Knowledge, attitudes and practices of health care workers regarding hepatitis B vaccination, in the Ekurhuleni Metro, Gauteng Province.

By

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DECLARATION

I, Patricia N. Africa, declare that this dissertation is my work. It is being submitted for the degree of Master of Public Health in the University of Limpopo, Medunsa Campus.

It has not been submitted before for any degree or any examination at this or any other University.

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Signature of candidate

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Date

The work presented in this dissertation was undertaken in the School of Public Health, Faculty of Health Sciences, University of Limpopo, Medunsa Campus.

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LIST OF ABBREVIATIONS

Anti-HBs: Hepatitis B surface antibody

Anti-HBc: Hepatitis B core antibody

AIDS: Acquired immunodeficiency syndrome

BBV: Blood-borne viruses

CDC: Centers for Disease Control

DNA: Deoxyribonucleic acid

DTP: Diphtheria, tetanus and pertussis

EPI-SA: Expanded Programme on Immunisation-South Africa

FDA: Food and Drug Administration

HAV: Hepatitis A virus

HBV: Hepatitis B virus

HCV: Hepatitis C virus

HBeAg: Hepatitis B endogenous antigen

HBIG: HBV immune globulin

HBsAg: Hepatitis B surface antigen

HCW: Health care worker

HEI: Higher Educational Institutions

Hib: Haemophilus influenza type b

HIV: Human immunodeficiency virus

IV: Intravenous

NDoH: National Department of Health

PCR: Polymerase chain reaction

PEP: Post exposure prophylaxis

NSI: Needle sticks injury

PHC: Primary hepatocellular carcinoma

SAVIC: South African Vaccination and Immunisation Centre

SHEA: Society for Healthcare Epidemiology of America

WHO: World Health Organisation

LIST OF OPERATIONAL DEFINITIONS

Hepatitis B: A liver disease caused by the hepatitis B virus (HBV)

Acute hepatitis B: A new symptomatic HBV infection. Clinical symptoms and signs can include anorexia, malaise, nausea, vomiting, abdominal pains, and jaundice. Extra hepatic manifestations of the disease can also occur.

Antibody to hepatitis B surface antigen (anti-HBs): A positive result for this test means you have antibodies to HBV, and are protected against HBV. This may be due to a prior HBV infection from which one has recovered, or one may already have been vaccinated.

Antibody to hepatitis B core antigen (anti-HBc): A positive result for this test means you have been infected by HBV, either in the past or at present.

Blood borne virus: A viral infection that can be spread by contact with infected blood. The pathogens of primary concern are HIV, HBV, HCV and viral haemorrhagic fevers.

Chronic HBV infection: Carriage of HBsAg for longer than 6 months

Epitopes: Also known as antigenic determinant; it is the part of a molecule that is recognised by the immune system, specifically by antibodies, B cells, or T cells

Genotype: It is an organism's full hereditary information, even if not expressed. The genotype represents its exact genetic make-up i.e. the particular set of genes it possesses

HBV carrier: A person with chronic HBV infection. The patient is potentially infectious, but may have no symptoms and no abnormalities on laboratory testing, or may have overt hepatitis or advanced liver disease.

HBV Serological marker: Antigens and antibodies associated with HBV infection include HBsAg and antibody to HBsAg (anti-HBs), anti-HBc, HBeAg and anti-HBe. At least one serologic marker is present during each of the different phases of HBV infection. They are typically used to differentiate between acute, resolving, and chronic infection.

Hepatitis B surface antigen (HBsAg): The outer surface of the virus. Testing positive for this antigen means you can easily pass the virus to others.

Icterus: Also known as jaundice, means a yellow pigment which is found in the blood and tissues. Any disease that causes destruction of liver cells or causes bile to become trapped in the liver can cause icterus, resulting in icteric disease

Immune-competent: An individual with a fully functional immune system

Immune-compromised: An individual with an improperly functioning immune system; a state in which the immune system's ability to fight infectious disease is compromised or entirely absent

Liver cirrhosis: A consequence of chronic liver disease characterised by replacement of liver tissue by fibrous scar tissue as well as regenerative nodules, leading to progressive loss of liver function.

Non-responder: A person who does not produce a protective antibody response to a primary 3-dose vaccine series, with anti-HBs concentrations of <10mIU/ml measured 1 month after the last dose.

Phenotype: It is an organism's actual observed properties, such as morphology, development, or behaviour

Primary Hepatocellular carcinoma: A fatal malignancy of the liver most closely linked to chronic hepatitis B virus infection and liver cirrhosis.

Responder: A person who produces a protective antibody response to a primary 3-dose vaccine series, with anti-HBs concentrations of ≥10mIU/ml measured 1 month after the last dose.

Serotype: Is a group of micro organisms or viruses classified together based on their cell surface antigens. Serotypes allow the epidemiologic classification of organisms to the sub-species level

Universal precautions: They are deliberate actions taken in health care settings to prevent the transmission of certain pathogens (especially BBV) from patient to patient, from patient to HCW and from HCW to patient

ABSTRACT

Introduction: Hepatitis B is a serious liver disease caused by the hepatitis B virus (HBV), with an estimated 360 million chronic infections worldwide, about a million of which die each year from chronic liver diseases. In South Africa (SA) over 50% of the population has been infected by HBV, and at least 3 million people are chronic HBV carriers. Chronic HBV carriers have the potential of transmitting HBV parenterally in the hospital setting, thus health care workers (HCWs) are at risk of contracting HBV, with the most likely exposure being via a needle stick injury (NSI). There is an effective vaccine against HBV which is recommended by the SA Department of Health, yet previous studies have shown that most HCWs are not vaccinated.

Aim and objectives: The study aimed to investigate the knowledge, attitudes and practices regarding hepatitis B vaccination amongst HCWs in the Ekurhuleni Metro. Objectives were to determine: (1) the level of knowledge of HCWs about vaccination against HBV; (2) the attitudes of HCWs towards vaccination against HBV; (3) the practices of HCWs regarding HBV prevention and (4) the barriers to / predictors for effective HBV vaccination among HCWs at Ekurhuleni Metro

Materials and Methods: This was a cross-sectional descriptive study which made use of a self-administered questionnaire that was sent to Ekurhuleni nurses and doctors who were working in 3 public hospitals, 7 district clinics, and 110 general practices.

Results: Two hundred and fifteen questionnaires were distributed and 161 were returned giving an overall response rate of 74.9%. HCWs do not report their NSI; over a third [37.6% (41/81)] always reported the NSI; while 72% (116/161) of HCWs had been vaccinated, only 61.2% (71/116) of those vaccinated had received all 3 doses of the vaccine.

For knowledge of HBV vaccination, 66.5% (107/161) scored poor; 31.7% (51/161) scored moderate; and 1.8% (3/161) scored high. For attitudes towards HBV vaccination, 0.6% (1/160) scored negative; 24.4% (39/160) scored neutral; and 74.5% (120/160) scored positive. A positive attitude score was a significant predictor for being vaccinated (OR=1.13, p=0.007)

Conclusion: Guidelines should be put in place to increase vaccination uptake and reduce the risk of exposure to HBV infection by HCWs.

CHAPTER 1 INTRODUCTION

1.1 Background

Hepatitis B is a disease caused by the hepatitis B virus (HBV), which is transmitted through percutaneous or mucosal exposure to infectious blood or body fluids (Center for Disease Control [CDC], 2006). It is a major problem because it can cause chronic infection, resulting in cirrhosis of the liver, liver cancer, liver failure, and death. In addition, several extra-hepatic lesions occur because of HBV infection, with this, there is deposition of immune complexes in different organs of the body especially, the kidney (Koff R, 1991). Persons with chronic infection also serve as the main reservoir for continued HBV transmission (CDC, 2006).

HBV accounts for an estimated 360 million chronic infections (World Health Organisation [WHO], 2006) with about a million who die each year from chronic liver diseases (South African Vaccination and Immunisation Centre [SAVIC], 2008). Most persons who become chronic carriers of the virus live in Asia and Africa (Breining Institute, 2006). These regions are said to be highly endemic for hepatitis B. In South Africa (SA), over 50% of the population have been infected by the virus, and at least 3 million people are chronic HBV carriers (SAVIC, 2008).

The major route of HBV transmission in sub-Saharan Africa is horizontal (i.e. transmission unrelated to recognised sexual, perinatal, or parenteral exposure) (Davies et al, 1989) in children under 5 years of age; however, percutaneous/ parenteral transmission is also an important mode of spread (Hollinger, 2001).

Health care workers (HCWs) may be exposed to the risk of infection with blood-borne viruses (BBVs) such as HBV, hepatitis C virus (HCV) and human immunodeficiency virus (HIV) via contact with blood (and other body fluids) in the course of their work (Kermode et al, 2005). The form of exposure most likely to result in occupational BBV infection is a needle stick injury (NSI).

HBV can be prevented by strict adherence to standard microbiological practices and techniques, and routine use of appropriate barrier precautions to prevent skin and mucous membrane exposure when handling blood and other body fluids of all patients in health care settings

(SAVIC, 2008). Following exposure to blood or body fluids, post-exposure prophylaxis can be administered as a combination of passive immunization with hepatitis B immunoglobulin (HBIG) and vaccination with the hepatitis B vaccine (SAVIC, 2008). However, the most cost-effective method to prevent and control hepatitis B is through pre-exposure vaccination (SAVIC, 2008).

It is important for HCWs to know their HBV status by being screened for the HBV surface antigen (HBsAg) and antibody (anti-HBs), and to be vaccinated against hepatitis B if found to be unprotected. This will protect them from being infected, and prevent them from spreading the virus which can infect patients. The vaccine has been found to be safe and effective, and can protect one for a lifetime (SAVIC, 2008). Education and prevention of infection with HBV should be emphasized, and all patients should be regarded as potential HBV carriers regardless of their medical history or condition.

1.2 Research Questions

1. What is the level of knowledge about hepatitis B immunization amongst HCW from Ekurhuleni Metro?
2. What attitudes do HCWs from Ekurhuleni Metro have towards hepatitis B vaccination?
3. What is the proportion of HCWs from Ekurhuleni Metro who have been vaccinated against HBV?
4. What are the barriers to / predictors for effective HBV vaccination among HCWs at Ekurhuleni

1.3 Study Aim and objectives

The study aims to investigate the knowledge, attitudes and practices (KAP) regarding hepatitis B vaccination amongst HCWs in the Ekurhuleni Metro

Objectives

- To identify the level of knowledge of HCWs about vaccination against HBV.
- To identify the attitudes of HCWs towards vaccination against HBV.

- To investigate the practices of HCWs regarding HBV prevention
- To identify the barriers to / predictors for effective HBV vaccination among HCWs at Ekurhuleni Metro

1.4 Rationale and problem statement

HBV is a priority occupationally acquired infection that is associated with serious public and personal health consequences, and is considered to be the most important cause of occupationally acquired viral hepatitis amongst HCWs. HCWs are at an increased risk for exposure to HBV when they come into contact with human blood products, or potentially infectious bodily fluids. The level of risk depends on the number of patients with the infection in the health care facility, the precautions the HCWs observe while dealing with these patients, and whether or not the HCW is successfully vaccinated against HBV.
A safe and effective vaccine against HBV is available throughout the world, yet many HCWs in resource-poor countries remain at risk because they are not vaccinated against HBV (Suckling et al, 2006).

This has been demonstrated in the study done at a Johannesburg hospital where a large number of HCWs were found to be not vaccinated (Vardas et al, 2002). This is because although the vaccine is recommended by the Dept of Health, it has not been made mandatory for HCWs in this country. Thus a personal choice is made by each HCW, and this choice depends on the knowledge and attitude that the HCW has, regarding vaccination against HBV.

CHAPTER 2 LITERATURE REVIEW

2.1 Aetiology of Viral Hepatitis

Viral hepatitis is a systemic illness which affects the liver predominantly by causing inflammation of liver cells. The illness results from infection by any of the hepatotropic viruses, namely HBV, hepatitis A virus (HAV), hepatitis C virus (HCV) and hepatitis D virus (HDV).

2.2 Epidemiology of HBV

2.2.1 Virology of HBV

The hepatitis B virus belongs to the *Hepadnaviridae* family (*hepa* from hepatotropic, and *dna* from the fact that its genetic material is made up of deoxyribonucleic acids [DNA]) (Zuckerman, 1996). Four open reading frames (ORFs) are encoded in the viral genome of HBV which is a partially double-stranded circular DNA genome with around 3200 base pairs. These ORFs produce the viral proteins C (core), P (polymerase), S (surface), and X (X protein) (Lau et al, 1993).

The following factors have a significant impact on the host antibodies that are produced by the different HBV proteins: age at which the host gets infected (Kew, 1996), the immune status of the host, and genetic factors such as the host's class II HLA genotype (Thursz et al, 1995)

Antibodies to the core antigen (anti-HBc) and to the endogenous antigen (anti-HBe) are the first to be produced after an attack by HBV. Anti-HBc persists indefinitely while anti-HBe vanishes after some time. Recovery is anticipated once the aforementioned antibodies appear, but the appearance of antibodies to the surface antigen (anti-HBs) confirms convalescence.

The virus is destroyed when the anti-HBs binds to the major neutralizing epitopes on the HBsAg. Life-long protection against HBV is provided after this. Thus, HBsAg is used in all HBV vaccines. A good response (i.e. $\geq$10 mIU/ml) will impart long-lasting immunity [Kane et al, 2000]. It is important to emphasize that adherence to licensed hepatitis B vaccination schedules

results in a protective concentration of anti-HBs that is 10 mIU/ml in 90-100% of healthy infants; children and adults (Shepard, 2006).

