



## Hepatitis B Virus infections and associated risk factors among medical waste handlers at the Kenyatta National Hospital, Nairobi Kenya

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### Abstract

**Background:** *Medical waste contains a wide range of potentially harmful microorganisms among which Hepatitis B virus are the most significant pathogens. This study is aimed to determine the sero prevalence of Hepatitis B Virus infection and risk profile among medical waste handlers in Kenyatta National Hospital. A cross sectional study was conducted. A questionnaire was used to capture socio demographic data and factors associated with Hepatitis B Virus infection. Serum samples were obtained from each participant and analyzed for Hepatitis B surface Antigen using the enzyme linked immune absorbent assay. Data analysis was done using SPSS version 22.0. Prevalence was calculated as a proportion of participants who were sero reactive to Hepatitis B Surface Antigen. A total of 185 medical waste handlers were recruited. The mean age was 41.5 years (SD 10.3 years) and 53% were females. The median duration of exposure to medical waste was 15 years (IQR 7.5- 20 years). Prevalence of HBV infection was 2.7% (5 medical waste handlers). There was no significant difference between the infected and uninfected participants in relation to risk profile ( $p > 0.05$ ). In conclusion, the prevalence of HBV among medical waste handlers was of intermediate endemicity in this population. Efforts to eliminate HBV in this population need to focus on increasing awareness, screening, offering universal vaccination and ensure all handlers are trained on infection control.*

**Keywords:** *Hepatitis B Virus, Medical waste handlers.*

## Introduction

Healthcare facilities generate infectious and hazardous waste that may threaten the health of patients themselves, health workers, medical and non-medical waste handlers if the disposal is not properly managed (Shiferaw *et al.*, 2011). Medical wastes (MWs) constitute a larger portion of infectious wastes, which are potentially dangerous, because they may be resistant to treatment and possess high pathogenicity or ability to cause disease (Fayez *et al.*, 2008). MWs consists of a broad range of materials from used lancets, needles and syringes to soiled dressings, biopsies, diagnostic samples, blood/body fluids, medical devices and other materials. Hazardous wastes are normally produced in labor wards, operation theatres, and laboratories (Srinivasa, 2001).

Improper health care waste management causes environmental pollution and infectious waste may lead to the transmission of a wide range of potentially harmful microorganisms such as Human Immunodeficiency virus (HIV), Hepatitis C Virus (HCV) and HBV which is the most significant pathogen and is perhaps the major infectious occupational disease (Shiferaw *et al.*, 2011). Indirect inoculation through improperly collected and/ or segregated sharp materials is considered to be an occupational hazard for MWH in health institutions (Anagaw *et al.*, 2012). Studies from developed countries have shown an increased rate of incidents of sharps injuries associated with waste handling (Fitz Simons *et al.*, 2008). HBV infection is one of the major diseases that cause serious public health problems. About 2 billion people have been infected with HBV, out of which more than 350 million individuals are chronically infected (WHO, 2000). It has been estimated that, annually about 1.2 million people die globally from chronic HBV infection, cirrhosis and liver cancer (Burnett *et al.*, 2005). Globally HBV endemicity ranges from high ( $\geq 8\%$ ) to intermediate (2-7%) and low ( $< 2\%$ ) (Juszzyk, 2000). The prevalence of HBV infection in Africa is on average more than 10%,

classifying the region as one of high endemicity for HBV (Kramvis *et al.*, 2007).

