

PREVALENCE OF ACCIDENTAL EXPOSURE TO SELECTED BLOOD-BORNE PATHOGENS AND UTILISATION OF POST EXPOSURE PROPHYLAXIS AMONG HEALTH WORKERS IN TWO KENYAN HOSPITALS

BY

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Declaration

I hereby declare that this dissertation is my original work and has not been presented for any **degree** award in any Institution or University.

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Dedication

I wish to dedicate this work to my daughters Rael, Sibia, and Linda, and son, Frank; to my entire family, and to all the health workers in our Nation who carry out their work dutifully with dedication, oblivious of all the risks that could befall them. We thank God for the calling in us *"born to serve others"*

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List of Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
AKU ERC	Aga Khan University Ethical Review Committee
AKUH, N	Aga Khan University Hospital, Nairobi
ARVS	Anti Retro Viral (Medicines)
ART	Anti- Retroviral Therapy
1339	Blood Borne Diseases
CCC	Comprehensive Care Centre
CDC	Centers for Disease Control and Prevention
CHS	College of Health Sciences
CI	•• Confidence Interval
CSF	Cerebro-Spinal Fluid
DVI	Division of Vaccines and Immunisations
EPINET	Exposure Prevention Information Network
ERB	Ethics Regulatory Board
ERC	Ethical Review Committee
FBO	Faith Based Organisation
FHS	Faculty of Health Sciences
HBIG	Hepatitis B Immune Globulin
HBsAg	Hepatitis B Surface Antigen
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HCWs	Health-Care Workers
HDU	High Dependence Unit
HIV	Human Immunodeficiency Virus
	Intensive Care Unit
^	International Labour Organisation
	Intra-Muscular Injection
	Institutional Research and Ethics Committee
	Intra-Venous Injection

KAIS	Kenya Aids Indicator Survey
KASPA	Kenya Service Provision Assessment
KAVI	Kenya AIDS Vaccine Initiative
KDHS	Kenya Demographic Health Survey
KMTC	Kenya Medical Training College
KNBS	Kenya National Bureau of Statistics
KNH	Kenyatta National Hospital
MOMS	Ministry of Medical Services
MTRH	Moi Teaching and Referral Hospital
NASCOP	National Acquired Immune Deficiency Syndrome and Sexually Transmitted Infections Control Programme
NGO	Non-Governmental Organization
NSI	Needle Stick Injury
OR	Odds Ratio
OSHA	Occupational Safety and Health Administration
OPIM	Other Potentially Infectious Material
PEP	Post Exposure Prophylaxis
PITC	Provider Initiated Testing and Counseling
PMTCT	Prevention of Mother-To-Child Transmission
PLWHA	People Living With Human Immune Deficiency Virus/AIDS
PPE	Personal Protective Equipment
PPS	Probability Proportional to Size
s c	Subcutaneous Injection
SIGN	Injection Safety Global Network
SPSS	Statistical Package for Social Sciences
STI	Sexually Transmitted Infections
UNAIDS	United Nations Agency of International Development
USA	United States of America
US	United States
UON	University of Nairobi
WHO	World Health Organization

Definition of Terms

Health Care Workers: In this study, health-care workers (HCWs) are defined as persons (e.g employees, **students**, contractors, attending clinicians, or volunteers) whose activities involve **contact with patients** or with blood or other body fluids from patients in a health-care facility.

Post-exposure prophylaxis (PEP): Is the set of services provided to manage specific aspects of **exposure** to Human Immunodeficiency Virus (HIV) and Hepatitis B Virus (HBV), and to prevent **HIV and HBV**, in one who is significantly exposed.

Occupational exposure: Is an event occurring in a health care setting, where any reasonable **anticipated** skin, eye, and mucous membrane or parenteral contact with blood, or other **potentially** infectious material that may result from performance of health workers duties.

Blood Borne Diseases (BBD): are the diseases spread by contact with blood, or other body fluids like **saliva**, urine, breast milk, semen, Cerebrospinal fluid (CSF), pleural and peritoneal fluids. The selected BBD in this study are HIV and HBV.

Abstract

Background: Worldwide it is estimated that more than 3 million Health care workers (HCWs) experience a percutaneous injury with a contaminated object annually. Half of these occur in sub-Saharan Africa (Pruss-Ustun *et al*, 2005). The Centre for Disease Control and Prevention (CDC) estimates that 380,000 needle-stick injuries occur in United States of America (USA) hospitals each year, and 61 % are caused by hollow-bore needles. It is estimated that 4.4 % of HIV infections and 32% of HBV infections among HCWs are due to occupational exposures (Rapiti *et al*, 2005). Studies in West Africa reported between 27-57.8% Needle stick Injury (NSI), while studies in the East African region reported NSI exposure rates of 40-60% among HCWs in Uganda and Tanzania. A study conducted in Kenyan rural health facilities in Thika district, reported an occupational exposure rate of 30 % among health workers (Taegtmeier *et al*, 2008) and in Kenyatta National Hospital (KNH), Ngesa reported an exposure rate of 59.5% among registered nurses in a public tertiary hospital in Kenya (Ngesa, 2006, unpublished data).

Objective: The aim of the study was to determine the prevalence of occupational exposures to selected blood-borne pathogens (HIV and HBV) among health workers, in two Kenyan hospitals, one public referral and teaching hospital and the other, a private university teaching hospital.

Methodology: This was a descriptive cross-sectional study carried out in Moi Teaching and Referral hospital (MTRH), Eldoret, and at the Aga Khan University Hospital, Nairobi (AKUH, N). Three hundred and sixty five (365) study participants were randomly selected by applying multi-stage probability sampling procedure. Quantitative data were collected by use of structured, close-ended questionnaires in the months of February and March, 2012 through face to face interviews. Data were analysed using EPI INFO 2000 and Statistical Products and Services solutions (SPSS) version 17.0. Patterns of association were analysed using Chi-square tests, while statistical significance was assessed using logistic regression.

Results: The overall prevalence of occupational exposures in the two facilities was 36%. In the Pnvate hospital the prevalence was 23%, compared to 43% in the public hospital. Type of

facility, department, availability and location of disposal container, and procedure being performed at the time of exposure were found to be significantly associated with occurrence of occupational exposures. The overall HB vaccination uptake was 53.4% fully vaccinated, 18.9% had partial, while 27.7% had never been vaccinated. Eighty percent (80%) of participants in the private hospital had received at least one dose of HBV vaccine as compared to only 68% in the public hospital. Out of all the participants who sustained percutaneous injuries in both hospitals, only 31% utilised HIV Post Exposure Prophylaxis (PEP), with perceived low risk of infection being the commonest reason why PEP was not used. There was no statistical significant difference in use of PEP between the two hospitals ($p=0.1371$). The overall exposure reporting rate was 54% in both hospitals, and the most common reason cited for not reporting was perceived low risk of transmission of HIV and HBV by the participants.

Conclusion: The prevalence of occupational exposures among health workers could be much higher than is documented due to under-reporting. There was a statistical significant difference between occurrence of occupational exposures and the type of facility, number of years in employment, staff category, department where one worked, type of procedure being performed and the availability of and location of the disposal container at time of exposure. There was a low PEP uptake of 31% in both hospitals but there was no statistical significant difference in the use of HIV PEP and HBV vaccination status in the two hospitals, and socio-demographic characteristics. There is an urgent need for the health institution managers and health partners to address the health workers perception of low risk of HIV and HBV transmission after an occupational exposure to blood, or other potentially infectious body fluids in the workplace.

Recommendations: Policy makers and health institution managers to formulate policy guidelines that enforce the primary prevention strategies on how to curb accidental occupational exposures. Health worker in-service training on HBV and HIV disease transmission, prevention and control should be undertaken as mandatory in continuous medical education; and should be made a requirement for licensing and registration by the relevant professional bodies. Health institutions should come up with standard operating procedures on how to report occupational exposures and access PEP. A copy of the National Guidelines on HIV PEP should be distributed to each department in all hospitals and HCWs trained periodically on its application. Hepatitis B

vaccination of HCWs should be given at no cost to the staff. An intensive educational **programme** to increase HBV vaccination rate of HCWs and improve HIV PEP uptake should be **rolled** out to **all** the health institutions. Further research should be conducted to address gaps in **Knowledge**, attitude, skills and workplace practices of health workers.

CHAPTER 1 INTRODUCTION

According to estimates of Occupational Safety and Health Administration (OSHA), more than 5-6 million HCWs and employees working in public safety occupations (e.g. fire fighters) worldwide could be exposed to Hepatitis B (HBV), Hepatitis C (HCV) and HIV (OSHA 2001). Such workers include doctors, dentists, nurses, phlebotomists, mortuary attendants, paramedics, laboratory and blood bank technologists and technicians, housekeeping personnel in healthcare institutions, laundry workers, operating theatres, radiology and maternity staff. The most common infections caused by blood borne pathogens are HBV, HCV and Acquired Immunodeficiency Syndrome (AIDS), from HIV infection. Exposure to blood borne pathogens poses a serious risk to HCWs. The study looked at Hepatitis B and HIV AIDS, which have a chronic sequel, with very high morbidity and mortality, and without a definitive cure. These are highly infectious viral agents, and that they also have PEP measures available. The study aimed at unraveling the characteristics and burden of occupational exposures, and whether these were reported to the risk management department, for risk assessment and post exposure prophylaxis utilisation among HCWs in two large, teaching urban hospitals in Kenya. The study design was a cross-sectional descriptive study which looked at the number and types of occupational exposures and the various predictor variables across a private and a public university teaching hospital. By the year 2010, there were 100,301 employees (not disaggregated by occupation) in health services out of which 55,565 were in the public sector (Kenya National Bureau of Statistics (KNBS), 2011). Distribution of HCWs according to type of facility was 53% in public, 23% in private, 20% in Faith Based Organisations (FBO), 3% in Non-Governmental Organisations (NGO), and 1% Others (Kenya Service Providers Assessment (KASPA), 2010). The results of this study are to be disseminated to policy makers, Health Institution Directors, Health Partners and Stakeholders for assimilation and action. Adoption of recommendations may help to improve healthcare workers health and safety at the workplace, and to curb morbidity and mortality of the health workforce.

1.1 Background Information

Healthcare workers (HCWs) worldwide face the risk of occupational infection by blood borne pathogens, including HIV, HBV and HCV. International standards and precautions exist for **preventing** injuries from sharp devices, as well as guidelines for post-exposure evaluation and prophylaxis, but HCWs working in limited-resource settings may not have adequate access to these recommended safety measures. This is especially of concern where the prevalence of blood-borne pathogens in the patient population may be relatively high (Sagoe-Moses *et al.*, 2001). Strategies put in place to prevent occupational exposures among health workers include education of HCWs on the risk, universal precautions and national and institutional infection control and prevention guidelines, reduction of invasive procedures, use of safer devices and procedures; and the post-exposure prophylaxis management and proper disposal of medical waste (OSHA, 1992). There are the standard precautions which are internationally recognized as a means to reduce the risk of HCWs exposure to blood and other potentially infectious material (CDC, 2007).

All exposed health workers are supposed to report to the infection control departments of their respective hospitals for notification and then to a physician for risk assessment. Clinical evaluation and laboratory tests are requested including HIV test, complete blood count, kidney and liver function tests, and hepatitis B surface Antigen (HBsAg) test. If negative for HBsAg test, immunization against HBV is supposed to be given, when available. Health workers who agree to HIV testing and turn out to be negative are given ARVs for prophylaxis depending on the risk assessment findings. There are National guidelines and policies on the use of PEP issued by NASCOP. Each hospital should have an outlined protocol on how to report occupational exposures to the relevant authority and how to access PEP without delays. Occupational transmission of hepatitis B poses a significant risk to HCWs. Because of this, in 1986, the US Department of Labour, in conjunction with Health and Human Services, issued recommendations for universal precautions to protect against exposure to body fluids. Subsequently, in 1991, the Occupational Safety and Health Administration (OSHA) published the ^{Fed}ederal Blood-borne Pathogens Standard (OSHA, 1991, Shapiro, 1995). This document Mandated that all HCWs with potential exposure to blood or other infectious materials either be

offered the hepatitis B vaccine series free of charge, demonstrate immunity to hepatitis B, or else **formally** decline vaccination (Agerton *et al*, 1995). The vaccination schedule is 3 doses of intramuscular (IM) injection given at month 0, 1 and at 6 months intervals.

Exposure to blood borne pathogens poses a serious risk to HCWs. It is estimated that the average **risk** for exposure for HIV transmission after a percutaneous exposure is 0.3%, and 0.09% to mucocutaneous exposure, the risk of HBV transmission is 6-30%, and HCV transmission risk is **1.8%** (Pruss-Ustun *et al*, 2005). Exposure to blood borne pathogens through a contaminated **needle** stick or cut with a sharp object is the most common mode of occupational transmission in **health-care** settings, Occupational exposure also may occur through splash to mucous membranes such as the eyes, nose and mouth; or through exposure to non-intact skin, such as **chapped**, abraded, infected, or cut skin (Ippolito *et al*, 1999). Factors influencing the risk to an **individual** HCW over a lifetime career include the number and types of blood contact **experienced** by the worker, the prevalence of blood-borne pathogen infection among patients **treated** by the worker, and the risk of transmission of infection after a single blood contact (Beltrami *et al*, 2000). For HCWs worldwide, the Attributable fractions for percutaneous **occupational** exposure to HBV, HCV and HIV are 37%, 39% and 4.4%, respectively (Pruss-Ustun *et al*, 2005). To minimize the risk of blood-borne pathogen transmission from HCWs to **patients**, all HCWs should adhere to standard precautions, including the appropriate use of hand **washing**, protective barriers, and care in the use and disposal of needles and other sharp **instruments** (Ippolito *et al*, 1999). Employers and health institutions should have in place a system that includes written exposure management protocols for reporting, evaluation, **counseling**, treatment, and follow-up of occupational exposures that may place a worker at risk of **blood-borne** infection (Beltrami *et al*, 2000).

An estimated 1000 people get infected with HIV each year worldwide as a result of occupational exposures (Gupta *et al*, 2008). Occupational exposures can be psychologically devastating to the

^{CW}> his family and workmates, if not well managed. There are standard safety precautions and PEP m

management guidelines and protocols in place in most hospitals, and HCWs should be well aware and have access to these services, in the event of an accidental blood exposure (CDC, ^{UMIA}> 2001, 1992). The occupational exposure to blood and other body fluids in hospital

settings has not been well documented in the developing countries, where resources are limited. **While it** may constitute a low, but significant risk of transmission of a variety of viral pathogens like HBV, HCV, and HIV, the magnitude of this risk needs to be established in our setup.

By 2007, an estimated 33.2 million people worldwide were HIV infected, (WHO, 2007). In Kenya an estimated 1.42 million people were living with HIV infection in 2007, with an adult (age 15-64) prevalence rate of 7.1%. In Nairobi province, HIV prevalence among adults aged 15-64 years was 8.8% (Kenya AIDS Indicator Survey (KAIS), 2007). In some resource poor countries, studies have documented higher HIV and HBV prevalence rates in hospital patients, than in the general population, especially those patients in the medical wards in the developing countries (Sagoe-Moses *et al*; 2001, Gumodoka, *et al.*, 1997). However, HCWs had the same HIV sero-prevalence as the general population, but were at risk from poor bio-safety as has been found in some studies. Blood borne pathogens of HIV and HBV are highly contagious, and once transmitted, they have a prolonged natural course, with progression to chronic stages, which have no cure whatsoever. The illnesses result in psychological and physical stress with loss of social and economic contributions towards one's community. This in turn impacts very negatively on the human resource structure of our nation's health service delivery system.

1.2 Research Problem

It is estimated that more than three million HCWs experience the stressful event of a percutaneous injury with a contaminated sharp object each year worldwide (Pruss-Ustun *et al*, 2005). Half of these would occur in Sub-Saharan Africa. It is estimated that 4.4% of all HIV infections amongst HCWs are due to occupational exposures (Rapiti *et al*, 2005). These adverse consequences impact negatively on the health system's workforce at a moment when shortages of HCWs are reported (Pruss-Ustun *et al*, 2005)). Occupational exposure to contaminated sharps may lead to additional problems, including the discrimination of HIV infected patients by HCWs for fear of one becoming infected through exposure, and psychological trauma. World Health Organisation estimates that 32% of new HBV infections, 40% of HCV infections and 5% of new HIV infections in our setup could be attributed to health-care related contaminations. A literature review revealed 33 reports of HCWs who have contracted HIV infection as a result of their work, and 4 of these were expatriate doctors who had worked in Africa (Veeken *et al*, 1991).

A study carried out in Kenyatta National Hospital among 158 registered nurses reported 59.5% had sustained inoculation injuries in the preceding year (Ngesa, 2006). A study done in rural health facilities in Thika district, Kenya, in 2002-2006, among 650 HCWs, showed that 30% had sustained NSI and only 4% of them utilised PEP services. The main reason for low uptake of PEP was fear of being tested, and a low perceived risk of HIV transmission (Taegtmeier *et al*, 2008). This study was done in a rural Kenyan district, which may not be representative of what is happening in urban settings like Nairobi, which had a higher than average National adult HIV prevalence rate of 8.8%. The study was carried out in two large hospitals situated in Nairobi city, and Eldoret town, one private and the other public, but sharing the same core business as University teaching hospitals and middle college level training centers. Moi Teaching and Referral hospital enrolled about 515 Bachelor of Nursing students, and 921 Medicine (health sciences) in the year 2010/2011, while AKUH, N enrolled about 279 disaggregated health service students in the year 2010/2011 (KNBS, statistical Abstract 2011).

Modeling of health care begins at the tertiary hospitals, and is then rolled down to the Peripheral hospitals in the rural settings; hence studies carried out in the large urban teaching hospitals, which are the health worker training grounds, are likely to generate recommendations

that may be rolled out to the smaller, rural facilities. The HCWs posted out to the rural facilities after training may help disseminate the new ideas learnt from this research, to their colleagues in the rural health facilities.

Research on the magnitude of occupational exposures in the private health facilities in Kenya seem to be limited, or have not been published, hence the need to do this study. Occupational exposures to blood borne diseases, although rarely reported, are common occurrences in resource-poor countries (Gupta *et al*, 2008), Kenya included. The prevalence of blood borne pathogens in many developing countries is high, but documentation of infections caused by occupational exposures in these countries is scarce (Sagoe-Moses *et al.*, 2001). Not much research has been done in this area of HIV PEP and there is no available data in this country on the national utilization levels of PEP by health care workers for occupational HIV exposures. **The** Kenya AIDS Indicator Survey (KAIS), 2007 did not capture data on occupational exposures to HIV in HCWs, since these are at a particular risk for infection during their day to day work. **The** registers routinely used in health facilities for reporting morbidity and mortality do not capture data on HIV/HBV occupational exposure and PEP use as an indicator.

