

# Incidence of occupational exposures in a tertiary health care center

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## Abstract

**Introduction:** Occupational exposure to Hepatitis B virus (HBV), human immunodeficiency virus (HIV) and Hepatitis C virus (HCV) infection is a cause of concern to all health care workers (HCWs), especially those, in hospitals. Among the HCWs, nurses, interns, technicians, resident doctors and housekeeping staff have the highest incidence of occupational exposure. **Aims:** To analyze the cases of needle stick injuries and other exposures to patient's blood or body fluids among health care workers. **Materials and Methods:** A detailed account of the exposure is documented which includes incidence of needle stick injuries (NSI) and implementation of post-exposure prophylaxis (PEP) as per the hospital guidelines. We report a two-year continuing surveillance study where 255 health care workers (HCWs) were included. PEP was given to HCWs sustaining NSI or exposures to blood and body fluids when the source is known sero-positive or even unknown where the risk of transmission is high. Follow-up of these HCW's was done after three and six months of exposure. **Results:** Of the 255 HCWs, 59 sustained needle stick injuries and two were exposed to splashes. 31 of the NSI were from known sources and 28 from unknown sources. From known sources, thirteen were seropositive; seven for HIV, three for HCV and three for HBV. Nineteen of them sustained needle stick during needle re-capping, six of them during clean up, six of them while discarding into the container, 17 during administration of injection, eight of them during suturing, two occurred in restless patient, 17 during needle disposal. **Conclusion:** So far, no case of sero-conversion as a result of needle stick injuries was reported at our center.

**Key words:** Human immunodeficiency virus, hepatitis B and C virus, Occupational exposure, post-exposure prophylaxis

## INTRODUCTION

Health care workers are at a high risk of exposure to blood and body fluids. Needle stick injuries, cuts and splashes are common occupational accidents exposing health care providers to different blood borne pathogens. The transmission of Hepatitis B virus, HIV and HCV has been related to injuries and frequency of exposure. According to WHO, 2.5 % of

HIV cases, 40% of HBV and HCV cases worldwide are the result of occupational exposure among health care workers.<sup>[1]</sup> The first report of HIV transmitted to a HCW as a result of an NSI was published in 1984.<sup>[2]</sup> Adherence to standard precautions, awareness about post exposure prophylaxis (PEP) is poor in developing countries among HCWs and documentation of exposures are suboptimal.<sup>[1]</sup> There are very few studies in India documenting the frequency, PEP protocols followed and consequences of needle stick injuries.<sup>[3-5]</sup>

## MATERIALS AND METHODS

A cross-sectional study among a selected group of health care providers was carried out during a period of two years from Jan 2009 to Jan 2011

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at A.J. Institute of Medical Sciences, Kuntikana, Mangalore. This study was undertaken to estimate the incidence of needle stick injuries and exposure to body fluids among HCW's and to understand Healthcare worker's perception of risk of occupational exposure to needles, blood and body fluids, to find out the correlates of exposure and to identify groups at high risk of sustaining maximum number of such exposures. Detailed account of the exposure along with their hepatitis B immunization status, the type of injury, degree of exposure, type of device and the source of exposure was documented on a reporting form. After approval from institutional ethical review committee, healthcare workers who are expected to be at risk of occupational exposure were included. Self reported cases and few other cases based on a questionnaire adapted from Centre for Disease Control(CDC) was used for data collection.<sup>[6]</sup> The set of questions was on occupational exposure in the last one year as shown in Table 1. Questions were asked about exposure to splash, circumstances of NSI, the activity that led to injury and the place of injury. All these questions had forced options. Other questions were about whom they would contact if exposed and reasons for not reporting the exposure (both had forced options). The last set of questions was on post exposure events - knowledge about availability of testing and treatment in their hospital as shown in the table. All occupational exposure to blood and body fluids are managed as per the hospital guidelines.

### **Inclusion criteria**

Health care workers who sustained injury or exposed to blood or body fluids while on duty were included.

### **Exclusion criteria**

Health care workers who sustained injury or exposed to blood or body fluids outside the hospital were excluded

Hospital has a protocol for management of healthcare workers following occupational exposure to blood borne pathogens. Following an accidental exposure to blood or hazardous body fluids, the HCW was asked immediately to wash the site with soap and water; rinse nose, mouth and eyes with copious amounts of saline or tap water. Infection control nurse (ICN) was informed about the incident and follow-up was carried out by the ICN for the affected HCW. ICN recorded the incidence and sequence of events and the Physician was asked to assess the risk and advice for PEP immediately.

