Prevalence and Factors Associated with Percutaneous Injuries and Splash Exposures among Health-Care Workers in Rift Valley Provincial and War Memorial Hospitals, Kenya

Everline Muhonja Mbaisi

A thesis submitted in partial fulfillment for the degree of Master of Science in Applied Epidemiology in the Jomo Kenyatta University of Agriculture and Technology

2011

DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

Signature: ……..……..….. Date: ……..…….

Everline Muhonja Mbaisi

This thesis has been submitted for examination with our approval as University Supervisors.

1. Signature:…… Date:…….

Prof. Zipporah Ng'ang'a

JKUAT, Kenya

2. Signature:…… Date:…….

Dr. Jared Omolo

FELTP, Kenya

3. Signature:…… Date:……..……

Dr. Peter Wanzala

KEMRI, Kenya

ACKNOWLEDGEMENT

I acknowledge the immense support I have received from my supervisors Prof Z. Ng'ang'a, ITROMID, JKUAT; Dr. J. Omolo, FELTP and Dr. P. Wanzala, CPHR KEMRI. Without their invaluable advice and guidance this thesis would not have been completed. I also wish to acknowledge the significant contributions I received from Dr. Joe Oundo, Resident advisor FELTP and Dr. Donna, CDC Atlanta.

I sincerely give my gratitude to the hospital management and staff for allowing me to conduct my work in their institutions.

I also wish to appreciate FELTP for the technical and financial assistance without which my work would not have reached this far.

Lastly I thank my family for the support and understanding they held as I undertook my thesis development work.

TABLE OF CONTENTS

`LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immunodeficiency Virus
ANA	American Nurses Association
CDC	Centers for Disease Control and Prevention
CPHR	Centre for Public Health Research
DNA	Deoxyribonucleic Acid
ERC	Ethical Review Committee
FELTP	Field Epidemiology and Laboratory Training Programme
HBeAg	Hepatitis B e Antigen
HBsAg	Hepatitis B Surface Antigen
HBV	Hepatitis B Virus
HCP	Healthcare Providers
HCV	Hepatitis C Virus
HCW	Healthcare Worker
HIV	Human Immunodeficiency Virus
ICU	Intensive Care Unit
IDU	Injection Drug Users
ITROMID	Institute of Tropical Medicine and Infectious Diseases
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KAIS	Kenya Aids Indicator Survey
KEMRI	Kenya Medical Research Institute
MCH	Maternal and Child Health

NASCOP	National AIDS and STI control Programme
NIOSH	National Institute of Occupational Safety and Health
NNRTIs	Non Nucleoside Reverse Transcriptase Inhibitors
NRTIs	Nucleoside Reverse Transcriptase Inhibitors
NSI	Needle sticks Injury
NtRTIs	Nucleotide Reverse Transcriptase Inhibitors
PEP	Post-Exposure Prophylaxis
PI	Protease Inhibitors
PPE	Personal Protective Equipments
RVPGH	Rift Valley Provincial General Hospital
RNA	Ribonucleic Acid
SSC	Scientific Steering Committee
STD	Sexually Transmitted Disease
STI	Sexually Transmitted Infections
USA	United States of America
WHO	World Health Organization

ABSTRACT

Accidental occupational exposure of healthcare workers to blood and body fluids after skin injury or mucous contact constitutes a risk for transmission of blood-borne pathogens. Such pathogens include Hepatitis B virus (HBV), Hepatitis C virus (HCV) or Human Immunodeficiency Virus (HIV). A study was conducted to determine the prevalence and associated factors for percutaneous injuries and splash exposure among healthcare workers in Rift Valley provincial and War Memorial hospitals. The study design was cross-sectional conducted from October to December 2010. Self reported incidents and circumstances surrounding occupational exposure were sought by use of interviewer administered semi-structured questionnaire. An audit was conducted to assess occupational exposure prevention programs. Twenty four percent of healthcare workers (n=348) reported having been exposed to blood and body fluids in the preceding 12 months. In RVPGH, percutaneous injuries were reported by 19% (n=305) and splash to mucous membrane by 7%, with 11% reporting multiple exposures. Higher rates of percutaneous injuries were observed among nurses (50%), during stitching (30%), and in obstetric department (25%). Forty eight percent (n=83) reported the incidents with 20% (n=83) taking PEP against HIV. Health workers aged below 40 years were more likely to experience percutaneous injuries (OR= 3.7; P-value=0.034) while previous training in infection prevention was protective (OR= 0.52; P-value=0.029). The facilities lacked an occupational risk control plan. Percutaneous injuries and splashes are common in Rift Valley and War Memorial hospitals. Preventive measures remain inadequate. Post-exposure management is poorly adhered

to with gross underreporting. Health institutions should have policies, institute surveillance for occupational risks and enhance training of health care workers.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Occupational exposure to blood or other body fluids in healthcare facilities constitutes a significant risk of transmission of HIV and other blood borne pathogens to healthcare workers. Occupational exposure constitutes percutaneous injuries, skin, eye, and mucous membrane contact with blood or other potentially infections material that may result from the performance of an employee's duty. These exposures can cause tremendous anxiety, fear and stress among healthcare workers (HCW) resulting in a negative impact on the HCW, their families and colleagues as well (Amita *et al.*, 2008). Healthcare workers are at risk of blood borne pathogens due to the nature of their work. Nurses experience the majority of needle-stick injuries worldwide including half of the exposures that have been reported in the United States (CDC, 2008; Pruss *et al*., 2003). Other individuals at risk include frontline patient care providers such as doctors, phlebotomists, laboratory personnel and support staff including housekeepers.

Needle-stick injuries cause the most common exposures among HCW (Pruss *et al*., 2003) under circumstances such as manipulating the needle in the patient, during disposal, accidental injury caused by colleague worker, during clean-up and recapping needles (CDC, 2008). Work organization factors include short staffing and a poor safety climate (Clarke *et al.,* 2002; Gershon *et al.,* 2000).

The World Health Organization (WHO) estimates that 3 million percutaneous exposures occur annually among 35 million HCW globally; over 90% occurring in resource constrained countries (Pruss *et al.,* 2005). Healthcare workers in Africa suffer on average two to four needle-stick injuries per year (Pruss *et al*., 2003), with Nigeria, Tanzania and South Africa reporting 2.10 injuries per HCW on average (Elisabetta *et al*., 2005). Worldwide occupational exposure accounts for 2.5% of HIV cases and 40% of Hepatitis B and C cases among HCWs (WHO, 2002). Each year as a consequence of occupational exposure, an estimated 66,000 Hepatitis B, 16,000 Hepatitis C and up-to 1,000 HIV infections occur among HCWs. These infections are preventable through infection control measures which have reduced the risk of HIV and hepatitis transmission among health workers (Amita *et al.,* 2008).

Most developing countries, unlike developed countries, may not have surveillance for occupational exposure to blood and body fluids, hence limiting estimation of the exact magnitude of such accidents. This study therefore aimed at determining the prevalence of occupational exposure, post-exposure management and factors associated with the exposure among healthcare workers in selected public and private hospitals in Nakuru, Kenya.

1.2 Problem Statement

Occupational health risks including exposure to blood and body fluids pose a great risk to healthcare system that is already experiencing acute staff shortages (Ministry of health, 2005). Data on occupational injuries in Kenyan hospitals is limited. In developing countries, and where the highest burden of HIV and hepatitis exists, there is

limited surveillance data regarding healthcare-related occupational exposures and the use of post-exposure prophylaxis (PEP), and their consequent health impact. Furthermore, lack of personal protective equipment (PPE), unavailability of safety devices, improper disposal of sharps and other medical waste, and a high demand for injections place HCW in these settings at a high risk for occupational exposures and infections.

1.3 Justification

Healthcare workers are at risk of blood-borne pathogens as a result of occupational exposure through sharps injuries and mucocutaneuos exposure. Little is known about the burden of occupational injuries and other hazards occurring among healthcare workers in Kenyan hospitals. Their occurrences are not well documented and with constrained and limited resources, the health system especially in the public sector is characterized by congestion, heavy workload, lack of adequate supplies and equipment posing a high risk of injuries and infections to healthcare workers. No surveillance system exist to monitor work related injuries and exposures.

Accurate information regarding the magnitude of occupational injuries in our population is crucial in order to undertake prevention efforts that would have an overall impact on the quality of health care. Loss of workers can undermine developing health systems; hence it is important that risks are minimized.

1.4 Research Questions

1. What is the prevalence of percutaneous injuries and splash exposure among healthcare workers in Rift Valley provincial and War-Memorial hospitals?

2. What factors are associated with these injuries and exposures?

3. What are the post exposure management practices?

1.5 Hypothesis

1.5.1 Null Hypothesis

There is no association between percutaneous injuries and splash exposures, and knowledge and practice among healthcare workers

1.6 Objectives

1.6.1 General Objective

To determine the prevalence and factors associated with percutaneous injuries and splash exposure among healthcare workers in Rift valley provincial and War-Memorial hospitals, Kenya, 2010

1.6.2 Specific Objectives

1. To determine the prevalence of percutaneous injuries and splashes among HCWs in Rift Valley Provincial and War Memorial hospitals, Nakuru
2. To determine factors associated with percutaneous injuries and splash exposure among HCWs
3. To establish reporting rate and post exposure management of percutaneous injuries and splashes by HCWs

CHAPTER TWO

LITERATURE REVIEW

2.1 Epidemiology of Occupational Exposure to Blood and Body Fluids

Healthcare personnel are at risk for occupational exposure to blood-borne pathogens such as Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) (Shiao *et al*., 2002; CDC, 2003). Exposure occurs through needle-sticks or cuts from other sharp instruments contaminated with infected patient's blood, or through contact of the mucous membrane (eye, nose, mouth) or non-intact skin with patient's blood. These preventable injuries expose HCWs to over 20 different pathogens; HIV, HBV and HCV are the three most important causes of occupational related infections, and to a lesser extent tuberculosis, diphtheria, Ebola, Herpes, Malaria and *Streptococcus pyogenes* (Tarantola *et al*., 2006; CDC, 2008).

Needle-stick injury (NSI) is the most common form of occupational exposure that results in transmission of infections. It has been estimated that 3 million HCWs experience percutaneous injuries with contaminated sharp objects each year (Pruss *et al*., 2005). Of these exposures approximately 385,000 occur in the United States (CDC, 2008). Healthcare workers in Africa are estimated to suffer on average two to four needle-stick injuries per year (Pruss *et al*., 2003). It is estimated that 2.5% of Hepatitis B, 40% of Hepatitis C and 4.4% of HIV infections are attributed to occupational exposures (WHO, 2002). Worldwide the annual number of infections attributable to sharps injuries in 2000 was almost 16000 for HCV, 66000 for HBV and 1000 for HIV.

These infections are thought to result in 145 premature deaths from HCV, 261 from HBV and 736 deaths from HIV between 2000 and 2030; half of these deaths would occur in sub-Sahara Africa (Pruss *et al*., 2005).

Hepatitis B is one of the most significant occupational infectious risks for healthcare providers. Viral hepatitis was first identified as an occupational hazard in healthcare settings more than 60 years ago (Leibowitz & Greenwald, 1949). Prevalence of hepatitis C is increasing around the world and its occupational transmission from infected patients to healthcare providers has become an important concern (Michelin & Henderson, 2010). Other pathogens transmitted through occupational route include Ebola virus, dengue virus, herpes simplex, varicella zoster, *Blastomyces*, *Cryptococci*, *Corynebacterium diphtheriae*, *Leptospira*, *Plasmodium* parasites, *Mycobacteria tuberculosis*, *Treponema pallidum*, *Toxoplasma* (Collins & Kennedy, 1987; Alweis *et al*., 2004; Bell 1997; Dereveaux *et al*., 1990; Wagner *et al*., 2004)

2.2 Consequences and Impact of Occupational Exposures

Percutaneous injuries are primarily associated with occupational transmission of HBV, HCV and HIV, but are also implicated in the transmission of more than 20 other pathogens. HBV, HCV and HIV are the most commonly transmitted pathogens during patient care (Tarantola *et al*., 2006).

These blood-borne infections have serious consequences including long term illness, disability and death (Pruss *et al*., 2005) hence among the important health risks. Exposure to needle-stick injuries and infectious diseases have been identified as factors linked to occupational stress among health care workers, which in turn leads to

psychological distress, burn-out, absenteeism, reduced patient satisfaction and diagnosis and treatment errors (NIOSH, 2008).

Economic analysis of the costs associated with the management of occupational exposure to blood and body fluids, including post-exposure prophylaxis was conducted in 2006 in the United States of America. The overall cost ranged from US$ 71 to US$5000 (O'Malley *et al*., 2007). Moreover, HCWs experience significant fear, anxiety and emotional distress following needle-stick injury, affecting their behavior as well as work (Lee *et al*., 2005).

2.3 Hepatitis B Virus

Hepatitis B Virus is a 42-nm DNA virus in the family Hepadnaviridae. It causes acute and chronic disease (Hollinger & Liang, 2001). Worldwide approximately 2 billion people have been infected with the virus with 350 million living with chronic infection and an estimated 1 million die of HBV-related liver diseases annually (Ocama *et al*., 2005). The Hepatitis B virus is 50 to 100 times more infectious than HIV (Viral Hepatitis Prevention Board, 1996). Hepatitis B virus is an important occupational hazard for health workers. The infection is preventable through the availability of a safe and effective vaccine. The vaccine has been available since 1982. The vaccine is 95% effective in preventing HBV infection and its chronic consequences and is the first vaccine against a major human cancer. Hepatitis B infection is a major global health problem and the most serious type of viral hepatitis. It causes chronic liver disease, liver cirrhosis and liver cancer (WHO, 2000). Hepatitis B Virus remains viable and infectious

in the environment for at least 7 days and can be present in high concentrations on inanimate objects even in the absence of visible blood (Lewis *et al*., 1988).

Hepatitis B Virus transmission patterns and the sero-prevalence of chronic HBV infection vary markedly worldwide. Countries of high or intermediate prevalence of HBV include Eastern Europe, Asia, Africa, Middle East and the Pacific islands (CDC, 2005a). Prevalence in developing countries is estimated at 8-15% (CDC, 2009).

One of the strategies to eliminate viral transmission is to vaccinate adults in high risk groups (Suckling *et al*., 2006). These include: those with high risk sexual behavior, household contacts, injection drug users, healthcare workers and international travelers to areas of high endemicity. Protection lasts at least 20 years and should be life-long (WHO, 2000).

Vaccine coverage among healthcare workers varies across countries. According to the WHO estimates; it varies from 18% in Africa to 77% in Australia and New Zealand (Hutin *et al*., 2003). In a study conducted in Nigeria, coverage was as high as 70.2% (Samwel *et al*., 2009). In a study conducted in Thika, Kenya, the coverage was found to be 12% (Suckling *et al.,* 2006). The reasons given for non-vaccination include low risk perception, staff being too busy, lack of knowledge about disease severity and vaccine efficacy, while others had no reasons.

2.4 Human Immunodeficiency Virus (HIV)

Human Immunodeficiency Virus was clearly demonstrated in 1984 to be the causative agent of acquired immunodeficiency syndrome (AIDS), formerly named Human T

Lymphotrophic virus type III (Popovic *et al*., 1984; Gallo & Wong, 1985). The first case in Kenya was described in 1984 (NASCOP, 2002).

Since the beginning of HIV/AIDS epidemic, almost 60 million people have been infected and 25 million people have died of HIV-related causes. In 2008, there were 33.4 million people living with HIV, with 2.7 million new infections and 2 million AIDS-related deaths. Sub-Saharan Africa accounts for 67% of all people living with HIV worldwide and has 14 million children orphaned by the epidemic (UNAIDS/WHO, 2009).

There are two types of HIV viruses; type 1 and 2. Human Immunodeficiency Virus type 1 is the cause of worldwide pandemic. It has subtypes A to K with sub-type C being the most virulent. According to WHO HIV/AIDS is classified into four clinical stages. Stage 1 which is asymptomatic; stage 2 characterized by mild infection; stage 3 with moderate infection and stage 4 characterized by severe infection (AIDS).

Human Immunodeficiency Virus is transmitted by three primary routes; sexual, parenteral (blood-borne) and perinatal (Jean, 2001). There is no data on prevalence of HIV among healthcare workers in Kenya; however, the prevalence in general population is estimated at 7.4% with gender and provincial variations (KAIS, 2007).

The first reported case of needle-stick transmitted HIV infection (Anonymous, 1984) led to increasing awareness and concern about risks to HCW posed by sharps injuries. Another case of HIV transmission from a patient to HCW was reported in 1986 (Stricof & Morse, 1986).