1.2.1 Research Questions

1. What is the prevalence of occupational exposures to selected blood-borne pathogens among HCWs in two University teaching hospitals, in Kenya (private and public)?
2. What are the risk factors and characteristics of occupational exposures among HCWs in the two hospitals (private and public)?
3. What is the reporting rate of occupational exposures by health workers in the two hospitals (private and public)?

What is the proportion of HCWs immunized fully against HBV, and the proportion of HCWs accessing PEP in the two hospitals (private and public)?

I 3 Conceptual Framework

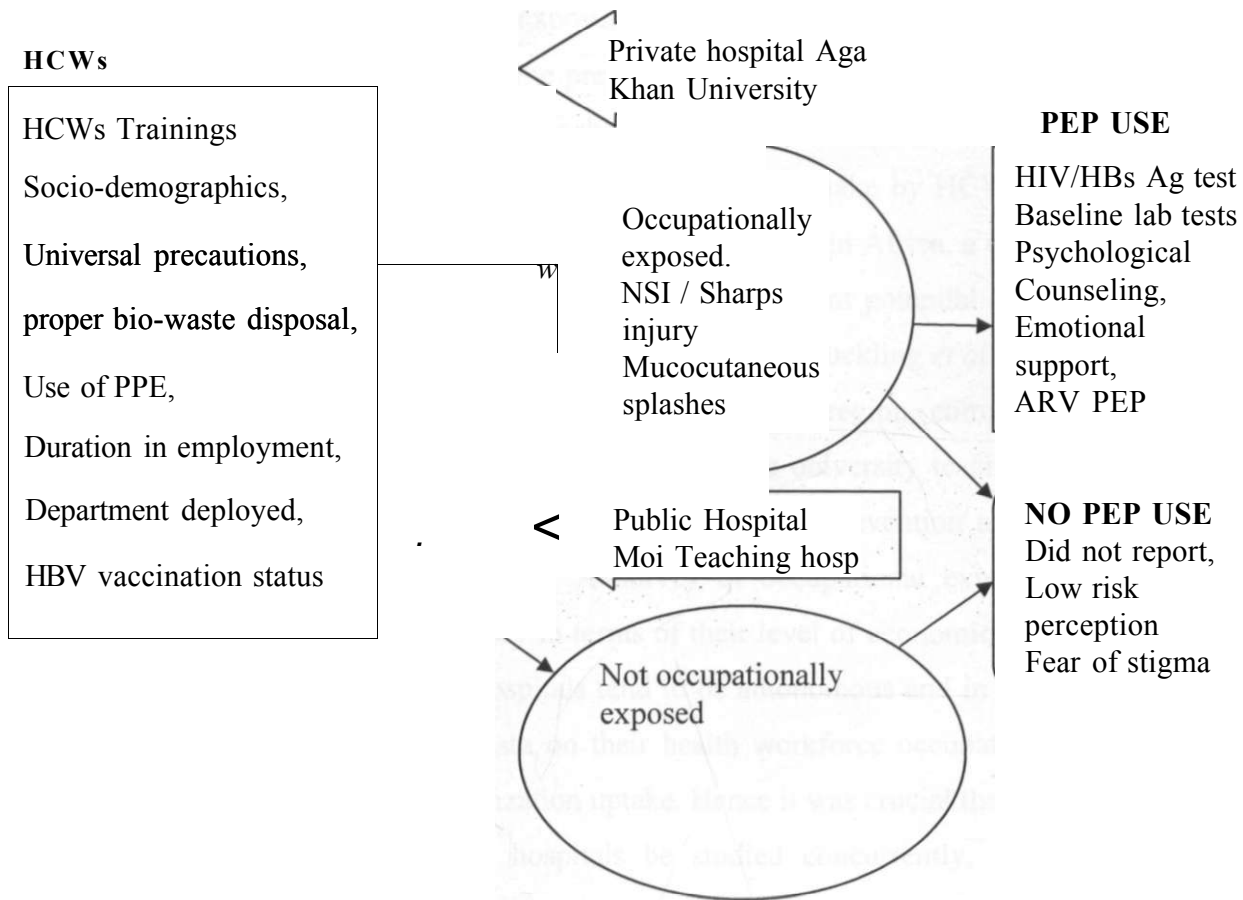


Figure 1.1 Conceptual Framework for HCWs Occupational Exposures and PEP use

The key factors that were analysed in this study are the HCW factors, the health facility or institutional factors, in terms of the resources available, and the occupational exposure factors, and whether reporting was done to the appropriate infection control and risk management department. If the exposure was reported, was PEP utilized or accessed? This is a modified health belief model. Scientific knowledge and clinical practice are essential in health service delivery; and all HCWs are expected to know and apply institutional, national and international Policies on infection control and occupational safety in promoting a safe work place (OSHA, 2001. 1992).

1.4 Justification of the study

There exists a risk of HIV and HBV exposure in healthcare workers due to the nature of their work and hence the need to establish the prevalence of occupational exposures to BBD and the level of PEP utilisation in a national teaching and referral hospital, and a private university teaching hospital and to unravel the factors affecting PEP uptake by HCWs. Although data on the prevalence and type of occupational exposures are limited in Africa, a cross-sectional survey in Kenyan hospitals found that 20-30% of HCWs had a recent potential exposure, and half of these had experienced multiple exposures (Siika *et al.*, 2009, Suckling *et al.*, 2006, M'ikanatha *et al.* 2007). There have not been any studies in the African region, comparing exposure rates among HCWs in a public teaching hospital and a private university teaching hospital, and the uptake of HBV vaccination and PEP use for HIV infection prevention among the health care personnel in the two different settings. A survey of occupational exposures among health workers from health facilities that vary in terms of their level of economic development has not been done in this country. Private hospitals tend to be autonomous and in the literature reviews carried out none documented any data on their health workforce occupational exposure rates, HBV vaccination status and PEP utilization uptake. Hence it was crucial that both the private and public tertiary University teaching hospitals be studied concurrently, to generate data for reference purpose.

Circumstances and factors surrounding the occurrence of NSIs were explored to provide evidence for establishing effective occupational safety standards and precautions regarding the handling of blood-related products at healthcare facilities in this country. The findings of this study will support recommendations for training and education in prevention of sharps injuries and application of universal standard precautions to be incorporated into the curriculum of medical and nursing schools in this country. Recommendations from this study may help policy makers in formulation, adoption and legislation enactment on procurement and, use of safer sharp devices and proper disposal of medical wastes. With evidence-based strategic planning, it^{ls} hoped that the health policy makers, will realize the need to formulate policy and guidelines to ensure that all HCWs, medical, paramedical and nursing students in their clinical years get^v vaccinated against HBV. The knowledge of risk factors and the circumstances in which these

exposures occur in our hospitals is very useful for developing proper preventive and control guidelines and education programs. These recommendations will help guide Health Service Managers to formulate and enforce proper HCWs occupational exposure surveillance systems, and to evaluate the existing infection control and prevention institutional policies.

While studies done in India and the USA show low reporting rates of occupational exposures and uptake of PEP, in Kenya, this could be postulated to be much lower, given our poor documentation and reporting systems. There is limited surveillance and data regarding occupational and non-occupational HIV exposure and the use of PEP in this country, and in most other resource constraint countries (Gupta *et al.*, 2008). Whereas prompt use of PEP ARV is estimated to reduce HIV transmission by 81% (Cardo *et al.*, 1997), and with well developed national guidelines and protocol on HIV PEP, this area is yet to be maximally exploited in the secondary prevention of HIV in this country. Although unproven, the presumed mechanism for HIV PEP comes from animal and human work suggesting that shortly after an exposure to HIV, a window period exists during which the viral load is small enough to be controlled by the host's body immune system. Anti Retroviral drugs (ARVs) given during this period may help to diminish or end viral replication thereby preventing development of HIV. There is need for the level of utilization of HIV PEP to be established in the health facilities for both occupational and non occupational HIV risk exposures, for planning purposes. There are limited studies done in this country involving private and public tertiary teaching health facilities, to evaluate occupational exposures among health workers, their report rate and utilization of PEP, and the HBV immunization coverage amongst HCWs.

Studies in the USA estimate that more than 3 million HCWs experience a percutaneous injury with a contaminated sharp object each year worldwide and half of these occur in Sub-Saharan Africa (Prus-Ustun *et al.*, 2005). Approximately 4.4% of all HIV infections among health workers are due to occupational exposures (Rapiti *et al.*, 2005). World Health Organisation (WHO) estimates that 32% of new HBV infections and 5% of new HIV infections in our setup could be attributed to health-care related contaminations (WHO, 2002). This research study findings and recommendations will help the Ministry of Health avert morbidity and mortality from these occupational exposures.

1.5 Objectives

1.5.1 Broad Objective

To determine the prevalence and characteristics of occupational exposures to selected blood-borne pathogens and utilisation of post-exposure prophylaxis among healthcare workers in Moi Teaching and Referral Hospital, and Aga Khan University Hospital.

1.5.2 Specific Objectives

1. To determine the prevalence of occupational exposures to HIV and HBV among HCWs in the two hospitals;
2. To describe characteristics of occupational exposures to HIV and HBV among HCWs in the two hospitals;
3. To determine the proportion of HCWs utilising PEP following occupational exposures in two Kenyan hospitals;
4. To determine the proportion of HCWs fully immunized against HBV in the two Kenyan hospitals, and
5. To determine the reporting rate of occupational exposures among health workers in the two Kenyan hospitals.

1.6 Hypotheses

The null hypotheses:

1. There is no difference in the characteristics of occupational exposures to selected blood-borne diseases among HCWs in a public University teaching hospital and a private University teaching hospital in urban settings.
2. There is no relationship between the level of utilisation of PEP and the socio-demographic factors of HCWs in the two hospitals.

There is no association between the number and type of occupational exposures and the occupational characteristics of the HCWs.

CHAPTER 2 LITERATURE REVIEW

The Centers for Disease Control and Prevention (CDC) had received voluntary reports of 57 cases of HIV sero-conversion associated with occupational exposure to HIV among U.S. health care personnel as of June 2001. An additional 138 infections were considered possible cases of occupational HIV transmission (CDC, 2001). A literature review revealed 33 reports of HCWs who have contracted HIV infection as a result of their work, and 4 of these were expatriate doctors who had worked in Africa (Veeken *et al*, 1991). Occupational transmission of HIV has been reported in most countries, and the CDC estimates that 380,000 needle-stick injuries occur in U.S. hospitals each year. Approximately 61% of these injuries are caused by hollow-bore needles (Gerberding, 2003). A survey of 601 nurses from 18 hospitals in Poland, found that 45.9% had at least 1 percutaneous exposure during the past year, and 74.4% of the total exposed did not report to the infection control centre (Ganczak *et al.*, 2006). Underreporting rates of 3-30% have been described by other studies and this has been one of the greatest challenges with occupational exposures to health workers (Gumodoka *et al*, 2003, Gupta *et al*, 2005, Du Toit *et al*, 2007,). With lack of stringent occupational exposure surveillance systems in our health facilities, the scenario here in Kenya, is likely to be worse.

The risk of acquiring HBV is related to the prevalence of HBV infection in the patient population with which the HCW works. Patients, who are HBsAg positive, either from acute or chronic infection, are potential sources of infection. Patients who are acutely infected may not be recognized since acute infection is symptomatic in only 10% of children and 30 to 50% of adults. Chronic HBV infection is often asymptomatic. Healthcare workers who work in settings with **patient** populations with a relatively high prevalence of HBV infection, such as urban and tertiary-care hospitals (which more commonly serve groups at high risk for HBV infection, such as injecting drug users), have been shown to be at greater risk of occupational HBV infection **than those** who work in rural or community hospitals (Harris *et al*, 1984). Hepatitis B vaccine **Provides** both pre-exposure and post-exposure protection against HBV infection. In 1991, OSHA ^{is} sued a standard that required employers to offer hepatitis B vaccine at no cost to employees ^{w,1}h reasonably anticipated contact with blood or other potentially infectious materials (OSHA, **1991**).

In the Czech Republic, hepatitis had been a state-reportable disease for many decades, and rates of hepatitis B among HCWs and the general population had been closely tracked since the 1970s. Previously reported studies had demonstrated that morbidity among HCWs due to viral hepatitis was 3.6 times higher than among the general population (Seyckova *et al*, 1984). Many of these studies were performed on small samples or did not consider specific HCW occupations. Despite limited resources, control of nosocomial hepatitis was given high priority by state officials in the early 1980s. This study demonstrated that a rigorous vaccination program can sharply reduce occupational transmission of hepatitis B and that such a program can be implemented in a country with modest resources, even during an era of profound national political change (Helcl *etal*, 1995).

A telephone survey conducted among 150 hospitals selected randomly from participants in the American Hospital Association 1991 annual survey found that 51% of the employees who were eligible to receive hepatitis B vaccine had completed the vaccination series (Agerton *et al*, 1995). By 1994, a telephone survey of 113 hospitals found that 67% of eligible employees had completed the hepatitis B vaccination series (Mahoney *et al*, 1997). Coverage levels among eligible employee groups surveyed in 1994 were 81% among phlebotomists, 72% among nurses, 71% among physicians and residents, 63% among nurse aides, 59% among custodial and security personnel, 44% among clerical administrative staff, and 44% among food service workers (Mahoney *et al*, 1997).

A study done on occupational exposures and utilization of PEP in a teaching hospital in India, found that of the 1955 HCWs, 484 HCWs reported 557 exposures. The interns had the greatest number of exposures at 53.1%, followed by residents at 19.3% exposures, and 55% reported use of Personal Protective Equipment (PPE) at the time of exposure. Percutaneous exposures were ^{e most} common across all cadres (Gupta *et al*, 2005). In a six-year prospective surveillance of NSI in a tertiary care centre in Mumbai, India, among HCWs found that out of 380 who reported NSI, 45% were nurses, 33% attendants, 11% doctors, and 11% technicians. Most NSI occurred ^{intr}avenous line insertion, followed by blood collection, surgical blade injury and tapping needles (Mehta *et al*, 2005).

In the CDC's retrospective case-control study of HCW, after controlling for other risk factors for HIV transmission, use of Zidovudine as PEP was associated with a reduction in the risk of HIV infection by approximately 81%. Although the results of this study suggest PEP efficacy, its limitations include the small number of cases studied and the use of cases and controls from different cohorts (Cardo *et al*, 1997). Although unproven, the presumed mechanism for HIV PEP comes from animal and human work suggesting that shortly after an exposure to HIV, a window period exists during which the viral load is small enough to be controlled by the host's body immune system. Anti retroviral drugs (ARVs) given during this period may help to diminish or end viral replication thereby preventing development of HIV disease.

A 5-year surveillance of needle stick and sharps injuries among health care workers in a teaching center in Saudi Arabia, during the years 2001-2005, found that, of the 133 HCWs who reported NSI, nurses sustained the highest number of injuries (45.1%), followed by doctors 26.3%, and downstream staff had 24.8% injuries. Most of the injuries (55%) occurred during procedures such as venepuncture or surgical procedure (Malak *et al*, 2008). A study done in a public teaching hospital in Malaysia found the prevalence of NSI to be 24.6%, with doctors having the highest prevalence, followed by nurses and Medical students in that order. Fifty nine percent (59%) of all those affected did not report their injuries to the infection prevention department (Lee and Hassim, 2005). A survey of 2002 HCWs in a Greek University teaching hospital, found that 284 exposures were reported by 247 HCWs, of whom 52.8% were nurses, 27.1% doctors, 14.4% housekeeping staff and 5.6% medical laboratory technicians. The age group that reported the highest rate exposure incidence per year was 21-30 year-olds. The highest number of reported incidents (48.9%) occurred in the wards, and the operating theatres (21.8%), with needles being the commonest implement that caused injury in 60.6% of incidents (Pournaras *et al*, 1999).

¹¹ Hanoi, a follow-up study was conducted among 642 HCWs from three hospitals and the results of the survey showed that in the selected hospitals 68.8 - 71.2% of HCWs had been injured by sharps during work. Lack of standard safety boxes in hospitals was reported and most containers for sharps disposal were made from plastic bottles. The NSI notification system was

not well established and many cases of NSI were not reported and managed in all the three hospitals (WHO. Safe Injection Global Network (SIGN) Report, 2005).

A study done in three university hospitals in Tehran, Iran, found that, out of 900 HCWs surveyed, 391 (43.4%) had at least one occupational exposure to blood or other infectious fluid. Percutaneous injuries were reported by 280 HCWs with an exposure reporting rate to an infectious disease specialist of 29%. Risk factors to exposure were the type of job, years of experience, and specific hospital wards (Hadadi *et al*, 2005). A similar study conducted in the teaching hospitals of Ankara University School of medicine, in Turkey, to determine the risk factors of occupational exposure, found that of the 988 HCWs interviewed, 64% had been exposed, and the most frequent cause of NSI was recapping the needle. Out of the HCWs exposed, 28% did not use personal protective equipment (PPE), and 67% health workers did not report the exposures (Azap *et al*, 2005).

A survey of 1485 HCWs interviewed from all levels of health facilities in Egypt showed that 529 (35.6%) had at least one NSI during the past three months and that the most common activity associated with NSI was needle recapping. Only 15.8% of HCWs reported receiving 3 doses of hepatitis B vaccine, with the highest vaccination coverage among professional staff (38%), and lowest among housekeeping staff (3.5%) (Taalat *et al.*, 2003). A study done in South Africa to determine the incidence of percutaneous injuries, reporting rate and use of gloves during procedures, among doctors in the school of Medicine at the University of Free State, found that only 47.6% reported the injury, 44.4% were aware of the reporting procedure and 7% did not know the reporting procedures. The use of gloves always during drawing of blood was documented in only 13.7% and 17.8% used when administering injections, while 86.8% used when handling a scalpel or other incision object (Du Toit *et al*, 2007).

In Kamenge University Referral Hospital, Burundi where reporting exposures is not mandatory, and exposed HCWs are not followed up, and all materials and care procedures are paid for by the HCW exposed; 219 HCWs, were interviewed, and 174 (79%) reported at least one exposure in the preceding year (injuries with contaminated sharps or splash exposures). Fifty four percent (54%) of the exposures involved needles used during clinical procedures, 16% during cleaning or

garbage disposal, and 8% during surgical procedures. Twenty six percent (26%) involved needle recapping, 14% discarded materials and 32% unexpected patient movement. Only 14% of the respondents, who reported an exposure, had sought medical advice and treatment (Le Pont *et al.*, 2003).

A study done in Nigeria to determine the epidemiology of needle stick and sharp instrument accidents in HCWs in a teaching hospital in Ibadan, Obafemi, Owolowo University found that 27% out of 474 HCWs experienced NSI during the previous year. Fifteen percent (15%) reported sharp instrument injuries, most commonly broken glass specimen containers. Only 43% had gloves available during procedures that involved exposure to patients' blood (Adegboye *et al.*, 1994). A similar study in Ilorin University teaching hospital, Nigeria found that there was a high incidence of NSI (57.8%) and the health workers in surgical departments were at higher risk (Medubi *et al.*, 2006). A multi-center study in three West African countries hospital wards reported 45.7% HCWs had sustained at least one accidental blood exposure and in 80.1% of these, it was a NSI, in 15.3%, it was a splash or contact with non-intact skin, and was a cut in 3.4% of the HCWs. These exposures were not notified or reported in 69.1% of the cases (Tarantola *et al.*, 2005). Other studies have documented low reporting rates elsewhere (Ngesa, 2006, Gumodoka *et al.*, 1997, Du Toit *et al.*, 2007).