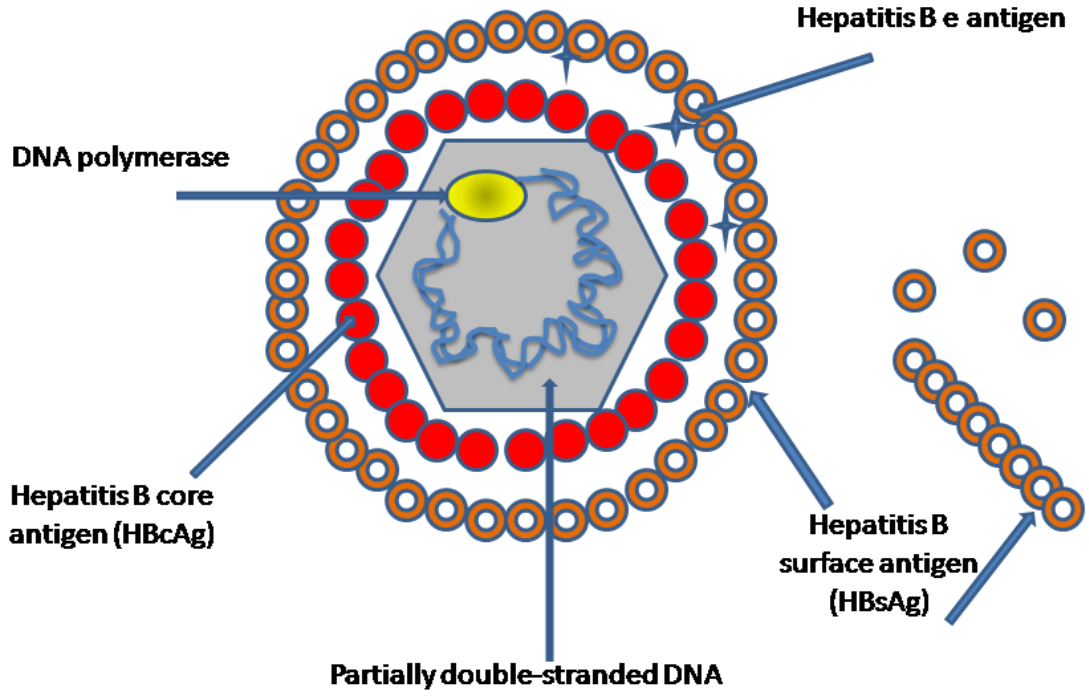

Figure 2.1: The Virus Particle (Wikipedia)

2.2.2 Transmission

The following are the routes of transmission: vertical (mother to child, which is mostly perinatal and rarely *in utero*), horizontal transmission in under 5 year-olds (mainly unexplained but thought to involve bites, lesions, and sanitary habits), and horizontal transmission in adult life (through sexual contact, and parenteral exposures, which include intravenous drug use, and exposure through medical procedures such as blood transfusions, and accidental exposures in the health care setting) (Custer, 2004).

There are marked geographic variations in the importance of these routes of transmission in relation to HBsAg seroprevalence, and the predominant mode of transmission in different areas

is strongly related to the degree of HBV endemicity. In highly endemic regions, disease transmission is commonly by exposure to chronically infected family members (including mother to child transmission and horizontal routes) (Ho-Hsiung et al, 2003)

Several studies have established that the transmission of HBV in sub-Saharan Africa occurs predominantly in early childhood, and is by the horizontal route rather than by perinatal transmission. There are different ways in which horizontal transmission is thought possible in this region, namely through saliva or traces of blood, as well as unsterile needles or tribal scarification (Kiire, 1996). There is low rate HBeAg positivity in women of child-bearing age in sub-Saharan Africa as compared to those found in South East Asia, which is why perinatal transmission is not a major route of transmission in the region (Kew, 1996).

Injecting drug use, sexual intercourse, and body piercing are the common routes by which HBV is acquired in low endemic countries (Shepard, 2006). Bites by bloodsucking vectors have not been proven to play a role in HBV transmission (Shepard, 2006)

2.2.3 Prevalence of HBV

The prevalence of chronic HBV infection in a given area is reflected by the primary method of transmission. The continental United States and Western Europe are the low prevalence areas in the world with less than 2% of the population that is chronically infected. Their primary method of transmission is drug abuse injection and engaging in unprotected sex. Despite this, there could be other methods present, though they are not as significant as the aforementioned (Redd et al, 2007).

Eastern Europe, Russia, and Japan, are regions of moderate prevalence, where 2-7% of the population is chronically infected, and all age groups are at risk. China, South East Asia, and sub-Saharan Africa are the high prevalence areas, where ≥8% of the population is chronically infected.

The HBsAg carrier rate in sub-Saharan Africa ranges from 9.6% in South Africa, to 20.6% in Zaire, while past exposure to HBV in adults ranges from 56.2% in Kenya to 91% in Senegal (Kiire, 1996)

The HBV prevalence in South Africa shows clear regional differences, with higher prevalence in rural areas as compared to urban areas. A study done in South Africa demonstrated a vast

difference in the carrier rate of HBV between children that were born in Soweto and those born in rural areas (1.1% versus 9.7-15%) and also a difference in women of childbearing age in the respective communities (2.7% versus 4.6-11%) This depicts a country with 'intermediate HBV endemicity and pockets of high endemicity' (Mphahlele et al, 2002)

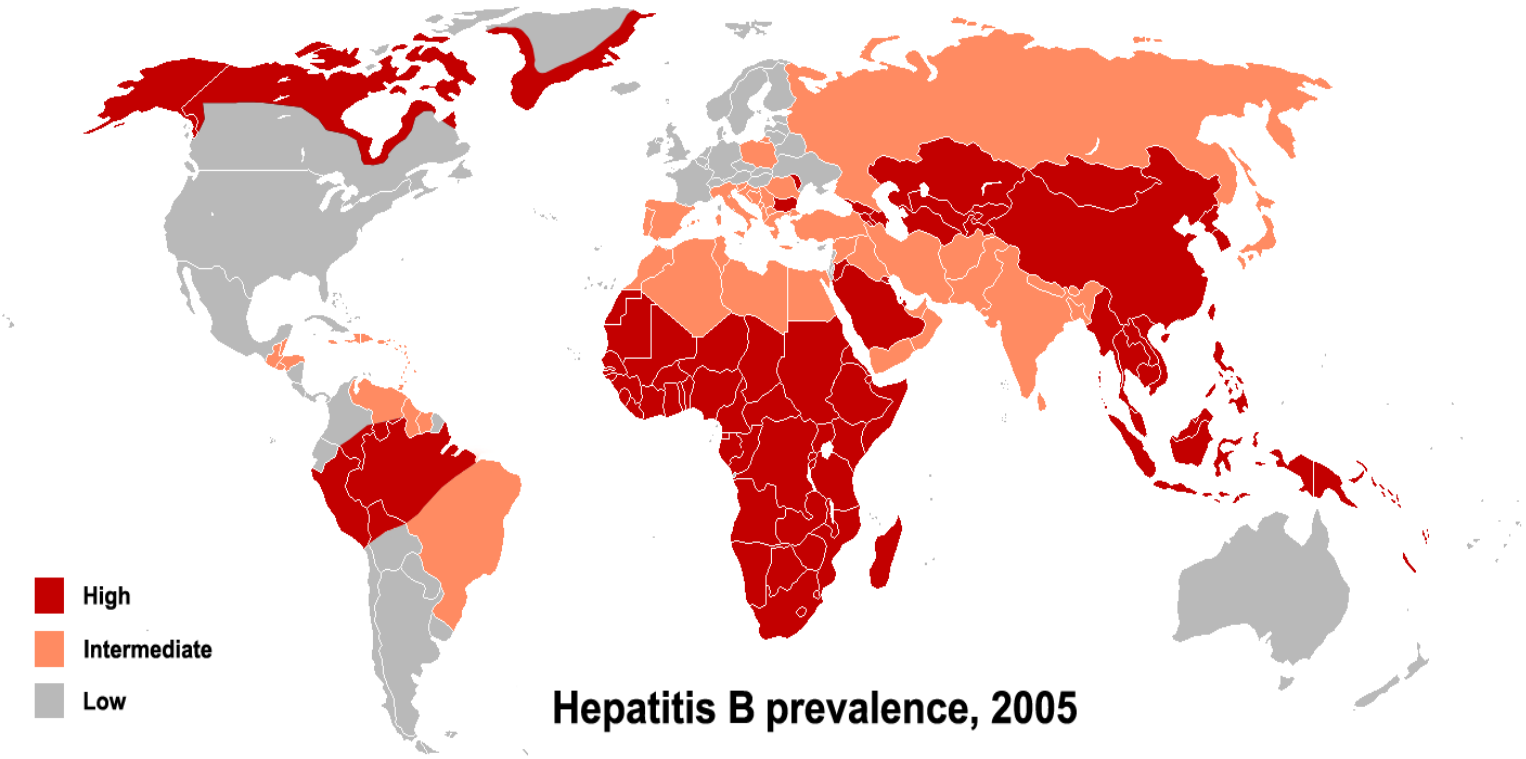

Figure 2.2: Hepatitis B Prevalence (Wikipedia)

2.2.4 Laboratory Diagnosis

2.2.4.1 Serological Markers:

Antigens and antibodies associated with HBV infection include HBsAg and antibody to HBsAg (anti-HBs), hepatitis B core antigen (HBcAg) and antibody to HBcAg (anti-HBc), and hepatitis

B e antigen (HBeAg) and antibody to HBeAg (anti-HBe). At least one serological marker is present during each of the different phases of HBV infection (Hoofnagle et al, 1991; Hollinger et al, 2001).

The serological markers typically used to differentiate between acute, resolving, and chronic infection are HBsAg, anti-HBc, and anti-HBs. (see Table 1.1). HBeAg and anti-HBe screening typically is used for the management of patients with chronic infection.

The presence of a confirmed HBsAg-positive result in serum indicates active HBV infection. All HBsAg-positive persons should be considered infectious. In newly infected persons, HBsAg is the only serological marker detected during the first 3 to 5 weeks after infection. The average time from exposure to detection of HBsAg is 30 days, ranging from 6-60 days (Hoofnagle et al, 1991).

In persons who recover from HBV infection, HBsAg is eliminated from the blood; anti-HBs develop within 3-4 months. The presence of anti-HBs indicates immunity from HBV infection. Persons who recover from natural infection will be positive for both anti-HBs and anti-HBc, whereas persons who respond to hepatitis B vaccine have only anti-HBs. Persons who become chronically infected, HBsAg and anti-HBc persist for life (McMahon et al, 2001).

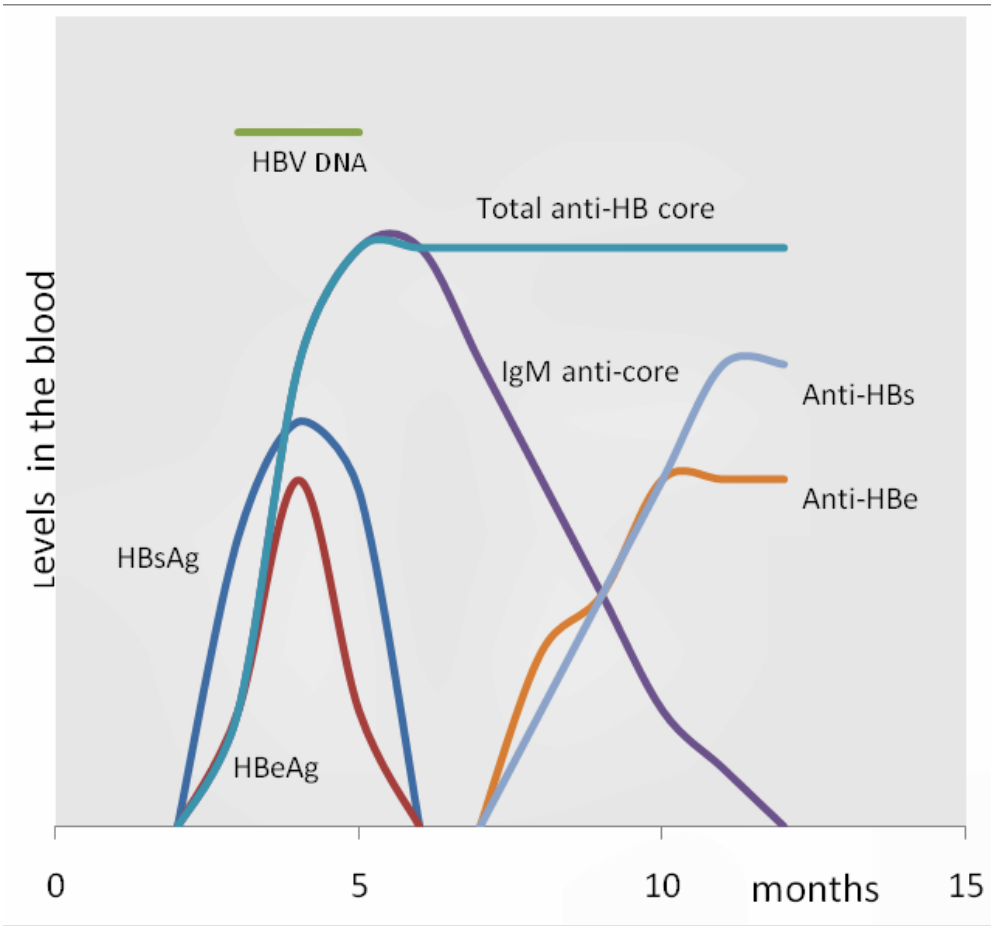

Figure 2. 3: Hepatitis B viral antigens and antibodies detectable in the blood following acute infection (Wikipedia)

2.2.4.2 Biochemical Tests:

Serum bilirubin levels are invariably elevated to peak levels of between 5 to 20 mg/dl in patients with typical icteric disease. Marked hyperbilirubinemia (serum bilirubin > 20mg/dl) suggests the presence of a more severe form of hepatitis, i.e., bridging hepatic necrosis, or acute hemolytic anemia complicating hepatitis in an individual with sickle cell anemia or glucose 6-phosphate dehydrogenase deficiency (Koff et al, 1980).

The serum transaminases, when measured serially, show a progressive rise beginning at the end of the prodromal period and reaching peak values of 500 to 5000I.U. within a few days. In patients with anicteric hepatitis, elevation of the serum transaminases may be the only indicator of liver disease. Serum alkaline phosphatase levels are near normal or mildly elevated and serum albumin levels are only slightly decreased. The prothrombin time may be slightly prolonged.

Marked prolongation of the prothrombin time suggests the presence of a more severe form of hepatitis (Koff et al, 1980).

