

# Occupational Blood Exposures in Health Care Workers at a Tertiary Teaching Hospital: Incidence, Characteristics and Transmission of Blood Borne Pathogens

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## Abstract

Health care workers (HCW) are at risk of contracting Hepatitis B, Hepatitis C and Human immunodeficiency viruses through Occupational Blood Exposure (OBE). Information on the incidence rate, epidemiological characteristics and transmission rate are essential to formulate effective preventive measures and management of OBE. From June-2016 to May-2018, OBE among HCW were captured systematically in EPINet (Exposure prevention information network) Register through Self reporting system. Data on number of in-patient days was collected. Incidence rate, epidemiological characteristics and transmission rate were analyzed and evaluated. Sixty seven OBE incidents were reported by HCWs accounting to an incidence rate of 0.2/1000 in-patient days. Of these, 94% were Needle stick injuries and 6% were Blood and body fluid exposures. OBE incidents occurred mainly in wards, emergency department and operation theatre with a rate of 38.8%, 35.8% and 14.9% respectively. Exposures were encountered mainly by Interns (32.8%), staff-nurses (22.4%), Post-graduate students (14.9%) and Nursing students (14.9%). Recapping of the needle was the activity which led to OBE in 37.3% and improper disposal of sharps in 22.38 % of the incidents. In addition, 19.4% and 8.95% of the incidents were due to accidental and patient factors respectively. None of the followed-up HCWs at the end of 6 months were infected by these exposures. The study brings out the epidemiological characteristics of OBE and throws a light on the target population among HCW who require more awareness and training to prevent OBE.

**Keywords:** Needle stick injury, Safe injection practices, Health care workers, Occupational blood exposures

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## INTRODUCTION

Health care workers (HCW) are at increased risk of coming in contact with patients' blood and body fluids and thereby contracting blood borne pathogens. Many infections can get transmitted through Occupational blood exposure including, Hepatitis B virus (HBV), Hepatitis C virus (HCV) and Human immunodeficiency virus (HIV) infections<sup>1</sup>. An Occupational Blood Exposure (OBE) is a percutaneous injury (e.g. a needle stick injury or cut with a previously used sharp medical device) or contact between a mucous membrane or non-intact skin with blood, tissue, or other body fluids that may place a HCW at risk of HBV, HCV, or HIV infection<sup>1</sup>. OBEs are common and to an extent inevitable in HCWs during patient care. According to WHO, out of 35 million HCWs worldwide, 3 million experience OBE. These exposures result in 70,000 HBV, 15,000 HCV and 500 HIV infections<sup>2</sup>. Due to OBE, the risk of transmission of infections range from as low as 0.2–0.5% for HIV to as high as 3–10% for HCV and 30% for HBV<sup>3,4</sup>. More than 90% of these infections occur in developing countries<sup>2</sup>. Also, OBEs result in significant psychological stress, depression and management costs<sup>5</sup>.

Though health care organizations have protocols to manage OBEs, OBE rates which reflect the lacunae in preventive protocols and negligence among HCWs and OBE associated infections in HCW are poorly evaluated<sup>6</sup>. All health-care institutions should ensure that HCW receive training to recognize and report occupational blood exposures. It should have a system in place to facilitate reporting such as designating a clinical area for reporting, wherein the working system is the same for 24 hours and which is readily accessible, ideally the emergency department. Also, the postexposure assessment process and prophylaxis should readily be available in such areas for timely management of the HCW<sup>7</sup>. Information on the incidence rate, epidemiological characteristics and transmission rates are essential to formulate effective preventive measures like adhering to universal precautions, safe injection practices and immunization against Hepatitis B. Very few studies have been done on OBE in developing countries and there is no data available in our region<sup>3</sup>. The aim of this study is to determine the incidence rate and epidemiological characteristics of OBE among HCWs and evaluate

the transmission rate of HBV, HIV and HCV due to these exposures.

