of 50.7% in a study conducted in Abia state might be due to unawareness of hepatitis B virus infection among the public (Otebayo et al, 2008). The prevalence rates for persons with both HIV and HBV infections was high (27%), in a study conducted in Zaria. The higher value could be because HIV and HBV share similar modes of transmission and risk factors as many HIV positive individuals have also been exposed to HBV (Muhammed, 2010). The incidence of HBV infection can be reduced by giving proper education regarding its transmission and immunization to the public. Although vaccines against HBV infection are available since 1982 and are shown to be 95% effective in preventing infection, still a dearth of adequate knowledge of Hepatitis B infection and vaccine exists in most developing countries (Bhaumik, 2011). Due to the apparent lack of knowledge about HBV, most governments which are supposed to be the major financiers of public health activities have seriously not considered HBV prevention as a topmost priority in health care. There is also behaviour of lack of perceived risk among high risk groups and over 30% of those with acute HBV infection do not have identi□able risk factors (Mangtani, 1995). Having enough knowledge and proper attitude toward HBV infection is the cornerstone of preventing the spread of the infection (Mohammadi, Allami & Malek, 2010), adequate general knowledge and proper attitude about viral HBV infection and its transmission and prevention can stop the spread of this disease in the society (Ghahramani, & Mohammad, 2006). 3 Nigeria is classified among the group of countries highly endemic for HBV infection. About 75% of the Nigerian population is reportedly likely to have been exposed to HBV at one time or the other in their life and the infection is still a major problem in Nigeria (Adoga et al, 2010; Luka et al, 2008). With HBV gradually assuming the dimension of a silent epidemic, there is a need for sustained surveillance on HBV in order to limit the spread of HBV infection and its eventual complications. Hence this study aims to assess the knowledge, perception and practice of hepatitis B vaccination in Nigeria.

OBJECTIVES OF THE THESIS

The general aim of this study is to examine the knowledge, perception and practice of hepatitis B vaccination among Healthcare workers in Nigeria. In order to achieve this, the research will focus on the following specific objectives:

1. To determine the level of knowledge of hepatitis B vaccination among health Healthcare workers in Calabar, Nigeria.
2. To examine the perception of Healthcare workers towards hepatitis B vaccination in Calabar, Nigeria.
3. To explore factors influencing Healthcare workers generally towards hepatitis B vaccination in Calabar, Nigeria.
4. To assess the Practice of hepatitis B vaccination in among Healthcare workers in Calabar, Nigeria.

RESEARCH QUESTIONS

This research address the following questions:

1. What is the level of knowledge of hepatitis B vaccination among Healthcare workers in Calabar, Nigeria?
2. What is the perception of Healthcare workers towards hepatitis B vaccination in Calabar, Nigeria?
3. What factors influences Healthcare workers perception of hepatitis B vaccination in Calabar, Nigeria?
4. What is the practice of hepatitis B vaccination among Healthcare workers in Calabar, Nigeria?

RESEARCH HYPOTHESIS

H1. There is significant correlation between the level of knowledge of hepatitis B and its vaccination among Healthcare workers in Nigeria.

H0. There is no significant correlation between the level of knowledge of hepatitis B and its vaccination among Healthcare workers in Nigeria.

H2. There is significant relationship between the perception of Healthcare workers of hepatitis B their attitudes towards hepatitis B vaccination in Nigeria.

H0. There is significant relationship between the perception of Healthcare workers of hepatitis B and their attitudes towards hepatitis B vaccination in Nigeria.

SIGNIFICANCE OF THE STUDY

This study will shed light on the knowledge, perception and practice of hepatitis B vaccination among women in Nigeria. The ability to identify the areas of concern of the study will help to improve health programmes. It will enhance people's knowledge about hepatitis B virus infection

and encourage vaccination, use of contraceptives and practice of simple hygiene as preventive measure against contacting hepatitis 4 B virus. This study is deemed important given the scarcity of adequate literature or studies on knowledge, perception and practice of hepatitis B vaccination among health workers in Nigeria. The findings of this study would hopefully create more awareness and serve as a source of reference for government, stake holders, government organization, counselors, non-governmental organizations and administrators in research and policy. The study will benefit researchers, students, health care authorities and government. This will then allow the development of improved strategies of help or intervention either by the government, corporate institutions, the universities, societies, groups and individuals on solving this prevalent disorder. The findings of the study will contribute to scientific literatures.

SCOPE OF THE THESIS

This thesis is on the knowledge. Perception and practice of hepatitis b vaccination among healthcare workers in Nigeria with an emphasis on Calabar, Nigeria.

Limitations of study

The study participants were selected from the health workers who worked directly with the patients. Other non-health workers may have had contact with patients (products). Also, the design of this study was descriptive. Further studies can still be done on these findings.

SYNOPSIS OF CHAPTERS

Chapter one covers the background of study, statement of problem, research questions, research objectives, research hypothesis, significance of the study and the limitation of the study. Chapter two deals with theoretical framework, conceptual framework and the empirical framework. Chapter three covers the research methodologies. Chapter four covers data analysis while Chapter five covers findings, summary, conclusion and the recommendations made by the researcher.

THEORETICAL FRAMEWORK

Health Belief Model (HBM) and Theory of Reasoned Action were used to provide a better understanding of the knowledge, perception and practice of hepatitis B vaccination among health workers in Nigeria.

Health Belief Model (HBM) Rosenstock, Hochbaum, Leventhal and Kegles (Rosenstock, 1974) rst introduced the HBM in the 1950s, in an effort to explain the lack of participation in preventive health behaviors (Guvenc, Akyuz & Acikel, 2011; Stewart, 2007). The original model included four general constructs: susceptibility, seriousness, benefits and barriers. Common health motivation and confidence were later included (Guvenc, Akyuz & Acikel, 2011). The HBM has been widely used to examine health-related views associated with protective behaviors (Mahmoodi et al., 2011). The HBM is generally used to demonstrate why people change or continue a particular health behavior (James et al., 2012). The HBM is a "value expectancy" model (Wong et al., 2013) meaning that behavior depends on "the individuals' expectancies or subjective probabilities concerning the outcomes of a given action and the perceived values or utilities attached to those outcomes" (Sutton, 1987). The HBM uses a cognitive approach with the goal to recognize patterns of health behaviors (Mahmoodi et al., 2011). The HBM is one of the oldest and most extensively used models where theory has been modified from the behavioral sciences to address health problems (Guvenc et al., 2011). In short, the Health belief Model is based on the assumption that if individuals regard themselves as susceptible to a condition, believe that condition would have potentially serious consequences, believe that a course of action available to them would be beneficial in reducing either their susceptibility to or severity of the condition, and believe the anticipated benefits of taking action outweigh the barriers to (or costs of) action, they are likely to take action that they believe will reduce their risks and better their situation and are) more likely adopt preventive behaviors (Becker, 1974) The Health Belief Model contains several primary concepts that predict why people will take action to prevent, to screen for, or to control illness conditions; these include perceived susceptibility, perceived severity, perceived benefits and perceived barriers to a behavior. The four perceptions serve as the main constructs of the model. Each of these perceptions, individually or in combination can be used to explain the knowledge, perception and practice of hepatitis B vaccination among health workers in Nigeria. 20 The basic assumption of the HBM is that people with "better information make better health decisions, with each step in the decision making process dependent on the previous decision or belief" (Hollister & Anema, 2004). According to the HBM, a person "must believe that he/she is susceptible to a condition; the condition is serious; there is a successful intervention for the condition; and can overcome all barriers to using the intervention. Each step is dependent on the previous belief" (Hollister & Anema, 2004). The HBM proposes that there are six general contributors to one's health beliefs:

i. Perceived susceptibility or the risk of developing the disease.
ii. ii. Perceived threats or severity of the disease
iii. iii. Perceived benefits from the health behavior outcome
iv. iv. Perceived barriers preventing the health behavior,
v. v. Health motivation or cues to action and

vi. vi. self-efficacy or belief in one's ability to carry out the health behavior affect an individual's 'acting on a health belief' (Davis, Buchanan, & Green, 2013; Guvenc et al., 2011; James et al., 2012; Mahmoodi et al., 2011; Wong et al., 2013). Perceived Susceptibility: Personal risk or susceptibility is one of the more powerful perceptions in prompting people to adopt healthier practices. The greater the perceived risk, the greater the likelihood of engaging in behaviours to decrease the risk. People will not change their health behaviors unless they believe that they are at risk (Chew et al, 2002). Perceived susceptibility refers to the belief that the individual is likely to have sickle cell anaemia as well as the belief that the person will likely pass on sickle cell disease to their future children. Relating this issue under study on hepatitis B virus infection, the greater the perceived risk of contracting hepatitis B virus infection as a result of the lack of lack of knowledge, perception and practice of hepatitis B vaccination among health workers in Nigeria. so, the need to educate and enlighten them on the grave dangers and risk factors attributed to engaging in risky behaviours that may lead to contracting hepatitis B virus infection. The knowledge on hepatitis B virus infection will provide information about the health and well-being of the Nigerian health workers to make important and major life decisions that will benefit them and their family members either now or in the future. When the Nigerian health workers weigh the risk and the benefits of engaging in risky behaviours that can make them contract hepatitis B virus infection disease, they will now choose the one with the most benefits. It is only logical that when people believe they are at risk, they will be more likely to do something to prevent it from happening. Unfortunately, the opposite also occurs. When people believe they are not at risk or have a low risk of 21 susceptibility, unhealthy and risky behaviours tend to result. For instance when people believe they are at risk of contracting hepatitis B virus infection, they will be more likely to avoid engaging in risky behaviours that can make them contract hepatitis B virus infection. While those who do not think that they are at risk of contracting hepatitis B virus infection would not undertake precaution measures. Perceived Severity: This perception emphasized on an individual's belief about seriousness or severity of contracting an illness or of leaving it untreated include evaluation of both medical and clinical consequences (for example, death, disability, and pain) and possible social consequences (such as effects of the conditions on work, family life, and social relations) (Rimer & Glanz, 2005). The probability that a person will change his/her health behaviors to avoid a consequence depends on how serious he or she considers the consequence to be. While the perception of seriousness or severity is often based on medical information or knowledge, it may also come from beliefs a person has about the difficulties a disease would create or the effect it would have on his or her life in general (Chew, Palmer & Kim, 1998). The combination of susceptibility and severity has been labeled as perceived threat. In this vein, the perception of residents of Calabar on the severity or seriousness and health implications of contracting hepatitis B virus infection will determine whether they will prefer to engage in risky behaviours that may make them susceptible to hepatitis B infection or not. Factors that influence perceived severity among of residents of Calabar on the hepatitis B infection

will include the life threatening state of the disease and the social stigma and discrimination attached to hepatitis B virus infection. According to the HBM if the people believe that they are likely to have hepatitis B virus infection and understand the severity of having the disease, the residents of Calabar perceives this as a threat. The likelihood that they will make an effort to seek knowledge on the disease, screening and testing to check their hepatitis B status and taking vaccination against hepatitis B infection, depends on their belief that these intervention will result in improved knowledge, perception
and practice of hepatitis B among health workers in Nigeria.