2.5 Hepatitis C Virus

Hepatitis C virus (HCV) is a small RNA virus previously known as non-A non-B hepatitis, belonging to family flaviridae. Hepatitis C Virus was discovered in 1989 (Choo *et al.,* 1989). Hepatitis C Virus infects approximately 170 million individuals worldwide. Infection by HCV is the most common chronic blood-borne infection in the United States; approximately 3.2 million persons are chronically infected. Sixty to 70% of persons newly infected with HCV are usually asymptomatic or have a mild clinical illness. The incubation period for acute HCV infection ranges from 2 to 24 weeks, with an average of 6 to7 weeks. Hepatitis C virus RNA can be detected in blood within 1-3 weeks after exposure. Chronic HCV infection develops in 70% to 85% of HCV infected persons; 60% to 70% of chronically infected persons have evidence of active liver disease.

Hepatitis C Virus is most efficiently transmitted through large or repeated percutaneous exposure to infected blood. The infection is common in injection drug users (Catherine *et al*., 2007). Study findings have indicated that sexual transmission of HCV is possible but inefficient (CDC, 2006).

2.6 Prevention of Occupational Exposures

Universal precautions aim to prevent transmission of blood-borne pathogens. The objective is to ensure health workers minimize risk of exposure to infected body fluids by assuming patients are infected with blood-borne pathogens (CDC, 2006; Nelofar *et al*., 2006). These measures are important, as it is estimated that the attributable fractions

for percutaneous occupational exposure are 37% for Hepatitis B, 39% for Hepatitis C and 4.4% for HIV (Elisabetta *et al*., 2005).

Many needle-sticks and other cuts can be prevented by using safer techniques (for example, not recapping needles by hand), disposing of used needles in appropriate sharps disposal containers, and using medical devices with safety features designed to prevent injuries. Using appropriate barriers such as gloves, eye and face protection, or gowns when contact with blood is expected can prevent possible exposure to the eyes, nose, mouth, or skin (CDC, 2003).

Effective needle-stick prevention measures include hazard elimination, engineering controls (use of safer devices such as retractable needles), administrative controls, work practice controls and use of personal protective equipments (ANA 2002; Elisabetta *et al*., 2005). A committed management is essential to ensure occupational health of its employees (Gershon *et al*., 2000). Different studies have reported a decline in NSI rate after implementation of multi-factorial approaches (Michael *et al*., 2008).

2.7 Risk of Occupational Transmission of Blood-borne Pathogens to Health-care Workers

The risk of healthcare workers acquiring blood-borne pathogens after occupational exposure depends on multiple factors: prevalence of infection in the specific population, frequency of activities capable of transmitting the infectious agent, nature and efficacy of exposure route, viral load and availability and efficacy of pre-exposure and post-exposure prophylaxis (CDC, 2003).

Factors influencing risk of transmission include depth of injury in case of sharp object; device that is visibly contaminated with blood; needle that was directly inserted in blood vessel; type of needle, whether hollow or solid; thickness of the needle; viral load of the source; quantity of blood or body fluid exposed; and duration of exposure (Varghese *et al*., 2003).

2.7.1 Risk of Hepatitis B virus infection after exposure

For a susceptible person**,** the risk from a single needle-stick or cut exposure to HBV infected blood ranges from 6% to 30% and depends on the hepatitis B e antigen (HBeAg) status of the source individual. Hepatitis B surface antigen positive individuals who are HBeAg positive have more viruses in their blood and are more likely to transmit HBV than those who are HBeAg negative (Weiner & Grady, 1982). There is no known risk of transmission of HBV from exposure to intact skin. The potential for HBV transmission through contact with environmental surfaces has been demonstrated in investigations of HBV outbreaks among patients and staff of hemodialysis units. Blood contains the highest HBV titers of all body fluids and is the most important vehicle of transmission in healthcare setting.

2.7.2 Risk of Hepatitis C virus infection after exposure

The average risk for infection after a needle-stick or cut exposure to HCV-infected blood is approximately 1.8% (Puro *et al*., 1995). The risk through mucosal exposure is unknown, but is believed to be small; however HCV infection from blood splash to the eye has been reported. There also has been a report of HCV transmission that may have

resulted from exposure to non-intact skin, but no known risk from exposure to intact skin. Data are limited on survival of HCV in the environment. The risk for transmission from exposure to fluids or tissues other than HCV-infected blood has also not been quantified but is expected to be low (CDC, 2003)

2.7.3 Risk of HIV infection after exposure

The risks for occupational transmission of HIV have been described; risks vary with the type and severity of exposure (CDC, 2001). In prospective studies of HCWs, the average risk for HIV transmission after a percutaneous exposure to HIV infected blood has been estimated to be approximately 0.3% (95% confidence interval (CI) of 0.2% - 0.5%) (Bell, 1997) and after a mucous membrane exposure, approximately 0.09% (CI=0.006%-0.5%). The risk of infection with HIV following a mucocutaneuos exposure was estimated to be 0.09 in a review of six studies (Ippolito *et al.*, 1993). Mucocutaneuos contacts contribute up-to 15% of all infections in HCWs (Jagger, 1996).

Risk of transmission after exposure to other fluids or tissues has not been quantified but is probably lower than for blood exposures. Epidemiologic and laboratory studies suggest that multiple factors might affect the risk for HIV transmission after an occupational exposure.

Increased risk has been found to be associated with exposure to a larger quantity of blood from the source person as indicated by the device (hollow bore needle) visibly contaminated with patient's blood, procedure that involved a needle being placed directly into blood vessel, or a deep injury. The risk was also increased for exposure to

blood from source persons with terminal illness, possibly reflecting high titer of HIV in blood (CDC, 2000).

2.8 Post Exposure Management of Occupational Exposures

Needle-sticks are common yet often under-reported (Osborne *et al.*, 1999). When levels of reporting have been examined, it is common for only a small proportion to be reported; knowledge about needle-stick injuries and possible infection from blood-borne pathogens is often low and risks under-estimated (Samir & Amitav, 2008). Unreported needle-stick and sharps injuries prevent HCW from receiving the necessary PEP. According to researchers, an estimated 40-70% of all needle-stick injuries are unreported (Osborne *et al*., 1999).

2.8.1 Action to be taken after exposure

Post-exposure management should include the immediate management of the site of exposure, evaluation of the exposure, source patient evaluation, baseline and follow up testing, counseling and PEP (Jean, 2001). Immediately following an exposure, needle-stick injury should be washed with water, splashes to the nose, mouth or skin be flushed with water and eyes irrigated with clean water.

No scientific evidence shows that using antiseptics or squeezing the wound will reduce the risk of transmission of a blood-borne pathogen. Using caustic agent such as bleach is not recommended. The incident should be reported to the department responsible for managing exposures. Prompt reporting ensures PEP is started as soon as possible if

recommended. Possible risks of acquiring HBV, HCV and HIV should be evaluated and discussed (CDC, 2003).

2.8.2 Vaccination

2.8.2.1 Vaccination against HBV

Hepatitis vaccine has been available since 1982 to prevent HBV infection. All HCW who have a reasonable chance of exposure to blood or body fluids should receive hepatitis B vaccine. Workers should be tested 1 to 2 months after the vaccine series is complete to make sure that vaccination has provided immunity against HBV infection. Hepatitis B immune globulin (HBig) alone or in combination with the vaccine (if not previously vaccinated) is effective in preventing HBV infection after exposure. The decision to begin treatment is based on factors, such as whether the source individual is positive for hepatitis B surface antigen, whether one has been vaccinated and whether the vaccine conferred immunity. Post-exposure prophylaxis and vaccination should begin as soon as possible after exposure, preferably within 24 hours, and not later than 7 days (CDC, 2003).

2.8.2.2 Vaccination against HCV

There is no vaccine against hepatitis C and no treatment after an exposure that will prevent infection. However, limited data indicate that antiviral therapy might be beneficial when started early in the course of HCV infection.

2.8.2.3 Vaccination against HIV

There is no vaccine against HIV. Use of antiretroviral drugs after occupational exposures may reduce the chance of HIV transmission. Post-exposure prophylaxis (PEP) is recommended for certain occupational exposures that pose a risk of transmission. For those exposures without risks of HIV infection, PEP is not recommended because the drugs used may have serious side effects (CDC, 2003).

2.8.3 Antiretroviral agents for post exposure prophylaxis

Antiretroviral agents currently available for the treatment and management of HIV infection include nucleoside (no phosphate groups) reverse transcriptase inhibitors (NRTIs), nucleotide reverse transcriptase inhibitors (NtRTIs), non-nucleoside reverse transcriptase inhibitors (NNRTIs), protease inhibitors (PIs) and a single fusion inhibitor. The recommendations provide guidance for two or more drugs for the PEP regimen on the basis of risk for transmission through the exposure (CDC, 2005b). Individuals receiving PEP should complete a full 4-week regimen. Differences in side effects associated with the use of the drugs may influence the choice of drugs in specific situations.

Treatment should begin as soon as possible. Starting treatment after a longer period (e.g. 1 week) may be considered for exposures that represent an increased risk of transmission. PEP with zidovudine has been shown to reduce the risk of HIV infection by approximately 81% in a case control study of healthcare workers (Cardo *et al*., 1997). Acceptance of PEP among HCW varies between 40-79% and 12 % - 33% of individuals interrupt PEP because of side effects (Puro *et al*., 2000; Parkin *et al*., 2000).

All HCWs with occupational exposure to HIV should have a baseline HIV antibody test and should receive counseling and follow-up. HIV antibody testing should be performed for at least 6 months after exposure. Extended follow-up is recommended for those who become infected with hepatitis C virus after an occupational exposure to a source co-infected with hepatitis C and HIV (Alvarado & Beltrami, 2003). Factors to consider in assessing need for follow up of occupational exposures include type of exposure, type and amount of fluid/tissue, infectious status of source and susceptibility of exposed person (CDC, 2001)

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area

The study was conducted in two hospitals situated in Nakuru central district (Figure 1); Rift valley provincial general hospital (RVPGH) and War Memorial hospital. RVPGH was selected randomly from a list of seven provincial hospitals and War Memorial hospital was randomly selected from a list of three private hospitals within Nakuru district. RVPGH is a referral hospital offering general services, with a catchment population of about 500,000, bed capacity of 588 and 60 cots, and an average monthly bed occupancy of 110%. War Memorial hospital provides general inpatient and outpatient services, with a bed capacity of 40.

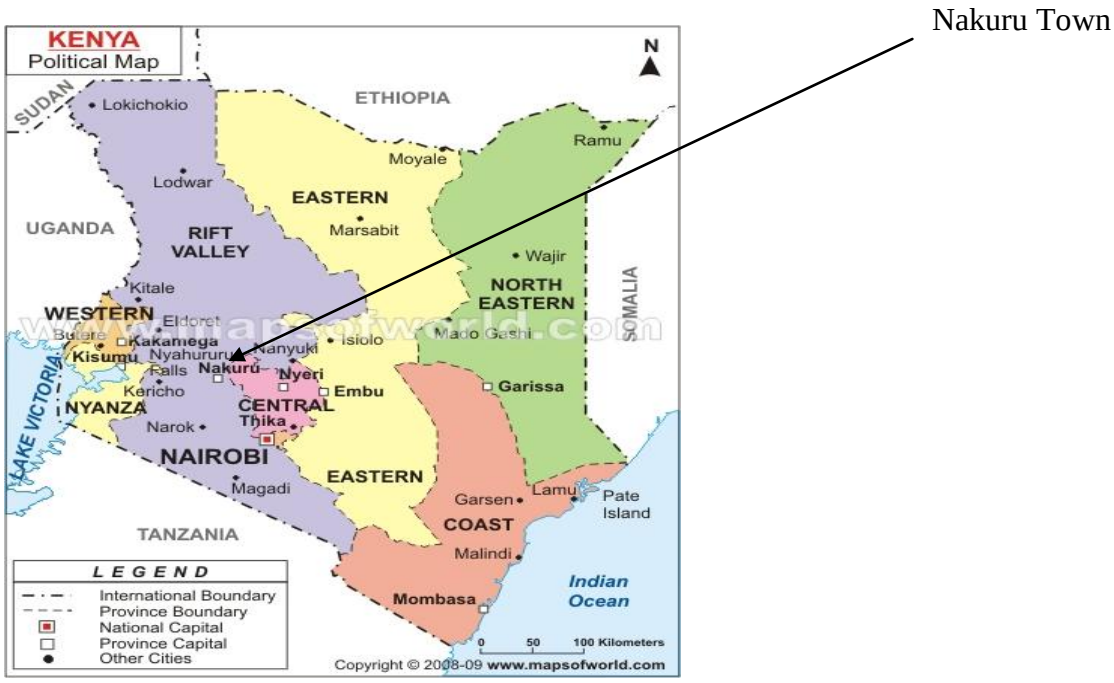

Figure 3.1 Map of Kenya showing Nakuru town

3.2 Study Design

A cross sectional study was conducted in October to December 2010 among a random sample of health-care workers at Rift Valley Provincial hospital and the whole population of eligible health care workers at War Memorial hospital. The study design was used to determine the prevalence rate of percutaneous injuries and splash exposures. Information on the relationship between percutaneous injuries and splash exposure and associated factors was gathered simultaneously by interviewing the HCWs using questionnaires.

3.3 Study Population

The study population consisted of health-care workers who came into contact with patients, or were potentially exposed to body fluids from patients while attending to or handling samples from patients. These healthcare workers included resident doctors and interns, clinical officers, nurses, laboratory personnel, mortuary attendants, housekeeping staff and students (nurses, clinical officers, lab technicians/technologists).

3.3.1 Inclusion criteria

Health-care workers directly involved in patient care, those indirectly involved in patient care but were potentially exposed to body fluids from the patients, and, those who gave consent to participate.

3.3.2 Exclusion criteria

Health-care workers not directly involved in patient care, with limited chances of contact with blood or body fluids. These included clerical officers, kitchen staff, and maintenance personnel, as well as health-care workers who did not give consent.

3.4 Sampling procedure and sample size determination

Stratified sampling method was used to recruit staff into the study, based on the various categories of HCWs, who were allocated proportionally considering the size of each stratum.

Sample size calculation, with finite population correction, using modified Cochran (1977) formula:

$n= (Nz^2pq)/d^2(N-1)+z^2pq$

Assumptions

$Z (1-\alpha/2) = 1.96$

p- Prevalence of needle-stick injuries in healthcare workers =17.2% (Gessessew & Kahsu, 2006)

q=1-p= 82.8% d (Absolute precision)=5%

N=population size

$n=705*1.96^2*0.172*0.828/ (0.05^2*(705-1)+1.96^2*0.172*0.828) =167$

Adjusted for non-response rate (20%) and stratification (15%)

167/0.80=209

209/0.85= 246

3.4.1 Sample size from each hospital

A minimum of 246 participants was selected from RVPGH. The number of HCWs in each stratum was determined by the formula "Number selected from each stratum= Population in stratum *(n/N)", as shown in table 1 below. Sampling frame included health-care workers in the hospital based on the eligibility criteria.

Table 3.1: Distribution of HCWs per Stratum, RVPGH

Professional Cadre	Total number	Number required (size of strata) (Population in stratum*n/N)
Doctors	60	21
Nurses	370	128
Clinical Officers	55	19
Dentists/Dental technologists	12	4
Lab technologists/technicians	36	13
Support staff	172	60
Morgue attendants	4	1
Total	709	246

In War Memorial hospital, all eligible health-care workers (50) were recruited as study participants. Since the population was small, a sample of HCWs would not have had adequate power to give a valid statistical association between exposures (risk factors) and occupational injuries and splashes to mucous membrane.

3.5 Data Collection Tools

Self reported occupational exposure to blood and body fluids in the preceding one year was elicited using a semi-structured questionnaire (Appendix A) adopted from CDC workbook for designing sharp prevention programme (CDC, 2008). The questionnaire

was pre-tested and modified as necessary. The questionnaires were administered by trained interviewers. Available records for 2005-2009 were reviewed for reported cases (Appendix C). An audit was done using a checklist (Appendix B) to identify the current status of infection prevention and control at the facilities; this included assessment of presence of occurrence books, PEP management protocol, and infection control committee.

Study variables included demographic data, occupational data, frequency and nature of exposures to include type of exposure, body site involved, depth of penetration, type of body fluid involved, type of device involved, procedure under which the exposure occurred and use of PPE, risk factors, HBV vaccination status and workers behavior post-exposure. Occupational exposures were defined as percutaneous injuries (needle-stick or cut with a sharp object) or contact of mucous membrane or non-intact skin with blood, tissue or other body fluids that are potentially infectious. Depth of injury was classified as superficial (scratch, little or no blood), moderate (penetrated through skin, wound bled) and deep (intramuscular penetration).