## MATERIALS AND METHODS

This observational prospective study was conducted at R.L. Jalappa hospital and research centre in southern India which is a tertiary care teaching hospital. It is a 1000 bedded tertiary care hospital with about 1100 - 1200 Health care workers at any given point of time involved in direct patient care; 200 consultants, 150 interns, 130 post graduate students, 590 nurses and nursing students, 82 housekeeping staff and 45 laboratory technicians.

Over a period of 2 years from June 1, 2016 to May 31, 2018, occupational blood exposures in health care workers were captured regularly and systematically in the EPINet (Exposure prevention information network) register through self-reporting system as per the Hospital infection control committee protocol<sup>7,8</sup>. According to the protocol, the exposed HCW reported to the physician on duty in the Emergency department as early as possible after the exposure, after taking the first aid measures. Serum samples from such exposed HCWs and the source patient (if the source patient was known) were drawn and sent to the laboratory immediately for HIV and HBsAg testing. Testing for HIV 1 and 2 was done by three different methods; Chemiluminescence assay, HIV Tridot and Aspen test, and reported as per the NACO guidelines<sup>9</sup>. HBsAg for Hepatitis B infection was tested by chemiluminescence immunoassay and immunochromatography. The OBE incident report was obtained from the exposed HCW by the infection control team which included the following; demographic details of the HCW, designation of the HCW, place of incidence, activity which led to incident, type of injury, severity of injury, site of injury, hepatitis B immunization status of the HCW, immediate first aid measures taken like washing the injured area and the HIV and Hepatitis B status of the source patient if known. Data on the number of Health care workers in the hospital was obtained and the number of in-patient days on monthly basis were collected from the Tracking registers from all the patient care areas in the hospital. HCWs who got exposed to HIV seropositive patients were given a stat dose of Tenofovir 300mg + Lamivudine

300mg + Efavirenz 600mg as antiretroviral therapy (ART) in the Emergency department as per the instruction by the physician and further referred to the integrated testing and counselling centre (ICTC) attached to our hospital where they were treated with Tenofovir 300mg + Lamivudine 300mg + Efavirenz 600mg ART drugs for a period of 28 days. For follow-up, all HCWs were counselled and advised to get tested after 6 weeks, 3 months, and finally after 6 months. The outcome of such exposed HCWs was recorded.

#### Statistical analysis

All data were entered into Microsoft excel using *SPSS statistical software (version 22)*. Incidence rate of OBE in a month was calculated by the formula<sup>8</sup>.

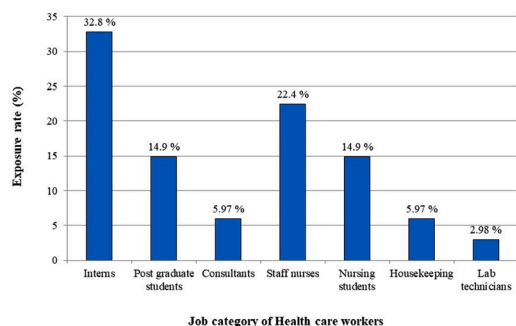
$\text{No. of OBEs in a month} \div \text{No. of inpatient days in a month} \times 1000$

The overall incidence over a period of 2 years was calculated by summing the monthly data. Epidemiological characteristics were analysed and evaluated.

## RESULTS

There were a total of 67 OBE incidents reported by health care workers and 3,35,000 inpatient days at R.L. Jalappa hospital and research centre, over a period of 2 years from June-2016 to May-2018 accounting to an OBE incidence rate of 0.2/1000 in-patient days. Of these, 63(94%) exposures were Needle stick injuries or sharp injuries and 4(6%) were Blood and body fluid exposures.

