

**Occupational Exposure to Blood-borne viruses among Healthcare Professionals in a Tertiary Hospital: present and past trends**

**Yashaswini M.K<sup>a</sup>, Praveen Kumar<sup>b</sup>, Lakshminarayana Sura Anjanappa<sup>a</sup>, Kirtilaxmi Benachinmardi<sup>\*a</sup>, Chandrakala. M<sup>c</sup>**

<sup>a</sup>Department of Microbiology, Rajarajeswari Medical College and Hospital, Bangalore, Karnataka, India-560074.

<sup>b</sup>Department of ENT, Rajarajeswari Medical College and Hospital, Bangalore, Karnataka, India-560074.

<sup>c</sup>Department of Community Medicine, Rajarajeswari Medical College and Hospital, Bangalore, Karnataka, India-560074

**Abstract**

**Background:** Healthcare workers (HCW) often neglect their occupational safety, while providing quality care to the patients.

**Objectives:** To know the prevalence and risk factors involved in transmission of Blood-borne viruses (BBV) to HCW and also to see the changes in prevalence in past 5 years and the factors involved in the changing trend.

**Materials and methods:** This is a cross sectional study for 5 years. Since January 2018, every reported occupational exposure of HCW in the hospital has been registered by the Hospital Infection Control Committee (HICC). Occupational exposure includes needle stick injuries, cutting and scratching with a sharp object, body fluids splash etc. Details of HCW exposed to BBV were recorded.

**Results:** From 2018 to 2022, a total of 186 (23.48%) HCW were exposed to blood and body fluids. Year wise occupational exposure rate was 5.43%, 5.2%, 4.2%, 4.2% and 4.54% for the year 2018, 2019, 2020, 2021 and 2022 respectively. Over 5 years, needle stick injury (38%) was the most common occupational exposure (OE). During 2018 and 19, nurses were most affected, whereas in 2020, 21, and 22 housekeeping staff were most commonly affected. 92.7% of HCW attended regular HIC training sessions.

**Conclusion:** A safe workplace can be provided to HCW by having a good administrative health policy, guidelines for the use of PPE, providing adequate PPE, regular training of HCW regarding the appropriate use of PPE, and BMW management.

**Keywords:** Blood borne viruses (BBV); Occupational exposure; Needle stick injury (NSI); Health Care Workers (HCW).

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**\*Correspondence:** [chandrakala.mallik@gmail.com](mailto:chandrakala.mallik@gmail.com)

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## Introduction

Healthcare workers (HCW) are always at risk of acquiring infectious diseases in addition to other hazards, compared to different occupational sectors. HCW often neglect their occupational safety, while providing quality care to the patients. Occupational exposure is defined as “the presence of a substance or risk factor in the work environment external to the worker” (Shi et al, 2020). In health care settings, if HCW do not follow standard precautions, they are at risk of acquiring blood borne viruses. BBV are Human Immunodeficiency virus (HIV), Hepatitis B virus (HBV), Hepatitis C virus (HCV), Hepatitis D virus (HDV) and also other viruses like Cytomegalovirus (CMV), Herpes simplex virus (HSV), and Parvovirus-19 (Mashoto et al, 2013). BBV can also be transmitted by other body fluids other than blood such as semen, vaginal secretions, amniotic fluid, and breast milk (Merchant et al, 2008).

Most of the time, HCW get exposure through percutaneous injury, as a result of a break in the skin caused by NSI or sharps contaminated with blood or body fluids and also through the splash of blood or body fluids into the eyes, nose, mouth or non-intact skin (WHO 2021). The risk of transmission for HIV through body fluids is 0.2 to 0.5%, HCV is 3-10% and HBV is 30-40% (Cheng et al, 2012).

The pooled prevalence of occupational exposure in HCW around the world was 56.6% and in the past year i.e 2021, it was 39% (Mengistu et al, 2022). There is lack of literature from south India about occupational exposure in HCW, hence this study was undertaken to know the prevalence and risk factors involved in transmission of BBV to HCW and also to see the changes in prevalence in the past 5 years and the factors involved in the changing trend.

## Material and methods

This cross sectional study was conducted for the duration of 5 years from 2018 to 2022 at Rajarajeswari Medical College and

Hospital, Bangalore, after obtaining ethical clearance from Institute Ethical Committee.

Since January 2018, every reported occupational exposure of HCW in the hospital has been registered by the Hospital Infection Control Committee (HICC). Occupational exposure includes needle stick injuries, cutting and scratching with a sharp object, body fluids or secretion splashing in the eyes, mouth, on the damaged skin, and patients' bites as well.