2.2.5 Treatment

There is no specific treatment for acute hepatitis B. Care is aimed at maintaining comfort and adequate nutritional balance, including replacement of fluids that are lost from vomiting and diarrhoea (WHO, 2004).

There are few treatment options that exist if the condition progresses to chronic hepatitis B. Treatment can cost thousands of dollars per year and is not available to most patients in developing countries.

There are two main classes of treatment:

- Antivirals: These are aimed at suppressing or destroying HBV by interfering with viral replication (Mahoney, 1999)
- Immune modulators: They are aimed at helping the human immune system to mount a defense against the virus.

The following are the common drugs to treat chronic HBV infection (Mayo clinic, 2006)

1. Interferon: It assists in stimulating the body's immune response to HBV and helps prevent the virus from replicating in the cells. There are a few cases where interferon eliminates the virus completely, although the virus can later return. The major drawback is the number of side effects it has.
2. Lamivudine (Epivir-HBV): It is an antiviral medication that helps prevent HBV from replicating in the cells. It generally has minimal side effects during treatment.
3. Adefovir dipivoxil (Hepsera): It is a drug taken as a pill once a day like Lamivudine. Its major benefit is that it is effective in people who are resistant to Lamivudine. It also has minimal side effects during treatment.

4. Entecavir (Baraclude): Latest approved drug by the FDA in March 2005. It has minimal side effects during treatment and is also taken once a day.

When liver damage is severe, liver transplantation may be the only option, and it has varying success. Unfortunately, not enough donor organs are available for every person who needs a transplant.

Liver cancer is almost always fatal, and often develops in people at an age when they are most productive and have family responsibilities. In developing countries, most people with liver cancer die within months of diagnosis. In higher income countries, surgery and chemotherapy can prolong life for up to a few years in some patients.

2.2.6 Prevention and Control

2.2.6.1 General precautions in the health care setting

- **Screening of Blood Products**

There are other forms of prevention of hepatitis B infection that were used before the introduction of hepatitis B vaccines. These include the screening of blood donors, and methods for the preparation of plasma-derived products which render HBV to be ineffective.

- **Injection safety**

The WHO defines safe injection as one that does not injure the recipient, does not expose the HCW to any preventable risk, and does not result in any waste that is likely to cause great harm to the community (Simonsen, 1999).

Injections have become one of the frequently used procedures in health care. Patients go as far as requesting for them as they believe medication is received stronger and faster. Doctors prescribe them with the belief that it will satisfy the patient. Over 70% injections given in some instances in a health care setting are unnecessary or could have been given in an oral formula, as 9 out of 10 patients receive an injection (Simonsen, 1999)

There is no harm caused by a safe injection. Harm only results once safe control measures are not practiced, predisposing to severe infections. Harm results when syringes and needles are re-

used in the absence of sterilization as seen in some areas in developing countries. Unsafe injection use occurs when needles or syringes have been repeatedly used, a practice that often occurs in impoverished countries (Kermode, 2005).

Common practices that are seen in most countries that expose HCWs to BBVs is poor collection and disposal of dirty injections. There are several suggestions that have been made to prevent and limit sharps injuries among HCWs, for instance, health education for behaviour change (e.g. not recapping needles), introduction of barriers to protect the HCW, safe techniques and devices (e.g. needleless and self-sheathing equipment) and improved organizational factors (e.g. better staffing levels) (Mahfouz, 2009)

Not withstanding, unsafe injection practices are a powerful source to transmit blood-borne diseases, HBV. Because infection with these viruses initially presents no symptoms, it is a silent epidemic. However, the consequences of this are increasingly recognized as a global challenge. It is indicated that each year unsafe injections cause an estimated 1.3 million early deaths, a loss of 26 million years of life, and an annual burden of USD 600 million in direct medical costs (Miller, 1999). As a result, the WHO hosts and coordinates the Safe Injection Global Network (SIGN), which assembles all major stakeholders to promote and sustain injection safety worldwide.

- **Universal precautions**

Effective ways of implementing universal precautions and guidelines for continuous education of HCW should be practiced by all health care institutions (Baker et al, 1999). Health authorities should abide by providing health care institutions with adequate equipment and supplies in order to avoid contravening the HCWs' right to protection against BBVs. There are four basic elements of universal precautions which have to be implemented in all health care settings; (1) body fluids should be handled with the same precautions as blood; (2) avoidance or limiting the use of sharp objects; (3) avoidance of skin or mucous membrane contamination; and/or (4) cleaning/ disinfecting/ sterilising (Barker et al, 1999).

It has been established that the application of universal precautions is virtually impossible in the emergency admitting rooms. This is because of the urgency associated with work in these

settings. As previously mentioned, NSIs are the most common injuries associated with BBVs. In this case it is important to promote the use of safe injections in all settings, as this is the commonest mode of transmission of BBVs. The use of unsafe injections has been associated with an estimated 8 – 16 million HBV infections which occur annually in the world (SIGN, 2008).

Wearing protective clothing during procedures, especially gloves and goggles, being careful, and knowing what to do after a NSI to prevent HBV infection is most important in the prevention of the spread of the virus.

- **Hepatitis B infected HCWs**

There are guidelines in place restricting the working practices of certain hepatitis B infected HCWs. The guidelines aim to reduce further the risk of transmission of infection from providers to patients. Additional tests are recommended on hepatitis B infected HCWs who are also HBeAg negative. When these HCWs perform exposure prone procedures, they should have their working practices restricted if their viral load is elevated. Hepatitis B infected health care workers refer to those who are HBsAg positive.

The Society for Healthcare Epidemiology of America (SHEA) emphasizes the use of appropriate infection control procedures. They recommend that HBeAg positive HCWs should routinely use double gloves and should not perform those activities that have been identified epidemiologically as associated with a risk for provider-to-patient HBV transmission despite the use of appropriate infection control procedures.

The Centers for Disease control and Prevention (CDC), issued guidelines for HIV and HBV infected HCWs. This was done in July 1991 after the national and international publicity surrounding iatrogenic HIV infection associated with a Florida dentist (CDC, 1991). Amongst the guidelines issued, there is one where there is a need to classify a subset of invasive procedures as ‘’exposure-prone.’’ These procedures is where the worker’s gloved hands may be in contact with sharp instruments, needle tips, or sharp tissues inside a patient’s open body cavity, wound, or confined anatomical space where the hands or fingertips may not be completely visible at all times. These procedures should not be performed by a HCW who is

HBeAg positive (UK DoH, 1994). This is because there is a markedly high viral burden that is associated with e-antigen positivity (100 million to 10 billion HBV particles per millilitre of blood) (CDC, 1985). As a result, barriers may not be relatively effective in preventing transmission.

All HCWs should be:

- educated to understand the mechanisms of bloodborne pathogen transmission
- shown methods to prevent transmission, and
- How to use those methods in all circumstances.

The principle that ‘’all blood and hazardous body fluids must be considered infectious, irrespective of a patient’s diagnosis’’, applies also to HCWs infected or potentially infected with BBD.

2.2.6.2 Post exposure prophylaxis (PEP)

Infection control measures were also introduced and individuals who had been exposed to the virus were given hepatitis B immune globulin (HBIg) as post-exposure prophylaxis (PEP). For example, in the developed world, HBIg is commonly administered to infants born to HBsAg-positive women. Despite these interventions’ ability to reduce the risk of HBV transmission, they were not as effective as immunization with the hepatitis B vaccine, especially given the fact that some centres were not as compliant in the screening of blood as they should have been. Thus the hepatitis B vaccine has been found to be the single most important hepatitis B prevention measure available (Shepard et al, 2006)

Currently, unprotected HCWs who have been exposed to HBV receive both HBIg and the hepatitis B vaccine as PEP. However, an early study done in Croatia compared the effectiveness of HB vaccine given alone, or when combined with HBIg, and found that this is not necessary (Palmovi et al, 1992). It demonstrated that anti-HBs developed in 94.6% of a group given a combined passive (HBIg) and active (HBV vaccine) immunization, and in 95% of a group given active alone, which showed that both regimens were similarly effective and comparable. Both groups had been given the first doses of HBV vaccine and HBIg within three days of exposure and these were followed by the doses of recombinant vaccine which were administered at one, two and six months later. This also shows the importance of receiving all the three doses of HB vaccine. In a control group which did not receive any PEP after exposure, 6% of the individuals

developed acute symptoms of HBV infection as compared to the previous two groups which had received PEP, and did not develop any symptoms of acute infection, emphasizing the fact that prevention was better than cure (Palmovi et al, 1992).

If an unvaccinated HCW finds himself exposed to blood or body fluid of an individual known to be positive for HBV, he should then receive the first dose of the vaccine and one dose of HBIg within 24 hours if possible, and the remaining 2 doses to be given 1 and 6 months after the first dose. He should then be tested 1-2 months after the vaccine doses have been completed. Even if the hepatitis B status of the source is unknown, the HCW should commence hepatitis B vaccine doses as soon as possible. Thereafter, testing of protective antibodies should be done (CDC, 2001).

2.2.6.3 Vaccination programmes

The Expanded Program on Immunization (EPI) was initiated in 1974 by the WHO with the goal of making vaccines available to all children throughout the world. The goal of the EPI is to reduce morbidity and mortality from vaccine-preventable diseases, and as such it is an essential element in primary health care. The original EPI vaccines were BCG (Bacillus Calmette-Guerin), DTP (diphtheria-tetanus-pertussis), oral polio, and measles. In a span of thirty years, immunization coverage has increased from 5% to about 80% of all children demonstrating the success of the program. In South Africa, additional vaccines were introduced during the 1990s (hepatitis B [Hep B), *Haemophilus influenza* type b [Hib]], and in 2009 the rotavirus, pneumococcal, and inactivated polio vaccines were introduced (SAVIC, 2009).

Universal HBV vaccination of infants in South Africa started in April 1995 (Tsebe et al, 2001). The EPI-SA schedule is based on the WHO accelerated schedule, with no hepatitis B vaccine given at birth. Hepatitis B vaccine is given at the same time as DPT-Hib: at 6, 10, and 14 weeks of life. There has been a significant reduction in HBsAg carriage amongst children in the first five years (1995-1999) after universal childhood HBV vaccination was introduced, as demonstrated by a study done in the Northern Province (Tsebe et al, 2001). These findings were supported by a KwaZulu-Natal study which showed a significant reduction in the incidence of

HBV-associated membranous nephropathy (MN) in children after a period of 6 years following the introduction of the HBV vaccine into the EPI-SA (Bhimma et al, 2003).

To date there is no national or provincial registration system available for assessing number of adults vaccinated with hepatitis B except the vaccinations that were administered through the childhood vaccinations registration. Employers are found not to keep any registry of staff that have accepted and received hepatitis B vaccine due to occupational exposure.

In addition to hepatitis B vaccine being included in the childhood immunization programme, the WHO recommended that it also be given to high risk groups such as intravenous drug users, HCWs with frequent blood exposure, and to children born to mothers who are HBsAg positive.

HCWs as professionals are major role players in the implementation of successful vaccination coverage as seen in the study done in Stockholm. The reason for non-vaccination amongst children was because parents stated that it had not been recommended by health professionals (Dannetun, 2006). The aforementioned point is brought into consideration as it is evident that among educated health professionals there is a need for professional guidance as concerns one's own immunization.

It is thus recommended that all HCWs be vaccinated with HBV in the commencement of their profession and before they are exposed to potentially infectious bloodborne diseases from their patients (NACI). Although HBV infection is recognized as one of the most dangerous transmissible diseases in the workplace, most HCWs remain unprotected from it despite it being a preventable disease (CDC, 1982). This is because the vaccine has not been made compulsory and health centres avoid providing it free of charge (Dannetun, 2006).

After HCWs have received the vaccine, they should have their HBsAg levels tested 4-6 weeks after completion of the doses to make sure that they have built up protection against HBV infection. No routine antibody testing or vaccine boosters are recommended once the HCWs blood test shows that they are protected (CDC, 2001). HCWs, who demonstrate that they have not developed protective antibodies after completion of the vaccine doses, should have all the 3 doses repeated and anti-HBs tested after 4-6 weeks after completion of the additional second doses.

2.3 Occupational HBV exposure

2.3.1 Introduction

According to the WHO, the estimated global number of HCWs is between 35 million to 100 million when including all health care related staff such as doctors, nurses and midwives who are in active practice. Assuming that the HBV prevalence rate is similar to that of the general population, it is thus obvious that the number of infected HCWs is a cause for concern, especially in under-resourced health systems (Viral Hepatitis Prevention Board [VHPB], 2005).

The risk of transmission of HBV to HCWs from patients is higher than that of HCWs to patients (VHPB, 2005). It has been demonstrated that the risk of transmission varies greatly amongst different disciplines, with surgery, gynaecology, and orthopaedic services having the greatest risk (Moghimi et al, 2007). Needle stick injuries, especially those involving hollow needles, have been reported as the most common route of transmission (Alam, 2002; De Villiers et al, 2007). It is essential that HCWs acknowledge the risk, and exercise caution. HCWs have to be taught about all potential sources of risk, not only the most common or important, and when injuries occur, it is important that they are reported and PEP provided. Standardization of the reporting procedures would help the process of data collection and analysis considerably.

A number of studies on the knowledge, attitudes, and practices (KAP) of HCWs regarding HBV infection from around the globe have been reviewed, since all of these studies include HBV vaccination as the most important practice in preventing the occupational risk of HBV infection.

2.3.2 Knowledge

2.3.2.1 Knowledge about occupational risks:

HCWs tend to underestimate the prevalence of HBV infection at the work place, as well as the risk for exposure. This is illustrated by a Bloemfontein study, where doctors were more worried about HIV than HBV. Amongst doctors who had been exposed to the HBV, 59.8% did not see the need to take PEP, and those who did, did not always complete the course of treatment. It was also found that there were two HCWs that had seroconverted to HBV that were reported, as

compared to none from HIV signifying that HBV was more infectious than HIV. (De Villiers et al, 2007). In contrast, 82% of nurses in a study done in Dublin, Ireland, knew that HBV transmission was 100 times more infective than HIV (McGrane et al, 2003).