A study of the epidemiology of needle stick injuries in house officers in Kinshasa, Zaire, found that 41% reported a needle stick accident during the previous year (McGeer *et al.*, 1990). In Malawi the HIV prevalence in the community is high, and is considerably higher still among hospital inpatients, as many are admitted due to HIV related diseases. In a small study, Oosterhout found that PEP was under-utilized, with only 19 of 29 HCWs (65.5%) initiating PEP (Van Oosterhout *et al.*, 2010). A retrospective audit was performed of all the files available in May 2003 to December 2008, and it was found that 203 occupational injuries were reported. The majority were NSI (76.3%), with most occurring in the obstetrics and gynecology departments. ^{Post} exposure prophylaxis was initiated in 83.6% of the cases (Maaten *et al.*, 2010). It is likely occupational injuries were under-reported.

^{In another} study in Mwanza region of Tanzania, of 434 HCWs, 15% had NSI, and 31% had

been splashed during the previous month to the survey in 1993. The Labour ward and casualty departments had the greatest risk of exposures. Gloves were worn during 53% of prick accidents (Gumodoka *et al.*, 1997). A study in Mulago National Referral and University teaching hospital in Kampala, Uganda, found that 57% of the respondents reported NSI in the last one year. Understaffing and lack of training on injection safety related to higher injury rates (Nsubuga *et al.*, 2005). A similar study in Mbarara Teaching hospital, found that 55% of respondents suffered NSI, and interns were the most affected group (Newsom & Kiwanuka, 2002). A study done to find the sero-prevalence and risk factors of HBV infection among 370 HCWs in a tertiary hospital in Uganda found that 60% were exposed to NSI, and 41% had exposure to mucous membranes. While the current HBV infection prevalence rate was 8.1%, the prevalence of a life time exposure to HBV was 48.1%. Whereas only 6.2% of the respondents were vaccinated against HBV infection, 48.9% were found to be susceptible to HBV infection (Ziraba *et al.*, 2003), who could have been protected by HBV immunization.

A study done during 2002-2006 in rural health facilities in Thika district of Kenya, among 650 HCWs, showed that only 4% of HCWs, who had needle stick injuries, utilized PEP services and the main reason for low uptake of PEP was fear of being tested, and a low perceived risk of HIV transmission (Taegtmeier *et al.*, 2008). Another study carried out in Kenyatta National Hospital (KNH) among Registered nurses to find the type and characteristics of occupational exposures to blood and OPIM found that; of the 158 nurses sampled 59.5% had inoculation injuries; of which 12.8% had sustained injuries twice and 34% more than twice (Ngesa, 2006). This corresponded favourably with figures reported from other studies elsewhere in the world. Further, a study done in the western part of Kenya at MTRH, reported that 91 HCWs were exposed and, of these 28% were nurses, 22% were medical and nursing students, and 20% were doctors. The most frequent type of exposures reported were NSI at 81% (Siika *et al.*, 2009).

Another study done in a rural mission hospital, Maua Methodist hospital in Meru, Kenya, in 2004, which had a low response rate of 44.1% with only 53 HCWs responding out of the 120 questionnaires distributed. Most of the respondents were and 71.7% of the respondents were nurses. The study found that out of 53 respondents who completed a self-administered questionnaire, 22.6% recalled a NSI in the preceding year, and only 33.3% of the injured

reported their injury. Thirty-two (65.3%) of 49 respondents had received at least 1 dose of HBV vaccine; only 12 (24.5%) of 49 respondents reported that they had received all 3 doses of vaccine (M'ikanatha *et al.*, 2007). This study is not generalizable to the rest of the Kenyan health facilities, given the low response rate, the convenience sampling method used, and the varied differences between mission hospital and the general public hospitals.

A cross-sectional study conducted to determine the prevalence and associated factors for percutaneous injuries and splash exposures among healthcare workers in Rift Valley provincial and War Memorial hospitals, in 2010 found that; of 348 health-care workers interviewed, 24% reported having been exposed to blood and body fluids in the preceding 12 months. Half of the sharps injuries were observed among nurses, 30% occurred during stitching and 22% in obstetric department. Forty eight percent (48%) of the exposure incidents were reported while only 24% of the exposed HCWs were started on PEP against HIV. Health workers aged below 40 years were more likely to experience sharps injuries (OR= 3.1; 95% CI=1.08-9.13), while previous training in infection prevention was protective (OR= 0.45; 95% CI=0.03-0.90) (Salas *et al.*, 2010).

A follow-up study carried out in a rural health facilities in Thika district of Kenya, among HCWs involved in direct patient care, laboratory staff and all staff involved in waste disposal, found that among the 554 interviewed, 30% reported one or more NSIs in the previous year. Eighty seven percent (87%) of participants had never been vaccinated for hepatitis B (Suckling *et al.*, 2006).

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Study Design

A descriptive cross-sectional, study was carried out in MTRH and AKUH where health workers in the study were interviewed using a closed-ended structured questionnaire.

3.2 Study Area

The study took place in two large teaching University hospitals in urban settings, Nairobi city, and Eldoret town in Western part of Kenya. Moi Teaching and Referral Hospital is a public tertiary care hospital, the second largest National referral hospital after Kenyatta National Hospital (KNH), and a teaching hospital for Moi University, College of Health Sciences, and for Kenya Medical Training College (KMTTC) that train nurses and clinical officers. It serves North Rift Valley, Nyanza and Western provinces, and parts of Eastern Uganda, and Southern Sudan. The tertiary hospital has a bed capacity of 459, with bed occupancy of 99.5 %.

The second study area was the Aga Khan University Hospital, Nairobi (AKUH, N), which has similar core business as MTRH, except it's a private teaching hospital. Aga Khan University Hospital, Nairobi has a well established Nurse Training School, as well as a Medical Internship and Post Graduate Specialist Training Centre. It has a bed capacity of approximately 150 and is one of the most comprehensive university hospitals offering comprehensive tertiary care in Nairobi, Kenya.

3.3 Study population

The study population included all HCWs aged 20-60 years, who were directly involved in patient **care**, and those who handled patient specimens and linen soiled with patients' blood or other body fluids in the two hospitals.



3.4 Inclusion and exclusion criteria

3.4.1 Inclusion criteria

1. Health workers who were aged 20-60 years;
2. Health workers who could speak and write English;
3. Health workers who gave informed consent,
4. Health workers who had worked for at least 1 month in the selected departments.

3.4.2 Exclusion criteria

1. Health workers who were on transfer out;
2. Health workers who were on permanent night duty;
3. Health workers who were on leave in the two hospitals at the time, and
4. Consultants and visiting HCWs in the two hospitals.

3.5 Sample size determination

The sample size was determined using the epidemiological formula for prevalence studies shown below (Wayne DW, 1999; pg183-184);

$$n = \frac{z^2 \times p(1-p)}{d^2}$$

Where z = critical value at 95% level of significance (= **1.96**)

p = estimated proportion of occupational exposures (= **30 %**) (Taegtmeier *et al*, 2008)

d = is the degree of precision, which is at $\pm 5 \%$

Substituting the formula,

$$n = 323$$

Adding 10 % to cater for non- response; n = 355

A total of 365 health workers were recruited for the survey as shown in Tables 3.1 and 3.2.

3.6 Selection of Study Subjects

Multi stage sampling method was applied in the selection of study participants as follows;

1. A purposive selection of the two hospitals from all other health facilities in the country was done.
2. Inclusion of perceived high risk departments from the two hospitals was done i.e. Maternity, Theater, Laboratory, Dental, Laundry, Radiology, Intensive Care Unit (ICU), Accident and Emergency department, and Surgical, Medical, and Pediatric Wards.
3. Health workers stratified by cadre of staff were selected by probability proportional to size (PPS) in each hospital i.e. doctors, nurses, laboratory technicians, medical and nurse students, and support staff.
4. Finally, systematic sampling of the individual staff, after listing all the staff in the department, by cadre. •

A sampling frame of each department selected was prepared by listing all the staff according to their cadre, and assigning them numbers. Subjects were selected from the strata by PPS (Figure 3.1).

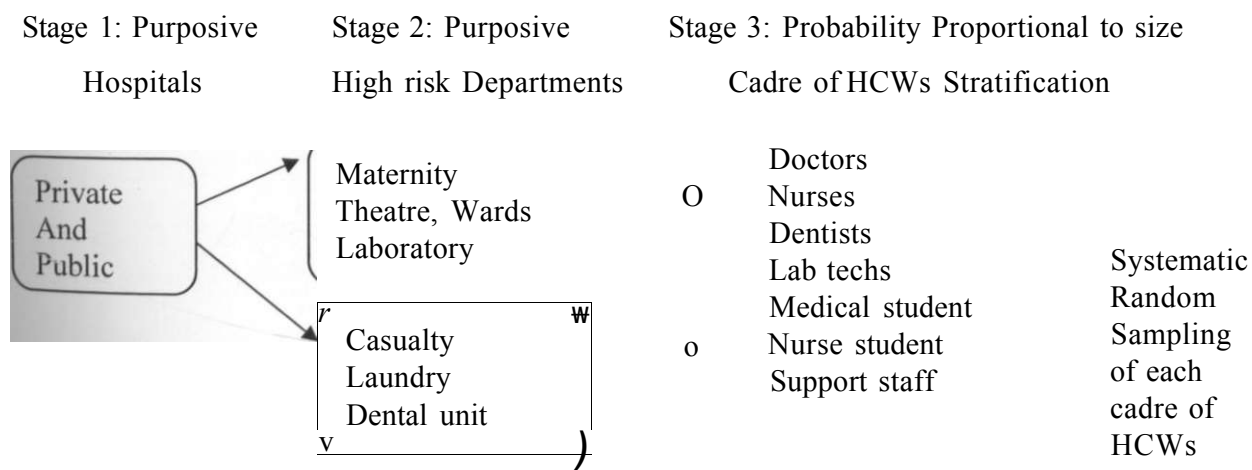


Figure 3.1 Sampling procedure flowchart

Table 3.1 Sampling frame according to staff category in the two hospitals

Cadre of staff	Private Sample size (N)	Public Sample size (N)	Total
Doctors	17 (70)	30 (139)	37 (209)
Nurses	73(520)	114(838)	187 (1358)
Dentists	4(12)	3(32)	07 (44)
Lab. Technicians	12 (89)	23 (141)	35 (230)
House keeping	11(50)	37 (50)	48 (100)
Laundry	4(20)	7 (50)	11 (70)
Radiology	2 (25)	13 (28)	15 (53)
Clinical officer	1	10(35)	10(35)
Other	2	2	03
Total	126	239	365

NB: The population of each staff category prior to sampling is in parenthesis.

There were no study participants sampled from HDU and paediatric ICU in the public hospital because these two departments did not exist in MRTH.

Table 3.2 A sampling frame based on hospital department/ward

Ward/Unit		AKUH	MTRH	Total
Maternity		15	30	45
Theatre		17	10	27
Laboratory		16	29	45
Surgical Ward		15	45	60
Paediatric Ward		4	4	08
Medical Ward		11	43	54
A&E	Adult	14	40	54
	Paeds	6		06
Dental Unit		4	4	08
Radiology Unit		4	11	15
H/Keeping		4	6	10
Laundry		4	7	11
HDU/ICU		12	10	22
Total		126	239	365

Moi Teaching and Referral Hospital had a total number of 838 nurses, 139 doctors, 32 dentists, 28 radiology staff, 214 support staff in the clinical areas, 141 laboratory staff and 50 house keeping staff working in laundry area. The departments sampled were accident and emergency, obstetrics and gynaecology, surgery and orthopedics, medical and paediatrics departments, radiology department, dental, intensive care unit (ICU) and high dependency unit (HDU), theatre, and laundry and housekeeping departments. Medical and nurses students rotating in the respective clinical departments during the survey were also sampled.

Khan University Teaching Hospital had 520 nurses, 85 registrars, 8 interns, 70 resident doctors, 10 dental staff, 25 radiology staff, 89 laboratory, 50 housekeeping and 20 laundry staff.

The health care workers in the clinical departments perceived to be high risk, and those support staff in the laundry department were proportionately sampled for recruitment in the study.

3.7 Variables

Outcome variables

1. Occupational exposures to blood and body fluids;
2. HBV Immunisation status, and
3. PEP utilisation.

Explanatory variables

1. Type of health facility, i.e. private or public teaching hospital;
2. Socio-demographic characteristics, namely sex, age, level of education and marital status;
3. Occupational characteristics, namely, the job category of health worker, duration in employment, department deployed in;
4. Work practices and activity during exposure, and
5. Use of personal protective equipment.

3.8 Data Collection

The data collection tool was a modified EPINET (Exposure prevention information network) structured questionnaire. A total of nine research assistants were recruited, and trained on how to obtain an informed consent and interview the participants using the research tools. Four research assistants were identified for AKUH, N and five assistants for MTRH, Eldoret. A pilot study to assess the accuracy of the questionnaires was carried out in Kenyatta National Hospital (KNH), where 39 health workers were randomly sampled from purposively selected high risk departments. The findings helped to further refine the questionnaire and the results from the analysis were used to check if the research questions were answered.

Data were collected using interviewer-administered structured questionnaires eliciting data regarding socio-demographic and occupational characteristics, including the frequency of exposures in the year preceding the study. Data collection was conducted in English language by trained research assistants, through face-to-face interviews. The questionnaire captured socio-demographic data, and occupational characteristics like, number of years in employment,

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department of deployment, type of exposure, date and time of exposure, activity during exposure, and the HBV vaccination status. This tool also checked if the exposure was reported to the appropriate department, risk assessment and use of PEP by the respondents. Moreover, the use of personal protective measures by the HCW, and attendance of trainings on HIV prevention, injection safety or universal precautions, and PEP for HBV and HIV were also inquired into.

3.9 Data Processing and Analysis

The data collected from the study were double-entered into Epi-Info version 3.5.1 and transferred to Excel and Statistical Products and Services Solutions (SPSS) version 17.0 for analysis. The primary unit of analysis was the hospitals for all major variables, but differences between departments within the same hospital was also explored (for instance, which departments had the highest rates of occupational exposure). Proportions (and 95% confidence intervals) were reported for key outcomes including the number of staff of different cadres having percutaneous or mucocutaneous exposures, the vaccination status for HBV amongst HCWs in the 2 hospitals, and the proportion of exposed staff who utilized PEP. Proportion of staff that used personal protective equipment such as gloves and gowns were analysed, as were the activities during exposure (for instance, whether the staff were fixing IV lines or recapping of needles during disposal). Outcomes were reported, first across all hospitals, then per hospital, and finally, per department and staff cadre. Patterns of association between reported outcomes and specific staff characteristics (for instance level of education and duration of employment) were analysed using chi-squared tests of association. Frequencies, cross-tabulations and contingency tables were produced for categorical variables, and these compared using Chi-square test of statistics, to assess level of significance. Statistical significance was set at $p < 0.05$. descriptive statistics and proportions of outcome variables were calculated and compared between the departments, across cadres of staff, and between private and public hospitals.

Multivariate analysis, (logistic regression) were used to determine how the outcome variable Occupational exposures to blood) was related to the independent or explanatory variables like demographic and occupational characteristics, hospital ownership (public or private), injection safety trainings, duration in employment, and availability of disposal containers among

others that were grouped as predictor variables. Multiple regressions were performed on SPSS version 17.0 to measure the effects of the explanatory (exposure) variables such as socio-demographic and occupational characteristics on the outcome variable of occupational exposure amongst the HCWs interviewed and the resultant odds ratio (OR) used to assess for the magnitude of risk.

3.10 Minimization of Biases and Errors

Purposive selection of the hospitals and departments may have generated some bias, but systematic random sampling of subjects helped minimize selection biases. Although it was **anticipated** that majority of bias could have been eliminated by the selection process, it is inevitable that some bias could have occurred. Bias due to confounding was taken care of at the data analysis stage, by multivariate analysis. Recall bias could have manifested since subjects were expected to use their objective memory to recall exposures. Training of the research assistants prior to data collection was for standardization among them. Editing of the questionnaires for completeness of data entry was done to minimise errors of omission.

Since this was a descriptive study at the hospital level, it was presumed that information on all potential factors that could explain differences in practices between the relatively well-resourced private hospital and the relatively poor-resourced public hospital was collected. Confounding was controlled for during data analysis.

3.11 Ethical Consideration

Participants signed an informed consent form to signify their willingness to participate after going through the informed consent information document. Participants were selected through a fair and equitable selection process based on chance in all the hospital departments purposively elected for the research. Participants had the right to ask questions, and to withdraw from the study without penalty or loss of benefits, if they chose to, and were not coerced, forced or bribed

¹⁰ Participate.

Individual human rights, privacy and dignity of the participants were upheld and respected, and their confidentiality was protected by using codes and serialized the questionnaires. No identifying information was disclosed in reports after the analysis or in any publications. In addition, data presentation avoided specific individual identity as sources of information by presenting the perspectives of groups of respondents within or across hospital study sites. Anonymity was protected by assigning codes to study sites as well as to respondents.

The study ensured that participants were protected from all possible harm while participating in the research. Ethical clearance was sought from the Kenyatta National Hospital and University of Nairobi Ethics and Research Committee (KNH/UoN-ERC), Moi Teaching and Referral Hospital and the Moi University Faculty of Health Sciences (FHS) MTRH/FHS Joint Institutional Review Ethics Committee (IREC), and the Aga Khan University Ethics Review Committee (AKU ERC) ethical committees, prior to the recruitment of participants. Permission to carry out the study in the respective institutions was sought from the directors of the two hospitals.

3.12 Limitations of the study

The study limitations include reliance on self-reported data which may not be very accurate; In particular, social desirability bias may have been present in the form of the underreporting of occupational exposures in the survey. Recall bias could also have been introduced given that a recall period of up to one year was used.

The cross sectional nature of the study could not allow any conclusion in terms of a specific causal direction for the outcome events or to note any variations over time periods.

The purposive sampling used at the level of selection of type of facility to be included may introduce some selection bias because Aga Khan Hospital may not be representative of all Private hospitals.

The small sample size of some of the job categories e.g. dentists might have resulted in large ^{Uncer}tainty intervals of their estimated association with an exposure incident.

This study did not evaluate existing interventions on safety issues for health workers, and future studies could be planned to investigate this.