In Kenya recent studies indicate the prevalence of HBV infection is at 5–30% among the general population (Ngaira *et al.*, 2016). Worldwide data on prevalence of HBV infection among MWHs is limited. Studies from developed countries have shown that occupational exposure to waste may result in HBV infection. Studies on sero prevalence of hepatitis B surface antigen (HBsAg) among health care workers have been reported to be 8.1% in Uganda and 9.7% in Ethiopia (Ziraba *et al.*, 2010; Blenkarn *et al.*, 2008). A study in Ethiopia found a HBV prevalence of 6.3% among MWH. The infection occurred upon exposure of MWH to health care waste, needle stick injuries, blunt object injuries, body fluids exposure to mucous membranes, lack of awareness on use of personal protective equipment (PPE) and inaccessibility to HBV vaccine (Yitayal *et al.*, 2011). In developing countries such as Kenya, healthcare wastes is often not segregated as required and hazardous and medical wastes are still handled and disposed-off together with domestic wastes due to inadequate resources to manage the wastes (Kagonji *et al.*, 2011; Abahand *et al.*, 2011). Furthermore waste management is often delegated to poorly educated and untrained laborers, who perform without proper guidance or adequate protection thus creating a great health risk of contracting HBV or other blood borne pathogens.

There is limited data on the prevalence of HBV among medical waste handlers in Kenya and therefore this study sought to determine the prevalence and risk factors associated with HBV infection among MWHs in Kenyatta National Hospital (KNH).

## Materials and Methods

### Study population

KNH has approximately 697 medical waste handlers who are works in different units of the hospital that include clinical areas, laundry, theatres, and wards. A total of 185MWH working

in KNH during the data collection period were included in this study.

### **Sampling procedures**

Simple random sampling technique was employed to recruit study participants. In this technique, all the medical waste handlers meeting the recruitment criteria were approached by a research assistant at their work place where they had the study explained to them in a language they can understand. Those willing to participate were enrolled into the study upon signing a consent form until the desired sample size was attained. Data collection was done through face to face interview using a structured and pre-tested questionnaire.

### **Blood sample collection**

From each of the participants enrolled, about 4-mL single draw whole blood sample was collected into a tube by veni-puncture. This whole blood sample was centrifuged at 10,000g for 10 minutes where serum was separated and stored at -80 °C.

### **Hepatitis B surface antigen ELISA**

Screening for HBsAg in all the 185 MWH was done with an ELISA technique, using the Hepanostika HBsAg Ultra (France), ELISA kit. In this, a sandwich ELISA involving primary and secondary anti-HBV were used to detect HBV surface antigen in plasma. Twenty five (25) micro liters ( $\mu$ l) of specimen diluents was assigned into micro Elisa wells. A 100  $\mu$ l of undiluted sample was added and incubated at 37 degrees Celsius for 60 minutes. Fifty (50)  $\mu$ l of the conjugate solution was added into each well and incubated at 37 degrees Celsius for 60 minutes. Washing was done using the phosphate buffer for six times and 100  $\mu$ l TMB substrate added into each well. The plate at this point was incubated at 15 to 30 degree Celsius for 30 minutes in the dark. Thereafter the reaction was stopped by adding sulfuric acid into each well and the plates were read at 450 nm wavelength.

### **Statistical analysis**

Statistical analysis was conducted using SPSS version 21. The prevalence of HBV among MWH

was presented as a proportion with 95% CI. Factors associated with HBV infection were analyzed using independent t test to compare mean age between those MWH that were infected and those not infected. In addition categorical variables such as marital status, education, vaccination against HBV, trainings on handling medical waste, history of blood transfusion, needle stick injuries, splashes of medical waste on the mucous membrane and PEP accessibility were associated with HBV infection using Chi-square test of association. All statistical tests were interpreted at 5% level of significance (95% CI).

### **Ethical considerations**

The study protocol and the informed consent were reviewed and approved by the University of Nairobi/ Kenyatta National Hospital Ethics and Review Committee (ERC), approval no. P519/09/2017.

## **Results**

### **Demographic and exposure characteristics**

A total of 185 medical waste handlers were recruited. The mean age was 41.5 years (SD 10.3 years) and 53% were females (shown in table 1). Majority were married (66.5%), 27.6% had college level of education, 83.8% were aware of HBV, 3.8% had ever taken a HBV test and only 27% had been vaccinated. The median duration of exposure to medical waste was 15 years (IQR 7.5-20). Less than half (43.2%) of the study population had received training on handling biohazard and pathological waste. Encounter with biological waste splashes and needle stick injuries were at 71.4% and 57.3% respectively. Only 37.8% of those who encountered splashes or sharp/ blunt penetrating injuries washed the sites of injury with running tap water. A few cases (28.1%) were reported to the supervisors and only a small proportion (17.8%) of the study participants knew if their department had an occurrence register/ book for tracking the occupational incidences. Only 8.1% of the participants knew of post exposure prophylaxis (PEP) and where to access it.