These findings are supported by those from other countries, with only 21.4% and 44% of HCWs from Iran and the UK respectively, knowing that HBV can be transmitted by NSI (Moghimi et al, 2007; Stein et al, 2003). In the study done in Iran, only 21.4% of surgeons demonstrated good knowledge about seroconversion rates of HBV after a NSI, with most (77.9 %) of them not knowing the seroconversion rate after a NSI from HBV infection. This is a worrying finding, because the risk of exposure for general surgeons is about three to four times greater than other disciplines (Fry, 2006). A study from Nigeria found a discrepancy in knowledge between doctors and nurses concerning the risk of acquiring HBV after a NSI, with 50.3% (72/143) of nurses and 32%(924/75) of doctors demonstrating knowledge of the risk (Adebamowo et al, 1997).

2.3.2.2 Knowledge about the hepatitis B vaccine

In a study conducted in Egyptian HCWs where poor vaccination coverage was reported, it was found 38% did not know how effective the vaccine is, whilst 47% were not sure of how long they would be protected by the vaccine (El-Awady, 1998). In contrast, vaccine effectiveness, and the belief that they were at risk of exposure were cited as reasons for being vaccinated by registered nurses in a study from Houston, USA, where high vaccination coverage was reported (McEwen et al, 2005).

In addition, a study done in Nigeria showed a variation in knowledge about the hepatitis B vaccine amongst HCWs, with doctors showing better knowledge than nurses, 48% and 36% respectively (Adebamowo et al, 1998). In an earlier study from the same author on Nigerian surgeons, it was found that lack of awareness about the vaccine was one of the factors leading to poor vaccination rates (Adebamowo et al, 1997).

A study in Dublin, Ireland, found that whilst the majority of HCWS were vaccinated against HBV and also checked their immunity, this was influenced by the knowledge about the benefits given by the vaccine (McGrane et al, 2003). However, in contrast to these findings, a Nigerian study on hospital personnel found that knowledge is inversely related to practice, since those with the least knowledge (non-clinical workers) were more likely (69.5 -76.3%) to be fully vaccinated than doctors (40.3%) and nurses (39.7%) (Fatusi et al, 2000).

2. 3.3 Attitude

2.3.3.1 Attitudes towards universal precautions

In a Birmingham, UK study, more nurses (86%) than doctors (41%) had the attitude that all patients should be treated as if they have a blood-borne pathogen. The nurses also had statistically significantly better attitudes towards universal precautions in general (washing hands before and after dealing with patients, and wearing gloves when drawing blood) than doctors, which translated into better practices than doctors, as discussed below (Stein et al, 2003)

In the study done in Iran it was shown that 70% of HCWs were concerned about blood borne viruses (BBVs), but despite this, their use of protective material appeared to be influenced by the perceived risk of transmission (Moghimi et al, 2007). The study shows that slightly more surgeons wore gloves based on the appearance of the patient, with 92.1% of surgeons wearing gloves when the patient had active hepatitis as compared to 89.4% when a patient was a hepatitis B carrier. Patients with active hepatitis B look clinically ill, there is gradual onset of tiredness, abdominal discomfort, decreased appetite, the liver becomes enlarged, and sometimes become jaundiced and may develop painful joints, skin rashes or inflammation of the liver, whereas a patient where a carrier state exists is not clinically ill (Prometheus Healthcare, 2001).

2.3.3.2 Attitudes towards vaccination

The main barrier to compliance with the guidelines to vaccination in a study done in Sweden was the employer's willingness to pay for the hepatitis B vaccine, with about 77% of unvaccinated

HCWs showing interest to be vaccinated against HBV if it was offered to them for free by the employer (Dannetun et al, 2006). Similarly, a study in Dublin, Ireland, found that the vaccine being offered free of charge influenced HCWS to be vaccinated against HBV (McGrane et al, 2003).

In contrast, in a study done in Nigeria on surgeons, it was found there was generally poor perception of risk of infection by HBV. However, in agreement with the previous studies, the costs of vaccines were cited as another reason for not being vaccinated (Adebamowo et al, 1997).

Another Nigerian study (where all interested employees at a teaching hospital were provided with a free recombinant hepatitis B vaccine under a vaccination programme which was conducted within the hospital grounds) demonstrated that 91.9% of the participants received at least one dose of the vaccine, and 53.8% managed to receive all three doses of the vaccine (Fatusi et al, 2000). The study further pointed out that amongst the participants, workers thought to have greater knowledge about HBV infection (doctors and nurses) were the one who were less interested in receiving the vaccine. Non-clinical workers (medical record personnel [76.3%] and engineering staff [69.5%]) demonstrated greater compliance, whilst clinical professionals (nurses [39.7%] and doctors [40.3%]) showed less compliance (Fatusi et al, 2000). This study highlighted greater apathy to the vaccination programme amongst clinical professionals, and that it was not about the cost of the vaccine, in contrast to the findings of the Swedish and Nigerian studies (Dannetun et al, 2006; Adebamowo et al, 1997).

In the study done by EL-Awady, 80.9% of participants felt that the work place was the best place to issue HB vaccine. The majority of the participants, 95.2%, gave their final opinion that the vaccine should be funded and only 60.9% thought the vaccine was unaffordable.

In a study done in Texas, USA, 8% of participating registered nurses were not willing to be vaccinated against hepatitis B, since they perceived themselves to be at low risk as they stated they were not practising as nurses, they also declined because of concerns about side effects, lack of concern about getting the illness, and doubts about the vaccines' effectiveness. Participants who were willing to be vaccinated believed that the vaccine was effective and also perceived themselves to be at risk of exposure, and the fact that the vaccine was provided free of charge also influenced their decision. (McEwen et al, 2005).

This was supported by a study done in Dublin where 83% of HCWs were vaccinated with all the required 3 doses of hepatitis B vaccine. Reasons to be vaccinated were their understanding of the benefits provided by the vaccine and that it was issued free of charge (McGrane et al, 2003).

A study done in Thailand where the vaccine was issued free of charge, their initial acceptance rate for vaccination was 65.7%, with 10.0% non acceptance and 24.3% of HCWs being undecided. Those that accepted the vaccine had confidence in the vaccine efficacy and in its safety, whereas those that refused had different types of fear (Israsena et al, 1992).

In view of the above literature, the vaccine has to be funded and issued at the workplace, and lack of interest by other HCWs has to be corrected.

2.3.4 Practice

2.3.4.1 Needle stick injury and Post Exposure Prophylaxis

Prevention of occupationally acquired HBV infection in HCW rests on two cornerstones - universal precautions for the prevention of blood-borne infectious agents, and hepatitis B vaccination, the latter being the focus of this study.

In developed countries, the safety of HCWs has been promoted by applying different interventions, namely, Universal Precautions, provision of personal protective equipment, routine hepatitis B vaccination, PEP, engineered safety devices, injury surveillance, and enactment of relevant legislation (Kermode et al, 2005).

In sub-Saharan Africa, the aforementioned practices are lacking despite a high prevalence of diseases caused by BBVs. Infection control practices in these countries are not optimized in that there is no available information on the reporting of occupational exposure to infected blood (Kermode et al, 2005).

In a study done in Saudi Arabia, 52 subjects (74%) out of 70 had experienced a NSI, and of those 34 (67%) had 1-2 pricks per year. Out of these, only 4 subjects (8%) reported the injuries to get PEP. A majority of them (48/52 [92%]) did not report the incident (Alam, 2002). Similarly, an Iranian study found that only 3.2% of surgeons stated they always reported NSIs, 6% sometimes, 12.4% occasionally, 19.9% rarely, and 59.6% never reported NSIs (Moghimi et al, 2007). This was despite the fact that 100% of them said they knew that HBV was

transmitted through a NSI, only 27% said they wore gloves all the time for phlebotomy procedure, 69% said occasionally and 4% stated they did not wear gloves at all (Moghimi et al, 2007). In the same study, only about 13 % of surgeons used double gloves when performing a surgical procedure based on the perceived risk of transmission. The findings were worse with older surgeons who were found never to use double gloves (Moghimi et al, 2007).

A Birmingham, UK study demonstrated a difference in the reporting of NSIs between doctors and nurses, where 53% (40/75) of doctors and 29% (41/143) of nurses had experienced a NSI. Of these, only 2% of the nurses did not report a NSI, compared to 28% of doctors who did not, which was found to be statistically significant (Stein et al, 2003). This was demonstrated again in hand washing where 58.7% and 64.3% of nurses always washing their hands before and after patient contact, compared to 10.7% and 26.7% of doctors. Similarly, 56.6% of nurses always wore gloves when taking blood, compared to 10.7% of doctors (Stein et al, 2003).

The importance of being given PEP was demonstrated in an early study done in Croatia, where HB vaccine alone or combined with HBIg in preventing the spread of infection was tested against a control group which did not receive either intervention. Final results showed that immunization, whether given as active alone or combined passive and active, provided protection as none of the participants developed acute hepatitis compared with 2(6%) of the 34 non-immunized individuals who did (Palmovic et al, 1992).

2.3.4.2 Vaccination

HCWs need to be protected against HBV by being vaccinated. The vaccine is safe and effective and it can protect one for a lifetime. Unfortunately it has been shown that a large number of HCWs in developing countries are not vaccinated against HBV as demonstrated by the following studies.

A study of 554 HCWs conducted in Kenya to establish their immunization status, found that only 12.8% (71/554) of HCWs had received vaccination previously and none had been screened for immunity or hepatitis B surface antigen (HBsAg) (Suckling et al, 2006). In this study 55% of HCWs were unprotected, thereby predisposing them to HBV infection.

These results are consistent with those found in the study done in Johannesburg, South Africa, which found only 21.2% of HCWs had a history of past immunisation against HBV, although 30.6% were immune either from past vaccination or natural infection (Vardas et al, 2002). In contrast to these low vaccination rates, a study on South African doctors in Bloemfontein found that 81% had previously been vaccinated (De Villiers et al, 2007).

It is also important for HCWs to complete the full vaccination schedule, and to check their HBV immune status thereafter. Although it was found that 93.3% of HCWs had been vaccinated in a study done in Iran, 23.7% had not completed the full vaccination schedule, and only 56.8% had checked their antibody levels (Moghimi et al, 2007). Similarly, in a study conducted in Egyptian HCWs, it was found that 40.6% had received only 1 dose, whilst only 29.1% had received all 3 doses (El-Awady, 1998). In addition, the study done in Birmingham demonstrated that only 40% of HCWs were fully vaccinated against hepatitis B. Amongst the HCWs who were partly vaccinated, the most common reason that was given for not having completed the vaccination course was that it had been forgotten (Dannetun, 2006).

The importance of checking antibody levels after vaccination is illustrated by the South African study carried out in Bloemfontein, where it was found that 81% of doctors exposed to NSIs said they had previously been vaccinated against hepatitis B infection. Moreover, amongst HCWs that were exposed to a NSI, there were two of them that seroconverted, and it was found that they had not been previously vaccinated. Seemingly, most assumed they were immune since only 21.7% underwent serological testing for HBV directly after the NSI (De Villiers et al, 2007).

2.4. Gaps in the literature that will be addressed by this study

Despite the availability of the vaccine in SA, and the fact that the DoH strongly recommends vaccination, HCWs are not being vaccinated, and the reasons why they are not being vaccinated are not understood in our context since there have been very few studies conducted on this topic in SA.

A study done on the higher educational institutions (HEIs) of South Africa which offer degrees in healthcare, identified that there were policies in place regarding the issuing of hepatitis B vaccine to the students, but that they were not adequate enough to protect the students against acquiring occupational HBV infection (Fernandes, 2008). A gap existed on the identification of a person responsible for the enforcement of the policy, and most policies did not make vaccination mandatory. Moreover, the study indicated that there was no standardization in the issuing of HBV to the students and of who covered the cost.

A study done in Switzerland highlighted the fact that there was a need to address the immunization programme amongst students at tertiary institutions as it was noticed that there were gaps in existence. It was identified that immunization programmes should be initiated and conducted before a student comes into contact with a patient (Baer et al, 2005).

Previously it was proven that the cost-effectiveness of hepatitis B vaccination could be improved by buying the cheapest vaccines, reducing wastage, administering the first dose early and improving the compliance in relation to further doses (Mphahlele, 2002). As a result, hepatitis B vaccination should be issued at the beginning of a health profession, that is, at HEIs. Although it is clear that this vaccine is recommended by most South African HEIs offering degrees in healthcare (Fernandes, 2008), vaccination uptake remains sub-optimal (Vardas et al, 2002). Thus it is necessary to do studies on the KAP of HCWs regarding hepatitis B vaccination.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Study Design

A cross-sectional descriptive study was conducted. The study followed a quantitative approach, and participants completed a self administered questionnaire to assess their KAP regarding HBV vaccination.

3.2 Setting and site selection

The setting of the study was in the Ekurhuleni Metro which is located in the Gauteng Province, east of Johannesburg. Ekurhuleni Metro controls 7 public hospitals and 19 clinics. In addition, there are 9 private hospitals and 552 general practitioners (GPs), according to the South African Medical Association (SAMA). It was originally planned to include the 9 private hospitals in the study, but they were later excluded as permission for access to staff was not obtained.

3.3 Population/ sample

All qualified doctors and nurses working at government clinics and hospitals who consented to take part in this study were included. Those who did not consent to take part in the study were excluded. General practitioners who were included in the study were those that were SAMA members, all those who were not on the SAMA list were excluded.

3.4 Sample size calculation

Using Epi Info version 3.2 (CDC, 2004), the sample size for a cross-sectional study was calculated at 80% power and a 95% confidence level, at 146. This was based on the following assumptions: (1) at least 21% of HCWs will be vaccinated (Vardas et al, 2002); (2) 40% of those who have good knowledge about HBV vaccination are vaccinated against HBV, and (3) 70% of those who have poor knowledge of HBV vaccination are vaccinated against HBV (Fatusi et al, 2000). Although this inverse relationship between knowledge and practice may not be found when studying only doctors and nurses (who should theoretically all have a good knowledge

about HBV vaccination), the sample size works out to 150 when the value for (2) is 70%, and the value for (3) is 40%. To increase the power of the study, allow for non-response and minimize errors introduced by bias, the sample size was increased to 215.