Perceived Benefits: The construct of perceived benefits is a person's opinion of the value or usefulness of a new behaviour in decreasing the risk of developing a disease. Even if a person perceives personal susceptibility to a serious health condition (perceived threat), whether this perception leads to behavior change will be influenced by the person's beliefs regarding perceived benefits of the various available actions for reducing the disease threat. People tend to adopt healthier behaviours when they believe the new behaviour will decrease their chances of developing a disease. Thus, individuals exhibiting optimal beliefs in susceptibility and severity are not expected to accept any recommended health action unless they also perceive the action as potentially beneficial by reducing 22 the threat (Chew et al, 2002). Similarly, when residents of Calabar had perceived the health benefits of having knowledge and engaging in safer, this will affect their perception on the practice. Some residents may prefer not having vaccination against hepatitis B infection, use contraceptive such as condom to avoid contracting the infection through sexual intercourse and avoided receiving untested transfused blood but when they are oriented on the benefits of these practices they are likely to change their perception. This is because having ba- sic knowledge on the hepatitis B infection is likely to decrease the chances of risk and danger of contracting hepatitis B infection among residents of Calabar. Perceived Barriers: One of the major reasons people do not change their health behaviors is that they think that doing so is going to be hard. Sometimes it's not just a matter of physical difficulty, but social difficulty as well. Changing your health behaviors can cost effort, money, and time. Since change is not something that comes easily to most people, the last assumption of health belief model addresses the issue of perceived barriers to change. This is an individual's own evaluation of the obstacles in the way of him or her adopting a new behavior. Of all the assumptions, perceived barriers are the most significant in determining behaviour change. The potential negative aspects of a particular health action perceived barriers may act as impediments to under- taking recommended behaviors. A kind of non-conscious, cost-benefit analysis occurs wherein individuals weigh the action's expected benefits with perceived barriers. "It could help me, but it may be expensive, have negative side effects, and be unpleasant, inconvenient, or time-consuming." Thus, "combined levels of susceptibility and severity provide the energy or force to act and the perception of benefits (minus barriers) provide a preferred path of action" (Rosenstock, 1974; Brown, DiClemente & Reynolds, 1991). Moreover in relation to the issue of the knowledge, perception and practice of hepatitis B vaccination among health workers in Nigeria are being influenced by some factors; these factors could be cultural factor, environmental factor, religious factors and even level of enlightenment.. In order for a new

perception to be adopted, a person needs to believe the benefits of the new behaviour outweigh the consequences of continuing the old behaviour. This enables barriers to be overcomed and the new perception to be adopted. Similarly, Nigerian health workers that accepts having knowledge and adopting healthier and safer behaviour feel like changing their perception are supposed to weigh both practices. They most consider the benefits and the barriers. The Health Belief Model, however, is realistic. It recognizes the fact that some- times wanting to change a health behavior isn't enough to actually make some- one do it, and incorporates two more elements into its estimations about what 23 it actually takes to get an individual to make the leap. These two elements are cues to action and self-efficacy**.**

vii. **Cues to Action**: In addition to the four beliefs or perception and modifying variables, the Health Belief Model suggests that behaviour is also influenced by cues to action (Mattson, 1999). Cues to action are events, people or things that move people to change their behaviour; they are external events that prompt a desire to make a health change. They can be anything from a hepatitis B infection van being present at a health fair, to seeing a poster on a wall on the need to go for a hepatitis B screening and the benefit of taking vaccination against hepatitis B, to having a relative die of hepatitis B infection disease. A cue to action is something that helps move someone from wanting to make a health change to actually making the change (Rimer & Glanz, 2005). In this regard, some residents of Calabar change their perception and it is important for the residents to avoid risky behaviours which have it own negative consequences on them. self-efficacy: In my mind, however, the most interesting part of the Health Belief Model is the concept of self-efficacy, an element which wasn't added to the model until 1988. Self-efficacy is defined as "the conviction that one can successfully execute the behavior required to produce the outcomes" (Bandura, 1997). Self-efficacy looks at a person's belief in his or her ability to make a health related change. It may seem trivial, but faith in your ability to do something has an enormous impact on your actual ability to do it. Thinking that you will fail will almost makes certain that you do. In fact, in recent years, self-efficacy has been found to be one of the most important factors in an individual's ability to successfully under take hepatitis B infection vaccination and screening and test for hepatitis B infection. Bandura distinguished self-efficacy expectations from outcome expectations, defined as a person's estimate that a given behavior will lead to certain outcomes. Outcome expectations are similar to but distinct from the HBM concept of perceived benefits. In 1988, Rosenstock, Strecher, and Becker suggested that self- efficacy be added to the HBM as a separate construct, while including original concepts of susceptibility, severity, benefits, and barriers. The original model was developed in the context of circumscribed preventive health actions (accepting p premarital genetic screening and counseling) that were not perceived to involve complex behaviors. Health Belief Model has successful explains the issue of the knowledge, perception and practice of hepatitis B vaccination among health workers in Nigeria

Ajzen and Fishbein's Theory of Reasoned Action According to the theory of reasoned action, the two main factors that influence a person's intention to perform a certain behavior

are attitudes and subjective norms (Glanz, 2002). A person holds a belief that a particular behavior leads to a particular outcome and evaluates the outcome and consequently forms a perception towards the behavior (Ajzen & Fishbein, 1980). Subjective norms on the other hand arise from normative beliefs which in turn shape a person's perception of social pressure to perform certain behaviors. This is important because it makes it possible for persuasive campaigns and other interventions to be more target-oriented through evaluation of the beliefs such as (subjective and normative beliefs) that underlie performance of certain behaviors. These beliefs, however, need not be necessarily rational in them but are acquired as one learns about one's world. The theory has also been found to predict attitude behavior relationships effectively and is therefore an important theoretic frame work for HBV risk reduction interventions. Fishbein and Ajzen buttressed their argument with the following quotation made by them. Fishbein cited: "I used the term "reasoned" because it is assumed that as one learns (for example. forms beliefs) about one's world's, one (often automatically) forms attitudes, perceived social norms, and perceptions of control, that in turn (and again often automatically) influence one's intentions and behaviors, That is, these "higher order" constructs (for example, attitudes, norms and intentions) are assumed to follow reasonable from one's beliefs about the world in which one lives" (Fishbein, 2011). The theory of reasoned Action by Fishbein and Ajzen (1980) was designed to explain not just health behavior but all volitional behaviours. This theory is based on the assumption that most behaviours of social relevance are under volitional (willful) control. In addition, a person's intention to perform (or not to perform) the behavior is the immediate determinant of that behavior. The goal is not to predict human behavior but also to understand it. According to this theory, a person's intention to perform a specific behavior or act like that leads to contracting hepatitis B virus infection is a function of two factors;

(i) Attitude (positive or negative) towards hepatitis B virus infection and

(ii) The influence of the social environment (general subjective norms) on hepatitis B virus infection. The knowledge, perception and practice of hepatitis B vaccination is determined by the person's belief that a given outcome will occur if he or she engage in risky behaviours such as sharing sharp object, receiving unscreened blood and having unprotected sex by the evaluation of the outcome. The social or subjective norm is determined by a person's normative belief about what important or "others think she would do and by the individuals motivation to comply with those other peoples wishes or desires. Perceptions towards hepatitis B virus infection are functions of beliefs in this theory. If a person believes that contracting hepatitis B virus infection is a positive action (like □nishing school), he or she would hard a favourable perception towards contracting hepatitis B virus infection. On the other hand a person who believes that having hepatitis B virus infection would mostly lead to serious negative outcomes (like health problems) will hold an unfavourable 25 perception. These beliefs that foundation of a person's perception towards hep- atitis B virus infection are referred to as behavioural beliefs. Subjective norms also is a function of beliefs. These are the person's beliefs that certain individuals and groups are for and against hepatitis B vaccination.

EMPIRICAL FRAMEWORK

According to Alabi AD1ID, Mautin GJ1ID, Ekundayo AA1ID (2023), the mean age of the respondents in this study was 32.41±0.32 years with the majority of the workers aged above 40 years. This is similar to research done in Edo state, southern Nigeria and Ado-Ekiti, southwest Nigeria to assess factors influencing knowledge of HBV vaccination among healthcare workers with a mean age of 34.90±9.46 years (2) and 35.00±4.50 years (18), respectively. The majority of the respondents were females (66.8%) with a similar occurrence in another study (18) with 66.5% females. The majority (64.7%) of the respondents in this study demonstrated good knowledge of HBV infection. This finding is encouraging because knowledge is an important factor for behavioural modification. This was in concordance with the 78.2% prevalence of good knowledge of HBV infection among healthcare workers reported in a study done in Usmanu Danfodiyo University Teaching Hospital, Sokoto (3). This result was also similar to those obtained in other studies where the knowledge of the respondents was assessed to be 65.2% (11) and 76.3% (17). This may be due to several pieces of training that the health workers might have undergone. The findings in this study also showed that the respondents were quite aware of the causative agent (89.4%), route of transmission through unsterilized syringes (98.4%), mother-to-child (77.4%) and blood transfusion (95.8%). Another study conducted on health workers in Maiduguri, Northern Nigeria (19), also showed a similarly high level of knowledge amongst them in questions related to aetiology (81.1%), and blood transfusion (70.8%). Also, in this present study, it was found that 15.3% of the respondents felt that the infection could be spread by touching, shaking hands and sharing eating utensils with infected persons (6.8%). There is therefore an urgent need to correct this knowledge status. Risk perception is the subjective judgment that people make about the characteristic and severity of a hazard. In this study, it was noted that the majority, 311 (89.5%) of the health workers perceived themselves to be more at risk of HBV infection than the general population with 31.6% of them feeling very strongly about this. This finding was in contrast to what was obtained in another study where only 21.3% of the respondents felt they had a high risk of contracting the infection based on the nature of their job (11). This would affect their attitude toward and practice of general infection control methods in the health facility. Hospital attendants are known to be frequently exposed to healthcare wastes that could contain infected blood and body fluids; they demonstrated a very low-risk perception of HBV infection. They were found less likely to perceive themselves to be at risk of the infection as compared to doctors, nurses and laboratory personnel, physiotherapists and pharmacist because they were not dealing directly with the patients. Even though the majority of respondents (64.7%) had good knowledge of hepatitis B

viral infection, and most of them (89.5%) perceived themselves to be at increased risk of the infection as compared to the general population, 167 (47.9%) which is a little less than half of the 348 respondents were vaccinated against the infection, and only 21 (12.7%) of those vaccinated took the complete three doses of the vaccine. This finding is a cause for concern because of the inevitable risk of the majority of the respondents contracting hepatitis B viral infection following accidental exposure to infectious healthcare wastes. Reports from other studies generally showed poor uptake of the hepatitis B vaccine. Findings of similar studies in various parts of Nigeria (13, 17, 20) showed a comparable pattern of low vaccine uptake of 14.2%, 21.2% and 33% respectively. It is even worse to note that the majority of those who claim to have taken the vaccine took only one or two doses and never bothered to complete the regimen (13). Reasons given by the respondents in this current study for non-completion of the vaccine doses included spacing between the vaccine doses being long (57.1%), inconvenience (38.2%) and doses being too many (4.7%). Some of them also felt that the vaccines were not available (37.6%), not accessible (14.1%) and lack of time (24.8%). This brings to the fore the importance of sensitisation and awareness programmes for health workers on the need to be immunised against infection. This study also showed that 18.4% of the respondents practised unprotected sex and 20% of them do not always wear their hand gloves at work. This is similar to the findings from the study done across three states in Nigeria (Lagos, Ogun and Abia states) (20) where 23.9% and 24% of the respondents practised unprotected sex and had multiple sexual partners. This definitely would make the risk of developing the infection higher among health workers.