With regard to the clinical areas, OBE incidents occurred mainly in wards and Emergency department. In the wards, there were 26 incidents accounting to a rate of 38.8% and in the emergency department, there were 24 incidents with a rate



**Fig. 1.** Job category of health care workers who had OBE

**Table 1.** Clinical areas Where OBE occurred

Clinical area where incident occurred	n / %
Wards	26 (38.8)
Emergency department	24 (35.8)
Operation theatre	10 (14.92)
Paediatric ICU	03 (4.47)
Blood bank	02 (2.98)
Adult ICU	01 (1.5)
Dialysis unit	01 (1.5)
Total	67 (100%)

of 35.8%. Ten exposures were reported from operation theatre contributing for 14.9% of incidents. Different clinical areas where the OBE incidents occurred is depicted in Table 1. Other areas which had OBE incidents are pediatric ICU, blood bank, adult ICU and dialysis unit with rates of 4.47%, 2.98%, 1.5% and 1.5% respectively.

OBE among different category of HCWs is represented in Fig. 1. Exposures were encountered mainly by doctors (36/67, 53.73%); Interns, Post-graduate students and consultants had 32.8%, 14.9% and 5.97% of the exposures respectively. The incidents among the nurses accounted for 37.3% (25/67 incidents); 22.4% of the incidents occurred among staff nurses and 14.9% of the incidents occurred in nursing students. Unfortunately, housekeeping staff who are not directly involved in patient care, also got exposed due to improper sharp disposal methods by other HCWs and accounted for 5.97% (4/67) of the incidents. The least rate of 2.98% (2/67 incidents) was seen among laboratory technicians.

Exposure rate based on the incidents among different category of health care workers based on the total number of workers in each category is shown in Fig. 2. Exposure rate was 3.75% (36/960), 2.59% (15/580), 2.44% (4/164), 2.22% (2/90) and 1.67% (10/600) among doctors, staff nurses, house keepers, laboratory technicians and nursing students respectively.

The activity leading to the incident or the cause for these exposures is shown in Fig. 3. Recapping of the needle was the most common activity which led to OBE in 37.3% of the incidents followed by improper sharp disposal methods in 22.38% of the incidents. It was found that inadequate skills were the cause for the incidents

in 11.94% of the exposures. To highlight the fact that exposures are inevitable at times in spite of effective training of health care workers and following vigilant practices, there were 19.4% and 8.95% of the incidents due to accidental and patient factors respectively.

All exposed health care workers were managed as per the NACO guidelines. Among 67 exposures, the source patients were positive for HIV and HBsAg in 4 cases each and source was unknown in 1 case. In 4/67 incidents, where the source patients were positive for HIV and in 1 incident, where the source was unknown, the healthcare workers were treated with antiretroviral drugs for a period of 28 days with counselling and monitoring. In other 4/67 incidents, where the source patients were positive for HBsAg, the exposed health care workers were tested for the anti HBs antibody titres. Three HCWs had protective Anti HBs titres whereas only 1 HCW had inadequate antibody titres; this health care worker was administered Hepatitis B immunoglobulin within 48 hours of exposure and Hepatitis B vaccine series was started and

completed. Overall, 61 individuals did not require any Post exposure prophylaxis.

Out of 67 exposed HCWs, 15 were lost for follow up. Remaining 52 exposed HCWs were tested for HIV and HBsAg after 6 weeks, 3 months and finally at the end of 6 months after the incident. None of these followed up HCWs were infected by these exposures.

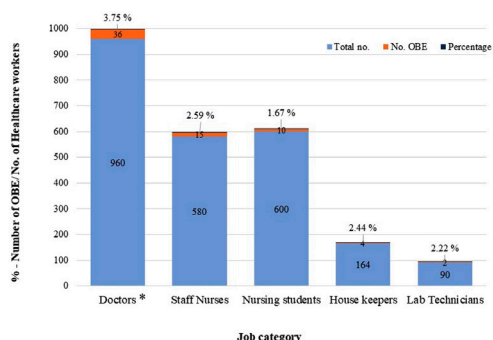
## DISCUSSION

Occupational blood exposures in the form of sharp injuries and splashes of blood and body fluids are common among health-care workers which make them vulnerable for developing many blood-borne infectious diseases. Occupational exposures are common in the developing countries and it is believed that 40–75% of these exposures are not reported. Unreported exposures are a serious problem; they lead to HCWs not receiving post exposure prophylaxis (PEP) against HIV and hepatitis B placing them at risk of developing these infections<sup>10</sup>.