CHAPTER 4 RESULTS

4.1 Socio-demographic characteristics of the study participants.

All the participants recruited in the study consented to participate, giving rise to a response rate of 100%. Although the desired sample size was calculated as 355, the study recruited 365 **participants**. A total of 365 healthcare workers were interviewed across two Kenyan hospitals.

Out of a total of 365 health workers interviewed, 126 were from AKUH, Nairobi and 239 from MTRH, Eldoret. The ratio of private to public facility study participants was 1:1.9.

Of the total participants, 203 were females and 162 were male, giving a male to female ratio of 1:1.25. Aga Khan Hospital, Nairobi had 75 (59.5%) female study participants and 51(40.5%) male health workers sampled, while Moi Teaching and Referral hospital had 128 (53.6%) female and 111 (46.4%) male study participants sampled.

The age group with the highest number of respondents in the study was 25-34 with up to 54% of all the participants falling in this age group.

The average number of years worked was 5.26, with a range of 1-30 years and a standard deviation of 4.83.

Three hundred and twenty nine of the study participants had attained tertiary education, 35 had secondary and only one had primary education. Sixty one percent (61%) of the study participants were married, while 36.7% were single (Table 4.1).

Table 4.1 Socio-demographic characteristics of study participants by type of Hospital (n=365)

Characteristic	Private (n=126)	Public (n=239)	Total	p-value
Age group	No. (%)	No. (%)	No. (%)	
18-24	13(10.3)	53 (22.1)	66(18.1)	0.044
25-34	75 (59.5)	123 (51.5)	198 (54.2)	
35-44	29 (23.0)	51 (21.3)	80 (21.9)	
45-54	8 (6.2)	11 (4.6)	19(5.2)	
Sex				
Female	75 (20.5)	128 (35.1)	203 (55.6)	0.203
Male	51 (14.0)	111 (30.4)	162 (44.4)	
Marital status				
Single	48(13.1)	86 (23.6)	134 (36.7)	0.359
Married	75 (20.5)	148 (40.6)	223 (61.1)	
Widowed	0	1 (0.3)	1 (0.3)	
Divorced	3 (0.8)		3 (0.8)	
Other	0	4(1.1)	4(1.1)	
Education				
Primary	1 (0.27)	0	1 (0.27)	0.075
Secondary	11 (3.0)	24 (6.6)	35 (9.6)	
Tertiary	114(31.2)	215(58.9)	329 (90.1)	
Job category				
Nurse	73 (20.0)	114(31.2)	187 (51.2)	0.049
Doctor	17(4.7)	30 (8.2)	47(12.9)	
laboratory	12(3.3)	23 (6.3)	35 (9.6)	
Dentist	4 (1.1)	3 (0.8)	7 (1.9)	
Housekeeper	11 (3.0)	37(10.1)	48(13.1)	
Laundry	4(1.1)	7(1.9)	11 (3.0)	
Radiology	2 (0.5)	13(3.6)	15(4.1)	
Other	2 (0.5)	1 (0.3)	3 (0.8)	

4.2 Prevalence of Occupational Exposures

The occurrence of occupational exposures in both hospitals was looked at in two aspects with regard to the type of exposure, (i.e. percutaneous or exposure by sharps injury, and mucocutaneous or exposure by mucous membrane splashes). Out of the 365 respondents interviewed, 131(36%) reported to have had percutaneous exposures; while a total of 126 (35%) **reported** mucous membrane exposures across both hospitals. Sixty three (17%) of all the study participants reporting exposure had sustained both percutaneous and mucous membrane exposures in the previous year.

Fifty six percent of participants who reported percutaneous exposures were females while 44% were males. Doctors were the most affected (45%), followed by nurses (43%) and housekeeping staff (33%). Theatre (59%) and general ward (51%) had the highest reported exposure incidents in both hospitals, followed by surgical ward (43%), labour ward (42%) and casualty (38%) departments. Radiology and HDU Units had no reported exposures. The HCWs who had received injection safety and HIV prevention training were 251 compared to 114 who had not. Out of those who reported exposure, 72% had received injection safety training. The use of Personal Protective Equipment (PPE) was very low in both hospitals ranging from 8% who used double pair of gloves, 13% used face/surgical mask and 15% used single pair of gloves at the time of the mucous membrane exposure.

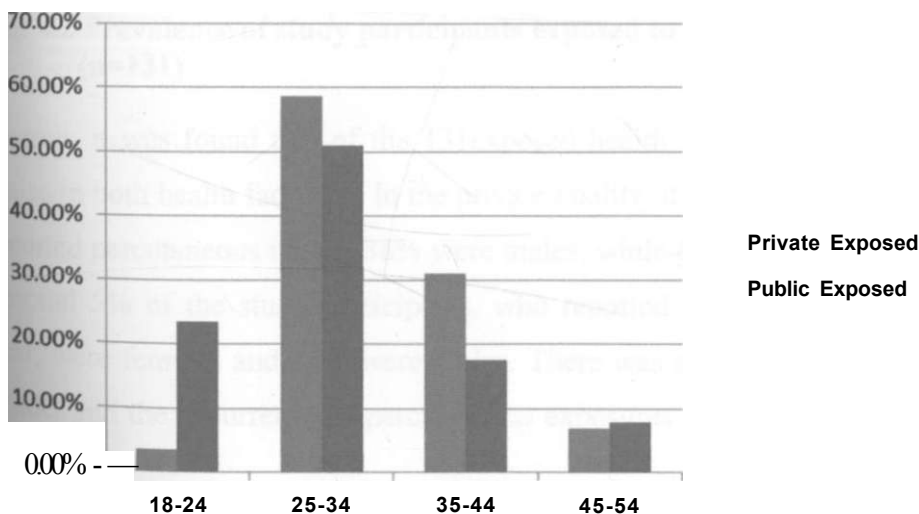
4.2.1 Prevalence of Percutaneous Exposures

Out of 126 participants sampled in the private hospital, 29 (23%) were found to have experienced at least 1 sharp exposure, of whom 13% had one exposure only, 6% had two exposures, 3% had three exposures, and 0.8% had more than five exposures. Forty five percent (45%) of the respondents exposed had repeated exposures in the preceding year (Table 4.2).

Table 4.2 Prevalence of sharps exposures among participants according to both hospitals (n=365)

Percutaneous exposures	Private		Public		Total
	Number	Percentage	Number	Percentage	
None	96	76.2	127	53.1	223
One	16	12.7	56	23.4	72
Two	08	6.4	28	11.7	36
Three	04	3.2	09	3.8	13
Four	0	-	01	0.4	01
Five	0	-	03	1.3	03
More than 5	01	0.8	05	2.1	06
Total	126	100	239	100	365

Overall the age group most affected was 25-34, with 52.7% of the participants having been exposed, followed by 35-44 with 20.6%, 18-24 with 19.1% and 45-54 with 7.6% exposures simultaneously. In the private hospital, the age group 25-34 had 58.6% HCWs exposed, 35-44 had 31.0% exposed, 45-54 age group had 6.9% exposed, and 18-24 age group had only 3.5% HCWs exposed. There was no statistically significant difference in the proportion of participants exposed in the different age groups in the private facility ($\chi^2= 15.3153$, $p =0.2246$). In the public facility, the age group with the highest percutaneous exposures was 25-34 with 51%, followed by 18-24 with 23.5%, 35-44 with 17.6% and 45-54 with 7.8%, respectively (Figure 4.1). There was a statistically significant relationship between age and the proportion of respondents exposed in the public hospital ($\chi^2=51.8190$, $p < 0.0000$) (Figure 4.1).



4.1 Number of participants exposed by age group and type of facility (n=131)

The public facility had a prevalence of 43% exposed out of the 239 health workers sampled (Figure 4.2). Of these, 23% had one exposure, 12% had two exposures, 4% had three exposures, 1.25% had five exposures and 2% had more than five exposures. Fifty percent of all the respondents who were exposed had repeated exposures in the one year preceding the survey (Figure 4.5). There was a statistical significant difference between the type of facility and percutaneous exposure, ($p = 0.0211$).

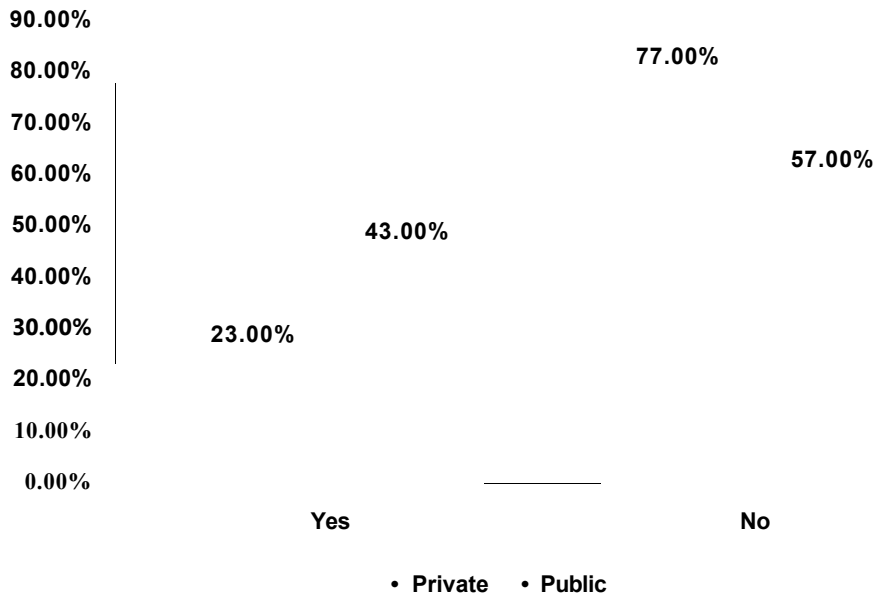


Fig. 4.2 Prevalence of study participants exposed to sharps injuries in the two hospitals (n=131)

Overall, it was found that of the 131 exposed health workers, 74 were females while 57 were males in both health facilities. In the private facility, it was found that of all the participants who reported percutaneous injury, 38% were males, while 62% were females. Whereas, in the public hospital 5% of the study participants, who reported percutaneous exposures in the preceding year, were females and 45% were males. There was a statistical significant difference between Gender and the occurrence of percutaneous exposures in both facilities ($\chi^2 = 13.1134$, $p = 0.0413$) (figure 4.3).

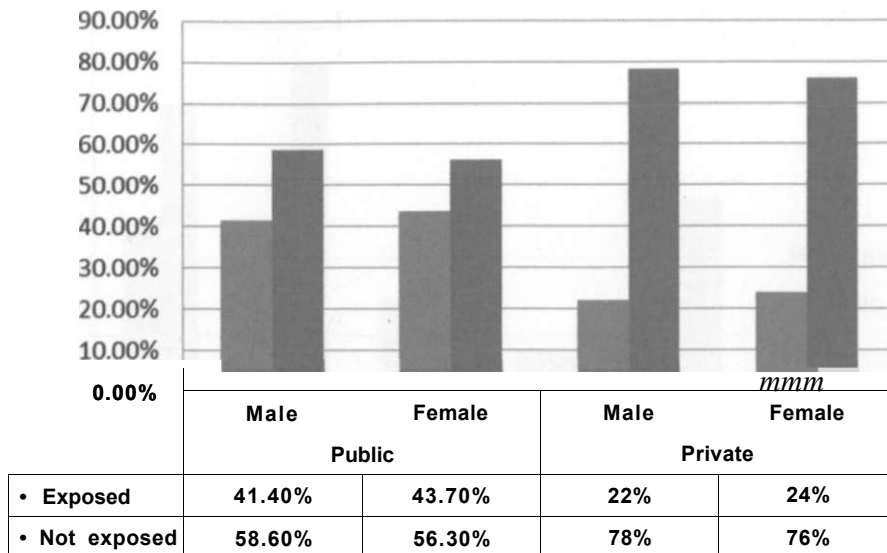


Fig. 4.3 Gender distribution of exposure status in both hospitals (n=131)

Analysis of the exposed participants and the staff category revealed that overall, doctors were the most affected with 45% reporting percutaneous exposures, while only 43% of the nurses sustained NSI, followed by 40% of clinical officers, and 33% of housekeeping staff. There was no statistical significant association between job category and the occurrence of NSI in both hospitals ($p=0.885$). Percutaneous exposure amongst different cadre of staff stratified by type of facility showed that doctors were the most exposed (35.3%) in the private facility, followed by the dentists (25%), nurses (24.7%), the laboratory and housekeeping staff with each having 18.2%. Whereas in the public facility analysis showed that nurses were the most affected with 55.3%, followed by the doctors with 50%, house keepers with 37.8% and laboratory with 17.4% (Figure 4.4).

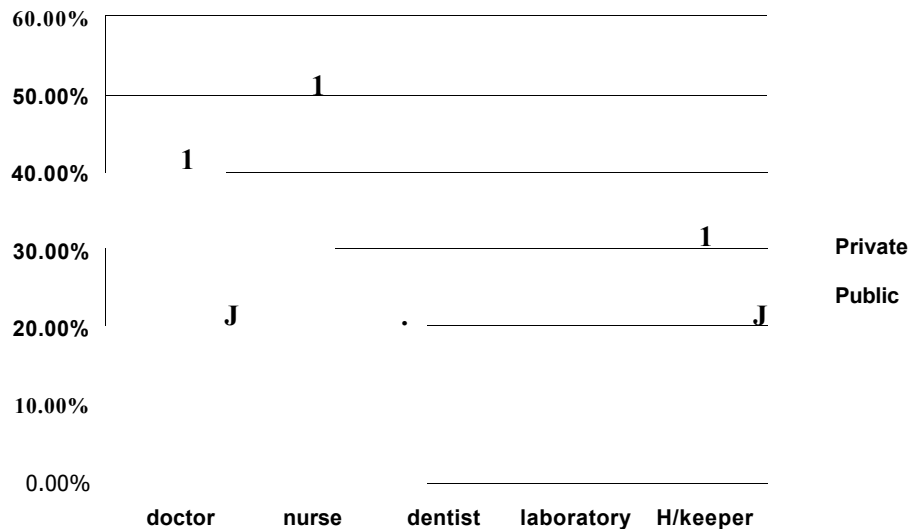


Fig. 4.4 Proportion of participants exposed according to job category and hospital (n= 131)

Percutaneous exposures occurred more commonly in theatre (53%), surgical ward (40%) and ICU (33%) in the private facility than in the medical (18%), laboratory (20%) and casualty (6%) departments. No exposures were reported by study participants sampled from radiology, HDU, and house keeping departments. In the public facility, theatre was most affected (70%), followed by the general ward (60%), labour ward (57%), casualty (50%), ICU (46%) and surgical ward (44%). Radiology, paediatric and house keeping departments had no participants reporting exposures in the public facility. The differences in occupational exposure among the participants from the different departments in the public facility were statistically significant ($p = 0.0148$). There was no statistically significant relationship between the departments of theatre, laboratory, ICU and paediatric wards and the occurrence of the outcome variable. The departments found to have a significant relationship between the two hospitals and the occurrence of occupational exposures were surgical ward, casualty, maternity and general wards (Table 4.3).

Table 4.3 Exposure status of participants according to department in each hospital (n=365)

Department	Private		Public		X ² Test statistic	P value
	Exposed	Not exposed	Exposed	Not exposed		
Theatre	9(53)	8(47)	7(70)	3(30)	0.7589	>0.2
General Ward	2(18)	9(82)	26(60)	17(40)	6.2728	<0.025
"Surgical Ward	6(40)	9(60)	20(44)	25(56)	27.7149	<0.001
Maternity ward	2(13)	13(87)	17(57)	13(43)	7.6974	<0.0005
Laboratory	3(20)	12(80)	3(10)	26(90)	0.7826	>0.2
Casualty	1(6)	15(94)	22(50)	22(50)	9.5006	<0.005
ICU	3(33)	6(67)	6(46)	7(54)	0.3616	>0.2
IHDLP	0(0)	4(100)				
ICU Paeds	1(17)	5(83)				
Dental	1(25)	3(75)	1(25)	3(75)	0	
Paediatric	1(25)	3(75)	0(0)	4(100)	1.1429	>0.2
H/Keeping	0(0)	4(100)	0(0)	6(100)	0	
Radiology	0(0)	4(100)	0(0)	11(100)	0	
Total	29	95	112	127		

Note: In parenthesis are percentages,

In the private facility, only 6.9% of the participants exposed had secondary education, while 93.1% had tertiary education. In the public facility 90.2% participants exposed had tertiary education while only 9.8% had secondary education. No staff with primary education had an exposure in both facilities (Figure 4.5).

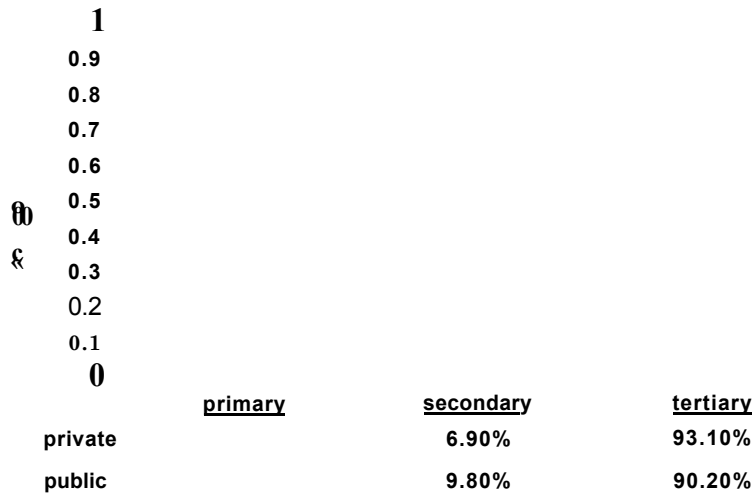


Figure 4.5 Distribution of participants according to level of education and type of hospital (n=131)

4.2.2 Prevalence of mucocutaneous exposures

Participants were asked about any mucous membrane splashes of blood or other potentially infectious body fluids in the previous one year. A total of 126 health workers across both hospitals reported they had sustained mucous membrane splashes in the previous year. In the private facility, a total of 27 (21.6%) study participants reported exposure, out of the 125 participants interviewed. Thirteen participants reported only one exposure while 14 (52%) reported repeated exposures (Figure 4.6).