CONCEPTUAL FRAMEWIRK

MEANING OF HEPATITIS B

The hepatitis (hep ah TIE tiss) B virus is one of the several viruses that can cause hepatitis. Hepatitis is an inflammation of the liver. Usually it is caused by infections or side effects of medicines. It is sometimes called “yellow jaundice” because the liver injury from hepatitis may cause an increase in bilirubin. Bilirubin is a chemical in the blood that can cause the skin to turn yellow. The hepatitis B virus can live in a person for his or her whole life. A blood test can show if the virus is present.

Hepatitis B is caused by a virus found in blood, semen, vaginal secretions and saliva. It is mainly spread through unprotected sexual activity or exposure to blood. The virus enters the body through a cut, a scraped area of skin or through mucous membranes (like the inside lining of the mouth). Hepatitis B can occur through direct blood-to-blood contact. It can be passed from an infected mother to her newborn during the delivery process, by an infected person during unprotected sex, and by the use of unsterile needles.

How to Help Stop the Spread of Hepatitis B

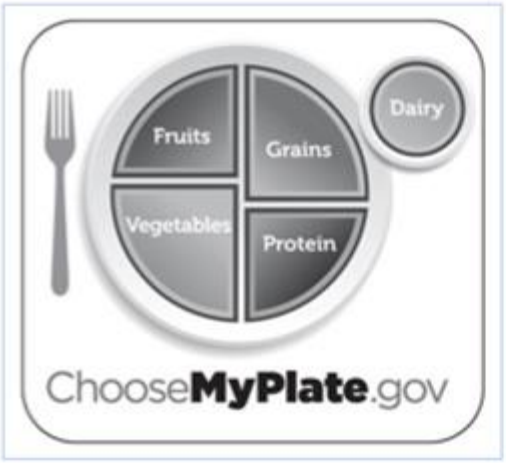
There are several things you can do to help stop the spread of this disease. Please follow these instructions until your doctor tells you the child with hepatitis is completely well:

- **Good hand washing by all family members must be done.** Hands should be washed using soap and warm water before meals, after using the bathroom and before preparing or serving food.

Picture 1 Good hand washing is very important!

- Wash your hands after caring for your child. You may have come in contact with the hepatitis B virus from such things as changing diapers, cleaning up vomit, or exposure to blood.
- Wear disposable gloves when handling blood (like helping to stop a nosebleed or bandaging a cut). Wash your hands after removing the gloves.
- Hepatitis B can be spread by sexual activity. Not having sex (abstinence) is the best way to keep Hepatitis B from being spread sexually. If an infected person has sex, **a condom should be used every time.** Condoms should be used until the doctor says there is no longer any risk of spreading the disease.
- All family members who are not infected should get Hepatitis B vaccines (2 to 3 shots).

Good Nutrition and Rest



Picture 2 A well-balanced diet includes these five food groups in the proportions shown.

- All family members should eat a well-balanced diet that includes foods shown in the graphic MyPlate (below). You can find more information about balanced nutrition on the website **ChooseMyPlate.gov** (**Picture 2**).
- All family members should get at least 8 hours of sleep each night.

- Young children who are ill should rest during the day when possible.

Medical Care

- Your doctor may give injections (special immune globulin and vaccine) to all family members who have been exposed to hepatitis. These medicines will prevent hepatitis.
- You will be contacted by the Health Department. A Health Department worker may visit your home to help you control this disease. He or she will ask several questions and will answer any questions you may have.
- It is very important for your child to keep taking all medicine as prescribed by the doctor.
- It is very important to bring your child to all follow-up appointments with the doctor.

Chronic (Long Term) Infection

After a Hepatitis B infection, most people recover. The virus is no longer in the blood or other body fluids. However, some people may not get rid of the Hepatitis B virus once they have been infected. These people are infected for a long time and are sometimes called chronic carriers.

A blood test can show if someone has been infected with Hepatitis B and if he or she is immune to Hepatitis B from either a past infection or from the Hepatitis B vaccine.

CHALLENGES POSED BY HEPATITIS B

Although there are effective vaccines and treatment strategies against hepatitis B (HB), it is still a significant health concern worldwide that can present in acute, permanent, severe liver failure and cancer forms resulting in high morbidity and death. Globally, 2 billion people have been infected with HB. There is an estimated more than 292 million people living with chronic hepatitis B (CHB) infection worldwide. The global HB surface antigen (HBsAg) positivity was estimated to be 3.9% in 2016 (HBF 2018a; Razavi-Shearer et al. 2018). Annually, 887,000 deaths occur each year due to HB and related illnesses, which were mainly related to advanced liver fibrosis and cirrhosis (WHO 2019a). The risk and progression of chronic infection are age-dependent and occur mainly in immunocompromised individuals. It is known that the younger an infected person is, the higher the risk of developing CHB infection. Although acute infection is generally cleared in immunocompetent, chronic infection develops in approximately 90% of infants, 30–50% of children aged five years, and 5–10% adults (Jefferies et al. 2018; Terrault et al. 2018; Hyun Kim and Ray Kim 2018; CDC 2020a). CHB infection is classified in five different clinical stages according to the HBsAg positivity (i) hepatitis B e antigen (HBe Ag) positive infection; ii) HBe Ag-positive hepatitis; iii) HBe Ag-negative infection; iv) HBe Ag-negative hepatitis, and v) HBsAg-negative stages that reflect the interaction between HBV replication and the immune system. Occult hepatitis B infection (OBI) is another sub-category that is characterized by a detectable HBV DNA with undetectable HBs antigen or serological markers of the previous viral exposure in the plasma (Malagnino et al. 2018). OBI is associated with severe liver damage and hepatocellular carcinoma (HCC), and poses a risk for individuals, especially in blood transfusional infection, HBV reactivation, chronic liver disease, and HCC (Roman 2018; Wang et al. 2020).

HBV spreads from mother to child, after exposure to infected blood or body fluids or sexual contact. In addition, HBV can survive and remain infective for several weeks on moist surfaces at room temperature (de Almeida et al. 2015; Terrault et al. 2018; Than et al. 2019). Despite being transmitted vertically from infected mother to a child, having sex with an infected partner, contacting the infected needle sticks or sharp object injuries, HBV is not transmitted through breastfeeding, hugging, kissing, coughing, and sneezing, or sharing food and drink (CDC 2020b). HBV vaccination is the main and the safest precaution from being exposed to the virus (WHO 2019a). HBV vaccine has been administered since 1982 and leads to a dramatic decline in HBV infections globally (Van Damme 2016; WHO 2017a). The vaccine against HBV is available and

can be administered from birth to older ages. ENGERIX-B®, RECOMBIVAX HB®, HEPLISAV-™ are three single-antigen vaccines while PEDIARIX®, TWINRIX® are two combination vaccines that are licensed for use in the United States (CDC 2020c). The recommended schedules for HBV vaccine are as follows: three-dose vaccination at 0, 1–2, and 6–18 months of a monovalent HepB (Heplisav-B) vaccine for infants; three-dose vaccination at 0, 1–2, and 6 months for the unvaccinated person, and alternative two doses of Recombivax HB at 11–15 years; two dose vaccinations of HepB at 18 years, and three-dose vaccination with Twinrix. Twinrix is a combination of HepA and HepB vaccine to be administered at 18 years and older (Dynavax 2018; CDC 2020c).

To reduce the spread of infection, the World Health Organization (WHO) European Region recommends the Universal Hepatitis B vaccination programs for infants born from HBsAg-positive mothers, all infants within the first 24 hours after birth, children up to 18 years old, and adults from the groups of high risk for HBV infection, i.e., people with infected sexual partners, homosexual men, hemodialysis patients, injecting drug users, and healthcare workers (WHO 2019b). In May 2016, the WHO addressed the first Global Health Sector Strategy on viral hepatitis 2016–2021 to end new CHB infections by 90% and reduce the mortality rate by 65% by 2030 (WHO 2016).

One of the most severe forms of hepatitis infections is hepatitis delta, also known as hepatitis D. The infection can develop in people infected with HBV (Gilman et al. 2019). Globally, an estimated of 5% of HBV are also infected with the hepatitis D virus (HDV) (WHO 2020). Individuals with HBsAg positive, the elevated alanine aminotransferase (ALT) level with undetectable HBV DNA should be screened for HDV antibodies and HDV RNA (Gilman et al. 2019). HBV-HDV co-infection is severe, and the risk of liver disease progression, liver cancer, early decompensated cirrhosis, and liver failure is higher (WHO 2020). Although there is no effective vaccine against HDV, vaccination against HBV also plays a significant role in protecting delta infection.

HBV, is a partially double-stranded DNA virus of 3.2 kilobases, and it transforms from pregenomic ribonucleic acid (RNA) to DNA by reverse transcription during its life cycle. The genome consists of an outer lipid envelope and inner nucleocapsid core encoded by four overlapping open reading frames, named C, X, P, and S (McNaughton et al. 2019; Wang et al. 2019). Although it is known as a virus with high replication ability, due to the absence of the proofreading reverse transcriptase enzyme, the naturally occurring mutations may arise in different genome regions. These regions may encode for polymerase, surface antigen, core/precore promoter, and comprise the X genes that significantly influence HBsAg expression and progression of HCC (Shaha et al. 2018; Arikan et al. 2019). Additionally, due to the complete overlapping of *pol* and *S* genes, drug resistance and nucleos(t)ide resistance mutations occurring in the *pol* gene can lead to changes in its product HBsAg (Kırdar et al. 2019).

The mutations in the gene C that encode for precore and core proteins are significantly correlated with liver disease progression in CHB patients (Al-Qahtani et al. 2018). The changes in the amino acid sequences: W28*, G29D, G1896A, G1899A, G1862T in the precore proteins that affect HBeAg, and F24Y, E64D, E77Q, A80I/T/V, L116I, E180A in the core proteins mutations are commonly identified and related to clinical severity (Kim et al. 2016; Wu et al. 2018).

The global genotype distribution of HBV differs in different geographic regions and areas worldwide (Rajoriya et al. 2017). HBV is classified into ten genotypes (A-J), and 40 sub-genotypes till today, according to the phylogenetic analysis (Rajoriya et al. 2017). Genotype A is predominant in Northwest Europe, North America, and Africa; genotypes B and C prevail in East Asia and far

East countries, while genotype D is widespread worldwide (Arikan et al. 2016; Kmet Lunacek et al. 2017). Genotype E occurs only in West Africa (Ambachew et al. 2018). Genotype F has been found in Central and South America, and genotype G has been reported in Turkey, France, Canada, Vietnam, Germany, and America. Genotypes H and I have been isolated in Central America, Mexico, Vietnam, and Laos; the recently identified genotype J has only been found in Japan (Mahmood et al. 2016). Fig. Fig.11 illustrates the distribution of HBV genotypes (A-J) worldwide. Additionally, the rate of HBV infection also differs in geographic regions. According to the HBsAg positivity, the prevalence of HBV infection is classified into low (< 2), low-intermediate (2–4.9%), high intermediate (5–7.9%), and high (≥ 8) (Kim et al. 2018). HBsAg is of the main concern, especially for the Western Pacific regions with 6.25 seropositivity. The global prevalence of CHB infection in the Eastern Mediterranean Region, South-East Asia Region, and European Region is estimated at 3.3%, 2.0%, and 1.6% respectively (Fig. (Fig.2)2) (WHO 2019a). HBV genotypes and sub-genotypes have been reported to effectively affect disease transmission, progression, and treatment outcome (Kmet Lunacek et al. 2017). Therefore, identifying HBV mutations and genotypes is essential for both disease manifestation and identification of individuals at risk of infection progression.