When reporting the occupational exposure, the exposed HCW is educated about the treatment of the wound and completes a standard form prescribed by HICC. The data concerning the occupational exposure are entered into the form: name, department, and qualifications of the exposed worker, type of exposure, object that caused the exposure, the working process in which the exposure occurred, whether wearing personal protective equipment (PPE) and following standard precautions and the type of the body fluids that a HCW was exposed to.

The form also requires information about the patient whose body fluid exposed person has been in contact with (name and surname, identity number, ID number- if known). After recording occupational exposure, HICC department urgently determined pre-existing immunity to HBV (anti-HBs-titre) and the initial serological status of exposed workers for HIV and HCV as well as the serological status of the patient for HBV, HCV and HIV (within 24 hours of reported occupational exposure). Serological status was determined using screening tests: hepatitis B surface antigen (HBsAg), and IgM and IgG antibodies to hepatitis B core antigen (anti-HBV) (IgM + IgG) for HBV, antibodies to HCV (anti-HCV) for HCV, antibodies to human immunodeficiency virus type 1 and/or 2 (anti-HIV) for HIV.

According to the estimates of the HICC, additional confirmation tests for HBV, HCV and HIV were carried out. Access to

the occupational exposure database is strictly limited only to the authorized and qualified staff.

### Statistical analysis

Chi square test was applied to assess the significance trend over time in the number of reported occupational exposures. The level of  $p < 0.05$  was considered statistically significant. Statistical analyses were performed using SPSS 9.2.0.0 statistical software.

### Results

In the analyzed period of five years, the average yearly number of workers subjected to the risk of exposure was 1083, including 260 physicians, 332 nurses and 491 representatives of other

professions (laboratory technicians, medical support staff, house keeping staff, student trainees).

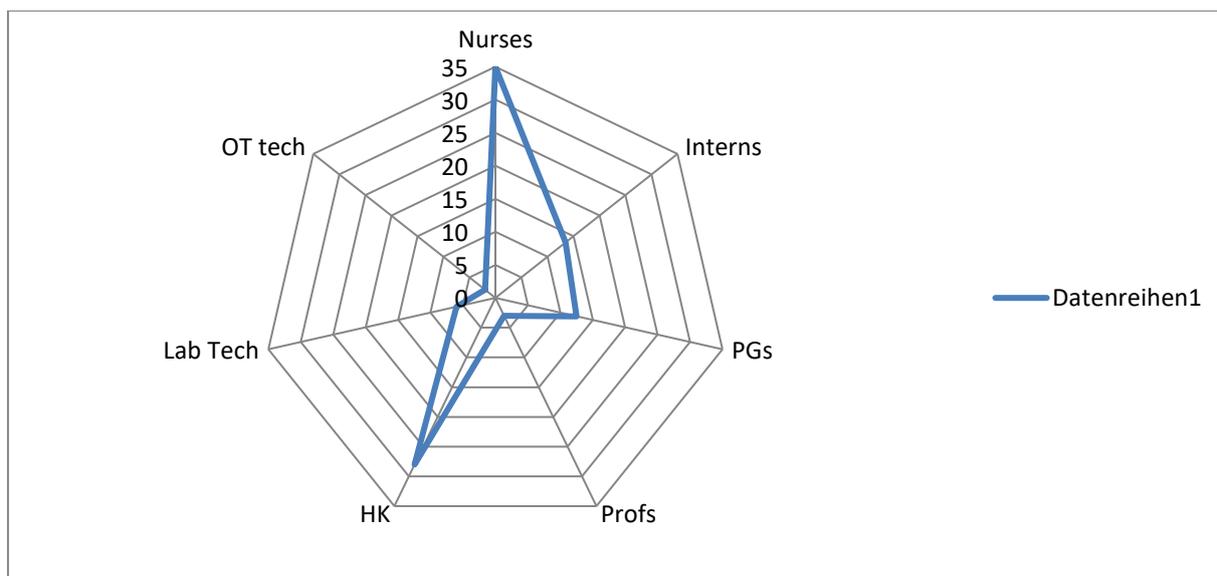
During the study period of 5 years, from 2018 to 2022, a total of 186 (23.48%) HCWs were exposed to blood and body fluids. Year-wise occupational exposure rate was 5.43%, 5.2%, 4.2%, 4.2%, and 4.54% for the years 2018, 2019, 2020, 2021 and 2022 respectively.

During 2018 and 19, nurses were most affected, whereas in 2020, 21, and 22 housekeeping staff were most commonly affected. There is Significant difference in year wise only in Interns HCW having occupational exposure as  $P < 0.05$ . The details of which are shown in (Table.1 , Fig.1).