3.6 Data Management and Analysis

Data was entered into Epi-info version 3.5.1 (CDC, Atlanta, USA) and cleaned prior to analysis. The data was stored in password protected computer and backed-up, with restricted access. Descriptive analysis was carried out using frequencies, proportions and means. The prevalence of percutaneous injuries and splashes was determined. Frequency of reporting and proportion of those who received PEP were also determined.

Bivariate analysis was carried out to determine measure of association (odds ratio) between occupational exposure and associated factors in RVPGH. Factors that were found to be significantly associated with the outcome, at P-value less than or equal to 0.1 were entered in multivariate logistic regression model to identify significant factors associated with the occupational exposures and estimate the magnitude of the adjusted odds ratio for each significant factor while controlling for confounding factors. Statistical significance of the associations was determined by Chi-square test (or fisher's exact test, where applicable), with a P-value of less than 0.05 considered significant. Regression equation (Breslow & Day, 1979) used was:

$\text{Log } (p/1\text{-}p) = b_0+b_1x_1+b_2x_2+\ldots\ldots\ldots b_kx_k$

Where p = probability of sustaining an occupational exposure

(p/1-p) = odds of sustaining occupational exposure

b_0 is the intercept (constant)

b_1, b_2, b_k are regression co-efficient (size of the contribution of that independent variable)

x_1, x_2, x_k represent the independent variables entered into the model

The dependent variable was having sustained occupational exposure (yes/no) while independent variables included in the model were age (<=40/>40) and having received training (yes/no) for percutaneous injuries. Working in casualty and surgical

departments were the independent variables for having sustained splash exposure to mucous membrane. When substituted, the equations become:

Log (odds of sustaining percutaneous injuries) = -2.1 + (1.31*age) + (-066*training),

Decreasing age is associated with an increase of sustaining percutaneous injury (odds of sustaining percutaneous goes up by 1.31 for every year under 40) and Increasing training decreases the risk of sustaining percutaneous injuries (odds of sustaining percutaneous injuries goes down by 0.66 for each HCW trained).

Log (odds of sustaining splash exposure) = -3 + (1.4*casualty) + (1.3*Surgical)

Working in casualty increases risk of sustaining splash exposure (odds of sustaining splashes goes up by 1.4 for every health care worker in casualty) and working in surgical department increases risk of sustaining splashes (odds of exposure goes up by 1.3 for every health care worker in surgical department)

3.7 Ethical Considerations

Ethical approval was obtained from Kenya Medical Research Institute (KEMRI) Scientific Steering Committee (Appendix E) and National Ethical Review Committee (Appendix F), and clearance sought from Rift valley provincial (Appendix G) and War-Memorial hospitals administrative authorities. Anonymity was maintained by coding rather than using participant's name in the questionnaire. Written informed consent was obtained from the participants (Appendix D). The purpose, risks and benefits and subjects rights were explained to participants. Participation was voluntary. Information was kept confidential at all steps of the study. All personnel involved (assistants) were

required to adhere to a code of conduct regarding confidentiality of information. Health-care workers exposed to sharps injuries and splash exposure were referred to infection control personnel and/or outpatient department for further management and follow up, at their respective hospitals.

CHAPTER FOUR

RESULTS

4.1 Demographic Characteristics of Respondents

Three hundred and five health-care workers were interviewed in RVPGH. More females (65.2%) than males were interviewed (Table 4.1). The ages of the study participants ranged from 19 to 56 years, with mean age of 32 years. Staff who participated in the study included doctors (8.2%), nurses (43.9%), clinical officers (14.1%), laboratory personnel (3.9%), dentists/dental technologist (1%), support staff (15.1%) and students (13.1%) who were on duty during the study period.

Table 4.1: Demographic Characteristics of the Respondents, RVPGH

Variable		**Frequency (%), N=305**
Sex	Male	106 (34.8)
	Female	199 (65.2)
Occupation	Doctors	25 (8.2)
	Nurses	134 (43.9)
	Clinical Officers	43 (14.1)
	Laboratory Personnel	12 (3.9)
	Dentists/Dental technologists	3 (1)
	Students	40 (13.1)
	Support staff	46 (15.1)
	Morgue attendant	1 (0.3)
Age-group	<=20 years	5 (1.6)
	21-30 years	164 (53.8)
	31-40 years	91 (29.5)
	41-50 years	31 (10.2)
	>50	14 (4.9)

In War Memorial hospital 43 HCWs were interviewed giving a response rate of 84%. Seven HCWs declined to participate in the study. The mean age was 36 years. Seventy four percent were female, with HCWs aged 21-30 years being the majority (34.9%). Health-care workers who were interviewed include nurses (41.8%), support staff (46.5%), one doctor (2.3%) and one student (2.3%) as seen in Table 4.2.

Table 4.2: Demographic Characteristics of Respondents, War Memorial Hospital

Variable		**Frequency (%), N=43**
Sex	Male	11 (25.6)
	Female	32 (74.4)
Occupation	Doctors	1 (2.3)
	Nurses	18 (41.8)
	Laboratory Personnel	1 (2.3)
	Students	1 (2.3)
	Support staff	20 (46.5)
Age-group	<=20 years	0
	21-30 years	15 (34.9)
	31-40 years	13 (30.2)
	41-50 years	14 (32.6)
	>50	1 (2.3)

4.2 Prevalence and Nature of Exposures

The overall prevalence of occupational exposure was 26.6% (N=305) in RVPGH in the previous 12 months. The prevalence of percutaneous injuries was 19.3% (N=305) and that of splash exposure to mucocutaneous membrane was 7.2% (Table 4.3). Seven persons (12% of 59) had more than 1 sharp injury, with mean number of injuries of 1.15 (SD=0.45). Percutaneous injuries were more common (73%) than splash exposures to mucocutaneous membrane. Four HCWs reported having had both percutaneous injuries and splash exposure to mucous membrane within the last 12 months.

Table 4.3: Prevalence of Occupational Exposure, RVPGH

Occupational exposure	**% (n/N)**
Overall	26.6 (81/305)
Percutaneous	19 (59/305)
Splashes	7.2 (22/305)

The prevalence of percutaneous injuries was high among female HCWs (21%), HCWs of age-group 31-40 (26.4%) and among HCWs with work experience of <10 years (20.4%). Splashes occurred more commonly among male (8.5%), among those of age-group 31-40 years (8.8%) and among HCWs with work experience of <10 years (8.6%) as shown in Table 4.4.

Table 4.4: Prevalence of Occupational Exposures by Sex, Age-group and Years of Experience, RVPGH

Variable		Prevalence,% (n/N)	
		Percutaneous	**Splashes**
Sex	Male	17 (18/106)	8.5 (9/106)
	Female	21 (41/199)	6.5 (13/199)
Age-Group (years)			
	<=20	0	0
	21-30	19.5 (32/164)	7.9 (13/164)
	31-40	26.4 (24/91)	8.8 (8/91)
	41-50	6.5 (2/31)	0
	>50	7 (1/14)	7 (1/14)
Years of Experience			
	<=10	20.4 (45/221)	8.6 (19/221)
	11-20	19.3 (11/57)	3.5 (2/57)
	>20	11 (3/27)	3.7 (1/27)

In War memorial hospital, the prevalence of percutaneous injuries was 11.6% (n=43). The prevalence of splash exposure to mucocutaneous membrane was 7%. The overall prevalence of occupational exposures was 19% (Table 4.5). Two HCWs reported multiple exposures (percutaneous injury and splash exposure).

Table 4.5: Prevalence of Occupational Exposure, War Memorial Hospital

Occupational exposure	% (n/N)
Overall	19 (8/43)
Percutaneous	12 (5/43)
Splashes	7 (3/43)

Three percutaneous injuries were reported by male (prevalence of 27.3%) while all incidents of splash exposures occurred among female HCWs, thus giving a prevalence of 9.4%. Health-care workers of the age-group 21-30 years were mostly affected, with a prevalence of 20% for percutaneous injuries. The prevalence of percutaneous injuries was high among HCWs with work experience of less than 10 years (13.6%), as shown in Table 4.6.

Table 4.6: Prevalence of Occupational Exposures by Sex, Age-group and Work Experience, War Memorial Hospital

Variable	**Prevalence, % (n/N)**	
	Percutaneous	**Splashes**
Sex Male (%)	27.3 (3/11)	0
Female (%)	6.3 (2/32)	9.4 (3/32)
Age-Group (years)		
<=20	0	0
21-30	20 (3/15)	6.7 (1/15)
31-40	15.4 (2/13)	7.7 (1/13)
41-50	0	7.1 (1/14)
>50	0	0
Years of Experience		
<=10	13.6 (3/22)	4.5 (1/22)
11-20	11.1 (2/18)	11.1 (2/18)
>20	0	0

The finger was the most common injured body site (80%) in RVPGH (Figure 4.1). The hand, arm and legs were less involved. Splashes to the eyes constituted 56%, to the mouth 52% with two HCWs reporting multiple site exposure. In War memorial hospital, all sharp injuries involved the fingers.

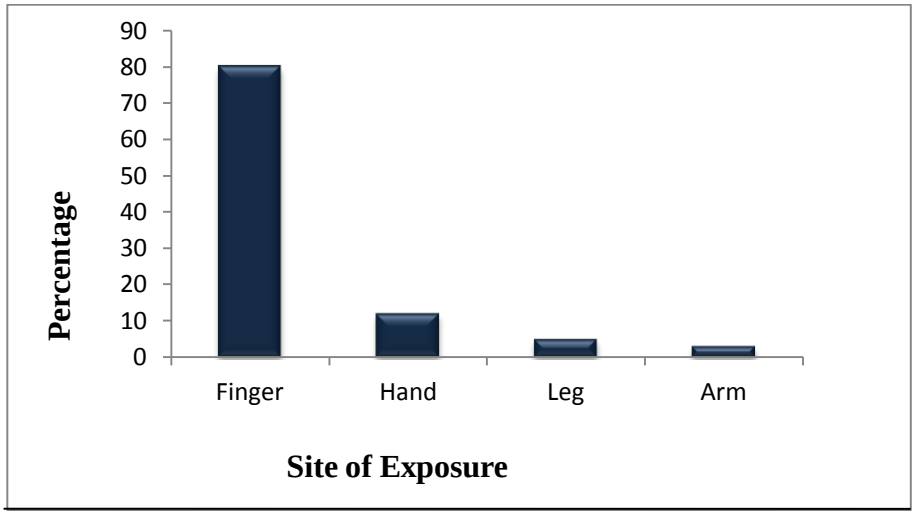

Figure 4.1: Frequency of Percutaneous Injuries by Site of Exposure, RVPGH

In RVPGH, 67.8% eight percent of the sharps injuries were superficial (scratch, little or no blood) while 1.7% involved deep penetration (intramuscular penetration). Thirty percent of the injuries were moderate (penetrated through the skin, wound bled), as shown in Table 4.7 below.

Table 4.7: Distribution of Percutaneous Injuries by Depth of Penetration, RVPGH

Variable	**Frequency (%), N=59**
Superficial	40 (67.8)
Moderate	18 (30.5)
Deep	1 (1.7)

In War Memorial hospital 3 percutaneous injuries were superficial, while one injury involved deep penetration (Table 4.8).

Table 4.8: Distribution of Percutaneous Injuries by Depth of Penetration, War Memorial Hospital

Variable	**Frequency (%)**
Superficial	3 (60)
Moderate	1 (20)
Deep	1 (20)

4.3 Circumstances Leading to Occupational Exposures

Various circumstances were associated with percutaneous injuries and splash exposures. These included: type of procedure, occupation, place of work, type of device and time of day. Hypodermic needle caused 39% of sharps injuries in RVPGH. Suture needles (25%), phlebotomy needles (12%) and branulars (14%) were associated with occurrence of needle-pricks (Figure 4.2). Devices classified as others were scissors, forceps, and lancets.

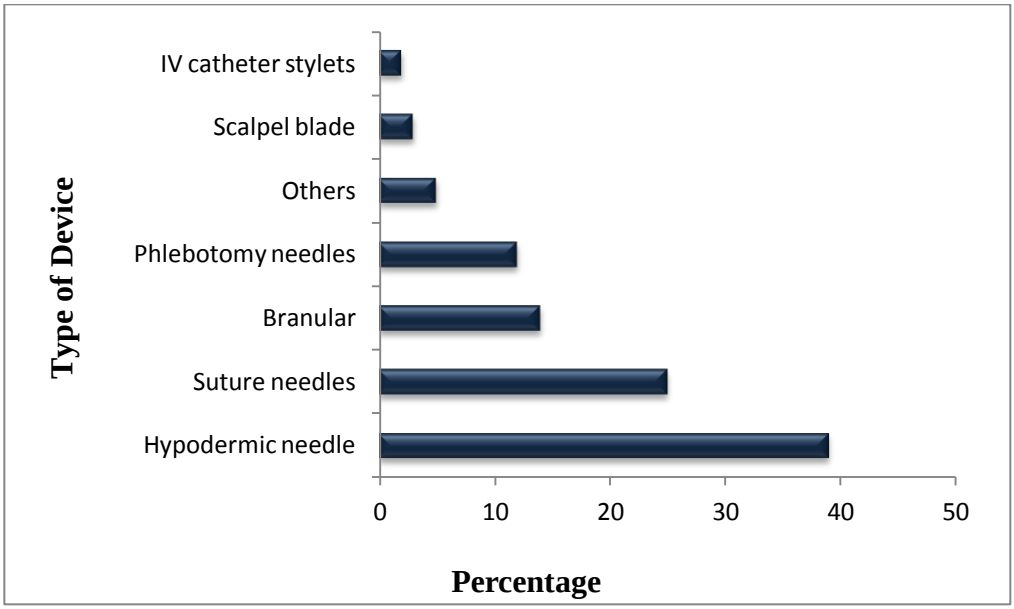

Figure 4.2: Distribution of Percutaneous Injuries by Type of Device, RVPGH

In War Memorial hospital 4 injuries were caused by hypodermic needles and one by surgical blade (Figure 4.3).

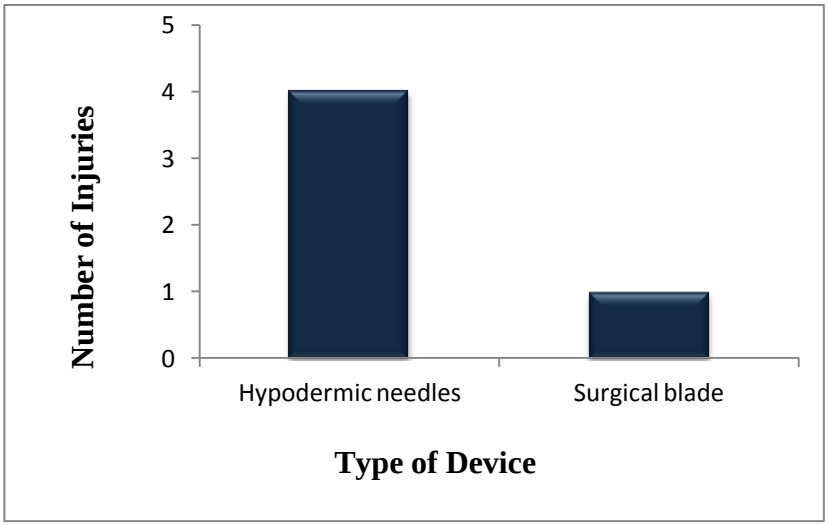

Figure 4.3: Distribution of Percutaneous Injuries by Type of Device, War Memorial Hospital

In RVPGH, there was equal distribution of sharp injuries in surgery, medical and pediatric departments (17%, n=59), with obstetrics and gynecology departments having the largest share of all percutaneous injuries (25%, n=59). Splash exposure occurred more commonly in surgery (31.8%, n=22), casualty (18.2%, n=22) and Obstetrics and gynecology department (13.6%, n=22), as shown in Table 4.9.

Table 4.9: Distribution of Occupational Exposures by Department, RVPGH

Department	Percutaneous Injuries, n (%) N=59	Splashes, n (%) N=22
Medical	10 (17)	2 (9.1)
Pediatric	10 (17)	2 (9.1)
Casualty	3 (5)	4 (18.2)
Laboratory	5 (8)	2 (9.1)
ICU	1 (2)	1 (4.5)
Obs/gyn	15 (25)	3 (13.6)
Surgery	10 (17)	7 (31.8)

In War memorial hospital, two injuries (40%) occurred in theatre, as shown in Table 4.10. Pediatric, obstetric and gynecologic and surgical departments had an equal share of percutaneous injuries and splash exposures.