This review describes virological assays, including serological and molecular techniques for diagnosing HB infection and updates on the most effective treatment strategies against the virus for the prevention of liver progression and cirrhosis in chronic HBV carriers.

Laboratory diagnosis of hepatitis B virus

Initial assessment of HBV infection begins with patient history, physical examination, evaluation of liver disease activity, and interpretation of different hepatitis markers and/or their combinations such as HBsAg, HB core antigen (HBcAg), HBeAg, HB surface antibody (anti-HBs/HBsAb), HB core antibody (anti-HBc), anti-HBc IgM, HB e antibody (anti-HBe), and focus on the detection of antigens and antibodies (WHO 2017b). The Hepatitis B Foundation (HBF) recommends screening all adults for HB with the triple serological marker panel that involves HBsAg, anti-HBs, and anti-HBc total (HBF 2018b). To classify the phases of the infection in HBV infected patients, the followings should be performed: i) the assays for HBsAg, HBeAg/anti-HBe, HBV DNA; ii) liver blood tests including aspartate aminotransferase (AST), alanine transaminase (ALT), and iii) transient elastography (Fibroscan) as a noninvasive test or needle liver biopsy as an invasive method for the presence of cirrhosis (EASL 2017).

HBV serological markers

Various serological assays can detect virus-specific antigens and antibodies which appear during and after HBV infection. These tests are used to determine whether a patient is susceptible to infection or immune due to passed infection or HBV vaccination (CDC 2020d). Currently, various serological diagnostic assays, including rapid diagnostic tests (RDTs) and laboratory-based immunoassays, such as enzyme immunoassays (EIAs), chemiluminescence immunoassays (CLIAs), electrochemiluminescence immunoassays (ECLs) are used (WHO 2017b). These tests can be performed with serum, plasma and/or capillary/venous whole blood and oral fluid specimens to detect the presence of antigens or antibodies against the virus with high analytical sensitivity, specificity, and accuracy (WHO 2017b). Dried blood spot (DBS) specimen may be an alternative type of specimen in settings where blood taking and RDTs laboratory testing are not available and/or accessible or from a person with poor venous access (WHO 2017b). The laboratory reports are given qualitatively or quantitatively as international units (IU) or signal per cutoff (S/Co) values (Terrault et al. 2018).

HBsAg. HBsAg is an envelope protein that is expressed on the surface of the infectious virion called Dane particles. The detection of HBsAg in the serum indicates the current HBV infection. The HBsAg positivity can be considered with a second surface antigen test before further evaluating HBV DNA in the regions with HBsAg prevalence < 0.4 (WHO 2017b). The incubation period for hepatitis is 90 days (60–150 days) after exposure to HBV, and HBsAg appears in the blood for about six weeks (1–10 weeks) after the first exposure to the virus (CDC 2005). During the immunological window period, HBsAg may disappear rapidly without the appearance of HB surface antibodies, and the IgM antibody is the only evidence of the infection during this period (Otero et al. 2018). If HBsAg positivity persists after six months, it implies the progression of a chronic infection. The quantitative immunochemiluminescence analysis is performed to evaluate HBsAg levels of CHB patients and is a useful marker for interferon alfa (IFN-α)-treated CHB patients with HBeAg negative (EASL 2017).

Anti-HBc. Detection of anti-HBc antigens confirms exposure to HBV and indicates acute, chronic, or resolved infection but not vaccine-induced immunity (Terrault et al. 2018). The presence of IgM antibodies, together with HBsAg positivity, generally indicates the acute infection that generally persists positive for not more than six months (Jackson et al. 2018). Individuals who are core-antibody positive and HB surface-antibody negative are chronically infected and show a decreased risk of HBV reactivation. There is also no clinical benefit of vaccination for the group of individuals who are positive only for core antibodies due to exposure to HBV or people who are positive for anti-HBc and anti-HBs due to immune control (Cholongitas et al. 2018; Ganczak et al. 2019).

HBeAg and anti-HBe. The presence of HBeAg correlated with active viral replication is indicative of the contagiousness of the patient. Whereas, the appearance of anti-HBe indicates the low level of viral replication and is strong evidence for infection resolution (CDC 2005). These tests are often used to determine the CHB infection phase (EASL 2017).

Anti-HBs or HBsAb. The presence of anti-HBs indicates the recovery and immunization against HB infection either by HB vaccine or prior infection. People whose first-degree relatives or sex partners are chronic carriers are recommended to be vaccinated if their triple serological screening tests are negative (EASL 2017). The anti-HBs titer should be ≥10 mIU/ml in order to be protective (Dini et al. 2017).

Biochemical parameters and fibrosis markers

The severity of liver fibrosis is assessed using biochemical parameters, including AST and ALT, which are enzymes released from the liver in response to damage and disease. The other biochemical parameters are gamma-glutamyl transpeptidase (GGT), alkaline phosphatase (ALP), bilirubin, serum albumin gamma globulin, full blood count, and prothrombin time (PT) (EASL 2017). When biochemical and HBV markers are inconclusive, then invasive and noninvasive methods are used to assess the stage of liver damage (EASL 2017). Since liver biopsy is an invasive, costly, and painful procedure compared to other techniques, various non-invasive methods are preferred to predict the stage of liver fibrosis and the presence of cirrhosis in CHB patients. The WHO recommends AST to platelet ratio index (APRI) calculated according to the formula: APRI = [AST/AST ULN (upper limit of normal) × 100/platelet count (10^9/l] to estimate the stage of liver fibrosis (WHO 2017b). TE is another noninvasive method; however, due to its limitations such as high cost, inaccurate results with elevated ALT levels, restriction with liver necro-inflammation, and obesity, the WHO recommends the APRI index as a relatively accurate method for predicting advanced liver fibrosis (EASL 2017; WHO 2017b; Huang et al. 2019). It has been recommended that 40 IU/ml as ULN value should be used in the APRI formula (WHO

2017b). ALT levels should also be measured in CHB patients as it correlates with disease severity. According to the WHO guidelines, the ULN ALT level is below 30 U/l and 19 U/l for men and women, respectively (WHO 2017b).

Molecular assays

The molecular diagnostic techniques are used for HBV DNA quantification, genotyping, detection of drug resistance mutations, and precore/core mutation analysis (Villar et al. 2015) Currently, UltraQual HBV PCR Assay, COBAS AmpliScreen HBV Test, Procleix Ultrio Assay, Procleix Ultrio Plus Assay, and COBAS TaqScreen MPX Test are FDA approved nucleic acids amplification tests (NATs) used for diagnosis of HB infection (FDA 2019)

HBV DNA quantification. HBV DNA quantification. HBV DNA by NAT is used to determine the infectivity of individuals and infectivity of HBsAg positive pregnant women to prevent mother to child transmission risk and reach a decision whether to treat diseases. The HBV DNA measurement with molecular technologies enables early detection of people at risk before HBsAg emerges and rules out OBI (Aghasadeghi et al. 2020). The testing of HBV DNA is also used to monitor the treatment response in CHB patients (WHO 2017b). The viral load of HBV is usually measured either in IU/ml or copies/ml by ultraviolet (UV) spectrophotometry, real-time PCR (rt-PCR), digital PCR, loop-mediated isothermal amplification (LAMP), transcription-mediated amplification (TMA), nucleic acid sequence-based amplification (NASBA), rolling circle amplification (RCA) as well as electrochemical, quartz crystal microbalance, microcantilever, and surface plasmon resonance biosensors (Liu and Yao 2015; WHO 2017b; Al-Sadeq et al. 2019; Sayan et al. 2019; Arikan and Sayan 2020). The HBV DNA level represents the disease progression, long-term results of CHB infection, and the treatment's achievement to prevent the progression of HCC. The measurement of the level of HBV DNA is recommended to be performed with a more sensitive rt-PCR assay with 10 IU/ml detection limit (EASL 2017).

HBV DNA genotyping, drug resistance, preC/core mutations. To date, ten genotypes of HBV, A to J, and more than 40 sub-genotypes that differ >8% and 4–8% nucleotide divergence in the genome, respectively, have been identified (Al-Sadeq et al. 2019). Different genotypes and sub-genotypes show different geographical distribution and are correlated with persistence of viral load, risk of developing cirrhosis, HBsAg seroclearance, antiviral therapy response, and prognosis due to the presence of mutations (Paudel and Suvedi 2019; Wang et al. 2019). It has been known that patients infected with HBV genotype A are more likely to develop CHB infection than patients infected with genotype B, associated with the development of antiviral resistance or genotype C, associated with acute hepatitis (EASL 2017; Wang et al. 2019). HBV genotyping is not required for initial diagnosis; however, genome sequencing for evaluation of HBV genotypes and drug resistance mutations are useful parameters for patients at risk of developing HCC in order to monitor an efficient therapy (EASL 2017).

There are many genotyping systems, including reverse hybridization, restriction fragment polymorphism (RFLP), multiplex nested PCR or real-time PCR, oligonucleotide microarray chips, reverse dot blot, restriction fragment mass polymorphism (RFMP), and invader assay (Fletcher et al. 2019). Molecular identification of HBV genotypes could also be done by sequencing the whole HBV genome, followed by phylogenetic analysis. Phylogenetic analysis is performed by constructing a phylogenetic tree with nucleotide sequences of the entire HBV genome to characterize different HBV genotypes and subgenotypes. A web-based program available through the National Center of Biotechnology Information is used that enables us to make the comparison between the newly obtained HBV sequences with the reference sequences available in GenBank.

BLAST or FASTA are tools for searching similar sequences available in the EBI web site (http://www.ebi.ac.uk/Tools/homology.html) (Schreiber 2007).
The whole-genome sequences of different HBV strains are aligned, and the phylogenetic tree is constructed using distance methods including neighboring joining (NJ), un-weighted pair-group using arithmetic averages (UPGMA) or character-based techniques including maximum parsimony (MP) and maximum likelihood (ML) (Rozanov et al. 2004; Schreiber 2007). The similarity method is considered the "gold standard" approach for genotyping and sub-genotyping and can be performed on individual genes on the HBV S gene instead of the complete genome. However, the partial sequencing (HBV S gene) allows determining only the HBV genotype, not the HBV sub-genotype (Pourkarim et al. 2014).
Apart from HBV genotyping, HBV drug resistance mutations are also tested by using sequence-based assays. Several sequence-based assays such as line probe assay have been developed; however, due to its accuracy, the Sanger sequencing of the PCR amplicon from the HBV reverse transcriptase region is accepted as a "gold standard". Real-time PCR reduces the risk of contamination due to its applicability and speed. Therefore, it is widely used to detect drug resistance mutations (Mou et al. 2016).