**HBV prevalence and risk profile of infection.**

As shown in table 2, the HBV prevalence among the MWH was 2.7% (5).

As shown in table 3, of the total five HBV infected MWH, none of them had either been tested for HBV before the study period or vaccinated against HBV or trained on handling of

pathogenic waste/ occupational health. All the five indicated having experienced a blunt or sharp penetrating injury and splashes onto their mucous membranes with body fluids contained in the biological waste while on duty. Only one among the five HBV infected MWH washed the exposed site with clean running water.

**Table 1:** Demographic and exposure characteristics

Variable	Frequency (%)
<b>Gender</b>	
Male	87 (47.0)
Female	98 (53.0)
<b>Mean age (SD)</b>	41.5 (10.3)
Min-Max	20-60
<b>Marital status</b>	
Single	48 (25.9)
Married	123 (66.5)
Divorced/Widowed	14 (7.6)
<b>Education</b>	
No school	1 (0.5)
Non completion of Primary school	17 (9.2)
Non completion Sec	59 (31.9)
Complete sec school	49 (26.5)
College	51 (27.6)
University	8 (4.3)
<b>Median years of exposure (IQR)</b>	15 (7.5-20)
<b>Knowledge of HBV</b>	
Yes	155 (83.8)
No	30 (16.2)
<b>Ever tested for HBV</b>	
Yes	7 (3.8)
No	178 (96.2)
<b>HBV vaccination</b>	
Yes	50 (27.0)
No	135 (73.0)
<b>Training on infection control</b>	
Yes	80 (43.2)
No	105 (56.8)
<b>Accidental pricks</b>	
Yes	106 (57.3)
No	79 (42.7)
<b>Injury/contact/splash</b>	
Yes	132 (71.4)
No	53 (28.6)
<b>Washed the site of injury</b>	
Yes	70 (37.8)
No	115 (62.2)
<b>Incidence report</b>	
Yes	52 (28.1)
No	133 (71.9)
<b>Recorded the incidence in the occurrence book (OB)</b>	
Yes	33 (17.8)
No	152 (82.2)
<b>PEP accessibility</b>	
Yes	15 (8.1)
No	170 (91.9)

**Table 2:** HBV Prevalence

HBsAg Positive	5 (2.7)
HBsAg Negative	180 (97.3)

**Table 3:** Risk profile of HBV infections

Variable	HBsAg		P value
	Positive	Negative	
<b>Gender</b>			
Male	2 (2.3)	85 (97.7)	1.000
Female	3 (3.1)	95 (96.9)	
<b>Marital status</b>			
Single	1 (2.1)	47 (97.9)	0.449
Married	3 (2.4)	120 (97.6)	
Divorced/widowed	1 (7.1)	13 (92.9)	
<b>Education</b>			
Below primary	1 (5.6)	17 (94.1)	0.335
Secondary and above	4 (2.4)	163 (97.6)	
<b>Median years of exposure (IQR)</b>	16 (16-23)	15 (7-20)	0.224
<b>Knowledge of HBV</b>			
Yes	4 (2.6)	151 (97.4)	0.592
No	1 (3.3)	29 (96.7)	
<b>HBV vaccination</b>			
Yes	0	50 (100.0)	0.325
No	5 (3.7)	129 (96.3)	
<b>Training on infection control</b>			
Yes	0	80 (100.0)	0.071
No	5 (4.8)	100 (95.2)	
<b>Accidental pricks</b>			
Yes	5 (4.7)	101 (95.3)	0.072
No	0	79 (100.0)	
<b>Injury/contact/splash</b>			
Yes	5 (3.8)	127 (96.2)	0.324
No	0	53 (100.0)	
<b>Washed site of injury</b>			
Yes	1 (1.4)	69 (98.6)	0.651
No	4 (3.5)	111 (96.5)	
<b>Recorded the incidence in the OB</b>			
Yes	0	33 (100.0)	0.588
No	5 (3.3)	147 (96.7)	