Health care workers were instructed to thoroughly wash the site with water and soap or an antiseptic solution and asked to immediately report to infection

control nurse (ICN). Detailed account of the exposure along with their hepatitis B immunization status, the type of injury and degree of exposure was also recorded along with the device of exposure on a reporting form. If the exposure occurred from a known source, the source's blood was collected for HBsAg, anti-HIV antibody and anti- HCV antibody testing. All sera were initially tested for HBsAg, anti-HIV antibody and anti- HCV antibody by enzyme linked immuno-sorbent Assay(ELISA) test (manufactured by J. Mitra diagnostics Microlisa-HIV ELISA, J. Mitra diagnostics Microlisa-HCV ELISA, J. Mitra diagnostics Hepalisa-HBsAg ELISA, Eliscan HIV 1/2 3<sup>rd</sup> generation ELISA kit, Eliscan HCV 3<sup>rd</sup> generation ELISA kit, HBsAg 3<sup>rd</sup> generation ELISA kit). This is a qualitative assay, each micro-well being coated with recombinant HCV antigen, HBV antibody and HIV antigen respectively. Positive sera were confirmed by repeat ELISA.

Simultaneously, the HCW's blood was also collected. If the source blood tested was negative, the HCW's blood was not tested further. If the source blood was positive for HBsAg, anti-HIV antibody or anti-HCV antibody, then the HCW's blood was also tested for baseline serostatus. The tests were repeated after a period of 3 months and 6 months in all exposed health care workers.

Appropriate PEP, as recommended by the Centre for Disease Control is administered to the affected health care worker.<sup>[7,8]</sup> An effective surveillance system is essential to safeguard the HCW's. According to previous studies, nurses are the group most at risk in any health care establishment.<sup>[9]</sup>

In a vaccinated individual if the source of infection is HBsAg positive, the post-vaccination anti-HBs level was estimated. An anti-HBs level >10 IU/ml is known to be protective. In such instances either no action may be taken or a booster dose of vaccine may be given. If anti-HBs level estimated is < 10 mIU/ml, a full course of vaccination is given. If anti-HBs level is between 10 and 100 mIU/ mL, a booster dose is given and if anti-HBs level is more than 100mIU/mL, the HCW is reassured.

If the post-vaccination anti-HBs level is not sufficient or a post-vaccination result is not available, Hepatitis B immunoglobulin (HBIG) is given followed by a booster dose of Hepatitis B vaccine.

If the source of infection is HBsAg negative, no action is necessary. The anti-HBs level in the injured is assessed. In an unvaccinated individual, one dose of HBIG is given within 72 h of exposure

**Table 1: Sample survey of healthcare personnel on occupational exposure to blood and body fluids / needle/sharp device information**

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Which of the following best describes your occupation/work area? (Check one.)

<input type="checkbox"/> Nursing staff	<input type="checkbox"/> Transport service
<input type="checkbox"/> Surgical staff	<input type="checkbox"/> Central supply staff
<input type="checkbox"/> Medical staff	<input type="checkbox"/> Maintenance/engineering staff
<input type="checkbox"/> Laboratory staff	<input type="checkbox"/> Housekeeping/Laundry services
<input type="checkbox"/> Dental staff	<input type="checkbox"/> Other staff
<input type="checkbox"/> Phlebotomy team	<input type="checkbox"/> Security
<input type="checkbox"/> Technician	<input type="checkbox"/> Medical / Dental / Other student

Which shift do you usually work?

1<sup>st</sup>                       2<sup>nd</sup>                       3<sup>rd</sup>

In the past 12 months, have you been injured by a sharp object OR exposed to blood/body fluids ?

No                       Yes                       Don't know if the object was previously used on a patient

If you had an exposure did you report? Please indicate the reasons for not reporting:  
(Tick all that apply)

Circumstance

Manipulating needle in patient

Manipulating needle in IV line

Suturing

Recapping

Discarding sharp into container

During clean-up

Other

Who would you contact first if you were injured by a needle or sharp object, or if you were exposed to blood or body fluid?