Treatment of hepatitis B virus infection

The treatment's primary goal is to save lives by decreasing liver cancer death, liver transplant, slow or reverse liver disease progression, and infectivity (Terrault et al. 2018). Nowadays, there are currently seven approved drugs: two formulations of IFN-standard and pegylated interferon (Peg IFN), and five nucleos(t) ide analogs (NUC): lamivudine (LAM), telbivudine, entecavir (ETV), adefovir (ADV), and tenofovir (TDF) (Lok et al. 2016). Guidelines suggest either standard or Peg IFN-α (IFN-a) immunomodulators such as standard or Peg IFN-α (IFN-a), or NUCs such as LAM adefovirdipivoxil, ETV, TDF, or telbivudine as treatment alternatives for CHB patients (Manzoor et al. 2015).
IFN-α is a host defense against HBV infections by interferon-stimulated genes (ISGs), which have immoral antiviral functions against a variety of viruses (Liang et al. 2015). Some studies have shown that in 76–94% of individuals, the treatment response is extended and is associated with more confirmatory clinical outcomes in terms of liver-related complications and survival (Niederau et al. 1996).
IFN-α-2a/b was the first certified treatment choice for CHB infection, and it replaced the standard IFN-α-2b because of pharmacokinetic properties. The pegylation is used to increase the half-life of interferon (Lok and McMahon 2009). The study reported that the treatment accomplishment percentage of Pegasys is 24% compared to 12% standard interferon (Cooksley et al. 2003). LAM is a cytidine NUC that prevents the reverse transcriptase enzyme of HBV; however, the resistance rates due to mutations in the YMDD locus of HBV polymerase is high (Chan et al. 2007; Manzoor et al. 2015). Hepsera is the tradename for adefovirdipivoxil, and ADV is a NUC. Hepsera has some side effects, including rash, swelling of the throat, lips, tongue, face, difficulty breathing, and proximal kidney tubular dysfunction (Ho et al. 2015). Despite side effects, the resistance rate of ADV is lower compared to LAM (Innaimo et al. 1997). Baraclude or ETV is a potent inhibitor of HBV's DNA polymerase enzyme, and resistance is rarely observed (Lai et al. 2006; Manzoor 2015).
Recommendations for the treatment of HBV/HIV (Human immunodeficiency)-coinfected persons are based on the WHO 2013 combine guidelines, which was updated in 2015, on the use of

antiretroviral drugs for treating and preventing HIV infection. Interferon or Peg IFN as antiviral therapy was eliminated from these guidelines because their use is restricted in LMICs due to its high cost and significant adverse effects that need careful monitoring (WHO 2015). In addition, Peg-IFN was found to have only about 20% sustained non-treatment response in terms of viral suppression and low HBsAg loss and seroconversion rates (Lin et al. 2016).

New generation NUCs act by inhibiting HBV DNA replication by normalizing ALT levels. Unfortunately, NUC's use relies on long-term therapy and induces drug-related mutant infection (Tsuge et al. 2013). NUCs rarely eliminate all of the chronic HBV infection and HBV replication (Jeng et al. 2010). In recent years, NUCs or IFN monotherapy or combination therapy in CHB treatment have been investigated to minimize the therapies (Scaglione and Lok 2012). Since the combination of NUCs and IFN can inhibit more than one step of the HBV lifecycle than mainly targeting the reverse transcriptase step by NUCs monotherapy (Wei et al. 2015). Benefits and limitations of antiviral drugs used against for HBV infection are given in Table I (Abdul Basit et al. 2017).

The chemical name of TAF is L-alanine, [(S)[[(1R)-2-(6-amino-9H-purine-9yl)-1 (methylethoxy]methyl] phenoxyphosphinyl]-1-methyl ethyl ester, (2E)-2-butenedioate (Gilead Sciences 2015). TAF pharmacokinetics are linear and dose-dependent. According to the 28-day phase 1b study, which assessed antiviral activity, safety, and pharmacokinetics in CHB patients, TAF was found to be well-tolerated and safe. However, some side-effects, including headache, nausea, fatigue, cough, and constipation, were also reported. The antiviral effect of TAF over the 4 weeks was demonstrated by changes in serum HBV DNA levels of the treated patient groups in the same study (Agarwal et al. 2015).

The review summarized the serological, molecular diagnosis techniques, and current treatment strategies for HBV infection. The initial diagnosis with the serological assays is used to detect HBsAg and other HBV antigens and antibodies. Next, molecular assays are performed to verify the first step of diagnosis, quantify HBV viral load, and identify HBV genotypes and determine drug resistance mutation. Although molecular assays are frequently preferred due to their high sensitivity, high cost, the need for experienced personnel, and numerous equipment for analysis are the main limitations of molecular analysis. In the future, there is a need for new technologies such as biosensors that provide faster time to result with not only high specificity, sensitivity, and low cost but also low false positive/negative ratio that can play a significant role in screening, diagnosis, and management of HBV infection. Additional technologies may also help to develop new treatment targets. A combination of the HBV therapies and small-molecule drugs or biologics will be necessary to control the HBV infection effectively.

KNOWLEDGE OF HEPATITIS B FROM HISTORICAL POINT OF VIEW

Knowledge on Hepatitis B Virus Infection The hepatitis B virus was discovered in 1965 when Blumberg and co-workers found the hepatitis surface antigen which was originally called the Australia antigen because it was found in serum from an Australian patient (Blumberg et al, 1965, 1977). Dr Baruch Samuel Blumberg was awarded the 1976 Noble Prize in Physiology or Medicine for this discovery. The virus was fully described in the 1970s (Dane et al, 1970). In recent times, the rapid and continuous discoveries of the viral disease around the whole world have improved our understanding of the complexity of this unusual virus. Although there has not been any substantial decrease in the overall prevalence of HBV, there is the hope that the next 6 generation will see a decline in both the worldwide carrier rate and the incidence of new HBV infections if

current HBV vaccinations are intensified. Grob and Esteban (1995) stated that HBV may be transmitted horizontally and vertically. Horizontal transmission occurs during adolescence or childhood, throughout sexual exposure, needle stick (both accidental or through intra- venous drug use), and blood transfusion (Alter et al, 1990). Therefore, any person with a bad history of sexually transmitted diseases (STDs), multiple sex- ual partners or an injecting drug user stands a higher chance of being infected with HBV (CDC, 2002). Exposure to blood is also by means of open wounds in households and other close contacts and multiple transfusions in hemophiliacs (Meheus, 1995). This view of exposure to risk was also shared by (Margolis et al, 1991) who argued that most of the infections occur among adolescents and young adults due to exposure to high risk activities they engage in at this stage of life. A vertical transmission occurs when an infected mother transmits the virus directly to the neonatal during child birth. Such transmissions are usually possible when the expectant mother suffers an acute infection of hepatitis B during pregnancy or if she is a chronic carrier during that period. The mode of this vertical transmission is not clear cut, but indications are that, infection might occur through a placenta cutting during childbirth. Majority of countries in Southeast Asia, the Western Pacific and Africa have high endemicity of HBV. In these settings the major mode of HBV transmission has been identified as vertical, where by mothers directly transmit virus to their infants during prenatal periods or where infected siblings, playmates, other members of different households transmit the virus to their younger ones (Maynard et al, 1988). A cross-sectional study by Margolis et al (1991) clarified that without prophylaxis, an estimated number of 6000 infants born to carrier mothers each year in the USA would develop chronic HBV infection as a consequence of prenatal transmission. A part from the above mentioned major modes of transmission, tattooing and body piercing tools have been recently discovered to have contributed significantly to the spread of the disease. The incidence of reported hepatitis B in different age groups in the USA is indicative of a life style disease linked with at-risk behavior in late adolescence (15-19 years) and young adult- hood (20-29 years).The disturbing risk factors are mostly sexual misconduct, tattooing, body-piercing, drug use or injection. In less developed countries, the use of crude methods during injections such as reused unsterilized or improperly sterilized needles and syringes are estimated to cause millions of cases of hepatitis B and C as well as HIV and other blood borne diseases globally (Kane, 1998). Knowledge is formed through interaction with the surroundings where individuals themselves construct their understanding of the world through experience. Its exchange is an integral part of learning as well as helping the individual to shape his or her abilities by converting theoretical and practical skills into new knowledge. Human knowledge is mostly acquired through communication 7 and its processes. Knowledge is the key to prevention and education is the key to knowledge. However, knowledge about the deadly disease in Nigeria and other sub Saharan Africa is low. A talk with people across the area has given the impression that a, majority of people there have little or no knowledge or understanding of the importance of their liver condition for good health. This lack of knowledge or awareness is not only limited to only hepatitis B but also their overall well-being in terms of health. There are a lot of factors impeding efforts put up by established institutions like WHO and other world organizations to curb the menace of hepatitis B globally. Notably among these is the lack of knowledge and awareness among health care providers, social service professionals, adolescents, members of the public and even policy makers. It is an established fact that though there has been a safe and effective vaccine for hepatitis B over the past

20years, universal vaccination is still lacking in many countries. One of the major obstacles identified for this drawback is the lack of commitment to preventive medicine and vaccines. Due to the apparent lack of knowledge about hepatitis B, most governments which are supposed to be the major financiers of public health activities have seriously not considered hepatitis B prevention as a topmost priority in health care and have opted for selective prevention strategies. Most interventions aimed at reducing HBV prevalence among high risks groups have failed because of the inability to access these groups. There is also lack of perceived risk among these high risk groups and over 30% of those with acute hepatitis B infection do not have identifiable risk factors (Mangtani, 1995). Few literatures have been able to take into cognizance geographical locations when assessing adolescent's knowledge about the deadly HBV. In a cross-sectional study conducted in Australia to assess secondary school student's level of knowledge about STIs including hepatitis B in rural and urban localities, it was found that rural students were more knowledgeable about issues of STIs compared to their urban peers (Lucke et al, 1993). A survey of rural Canadian students STDs knowledge revealed high levels of knowledge among both rural and urban students (Svenson et al, 1992). Wyn (1994) and Wright (1991) revealed that although hepatitis B presents real risks to adolescents, knowledge of the disease and asymptomatic presentation has been found to be very low among secondary school students. Ma (2007) examined the knowledge of HBV and liver cancer among 256 Vietnamese Americans with low socioeconomic status. The results showed that the participants had general knowledge of HBV, but only 22% knew that HBV could spread through unprotected sex. Many did not know that liver cancer is preventable or that it is curable. Only a third of the participants knew about the vaccine that protects against HBV. An average knowledge is confirmed by Vu et al (2012) in a study that investigated knowledge about HBV among 433 Vietnamese men in Australia. About 17 half of the respondents knew that HBV could spread by unprotected sex. Only 32% of them knew that sharing food and drink with an infected person is not a risk factor for being infected with HBV. Knowledge about the progression and character of the disease was higher. Approximately 60% knew that long-time infection still can transmit the disease, be asymptomatic and that treatment is available. Less than half of the respondents knew 8 that it could turn into a lifelong disease. A study was carried out in China by Chao et al (2010) to investigate the knowledge about HBV among 250 health professionals by handing out a questionnaire at the "China national conference on the prevention and control of viral hepatitis". The results showed that even among highly educated health professionals the knowledge and education was deficient. One-third of the respondents did not know that it is common for chronic HBV infection to be asymptomatic or that it can lead to liver cancer, liver cirrhosis and premature death. The authors believe that this increases the risk of health professionals overlooking the significance of screening even those who are asymptomatic, and vaccinating those who need it. Muhammad, Waseem and Zul□kar (2011) also found that factors associated with greater knowledge about HBV are high educational level or employment in professional jobs. The study by Taylor et al (2005) investigated knowledge and awareness of hepatitis B among randomly selected Vietnamese adults living in the United States. About 81% of the 715 adults that participated in the study had heard of hepatitis B and 67% had been tested for HBV. The knowledge of the infection was generally good, with about three-quarters knowing the different ways of transmission but only 69% knew about infection through unprotected sex. Hwang, Huang and Yi (2010) investigated knowledge about HBV and predictors