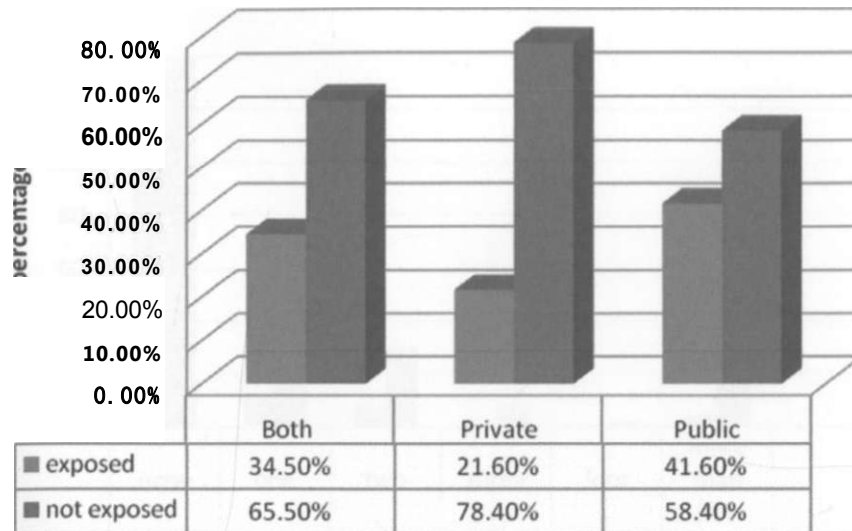


Fig.4.6 Prevalence of Exposure via mucous membrane by type of facility (n=365)

The public facility had 99 (41.4%) health workers who reported mucous membrane exposures, and of these 43% reported only one exposure, 23% reported two exposures, 8% reported three, 2% reported four and 16% reported more than five exposures the previous year. Fifty seven percent (57%) participants reported having sustained multiple exposures. The private hospital had 27 (21.6%) of study participants reporting exposure via mucous membrane splashes. Thirteen (48%) participants reported only one exposure while 14 (52%) reported multiple exposures. There was a statistical significant association between type of facility and frequency of mucous membrane exposures among the health workers ($\chi^2 = 15.1729$, $p = 0.0096$) (Figure 4.7).

160
140
120
100
80
60
40
20
0

	none	one	two	three	four	more than five
• private	98	13	8	1	1	4
• public	139	43	30	8	2	16

Fig.4.7 Frequency of mucous membrane exposures per HCW in each facility (n=126)

The mucous membrane exposures stratified by level of education for each type of facility analysis showed that 96.3% of the participants exposed had tertiary education in the private facility, while only 3.7% had secondary education. In the public facility, 93.9% had tertiary education while only 6.1% had secondary education (Figure 4.8).

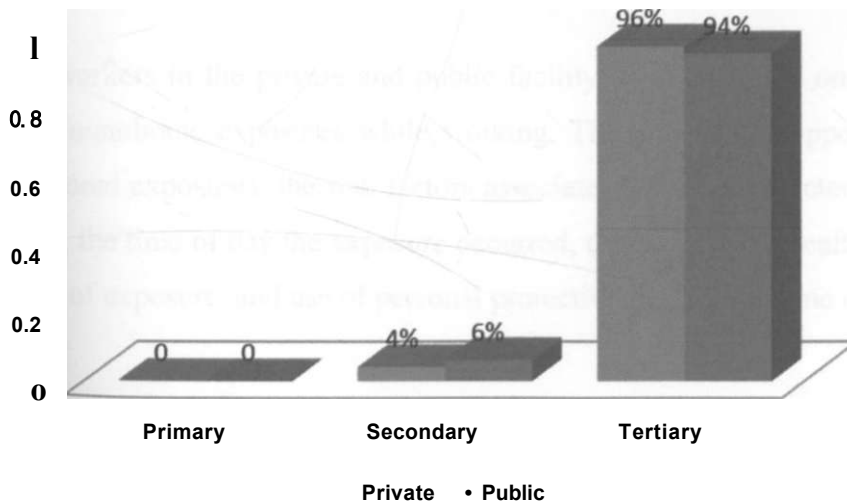


Figure 4.8 Participants with mucocutaneous exposure by level of education (n= 126)

Distribution by gender in the private facility showed a higher proportion of females exposed, where 16 (59.3%) females were exposed, as compared to 11(40.7%) male HCWs interviewed. In the public hospital gender distribution showed that 55(43.3%) females were exposed, as compared to 44 (39.6%) males (Figure 4.9).

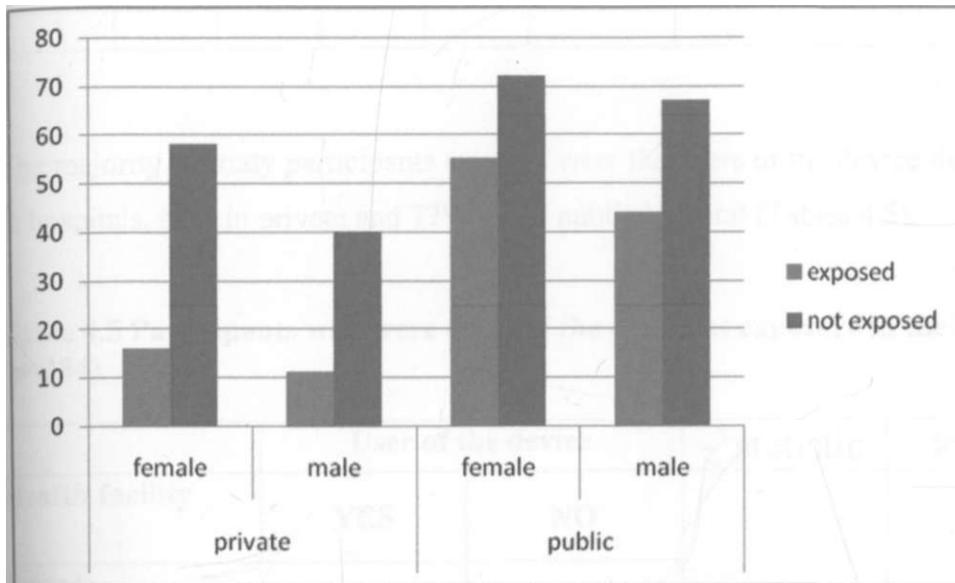


Fig.4.9 Distribution of participants according to type of exposure status, gender and type of facility (n=126)

4.3 Characteristics of health workers who sustained occupational exposures

Health workers in the private and public facility reported either one or both percutaneous and mucous membrane exposures while working. The study was supposed to identify the type of occupational exposures, the risk factors associated and the characteristics of the exposures. For instance, the time of day the exposure occurred, the activity the health worker was engaged in at the time of exposure, and use of personal protective gear, at the time of exposure.

The more number of years one had worked in the public facility seemed to be protective against ΔSI , while the reverse was true in the private hospital. There was a statistically significant association between the number of years worked and the outcome of percutaneous occupational exposure, among health workers in the public facility ($p=0.0081$) (Table 4.4).

Table 4.4 Participants with sharps exposures and years of work experience (n=131)

Exposed HCWs and years of work experience							
Category	01-05	06-10	11-20	21-30	Total	Chi-square	p-value
Private	12	11	06	0	29	85.0861	0.1389
Public	77	17	07	01	102	132.4604	0.0081
Total	89	28	13	01	131		

majority of study participants exposed were the users of the device that caused the exposure in hospitals, 69% in private and 77% in the public hospital (Tables 4.5).

Table 4.5 Participants who were users of the device at exposure in the two hospitals (n=134)

Health facility	User of the device		x ² statistic	p-value
	YES	NO		
Private	20 (69)	9(31)	9.0	<0.01
Public	81 (77)	24 (23)		
Total	101(77)	33 (23)		

where values in parenthesis are percentages.

The device causing the injury was reported to be a hollow needle in 67.7% of health workers in the private facility, and 61.7% in the public hospital, while solid sharps attributed to 25.8% of exposures in the private, and 20.3% in the public facility. Broken glasses caused 18% of the exposures in the public hospital staff, compared to 6.5% in the private hospital (Table 4.6).

Table 4.6 Causes of exposures according to type of hospital (n=131)

	Private	Public	TOTAL
a) Hollow needle			
Hollow needle on disposable syringe	14	54	68
Needle on IV line	3	12	15
Spinal or epidural needle	1	3	4
Unattached Hypodermic needle	1	5	6
Vacuum tube blood collection holder/needle	2	4	6
Winged needle (butterfly)	0	1	1
TOTAL	21 (67.7%)	79 (61.7%)	100
b) Solid sharp			
Lancet	0	3	3
Scalpel	2	7	9
Suture needle	6	16	22
TOTAL	8 (25.8%)	26 (20.3%)	34
c) Glass			
Glass slide	1	1	2
Medication ampoules	1	22	23
TOTAL	2 (6.5%)	23 (18%)	25

The device that caused the injury was reported to be a "safety design" with a shielded, recessed, retractable, or blunted needle or blade by half of the participants in the public facility; and by only 10% of the participants in the private (Table 4.7).

Table 4.7 Knowledge if the injuring device was safety design (n=135)

Safety design of device causing injury	Private hospital	Public hospital
Yes	03 (10)	53 (50)
No	26 (86.7)	30 (29)
Unknown	01 (3.3)	22 (21)

In parenthesis are percentages.

Most injuries occasioning the exposure occurred during IM/SC or IV injection administration in hospitals, with the private having 37%, and the public facility with 25%. Suturing was associated with 23% of the exposures in the private hospital, followed by drawing venous blood and cannulating /starting an IV infusion with 6.7%. The public facility had more injuries associated with cannulating /starting an IV infusion 16%, obtaining a body fluid, tissue or biopsy

16%, suturing 11.4% and unknown or not applicable with 10.5%. There was found to be a statistically significant difference between the type of procedure the HCW was performing at the time of injury and the occurrence of sharps exposure ($p < 0.000$) (Table 4.8).

Table 4.8 Distribution of injured participants in relation to the performed procedure (n=135)

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What procedure was the device used for?	Private	Public
Unknown/Not applicable	2	11
Breaking ampoule to access medication	0	6
Cannulating/starting an intravenous infusion	2	17
Drawing venous blood	3	4
Flushing an IV line or port with a syringe	1	5
IM/SC injection or IV injection	11	26
Injecting or aspirating with a syringe but not IM,SC, or IV	2	4
Obtaining a body fluid tissue sample or biopsy	1	17
Performing a finger stick or heel stick	0	3
skin blade cutting incision	1	0
Suturing	7	12

About 29.5% of occupational injuries occurred before using/preparing to use the device, 24% during use of the device, 13.3% while restraining patient and 9.5% occurred after use but before disposal. In about 9.5% of the exposures, the device was left on the floor, table, bed or inappropriate place in the public facility (Table 4.9). In the private facility, 33.3% exposures occurred during use of the device, followed by before using/preparing to use (20%), and after use before disposal (20%), and while putting item into disposal container (13.3%). There was a statistically significant association between the time point during the procedure when the injury occurred and outcome of NSI exposure ($p = 0.000$) (Table 4.9).

Table 4.9 Number and percentage of injuries that occurred during different types of Procedures (n=135)

When did the injury occur?	Public		Private	
	Number	Percent	Number	Percentage
After disposal item sticking out opening of disposal box	3	2.9	1	3.3
Before using/Preparing to use the	31	29.5	6	20
Between steps of a multi step procedure	2	1.9	0	0
Breaking of medication ampoule	1	1.0	0	0
Device left on floor table bed or inappropriate place	10	9.5	3	10.0
During use of the device	25	23.8	10	33.3
From item left on or near disposal container	2	1.9	0	0
Item pierced side of disposal container	3	2.9	0	0
Other after use before disposal	10	9.5	6	20
While breaking medication ampoule	1	1.0	0	0
While putting item into disposal container	2	1.9	4	13.3
While recapping used needle	1	1.0	0	0
While restraining patient	14	13.3	0	0
Total	105	100.0	30	100.0

Most of the occupational exposures occurred while a disposal container was available and within arms reach in 57% of cases, out of reach but in the same room in 29% of the HCWs exposed, and in a different room in 11% of the cases in both types of hospitals (Table 4.10).

Table 4.10 Participants exposed by location of sharps disposal container (n=135)

Availability of disposal container at the time of exposure:	Public		Private	
	Number	Percent	Number	Percent
In a different room	9	8.6	4	13.3
Not applicable	6	5.7	0	0
Out of reach but in the same room	33	31.4	8	26.7
Within arms reach	57	54.3	18	60.0
Total	105	100.0	30	100.0

Two thirds of the participants in the public hospital reported that the available disposal container was a plastic container, while a third said that it was a proper sharps disposal container. In the private hospital, 90% reported that they had proper sharps disposal containers available at the time of exposure (Table 4.11).

Table 4.11 Percutaneous exposure and type of disposal container available (n=130)

The availability of and type of disposal container:	Public		Private	
	Number	Percent	Number	Percent
A cardboard container	1	1.0	1	3.3
A plastic container	68	68.0	1	3.3
A reused box or container	0	0.0	1	3.3
Sharps disposal container	31	31.0	27	90
Total	100	100.0	30	100.0

NB: Missing values omitted in the public hospital.

4.4 Results of Multivariate Analysis

Logistic regression analysis was done for various predictor variables to determine if there were any statistical significant relationships between them and the occurrence of the outcome variable, and the results are presented in Table 4.12. The predictor variables included socio-demographic characteristics, type of hospital, department, job category, and number of years worked in employment. The outcome variable was occupational exposures, percutaneous or mucocutaneous among study participants. The variables found to have a statistical significant association with occupational exposure were type of health facility, procedure being performed when the exposure occurred, and whether the study participant was the user of the device causing injury as shown in Table 4.12.

Table 4.12 Results of multivariate Analysis

Variable	p	Wald's statistic	d.f	p-value	Odds Ratio
Age-group(45-54)		1.084	3	0.781	.
18-24	1.142	0.176	1	0.675	0.319
25-34	-0.177	0.005	1	0.946	0.838
35-44	-0.895	0.112	1	0.737	0.408
Sex	-0.055	0.063	1	0.802	0.946
Job category	0.007	0.021	1	0.885	1.007
Department	-0.018	0.427	1	0.513	0.982
No. of Years worked	-0.14	0.305	1	0.581	0.986
Facility (Public)	-0.295	5.089	1	0.024	0.745 •
Private	-0.912	13.450	1	0.000	0.402
Education level		0.49	2	0.976	.
Primary	-20.635	0.000		1.000	0.000
Secondary	-0.083 •	0.049		0.825	0.921
Tertiary	-0.568	24.504		0.000	0.567
Marital status		2.222		0.65	
Married	-42.406	0.000	1	0.999	0.000
Single	-21.669	0.000	1	1.000	0.000
Widowed	-21.203	0.000	1	1.000	0.000
Divorced	-21.987	0.000	1	1.000	0.000
Other	21.204	0.000	1	1.000	1.616E9
No Safety training	-0.247	1.059	1	0.303	0.781
Safety training	-0.513	15.471	1	0.000	0.599
No. of hours worked	-0.008	0.203	1	0.653	0.992
Time of injury AM	0.125	0.015	1	0.903	1.133
Evening	18.495	0.000	1	0.999	1.077E8
Late AM	18.495	0.000	1	0.998	1.077E8
Night	18.495	0.000	1	0.998	1.077E8
PM	2.708	13.750	1	0.000	15.000
Activity performed	1.041	86.878	1	0.000	2.833
When NSI occurred	1.356	58.844	1	0.000	3.880
Disposal container ^variability	2.246	75.769	1	0.000	9.453
User of NSI device		97.703		0.000	58.749
Yes	2.762	43.056	1	0.000	15.833
No	18.441	6996.698	1	0.998	1.020E8

4.5 Hepatitis B vaccination and HIV post exposure prophylaxis.

4.5.1 Hepatitis B vaccination status

The participants who were interviewed about their hepatitis B vaccination status were found to be 53.4% fully immunised, 18.9% partially and 27.7% had never been vaccinated in both hospitals. The private facility had 44.4% of the participants interviewed reporting that they were fully immunised, 35.7% were partially immunised, while 19.8% had never received any HBV vaccination. Out of those vaccinated, whether partially (86.7%) or fully (85.7%), over 85% of the health workers reported having received the vaccination free of charge in the private facility. The public facility had 58.2% of their HCWs fully immunised, 10% partially immunised and 31.8% had never received any HBV vaccination (Figure 4.10).

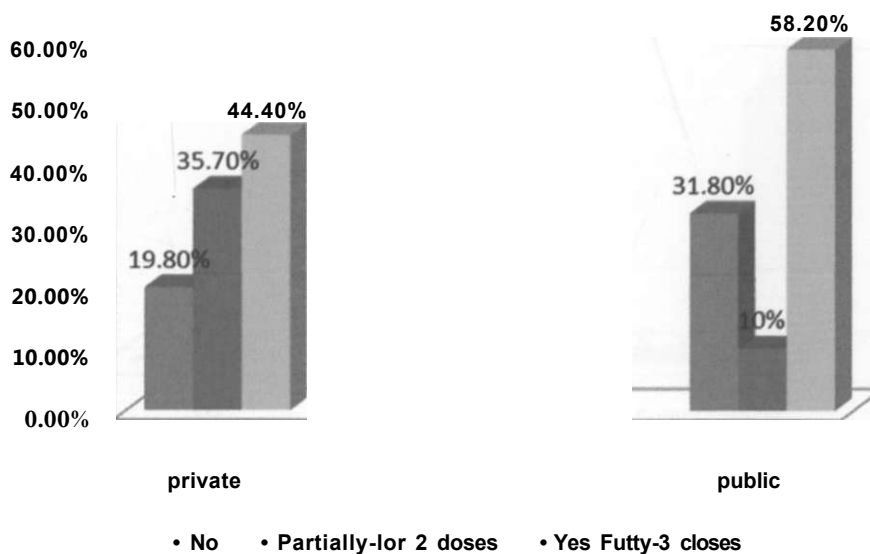


Fig. 4.10 Distribution of Participants according to vaccination status and type of facility (n=365)

Out of those participants who were fully immunized, 32.4% reported having received the vaccines free of charge and 66.9% said it was not free of charge. Of those who were partially vaccinated, 20.8% reported that it was free, while 79.2% said that it was not free. Seventy six⁽⁷⁶⁾ out of 239 of the staff sampled had never been vaccinated against HBV in the public hospital making one to wonder whether the cost was a prohibitive factor (Table 4.13).

Table 4.13 Distribution of Participants as to whether they received HB vaccination free or not(n=365)

Did you receive the Hepatitis B vaccine free of charge?	Public		Private	
	Number	Percent	Number	Percent
No	134	56.1	17	13.5
Not vaccinated	54	22.6	20	15.9
Yes	51	21.3	89	70.6
Total	239	100.0	126	100.0

In the private facility, 93% of study participants fully immunized had tertiary education, while 7% had secondary education. Ninety two percent (92%) of those who had not been vaccinated had tertiary education and 8% had secondary. The level of education had no statistically significant association with the vaccination status of HCWs in the private facility, ($\chi^2 = 2.3828$, $P=0.6657$) (Figure 4.11a).