Table 4.10: Distribution of Occupational Exposures by Department, War Memorial Hospital

Department	Percutaneous Injuries, n (%) N=5	Splashes, n (%) N=3
Theatre	2 (40)	0
Paediatric	1 (20)	1 (33)
Obs/gyn	1 (20)	1 (33)
Surgery	1 (20)	1 (33)

Nurses were more commonly injured than other HCWs (50% in RVPGH). Clinical officers followed with 17.2% exposed to sharps injuries in RVPGH (Figure 4.3). Overall nurses were commonly injured during injection (55.6%) and stitching (82.4%), laboratory personnel during blood specimen collection (27.3%) and supportive staff during environmental cleaning (50%). Other HCWs involved were doctors, dentists, students and support staff (Figure 4.4).

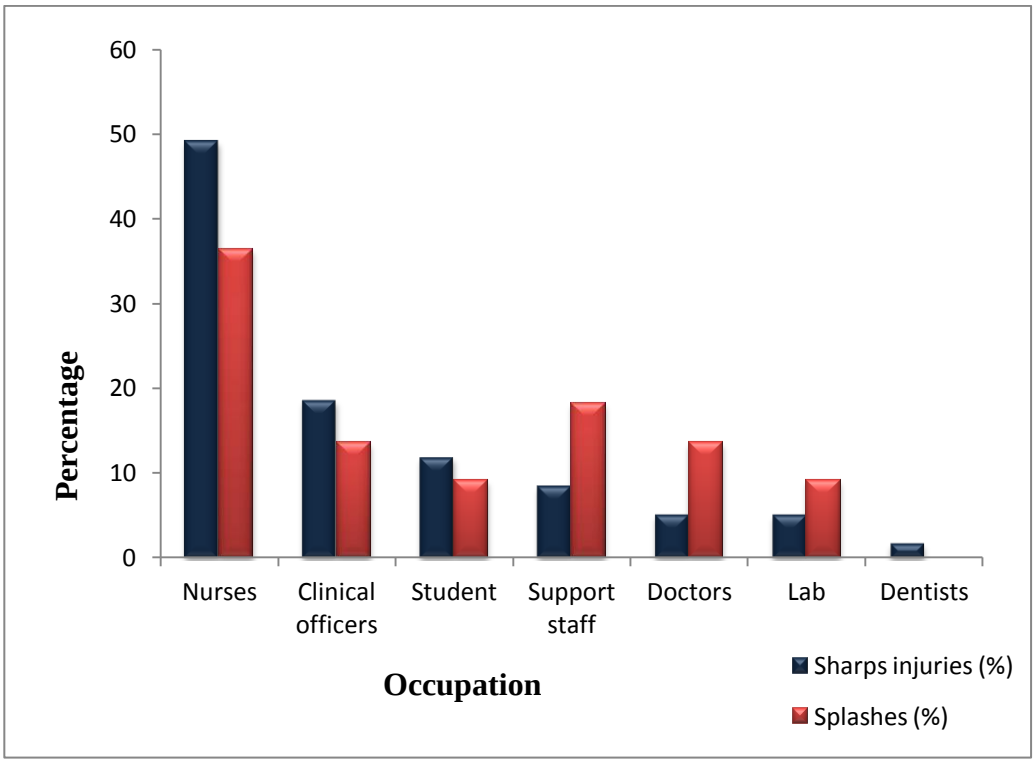

Figure 4.4: Distribution of Sharps Injuries (Percutaneous) and Splashes by Occupation, RVPGH

In War Memorial hospital, three nurses (60%), one support staff and one doctor reported percutaneous injuries. Splash exposure was reported by two nurses (66.7%) and one support staff (Figure 4.5).

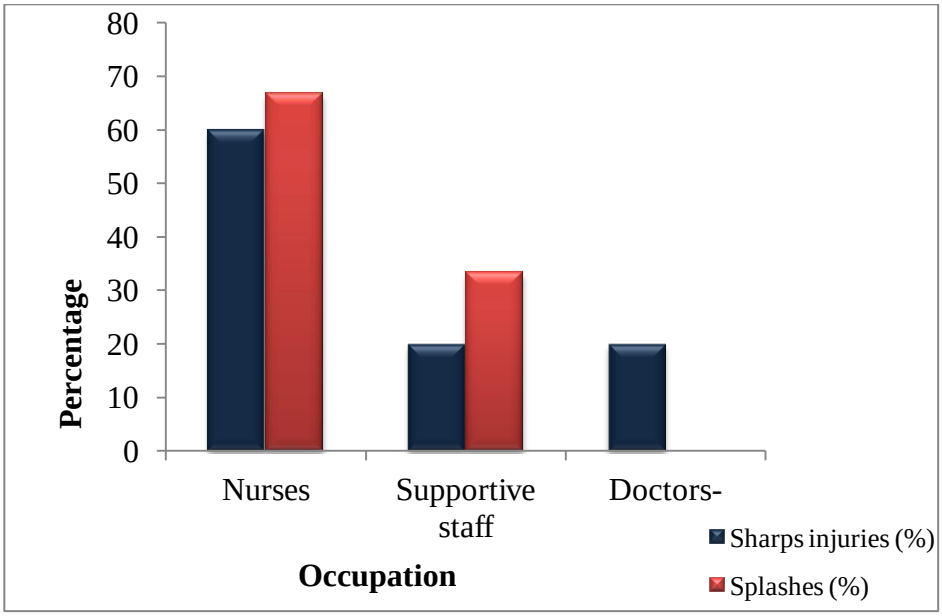

Figure 4.5: Distribution of Sharps Injuries (Percutaneous) and Splashes by Occupation, War Memorial Hospital

In RVPGH, 29% (n=59) of percutaneous injuries during stitching, 19% occurred during blood specimen collection, 19% during handling of intravenous line and 15% during administration of injections (Figure 4.6). Procedures classified as others were shaving, bed making and tooth extraction.

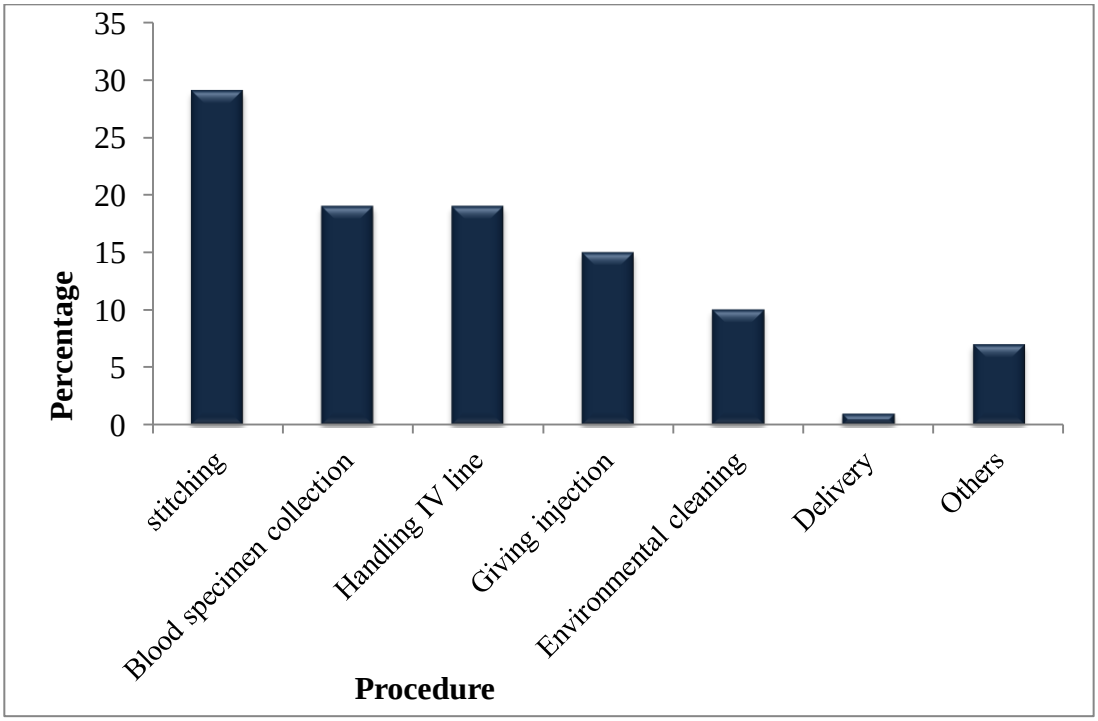

Figure 4.6: Percutaneous Injuries by Type of Procedure, RVPGH

In War Memorial 40% (N=5) occurred during stitching, 20% during environmental cleaning and 20% during blood specimen collection (Figure 4.7). Other procedures were setting up intravenous line and shaving.

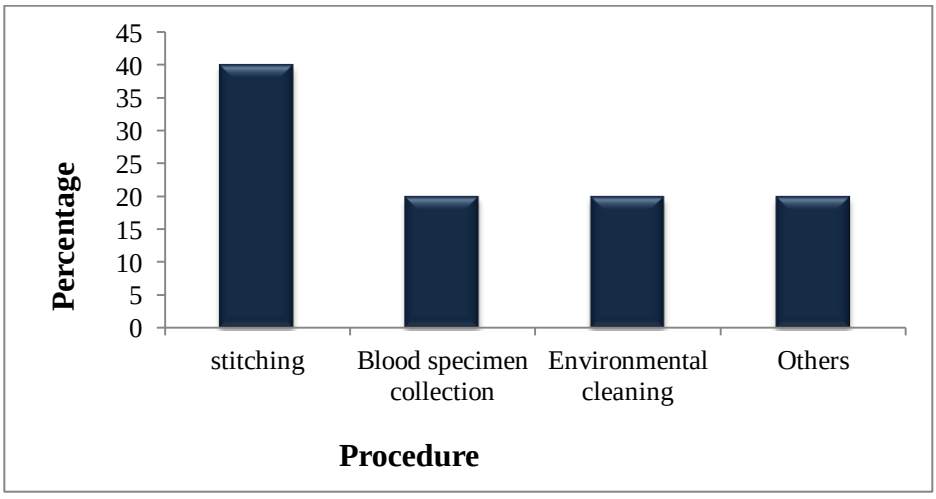

Figure 4.7: Percutaneous Injuries by Type of Procedure, War Memorial Hospital

Injuries occurred during insertion, withdrawal or manipulation of needle (34%, N=59). Handling uncooperative patient (RVPGH 22%, N=59) and patient movement (20%, N=59) also precipitated the occurrence of sharp injury (Figure 4.8). Other circumstances include recapping of the needle after use, causing 2 injuries (3.4%, N=59). Situation classified as others included urgency (in emergency situations), accidental pricks by sharps not disposed properly and use of hands instead of forceps during stitching.

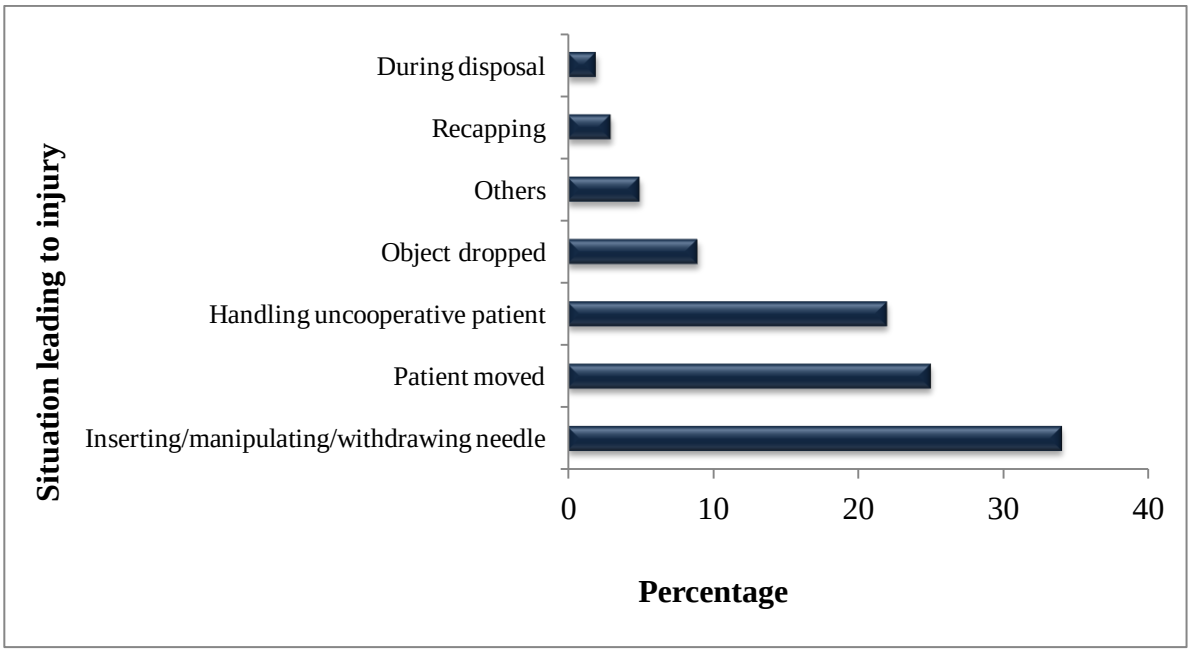

Figure 4.8: Percutaneous Injuries by Situation (Precipitant), RVPGH

Splash exposure occurred during insertion/manipulation/withdrawal of needles (23%, N=22), with 18% caused by splash from an injured artery. Other precipitants of splash exposure were handling uncooperative patient (14%), during disposal (9%), rapid gush of fluid during spontaneous rupture of amniotic membrane (9%) and accidental splash by a colleague (5%) as shown in Figure 4.9. Precipitants classified as others were rapid

expulsion of fetus during delivery, dislodging blocked intravenous line and shaking specimen bottle.

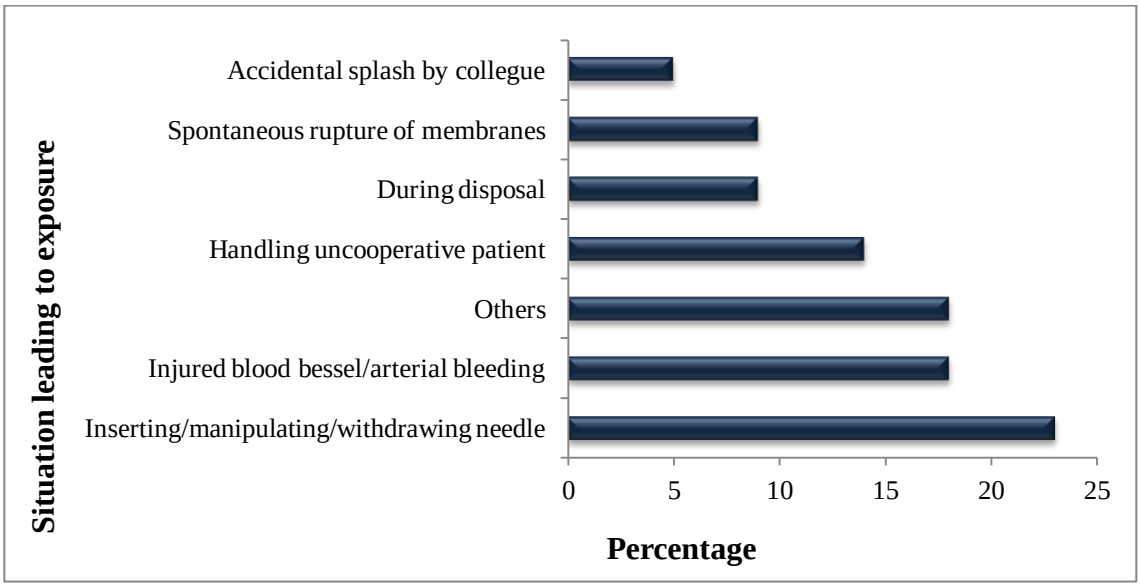

Figure 4.9: Splash exposure by Situation (Precipitant), RVPGH

In War Memorial hospital One injury (20%, N=5) was caused by recapping. Accidental injuries caused by colleague persons contributed to one (20%) sharps injury in War Memorial hospital (Table 4.11).

Table 4.11: Situations Leading to Percutaneous Injuries, War Memorial Hospital

Situation/Precipitant	**Frequency (%)**
Recapping	1(20)
Accidental prick by colleague	2 (40)
During disposal	1(20)
Sharp objects not disposed, left lying on surface	1(20)

Situations that precipitated occurrence of splash exposure included spontaneous rupture of membranes, arterial bleeding and HCWs shaking specimen bottle.

Majority of percutaneous injuries occurred during the day with 42.4% (N=59) of cases occurring at morning hours and 35.6% occurring in the afternoon (Table 4.12). However, 6.8% of injured HCWs could not recall time the injury occurred.

Table 4.12: Distribution of Percutaneous Injuries by Time of day, RVPGH

Time of Day	**Frequency (%)**
Morning	25 (42.4)
Afternoon	21 (35.6)
Night	9 (15.3)
Unsure	4 (6.8)

In war Memorial hospital, 3 injuries occurred during the day. Two occurred at night (Table 4.13)

Table 4.13: Distribution of Percutaneous Injuries by Time of day, War Memorial hospital

Time of Day	**Frequency (%)**
Morning	2 (40)
Afternoon	1 (20)
Night	2 (40)

One hundred and fifty five (51%, N=305) HCWs reported having received training on injection safety/infection prevention and control (Figure 4.10) in RVPGH.