Supervisor

Occupational/employee health

Infection control nurse

Emergency room

Personal physician

Don't know

Would not contact anyone

Type of Exposure : Percutaneous (Needle or sharp object that was in contact with blood or body fluids)

Mucocutaneous : Mucous Membrane                       Skin                       Bite

Type of fluid or material:

Blood/blood products                       Visibly blood+ body fluid

Non-visibly blood + body fluid                       Visibly bloody solution

Body site of exposure:  Hand/finger/Eye/Mouth/nose/Face/Arm/Leg/Other:.....

If percutaneous exposure: Depth of injury

Superficial (e.g., scratch, no or little blood)

Moderate (e.g., penetrated through skin, wound bled)

Deep (e.g., intramuscular penetration)                       Unsure/Unknown

Was blood visible on device before exposure?                       Yes                       No                       Unsure/Unknown

If mucous membrane or skin exposure: (Check only one.)

Approximate volume :  Small (e.g., few drops)                       Large (e.g., major blood splash)

If skin exposure, was skin intact?                       Yes                       No                       Unsure/Unknown

Was the source individual identified?                       Yes                       No                       Unsure/Unknown

Provide the serostatus of the source patient for the following pathogens:

	Positive	Negative	Unknown
HIV Antibody	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HCV Antibody	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HBsAg	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Table 1: continues...

**Table 1: Continued**


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If known, when was the serostatus of the source determined?

At the time of exposure Post-exposure Testing

If you had an exposure that you did not report, please indicate the reasons

No time to report

I did not know the reporting procedure

I was Concerned about confidentiality

I thought I might be blamed or get in trouble for having the exposure

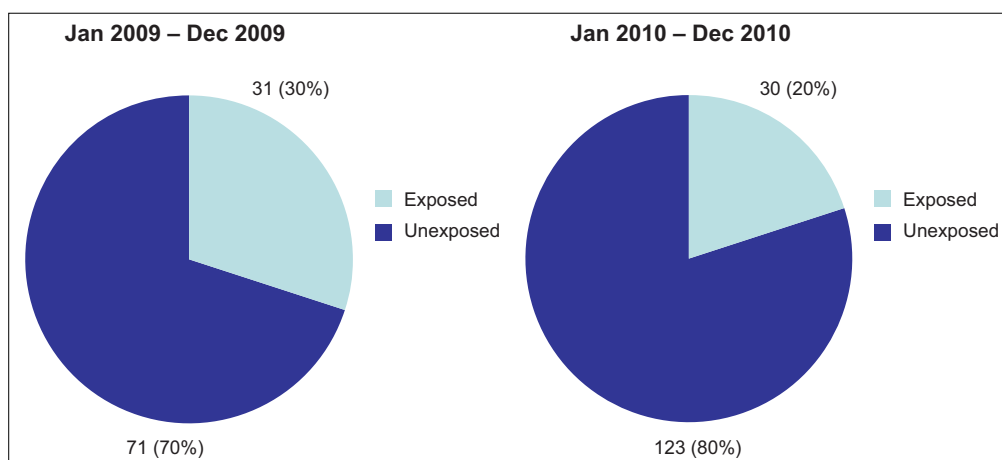
I thought the source patient was low risk for HIV and/or hepatitis B or C

I thought the type of exposure was low risk for HIV and/or hepatitis B or C

I did not think it was important to report

Other : \_\_\_\_\_)

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**Figure 1: Incidence of Needle Stick Injuries at AJ Hospital**

(0.06 ml / kg body wt. I.M). An accelerated course of active immunization is started two weeks later.

If the source of infection is HIV positive, then the HCW was started immediately on antiretroviral therapy, which involves taking Zidovudine (ZDV), for 28 days. In addition to ZDV, Lamivudine and Indinavir (protease inhibitor) are also offered. Characteristics of the exposure and the source patient will be taken into consideration when recommending PEP.

The risk of transmission of Hepatitis C virus is 1.8%.<sup>[10]</sup> If the source of infection is HCV positive, since no post-exposure prophylaxis is available, the tests for anti-HCV antibodies and liver function test need to be done at the time of exposure.