**Table 1. HCW having occupational exposure**

Occupation	Number of cases year wise						P-Value
	2018	2019	2020	2021	2022	Total Number (%)	
<b>Nurses</b>	18	19	12	8	8	65 (35)	0.07146
<b>Interns</b>	6	3	0	9	7	25 (13.5)	<b>0.04042</b>
<b>PGs</b>	5	6	4	4	4	23 (12.5)	0.95186
<b>Profs</b>	0	0	2	1	3	6 (3)	0.22546
<b>HK</b>	8	9	13	10	12	52 (28)	0.79908
<b>Lab Tech</b>	4	3	2	1	2	12 (6)	0.70513
<b>OT tech</b>	2	1	0	0	0	3 (2)	0.25477
<b>N (%)</b>	43 (23)	41 (22)	33 (18)	33 (18)	36 (19)	186 (100)	

PG-Post graduate, Prof-Professor, HK-House keeping; Interpretation: There is Significant difference in year wise only in Interns HCW having occupational exposure as  $P < 0.05$ .



**Fig.1. Incidence rate of OE in various HCW**

Over 5 years, needle stick injury (38%) was the commonest occupational exposure (OE) followed by surgical instruments (during surgery). However during 2018 and 2019 OE by surgical

instruments was common, details are shown in (Table.2). There was no statistical difference seen in cause and method of OE.

**Table 2. Methods of Occupational exposure**

Methods	Number of cases year wise						P-Value
	2018	2019	2020	2021	2022	Total Number (%)	
Intravenous cannula/needle	10	13	8	6	6	43 (23)	0.39356
Syringe needle	14	11	13	13	19	70 (38)	0.63189
Surgical	17	14	10	9	9	59 (32)	0.36628
Splash	2	3	2	5	2	14 (7)	0.65747
<b>Total</b>	43	41	33	33	36	186 (100)	

NSI while picking the biomedical waste (BMW) (28%) was the commonest method of OE in all the five years,

followed by during disposal, needle use, blood sampling, recapping and splash, details are shown in (Table.3).

**Table 3. Causes of occupational exposure**

Causes	Number of cases year wise						P-Value
	2018	2019	2020	2021	2022	Total Number (%)	
Needle use	10	9	6	5	7	37 (18)	0.67634
Recapping	4	2	4	4	5	19 (11)	0.86759

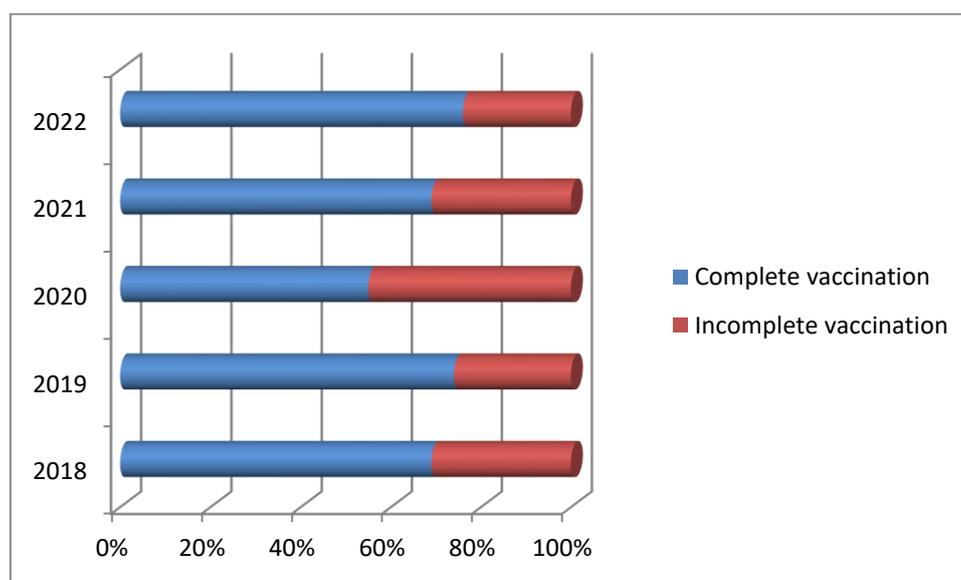
<b>Disposal</b>	8	9	9	6	8	40 (22)	0.94502
<b>After disposal /while picking BMW</b>	11	12	8	10	10	51 (28)	0.92984
<b>Blood sampling</b>	8	6	4	3	4	25 (13)	0.52493
<b>Splash</b>	2	3	2	5	2	14 (8)	0.65747
	43	41	33	33	36	186 (100%)	

Most of the OE occurred in the wards (42.5%) followed by casualty (17%) and diagnostic areas (13.5%). Details are shown in (Table.4). HBV vaccination was complete in nearly 70% except during covid-19 pandemic i.e. in 2020, (Fig.2) when routine services were hampered.

More than 80% of HCW were wearing PPE while having OE (Fig.3). An average of 92.7% of HCWs attended regular HIC training sessions. Doctors were 96.6%, nurses 95.7%, cleaning staff 86.2%, and supporting staff 78.1% (Fig.4).