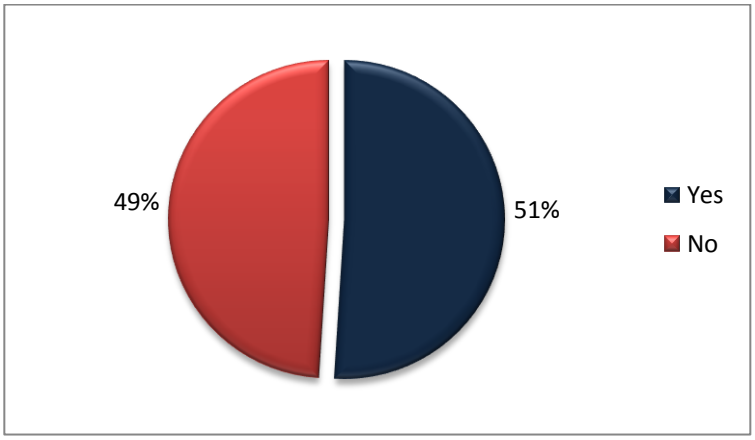

Figure 4.10: Proportion of HCWs Trained on Injection Safety/Infection Prevention and Control, RVPGH

War Memorial has 84% (N=43) of its HCWs trained on injection safety/infection prevention and control (Figure 4.11).

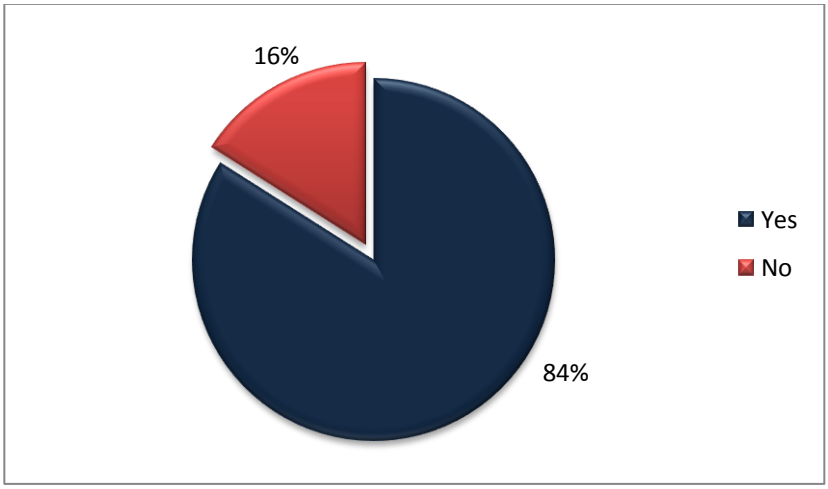

Figure 4.11: Proportion of HCWs Trained on Injection Safety/Infection Prevention and Control, War Memorial Hospital

4.4 Factors Associated with Percutaneous Injuries and Splash Exposures, RVPGH

On bivariate analysis, factors that were found to be significantly associated with percutaneous injuries include having received training and age below 40 years (Table 4.14). HCW's occupation, gender, station and procedure were not significantly associated with exposure to sharps injuries.

Table 4.14: Factors Associated with Percutaneous Injuries among HCWs, RVPGH

Variable	Exposed	Not Exposed	OR	95% CI	P-value
Age					
<=40	56	204	3.84	1.15-12.86	0.02*
>40	3	42			
Gender					
Female	41	158	1.3	0.7-2.3	0.45
Male	18	88			
Work duration					
<=10 years	45	176	1.3	0.66-2.48	0.46
>10 years	14	70			
Job Category					
Nurse	29	105	1.3	0.73-2.3	0.37
Doctor	4	25	0.6	0.19-1.73	0.32
Lab personnel	3	9	1.4	0.37-5.38	0.42
Clinical officer	11	32	1.5	0.72-3.3	0.26
Student	7	33	0.9	0.36-2.07	0.75
Trained					
Yes	22	133	0.51	0.28-0.91	0.021*
No	37	113			
Department/Station					
Paediatric	10	26	1.72	0.78-3.81	0.17
Medical	10	28	1.6	0.72-3.49	0.25
Surgical	10	37	1.2	0.54-2.48	0.42
Laboratory	5	17	1.3	0.44-3.52	0.42
Casualty	3	21	0.6	0.16-2.0	0.28
Obstetric/Gynecology	15	68	0.9	0.47-1.7	0.73

*Significant factors

The independent predictors of percutaneous injuries on multivariate analysis were age below than 40 years (aOR=3.7, P-value=0.034) and having been trained (aOR=0.52, P-value=0.029) (Table 4.15).

Table 4.15: Logistic Regression of Factors Associated with Percutaneous Injuries, RVPGH

Variable	**aOR**	**95% CI**	**P-value**
Age<=40	3.7	1.1-12.4	0.034
Trained	0.52	0.29-0.94	0.029

Working in surgical department was significantly associated with splash exposure to mucous membrane, on bivariate analysis (OR=2.8, P-value=0.036) as shown in Table 4.16.

Table 4.16: Factors Associated with Splash Exposure among HCWs, RVPGH

Variable	**Exposed**	**Not Exposed**	**OR**	**95% CI**	**P-value**
Age					
<=40	21	238	3.97	0.52-30.3	0.12
>40	1	45			
Gender					
Female	13	186	0.7	0.3-1.8	0.53
Male	9	97			
Work duration					
<=10 years	19	202	2.5	0.7-8.8	0.13
>10 years	3	81			
Job Category					
Nurse	8	126	0.7	0.3-1.8	0.46
Doctor	3	26	1.7	0.5-6.1	0.33
Lab personnel	2	10	2.7	0.6-13.3	0.21
Clinical officer	3	40	1	0.3-3.4	0.62
Student	2	38	0.6	0.4-2.9	0.43
Trained					
Yes	11	124	1.3	0.5-3.1	0.57
No	11	159			
Department					
Paediatric	2	34	0.73	0.2-3.3	0.5
Medical	2	36	0.7	0.15-3.06	0.47
Surgical	7	40	2.8	1.1-7.4	0.036*
Laboratory	2	20	1.3	0.3-6.03	0.48
Casualty	4	20	2.9	0.9-9.5	0.08

*Significant factors

Working in casualty (aOR=4.05, P-value=0.03) and surgical department (aOR=3.5, P-value=0.014) were found to be significantly associated with exposure in multivariate logistic regression model (Table 4.17).

Table 4.17: Logistic Regression of Factors Associated with Splash Exposures, RVPGH

Variable	aOR	95% CI	P-value
Casualty	4.05	1.2-13.9	0.03
Surgical department	3.5	1.3-9.7	0.014

4.5 Use of Personal Protective Equipment

At the time of the exposure, 98% (N=59) and 60% (N=5) of HCWs at RVPGH and War Memorial hospitals respectively wore protective equipments. Double gloves were worn by 9% and 7% at the respective hospitals. No eye shield or face shield was worn during execution of procedures at the time splash exposures occurred. Masks were worn by only 4 (18%, n=22) HCWs in RVPGH

4.6 Vaccination against Hepatitis B Virus

Forty seven point five percent of respondents (N=305) reported having started vaccination series against hepatitis B virus in RVPGH. However, 128 (42%, N=305) were fully vaccinated, having received three doses of the vaccine (Table 4.18). There was a significance difference in vaccine coverage between doctors and all other categories of HCWs (OR=38, P-value=<0.0001).

Table 4.18: History of Vaccination against Hepatitis B Infection, RVPGH

	Frequency (%)
Vaccinated against Hepatitis B	145 (47.5)
Number of doses received	
1	4 (2.8)
2	13 (9)
3	128 (88.3)

Reasons cited by HCWs for not having been vaccinated included vaccine not available (67%, N=30), not aware of the need to be vaccinated (17%) and low risk perception (7%) in RVPGH (Figure 4.12). Reasons classified as others were affordability (high cost), and fear of side effects of the vaccine.

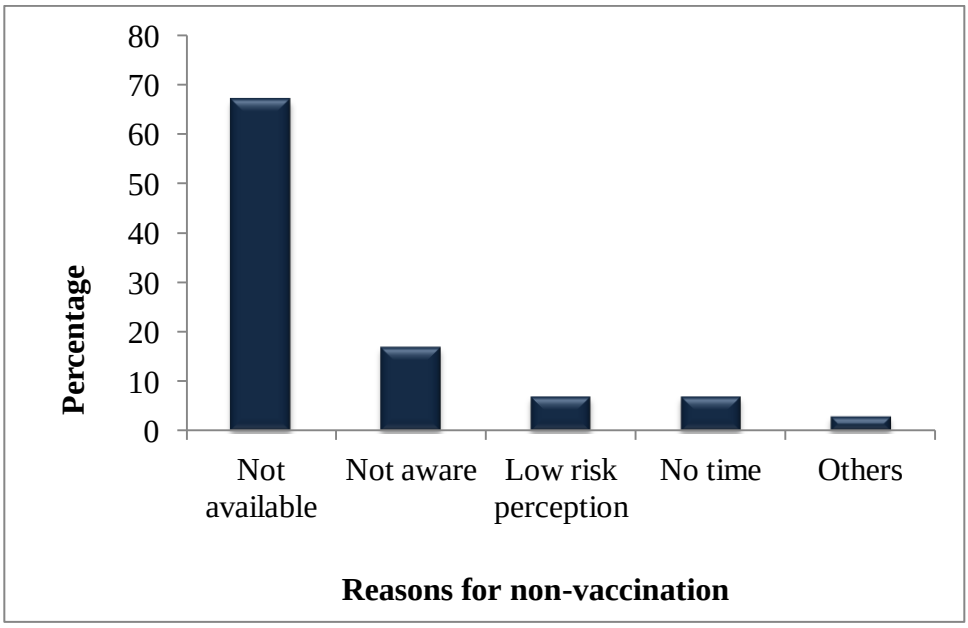

Figure 4.12: Reasons for Non-vaccination against Hepatitis B, RVPGH

In War Memorial hospital 30 (70%, N=43) HCWs started vaccination series but only 11 (26%, N=43) were fully vaccinated against HBV (Table 4.19).

Table 4.19: History of Vaccination against Hepatitis B Infection, War Memorial Hospital

	Frequency (%)
Vaccinated against Hepatitis B	30 (70)
Number of doses received	
1	11 (36.7)
2	8 (26.7)
3	11 (36.7)

Reasons cited for not having been vaccinated against HBV were unavailability (38.5%), Lack of awareness (38%), negligence (no specific reason cited, 15%) and low risk perception at 8% (Figure 4.13).

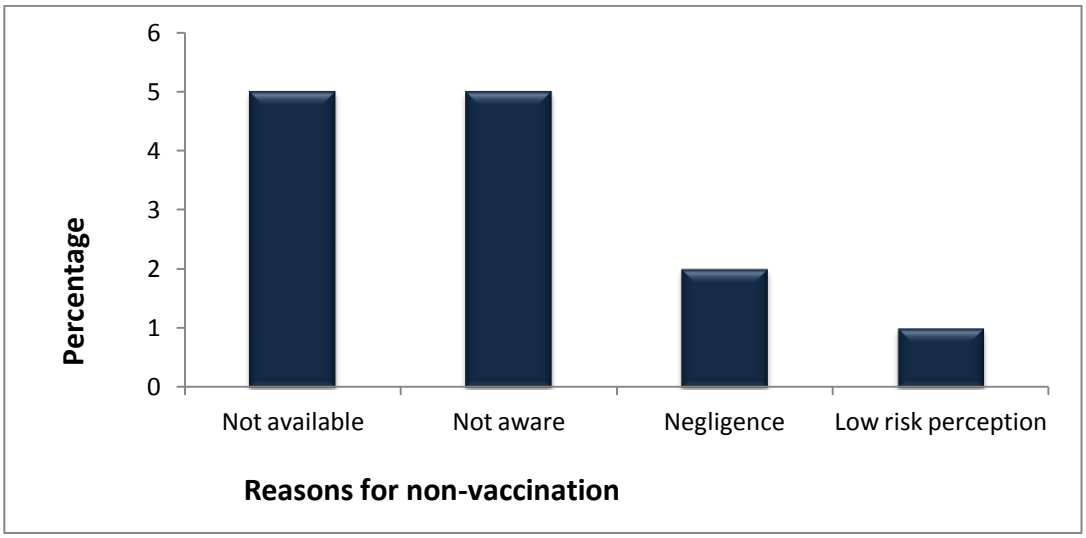

Figure 4.13: Reasons for Non-vaccination against Hepatitis B, War Memorial Hospital

4.7 Management of Occupational Exposure

In RVPGH 31 HCWs (52.5%, n=59) reported percutaneous injuries. Source patient was identified by 91.5% (n=81) of all cases. Nine (12%) were HIV positive, 64 (83%) were negative while the status of 4 (5%) was unknown. Source patients were not investigated for hepatitis B or hepatitis C infection. Ninety four percent of HCWs reported immediately within an hour (Table 4.20)

Table 4.20; Analysis of Incidents Report, RVPGH

Description	**Percutaneous Injuries Frequency (%)**	**Splash Exposure Frequency (%)**
Reported incidence	31 (52.50)	6 (27)
Source patient identified	54 (91.5)	16 (73)
Time of reporting Immediately Within24 hours	 29(94) 2 (6)	 6 0

In War Memorial 4 (80%, N=5) HCWs reported percutaneous injuries (Table 4.21). Source patient was identified by 4 (80%) and 3 HCWs reported immediately within an hour. Two HCWs reported splash exposure, while source patient was identified in all the three cases.

Table 4.21; Analysis of Incidents Report, War Memorial Hospital

Description	**Sharps Injuries N=5 Frequency (%)**	**Splash Exposure N=3 Frequency (%)**
Reported incidence	4 (80)	2
Source patient identified	4 (80)	3
Time of reporting Immediately Within24 hours	 3 (75) 1 (25)	 2 0

Nine (31%, N=29) indicated that they thought the exposure material was noninfectious, while 3 (10%, N=29) were ignorant about the risk posed by the exposures. Seven percent were not aware that they should report (Table 4.22). Other reasons included not knowing whom to report to, felt no need to report (ignored) and self management of exposure.

Table 4.22: Reasons for not Reporting Occupational Exposures, RVPGH

Reasons for not reporting	**Percutaneous Injuries, Frequency (%)**	**Splash Exposures, Frequency (%)**
Thought non-infectious	9 (32)	3 (20)
Exposure not emergency	4 (14)	1 (7)
Others	4 (14)	0
Did not want others to know (Stigma)	3 (11)	0
Thought injury was minor	2 (7)	2 (13)
Did not know risk	2 (7)	1 (7)
Not aware that should report	2 (7)	3 (20)
No reporting system	1 (4)	1 (7)
No time for reporting	1 (4)	3 (20)
Already immunized against hepatitis B	0	1 (7)

Reasons cited for not reporting percutaneous injuries in War Memorial hospital was that the HCW did not know the risks associated while that given for not reporting splash exposure was that there was no reporting system in the facility.

Cleaning the injury site with running water was the most frequently used first aid measure in over 80% (N=59) of HCWs injured. Other measures used for immediate management included squeezing the site (3%), cleaning with hypochlorite (5%) and cleaning with methylated spirit (15%). However, 8% of HCWs did not take any action concerning the injury (Figure 4.14). For splash exposures, 19 (86%, N=22) HCWs cleaned the site under running water while three did not take any action.