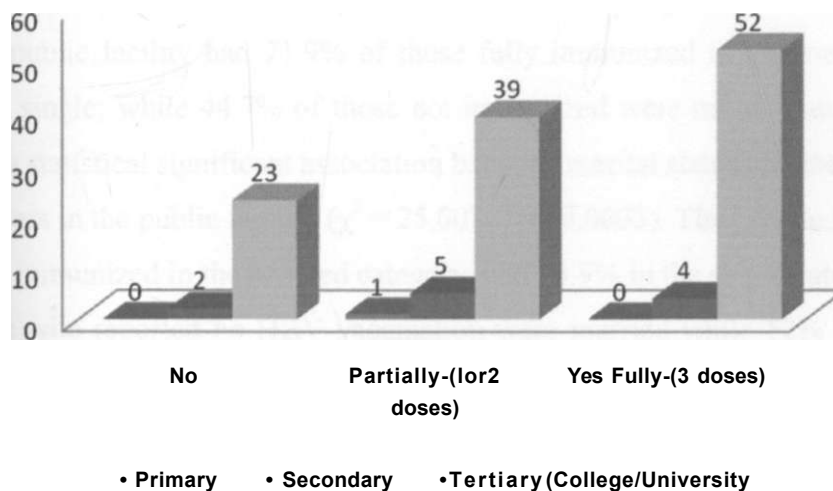


Figure 4.11a Vaccination status of participants in the private facility by level of education (n=126)

In the public facility, 91.4% of participants who were fully immunized had tertiary level of education, while 8.6% had secondary education. Of the health workers who had not been vaccinated against HBV, 88.2% had tertiary education, while 11.8% had secondary education. Public facility had no participants in the category of primary education. There was no statistical significant difference between level of education and the vaccination status of participants in the Public facility, ($\chi^2 =0.7386$, $P= 0.6912$) (Figure 4.1 lb).

No	Partially-(1or 2 doses)	Yes Fully-(3 doses)
	• Secondary	• Tertiary(College/University)

Figure 4.11b Vaccination statuses of participants in the public facility by level of education (n=239)

The public facility had 71.9% of those fully immunized in the married category while 26.6% were single; while 44.7% of those not immunized were married and 52.6% were single. There was a statistical significant association between marital status and the vaccination status of health workers in the public facility ($\chi^2 = 25.0078$, $p= 0.0003$). The private facility had 64.3% of HCWs fully immunized in the married category, and 33.9% in the single category. Forty eight percent of those who reported no HBV vaccination were married while 52% were single. There were no HCWs in the widowed and "other" categories in the private. There was no statistical significance between marital status and vaccination status in the private facility ($\chi^2 =3.8563$, $p=0.4258$).

4.5.2 Use of post exposure prophylaxis

The study participants were asked if HIV PEP was available to them and 84% said that it was available, 6% said it was not available and 10% did not know if it was available. Of those who sustained a percutaneous exposure in both hospitals only 31% reported appropriate use of HIV PEP overall. Reason for not utilizing PEP was predominantly cited as due to perceived low risk of infection in 63.4%. Other reasons were noted to be due to ARV drug side effects, fear of social stigma and did not know about PEP availability (Table 4.14).

Table 4.14 Reasons given by Participants as to why PEP was not used by type of facility (n=80)

Response	Public		Private	
	Number	Percent	Number	percent
Did not know about PEP	3	4.9	2	10.5
Drug side effects	1	1.6	6	31.6
Fear of social stigma	3	4.9	1	5.3
Other	4	6.6	0	0.0
PEP was out of reach	1	1.6	0	0.0
Perceived low risk	49	80.3	10	52.6
Total	61	100	19	100

Overall participant analysis showed that of all the participants who were exposed, only one third **utilized** ARV PEP appropriately. In the private facility out of those who had an occupational exposure, only 33.3% utilized PEP appropriately, 66.7% did not. Perceived low risk (52.6%), **drug** side effects (31.3%), and did not know about PEP (10 %) were the most common reason **cited** for not using PEP. In the public hospital 30.5% utilized PEP appropriately, while 69.5% **did** not (Figure 4.12).

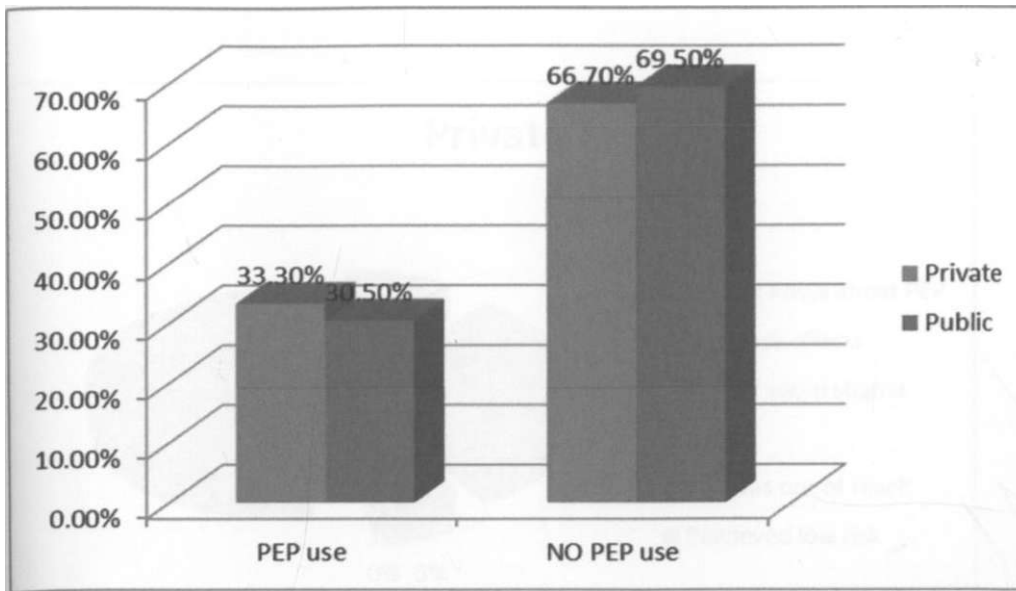


Fig.4.12 Percentage of participants who utilized PEP in both hospitals (n=135)

Perceived low risk was the most common reason (80.3%) why PEP was not utilised in the public facility, while other (6.6%), fear of social stigma (4.9%), and "did not know about PEP" (4.9%), PEP was out of reach (2%) accounted for the remainder (Figure 4.13a).

Public

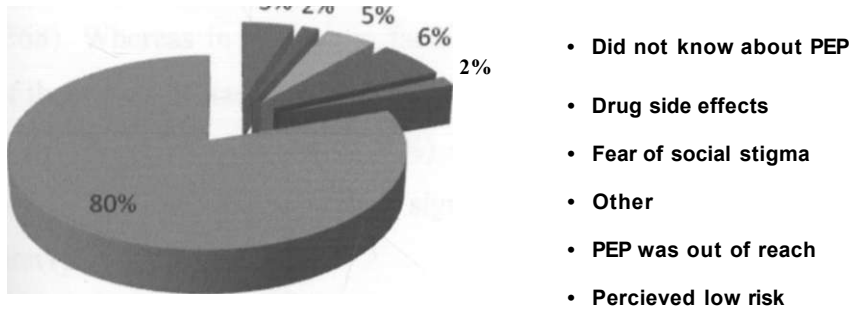
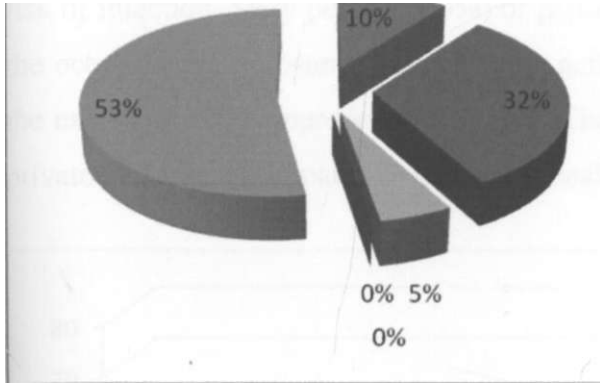


Figure 4.13a Reasons given by participants as to why PEP was not used in the public facility (n=61)

Reasons for not utilizing PEP by the exposed study participants in the two facilities were reported as shown Figure 4.13b. The main reason for not utilizing PEP was noted as perceived low risk of exposure for both private (52.6%) and public (80.3%), health workers (Figure 4.13b).

Private



- Did not know about PEP
- Drug side effects
- Fear of social stigma
- Other
- PEP was out of reach
- Perceived low risk

Figure 4.13b Reasons given by participants as to why PEP was not used in the private facility (n=19)

Of the 29 participants who reported percutaneous exposures in the private facility, 66.7% did not use PEP, while 33.3% used PEP. All those who used PEP had tertiary education, while those who did not use PEP, 90% had tertiary education, and 10% had secondary education. There was no statistical significance between education level and use of PEP in the private facility ($p=0.4368$). Whereas in the public facility 69.5% did not use PEP while 30.5% utilized PEP. Most of those who utilized PEP had tertiary education (87.5%), while only 12.5% had secondary education. Ninety two percent (92%) of health workers who did not use PEP had tertiary education. There was no statistical significant difference between use of PEP and level of education ($p=0.3595$).

4.6 Occupational exposure reporting rate

Of all the study participants interviewed in the two hospitals, and those who had sustained an occupational exposure, only 54% reported to the relevant Infection control and prevention department. Forty percent (40%) of participants did not report the exposure due to perceived low risk of infection. Sixty percent (60%) of participants interviewed in the private hospital reported the occupational exposure to the relevant authority, while 50.5% in the public facility reported the exposure to the appropriate authority. The reporting rate was found to be fairly high in the private hospital as compared to the public health facility (Figure 4.14).

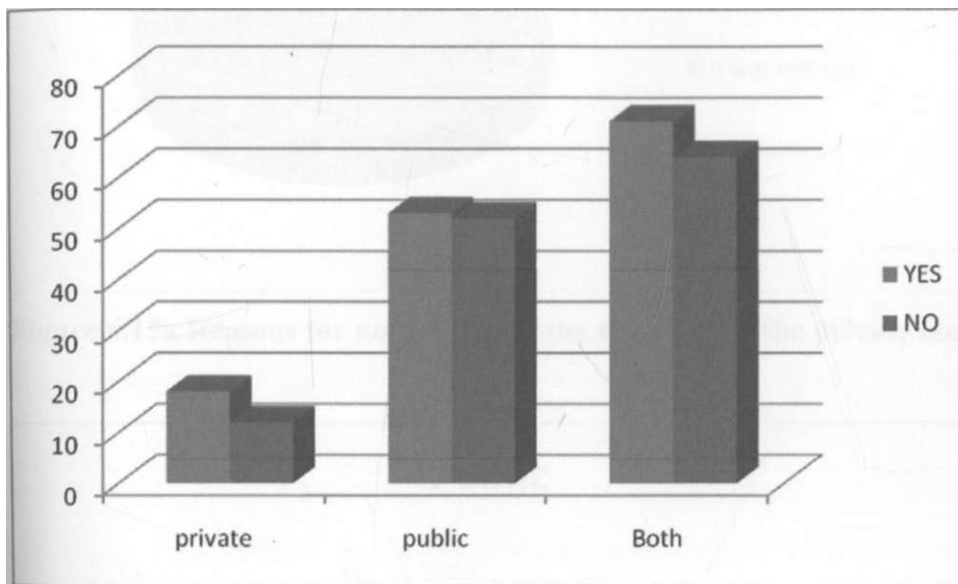


Fig.4.14 Comparison of reporting among study participants according to type of facility (n=135)

Reasons for not reporting in the private facility were perceived low risk in 83% of participants who were exposed, 9% did not know where to report and 8% were too busy to report to the relevant authorities (Figure 4.15a). In the public facility the exposure was perceived as low risk^w as the main reason accounting for 84% of those HCWs who did not report, 8% said it was due^{to} fear of consequences 6%, were too busy, and 2.0% did not know where to report (Figure 415b).

Only one percent of the participants who reported their exposure in the private facility revealed the injury caused them to bleed, while 87% in the public hospital revealed that the injury

caused them to bleed. Severity of injury, which may mean a higher risk of exposure, had a statistical significant association with reporting of the injury, in the public facility, where the Odds Ratio (OR) = 4.45, and Mantel-Haenszel (MH) $\chi^2 = 9.819$, $p = 0.001728$.

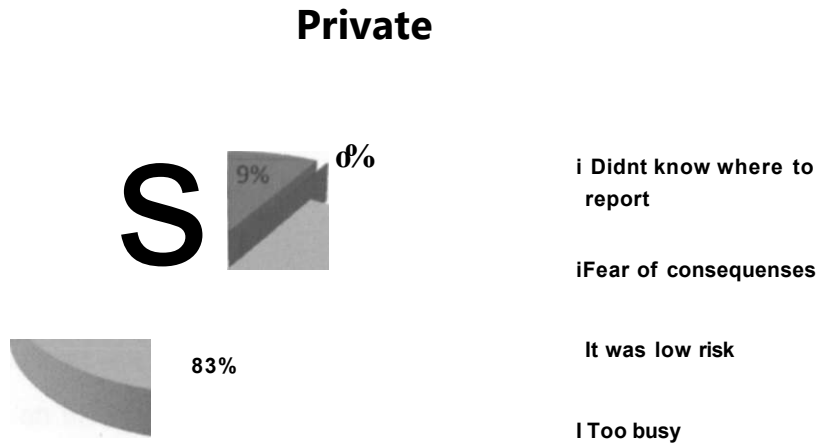


Figure 4.15a Reasons for not reporting the exposure in the private facility (n=135)

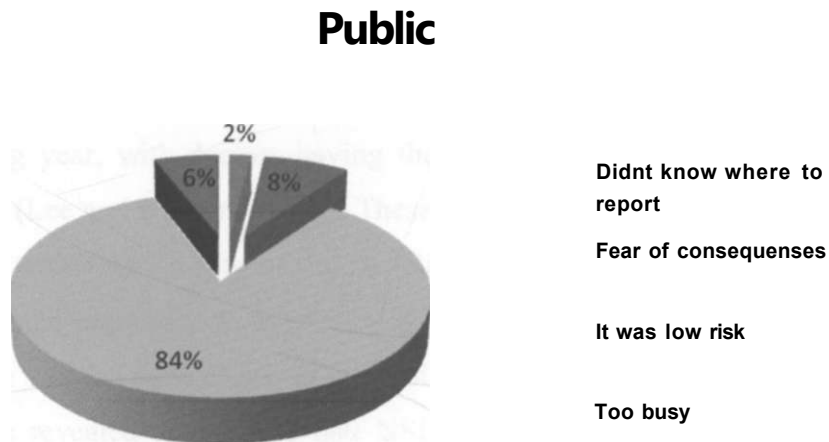


Figure 4.15b Reasons for not reporting the exposure in the public facility (n=135)

CHAPTER 5 DISCUSSION

5.1 Prevalence of occupational exposures

The results of this study as documented have shown that there is a higher prevalence of occupational exposures in the public facility (42.7%) than in the private (23.2%) by almost double. Some of the factors could be attributed to lack of medical supplies and logistics, and understaffing amidst high patient numbers in the public hospital. The working environment, understaffing, long working hours and staff burnout are other contributing factors. Health worker occupational exposure is more common in our health institutions than may be reported by researchers and under-reporting of exposures remains one of our greatest challenges.

These findings are similar by those from other studies elsewhere in the world as illustrated below. In an urban community in Mongolia, a study carried out in two public tertiary hospitals by found that the incidence of NSIs during the three months prior to the survey was 38.4%. The frequency of incidence was once for 14.7%, twice for 11.0%, and three times or more for 12.6% (Kakizaki *et al.*, 2011). In Tehran, Iran a study conducted among HCWs in three University teaching hospitals found that 43.4% had been exposed at least once to blood in the preceding 12 months, and out of this, only 29% reported the exposure (Hadadi *et al.*, 2005). A follow-up study done in India, Pune, a large public teaching university hospital, found an exposure rate of 24.8% (Gupta *et al.*, 2005), while in Malaysia, findings were 24.6% had at least one exposure in the preceding year, with doctors having the highest prevalence, followed by nurses and medical students (Lee and Hassim, 2005). These rates are similar to the findings in the private teaching hospital which had a rate of 23.2%. Similar studies elsewhere found higher rates of HCWs occupational exposures than this study. For instance, a study conducted in Turkey, found an exposure rate of 64% (Azap *et al.*, 2005), while in Poland, a survey of 601 nurses from 18 hospitals revealed that 45.9% had NSI in the preceding year and 74.4% did not report the exposure to relevant authority (Ganczak *et al.*, 2006). The findings of the public hospital health workers occupational exposure rate compare closely with the Poland study findings.

Similar studies in the developing countries in Africa have reported comparable findings to this study. A study done in Nigeria, Obafemi, Owolowo University, found that 27% of HCWs

interviewed had sustained NSI (Adegboye *et al*, 1994). In a survey of hospital wards in 3 West African countries, it was found that 45.7 % of HCWs interviewed had accidentally been exposed to blood (Tarantola *et al*, 2005). Another similar study done in Kinshasa, Zaire reported that 41% of HCWs sampled had been exposed to NSI (McGeer *et al*, 1990). A study in Mulago, National Referral and University teaching hospital in Kampala, Uganda, found that 57% of the respondents reported NSI in the last one year (Nsubuga *et al*, 2005). Understaffing and lack of training on injection safety related to higher injury rates. The rates are varied depending on the adequacy of staff available and use of personal protective equipment. A recent HCWs survey in Kenya of several public and private health facilities found that 20% had occupational exposures, and half of these had multiple exposures during the preceding year (NASCOP, 2006). There are more cases of NSI than mucous membrane splashes reported in other studies, as was the finding in this study. In a study done in a tertiary hospital in Uganda among 370 HCWs where it was found that 60% of HCWs had sustained NSI in the preceding year compared to 41% who had splash exposures (Ziraba *et al*, 2003).

A study carried out among registered nurses in a tertiary hospital in Kenya, KNH showed that 59.5% of the nurses had sustained inoculation injuries, and 325 mucous membrane splashes were reported by the 158 nurses sampled (Ngesa, 2006). A cross-sectional study in two hospitals in the Rift valley province of Kenya reported 24 % occupational exposures to blood and body fluids in the preceding year, 18% via NSI, 7.2 % to mucus membrane splashes and 11% had multiple exposures (Salas *et al*, 2010). A follow-up study in Thika district rural health facilities, in Kenya found an occupational exposure rate of 30% among health workers in public hospitals, (Taegtmeier *et al*, 2008).

5.2 Characteristics of occupational exposures

The age group with the highest occupational exposures was 25-34 in both hospitals. There was a statistical significance between age group and percutaneous exposures in the public facility, but on logistic regression analysis, (Odds Ratio (OR) = 1.07), age group was found not to have any greater risk on the occurrence of occupational exposures in both facilities. A study conducted in ^a Greek University teaching hospital found the age group 21-30 to have the highest exposure

incidence per year, with NSI being the commonest cause of injury in 60.6% of HCWs (Pournaras *et al*, 1999), contrary to this study finding. Factors found to have a statistical significant association with occupational exposure were type of facility, number of years of experience, type of job, and department where one worked. The more number of years one worked was found to be a risk factor in the public hospital, yet overall there was no statistical significance (C)R=0.986 between number of years of experience and the occurrence of percutaneous exposures. The department where the HCWs worked was found to be statistically significant in the public hospital and the department with the highest NSI exposures reported was theatre for both hospitals. In the private hospital this was followed by surgical ward and ICU, while in public facility it was followed by general ward and labour ward.