The risk increased for exposures to blood from source patients with terminal illness, probably reflecting the higher titer of HIV in blood late in the course of AIDS. Although failures of Zidovudine post-exposure prophylaxis (ZDV PEP) have occurred, ZDV PEP is associated with a decrease of approximately 79% in the risk for HIV

seroconversion after percutaneous exposure to HIV-infected blood. If the exposure involved a larger quantity of blood, indicated by a device visibly contaminated with the patient's blood, a procedure that involved a needle placed directly in a vein or artery, or a deep injury then there is an increased risk of transmission of virus.<sup>[11,12]</sup>

## RESULTS

A selected group of health care providers were included in our study during a period of two years from Jan 2009 to Jan 2011 at A.J. Institute of Medical Sciences, Kuntikana, Mangalore. A comparison of the healthcare worker's exposure to occupational health care hazards during the period of two years is shown in Figure 1. Out of the 255 HCWs, 59 sustained needle stick injuries and two were exposed to splashes making a total of 61 exposures. 31 of the NSI were from known sources and 28 from unknown sources. Most needle stick injuries involved the hospital nurses as shown in Table 2. Majority of them got injured during their first shift as shown in Table 3. From known sources, 13 were seropositive; seven for HIV, three for HCV

and three for HBV. Nineteen of them sustained needle stick injuries during needle recapping, six of them during clean up, six of them while discarding into the container, 17 during manipulating needle in patient or injection administration, eight of them during suturing, two in restless patient, 17 during needle disposal. No one received ZDV alone (irrespective of whether it was minimum, moderate or high risk exposure). Seven of the HIV exposed HCWs received triple drug combinations and were followed up after 3 months and after 6 months. When repeat ELISA was negative, we called it as no seroconversion. All the seven of them received PEP for a duration of three months. The prophylaxis was started within 24 h of exposure. No seroconversion occurred for HIV, HBV or HCV. The tests were repeated after a period of 3 months and again after 6 months for all the exposed health care workers. So far, no cases of sero-conversion as a result of needle stick injuries or exposures were reported at our center. Thirty-six of the 61 affected contacted ICN, five of them reported to the emergency room, five of them contacted the personal physician, one of them contacted employee health officer, 14 of them revealed their status only after the distribution of the questionnaire. In our study too, the most common site of exposure is the finger of the non dominant hand as reported in other studies as recapping was the most common cause of needle stick injury. Most of them sustained injury during their first shift of duty as reported elsewhere due to the number of cases admitted during the day time and investigations sent for during that time compared to the rest of the time in the day as shown in Table 3.

**Table 2: Categories of exposed HCWs**

Year	2009	2010
Medical staff	2	0
Surgical staff	3	0
Nursing staff	14	26
Housekeeping staff	2	2
Laboratory technicians	6	1
Students	3	1

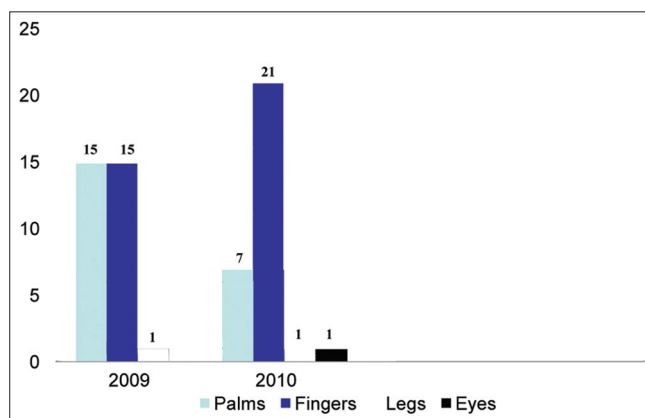
**Table 3: Shift-wise distribution of exposure**

Year	2009	2010
1 <sup>st</sup> Shift	26	27
2 <sup>nd</sup> Shift	5	3
3 <sup>rd</sup> Shift	0	0

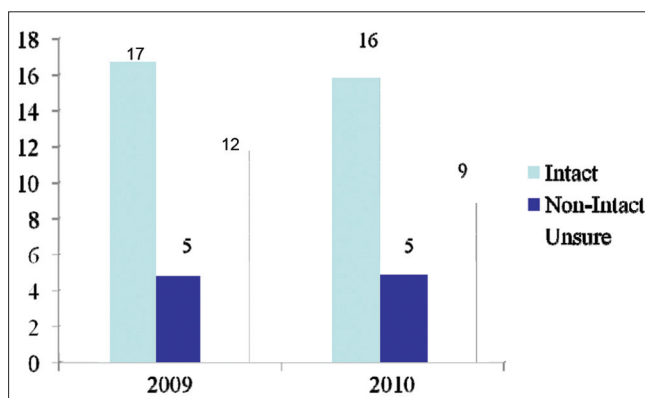
**Table 4: Sero-status of source**

Sero-status of Source	2009	2010
HIV positive	4	3
HBsAg positive	2	1
HCV positive	2	1