of HBV vaccination among 251 Vietnamese American college students. More than half of the participants were aware that HBV could be transmitted via unprotected sex and 18 contaminated blood; though most of the participants' thought that HBV was transmitted through food and water. Less than one third knew that Asian Americans have higher risk of being infected with HBV than other people. About 87% had heard about HBV before and they had significantly greater knowledge compared to those who had not heard about the disease. The knowledge was also greater among those who had been screened for, or vaccinated against HBV, or had family members diagnosed with HBV or liver cancer. The study also indicated that women had greater knowledge about HBV compared to men. About 43% of the participants reported being vaccinated against HBV and they had greater knowledge than those who had not been vaccinated. Older participants or participants who were sexually active and/or knew someone with HBV were less likely to have been vaccinated. 2.3 Attitude of People towards Hepatitis B Virus Infection Atkinson (2003) defined attitude as the favorable or unfavorable reaction to objects, people, situations or other aspects of the world. Other social psychologists considered attitudes to include factors such as cognition, affection and behavior (Kruglanski et al, 2007). They further explained the cognition aspect of a person to mean a person's knowledge of something, the affective component 9 represents an individual's feelings and evaluations that influence the standpoint for or against something and the behavioral aspect to be, the way people act towards a situation or a person and the motivation to make changes. Attitudes as suggested by psychologist are formed through experiences in lifetime and are usually determined by beliefs and the evaluation of such beliefs. Attitudes formed by individuals in society can be comprehensive as well as unspecific. Fishbein (1975) indicated that comprehensive attitudes are more stable and are usually strongly held by the owners therefore, very difficult if not impossible to be influenced as compared to unspecific attitudes. A person's behavior can be predicted by using the strength and consistency of his or her attitude. In this regard, any intervention that is aimed at changing the behavior of an individual must first of all have enough information about his or her attitudes and then employ methods that will help change these attitudes. Attitudes of which one is aware of or that are based on one's own experience can predict behavior to a higher degree than attitudes that do not meet these criteria (Smith, Atkinson and Hilgard, 2003). Smith, Atkinson and Hilgard (2003) indicated those possible factors that could help influence the attitudes of an individual include, the nature of the sender (for example. the nurse, doctor, health worker or professional in a counseling situation), the receiver (for example, the patient), the message itself and the social context in which the information was communicated. Trustworthiness, expertise and interpersonal attraction are important signs that should be exhibited by the sender in order to influence a person's attitude. It is important to state that for a sender to be able to make an impact on the attitude of a receiver factors such as sex, age, self-esteem and knowledge have an important role to play. Knowledge does not necessarily influence a person's attitude. People may be knowledgeable about a particular risk behavior but may still go ahead to do it. Knowledge about hepatitis B is necessary but the provision of knowledge alone is not sufficient since it does not necessarily lead to the behavior change. Attitudes, values and beliefs (including perceptions about personal vulnerability to infection) as well as cultural norms and the influence of family, peers and the media are all important determinants of whether or not appropriate behavior is adopted by adolescents (Emmons et al, 1986). Another important motivation for a behavior change among adolescents or anybody

at risk of a health risk is the feeling of compassion for those already affected. This is backed by the fact that stigmatization of disease is often a sign of denial of potential personal risk (Parker & Aggleton, 2003). Practice may be executed consciously or un- consciously which may lead to positive or negative outcomes. Individuals in society do different things for reasons best known to them. Some of the practices people engage in and for that matter adolescents are due to individual preference, peer influence, societal pressure or cultural beliefs, norm systems or for the sake of fun. In the case of adolescents, where the struggle for self-identity and group acceptance is paramount, most of the practices they engage in are 10 peer-induced. Another prominent fact in determining adolescent practices is cultural endorsement. In a society where tattooing and piercing of ears and eyes is fashionable, adolescents are highly motivated to do so because they will not receive criticisms from society. Societies where premarital sex is not punishable, adolescents are likely to engage in sexual intercourse since it is at this stage they begin to explore the functions of their body parts. Risk-taking has been identified by psychologist as one of the trademarks of adolescents. The psychological literature on risk-taking suggests that males are greater risk-takers than females, and that adolescents tend to be greater risk-takers than adults (Arnett, 1994). Jessor and Jessor (1997) argued that people actively seek out risks in order to take control of their lives, deal with anxiety, frustration, inadequacy and failure; gain admission to peer groups. Carroll et al (2002) and Martel et al (2002) in a cross-sectional study discovered that young adults are increasingly acquiring body piercing in recent times. Piercing of different body parts has globally become a fashion among a lot of youths in various cultures for centuries (Miller, 1997). Millner and Anderson (2001) considered body piercing as a mainstream activity for adolescents and young adults in the western society even though most of them are aware of its health effects such as bleeding, pain, infections, and allergic reactions. One of the infection-related concerns of body piercing being raised by medical experts is its potential to transmit HBV and HIV due to improper sterilization of piercing tools (CDC, 2002). A cross-sectional study conducted among university undergraduates revealed that 51% of the students reported currently or previously having body piercing (Mayers, Judelson and Moriarty 2002). A clinic based survey conducted among adolescents aged 12-21 years at the Naval Medical Center in San Diego in 2000- 2001 reported similar results with 27% of the participants having pierced their bodies (Carroll et al., 2002). The study further highlighted the most commonly pierced parts of the body of adolescents and young adults as navel, tongue and the cartilaginous portions of the ears and that of the uncommon sites included, eyebrow, lips, nipples and genitals. Several studies have shown an association between body piercing and hepatitis B sero-conversion transmission. Johnson et al (1974) concluded that most of the cases of hepatitis B that have been attributed to piercing, results in fulminate hepatitis and eventually leads to death of the person. A cross-sectional survey conducted by Forbes, (2001) among 341 young students in the Southwestern public University in America found that there was a statistically significant difference between men and women with body modification including tattooing and piercing compared to their counterparts. Another cross- sectional study by Braithwaite et al, (2001) among 860 adolescents' detainees in Atlanta in the United States also recorded similar results among those with body piercing and those without. Cross-sectional survey by Carroll, Ri□enburgh and Roberts (2002) on risk behavior and tattooing among adolescents documented that teenagers who engage in tattooing or body piercing were significantly more 11 likely to get involved in other high risk behaviors such as drug use, unprotected sex, and suicides

than non-participants. The contribution of sexual intercourse to the transmission of HBV is dicey depending on the context. While in most developing countries, unprotected sex with the opposite sex by sexually active adolescents has been found to be the major source of transmission of infectious diseases and viral diseases, their counterparts in the developed world are noted for men having sex with men or women with women. This notwithstanding, the role of heterosexual intercourse in these settings in the spread of hepatitis cannot be overemphasized. The contribution of heterosexual sex in the spread of HBV has well been documented and reported with increasing frequency as confirmed by a study conducted in the United States in 1988 which reported that heterosexual transmission of HBV infection accounted for all reported cases of hepatitis B in the United States (Alter et al, 1990). Additionally, the risk of contracting any viral infections by blood transfusion of screened blood largely depends on the use of donated blood during the window period, where the antibodies were not easily detectable either because their production has not yet started or antibody levels are so low that the test system could not detect them. In 2002, an epidemic erupted in the West Nile where HBV was detected for the □rst time after a successful screening and transplanting exercise (CDC, 2002). A similar study conducted in Kumasi, Ghana to assess the risk of hepatitis B virus infection by transfusion revealed that recipients of screened blood less than 10 years of age had 1:11 ratio chance of contracting HBV even after screening. This was attributed to the underestimated risks of infection as well as the poorly conducted manner in which screening test was done (Allain et al, 2003). Dobson et al (1995) in a study on modes of HBV preventions have suggested that due to the difficulties involved in getting teenagers to enter the clinics for preventive health measures, school-based HBV vaccination programs should be resorted to because of their effectiveness proven so far. The above practices engaged in by adolescents mostly expose them to a lot of infectious diseases which hepatitis is not an exception. A report from the USA on Health Care Worker's attitudes towards vaccination found that they are reluctant to be vaccinated, as they fear plasma-derived vaccine as it contains attenuated HBV virus (Twitchell, 2003). However many studies have found a positive correlation between increased knowledge and up- take of HBV vaccination. For example, studies in Nigeria, Spain, and Taiwan found that most vaccinated nurses and dental students acquired knowledge of HBV from their nursing degree and from working in high-risk areas that expose them to HBV (Hu et al., 2004). Contrary to these findings, a study that was conducted in the UK on nurses' reports that nurses did not finish their vaccination schedule despite having studied a course on vaccination, and midwives who were not immunized showed lack of awareness of the existence of the vaccine (Lee, Carrilo and Flemming 2009). In a study that was conducted in Saudi Ara- bia, low immunization uptake was identified among dental sta□ despite their knowledge and availability of the vaccine (Stein et al., 2006). In Slonim et 12 al (2005) study, carried out in the U.S., 96 adolescents were individually inter- viewed and 17063 adolescents and young adults filled in a 20 questionnaire. The participants were European-Americans, African-Americans, multiracial, Native Americans, Asian and Pacific Islanders, and other races. The study showed that the most common barrier to hepatitis B vaccine acceptance was that the adolescents did not like getting shots (94%) and time-related barriers (50%), as they had to come back two more times to the clinic to get the remaining doses of vaccine. Almost two-thirds of the adolescents that were interviewed could not provide any correct information before their clinic visit about hepatitis B. In a study (Nguyen et al., 2010) carried out in the U.S. among Vietnamese- Americans, 1704 respondents participated in a computer-assisted