A multistage proportionately representative stratified random sampling method was used as follows:

1st stage: Random selection of 7 clinics and 3 public hospitals

2nd stage: Random selection of a proportionately representative sample of HCWs stratified according to occupation (doctors and nurses) and selected clinics and hospitals

Also, systematic sampling (every 10th name on the SAMA register) of GPs who do not work in clinics and hospitals was undertaken.

The sampling frame (a list of doctors and nurses working at each institution, and of GPs) was used to divide the sample proportionately in these different strata (see Table3.1).

At the clinics, randomly selected nurses who consented to participate were given questionnaires. All the doctors working at the clinics were asked to participate as there were only 4 of them

.

In government hospitals, randomly selected nurses and doctors who consented to participate were given questionnaires. The HCWs were asked not to write their names on the questionnaires unless they wanted to be tested for HBV. Those who wanted to be tested for HBV were asked to give their cell phone numbers.

Systematic random sampling was done amongst the 552 GPs listed on the SAMA registry. A questionnaire was posted to every 10th GP, thus 55 questionnaires were posted. The sample size needed for GPs was only 24, but this was increased to 55 to allow for a large proportion of non-responders. Also, a self addressed stamped return envelope was posted with the questionnaire to increase the proportion of responders.

Table3.1: The relationship between population and sample sizes

Facilities	**Population**	**%**	**Sample size**
Clinics (19)	Doctors: 4 Nurses: 82	0.10 1.97	Doctors: 4 Nurses: 4
Govt Hospitals (7)	Doctors: 562 Nurses: 2957	13.52 71.13	Doctors: 24 Nurses: 128
General practitioners	552	13.28	Doctors: 55
TOTAL	Doctors: 1118 Nurses: 3039	100	215

3.5 Data Collection Tool

Data was collected through a questionnaire (see Annex A) which was formulated by the researcher, based on the literature review. The questionnaire was divided into 4 sections.

1: Demographics. Questions comprised of respondents' race, age, gender, job category, duration as health care worker (years) and health care site.

2: Knowledge test. Since the study population was HCWs, respondents were expected to know that one can get hepatitis B through a needle stick injury; there is an effective vaccine for hepatitis B; after vaccination for hepatitis B, a blood test is needed to confirm immunity against hepatitis B; the hepatitis B vaccine provides 100% protection for 90% of adults and children; the hepatitis B vaccine protects against HBV for at least 15 years; patients who are vaccinated against hepatitis B can still be considered as a possible source of hepatitis B; a person who has been vaccinated or recovered from a previous hepatitis B infection, can still infect others.

Statements were phrased either correctly or incorrectly, and respondents had to choose one option between "true”,” false” “don’t know”.

3: Practice test. This was concerned with exposure to and/or protection against hepatitis B virus. Information concerning vaccination, such as, have you been vaccinated against hepatitis B virus?, if vaccinated, how many doses?, was your immunity against hepatitis B checked after vaccination?, how many times during your working lifetime have you experienced a needle stick or sharps injury involving a needle or sharp instrument that had been used on a patient?, how many times in the last year have you experienced blood or body fluids splashing in your eyes or mouth?, and do you wear protective clothing when handling blood or body fluids?.

The analysis identified the level of practice of HCWs about vaccination against HBV. Respondents had to choose one of the options, namely, for vaccination: 1 dose, 2 doses or 3 doses; for immunity: checked and not checked; protected and not protected; for universal precautions: always, sometimes, never and don’t know.

4: Attitude test. Questions consisted of: hepatitis B vaccination should be compulsory for HCWs; hepatitis B vaccination is too expensive; I am scared of being vaccinated because it hurts; I am not at risk for hepatitis B because I am always careful when examining patients and taking specimens; I am not at risk for HBV because I am a healthy person; I don’t trust vaccinations; and vaccination is against my religion or traditional beliefs. From these questions respondents had to choose one of the options: strongly, agree, don’t know, disagree, and strongly disagree.

3.6 Data collection methods

A questionnaire, designed by the researcher to collect data on HBV KAP (see Annex A), was printed. For doctors and nurses working at public clinics and hospitals, the selected participants were initially informed about the study at their place of work, and those who consented were given a questionnaire. However, for the GPs, the questionnaire was mailed, without initially speaking to them.

Initially, an appointment for 30 minutes was made with the individual prospective respondents to answer questionnaires in the researcher's presence. However, the respondents were found to be too busy with their routine work, thus the questionnaires were filled in by the respondents on their own, and left with the sisters in charge of the different departments and collected the following day.

Data from the questionnaires were captured using SPSS 14.0. These included answers to questions on demographics, knowledge about hepatitis B vaccination, practices regarding hepatitis B vaccination, and attitudes towards hepatitis B vaccination (see Annex A).
Coding was performed in accordance with the coding manual (see Annex B).

3.7 Data Analysis

Data were stratified according to the type of medical facility, and occupation.
Descriptive statistics were performed automatically by SPSS 14.0.
Also using SPSS 14.0, data from the different strata were entered into contingency tables, to compare types of medical facilities, and HCWs' occupations. Binary logistic regression analysis was done to identify predictors of vaccination uptake, and Chi-square and Student t-test p-values were calculated to ascertain the statistical significance of any barriers identified, with p-values less than 0.05 being considered as statistically significant

3.8 Reliability and Validity of the study

The questionnaire was pre-tested on 10 HCWs from an institution which was not randomly selected (i.e. one that was not selected during the 1st stage of multistage sampling). This was done to check on the validity of the questions, i.e. to see if the questions were clear and gave valid information.
The questionnaire was formulated in such a way that the measure accounts for all the elements of the variables, which are knowledge, attitudes and practices. This ensured content validity.

Threats to external validity were prevented as random selection of HCWs was done during sampling. HCWs were sampled from different health care settings. Simple random selection also allowed one to draw externally valid conclusions about the entire population based on the sample.

3.9 Bias

Errors introduced by bias were minimized by making the study sample statistically powerful (i.e. at 80% power and 95% confidence), and then increasing the sample size further. Also the sample was randomly selected, to make the sample as representative of the population as possible. These steps minimized errors due to the following:

Recall Bias

This could have resulted when those who had previously been occupationally exposed to HBV (for example through a NSI) recalled facts about HBV and HBV vaccination better than those who had never been exposed.

Volunteer bias

A poor response rate results in volunteer bias, since volunteers may have different health behaviours than people who refuse to participate. Volunteer bias is unavoidable, since people cannot be forced to take part in a study. However, it was minimized by increasing the sample size to allow for non-response, and a statistically powerful sample size was reached.

3.10 Ethical Considerations

The protocol was submitted for ethical clearance to the Research, Ethics and Publications Committee of the National School of Public Health, University of Limpopo, and to the Medunsa Research Ethics Committee.

Permission to conduct the study was requested from the Gauteng Province, the Ekurhuleni Metro and the facilities where the study was to be conducted.

An example letter (addressed to one specific hospital) asking for permission is included as Annex D

Confidentiality was maintained throughout the study. Questionnaires were made anonymous, unless HBV testing was requested. These were stored in a sealed box after data collection.

In addition, an invitation for free HBV testing for markers of infectivity and immunity was included. Although this did not address any of the study objectives, it was offered as a benefit of partaking in the study, and was part of the over-arching project under which this project falls (MREC/PH/87/2008: IR – Institutional policies and training in hepatitis B virus prevention and control, and the infectivity and immunity of health care workers in South Africa). A written informed consent was signed by those wishing to be tested for HBV, and in this case participants gave their names and contact details so that their results could be given to them. Their results (which do not form part of this study) were treated confidentially, and questionnaires were not linked to laboratory specimens by name, but by a computer generated laboratory number.

CHAPTER 4: RESULTS

4.1 Response rate

Two hundred and fifteen questionnaires were distributed as described, and 161 were returned, giving an overall response rate of 74.9%. There was a response rate of 73.6% (112/152) from the public hospitals, 41.1% (46/112) being doctors 48.2% (54/112) being nurses, and 10.7% (12/112) not stating their job category. Since 128 questionnaires were handed to nurses, and 24 were handed to doctors, yet only 54 questionnaires were received with the job category "Nurse" ticked, and 46 were received with the job category "Doctor" ticked, an assumption can be made that a number of nurses did not answer their questionnaires but handed them to doctors, thereby adding to their number. As a result, the response rate from public hospitals for nurses was 42.2% (54/128), and that for doctors was 191.6% (46/24). Moreover, 30 questionnaires were received with only clinic ticked; 2 questionnaires were ticked for public and private; 2 public and clinic, 2 public and GP and 1 private and GP (see Table 4.3). This resulted in the increase of responses by the nurses to 87. In addition, there was a 100% response rate from the clinics after 8 questionnaires (4 to nurses and 4 to doctors) were issued. As a result, there was an overall response rate of 68.9% (91/132) for nurses.

The discrepancy is assumed to be due to the fact that HCWs work at more than one health care institution.

Fifty five questionnaires were handed out to GPs and 12 were returned, giving an overall response rate of 21.8% (12/55). Thus the majority of general practitioners in private practice [78.2% (43/55)] did not respond to the questionnaire as compared to the doctors in the public hospital, where the response rate was more than 100%.

4.2 Descriptive statistics

4.2.1 Demographic profile of respondents

The majority of the respondents were Black (77.6% [125/161]) (see Figure 4.1), female (70.8% [114/161]) (see Figure 4.2), and over the age of 40 (53.4% [86/161]) (see Table 4.1). Nurses predominated (56.5% [91/161]) (see Figure 4.3), and the majority of respondents (57.1% [92/161]) had been employed as HCWs for more than ten years (see Table 4.2). Since public hospitals represented the largest sector in this study, and 6 HCWs who worked either in the private sector or in clinics also worked in public hospitals, the majority of respondents (73.3% [118/161]) worked at public hospitals (see Table 4.3).

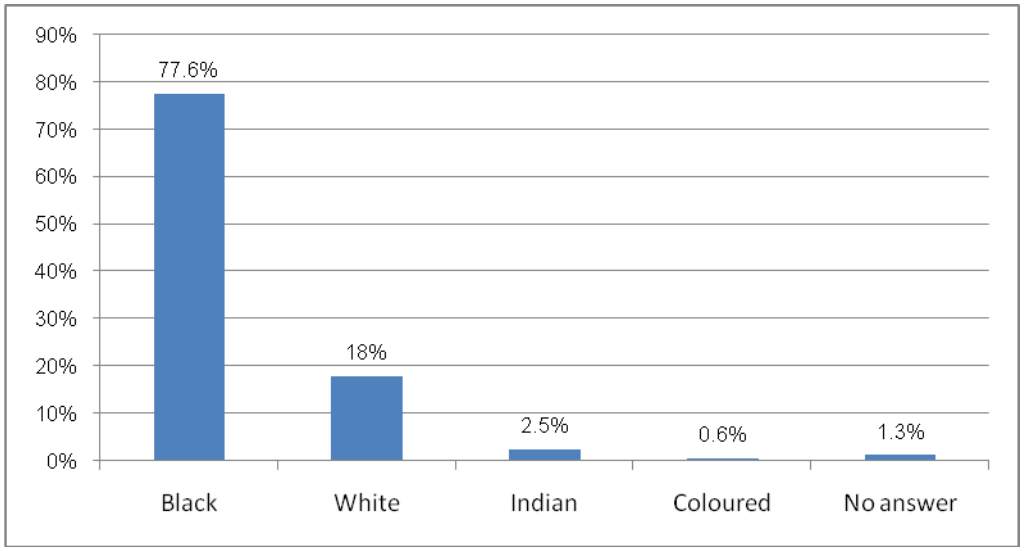

Figure 4.1: Bar chart showing distribution of race

Table 4.1: Frequency distribution of age of HCWs

Age	Frequency	%
20 – 30yrs	40	24.8
31 – 40yrs	35	21.8
41 – 50yrs	59	36.6
> 50yrs	27	16.8

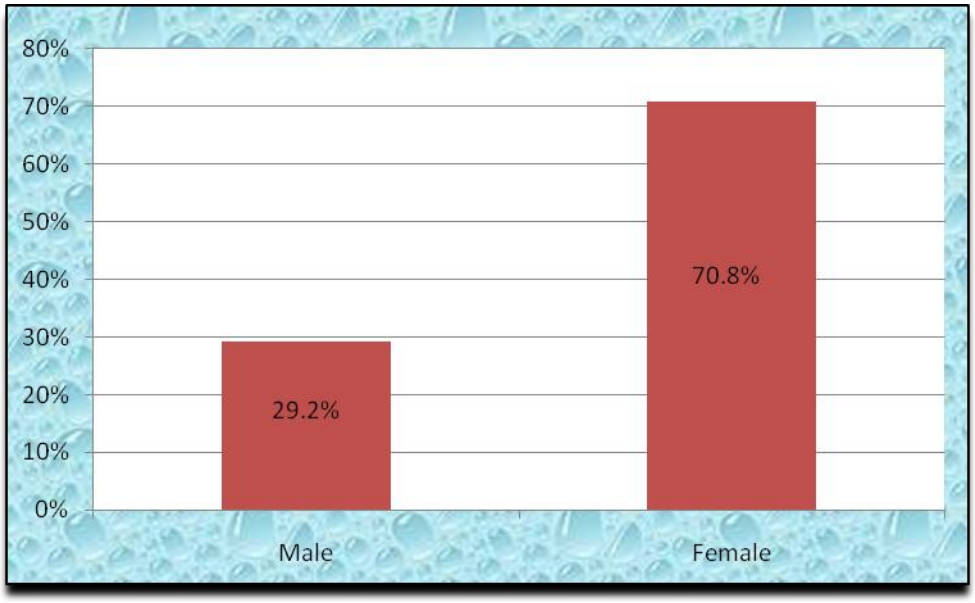

Figure 4.2: Bar chart for Gender

Table 4.2: Frequency distribution of employment as HCW in years

Years employed as HCW	Frequency	%
≤ 5yrs	44	27.3
6 – 10 yrs	24	14.9
11 – 15 yrs	23	14.3
16 – 20 yrs	25	15.6
> 20 yrs	44	27.3
No answer	1	0.6