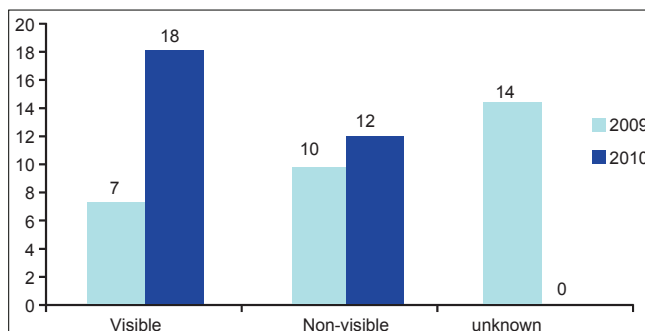
Based on the self-reported cases and the survey questionnaire, the site of exposure, status of the skin on exposure, presence of visible blood and the depth of injury are shown in Figures 2, 3, 4 and 5. Few of the reasons mentioned for not reporting the incidence to the higher authorities are as follows: Ten of them did not know reporting procedures, nine of them were concerned about their confidentiality, three of them thought the source was low risk for HIV/HCV/HBV, one of them thought the type of exposure was low risk for HIV/HCV/HBV and four of them did not think it was important to report. The sero-status of the patient's who could be the source of the infection among the healthcare workers



**Figure 2: Site of Exposure**



**Figure 3: Status of skin on Exposure**



**Figure 4: Presence of Blood**

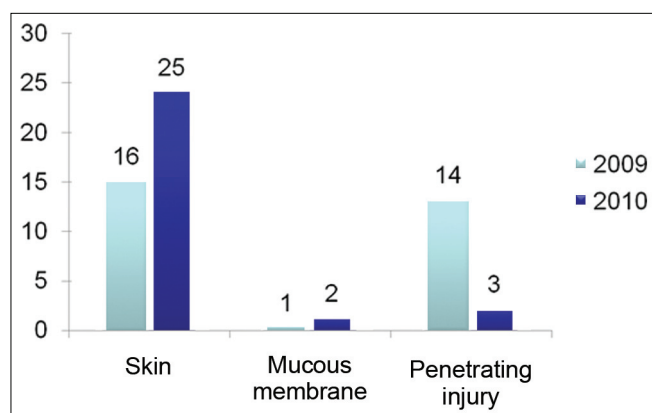


Figure 5: Depth of Injury

exposed is as shown in Table 4. However, no sero-conversion was observed among these healthcare workers who were followed up for over a period of six months.

## DISCUSSION

Infection due to blood borne pathogens can be greatly reduced by strictly practicing infection control guidelines. These include hand washing, use of personal protective equipments, training of the staff, having a check on the proper disposal of waste, and good surveillance system on hospital-acquired infections. Many studies have shown that risk assessment may not be possible in patients with massive bleeding, severe trauma, cardiac or central nervous system emergencies presenting to casualty.<sup>[13]</sup> Hence, it becomes important for all the HCWs to practice standard precautions at all times for all patients. There is no justification for taking any discriminatory measures of safety precautions based on the sero-status of the individual, as some patients may be in the window period of infection and may be non reactive for HIV and HCV antibodies, but can transmit the disease. Our study emphasizes the need for stringent practice of standard precautions irrespective of the HIV status, by all HCW's at all levels. According to the WHO, nurses are the group most at risk in any healthcare setup which was in concordance with our study too. Among the 59 accidental needle stick injuries reported in our study, 19 were due to recapping of needles. Hence, to avoid needle stick injuries, vacutainer should be placed on the surface of the table and then re-cap the needle or newer devices should be designed so that the HCW's are protected to certain extent from NSI.

The percentage of people who did not report the incidence of exposure was found to be 23% in

our study. Under-reporting of cases is reported in many other studies which has been observed in our study too.<sup>[14-17]</sup> This study has analyzed across different categories of HCW's perception of risk of occupational exposure to blood borne infections. Many students, (both medical and nursing) felt that it was not important to report. Regular training of the healthcare workers is absolutely essential across all levels of occupation groups for reducing the incidence of NSI and exposure to blood and body fluids. Incidence of occupational exposures is inversely related to training.<sup>[18]</sup> Hospitals should therefore focus on policies for reducing transmission, and should create awareness among both staff and students about the safety precautions by conducting seminars, sessions, and training programs from time to time.

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