telephone interviewing survey. The interviews included questions about knowledge, beliefs and communication regarding HBV testing. The study showed that 17.7% re- ported a family history of hepatitis B and 61.6% had been tested for hepatitis B. Only 26.5% reported that they had been vaccinated against HBV, which was disappointingly low. Studies conducted in Iran and Egypt found high uptake of free vaccine among young surgeons (Allam, Helmy and Lucena 2003; Moghini et al., 2007). In Sweden despite the availability of free vaccine seventy six per- cent heath care workers were not vaccinate, they either forgot or never made appointment for vaccination (Dannetun et al., 2006). Study in Nigeria found that only twelve percent of the unvaccinated respondents could not afford the vaccine (Adebamowo et al., 1998). 2.4 Factors Influencing People's Attitudes towards Hepatitis B Virus Infection Hepatitis B (HB) is a serious blood born infection that affects the liver and caused by hepatitis B virus (HBV). It is infectious and the most common cause of chronic hepatitis, liver cirrhosis and hepato-cellular carcinoma (World Health Organization, 2011). Hepatitis B is a very important public health problem affecting almost 10% of the world population (Park and Park, 2007). According to 2009 WHO report, about 2 billon people are affected with HB worldwide, more than 350 million suffered from chronic lifelong infection and, more than one million of individuals die because of cirrhosis and liver cancer every year (Deisenhammer et al 2007) In a study made in Singapore (Tan et al., 2005) the authors looked into the health- seeking behaviours of those infected with HBV by interviewing 39 HBV infected individuals. Those who had a family member that had had HBV-related liver disease or had liver abnormality themselves, were more likely to seek help. They wanted to know if their own livers were functioning normally, but were at the same time reluctant to □nd out the results of a test, in fear of it. The authors concluded that the low compliance to follow-up among the patients was partly due to a widespread perception that there was no efficient treatment to the disease. Many patients preferred traditional medication such as herbs instead of western medication, which was perceived not to be as effective (Tan et al., 2005). 13 In a study by Mohammed et al (2012), knowledge, attitudes and practices among 483 chronically HBV infected people in Malaysia was investigated. The study showed that more than half of the participants felt worried about the diagnosis and 19 felt anxious about spreading the HBV infection to family and friends. A third of the participants felt embarrassed to make their diagnosis public. About 11.6% reported that they would not tell their doctor or dentist about being HBV positive, while most of them would tell their family and friends. Many of the participants had changed their life-style habits after receiving the HBV diagnosis. A majority of those who had smoked and drunk alcohol reduced their intake-level and about half of the participants made healthier food choices and increased their daily exercise level. A large increment about encouraging family members to be screened for HBV was also noticed after receiving the HBV diagnosis (Muhammed, 2010). The threat posed by the global HBV epidemic continues to assume alarming proportions in areas of public health and national development. Globally, two billion people have been infected with HBV at some point in time in their life time and 360 to 400 million people which represents more than 5% of the world's population are chronic carriers with an estimated 600,000 deaths each year due to consequences of HBV. It is estimated to be the tenth cause of deaths worldwide (WHO, 2008). Hepatitis B virus mostly affects the liver and can cause liver cancer. The disease is 50 to 100 times more infectious than the deadly human immune-deficiency virus (HIV) and can remain on an untreated part of the body for close to seven days (Hepatitis Foundation International, 2006). The incidence of acute

hepatitis B varies greatly from country to country as a result of insufficient reliable data and comparisons between countries is often difficult due to different reporting systems with limited quality (Grob, 1995). The WHO has therefore demarcated the world according to chronic hepatitis B prevalence into three major blocks which include high, intermediate and low prevalence. High prevalence areas have a prevalence of chronic hepatitis B infection that is equal to or greater than eight (8%) made up of countries from North America, South America, Sub-Saharan Africa and most Asian countries. Intermediate prevalence areas have a prevalence rate which ranges between 2% and 7% and include countries from South America, North Africa, Western Europe, Eastern Europe and the Indian subcontinent. Low prevalence areas are estimated to have a prevalence of chronic infection less than (2%) which includes most of the North American countries, Australia and most of Western Europe including the United Kingdom (UK). Hepatitis B transmission route varies ac- cording to the prevalence rate of the virus. Countries with very high prevalence rate usually have vertical transmission as the main route of transmission which is mostly found during childhood. Countries with intermediate prevalence rates normally have horizontal transmission as its major route where the disease is transmitted through sexual contact or through injecting of drugs. In countries with low prevalence rates such as the United Kingdom, the epidemic is mostly acquired during adulthood through sexual intercourse or injecting of drugs. 14 According to the National Institute for Health and clinical Excellence (2006), chronic hepatitis infection can be treated in high income countries with the combination of drugs and that people with severe liver cases are given liver transplants as well as surgery and chemotherapy for liver cancer patients to prolong their lives. These options are unfortunately unavailable to those in low income countries due to the expensive nature of these treatments. Hence the only option for them is to stick to the saying that, “prevention is better than cure” through the use of vaccine. The WHO (2006) reported that hepatitis B vaccine has an excellent record of safety and effectiveness with over one billion doses used worldwide since 1982 and that it has a 95% capacity to prevent children and adults from contracting chronic infection if they are not already infected with the disease. Completion of the hepatitis B vaccination series is the safest and the most effective way of protecting against hepatitis B. The World Health Organization has targeted hepatitis B as one of eight infectious diseases that should be controlled through vaccination efforts. For the purpose of propagating this agenda the WHO in 1991 instructed all countries to incorporate hepatitis B vaccination into their national vaccination programs. But as of 2006, only 164 countries have acted according to the directive with most countries coming from East and South East Asia, the Pacific, Islands, Australia, Western Europe and the Middle East (WHO, 2006). Africa, the second largest continent in the world covers 3,030,000 km2 of land i.e. one-fifth of the global land area. Despite the fact that it is sparsely populated with an estimated 800 million inhabitants, it accounts for 12% of the world’s population. Although, the high prevalence of infectious HBV has been well documented worldwide in well-equipped correctional facilities, such information on the exact prevalence of the deadly disease has been so sparse in Africa. This could be attributed to underreporting and ineffective data collection strategies in the continent. However, from the few data available, it is estimated that out of the 360 million chronic global carriers of HBV, about 65 million of these chronic carriers live in Africa (WHO, 2004). In addition, of the estimated 1.3 million deaths recorded annually due to HBV related causes, about 250,000 come from Africa (Kew, 1992). Study indicates that those who believe in HBV-related myths and misconceptions are less likely

to be vaccinated. Misconceptions about HBV infection, screening, or vaccination may impede attitudes and behaviors related to HBV prevention. Common misconceptions include belief that HBV screening tests can be harmful or that hepatitis B is not treatable, inadequate knowledge of the detrimental health effects of hepatitis B (such as liver damage), and belief that hepatitis B is caused by smoking tobacco. Efforts are needed to correct misconceptions, raise awareness of the severity of HBV, and promote HBV screening and vaccination among communities. Study suggests that HBV awareness can translate directly into screening and vaccination, as participants who perceived chronic hepatitis B as more serious were more likely to have been screened for 15 the disease and more likely to report intention to vaccinate (Shepard, 2006; Levy, Nguyen and Nguyen, 2010; Choe, 2006). Social support from community members may have a significant impact on individual health decision-making behavior. Accordingly, among our study population, the majority of participants reported that they would be swayed by peer recommendations to screen or vaccinate and reported influence of peer recommendation to vaccinate was a significant factor in both prior vaccination behavior and future vaccination intent. That is, participants who reported being positively influenced by peer recommendations were more likely to follow (and intend to follow) good vacci- nation practice. Additionally, we found that perceived social approval of HBV vaccination and screening by doctors and family was positively associated with individual health behaviors. Peer and community-level efforts among the Vietnamese community have been effective in addressing cancer prevention, and our study indicates that similar approaches may be effective for HBV prevention as well (Hsu, 2007). Unlike human immune-deficiency virus (HIV), youths do not associate hepatitis infections with sexual activities. Youths are mostly at a stage where they can easily contract infection; however, no manifestation seems to reduce the fears of HBV among them. However, numerous activities of young females put them at risk; these activities include unprotected intercourse and multiple sexual relationships, manicure and pedicure, getting tattoos, undergoing beautification scarring and body and ear piercing, and coming in contact with blood specimens at the schools' science and medical laboratories (Meheus, 2000). HBV is 50 to 100 times more infectious than HIV and is a major occupational risk for physicians, surgeons and serious problem of public health and a major cause of morbidity and mortality especially in developing countries (Adoga, et al. 2010 & WHO, 2000). However, the incidence of HBV infection can be reduced by giving proper education regarding its transmission and immunization to public, all healthcare workers (HCWs) and students. Although vaccines against HBV infection are available since 1982 and are shown to be 95% effective in preventing infection, still a dearth of adequate knowledge of Hepatitis B infection and vaccine exists. (Misra B et al l. 2009 & Bhaumik, Choudhury and Sinha, 2011).Thus, an emphatic awareness and immunization programme can be helpful to reduce the further progression of this disease. HBV is contagious and easy to be transmitted from one infected individual to another by blood to blood contact, mother to child, unprotected sexual in- tercourse, sharing of eating utensils and other barber shop and beauty salon equipment (Yayehyirad et al., 2007). The main transmission routes include pre- natal infection, skin and mucous membrane infections caused by contaminated blood or body, sexual contacts and injection drug abuser. In addition, tattooing, ear piercing, acupuncture, dialysis, and even using a syringe can be the source of infection. In volunteer blood donors, the prevalence of anti HB reflection ranges from 5–10%. But the prevalence is higher in lower socio-economic status, older age group and those persons exposed to blood products (Burnett, 2013; Muhammad,

2010). Prevalence of infection, modes of transmission and 16 human behavior conspire to geographically different epidemiologic patterns of HB infection (Ayola and Adelaja, 1986). The practice of modern medicine have contributed a lot in the increase of the case and spreading of blood born diseases like Human immune deficiency virus and HBV due to lapse in the sterilization technique of instruments and improper hospital waste management as 10 to 20% health care waste is regarded hazardous (Taneja and Biswal, 2009). Prevention against any disease is proportional to knowledge, attitude and practice (KAP) of the population and reflection of the importance that is paid to health related issue by the society. Health care workers should familiarize themselves with "universal precautions", which is defined by Center for Disease Control, as a set of precautions designed to prevent transmission of Human immune-deficiency virus (HIV), HBV, and other blood-borne pathogens when providing □rst aid or health care. Under universal precautions, blood and certain body fluids of all patients are considered potentially infectious for HIV, HBV and other blood borne pathogens (Johnson, 1992). Vaccination gives long term protection from HB infection, possibly life-long. KAP surveys are representative of a specific population to collect information on what is known, believed and done about a particular topic, and are the most often used study tool in health-seeking behavior research (World Health Organization, 2008). Knowledge is usually assessed to see how far community knowledge corresponds to biomedical concepts (Good, 1994). Practices in KAP surveys usually inquire about preventive measures or different health care options. Normally, hypothetical questions are asked, so it permits statements about actual practices, rather, it yields information on people's behaviors or on what they know should be done (Yoder, 1997). 2.5 Behaviour towards Hepatitis B Virus Infection Screening of blood and blood products contributes to the reduction of trans- mission of HBV for patients. For example, in the USA the routine screening of donor blood for HBV reduced post transfusion HBV by a third (Yap, 1990). Those who regularly use such products such as haemophiliacs, who use factor VIII, are also encouraged to be vaccinated to prevent HBV infection, as an additional safety measure since the current testing for HBV does not guarantee 100% safety of these products (Yap, 1990). The safety of blood and blood products largely depends on the quality of laboratory testing. This means quality of testing in terms of the policies and protocols, markers of HBV screened for, and training and qualifications of personnel have to be of the highest standard (Yap, 1990). The World Health Organization (WHO) recommends that blood and blood products should be screened for at least the HIV, HBV, HCV and syphilis as a minimum requirement (Klein et al, 2007). Worldwide 148 countries provided WHO with their data for screening blood, and 41 of these indicated that they couldn't screen all the donated blood for one or more of the recommended pathogens (Klein et al, 2007). The report indicated that out of the 40 countries in sub-Saharan Africa, 28 had not yet implemented national quality systems that 17 need to be in place for effective screening of blood and blood products (Klein et al, 2007). It is important to have a fully implemented national policy of screening all blood donations for HBV. Of the literature consulted only Kenya, South Africa, Tanzania, Zambia and Zimbabwe are reported to have such policies (Mphahlele et al, 2002). It is estimated that 3-22% of blood donors in sub- Saharan Africa are chronic carriers of HBV therefore screening of blood and blood products is critical to prevent infection of the recipients of these products (Allain et al, 2003). The WHO estimates that not more than 50% of blood donated in sub- Saharan Africa is screened for HBsAg (Allain et al, 2003). This is partly because screening is not perceived to be of primary importance