## Discussion

Data on the infection rates for HBV among MWH in Kenya is rare. Hence the present study determined the seroprevalence of HBV in MWH and possible risk factors observed in this cohort. This study revealed a HBV infection rate of 2.7% (5) among MWH at KNH in Nairobi, Kenya. WHO classifies this region as an intermediate endemicity (with HBV prevalence ranging between 2 and 7%) (WHO, 2009). This study results agree with results from similar studies which reported HBV infection prevalence of 2.3%

among medical waste handlers in Libya (Franka et al., 2009). A lower HBV prevalence of 1.59% among MWH was reported in a Palestinian study (Al-khatib et al., 2009). In contrast, a higher prevalence of 6.0% among MWH was reported in Ethiopia (Anagaw et al., 2012) and 12.9% in Brazil (Ferreira et al., 1999).

None of the observed risk factors showed statistically significant association with HBV infection in this study. However, the rate of exposure to mucous membranes with body fluids and penetrating injuries with blunt or sharp

objects was higher at 71.4% and 57.3% respectively. This is an indication of the poor standards of occupational safety practices at the study site due to underutilization of the available personal protective equipment probably due to lack of training, supervision and routine assessment. Blood borne infection can occur through a sharp or blunt penetration injury and splash inoculation into the eyes and the mucous membranes (Blenkhard et al., 2008). In an Italian study among the MWH, needle stick pricks was the most common source of exposure (58.4%), where exposure to the mucous membrane was 22.7% (Ippolito et al., 1993). In our study, the MWH indicated how sharp containers are incorrectly and inadequately closed. They cited that sharps were carelessly discarded into waste sacks intended for soft waste by the health care workers and also indicated carrying overfilled waste bags. This study established that waste was not properly segregated according to the definite standards.

Provision of education to waste handlers and waste treatment facility operators is essential in any health institution. This should focus on equipping the MWH with skills to handle pathogenic waste, transport waste and manage spills. With adequate training, risk of injuries would be minimal translating to effective waste management (Health and safety training, 2007).

In this study, only 43.2% of the participants had been trained on occupational health and handling of pathogenic wastes. Of the total MWH infected with HBV, none of them had been trained, thus increasing their risk chances of acquiring the infection while on duty.

Vaccination against HBV in cohorts at risk of acquiring HBV, such as health care workers has demonstrated the effectiveness of the HBV vaccine in preventing new infections (Lanphear et al., 1993). In this study only 3.8% of the study participants had tested for HBV and only 27% had been vaccinated against the infectious virus. The low rate of vaccination is comparable to studies conducted among MWH in Turkey (27.5%),

Libya (27.5%) and UK (21%) (Franka, 2009; Zeynep, 2008, Blenkham, 2008). This indicates the low utilization of the HBV vaccine among this risk group probably due lack of knowledge, sensitization and occupational health trainings.

A small proportion (17.8%) of the MWH knew of an existing occurrence register in their area of operation. All of the five HBV infected MWH did not know the use and existence of an occurrence register. The under reporting could be due to fear of reprisal and individual recall bias. This indicates that almost all waste handling errors and injuries were not documented, thus there lacked an accident management policy in the units studied. Documentation of the incidences in the occurrence register is paramount to prevention of re- occurrence. It is also useful in forming interventional strategies during policy development and regulations. Less than a third of the study population (28.1%) reported their exposure incidences to their supervisors. PEP was only accessible to 8.1% percent, whereas none of the infected MWH understood the use of PEP and where to access it.

### **Limitations**

The study did not determine if the study population had antibodies to HBV (anti- HB), indicating previous exposure. It was also difficult to establish whether those infections occurred before or after employment as MWH, since there was no HBV screening at the time of employment leading to lack of cause and effect relationship.

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