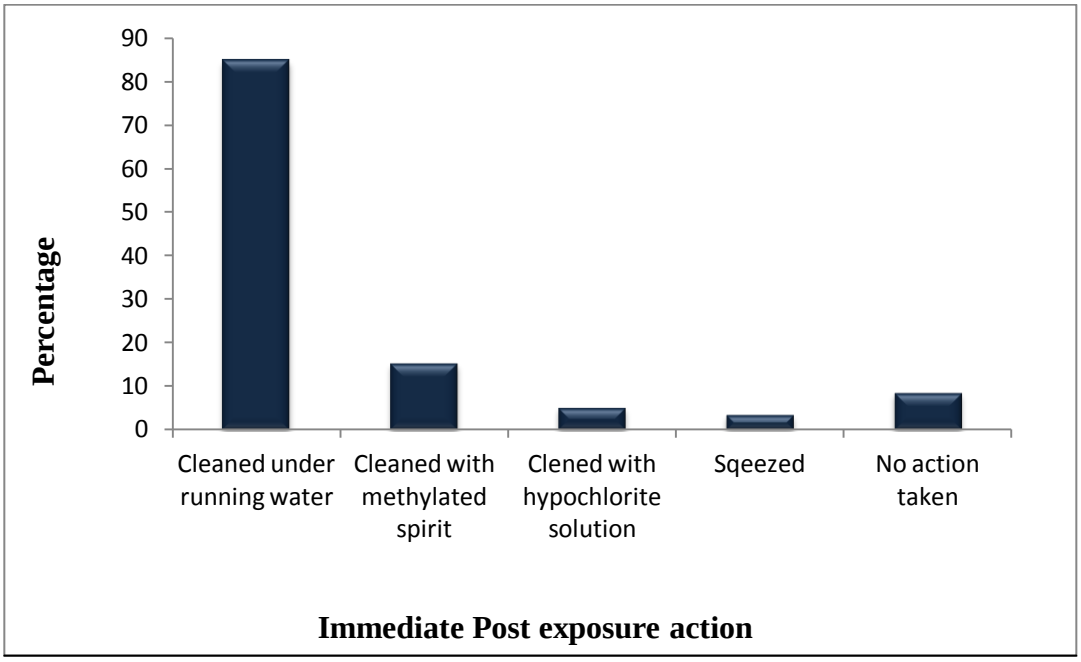

Figure 4.14: Immediate Post-Exposure Management for Percutaneous Injuries, RVPGH

In War memorial hospital, three HCWs (N=5) with percutaneous injuries cleaned under running water, one squeezed the site and one did not take any action (Figure 4.15). The splashes were cleaned under running water (1), wiped with wet gauze (1) and one did not take any action (N=3).

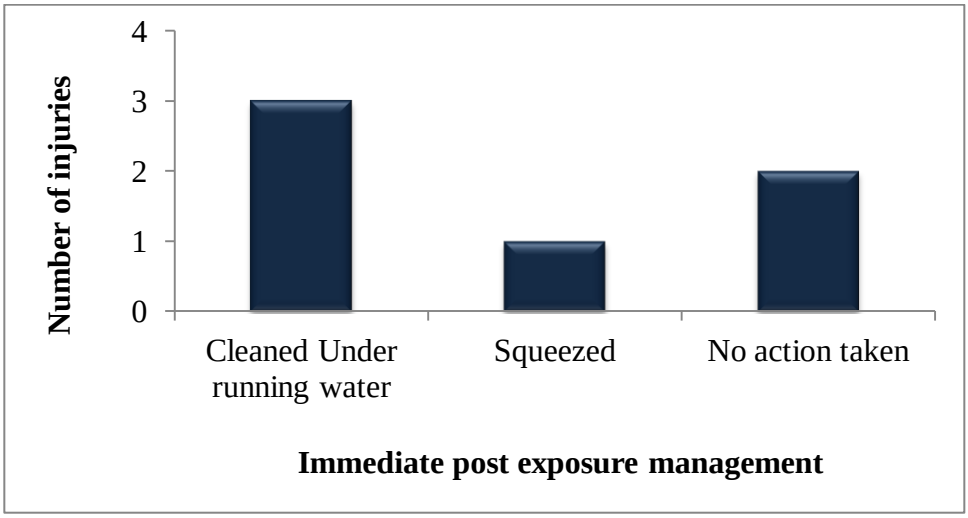

Figure 4.15: Immediate Post-Exposure Management for Percutaneous Injuries, War Memorial Hospital

In RVPGH, 30% of the HCWs who sustained percutaneous injuries had their baseline HIV testing done. Fifteen (25.4%, N=59) received PEP for HIV and 11 (18.6%, N=59) received follow up care Only 4 (18.2%, N=22) with splashes undertook baseline HIV testing (Table 4.23).

Table 4.23; Adherence to Post Exposure Management, RVPGH

Variable	Percutaneous Injuries Frequency (%)	Splashes Frequency (%)
Baseline HIV testing	18 (30.5)	4 (18.2)
Received PEP for HIV	15 (25.4)	3 (13.6)
Reasons for no PEP Ignored Not aware Others	 26 (59.1) 4 (9.1) 14 (31.8)	 13 (68.4) 4 (21.1) 2 (10.5)
Follow up care	11 (18.6)	2 (9)

In War memorial hospital, three (60%, N=5) HCWs tested for HIV after the injury, however, only two (40%, N=5) received post-exposure prophylaxis for HIV and received follow up care and tested after 3 months (Table 4.24). None of the injured HCW had Hepatitis B and C tests carried out and none received post-exposure management for hepatitis.

Table 4.24; Adherence to Post Exposure Management, War Memorial Hospital

Variable	Percutaneous Injuries Frequency (%)	Splashes Frequency (%)
Baseline HIV testing	3 (60)	1 (33)
Received PEP for HIV	2 (40)	0
Reasons for no PEP Ignored Not aware Others	 2 (66.7) 1 (33.3)	 2 (66.7) 0 1 (33.3)
Follow up care	2 (40)	0

Reasons for not receiving PEP varied among the HCWs. In RVPGH, 59% (n=59) of those with percutaneous injuries just ignored the incident, 9.1% were not aware of the need to take PEP. Sixty eight percent (n=22) of HCWS with splash exposure ignored. In War Memorial, two HCWs ignored and one was not aware of PEP. Other reason for not receiving PEP included patient's HIV sero-status being negative. Having PEP was strongly associated with patient sero-status being positive (OR=22, PV=0.002).

4.8 Audit Results of Occupational Exposures Control Programme

Occupational exposure control activities are undertaken by infection control committees in RVPGH and War Memorial hospital. However, occupational risk control plan was not available at both facilities. Although HCWs were aware of the need to report incidents of exposures to blood and body fluids, no written reporting protocol existed. No occurrence books existed in departments where such events could be recorded and evaluated. Trainings on infection prevention and injection safety have been held although not regular.

Personal protective equipments were available except eyewear, face-shield and masks (available in Theatre and ICU). Sharps containers were also available; however, they were not properly assembled. Sharps injuries/exposures log has not been available, and was recently introduced in RVPGH (2010). Health care workers had access to PEP drugs at no cost. Engineering control-safety devices such as auto disable/retractable syringes were not available at both facilities.

4.9 Review of Records on Occupational Exposures (2005-2009)

No records on occupational exposures were available in RVPGH and War Memorial hospital. However, in RVPGH, records on PEP existed at the comprehensive care centre. However, the records were incomplete and non specific to RVPGH. No specific data existed for HCWs.

CHAPTER FIVE

5.0 DISCUSSION

This study revealed that occupational injuries are still common and a concern among health-care workers. Rift Valley Provincial hospital had the highest prevalence of percutaneous injuries (19.3%) in the preceding one year. This may be attributed to the fact that being a public hospital, it has a high workload, a factor identified to be associated with occurrence of occupational injuries (Elliot *et al.,* 2005). The prevalence of 19.3% of sharps injuries is similar to a report from United Arab Emirates (Jacob *et al*., 2010), in which 19% of HCWs reported sharps injuries. It is reported that in developing countries where the prevalence of HIV-infected patients is the highest in the world, the number of needle-stick injuries is also the highest (Wilburn, 2004). However, the prevalence of splash exposure to mucous membrane was low (7%) as compared to that reported (25%) in Ethiopia (Gessessew & Khasu, 2006) and 18% in a study conducted in India (Amita *et al.,* 2008). Other possible reasons for high prevalence of percutaneous injuries include lack of specific programme measures to address occupational challenges such as inadequate PPEs, lack of safer sharp devices, lack of information and non-adherence to standard precautions.

The prevalence of percutaneous injuries was high among those with experience less than 10 years (20.4%, RVPGH and 13.6%, War Memorial hospital). Clarke *et al*. (2002) in their study, found that the probability of ever having a needle-stick injury was inversely

related to years of experience. This may be attributed to inadequate skills and knowledge regarding injection safety.

Accidental exposures were more frequently reported by females (Prevalence of 21%). Despite the absence of a statistically significant association between gender and occupational exposure to blood, similar results have been previously reported (Wood *et al.,* 2006).

Among the procedures that placed HCWs at risk of NSIs, stitching was the highest (29% in RVPGH), followed by blood specimen collection (19%). Cervini & Bell (2005) reported that majority of injuries among doctors occurred while stitching (46%). Situations precipitating injuries include manipulating needles (34%), patient movement (20%), recapping (3.4%), and the unsafe collection of sharps and sharps disposal (3%). This is comparable to findings in which manipulating the needle contributed to 26% and recapping 6% of injuries (CDC, 2008). In another study, recapping was identified to account for 8.3% of percutaneous injuries (Amita *et al.,* 2008).

Although all healthcare workers in contact with patients are at risk to exposure to blood and body fluids, nurses reported most percutaneous injuries (50%) and splash exposures (40%). According to other studies, nurses experience the majority of needle-stick injuries in the world including half of the exposures that occur in USA (CDC, 2008; Pruss *et al.,* 2003). Nurses are more likely to handle sharp devices and have more contact with patients.

Hypodermic needle caused 39% of percutaneous injuries in RVPGH and 80% in War Memorial hospital. Other hollow-bore needles that caused injuries include branulars and phlebotomy needles. Overall, hollow-bore needles caused 67% of injuries. Russi *et al.* (2000) reported that 62% of exposures to blood and body fluids involved hollow-bore needles. Hollow-bore needles have been identified as a risk factor that enhances transmission of pathogens, due to its nature of containing residual blood and other fluids and hence the most hazardous instruments among medical sharp devices (Elliot *et al.*, 2005).

Majority of exposures occurred during the morning shift (42%). This may be attributed to busy schedule at the time and the pressure among staff to complete tasks. In addition, more invasive procedures are performed in the morning. In other studies, analysis of 411 recorded exposures demonstrated that more people were exposed between 9.00 am and 11.00 am (Macias *et al.*, 1996).

Health-care workers of the age-group 31 to 40 had the highest prevalence of percutaneous injuries (26.4%, RVPGH). Age below 40 years was significantly associated with sharps injuries (aOR= 3.7; P-value=0.034). This is comparable to a study conducted in Turkey in 2008 in which young age was a risk factor for occupational injuries (Hosoglu *et al.*, 2009). This is possibly due to limited professional experience and the fact that young HCWs tend to be enthusiastic and aggressive in their work.

Previous training in infection prevention was protective (aOR= 0.52; P-value=0.029). Elliot *et al.,* (2005) identified insufficient training as a risk factor to incidents of percutaneous injuries. According to a study conducted by Nsubuga *et al.* in Uganda 2005, lack of training was identified as a risk factor for needle-stick injuries. Training enhances awareness and improves skills among health-care workers.

Working in casualty (aOR=4.05, P-value=0.03) and surgical department (aOR=3.5, P-value=0.014) were identified as risk factors for sustaining splash exposure to mucocutaneous membrane. This is comparable to findings by Hosoglu *et al.*(2009) in Turkey, in which working in a surgical site was a significant factor for occupational exposure Possible explanation is that casualty is an emergency unit where procedures are carried out as urgent, while in surgical department, the kind of procedures carried out tend to predispose HCWs to splashes.

National Institute of Occupational Safety and Health, United States identifies the following as predisposing factors to needle-stick injuries; over-use of injections and unnecessary sharps, lack of supplies (disposable syringes, safer needle devices, sharps disposal containers), lack of access to, and failure to use sharps container immediately after use, poorly trained staff, needle-recapping, no engineering control, such as safer needle devices, passing instruments from hand to hand as on operating room, and lack of hazard awareness and training (NIOSH, 2008). This is in agreement with findings from this study in which 51% of staff are untrained (RVPGH), facilities lack safety devices and needle recapping is still practiced.

Hepatitis B vaccination coverage among HCWs was low at 40% (fully vaccinated). According to the WHO estimates, vaccination coverage varies from 18% in Africa to 77% in Australia and New Zealand (Hutin *et al.,* 2003). In a study conducted in 2005, Thika district Kenya, only 12.8% of HCWs were vaccinated (Suckling *et al.,* 2006). Doctors were more likely to be vaccinated among the HCWs (OR=38, P-value<0.001). In a study conducted in Pakistan, doctors were more likely to be vaccinated as compared to other category of HCWs (Attaullah *et al.,* 2011).

There are many potential reasons for low HBV vaccine coverage, the most common being unavailability of the vaccine at the health facility. While the vaccine is available at the market at a cost, HCW have relied on provision by their institutions. However, there is a moderately good awareness among HCWs. Other potential reasons identified in our study and supported by other studies include busy schedules, lack of knowledge about severity and vaccine efficacy, and low risk perception (Abdul *et al.,* 2007). Seven percent of health workers did not use barrier protection during execution of procedures. Skin and mucous membrane contacts can be prevented with the use of barrier precautions such as gloves, masks, gowns, and goggles. However since the greatest risk of blood-borne pathogen transmission come from percutaneous injuries, changes in techniques or use of safety devices is required. Tokars *et al.* (1992) noted that half of the percutaneous injuries during suturing occurred when fingers instead of instruments were used. Use of personal protective equipment is critical in prevention of exposures.

In this study, over 80% of HCWs washed the injured site under running water and 54% took no action. However, a number of staff used disinfectants (hypochlorite solution or methylated spirit) to clean the site, while others squeezed the site probably due to lack of knowledge about what immediate action to take. In a study conducted by Rahul *et al.* (2010) in India, 60.9% of HCWs washed the site with soap and water and 14.8% took no action.

Forty five percent of HCWs did not report the occurrence of exposures. Unreported needle-stick and sharp injuries are a serious problem and prevent injured HCWs from receiving PEP against HIV, which is shown to be 80% effective against HIV infection. According to researchers, 40%-70% of all needle-stick injuries are unreported (Wilburn, 2004). Clarke *et al.* (2002) in their study, found out that only 29% of exposed respondent reported the incident. Reasons for not reporting include; source thought to be non-infectious, too little time to report, lack of reporting protocol, low risk perception while other feared stigma. Moreover, underreporting may be related to unwillingness to reveal incidence or lack of motivation due to the belief that HCWs can handle the issue themselves.

Less than half of the exposed (25%, RVPGH) took a course of PEP against HIV/AIDS. However, this figure is high as compared to that reported in a study conducted in India where only 7.8% of HCWs took a course of PEP (Rahul *et al.*, 2010). As most HCWs did not report the exposures, they were not evaluated for indication of PEP, therefore it is important to note that the number required to take PEP may not be exact. Over 59%

of HCWs ignored the exposure. Fear of side effects has been cited as one factor against HCWs taking ARVs. A significant proportion of HCWs demonstrated lack of knowledge concerning PEP. No laboratory testing is carried out for HBV and HCV infections. Reporting injuries and documenting all blood-borne exposures are essential for having the evidence to analyze for preventive measures.

5.1 Study Limitations

As information was self reported, misclassification of HCWs as exposed or not exposed is possible. Information on exposure was sought for the preceding 12 months; there is a possibility of recall bias among the HCWs. Due to small population size in War Memorial hospital, small figures were presented in the results. Moreover, sampling could not be done as a small sample size lacks power to give valid results.

5.2 Conclusions

Percutaneous injuries and splashes are common in Rift Valley and War memorial hospitals. Factors that are significantly associated with percutaneous injuries include age below 40 years (risk factor) and training (protective factor). Working in casualty and surgical departments were significantly associated with splash exposure. Post-exposure management is poorly adhered to with gross underreporting of the exposures.

5.3 Recommendations

Efficient strategies to protect HCWs from occupational exposures to blood and body fluids should be identified and implemented. Facilities should establish surveillance system for registering, reporting and management of occupational injuries and

exposures. Other safety measures include enhancing workers safety by providing safety devices such as auto disable/retractable needles, adhesive tapes and blunt sutures. Ensuring availability of PPEs and maintaining adequate stock is the responsibility of facilities authorities. All HCWs should be trained, sensitized and updated on issues related to infection prevention and occupational risk reduction. Hepatitis B vaccination is recommended for HCWs and institutions should provide mandatory immunization programmes for their HCWs.