Nurses had more percutaneous exposures in the public facility than the doctors. These findings were similar to those reported in a study conducted in Western Kenya (MARTH), where 28% of the exposed were nurses, 22% were medical and nursing students, 20 % were doctors, 8% were patient attendants, and 7% were clinical officers (Siika *et al*, 2009). Theatre was the department with the highest reported incidents of occupational exposure in both hospitals, and this is in keeping with findings from other studies elsewhere. A similar study done in Ilorin University, Nigeria found a NSI prevalence rate of 57.8%, and the HCWs in the surgical departments had the highest risk of exposure (Medubi *et al*, 2006).

Whereas in the private hospital it was found that doctors had more percutaneous exposures than nurses. This was similar to a study conducted in Malaysia, where it was found that doctors were the most affected cadre, followed by nurses and medical students (Lee and Hassim, 2005). Furthermore, a study in South Africa had found that interns were the most affected category of staff (Du Toit *et al*, 2007), and similarly, a study conducted in Pune, a public teaching hospital in India found that interns doctors were the most affected cadre of staff (Gupta *et al*, 2005).

The device causing the injury was reported to be a hollow needle in 65% of the exposures in both hospitals in this study. Similarly, studies elsewhere in the USA hospitals by CDC found that approximately 61% of the 380,000 estimated exposures that occurred among HCWs were due to hollow-bore needles (Gerberding, 2003). A study in Western Kenya reported 67% hollow-bore

needle injury as the most frequent type of exposure, 14% solid needle injury, 13% mucocutaneous exposure, and 8% scalpel injury (Siika *et al*, 2009).

The activity being performed during the exposure was more commonly administering an IM/SC or IV injection 37%, suturing 23%, drawing venous blood 10% and cannulating an IV line in the public hospital. However, contrary to this, studies elsewhere in India, Mumbai, in a tertiary care center, it was reported that nurses (45%) were the most affected, and most NSI exposure occurred during intravenous line insertion followed by blood collection, surgical blade injury and recapping needles (Mehta *et al*, 2005). A similar study in Ankara University in Turkey, found that 64% of HCWs had sustained a NSI, and recapping needles was the most common cause associated with the exposure injury (Azap *et al*, 2005). This is contrary to these study findings.

Most exposure injuries occurred before use or while preparing to use and during the procedure in both private and public facilities. However, in the private facility, more exposure occurred after use, during disposal, and while putting item into disposal container, while in the public facility, it occurred while restraining the patient, after use, before disposal or device left on the bed, table or inappropriate place. Availability of sharps disposal container in the room, within arm's reach during a procedure is mandatory, before the start of any medical procedure. At the time of exposure 54-60% reported there was a sharps disposal container within arm's reach, 28-31% reported out of reach but within the room and 9-13% reported that the sharps disposal container was in a different room. This compares to a study in Nigerian teaching hospital. Owolowo University, where it was found that procedures associated with NSI included unexpected patient movement, disposal of used needle and recapping in that order (Adegboye *et al*, 1994).

5.3 Utilisation of Post-exposure prophylaxis

5.3.1 Hepatitis B vaccination status of health workers

In the Czech Republic, previously reported studies had demonstrated that morbidity among HCWs due to viral hepatitis was 3.6 times higher than among the general population (Seyckova *et al*, 1984). Despite limited resources, control of nosocomial hepatitis was given high priority by state officials in the early 1980s. A study in the Czech Republic demonstrated that a rigorous vaccination program could sharply reduce occupational transmission of hepatitis B and that such a program could be implemented in a country with modest resources (Helcl *et al*, 2000). Studies from the USA have documented a decrease in hepatitis B rates among HCWs after adoption of OSHA, 1991 guidelines (Mahoney *et al*, 1997).

In the private hospital, of those surveyed, over 85% reported getting the vaccines free of charge whereas, in the public hospital, only 31% reported getting the vaccines free of charge. The charging of the vaccines could have made it difficult for the health workers to get vaccinated due to unaffordability. In Iran, a study found that over 85% of HCWs surveyed had been vaccinated against HBV, and out of this 75.4% had completed a three dose schedule. Ninety eight percent of residents were more likely to have completed vaccinations than the housekeeping staff (42%). The findings in this study are quite low, compared to the Iran and Pakistan studies, but fairly high comparing with findings from a study done in Egypt, where only 15.8% of HCWs reported receiving 3 doses of hepatitis B vaccine (Talaat *et al*, 2003). Vaccination coverage was highest among professional staff (38%) and lowest among housekeeping staff (3.5%).

In Uganda, a study reported that only 6.2% of HCWs were vaccinated against HBV, with 20.3% of doctors having been vaccinated. Out of those who reported ever being vaccinated, only 34.8% had completed the recommended three dose schedule (Ziraba *et al*, 2010). The vaccination coverage reported in this study was very low compared to other developing countries like Pakistan with vaccination coverage of over 80% (Ali *et al*, 2005). Vaccination of health care workers against hepatitis B virus in Uganda was not mandatory and there was no formal framework for delivering vaccines to HCW (Ziraba *et al*. 2010). Results show that a large Proportion of HCW appreciate the need to be vaccinated, with more than 95% indicating that they were willing to be vaccinated if the vaccine was provided free of charge. The lack of policy

and a formal delivery system targeting HCW is a key challenge, with the high cost of vaccine, if left to the HCWs in this country.

In Thika district of Kenya, a study conducted in rural health facilities reported a low vaccination level of 13% of the HCWs surveyed; 87% had never received HBV vaccine (Suckling *et al*, 2008). Another study in a rural mission hospital, Maua Methodist in Kenya, found that 65.3% of the 53 HCWs interviewed had at least one dose of HBV vaccination (M'ikanatha *et al*, 2007). In this study, 72% of the HCWs had at least one dose of HBV vaccine and it shows a slightly higher vaccine uptake here being tertiary hospitals.

5-3.2 Post exposure prophylaxis utilisation

The findings in this study showed that out of all those who were exposed in the private facility, only one third (33.3%) utilized PEP, while two thirds did not. The most common reason why PEP was not used was reported as perceived low risk of infection transmission in 52.6% of respondents in the private hospital, and in over 80% in the public facility. There was no statistical difference between level of education and use of PEP, or between type of facility and use of PEP. These findings are higher than those reported by other studies conducted here in Kenya. This compares to local and regional studies done elsewhere in the developing countries.

In Kenyan rural health facilities, of Thika district, where 650 HCWs were sampled, it was reported that only 4% had utilized PEP in the years 2002-2006. The main reason for a low PEP uptake was cited as fear of being HIV tested and a perceived low risk of HIV transmission (Taegtmeyer *et al*, 2008). A study of the outcomes of HIV PEP programme in Western Kenya conducted MTRH showed that of the 91 HCWs who sought PEP, 79% agreed to have baseline HIV testing, while 21% declined. It was not clear whether their refusal was due to prior knowledge of their HIV status or fear of testing positive. Only 4% of HCWs who started ARV PEP discontinued due to drug side effects, but the remainder reported having completed the course (Siika *et al*, 2009). A similar study carried out at the Rift Valley Provincial General Hospital and War Memorial hospital in Nakuru Town in Kenya found that the PEP uptake by the health workers after occupational exposures was only 24% (Salas *et al*, 2010).

5.4 Occupational exposure reporting rate

The reporting rates for needle stick injuries were only 60%, in the private facility and 50.5% in the public facility. Health workers perceived the percutaneous exposure as low risk and this was the commonest reason for not reporting, followed by the reason that they were too busy. Under reporting is a major concern worldwide. In Malaysia, a study done in a public university teaching hospital found a reporting rate of 59% (Lee and Hassim, 2005). In Poland, survey of 601 nurses from 18 hospitals revealed that 74.4% of the participants who were exposed, did not report the incident to the relevant authority (Ganczak *et al*, 2006). A similar study carried in Ankara University, in Turkey found that of the 64% participants who reported NSI exposure, only 33% reported to the relevant authority (Azap *et al*, 2005)." Other studies in Africa reported a non-reporting rate of 60-70% of occupational exposure incidents (Adegboye *et al.*, 1994, Ngesa, 2006, Nsubuga and Jaakola 2005). There seemed to be a higher reporting rate in the private facility due to the fact that there are well established and defined mechanisms and policies on exposure reporting in place. The private hospital had strict occupational exposure surveillance managed by two departments, the occupational safety department and infection control department.

A study done in South Africa to determine the incidence of percutaneous injuries, reporting rate and use of gloves during procedures among doctors in the school of Medicine at the University of Free State, found that only 47.6% reported the injury (Du Toit *et al*, 2007). On the other hand, a study of HCWs occupational exposure in Maua Methodist hospital in Meru, Kenya, it was noted that of the 22.6% health workers exposed in the preceding year, only 33.3% reported the injury to the relevant authority (M'ikanatha *et al*, 2007). Furthermore, another study conducted at the Rift Valley provincial hospital and War Memorial hospital in Kenya, found that only 48% of the exposure incidents were reported and of these, only 24% initiated PEP (Salas *et al*, 2010).

CHAPTER 6 CONCLUSIONS

Based on the findings of this study, it can be concluded that the prevalence of occupational exposures among health workers is quite common, and the risk factors that are significantly associated with percutaneous exposures are type of health facility, the type of procedure being performed, whether one was the user of the device and the availability of the disposal container at the time of the exposure.

Age, sex, literacy level and marital status were found not to have any statistical significant association with the occurrence of occupational exposures among healthcare workers in the two hospitals.

The hepatitis B vaccination status for study participants was found to be quite low at 53.4% compared to other states in Europe and USA where national policies have been developed concerning mandatory free health care workers HBV immunization by all employers.

The utilisation of PEP is still quite low (31.9%) given that the National guidelines and free ARVs are widely available, and HIV PEP is given at no charge in the public hospitals. Perceived low risk of disease transmission was cited as the major reason for not utilising PEP.

There is gross under-reporting of occupational exposures in both the public and private hospitals (55%). The main reason for health workers not reporting the occupational exposures was perceived low risk of HIV and HBV transmission. A few cited that the reporting mechanisms and procedures were too cumbersome and time consuming.

CHAPTER 7 RECOMMENDATIONS

1. Primary prevention of accidental occupational exposures among health workers is paramount and efforts by the Ministry of Health Directors should be geared towards health managers reducing unnecessary injection prescriptions, and unwarranted invasive medical procedures, and adequate preparations prior to any medical procedures.
2. An intensive educational programme should be set up by the MOH and stakeholders, to increase vaccination rate of the health workers. The Ministry of Public Health and Sanitation should mandate the incorporation of free HBV vaccination in the National vaccination program by the Division of Vaccines and Immunisation (DVI). The element of cost may be hindering access to and vaccination with HBV vaccine.
3. Tertiary health facilities should see to the establishment by their infection control committees of a pre-employment vaccination programme against Hepatitis B virus. This should then be rolled down to the peripheral health care facilities. A national policy on health workers HBV immunisation should be developed and efficient mechanisms of HBV vaccination delivery to the HCWs to be put in place, with proper immunization documentation records, and means of follow-up to ensure completion of the 3dose vaccine schedules.
4. Health workers pre-service and in-service trainings and regular updates on the infection prevention and control of blood-borne diseases and injection safety should be stressed by all health institutional managers. Tertiary health facilities should have occupational safety training on HIV and other blood-borne diseases incorporated into the continuous medical education curriculum to ensure that all HCWs get in-service refresher courses and trainings on PEP, and standard precautions.
5. Hospital Directors should establish and strength occupational exposure reporting mechanisms in each hospital, with clear documentation. All departmental heads to communicate this to all health workers under them. Posters to this effect to be put in strategic places in all the hospital departments. Bureaucracy to the reporting procedures

should be minimized by the directors of the hospitals so that HCWs do not find it cumbersome and time wasting.

6. Introduction of a system for the computerized collection of information on work records and NSIs and proper health worker occupational exposure surveillance in all hospitals would facilitate the production of accurate data for monitoring the occurrence of occupational exposures, and the management of sharps and medical waste.

Future research:

More research to be carried out by social scientists to try and establish the extent to which health workers knowledge, attitude and practice influence the reporting of occupational exposures and their utilisation of PEP. This can help plan preventive interventions logically.

Research on the cost effectiveness of the current infection control and prevention interventions in our health institutions should be carried to evaluate the best practices to be adopted regarding health workers health and safety.

More similar studies to be conducted in the private health institutions, because of limited data on occupational exposures in the private health sector.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE

HEALTHCARE WORKER BLOOD EXPOSURE SURVEY

- 1) **Type of Facility:** • 1 Private • 2 Public **Unit/Ward:** _____
- 2a) **Number of Years in work experience:** _____ **Gender** D1 M • 2 F
- b) **What is your Age** • 18 - 24 • 25 - 34 • 35 - 44 • 45 - 54 • Above 55?
- c) **Marital status:** • 1 Married • 2 Single • 3 Divorced **D4** Widowed **D5** other: _____
- d) **Level of education:** D1 none 2D Primary 3D secondary 4D Tertiary(College/University)
- 3) **Check job category below:**
- 1 Doctor
 - 2 Nurse
 - 3 Dentist
 - 4 Laboratory worker
 - 5 House keeper
 - 6 Laundry worker
 - 99 Other, Describe: _____
- 4 a) Approximately how many hours do you work in a typical week? _____ Hours per week.
- b) Does your work involve: **1** • overtime 2D Night duty 3D direct shift 4D on-call
- 5) Have you received safety training for preventing bloodborne pathogen exposure in the past year? D1 Yes D 2 No
- 6) Have you been vaccinated against Hepatitis B?
- D 1 Yes, fully-3 doses D 2 Partially-1-or 2 doses D3 No
- 7) Did you receive the Hepatitis B vaccine free of charge?
- D1 Yes D 2 No D 3 Not Applicable
- 8) Is HIV post-exposure prophylaxis available to you?
- 1 Yes D 2 No D 3 Unknown
- 9) How many needle sticks or cuts have you sustained at work in the past year?
- D 0 (None) D 1 D 2 D 3 D 4 • D 5 D more than 5

Questions 10-20: Refer *ONLY* to your *MOST RECENT* injury at your current job (even if it was more than one year ago)

10) What time of day did the injury occur? DAM • Late AM • PM • Evening Night

11) Were you the user of the device that injured you, or was someone else the original of the device? ^{US ^ r}

• I was the user of the device (I performed the procedure) • I was not the user of the device

12) What device caused the injury?

• **Hollow needle:**

- 1 Needle on disposable syringe <
- ... 2 Vacuum tube blood collection holder/needle
- 3 Spinal or epidural needle
- 4 Unattached hypodermic needle
- 5 Needle on IV line (*IV line connectors*)
- 6 winged steel needle (*butterfly*)
- 99 other needle, describe:

Solid sharp:

- 13 Lancet (*finger or heel sticks*)
- 14 Scalpel
- 15 Suture needle
- 99 other sharp item: describe;

Glass:

- 17 Medication ampoules
- 18 Glass slide
- 19 Vacuum tubes (*glass*)
- 20 Capillary tubes
- 99 other glass item: describe;

13) Was the device causing the injury a "Safety Design" with a shielded, recessed, retractable, or blunted needle or blade?

- 1 Yes
- 2 No
- 3 Unknown

14) What procedure was the device used for?

- 1 Unknown/Not applicable
- 2 Cannulating/starting an intravenous infusion
- 3 IM/SC injection, or IV injection
- 4 Flushing an IV line or port with a syringe
- 5 Injecting or aspirating with a syringe but not IM, SC, or IV
- 6 Obtaining a body fluid, tissue sample, or biopsy

- 7 Performing a finger stick or heel stick
- 8 Drawing venous blood
- 9 Suturing
- 99 other; describe

15) When did the injury occur?

- 1 Before using/preparing to use device (*item broke/slipped, etc.*)
- 2 Device left on floor, table, bed, or inappropriate place
- 3 During use of the device (*item slipped, patient jarred item, etc.*)
- 4 Other after use-before disposal (*on way to trash, etc.*)
- 5 While restraining patient
- 6 From item left on or near disposal container
- 7 Between steps of a multi-step procedure (*passing, etc.*)
- 8 While putting item into disposal container
- 9 Disassembling device or equipment
- 10 After disposal, item sticking out opening of disposal box
- 11 Processing of reusable instrument (*sorting, cleaning, etc.*)
- 12 Item pierced side of disposal container
- 13 While recapping used needle
- 14 After disposal, item sticking out of trash bag or other
- 15 Inappropriate waste container (*rubber stopper, IVport, etc.*)
- 99 Other: describe

16) At the time of your exposure, was a disposal container available:

- 1 within arm's reach
- 2 out of reach but in the same room
- 3 in a different room
- 4 not applicable

17) If a disposal container was available, was it:

- 1 A cardboard container
- 2 A plastic container
- 3 A re-used box or container (*not designed specifically for sharps disposal*)
- 4 sharps disposal container (*specifically designed for sharps disposal*)

18) Was the device or item visibly contaminated with blood?

- 1 Yes
- 2 No
- 3 Unknown

19) Did the injury cause you to bleed?

- 1 Yes
- 2 No
- 3 Unknown

20 a) Did you report this injury to the appropriate authority? {If no skip to Q.21}

- 1 Yes
- 2 No

b) Where did you report to? • 1 Head of department D2 occupation safety D3 infection

Control • 4 Comprehensive care centre • 5 casualty D6
other:

21) What reason did you have for not reporting? • 1 Too busy D2 didn't know where to report

- 3 it was low risk D4 Fear of consequences
- other

22 a) Was ARV post-exposure prophylaxis (PEP) utilized appropriately? • 1 Yes • 2 No

b) If no, state reason why: • 1 perceived low risk • 2 Drug side effects • 3 Fear of social

stigma D4 did not know about PEP • 5 PEP was out of reach • 6 other

The remaining questions refer to blood or bodyfluid exposures to the eye(s).

23) How many times has blood or bodily fluids splashed into your eye(s) at work in the past year? DO (None) • 1 D2 D3 D4 D5 • more than 5

Questions 22-25 refer ONLY to your MOST RECENT splash at your current job (even if it was more than 1 year ago)

24) Was the eye exposure a result of?

- 1 Direct patient contact
- 2 Suction canister spilled, leaked, or broke
- 3 Contact with contaminated item (*drape, sheets, equipment*)
- 4 other irrigation/fluid container spilled, leaked, or broke.
- 5 Tubing leaked, disconnected, broke, sprayed.
- 6 Bag or pump spilled, leaked, or broke
- 7 Intubating or extubating patient
- 8 Specimen container spilled, leaked, or broke
- 9 other, describe__

25) Which barrier garments were you wearing at the time of your eye exposure?