Our study found an OBE incidence rate of 0.2/1000 inpatient-days. The incidence is less when compared to other studies<sup>11</sup>. Regular induction training and periodic training of all category of health care workers on occupational blood exposures and the importance of its reporting and management led to good reporting system in our study as well as helped to achieve a low incidence rate.

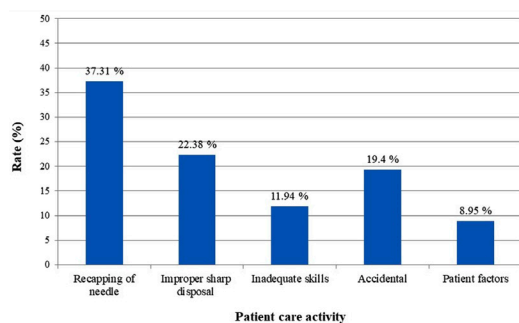
With regard to the clinical areas, incidents occurred mainly in wards (38.8%) and Emergency department (35.8%) followed by Operation theatre (14.92%). This is similar to the findings in a study done by Lee et al.<sup>6</sup>

Among job categories, exposures were encountered mainly by Doctors who contributed for 53.73% of the incidents, followed by staff-nurses (22.4%) and others which is in concordance with other studies<sup>3,12</sup>. Among doctors, interns and post graduate students accounted for majority of the incidents which corresponds with other reports from India<sup>13,14</sup>. This is probably because they are more commonly involved in clinical procedures in our set up as it is a teaching hospital. Most of the exposures occurred in newly joined interns and post graduate students. This can be attributed to factors like, lack of experience, less knowledge regarding safe injection practices and



\* Doctors: Interns, Post graduate students and Consultants

**Fig. 2.** Exposure rate among different category of health care workers



**Fig. 3.** Health care activity leading to OBE

handling the heavy workload of patients under pressure situations.

With respect to the health care activities leading to OBE, accidental events, patient factors and inadequate skills together accounted for the majority of incidents (40.3%) which are very difficult to prevent. Although, it may not be practically feasible to avoid their occurrence altogether, it can be minimized to a large extent by following safe practices. Recapping of needle and improper disposal of needle accounted for 37.31% and 22.38% of the OBE incidents respectively and similar findings were reported by a study at Delhi<sup>15</sup>. Even though, the contaminated needles and other contaminated sharps should not be bent, recapped, or removed, many studies have revealed that recapping is still prevalent among HCWs which also holds good in this study<sup>11,15</sup>. To emphasise on these preventable aspects of OBEs and the importance of OBE reporting, our hospital has implemented induction training for new HCWs and annual continuing education for all HCWs. The present study did not show any seroconversion in HCWs who could be followed up after OBE. Our hospital's strict infection control policy being in place with timely management of the exposed HCWs as per guidelines, likely contributed to achieve this. Although, there was no transmission in these HCWs, this could be finally known only after 6 months of the OBE incident. Therefore, after the incident and during the period of follow-up, HCWs went through severe psychological stress anticipating negative consequences. Few studies have shown the transmission in exposed individuals<sup>6</sup>.

## CONCLUSION

The study brings out the epidemiological characteristics of exposed health care workers, thereby throwing a light on the target population who require more awareness and training to prevent OBE. Every effort should be made to prevent OBE through education and implementation of safe injection and working practices. Providing initial and continuing training for health care workers is very important. Prevention of OBE by adhering to the universal precautions, must remain a priority in any healthcare setting to prevent the transmission of HIV, Hepatitis B and HCV as well as to avoid the psychological trauma.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## FUNDING

None.

## AUTHORS' CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

## DATA AVAILABILITY

All datasets generated or analyzed during this study are included in the manuscript.

## ETHICS STATEMENT

The study was approved by the institutional Ethics committee (IEC).

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