REFERENCES

Abdul R. M., Munit A. S. & Salahuddin A. (2007). Hepatitis B vaccination status and knowledge, attitude, practices of health care workers regarding Hepatitis B and C in a tertiary care setting of Karachi. *Pak. Med. Net* 16(4):105-107

Alvarado R. F. & Beltrami E. M. (2003). New guidelines for occupational exposure to blood-borne viruses. *Cleveland Clin J Med* 70. (5):463

Alweis R. L., DiRosario K., Conidi G., Kain K. C., Olans R. & Tully J. L. (2004). Serial nosocomial transmission of *plasmodium falciparum* from patient to nurse. *Infect Control Hosp Epid* 25 (1):55-9

American Nurses Association (2002). ANA's needle-stick prevention guide. Available atwww.nursingworld.org/mainmenucategories/OccupationalEnvironmental/health/SafeNeedles/Needestickprevention.aspx

Amita G, Shuchi A, Jaygow , Anandini K, Anita B, Shreepad M. B., Nkhil G, Robert C. B. & Arjun C. K. (2008). High risk for occupational exposure to HIV and utilization of post-exposure prophylaxis in a teaching hospital in pune, India. *BMC infect dis* 8:142 doi:10.1186/1471-2334-8-142

Anonymous (1984). Needle-stick transmission of HTLV-III from a patient infected in Africa. *Lanc* 2:1376-1377

Attaullah S., Sanaullah Khan S., Sultan A., Shahd N., Ijaz A., Naseruddin H. & Sami S. (2011). Prevalence of HBV and HBV vaccination coverage ijn health care workers of tertiary hospitals of Peshawan, Pakistan. *Viral J* 8:275

Bell D. M. (1997). Occupational risk of Human Immune-deficiency Virus infection in healthcare workers: an overview. *Am J Med* 102(5B):9-15

Breslow N. E., Day N. E., (1979). Logistic regression for large data. 193-196

Cardo D. M., Culver D. H., Ciesielski C. A. & Srivastava P. U. (1997). A case control study of HIV seroconversion in healthcare workers after percutaneous exposure. *N Engl J Med.* 337:1485-1490. 67

Catherine S. T., Abdullah M. A., Steffanie A. S., Paul T. S., Boulos B. & Naquibullah S. (2007). HIV, Hepatitis C and Hepatitis B infections and associated risk behavior in injection drug users, Kabul, Afghanistan. *Emerg infect Dis J* 13:1327-1331

CDC (2000). Universal Precautions for Prevention of Transmission of HIV and Other Blood-borne Infections. http://www.cdc.gov/. Accessed 1st march 2010

CDC (2001). Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV and HIV and recommendations for post-exposure prophylaxis. *MMWR* 50 (11):1-52

CDC (2003). Exposure to blood: What Healthcare Personnel need to know: Atlanta: Centers for Disease Control and Prevention, Department of Human Health and Human Services.

CDC (2005a). A comprehensive immunization strategy to eliminate transmission of Hepatitis B Virus infection in the United States: recommendations of the Advisory Committee on Immunization Practices (ACIP). Part 1: immunization of infants, children, and adolescents. *MMWR* 54 (No. RR-16)

CDC (2005b). Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HIV and recommendations for Post-exposure Prophylaxis. *MMWR*. 54/No. RR-9; 1-9

CDC (2006). Estimates of disease burden from viral hepatitis. Atlanta, GA: US Department of Health and Human Services, CDC; Available at http://www.cdc.gov/ncidod/diseases/hepatitis/resource/PDFs/disease_burde.pdf

CDC (2008). Workbook for Designing, Implementing and Evaluating a sharps injury prevention program. United States. Centers for Disease Control and Prevention;

CDC (2009). Epidemiology and Prevention of Vaccine- Preventable diseases. 11th edition. Washington DC; Public Health Foundation, 99-122

Cervini P. & Bell C. (2005). Needle-stick injuries and inadequate post exposure practice in medical students. *J Gen Intern Med* 20:419-421

Choo Q. L., Weiner A. J., Overby L. R., Kuo G., Houghton M. & Bradley D. W. (1989). Isolation of a cDNA clone derived from blood borne non-A non-B viral hepatitis genome. *Science* 244;359-362

Clarke S. P., Sloane D. M. & Aiken L. (2002). Effects of hospital staffing and organizational climate on needle-stick injuries to nurses. *Am J Pub Health* 92(7):1115-1119

Cochran W. G. (1977). Sampling techniques, 3rd edition. New York: Wiley and sons

Collins C. H. & Kennedy D. A. (1987). Microbiological hazards of occupational needle-stick and other sharps injuries. *J Appl Bacteriol* 62:385-402

Devereaux H. M., Stead W. W., Cauthern M. G., Bloch B. A. & Ewing M. W. (1990). Nosocomial transmission of tuberculosis associated with a draining abscess. *J Infect Dis* 286-95

Elisabetta R., Pruss U. & Yuvan H. (2005). Assessing the burden of disease from sharps injuries to healthcare workers at national and local levels. Geneva: World Health Organization, *(Environ Burden Dis S No. 11)*

Elliot S. K., Keeton A. & Holt A. (2005). Medical students' knowledge of sharps injuries. *J Hosp Infect* 60(4):374-7

Gallo R. C. & Wong Staal F. (1985). A Human T- Lymphotropic retrovirus (HTLV-III) as the cause of the acquired immunodeficiency virus syndrome. *Ann Intern Med* 103(5):679-89

Gershon R. R., Karkashian C. D., Grosch J. W., Murphy L. R.,m Escamilla-Cejudo A. & Flanagan P. A., Bernacki E., Kasting C. & Martin L. (2000). Hospital safety climate and its relationship with safe work practices and workplace exposure incidents. *Am J Infect Control* 28:211-21

Gessessew A. & Khasu A. (2006). Occupational exposure of health workers to blood and body fluids in six hospitals of Tigray region: Magnitude and management. *Ethiop Med J* 47(3):213-9

Hollinger F. B. & Liang T. J. (2001). Hepatitis B virus, Fields virology, 4th edition. Philadelphia, Lippincott Williams & Wilkins, 2971

Hosoglu s., Akalin S., Sunbul M., Otkun M. & Ozturk R. (2009). Predictive factors for occupational blood-borne exposure in Turkish hospitals. *Am J Infect Control* 37(1):65-9

Hutin Y., Hauri A., Chiarello L., Cattlin M., Stilwell B. & Ghebrehiwet T. (2003). Injection Safety Best Practices Development Group. Best infection control practices for intradermal, subcutaneous and intramuscular needle injections. *Bull WHO* 81:491-500

Ippolito G., Puro V. & De Carli G. The Italian study group on occupational risk of HIV Infection (1993). The risk of human immunodeficiency virus infection in healthcare workers: Italian multicentre study. *Arch intern Med* 153:1451-58

Jacob A., Newson S. M., Murphy E. & Dick F. (2010). Sharps injuries among healthcare workers in the United Arab Emirates. *Occ Med* 60(5):395-7

Jagger J. (1996). Reducing occupational exposure to blood borne pathogens: where do we stand a decade later? *MMWR* 46:21-23

Jean R. A. (2001).A guide to the Clinical care of women with HIV. 3383-94

KAIS (2007). *Kenya AIDS indicator survey*; Final Report, NASCOP.

Lee J. M., Botteman M. F., Xanthakos N. & Nicklasson L. (2005). Needlestick injuries in the United States. Epidemiologic, economic and quality of life issues. *Am Ass Occ Healh Nurs J* 53(3):117-133

Leibowitz S. & Greenwald L. (1949). Serum Hepatitis in a blood bank worker. *J American Med Ass* 140:1331-1333

Lewis T., Osborn L. M., Lewis K. Brockert J., Jacobsen J. & Cherry J. D. (1988). Influence of parental knowledge and opinions on 12-month diphtheria, tetanus and pertussis vaccination rates. *Am J Dis Child* 142:283-6

Macias D. J., Hafner J., Brillman J. C. & Tandberg D. (1996). Effect of time of day and duration into shift on hazardous exposures to biological fluids. *Acad Emerg Med Jun* 3(6):566-756

Michael W., Mclaws, Slater M. L. & Karen (2008). Needle-stick injuries in a major teaching hospital: The worthwhile effect of hospital-wide replacement of conventional hollow-bore needles. *Am J Infect Con.* 36:180-186. Doi:10.1016/j. ajic. (Pubmed)

Michelin A. & Henderson D. K. (2010). Infection control guideline for prevention of healthcare associated transmission of Hepatitis B and C viruses. *Clin liver Dis* 14(1):119-36;ix-x

Ministry of Health, Republic of Kenya (2005). Reversing the Trends. The second National Health Sector Strategic Plan of Kenya-NSSHP II 2005-2010

National AIDS/STI Control Programme (NASCOP), Kenya (2002). AIDS in Kenya: 6th Edition. Ministry of Health.

Nelofar M., Farhang B. M., Ali R. K., Masooma P. H. & Mariam N. (2006). Knowledge and practices of healthcare workers and medical students towards universal precautions in hospital in Mazandaran Province. *East Medit Health J* 12:653-61

NIOSH (2008). Exposure to stress. Occupational hazards in hospitals. National Institute for Occupational Safety and Health, 136. Available at http://www.cdc.gov/niosh/topics

Nsubuga Fredrick M. & Marttta S. (2005). Injuries among nurses in Sub-Saharan Africa. *Trop Med Int Healt* 10(8):773-781

O'Malley E. M., Scott R. D., Gayle J., Dekutoski J., Foltzer M., Lundstrom T., Welbel S., Chiarelo L. & Panlilio A. (2007). Costs of management of occupational exposures to blood and body fluids. *Infect Control Hosp Epidemiol* 28(7):774

Ocama P., Opio C. K. & Lee W. M. (2005). Hepatitis B virus infection: current status. *Am J Med* 118:1413.e15-1413.e22

Osborn E. H. S., Papadakis M. A. & Gerbeding J. L. (1999). Occupational exposures to body fluids among medical students: a seven-year longitudinal study. *Ann Intern Med* 130:45-51

Parkin J. M., Murphy M., Anderson J., El-Gadi S., Forster G. & Pinchng A. J. (2000). Tolerability and side effects of post-exposure prophylaxis for HIV infection. *Lanc*, 355(9205):722-23

Popovic M., Sarngadharan M. G., Read E. & Gallo. (1984). Detection, isolation and continuous production of cytopathic retroviruses (HTLV-III) from patients with AIDS and pre-AIDS. *Science* 224 (4648): 497-500. Doi:10.1126/science.6200935.PMID 6200935

Pruss U. A., Rapiti E. & Hutin Y. (2003). Sharps injuries; Global burden of diseases from sharps injuries to healthcare workers. Geneva Switzerland: World Health Organization. Available at www.who.int/peh/burden/9241562463/sharptoc.htm

Pruss U. A., Rapiti E. & Hutin Y. (2005). Estimation of global burden of disease attributable to contaminated sharps injuries among healthcare workers. *AM J Ind Med* 48(6):482-490

Puro V., Govoni A., Mattioli F., de Carli G. & Ippolito G. (2000). Antiretroviral post-exposure prophylaxis in Italy. XIII International AIDS conference. Durban, South Africa (Abstract Wepec4311)

Puro V., Petrosillo N. & Ippolito G. (1995). Italian study group on occupational risk of HIV and other blood-borne infections: risk of Hepatitis C seroconversion after occupational exposure in healthcare workers. *Am J Infect Control* 23:273-7

Rahul S., Rasania S.K., Anita V., & Saudan S. (2010). Study of prevalence and response to needlestick injuries among health care workers in a tertiary care hospital in Delhi, India. *Indian J Community Med* 35(1):74-77

Russi M., Buitrago M., Goulet J., Calcello D., Perlotto J. & Van Rhijn D. (2000). Anti-retroviral prophylaxis of health care workers at two urban medical centers. *Indian J Occ Environ Med* 42:1092

Samir A. & Amitav B. (2008). Occupational exposure to blood and body fluids among health care workers in a teaching hospital in Mumbai, India. *Indian J Community Med* 33(1):26-30

Samwel S. O., Aderibigbe S. A., Salami T. A. T. & Babatunde O. A. (2009). Health workers' knowledge, attitude and behavior towards hepatitis B infection in southern Nigeria. *Int J Med and Med Sciences* 1(10):421

Shiao J., Guo L. & Mclaws M. L. (2002). Estimation of the risks of blood-borne pathogens to heath care workers after a needle-stick injury in Taiwan. *Am J Infect Control* 30:15-20.doi 10.1067/mic.2002.119928 (Pubmed)

Stricof R. L. & Morse D. L. (1986). HTLV-III/LAV sero-conversion following a deep intramuscular injury. *N Engl J Med* 314:1115

Suckling R. M., Taegmeyr M., Nguku P. M., Alabri S. S., Kibaru J., Chakaya J. M., Tukei P. M. & Gilks C. F. (2006). Susceptibility of healthcare workers in Kenya to Hepatitis B; new strategies for increasing vaccination uptake. *J hosp infect* 64(3):271-7

Tarantola A., Abiteboul D. & Rachline A. (2006). Infection risks following accidental exposure to blood or body fluids in healthcare workers: a review of pathogens transmitted in published cases. *Am J Infect Control* 34(6):367-75

Tokars J., David M., David H., Ruthanne M., Meryl H., Edward P., Bruce F., Denise F., Mary E., Penny S. & William J. (1992). Percutaneous Injuries during Surgical Procedures**.** *J American Med Ass* 267(21):2900

UNAIDS & WHO (2009). AIDS Epidemic Update; Global facts and figures. Geneva:UNAIDS

Varghese G. M., Abraham O. C. & Mathai D. (2003). Post-exposure prophylaxis for blood borne viral infections in healthcare workers. *Postgrad Med J* 79:324-25

Viral Hepatitis Prevention Board (1996). Prevention and control of hepatitis B in the community. Communicable Disease series, 1.

Wagner D., De With K., Huzly D., Hufert F., Weidmann M., Breisinger S., Eppinger S., Kern V. & Bauer M. (2004). Nosocomial transmission of dengue. *Emerg Infect Dis* 10(10):1872-3

Weiner B. G. & Grady G. F. (1982). Accidental hepatitis B surface antigen positive inoculations; use of e antigen to estimate infectivity. *Ann intern med* 97:367-9

WHO (2000). Heptitis B fact sheet. Geneva, Switzerland: World Health Organization; Available at http://www.who.int/mediacentre/factsheets/fs204/en

WHO (2002). Reducing risks, promoting healthy life. The world health report. Geneva: World Health Organization;

Wilburn S.Q, (2004). Needle and sharps injury prevention. *Online J Issues in Nurs.* 89(3) Available from http://nursingworld.org/ojin/topic25/tpc25_4.htm.

Wood A. J., Nadershahi A. N., Fredekind R. E., Cuny J. E. & Chambers D. W. (2006). Student Occupational Exposure Incidence: Perception versus Reality. *J Dent Edu* 70(10):1083

APPENDICES

Appendix 1: Questionnaire

Research Title: Prevalence and factors associated with percutaneous injuries and splash exposure among healthcare workers

A. Identifiers

1. Questionnaire number ☐

2. Interview Date __ __/__ __/__ __ __ __ (dd/mm/year)

3. Interviewer Name/Code __ __ __

4. Facility Name _____

B. Demographics

5. Sex ☐1. Male ☐ 2. Female

6. Age (in years) ☐

7. Marital Status ☐1. Single ☐2. Married ☐3 Divorced ☐4.Others _____

8. Residence _____

C. Occupational and clinical data

9. Occupation

☐1. Doctor (Consultant) ☐2. Doctor (Medical Officer) ☐ 3.Doctor (Intern)

☐4. Nurse (Registered) ☐5. Nurse (Enrolled) ☐6. Clinical Officer

☐7. Laboratory technologist/technician ☐8. Support staff ☐9. Student nurse

☐10. Clinical officer ☐11. Student lab technician/technologist

☐12. Mortuary attendant ☐13. Others, specify _____

10. Work station/Department *(Tick all that apply)*

☐1. Operating theatre ☐2. Casualty ☐3. ICU

☐4. Obstetrics/Gynecology ☐5. Surgical ward ☐6. Pediatric unit

☐7. Medical unit ☐8. Others specify_____

11. Years of work ☐☐

D.1 Exposure history - percutaneous injuries

12. In the last 12 months, did you sustain a sharp injury by an object previously used on patient**?** ☐1. Yes ☐2. No

If no, skip to Q25

13. If yes, how many different incidents were you injured? ☐☐

14. If yes, specify the type of device

☐1. Hypodermic needle ☐2. Suture needles ☐3. IV catheter stylets

☐4. Phlebotomy needles ☐5. Scalpel blade ☐6. Branular

☐7. Others, specify_____

15. If yes, what was the depth of the injury?

☐1. Superficial (scratch, no or little blood)

☐2. Moderate (penetrated through skin, wound bled)

☐3. Deep (intramuscular penetration) ☐4. Unsure/unknown

16. What was the body site of exposure?

☐1. Arm ☐ 2. Hand ☐ 3. Finger

☐4. Leg ☐5.Others, specify _____

17. What was the type of fluid or material involved?

☐1. Blood ☐2. Visibly bloody body fluid

☐3. Non-visibly bloody body fluid ☐4. Other body fluid, specify_____

18. What time of the day did you have the exposure?

☐1. Morning (6am-1pm) ☐2. Afternoon (2pm-7pm) ☐3. Night (8pm-5am)