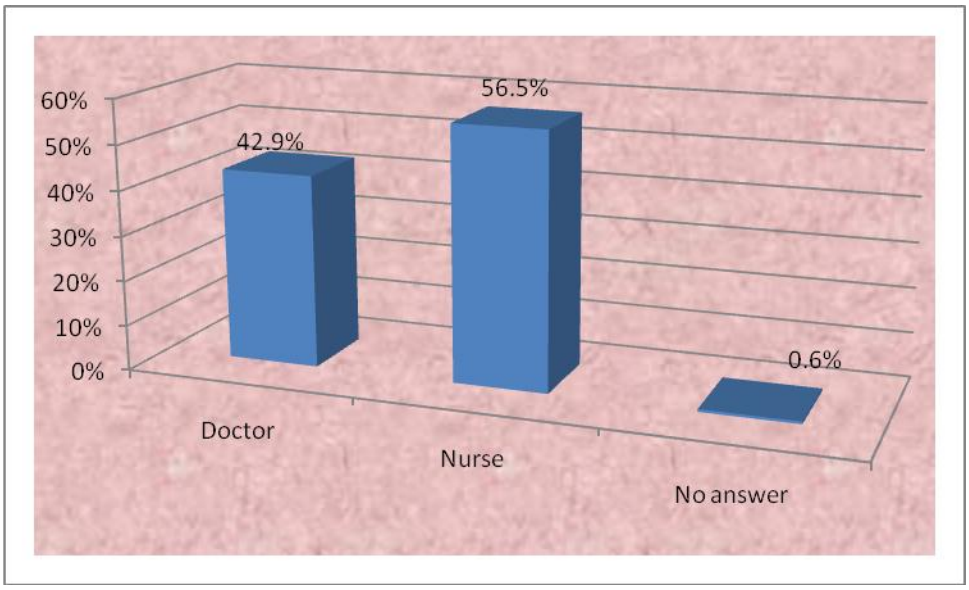

Figure 4.3: Bar chart on Job category

Table 4.3: Frequency distribution of health care sites

Healthcare sites	**Frequency**	**%**
Public hospital	112	69.5
Clinic	30	18.6
General practice	12	7.4
Public & Private	2	1.3
Public & Clinic	2	1.3
Public & General practice	2	1.3
Private & General practice	1	0.6

4.2.2 Knowledge about vaccination against hepatitis B

The first research objective in this study was to identify the level of knowledge of HCWs about vaccination against HBV. Nine items comprised the Knowledge index from which a total score was obtained. This index measured the number of correct responses on general knowledge questions regarding vaccination against HBV. The potential range of scores was 0 to 9 (see Annex B). Poor knowledge was defined as scores of 3 or less, moderate knowledge as 4 to 6, and good knowledge as 7 to 9. The actual scores ranged from 0 to 8 with a mean score of 3.13 (*SD* = 1.47), a median of 3, and a mode of 3. Overall, 66.5% (107/161) had poor knowledge, 31.7% (51/161) had moderate knowledge, and 1.9% (3/161) had good knowledge (see Table 4.4 and 4.6).

The distribution of answers to the knowledge questions are shown in Table 4.5.
From Tables 4.5 it can clearly be seen that the vast majority of respondents knew that HBV can be contracted from a NSI, and that there is an effective vaccine to protect against HBV. However, it is also clear that the vast majority do not know just how effective the vaccine is, or how long they will be protected against HBV after vaccination.

Table 4.4: Frequency distribution of knowledge scores

Total Score	Frequency	Percent
0	1	.6
1	17	10.6
2	40	24.8
3	49	30.4
4	27	16.8
5	14	8.7
6	10	6.2
7	2	1.2
8	1	.6
Total	161	100

Table 4.5: Distribution of answers to knowledge questions

Variables	True No (%)	False No (%)	Do not know No (%)
Can get hepatitis B through a needle stick injury	147(91.3%)	5(3.1%)	5(3.1%)
There is no effective vaccine for hepatitis B	13(8.1%)	141(87.6%)	7(4.3 %)
There is no need for a blood test	21(13%)	117(72.7%)	23(14.3 %)
Hepatitis B vaccine provides 100% protection for 90% adults	84(52.2%)	37(23.0%)	40(24.8 %)
Hepatitis B vaccine protects against HBV for at least 15 years	49(30.4%)	46(28.6%)	66(41.0 %)
Vaccinated patients should not be considered as a possible source of HBV	54(33.5%)	82(50.9%)	25(15.5 %)
A person vaccinated or recovered from hepatitis B can infect others	67(41.6%)	65(40.4%)	29(18.0 %)
HIV is more infectious than hepatitis B virus	32(19.9%)	109(67.7%)	20(12.4%)
For protection against hepatitis B, one needs a titre of at least 10mIU/ml	37(23.0%)	23(14.3%)	101(62.7%)

Table 4.6: Distribution of knowledge of HCWs

Knowledge	Frequency	Percent
Poor knowledge	107	66.5
Moderate Knowledge	51	31.7
Good Knowledge	3	1.9
Total	161	100.0

Table 4.7: Cross tabulation between knowledge and being vaccinated

Knowledge	Vaccination against HBV		Total
	No	Yes	
Poor knowledge	30	77	107
Moderate Knowledge	15	36	51
Good Knowledge	0	3	3
Total	45	116	161

4.2.3 Attitudes of HCWs towards vaccination against HBV

The second research objective in this study was to identify the attitudes of HCWs towards vaccination against HBV. There were seven statements to assess participants' attitude towards HBV. All the statements had 5-point Likert scale answers ranging from +2 (strongly agree) to -2 (strongly disagree) for positive statements, and from +2 (strongly disagree) to -2 (strongly agree) for negative statements. Thus the total possible scores ranged from -14 to +14 (see Annex B). Negative attitude was defined as scores of -5 or less, neutral as -4 to +4, and positive attitude as +5 to +14. The actual range of total scores were found to be between -7 and +14 with a mean score of 6.94 (*SD* = 4.01), a median of 7, and mode of 6. It was found that 55.9% had scored 7, which means the overall attitude was good. The frequency distribution of scores for attitude questions is shown in table 4.8, while the distribution of answers to attitude questions is shown in Table 4.9. As shown in Table 4.10, the majority had a positive attitude. Among those who vaccinated, the majority (82.8%, [96/116]) had a positive attitude towards vaccination as shown in Table 4.11.

Table 4.8: Frequency distribution of attitude scores

Total Score	Frequency	Percent
-7	1	.6
-3	1	.6
-2	1	.6
-1	2	1.2
0	6	3.7
1	4	2.5
2	7	4.3
3	12	7.5
4	7	4.3
5	11	6.8
6	24	14.9
7	14	8.7
8	12	7.5
9	10	6.2
10	7	4.3
11	17	10.6
12	18	11.3
13	4	2.5
14	3	1.9
Total	**161**	**100**

Table 4.9: Distribution of answers to attitude questions

Hepatitis B vaccination	Strongly agree	Agree	Do not know	Disagree	Strongly disagree
Should be compulsory	109(67.7%)	39(24.2%)	8(5.0%)	4 (2.5%)	1(0.6%)
Is too expensive	8(5.0%)	27(16.8%)	84(52.2%)	27(16.8%)	15(9.3%)
Am scared of vaccination	6(3.7%)	14(8.7%)	12(7.5%)	65(40.4%)	64(39.8%)
Always careful therefore don't need it	10(6.2%)	26(16.11%)	15(9.3%)	73(45.3%)	37(23.1%)
Not at risk therefore don't need it	3(1.9%)	11(6.8%)	19(11.8%)	75(46.6%)	53(32.9%)
Do not trust	4(2.5%)	7(4.3%)	12(7.5%)	73(45.3%)	65(40.4%)
Against my religion / culture	1(0.6%)	4(2.5%)	5(3.1%)	63(39.1)	88(54.7%)

Table 4.10: Distribution of attitude of HCWs

Attitude	**Frequency**	**Percent**
Negative Attitude	1	.6
Neutral	40	24.8
Positive Attitude	120	74.5
Total	161	100.0

Table 4.11: Cross tabulation between attitude and being vaccinated

Attitude	**Vaccination against HBV**	
	No	Yes
Negative Attitude	0	1
Neutral	20	19
Positive Attitude	24	96

4. 2.4 Practices of HCWs regarding prevention of HBV

The third research objective in this study was to investigate the practices of HCWs regarding HBV prevention.

4.2.4.1 Vaccinated HCWs

The results for vaccination uptake and testing for immunity are presented in Table 4.12, while Table 4.13 shows the distribution of vaccination uptake according to profession, and Figure 4.4 illustrates the proportions of the vaccinated who had received between 1 and 3 doses of vaccine.

Table 4.12: Distribution of answers to protection against hepatitis B

Vaccination and protection against hepatitis B	**Number (%)**
Have you been vaccinated against hepatitis B virus? (n=161)	
Yes	116 (72.0)
No	39 (24.2)
Don't know	6 (3.7)
Was your immunity against hepatitis B checked after vaccination? (n=116)	
Checked	32 (27.6)
Not checked	84 (72.4)
If checked, are you Protected? (n=32)	
Protected	30 (93.75)
Not protected	1 (3.125)
Don't know	1 (3.125)

Table 4.13: Cross tabulation of being vaccinated against hepatitis B with job category

Job Category	**Vaccination against HBV**	
	No or Do not Know (%)	Yes (%)
Doctor	14(8.7)	56 (34.8)
Nurse	31(19.3)	60(37.3)
Total	45(28)	116(72)

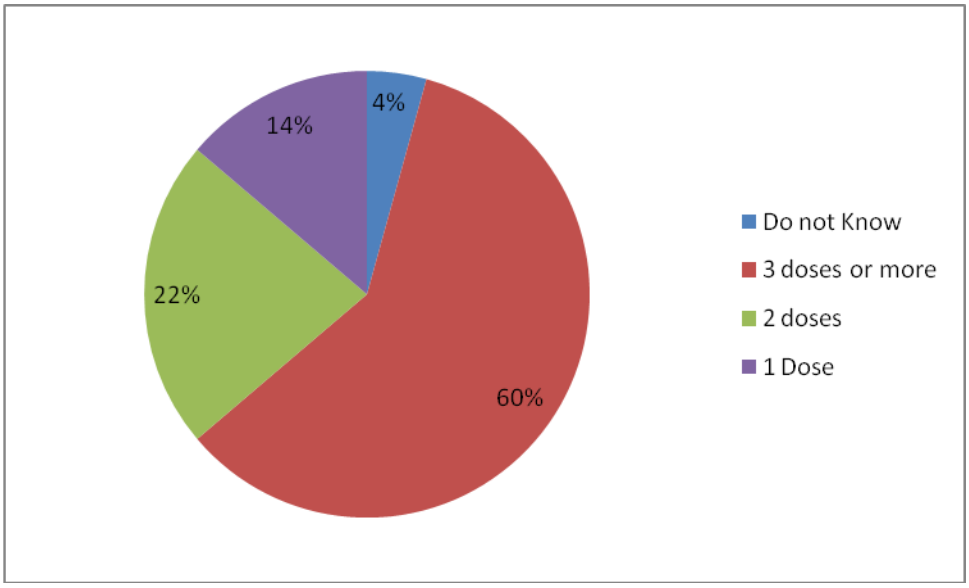

Figure 4.4: Pie chart showing vaccine doses received

4.2.4.2 Occupational exposures

Experiences of needle stick injury:

The majority of the HCWs (67.7%, [109/161]) experienced needle stick injury. Among them, over a third (37.6%, [41/81]) reported always and those who reported among them 40.7% [33/81] took PEP.

Table 4.14: Experience of needle stick injury among HCWs (n=161)

No of times Needle stick injury	Frequency	Percent
More than 10 times	5	3.1
6 - 10 times	17	10.6
2 - 5 times	47	29.2
Once	40	24.8
Never	52	32.3
Injury reported (n=109)		
Never	28	25.7
Sometimes	40	36.7
Always	41	37.6
PEP given (n=81)		
No	48	59.3
Yes	33	40.7

Experience of being splashed by blood / body fluids

Almost two thirds (65%, [105/161]) of the HCWs had not experienced being splashed with blood / body fluids. (See Figure 4.5)

Use of protective clothing

All (100% [161/161] HCWs indicated that they did not wear protective clothing when handling patients.

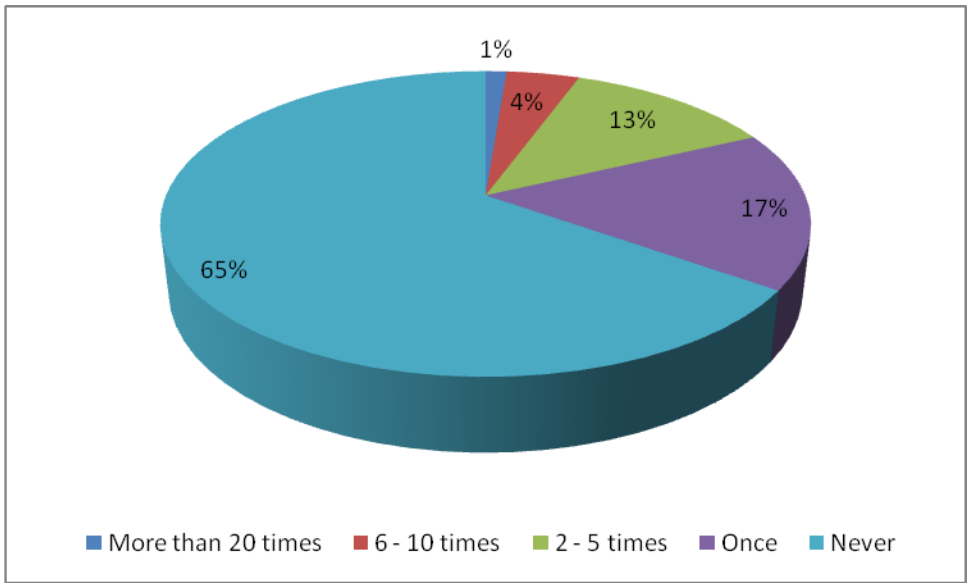

Figure 4.5: Experience of body fluids splashing among HCWs

4.3 Barriers to / predictors for effective hepatitis B vaccination

The fourth research objective in this study was to investigate the barriers to / predictors for effective HBV vaccination among HCWs

Firstly, binary logistic regression was used to find significant predictors for doing hepatitis B vaccination. A positive attitude score was a significant predictor for doing vaccination (OR=1.13, p=0.007). Table 4.15 shows that participants are 1.133 times more likely to vaccinate as their attitude score increases by 1 (one).