- 1 Single pair gloves
- 2 Face/Surgical mask

- 3 Double pair gloves
- 4 Fluid resistant surgical gown (*GORE-TEX®*, *plastic*, *etc.*)
- 5 Goggles
- 6 Fluid resistant apron
- 7 Eyeglasses (*not a protective item*)
- 8 Cotton surgical gown
- 9 Face shield
- 99 Other, describe:

26) Did you report this exposure to the appropriate authority?

- 1 Yes
- 2 No

27) Where did you report to? • Head of department • Infection control • Casualty

- Occupational safety
- Comprehensive care centre
- other

28) Was HIV PEP utilised? • 1 Yes • 2 No

APPENDIX 2 A: INFORMED CONSENT SHEET

PREVALENCE OF OCCUPATIONAL EXPOSURE TO SELECTED BLOOD-BORNE DISEASES AND UTILISATION OF POST EXPOSURE PROPHYLAXIS AMONG HEALTH WORKERS

My name is **Dr. Brenda Makokha**, and I work for the Ministry of Public Health and Sanitation. I am currently undertaking further studies in Master of Public Health (MPH) at the University of Nairobi, College of Health sciences, Kenyatta National Hospital. Part 11 of the course requires us to undertake a Health Systems Research study (HSR), which is why we are carrying out this study entitled; **"The prevalence and characteristics of occupational exposures to blood and utilisation of post exposure prophylaxis among health workers in Moi Teaching and Referral Hospital and Aga Khan University Hospital, Nairobi."** The overall aim is to improve health and well-being for people in Kenya and other parts of Africa by developing new ways and improving old ways of preventing and treating occupational exposures to blood.

We are conducting this study to understand how occupational injuries and exposures can be prevented, and when they do occur, how the health workers utilise post exposure prophylaxis for HIV and HBV. The study will help the government understand how its policies (injection safety and Bio-waste disposal) are working in practice, and what needs to be done to improve the existing infection prevention control strategies.

If you are willing to be interviewed, your views are very important and will help us improve on occupational safety and health administration. The interview will take approximately 30 minutes to complete. We will take notes during the interview and, if you are in agreement, we will also tape record it to ensure that your views are recorded accurately. We will also be interviewing other health workers at different levels in the two hospitals and health system programmes like NASCOP. When the study is finished we will combine all the information, and will then feedback the overall findings to local and national leaders and health care managers.

Voluntary Participation

Participation in this study is entirely voluntary. If you agree to help with this research and later change your mind you are free to withdraw at any time. You won't be discriminated against in any way if you either do not agree to participate, or if you later withdraw. Your rights will be respected.

Confidentiality

The information will be used for research purposes only. To ensure confidentiality we will not disclose your identity, or use your name or job title in any reports of this work. Only general terms will be used to indicate who took part such as: senior staff in the Ministry of Health *or* the Moi Teaching and Referral Hospital and Aga Khan University Hospital or NASCOP. If *y o u* don't wish to be quoted word for word, even anonymously, you may say so at the end of the interview, and we will respect this wish. No one other than the research team and yourself will be allowed to see the record of the interview without your permission.

Risks of the research

We do not believe there are any serious risks to taking part in this research, but psychological and social harm could be anticipated, which could be attributed to the occupational exposure event. All we ask is your time to conduct the interview.

Benefits of the research

While there are no direct benefits to you, the information will be used to improve on our primary prevention strategies in the workplace and enhance our health training curricula in the future, and this will go a long way to improve the health of Kenyans by ensuring a healthy work force in our health institutions.

The study has been approved by the Ethical Review committee of KNH/UoN, and by the Moi University committee and by the AKUH, N Ethical committee, and the Directors of the two hospitals.

If you have any queries or concerns about this research, please contact: **Dr. Brenda Makokha** at, **PO Box 50081-00200, Tel 0722 808477** or,

You may also contact **The Chairman/ Secretary, KNH/UON Ethical Review Committee, P.O. BOX 20723-00202, Nairobi, and Tel: 020 726300-9.**

Do you have any questions?

Are you willing to participate?

Are you willing for us to tape record the interview?

I _____, have explained to the participant, the informed consent as above, and answered any questions raised on the above subject, on this day, dated

If you are willing to participate, then you will sign and date the informed consent form attached.

APPENDIX 2 B: CONSENT FORM FOR INTERVIEWS/DISCUSSIONS

(Explanation to be given verbally and form used in an appropriate language)

Study Title: The prevalence and characteristics of occupational exposures to selected blood borne pathogens (HIV and HBV), and utilization of PEP among health workers in MTRH and AKUH in Nairobi

Investigator(s): Dr. Brenda Makokha

Once you sign below it shows that you have agreed to join the study. If you do not understand any part of the information you have (been) read be sure to ask questions. Please do not agree to sign until all your questions have been answered.

I wish to take part in the study entitled, "**prevalence of occupational exposures to HIV/HBV and utilization of PEP among health workers in two teaching hospitals in Kenya**". I understand that this will involve an interview of approximately half an hour on my views and experience of occupational exposures and PEP use. I also understand that I may, at any time during the study, withdraw my consent without loss or penalty.

I confirm that:

- 1) I am willing to be interviewed
- 2) I am / am not* willing for a tape recording of the interview to be made in addition to written notes. (* Delete as appropriate).

Signature (or thumb print) of participant

Name in capitals _____ Date

I have read the information sheet to _____(participant's name) in a language he/she understands. I believe that he/she gives consent to take part in the study.

Signature of researcher _____ Date

Name in capitals

I have witnessed the above being discussed with
(participant's name) in a language he/she understands. I believe he/she gives consent to take part.

Signature of witness _____ Date

Name in capitals

KIAMBATISHO 3A: CHETI CHA WARAKA WA IDHINI

VIPIMO VYA MFIDUO WA MAGONJWA YA MAAMBUKIZI YANAYO SABABISHWA NA KUJIFUNUA KWA DAMU KWA WAFANYIKAZI WA AFYA NA UTUMIAJI WA DAWA ZA KUPUNGUZA MAKALI BAADA YA KUJIFUNUA KWA MAGONJWA HAYA KWA WAFANYIKAZI WA AFYA.

Jina langu ni Dkt. Brenda Makokha, na nina fanya kazi na Wizara ya Afya ya Umma na Usafi wa Mazingira. Kwa sasa nasomea shahada ya pili ya Afya ya Umma (MPH) katika Chuo Kikuu cha Nairobi, Chuo cha Sayansi ya Afya, Hospitali ya Taifa ya Kenyatta. Sehemu ya pili ya masomo haya inahitaji sisi kufanya utafiti wa mifumo ya Kiafya ((HSR), ambayo ndiyo maana sis tunafanya utafiti huu uitwao; "Vipimo vya mfiduo wa magonjwa ya maambukizi yanayo sababishwa na kujifunua kwa damu kwa wafanyikazi wa afya na utumiaji wa dawa za kupunguza makali baada ya kujifunua kwa magonjwa haya kwa wafanyikazi wa afya kwenye hospitali ya rufaa ya Moi na Hospitali ya chuo kikuu cha Aga Khan, Nairobi'. Lengo la jumla ni kuboresha afya na ustawi kwa watu wa Kenya na maeneo mengine ya Afrika kwa kubuni njia mpya na kuboresha njia za zamani za kuzuia na kutibu ufunuaji kwa damu kwajili ya kazi unayofanya.

Sisi tunafanya utafiti huu kuelewa jinsi majeraha kazini na kujifunua vinaweza kuzuiwa, na wakati vipapo fanyika, jinsi wafanyakazi wa afya wanavyotumia madawa yakupunguza makali kwa virusi vya UKIMWI na virusi vya HBV. Utafiti huu utasaidia serikali kuelewa jinsi sera zake (usalama wa sindano utupaji wa takataka za maambukizi) zinavyo fanya kazi kwa sasa, na nini kitakikana kufanywa ili kuboresha mikakati ya kudhibiti na kuzuia maambukizi.

Kama wewe ukotayari kuhojiwa, maoni yako ni muhimu sana na itatusaidia kuboresha usalama kazini na utoaji huduma za afya. Mahojiano haya yatachukua kiasi cha dakika 30 kukamilika. Tutaandika vidokezo wakati wa mahojiano na, kama wewe utakubali, pia tuta rekodi mahojiano kwenye tepu ili kuhakikisha kwamba maoni yako yamerekodiwa sahihi. Sisi pia tutawahoji wafanyakazi wengine wa afya katika vyeo mbalimbali katika hospitali hizi mbili na pia mipango na mifumo ya afya kama NASCOP. Wakati utafiti utakapomalizika tutaunganisha taarifa zote, na kisha maoni ya matokeo yote kwa ujumla yatapewa viongozi wenu na viongozi wa kitaifa na wasimamizi wa huduma za afya.

Kushiriki ni kwa hiari

Cushiriki katika utafiti huu ni kwa hiari. Kama unakubali kusaidia utafiti huu na baadaye ;ubadili akili yako na ukatae utakuwa huru kutoka wakati wowote. Huwezi kubaguliwa kwa lamna yoyote kama wewe utakataa kushiriki, au kama baadaye kujiondoa. Haki zako iitaheshimiwa.

siri

abari zitatumika kwa madhumuni ya utafiti tu. Kuhakikisha siri hatutatoa kutambulika kwako, i kutumia jina lako au cheo chako cha kazi katika taarifa yoyote ya utafiti huu. Maneno ya mla tu ndio yatumika kuonyesha walishiriki kama vile: wafanyakazi wa vyeo vya juu wa izara ya Afya au Hospitali ya rufaa ya Moi na Hospitali ya chuo Kikuu cha Aga Khan au \SCOP. Kama hutaki kunukuliwa neno kwa neno, hata kama ni bila kutambulika, unaweza

kutuambia mwisho wa mahojiano, na sisi tutaheshimu unavyotaka. Hakuna mtu yeyote isipokuwa wafanyi kazi wa utafiti huu na wewe mwenyewe ndio wataruhusiwa kuona rekodi za mahojiano bila idhini yako.

Hatari za utafiti

Hatuamini kuwa kuna hatari kubwa ya kushiriki katika utafiti huu, lakini madhara ya kisaikolojia na kijamii yanaweza kutarajiwa, ambayo yanaweza kuhusishwa na tukio la mfiduo wakati wa kazi. Lile tunaloomba ni wakati wako ili tuweze kufanya mahojiano.

Faida za utafiti

Ingawa hakuna faida ya moja kwa moja kwako wewe, habari zitatumika kuboresha mikakati msingi yetu ya kuzuia maambukizi kazini na kuimarisha mafunzo ya afya katika siku zijazo, na hii litaendelea murefu na kuboresha afya ya Wakenya kwa kuhakikisha kuwa kuna wafanyikazi wenye afya kwenye taasisi zetu za kiafya.

Utafiti huu umepitishwa na kamati ya Maadili ya Hospitali kuu ya Kenyatta/ Chuo kikuu cha Nairobi (KNH/UON) na Kamati ya maadili ya Chuo kikuu cha Moi na Kamati ya maadili ya chuo kikuu cha Aga Khan , na Wakurugenzi wa hospitali hizo mbili.

Ukiwa na swali lolote au tashwishwi yoyote kuhusu utafiti huu, tafadhali wasiliana na **Dkt. Brenda Makoha** kwa anwani **Sanduku la posta 50081-00200, Nairobi, nambari ya simu 0722 808477** au,

Unaweza wasiliana na **Mwenyekiti/ Katibu mkuu, Kamati ya maadili ya Hospitali kuu ya Kenyatta/ Chuo kikuu cha Nairobi Sanduku la Posta 20723-00202, Nairobi, na Simu 020 726300-9**

Je, uko na swali lolote?

Je, uko tayari kushiriki?

Je, uko tayari sis ku rekodi mahojiano kwenye tepu?

Mimi _____, nimemueleza mshiriki, waraka wa idhini kama ulivyoandikwa hapo juu, na nimeyajibu maswali yote aliyouliza kuhusinana na utafiti huu, Siku hiii, Tarehe

Kama wewe ukotayari kushiriki, basi utatia saini na tarehe waraka wa idini ufuatao.

KIAMBATISHO 3 B: FOMU YA IDHINI YA MAHOJIANO/ MAJADILIANO

(Maelezo yapeanwe kwa maneno na lugha sahihi)

Study Title: Vipimo vya mfiduo wa magonjwa ya maambukizi yanayo sababishwa na kujifunua kwa damu kwa wafanyikazi wa afya na utumiaji wa dawa za kupunguza makali baada ya kujifunua kwa magonjwa haya kwa wafanyikazi wa afya kwenye hospitali ya rufaa ya Moi na Hospitali ya chuo kikuu cha Aga Khan, Nairobi'

Mtafiti mkuu: Dkt. Brenda Makokha

Mara tu baada ya kuweka sahihi hapa chini inaonyesha kwamba umekubali kujiunga na utafiti huu. Kama hauelewi sehemu yoyote ya habari ambayo umeisoma (imekuwa ikiisoma) kuwa na ari ya kuuliza maswali. Tafadhali usikubali kuweka sahihi mpaka maswali yako yote yawe yamejibiwa.

Ningependa kushiriki kwenye utafiti uitwao, "**Vipimo vya mfiduo wa magonjwa ya maambukizi yanayo sababishwa na kujifunua kwa damu kwa wafanyikazi wa afya na utumiaji wa dawa za kupunguza makali baada ya kujifunua kwa magonjwa haya kwa wafanyikazi wa afya kwenye hospitali mbili za kimafunzo nchini Kenya**"

Ninaelewa kwamba hii itahusisha mahojiano ya karibu nusu saa kuhusu maoni yangu na uzoefu wa kazi na matumizi ya madawa ya kupunguza makali ya maambukizi (PEP). Mimi pia naelewa kwamba ninaweza kwa wakati wowote wakatika wa kipindi cha utafiti huu kujitoa bila hasara au idhabu kwangu.

limi nathibitisha kwamba:

I Niko tayari kuhojiwa

Niko / Siko* tayari kwa kurekodiwa kwa mahojiano pamoja na kuandika vidokezi Futa isio takikana).

ihi (au alama ya kidole gumba) ya mshiriki;

la Mshiriki kwa herufi kubwa

Tarehe:

Nimemusomea cheti cha waraka wa idhini _____ (jina la mshiriki) kwa lugha ambayo anaielewa. Naamini yakuwa yeye anatoa idhini ya kushiriki katika utafiti huu.

Sahihi ya Mtafiti: _____ Tarehe;

Jana la Mtafiti kwa herufi kubwa: _

Nimeshuhudia yaliyoko hapojuu yakizungumziwa
(jina la mshiriki) kwa lugha ambayo anaielewa. Naamini yakuwa yeye anatoa idhini ya kushiriki katika utafiti huu.

Sahihi ya shahidi: _____ Tarehe;

Jana la shahidi kwa herufi kubwa

Appendix 4 A KNH/UON-ERC Approval



UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
(254-020) 2726300 Ext 44JSS
Ref: KNH-ERC/A/267

KNH/UON-ERC
Email: uonknh_erc@unobi.ac.ke
Website: www.unobi.ac.ke



KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi
1st November 2011

Dr. Brenda Makokha
School of Public Health
College of Health Sciences
University of Nairobi

Dear Dr. Makokha

Research Proposal: "Prevalence of Accidental Exposure to selected Blood-borne Pathogens and post exposure prophylaxis among Health workers in two Kenya Hospitals (P376/09/2011)"

This is to inform you that the KNH/UON-Ethics & Research Committee has reviewed and **approved** your above revised research proposal. The approval periods are 1st November 2011 to 21st October 2012.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimens must also be obtained from KNH/UON-Ethics & Research Committee for each batch.

On behalf of the Committee, I wish you a fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of the data base that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

A handwritten signature in black ink, appearing to read "A. N. Guantai".

PROF A N GUANTAI

SECRETARY, KNH/UON-ERC

c.c. The Deputy Director CS, KNH
The Principal, College of Health Science, UON
The Director, School of Public Health, UON
The HOD, Medical Records, KNH
Supervisors: Mr. Lambert Nyabola, School of Public Health, UON
Prof. Mutuku A. Mwanthi, School of Public Health, UON

"PROTECT TO DISCOVER"

Appendix 4 B IREC MRTH-MOI UNIVERSITY Approval



MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Ttl: 33471/2/3



MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET
Tel: 33471/2/3
9th November, 2011

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

Reference: IREC/2011/151
Approval Number: 000750

Dr. Brenda Makokha,
• School of Public Health,
College of Health Sciences,
UNIVERSITY OF NAIROBI.

Dear Dr. Makokha,

FORMAL APPROVAL

The Institutional Research and Ethics Committee has received your request for approval of your study titled:

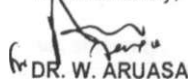
"Prevalence of Accidental Exposure to Selected Blood-Borne Pathogens and Post Exposure Prophylaxis among Health Workers in Two Kenya Hospitals".

On the basis of your study review and approval by the Kenyatta National Hospital/University of Nairobi-Ethics and Research Committee (ERS), IREC is glad to inform you that your study has been granted a Formal Approval Number: **FAN: IREC 000750** on 9th November, 2011. You are therefore permitted to continue with your study.

Note that this approval is for 1 year; it will thus expire on 8th November, 2012. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Yours Sincerely,


DR. W. ARUASA

AG. CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE



cc: Director MTRH
Principal CHS
Dean SOM
Dean SPH
Dean SOD
Dean SON

Appendix 4 C THE AGA KHAN UNIVERSITY ERC Approval



The Aga Khan University Hospital, Nairobi

P.O. Box 30270 • 00100 G.P.O., Nairobi, Kenya
Tel: (254 20) 3740000 / 3662000 / 3742531 / 353999
Fa*. (254 20)3741749

November 25, 2011

Dr. Brenda Makokha
C/o School of Public Health
University of Nairobi
NAIROBI

Dear Dr. Makokha,

**Re: Request to undertake Research at the Aga Khan University Hospital, Nairobi:
"Prevalence of accidental exposure to selected blood-borne pathogens and post-exposure
prophylaxis among health workers in two Kei van hospitals".**

Your letter dated 7th November 2011 refers.


We are pleased to inform that your request has been approved and permission granted to carry out the study on "**Prevalence of accidental exposure to selected blood-borne pathogens and post exposure prophylaxis among health workers in two Kenyan ho: pitals**" for your Masters of Public Health Degree at the School of Public Health, University of Nairobi.

You will be expected to liaise/ work closely with our staff, Loyce Kihungi of Infection Control and George Ongete of Occupational Health.

As, pertains to the study, please take note of the following terms and conditions:

1. This hospital will, in no way, be responsible for funding of this project.
2. No material belonging to the hospital e.g files, electronic data devices, etc may be taken out of the hospital premises.
3. On completion of the study, a copy of the report will be presented to the Aga Khan University.
4. No part of the study may be published without written permission from The Aga Khan University.

Yours sincerely,


Dr. John Tole
Associate Dean Clinical Affairs &
Chief of Staff

Copy: Loyce Kihungi (Tel. 366 2216)
George Ongete (Tel. 366 2178)

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