or cost e□ective in some African countries since 50% of blood donors and recipients have had natural exposure to HBV, thus most donors are thought to not be infectious, and most recipients are thought to not be susceptible (Allain et al, 2003). Lack of funds is another contributory factor (Allain et al, 2003). According to WHO, lack of effective screening results in 16 million new cases of HBV annually in the whole world (Klein et al, 2007). In a recent study to assess the risk of transfusion-transmitted infections in sub-Saharan Africa it was found that even if the transfusion requirements recommended by WHO were met, transfusions alone would be responsible for 28 595 HBV infections annually in sub-Saharan Africa (Jayaraman et al, 2010). Some African countries including Botswana screen for HBV using HBsAg only. Detection of anti-HBc is considered by some of these countries to be of limited value since HBsAg appears first and disappears in most non- infectious cases. So for them it appears to serve a diagnostic purpose only, with little regard for the prognosis. However during resolution of infection and occult HB, HBsAg may decline to undetectable levels but the donor in both instances may be potentially infectious (WHO, 2010). Occult HBV infection is defined as the detection of HBV DNA without HBsAg, with or without the presence of HBV antibodies outside the acute phase window period (Allain et al, 2004). It has also been demonstrated that occult HB donors with anti-HBs or anti-HBc are infectious in immuno-compromised organ or bone marrow transplant patients (Allain et al, 2004). It is of value to test for anti-HBc in such situations, but it would be also necessary to distinguish between non-infectious individuals who have resolved their infections naturally and those who are potentially infectious. Because of the high cost of testing for circulating HBV DNA, it is recommended to test for a substantial amount of anti-HBs since these antibodies confer immunity to the individual. A minimum of 100mIU/ml is considered essential to guarantee safety of blood and blood products (WHO, 2010). Ideally African countries should be testing for HBsAg, anti-HBc and anti-HBs to reduce the cases of post transfusion HB (Rabenau et al, 1996). Even though HBV has become a major source of health concern worldwide, 18 we should also be reminded by the good news that it is the only STD that can be prevented by vaccination (CDC, 2002).The prevention of HBV globally has become one of the topmost priorities of major political actors and decision makers in recent years. The disease is prevented by the use of safe and effective vaccine which became available in 1982 through funding and implementation of hepatitis B immunization programs. Measures for HBV prevention have been geared towards avoidance of unsafe blood exposure or blocking of transmission before the advent of the vaccine. Unsafe blood transfusion has been a major force in the transmission of HBV globally (Wang & Wong, 1960). The enactment of a law for the donation and management of blood in blood banks across the world has aggressively fought this channel of HBV transmission. This notwithstanding, current researches have showed that blood transfusion is regaining its position as one of the major risk factors for HBV transmission glob- ally. This finding is attributed to the presence of occult HBV infection (OHBVI) among blood donors (Shang et al, 2007). It is also worth mentioning that the global acceptance of the auto-disposable syringes (ADS) has considerably reduced the incidence of HBV infections that occur due to unsafe injections. Also, as a result of the extensive use of invasive medical procedures, iatrogenic HBV infections are no longer frequent. There have also been speculations that dental care operations which are capable of causing oral mucous membrane injuries is becoming a major route to HBV transmission if steps are not taken to prevent it (Zhang et al, 2008). HBV per se does not have a permanent treatment; therefore the surest antidote to the

global epidemic is prevention. There has not been any universal agreement on drugs used for the temporary treatment of the HBV in the world even though two therapeutic agents such as interferon-alpha (IFNa) and lamivudine are currently used by many countries for the treatment of the disease. Interferon- alpha is a potent cytokine with antiviral and immune-modulating actions which is produced in response to viral infection (Sen & Ransoho□, 1993). Temporary treatment of the disease is therefore aimed at suppressing viral replication, reducing the risk of progressing to advanced liver disease or inflammation of the liver and the development of complications such as liver failure or liver cancer. Chronic hepatitis B is therefore easily managed rather than treated. Some of the general management strategies for HBV recommended by medical experts include; Avoidance of: 1. Heavy alcohol consumption. 2. Unprotected sexual intercourse with partners who are not vaccinated. 3. Sharing of needles or other items that potentially contain blood such as shavers or toothbrushes 4. Donation of blood or organs 19 5. Screening of family members and sexual partners for HBV infection and vaccination of those who are sero-negative 3. Patient education and long-term follow-up with regular testing of liver bio- chemistry and surveillance of hepatocellular.

FINDINGS

A total of 392 HCWs who are employees of the UCTH and GHC were recruited into the study with ages ranging between 19 and 64 years and the mean age being 38.66 ± 9.50 years [Table 1]. Most of the respondents were within the age group of 25–34 years (30.4%) followed by the age group of 35–44 years (29.1%), 45–54 years (21.4%), 55–64 years(4.8%), and 15–24 years(4.3%), respectively.

More of the HCWs were females (66.6%) while 33.4% were males. The majority of them had tertiary education (91.1%), while others had secondary (5.6%) and primary education (2.0%). The majority of the respondents(64.3%) were married, followed by those that were single (31.4%). Others were widowed (2.0%) or separated (1.3%). Most of the HCWs were from the southern senatorial district in CRS (73.2%), while the rest were from central (16.3%) and northern (3.8%) senatorial districts. Only 2.3% of the HCWs(2.3%) were not from CRS.

The predominant religion practiced by the respondents was Christianity (95.7%) while the rest practiced Islam (0.8%) and other(0.5%) religions. Hepatitis B vaccination status among health-care workers Out of the 392 HCWs interviewed about their vaccination status, 385 (98.2%) of them responded but 7 (1.8%) did not.

Among the 385 HCWs, who responded to questions about their vaccination
status, 242 (62.9%) had received at least one dose of HBV vaccination while the remaining 143 (37.1%) had never been vaccinated before as shown Figure 1.

In the same vein, among the 242 HCWs that were vaccinated against HBV, only 43.2% of them have been fully vaccinated (i.e., received 3 doses of vaccine) while the rest of them only received either 2 doses(24.8%) or just 1 dose (31.8%) of HBV vaccine as shown in Figure 2. Knowledge of hepatitis B virus infection among health-care workers

The mean aggregate knowledge score among the study participants was found to be 30.46 ± 6.04 which is approximately equivalent to 72.5%. Given that an aggregate score of 70% and above was considered adequate while an aggregate score below 70% was considered inadequate, 67.9% of the respondents were found to have adequate knowledge about HBV vaccination and infection while 32.1% of them were found to have inadequate knowledge as shown in Table 2.

Barriers to assessing optimal hepatitis B virus vaccination among health-care workers As shown in Figure 3, out of a total of 205 (52.3%) HCWs that responded to questions on why they could not achieve optimal vaccination status, 38.3% reported difficulty in accessing vaccination services, 28.3% said it was due to lack of information while 22.4% claimed it was because of time constraint. Other reasons given by the rest of the respondents were high cost of getting vaccinated (7.3%), fear of vaccine safety (2.9%), and other reasons (0.5%).

History of occupational exposure among health care workers Out of the 390 HCWs that responded to the question regarding occupational exposure at the workplace, 264 (67.7%) admitted to occupational exposure, whereas 126 (32.3%) had no such experience, [Figure 4]. Using Chi-square test of association as shown in Table 3, doctors had the highest rate of occupational exposure at the workplace and this association was found to be statistically significant ($P \leq 0.005$).

Factors affecting optimal hepatitis B virus vaccination status among health-care workers The relationship between optimal vaccination status and important socio-demographic factors (age group, sex, level of education, category of HCWs, place of origin, and marital status) as well as knowledge of HBV was explored using Chi-square test of association.

As shown in Table 4, a significant association was found between age group ($P = 0.028$), educational level ($P = 0.003$), place of origin ($P = 0.005$), category of health worker ($P = 0.005$), knowledge of HBV, and HBV vaccination status ($P = 0.005$). However, sex ($P = 0.204$) and marital status ($P = 0.270$) were not significantly associated with HBV vaccination status.

A binary logistic regression was thereafter then performed to assess the association of the significant socio-demographic factors and knowledge of HBV on optimal vaccination status. As shown in Table 5, only two of the independent variables (category of HCWs and knowledge of HBV) made a unique contribution to the model out of the five independent variables.

It was shown that the odds of reporting optimal vaccination status among doctors were 4.7 times the odd of having optimal vaccination among other HCWs, respectively.

Furthermore, it was shown that the odds of reporting optimal vaccination status among HCWs with adequate HBV knowledge was 2.2 times more compared to the odd of reporting same among HCWs with inadequate HBV knowledge.

RECOMMENDATIONS

Based on the findings of this study, these are the recommendations:

1. The healthcare workers should make hepatitis vaccination a compulsory requirement in the practice of the different professions within the health industry.
2. The communities should work out their own strategy on ways of preventing the spread of hepatitis B virus infection from patients to healthcare workers and vise versa in the society.
3. Effective health education campaigns should be provided to elucidate the risk factors of hepatitis B virus infection to the healthcare workers and general public at large.
4. Furthermore, public awareness on the importance of hepatitis b vaccination should be intensified using mass media to give healthcare workers access to comprehensive information on hepatitis B virus infection.

5. Enough, information and education should be provided to improve their knowledge through the use of leaflets, handbills, posters and the media on hepatitis B virus infection

CONCLUSION

HBV infection among HCWs is of particular concern given its high transmissibility relative to other blood-borne viruses, including documented transmissions from infected HCW to patient. Fortunately, instances of HCW-to-patient transmission of HBV have been relatively rare and have substantially decreased in frequency over the past four decades, presumably due to more vigilant screening and vaccination of HCWs, the use of universal precautions and double-gloving during EPPs, and formal recommendations from governing bodies on the appropriate restrictions of practice of infected HCWs. Our review of the published cases of HCW-to-patient transmission of HBV provides historical data for these formal recommendations. Our review also highlights the differences between recommendations for management of HBV-infected HCWs by various governing bodies, though a common feature is that no governing body uniformly prohibits the practice of EPPs by an HBV-infected HCW. While HBV is highly transmissible through parenteral and mucous membrane exposures, the formal recommendations set forth by the various governing bodies discussed above have helped to codify the manner in which we manage HBV-infected HCWs, thus reducing the risk of transmission to patients while balancing the need to protect the private health information of HCWs and their ability to continue to perform the work for which they are trained to do.

CONSENT FOR PUBLICATION

AVAILABILITY OF DATA AND MATERIALS

The data and materials associated with this research will be made available by the corresponding author upon reasonable request.

COMPETING INTERESTS

There are no competing interests in this research work from the authors.

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CONTRIBUTION TO EXISTING KNOWLEDGE

This thesis adds to the existing literature in the field of public health and medicine. It also reveal the knowledge, perception and practice of hepatitis B vaccination among health workers in Calabar, Nigeria.

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