☐4. Unsure

19. What day of the week did you experience the exposure?

☐1. Monday ☐2. Tuesday ☐3. Wednesday ☐4. Thursday

☐5. Friday ☐6. Saturday ☐7. Sunday ☐8. Unsure

20. Under what procedure did you have the exposure? *(Tick all that applies)*

☐1. Surgical operation ☐2. Giving injection ☐3. During stitching

☐4. During blood specimen collection ☐5. Handling of intravenous line

☐6. Environmental cleaning ☐7. Conduction of delivery

☐8. Handling specimen in the lab ☐9. Handling cadaver in the mortuary

☐10. Others specify_____

21. How did the injury occur?

☐1. During recapping of needle ☐2.Handling uncooperative/combative patient

☐3. Accidental injury by colleague ☐ 4. Patient moved ☐5. During disposal

☐6. Sharp object dropped ☐7. When inserting/ manipulating/withdrawing needle

☐8.Others, specify _____

22. Were you wearing any protective equipment?

☐1. Yes ☐2. No

If no, skip to Q24

23. If yes, specify

☐1. Single pair gloves ☐ 2. Double pair gloves ☐ 3. Eye shield

☐4. Face shield ☐ 5. Gown ☐ 6. Mask

☐7.Others, specify_____

24. If no, give reasons

☐1. Low risk perception ☐2. Not available ☐3. Inadequate supply

☐4. Lack of knowledge ☐5. No reason ☐ 6.Others, specify_____

25. Have you undergone an in-service training on injection safety? 1. Yes ☐ 2. No ☐

E.(1) Post-exposure management for percutaneous injuries *(If multiple exposures, use extra sheet of paper)*

26. What immediate action did you take after the exposure incident?

☐1. Cleaned under running tap water ☐2. Squeezed the site

☐3. Cleaned with hypochlorite solution ☐4. Cleaned with methylated spirit

☐5. No action taken ☐6.Others specify _____

27. Did you report the incident? ☐1. Yes ☐2. No

If no, skip to Q30

28.If yes, to who? Specify _____

29. If yes, after how long?

☐1. Immediately within an hour ☐2. Within 24 hours

☐3. After 24 hours and within 48 hours ☐4. Between 48- 72 hours

☐5. After 72 hours

30. If no, give reasons

☐1. No reporting system/not aware of reporting method ☐2. Did not know risk

☐3. Not aware that I should report ☐4. Thought non infectious

☐5. No time for reporting ☐6. Exposure not emergency

☐7. Already immunized against hepatitis B

☐8. Others, specify _____

31. Was the source patient identified? ☐1. Yes ☐ 2. No ☐3.Don't know

Provide sero-status of the source patient for the following pathogens

	Positive	Negative	Refused	Unknown
HIV antibody				
HCV antibody				
HbsAG				

32. Did you have your blood drawn for baseline investigations? ☐1. Yes ☐2. No

33. Did you receive any post exposure prophylaxis? ☐1. Yes ☐No

☐3.Notrequired after evaluation

If no, skip to Q35

34. If yes, specify

☐1. HBV vaccine ☐2. HBV and immunoglobulin ☐ 3. Antiretroviral for HIV

☐4. Others specify _____

35. If no, why?

☐1. Ignored ☐2. No protocol available ☐3. Not aware

☐4. Others specify _____

36. Did you receive follow-up care? ☐1. Yes ☐2. No

37. If yes, specify _____

_____

_____

38. Please describe your sero-conversion status as a result of the exposure

☐ 1. Tested positive for HIV ☐ 2. Tested negative for HIV

☐ 3.Tested positive for HBV ☐ 4. Tested negative for HBV

☐ 5. Tested positive for HCV ☐ 6.Tested negative for HCV

☐ 7. Not tested for HBV/HIV/HCV ☐ 8. Not applicable

39**.** Had you been vaccinated against hepatitis B virus before? ☐1. Yes ☐2. No

If no, skip to Q41

40. If yes, how many doses did you receive? _____

41. If no, why?

☐1. Not aware ☐ 2. Low risk perception ☐3.No time/too busy

☐4. Lack of knowledge ☐ 5. Not available

☐6. Others, specify _____

D.2 Exposure history- splashes

42**.** In the last 12 months, did you sustain an exposure to splash by blood or body fluid to mucous membrane? ☐1. Yes ☐ 2. No

43. If yes, how many exposures did you sustain during this period? _____

44. What was the approximate volume of material?

☐1. Small (e.g. few drops) ☐2. Large (e.g. major blood splash)

45. What was the body site of exposure?

☐1. Eye ☐2. Mouth ☐3. Nose ☐4. Others, specify _____

46. What was the type of fluid or material involved?

☐1. Blood ☐2.Visibly bloody body fluid

☐3. Non-visibly bloody body fluid ☐4. Other body fluid, specify_____

47. What time of the day did you have the exposure?

☐1. Morning (6am-1pm) ☐2. Afternoon (2pm-7pm) ☐.Night (8pm-5am) ☐4. Unsure

48. What day of the week did you experience the exposure?

☐1. Monday ☐2. Tuesday ☐ 3. Wednesday ☐4. Thursday

☐5. Friday ☐ 6. Saturday ☐7. Sunday ☐ 8. Unsure

49. Under what procedure did you have the exposure? *(Tick all that applies)*

☐1. Surgical operation ☐2. Giving injection ☐ 3. During stitching

☐4. During blood specimen collection ☐5. Handling of intravenous line

☐6. Environmental cleaning ☐7. Conduction of delivery

☐8. Handling specimen in the lab ☐9. Handling cadaver in the mortuary

☐10. Others specify_____

50. How did the injury occur?

☐1. Handling uncooperative/ combative patient ☐2. Patient moved

☐3. Collision with other person ☐4. During disposal

☐5. When inserting/ manipulating/withdrawing needle

☐6. Others, specify_____

51. Were you wearing any protective equipment?

☐1. Yes ☐ 2. No

If no, skip to Q53

52. If yes, specify

☐1. Single pair gloves ☐ 2. Double pair gloves ☐ 3. Eye shield

☐4. Face shield ☐ 5. Gown ☐ 6. Mask

☐7. Others, specify_____

53. If no, give reasons.

☐1. Low risk perception ☐2. Not available ☐ 3. Inadequate supply

☐4. Lack of knowledge ☐5. No reason ☐ 6. Others, specify_____

E. (2) Post- exposure management for splash exposure *(If multiple exposures, use extra sheet of paper)*

54. What immediate action did you take after the exposure incident?

☐1. Cleaned under running tap water ☐2. Squeezed the site

☐3. Cleaned with hypochlorite solution ☐4. Cleaned with methylated spirit

☐5. No action taken ☐6. Others specify _____

55. Did you report the incident? ☐1. Yes ☐2. No

If no, skip to Q58

56. If yes, to who? Specify _____

57. If yes, after how long?

☐1. Immediately within an hour ☐2. Within 24 hours

☐3. After 24 hours and within 48 hours ☐4. Between 48- 72 hours

☐5. After 72 hours

58. If no, give reasons

☐1. No reporting system/not aware of reporting method ☐2. Did not know risk

☐3. Not aware that I should report ☐ 4. Thought non infectious

☐5. No time for reporting ☐ 6. Exposure not emergency

☐7. Already immunized against hepatitis B

☐8. Others, specify _____

59. Was the source patient identified? ☐1. Yes ☐2. No☐ 3. Don't know

Provide sero-status of the source patient for the following pathogens

	Positive	Negative	Refused	Unknown
HIV antibody				
HCV antibody				
HbsAG				

60. Did you have your blood drawn for baseline investigations? ☐1. Yes ☐2. No

61. Did you receive any post exposure prophylaxis? ☐1. Yes ☐ 2. No

☐3. Not required after evaluation

If no, skip to Q62

62. If yes, specify

☐1. HBV vaccine ☐2. HBV and immunoglobulin ☐ 3. Antiretroviral for HIV

☐4. Others specify _____

63. If no, why?

☐1. Ignored ☐2. No protocol available ☐3. Not aware

☐4. Others specify _____

64. Did you receive follow-up care? ☐1. Yes ☐2. No

65. If yes, specify _____

_____

_____

66. Please describe your sero-conversion status as a result of the exposure

☐ 1. Tested positive for HIV ☐ 2. Tested negative for HIV

☐ 3.Tested positive for HBV ☐ 4. Tested negative for HBV

☐ 5. Tested positive for HCV ☐6.Tested negative for HCV

☐ 7. Not tested for HBV/HIV/HCV ☐ 8. Not applicable

APPENDIX 2: AUDIT CHECKLIST

DEPARTMENT_____

QUESTION	YES	NO	COMMENTS
Infection control team/ committee in place (minutes available)			
Occupational risk control plan in place (Plan available)			
Availability of departmental occurrence book			
Reporting procedure in place (documented and available in wards)			
Periodic Training on Occupational risk reduction conducted(Records available, indicate period between trainings)			
Risk Management protocol in place			
PEP Drugs available round the clock			
PEP drugs free of cost			
PEP management record in place			
Availability of safety devices Auto-disable syringes, blunt suture needles/stapling devices/tissue adhesives			
Personal protective equipment available Gloves Masks Gowns/aprons Eye shield Boots Heavy duty gloves			
Availability of sharp containers In all departments At point of use In stock			
Sharps properly disposed (properly assembled safety container, located at point of use within, ¾ filled, no visible protruding sharps)			

APPENDIX 3: RECORD REVIEW FORM

Date of review _____Period; 2005 to 2009

Job Cadre _____

Variables	2005	2006	2007	2008	2009
Total number of with exposure history					
Number tested for HIV prior to PEP					
Number vaccinated against HBV before					
Number received PEP					
Exposure by type/nature 1. Non-intact skin 2. Mucosal 3. Percutaneous					
Exposure by area of work 1. Surgical wards 2. Obstetrics/Gynecology 3. Theatre 4. Laundry 5. Medical 6. Paediatric 7. Emergency 8. Others					
Time of exposure					
Day of exposure					
Body fluid involved 1. Blood 2. Others					
Body site involved					
Source patient identified					
Needle stick injuries involving hollow needles					
Injury depth 1. Superficial 2. Moderate 3. Deep					
Circumstances under which exposure occurred					
Situations PPEs used					

APPENDIX 4: INFORMED CONSENT FORM

Title: Prevalence and factors associated with percutaneous injuries and splash exposure among healthcare workers in Rift Valley Provincial and War-Memorial Hospitals

Principal investigator: Mbaisi Everline Muhonja

Institute of Tropical Medicine and Infectious Diseases (ITROMID)

Part I

You are invited to participate in this research study. The objective of the study is to determine the prevalence and factors associated with percutaneous injuries and splash exposures among healthcare workers. You have been selected as participant. We ask you to read the explanation of the study and ask questions.

Study procedures

The study involves an interview process by use of a questionnaire. This should take about 20 minutes to complete. Each questionnaire has a unique number for identification. Anonymity will be maintained. No forms of identification such as names will be used. Information that you give us will kept confidential.

Risks of the study

There are no risks or discomforts that are anticipated from your participation in this study. Minor inconvenience may result from the brief amount of time necessary to complete the questionnaire.

Benefits

There are no direct benefits by participating in this study. However, this study is expected to yield information about occupational health and risks that will be useful in informing decisions concerning health workers' working conditions, post exposure management and surveillance of occupational injuries, and hence improve services in general.

Confidentiality

All information from the study will be kept confidential. Records will be kept private and stored in a lockable drawer with restricted access. The questionnaire will bear a number and your name will not be used. The information will not be disclosed to any unauthorized persons; and will be reviewed by officials at ITROMID. The results of the research will be published in a professional/peer reviewed journal and may be presented in professional meetings.

Voluntary participation

Participation in this study is entirely voluntary. It is your choice whether to participate or not. Refusal to participate will involve no penalty.

Contacts and Questions

Any questions regarding the study may be directed to:

Mbaisi Everline Muhonja, Telephone number 0725273110, P.O. Box 225, Nairobi.

Or,

Director, ITROMID, P.O Box 62000, 00200 Nairobi, Telephone 254-67-52711/52181-4

Or,

Chairman, KEMRI National Ethical Review Board, P.O Bo 59840-00200, Nairobi

Part II: Agreement

I have read the information provided/the information has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Participant's name: _____

Signature: _____ Date: __ __/__ __/__ __ __ __

Name of person obtaining consent: _____

Signature: _____ Date: __ __/__ __/__ __ __ __

APPENDIX 5: APPROVAL LETTER, KEMRI SCIENTIFIC STEERING COMMITEE

KENYA MEDICAL RESEARCH INSTITUTE

P.O. Box 54840 - 00200 NAIROBI, Kenya
Tel: (254) (020) 2722541, 2713349, 0722-205901, 0733-400003; Fax: (254) (020) 2720030
E-mail: director@kemri.org info@kemri.org Website:www.kemri.org

K.E.M.R.I. SECRETARY 16 AUG 2010

ESACIPAC/SSC/6766

10th August, 2010

Everline M. Muhonja

Thro'

Director, CPHR
NAIROBI

forwarded 17/8/10

REF: SSC No.1865 (Revised) – Prevalence and factors associated with percutaneous injuries and splash exposure among health-care workers in Rift Valley Provincial and War-memorial Hospitals, 2010

I am pleased to inform you that the above-mentioned proposal, in which you are the PI, was discussed by the KEMRI Scientific Steering Committee (SSC), during its **170th meeting** held on **3rd August, 2010** and has since been approved for implementation by the SSC.

The SSC however, advises that work on this project can only start when ERC approval is received.

for

Sammy Njenga, PhD
SECRETARY, SSC

APPENDIX 6: APPROVAL LETTER, KEMRI ETHICAL REVIEW COMMITTEE

KENYA MEDICAL RESEARCH INSTITUTE

P.O. Box 54840 - 00200 NAIROBI, Kenya
Tel: (254) (020) 2722541, 2713349, 0722-205901, 0733-400003; Fax: (254) (020) 2720030
E-mail: director@kemri.org info@kemri.org Website:www.kemri.org

KEMRI/RES/7/3/1 **October 8, 2010**

TO: **EVERLINE B. MUHONJA,**
PRINCIPAL INVESTIGATOR

THRO': **DR. YERI KOMBE**
THE DIRECTOR, CPHR,
NAIROBI

RE: **SSC PROTOCOL NO. 1865 (*RE-SUBMISSION*): PREVALENCE AND FACTORS ASSOCIATED WITH PERCUTANEOUS INJURIES AND SPLASH EXPOSURE AMONG HEALTHCARE WORKERS IN RIFT VALLEY PROVINCIAL AND WAR-MEMORIAL HOSPITALS.**

Make reference to your letter dated September 30, 2010 received on October 4, 2010. Thank you for your response to the issues raised by the Committee. This is to inform you that the issues raised during the 182nd meeting of the KEMRI/ERC meeting held on 6th September 2010, have been adequately addressed.

Due consideration has been given to ethical issues and the study is hereby granted approval for implementation effective this **8th day of October 2010,** for a period of twelve (12) months.

Please note that authorization to conduct this study will automatically expire on **7th October 2011.** If you plan to continue with data collection or analysis beyond this date, please submit an application for continuing approval to the ERC Secretariat by **26th August 2011**.

You are required to submit any amendments to this protocol and other information pertinent to human participation in this study to the ERC prior to initiation. You may embark on the study.

Yours sincerely,

R.C. Kithinji

R. C. KITHINJI,
FOR: SECRETARY,
KEMRI/NATIONAL ETHICS REVIEW COMMITTEE

-8 OCT 2010

In Search of Better Health

APPENDIX 7: APPROVAL LETTER, RESEARCH AND ETHICS COMMITTEE, RVPGH

MINISTRY OF HEALTH

Telegrams: "PROVMED", Nakuru
Telephone: Nakuru 215580-90
When replying please quote

Ref. No. .....

PROVINCIAL GENERAL HOSPITAL
RIFT VALLEY PROVINCE
P.O. Box 71
NAKURU

RII/VOL.I/08

Date: 14/9/2010

To: Mbasi Everline Mohanja
P.O. Box
Nairobi

Dear Mohanja

RE: APPROVAL TO UNDERTAKE RESEARCH AT THE RIFT VALLEY PROVINCIAL GENERAL HOSPITAL

Reference is made to your letter dated 20th July 2010 seeking permission to do research at Provincial General Hospital, Nakuru on "Prevalence and factors associated with percutaneous injuries and splash exposure among health-care workers in Rift valley provincial and war-memorial hospital, 2010"

Permission has been granted/~~Not granted~~ for the research. It is hoped that you will adhere to the ethics and standards that relate to research at our institution.

Thank you.

Yours sincerely

17 SEP 2010

MEDICAL SUPERINTENDENT

17 SEP 2010
P. O. Box 71
NAKURU

CHAIRPERSON
RESEARCH AND ETHICS COMMITTEE