Table 4.15: Binary logistic regression

Variables	Vaccinated Mean score	Unvaccinated mean score	p-value	Odds ratio (OR)	95% C.I. for OR	
					Lower	Upper
Knowledge Score	3.18	3.05	.325	1.132	.885	1.448
Attitude Score	7.49	5.66	.007	1.133	1.034	1.241
Constant			.669	.788		

Secondly, the student's t-test was used to compare the mean scores for knowledge and attitude for the vaccinated versus the unvaccinated HCWs. No significant difference was found for knowledge (t=0.523, p=0.602). However, the mean attitude score was found to be significantly different (t=2.648, p=0.009) between vaccinated and unvaccinated participants, which confirmed the results from the logistic regression.

Table 4.16: Comparing the mean scores for knowledge and attitude between vaccinated and unvaccinated

	95% Confidence Interval of the Difference				
Variables	t	p value	Mean Difference	Lower	Upper
Total Knowledge Score	.523	.602	.136	-.377	.648
Total Attitude Score	2.648	.009	1.832	.466	3.199

Thirdly, knowledge and attitude scores were collapsed into discrete variables as described above, and Pearson's chi-square p-values were calculated to investigate associations between

knowledge and vaccination (Table 4.17), and between attitudes and vaccination (Table 4.18). The results confirmed those of the logistic regression and t-test.

Table 4.17: Cross-tabulation between knowledge score and vaccination against HBV

Knowledge Score	**Vaccination against HBV**		**Pearson Chi-Square**
	No and Do not Know	Yes	
Poor knowledge	29	77	1.232 (p=0.540)
Moderate Knowledge	15	36	
Good Knowledge	0	3	
Total	44	116	

Table 4.18: Cross-tabulation between attitude score and vaccination against HBV

Attitude Score	**Vaccination against HBV**		**Pearson Chi-Square**
	No and Do not Know	Yes	
Negative Attitude	0	1	14.828 (p = 0.001)
Neutral	20	19	
Positive Attitude	24	96	
Total	44	116	

The chi-square test of association was also used to find associations between vaccination uptake and socio-demographic variables (See Tables 4.19 – 4.22). Job category was the only variable that was significantly associated (χ^2= 4.563; p=0.049) with taking vaccination, and it was found that doctors were 2.23 times more likely to take the vaccinations as compared to nurses.

Table 4.19: Cross tabulation of race and vaccination against HBV

Race	Vaccination against HBV		Chi-square test
	No	Yes	
African	40	86	5.019 (p=0.170)
White	3	26	
Indian	1	3	
Coloured	0	1	

Table 4.20: Cross tabulation of gender and vaccination against HBV

Gender	Vaccination against HBV		Chi-square test
	No	Yes	
Male	12	34	0.065 (p=0.847)
Female	32	82	

Table 4.21: Cross tabulation of job category and vaccination against HBV

Job category	Vaccination against HBV		Chi-square test	Odds Ratio (95% CI for OR)
	No	Yes		
Doctor	13	56	4.563 (p=0.049)	2.23 (1.06 – 4.68)
Nurse	31	60		

Table 4.22: Cross tabulation of duration as HCW and vaccination against HBV

Duration as HCW	Vaccination against HBV		Chi-square test
	No	Yes	
5 years or less	10	34	2.998 (p=0.558)
6 - 10 years	7	17	
11 - 15 years	6	17	
16 - 20 years	5	20	
More than 20 years	16	28	

CHAPTER 5: Discussion, conclusion, and recommendations

5.1. Discussion

5.1.1 Response rate

An overall response rate of 74.9% (161/215) was achieved in the study. This means that the results are adequately representative of the target population from which it was drawn as it was above the required 70% response rate (Patel et al, 2003). The response rate in the public hospitals for nurses was 42.2% (54/128) and that for doctors was 191.6% (46/24), which was extraordinary as doctors are known to be poor responders (Cartwright A, 1978). This could be assumed to be due to the fact that the respondents identified with the researcher because they share the same profession.

Holbrook Allyson, identified response rates as a function of two different aspects of the interaction with respondents, namely contacting respondents and gaining their cooperation. There are different variables that have significance in non-response, namely, occupation, income, number of hours worked, and knowledge of condition under survey (Boshuizen et al, 2005).

Questionnaires to the GPs were mailed without initially speaking to them, and there was no follow-up made either telephonically, or by mail for non-responders. This was because of time and financial constraints.

According to a study done in United Kingdom, a 41% response rate was received from GPs after a survey was sent out once. Non-responding GPs were surveyed to determine the reasons for failure to respond initially to the survey. The commonest reason given was that the GPs were overwhelmed with questionnaires from different sectors; moreover, they had limited time and resources as compared to employed doctors (MacPherson et al, 1995). Another study done in North of England discovered that GPs were significantly more depressed and less satisfied with their job compared to the employed doctors, as a result, they displayed greater levels of job dissatisfaction and depressive symptoms. All this predisposes to failure of participation to surveys (O'Connor et al, 2000).

5.1.2 Knowledge

Health care workers are at an increased risk of blood borne diseases. The most common form of accidental exposures is due to NSI. Exposures could also result from sharp objects such as scalpels and broken glasses, as well as from mucosal exposures after blood splash or bodily fluids (De Villiers, 2007).

A few questions on knowledge were answered correctly by a majority of respondents. A majority of HCWs (91.3% [147/161]) knew that one could get HBV through a needle stick injury, and 87.6% (141/161) knew that there is an effective vaccine to protect against HBV. This is in contrast to studies done in Iran and the UK, where 21.4% and 44% respectively of HCWs knew that HBV can be transmitted by NSI (Moghimi et al, 2007; Stein et al, 2003), and 38% of HCWs in Egypt not knowing how effective the vaccine is (El-Awady, 1998).

About two thirds (67.7% [109/161]) of HCWs knew that HBV was more infectious than HIV. This was similar to a study done in Dublin, Ireland, where 82% of nurses knew that HBV transmission was 100 times more infective than HIV (McGrane et al, 2003).

Finally, 50.9% (82/161) knew that being vaccinated does not exclude one from being considered a possible source of hepatitis B, and 72.7% (117/161) knew that one has to be tested in order to be sure that one is protected. This finding is similar to a study done in Dublin which showed that nurses had knowledge about the hepatitis B virus infection. This is demonstrated by the fact that of the 83% HCWs who had completed a full course of hepatitis B immunization, 93% reported a hepatitis B antibody level on completion of the immunization; 14% knew their actual titer and 78% reported immunity (McGrane et al, 2003). Similarly, a study done in Birmingham, demonstrated that 70% (153/218) HCWs stated that they treat every patient as if he is carrying a BBV.

What is disappointing is that a substantial number 23% (37/161) of HCWs did not know for how long an individual could be protected against HBV after being vaccinated. This finding is similar to a study done in Egyptian HCWs, where it was found that 47% were not sure of how long they would be protected by the vaccine (El-Awady, 1998).

The study found that 66.5% (107/161) of HCWs had poor knowledge regarding vaccination against HBV, with only 23.0% (37/161) knowing that one needs a titre of at least 10mIU/ml of

anti-HBs in order to be protected against HBV. This raises the suspicion that HCWs have not been adequately trained about BBVs. The study done is similar to a study done in Egypt which demonstrated that 47% of HCWs did not exactly know the duration of vaccine validity (El-Awady, 1998)

5.1.3 Attitude

The study found that 55.9% (90/161) had a positive attitude towards HBV vaccination, which is similar to a study done in Birmingham where more nurses (86%) than doctors (41%) had the attitude that all patients should be treated as if they have a blood-borne virus. The majority of HCWs (91.3%) knew that one can get HBV through a NSI, and the majority 79.5% (128/161) of HCWs did perceive themselves to be at risk of exposure to HBV since they either disagreed or strongly disagreed that they were "not at risk for hepatitis because I am always careful when examining patients and taking specimens". This finding is similar to a study done in Iran which showed that 70% of HCWs were concerned about BBV, but despite this, their use of protective material appeared to be influenced by the perceived risk of transmission (Moghimi et al, 2007).

The majority of HCWs 67.7% (109/161) and 24.2% (39/161), either strongly agreed or agreed respectively, that hepatitis vaccination should be made compulsory.

In addition, 68.3% (110/161) of HCWs either did not agree or did not strongly agree that "being careful" qualified one for "not being at risk for HBV" when examining patients and taking specimens. This finding is similar to those of a study done in Texas, where only 8% of participating nurses were not willing to be vaccinated against hepatitis B, since they perceived themselves to be at low risk as they were not practicing as nurses and there was lack of concern about getting the illness (McEwen et al, 2005).

Only 2.2% (36/161) HCWs agreed that they were not at risk for HBV because of always being careful when examining patients and taking specimens.

A majority 85.7% (138/161) of HCWs either disagreed or strongly disagreed on a question ''I do not trust vaccinations'', and 93.7% (151/161) either disagreed or strongly disagreed on 'vaccination is against my religion/ traditional beliefs''.

In contrast to studies done in Sweden (Dannetun et al, 2006) and Nigeria (Adebamowo et al, 1997) where HCWs had a negative attitude towards vaccination because it was expensive, the

majority (52.2% [84/161]) of HCWs in this study did not know that it is expensive, and therefore did not have a negative attitude towards it's expense. This finding may be due to the HCWs not having to pay for the vaccine themselves, but the question about who pays for their vaccination was not posed to the participants. .

5.1.4 Practice

The majority of HCWs (72% [116/161]) has been vaccinated against HBV, however of those vaccinated, only 27.6% (32/116) had their immunity checked and 93.75% (30/32) stated they were protected. This is in contrast to a study done in Kenya where it was found that only 12.8% (71/554) of HCWs had received vaccination previously and none had been screened for immunity or HBsAg (Suckling et al, 2006).

In this study 91.3% of HCWs knew that HBV was transmitted through a NSI but despite this, only 55.9% of them always wore protective clothing when handling blood or body fluids and 38.5% said occasionally. These findings compare favorably to the practice of HCWs seen in Iran, where only 27% said they wore gloves all the time and 69% said occasionally (Moghimi M et al, 2007).

The CDC recommendation is to test for antibody after completion of three injections of HBV vaccine, and if negative, give a second dose vaccine and test again for anti-HBsAg antibodies. If there is no antibody response, no further vaccination is recommended.

The majority of HCWs (67.7% [109/161]) experienced a NSI Among them, over a third (37.6% [41/81]) always reported the NSI, and of these 40.7% (33/81) took PEP for HBV. This finding compares favorably to the study done in Bloemfontein, where only 8.7% of HCWs who were exposed to HBV had received PEP for HBV after a NSI, with the majority having been vaccinated and thus assuming they were protected and not in need of PEP (De Villiers et al, 2007).

Nevertheless, injuries go undocumented in many developing countries as compared to the US, where one out of three needle stick injuries are reported (Roy et al, 1995). It has been pointed out that the prevention of an occupational infection with BBVs like HBV is dependent on the integration of: exposure avoidance, immunization, and PEP (Gerberding, 1995).

Overall, it was found that 71.2% had scored 12 or more indicating overall practices towards HBV prevention was good. Nurses had a higher mean score (M=13.09) for practice compared to

doctors (M=12.11) and the difference was statistically significant (t=2.14, p=0.017). This finding is similar to a study done in Birmingham where it was found that only 2% of the nurses did not report a NSI as compared to 28% of doctors who did not, which was statistically significant (Stein et al, 2003

5.1.5 Barriers to / predictors for vaccination of HCWs

Although reasons for not vaccinating were not asked directly in this study, it was possible to establish barriers to / predictors for vaccination uptake. These findings may help to explain why there were 24.2% (39/161) HCWs who reported that they were not vaccinated against HBV.

Although knowledge about vaccination for HBV was found to be generally poor, fortunately poor knowledge was not found to be a statistically significant barrier to vaccination, nor was good knowledge found to be a statistically significant predictor of vaccination uptake. This finding is similar to a study done in Houston, USA where vaccine effectiveness and the belief that they were at risk of exposure were cited as reasons for being vaccinated by registered nurses. However, a study done in Nigeria demonstrated that workers thought to have greater knowledge about HBV infection (doctors and nurses) were the ones who were less interested in receiving the vaccine. Non-clinical workers (medical record personnel [76.3%] and engineering staff [69.5%]) demonstrated greater compliance, whilst clinical professionals (nurses [39.7%] and doctors [40.3%] showed less compliance (Fatusi et al, 2000

In this study, the majority of respondents had a good attitude towards vaccination for HBV, and the study found that good attitude was a statistically significant predictor of vaccination uptake (OR=1.13; p=0.007), and was also statistically significantly associated with vaccination uptake using both the student's t-test to compare mean scores (p=0.009), and the chi-square test to compare negative / moderate / positive attitudes (p=0.001). Conversely, these findings also show that a poor attitude towards vaccination against HBV is a barrier to vaccination uptake, which is supported by a study from Nigeria which highlighted greater apathy to the vaccination programme amongst clinical professionals (Fatusi et al, 2000).

Finally, it was found that being a doctor was statistically significantly associated with vaccination uptake, with doctors being 2.23 times more likely to be vaccinated than nurses (p=0.049). This finding stands in contrast to a study done in Saudi Arabia which demonstrated an

overall compliance to hepatitis B vaccination of 78.7% (37/47) amongst all categories of HCWs in ICU (Panhotra et al, 2005).

5.2 Conclusion

It can be concluded from the study that there was overall lack of knowledge amongst the majority of HCWs, despite a positive attitude in the majority of them. This positive attitude was found to be a predictor of vaccination uptake, and fortunately poor knowledge was not found to be a barrier. Nevertheless, it is clear that training in BBVs is sub-optimal at the tertiary institutions that train these HCWs.

There is a lack of implementation of policies shown in this study as reflected by the following: Inadequate safe injection practices observed as more than fifty percent of HCWs experienced needle stick injuries; protective clothing were not worn by HCWs, as such, the HCWs' right to protection against BBV is contravened. Not all HCWs were vaccinated, not all those vaccinated were given 3 doses, and not all those vaccinated were tested for immunity. It is thus clear that there is no consistent vaccination policy at the institutions where these HCWs are employed.
There is an existing gap at South African health care facilities in the management of hepatitis B virus amongst HCWs, despite the vaccination being approved by the National Department of Health (NDoH).

5.3 Recommendations

There is a need to inform the HCWs of the availability of an effective, safe vaccine that prevents HBV. This has been identified as a cost-effective public health intervention for protection against HBV. Although a majority of HCWs demonstrated a positive attitude, education on HBV infection has to be continued to target those who still have a negative attitude and to prevent regression.

All health care facilities should have programs designed to minimize risk, including infection control programs. This demonstrates the fact that it is both the duty of the employee and the employer to curtail the spread of the infection.

It is recommended that hepatitis B vaccine protocol should be available at each health care facility, and a representative body to monitor and evaluate the policies that are in place, and to see to it that they are implemented and adhered to.

In addition, programs need to be implemented to identify HBsAg positive HCWs, and to refer them for appropriate medical management, and provide vaccination to their contacts, preferable, this should be done at the beginning of the HCWs profession. Extending these services to HCWs identified as HBsAg positive will help prevent serious sequelae in chronically infected HCWs and enhance vaccination strategies for elimination of HBV transmission. HCWs that are chronically infected with HBV can treat patients, but there are guidelines in place restricting the working practices of certain hepatitis B infected HCWs. The Society for Healthcare Epidemiology of America (SHEA), states that there should be encompassing education concerning BBV for all HCWs, and the importance of worker privacy and medical confidentiality. The Society also emphasizes on the need for HBeAg positive HCWs that they should routinely double glove and should not perform invasive procedures.

Similarly, there is a need to test immunity so that persons who do not respond to revaccination would be tested for anti-HBs. Persons who test negative for anti-HBs would be considered to be susceptible to HBV infection, and thereafter would be counseled about precautions to prevent HBV infection and the need to obtain HBIG post exposure prophylaxis for any known or likely parenteral exposure to HBsAg-positive blood.
Finally, for hepatitis B to be monitored amongst HCWs, an immunization card is recommended, and health care facilities should have a medical record of their employees.

HCWs should play an important role in the implementation of the nationally recommended vaccinations; failure by HCWs to follow the recommended programme of hepatitis B vaccination is tantamount to failure in the success of the programme. By managing the vaccination programme, the department aims to achieve a high standard of public health.

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APPENDICES

Annex A: Data collection tool

Name of Project: **The knowledge, attitudes and practices of health care workers regarding hepatitis B vaccination, in the Ekurhuleni Metro, Gauteng Province.**

The aim and objectives of the study have been sufficiently explained to me. I have not been pressurized to participate in any way. I understand that participation in this study is completely voluntary and that I may withdraw from it at any time and without any adverse consequences.

I know that this study has been approved by the Research, Ethics and Publications Committee of the University of Limpopo, Medunsa Campus and the Department of Health. I am fully aware that the results of this study will be used for scientific purposes and may be published. I agree to this, provided my privacy is guaranteed.

By completing this questionnaire, I consent to participate in this Study.

A. Demographic Information

1. Race

a) African	b) White	c) Indian	d) Coloured	e) Other

2. Age

a) 20 – 30	b) 31 – 40	c) 41 – 50	d) >50

3. Gender

a) Male	b) Female

4. Job category

a) Doctor	b) Nurse

5. Duration as health care worker (in years)

a) ≤ 5	b) 6 – 10	c) 11 – 15	d) 16 – 20	e) > 20

6. Health care site

a) Public hospital	b) Private hospital	c) Clinic	d) General practice

B. General questions about protection against hepatitis B

7. One can get hepatitis B through a needle stick injury

a) True	b) False	c) Don't know

8. There is no effective vaccine for hepatitis B

a) True	b) False	c) Don't know

9. After vaccination for hepatitis B, there is no need for a blood test to confirm immunity against hepatitis B

a) True	b) False	c) Don't know

10. Hepatitis B vaccine provides 100% protection for 90% of adults and children

a) True	b) False	c) Don't know

11. Hepatitis B vaccine protects against HBV for at least 15 years

a) True	b) False	c) Don't know

12. Patients who are vaccinated against hepatitis B should not be considered as a possible source of hepatitis B

a) True	b) False	c) Don't know

13. A person who has been vaccinated or recovered from previous hepatitis B infection, can infect others

a) True	b) False	c) Don't know

14. HIV is more infectious than hepatitis B virus

a) True	b) False	c) Don't know

15. In order to be protected against hepatitis B, one needs a titre of at least 10mIU/ml of antibodies against hepatitis B

a) True	b) False	c) Don't know

C. Your exposure to / protection against hepatitis B

16. Have you been vaccinated against hepatitis B virus?

a) Yes	b) No	c) Don't know

17. If vaccinated, how many doses?

a) 1 dose	b) 2 doses	c) 3 doses	d) Don't know

18. Was your immunity against hepatitis B checked after vaccination?

a) Checked	b) Not checked	c) Don't know

19. If checked, are you….

a) Protected	b) Not protected	c) Don't know

20. How many times during your working lifetime have you experienced a needle stick or sharps injury involving a needle or sharp instrument that had been used on a patient?

a) Never	b) Once	c) 2 - 5	d) 6 – 10	e) 11 – 20	f) >20

21. If you have experienced needle stick injuries, have you reported them….

a) Always	b) Sometimes	c) Never

22. If you have reported a needle stick injury were you given post exposure prophylaxis that included the hepatitis B vaccine?

a) Yes	b) No	c) Don't know

23. How many times in the last year have you experienced blood or body fluids (e.g. amniotic fluid or liquor) splashing in your eyes or mouth?

a) Never	b) Once	c) 2 - 5	d) 6 – 10	e) 11 – 20	f) >20

24. Do you wear protective clothing when handling blood or body fluids?

a) Always	b) Sometimes	c) Never

D. Your opinion about hepatitis B vaccination

25. Hepatitis B vaccination should be compulsory for HCWs

a) Strongly agree	b) Agree	c) Don't know	d) Disagree	e) Strongly disagree

26. Hepatitis B vaccination is too expensive

a) Strongly agree	b) Agree	c) Don't know	d) Disagree	e) Strongly disagree

27. I am scared of being vaccinated because it hurts

a) Strongly agree	b) Agree	c) Don't know	d) Disagree	e) Strongly disagree

28. I am not at risk for hepatitis B because I am always careful when examining patients and taking specimens

a) Strongly agree	b) Agree	c) Don't know	d) Disagree	e) Strongly disagree

29. I am not at risk for HBV because I am a healthy person

a) Strongly agree	b) Agree	c) Don't know	d) Disagree	e) Strongly disagree

30. I do not trust vaccinations

a) Strongly agree	b) Agree	c) Don't know	d) Disagree	e) Strongly disagree

31. Vaccination is against my religion / traditional beliefs

a) Strongly agree	b) Agree	c) Don't know	d) Disagree	e) Strongly disagree

E. Would you like to have a free test to ascertain if you are protected against hepatitis B?

a) Yes	b) No

If you wish to be tested, please provide your name and contact details below so that we can arrange for you to be bled and tested. Your results will be used in a separate study which will be explained to you, after which you will need to sign informed consent before being tested. Your test results will be given to you, and if your results indicate that you need any further counselling on hepatitis B infection and vaccination, this will be given to you free of charge.

…….. ……

Name: Telephone number

Annex B: Coding

Variables	Description of variables
Race	Coded 1 if the person is an African Coded 2 if the person is white Coded 3 if the person is an Indian Coded 4 if the person is a Coloured Coded 5 as other
Age group in years	Coded 1 if 20 – 30 Coded 2 if 31 – 40 Coded 3 if 41- 50 Coded 4 if >50
Gender	Coded 1 as male Coded 2 as female
Job category	Coded 1 as doctor Coded 2 as Nurse
Duration as HCW(years)	Coded 1 if it is $\leq$ 5 Coded 2 if it is 6 – 10 Coded 3 if it is 11 – 15 Coded 4 if it is 16 – 20 Coded 5 if it is > 20
Health care site	Coded 1 if it is public hospital Coded 2 if it is private hospital Coded 3 if it is clinic Coded 4 if it is general practice

Question about protection against hepatitis B	
Can get hepatitis B through a needle stick	Coded 1 if it is true Coded 0 if don't know Coded 0 if it is false
No effective vaccine for hepatitis B	Coded 0 if it is true Coded 0 if don't know Coded 1 if it is false
No need for blood test to confirm immunity after vaccination	Coded 0 if it is true Coded 0 if don't know Coded 1 if it is false
Hepatitis B vaccine provides 100% protection for 90% of adults and children	Coded 1 if it is true Coded 0 if don't know Coded 0 if it is false
Hepatitis B vaccine protects against HBV for at least 15 years	Coded 1 if it is true Coded 0 if don't know Coded 0 if it is false
Patients vaccinated against hepatitis B should not be considered as a possible source of hepatitis B	Coded 0 if it is true Coded 0 if don't know Coded 1 if it is false
HIV is more infectious than hepatitis B virus	Coded 0 if it is true Coded 0 if don't know Coded 1 if it is false
In order to be protected against hepatitis B, one needs	Coded 1 if it is true Coded 0 if don't know Coded 0 if it is false

a titre of at least 10mIU/ml of antibodies against hepatitis B	

Exposure to/ protection against hepatitis B	
Vaccinated against hepatitis B virus	Coded 1 if it is yes Coded 0 if don't know Coded 0 if no
Number of doses	Coded 1 if it is 1 dose Coded 2 if it is 2 doses Coded 3 if it is 3 doses Coded 0 if don't know
Was immunity checked after vaccination	Coded 1 if it is checked Coded 0 if don't know Coded 0 if not checked
If checked, are you…..	Coded 1 if it protected Coded 0 if don't know Coded 1 if not protected
Number of times a needle stick injury experienced	Coded 5 if it is never Coded 4 if it is once Coded 3 if it is 2 – 15 Coded 2 if it is 6 – 10 Coded 1 if it is 11 – 20 Coded 0 if it is > 20
Was needle stick injury reported after experience	Coded 1 if it is always Coded 0 if it is sometimes Coded -1 if it is never

Was PEP given after a reported a needle stick injury	Coded 1 if it is yes Coded 0 if don't know Coded 0 if it is no
Number of times experiencing blood or body fluids splashing	Coded 5 if it is never Coded 4 if it is once Coded 3 if it is 2 – 15 Coded 2 if it is 6 – 10 Coded 1 if it is 11 – 20 Coded 0 if it is > 20
Wear protective clothing when handling	Coded 1 if it is always Coded 0 if it is sometimes Coded -1 if it is never

Opinion about hepatitis B vaccination	
Hepatitis B vaccination should be compulsory for HCWs	Coded 2 if it is strongly agree Coded 1 if it is agree Coded 0 if don't know Coded -1 if it is disagree Coded -2 if it is strongly disagree
Hepatitis B vaccination is too expensive	Coded 2 if it is strongly disagree Coded 1 if it is disagree Coded 0 if don't know Coded -1 if it is agree Coded -2 if it is strongly
Scared of being vaccinated because it hurts	Coded 2 if it is strongly disagree Coded 1 if it is disagree Coded 0 if don't know

	Coded -1 if it is agree Coded -2 if it is strongly agree
Not at risk for hepatitis B because I am careful	Coded 2 if it is strongly disagree Coded 1 if it is disagree Coded 0 if don't know Coded -1 if it is agree Coded -2 if it is strongly agree
Not at risk for HBV because I am healthy	Coded 2 if it is strongly disagree Coded 1 if it is disagree Coded 0 if don't know Coded -1 if it is agree Coded -2 if it is strongly agree
Do not trust vaccinations	Coded 2 if it is strongly disagree Coded 1 if it is disagree Coded 0 if don't know Coded -1 if it is agree Coded -2 if it is strongly agree
Vaccination is against my religion/ traditional beliefs	Coded 2 if it is strongly disagree Coded 1 if it is disagree Coded 0 if don't know Coded -1 if it is agree Coded -2 if it is strongly agree

Annex C:

Invitation Letter

Name of Study: Knowledge, attitudes and practices of health care workers regarding hepatitis B vaccination, in the Ekurhuleni Metro, Gauteng Province.

The aim and objectives of the study have been sufficiently explained to me. I have not been pressurized to participate in any way. I understand that participation in this study is completely voluntary and that I may withdraw from it at any time and without any adverse consequences.

I know that this study has been approved by the Research, Ethics and Publications Committee of the University of Limpopo, Medunsa Campus, and permission to carry out the study has been given by the Gauteng Department of Health, and the Ekurhuleni Metro. I am fully aware that the results of this study will be used for scientific purposes and may be published. I agree to this, provided my privacy is guaranteed.

I hereby give consent to participate in this Study.

……
Signature

……. ……
Name Date

....
Place Contact Details

Statement by the Researcher

I provided verbal information regarding this study
I agree to answer any future questions concerning the study as best as I am able.
I will adhere to the approved protocol.

Dr P.N. Africa
....
Name of Researcher Signature Date

.....
Place

Annex D:
Permission Letter

P. O. Box 2103
Benoni
1500
11 July 2008

The CEO: Dr Msibi
Tembisa Hospital
Private Bag X7
Olifantsfontein
1630

Dear Dr Msibi

Re: Permission to conduct a study in the Hospital

I am studying for a Master of Public Health at the National School of Public Health, University of Limpopo (Medunsa Campus) in Pretoria.
I am required to submit a research report as part of the course. I would like to conduct a research study on the knowledge, attitudes and practices of health care workers (doctors and nurses) regarding hepatitis B vaccination, in a representative sample of public and private hospitals and clinics, and general practitioners in the Ekurhuleni Metro, Gauteng Province.

Participation of the HCWs in this study is voluntary. Consent will be obtained from the participants. The questionnaire used will be anonymous. Confidentiality of all the records obtained whilst in this study will be maintained.
Results of the research study may be published, but names will not be used. If you have any questions concerning the research study, please call me at 082 8039 010 (or Mrs Rosemary Burnett at 083 6363 931)

I would be grateful to be given the opportunity to conduct this study in the hospital.

Yours sincerely
Dr P. N. Africa