**Table 4. Area wise distribution of occupational exposure**

Area	Number of cases year wise					Total (%)
	2018	2019	2020	2021	2022	
<b>Ward</b>	15	16	16	13	19	79 (42.5)
<b>Casualty</b>	9	5	6	8	4	32 (17)
<b>OPD</b>	5	8	0	2	4	19 (10)
<b>ICU</b>	0	4	6	6	4	20 ( 11)
<b>OT</b>	4	2	1	1	1	9 (5)
<b>Dialysis</b>	2	0	0	0	0	2 (1)
<b>Diagnostics</b>	8	6	4	3	4	25 (13.5)
<b>Total</b>	43	41	33	33	36	186 (100)



**Fig.2. Vaccination status of exposed HCWs (%)**

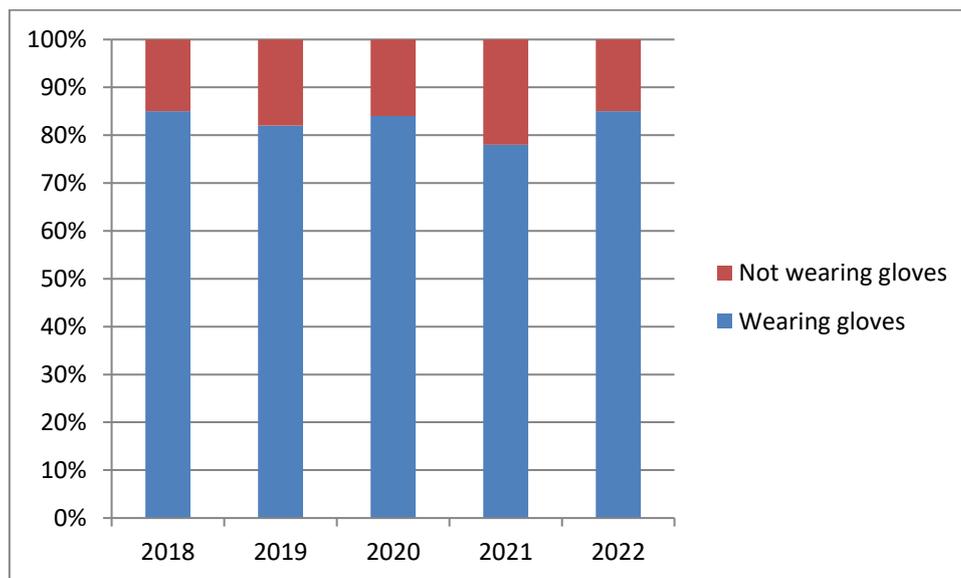


Fig.3. Exposed HCWs wearing PPE (%)

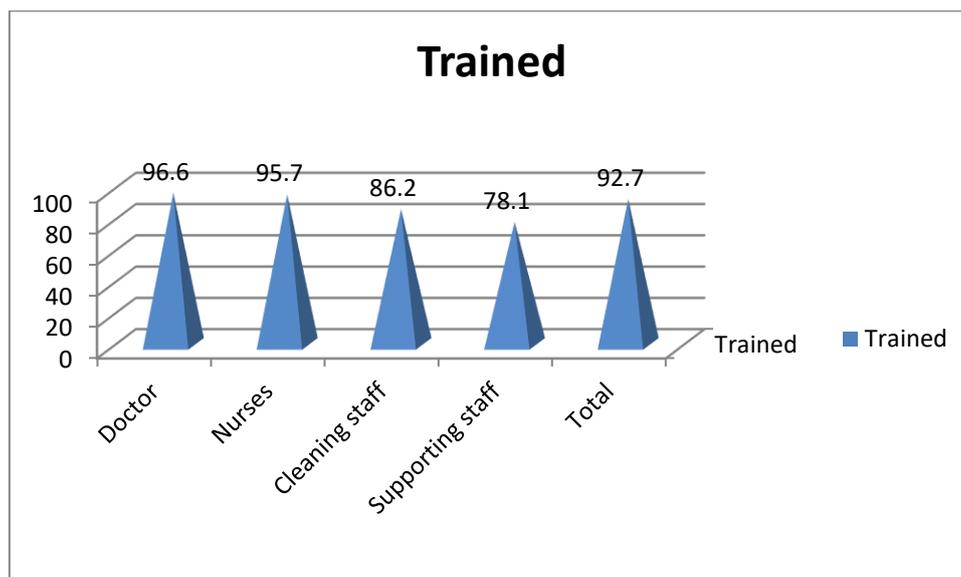


Fig.4. HCWs attending HIC training (%)

**Discussion**

While giving quality health care to patients, HCW neglect their health and accidental injury and exposure to bloodborne pathogens is not uncommon. The study is unique in a way that actual data is collected as and when occupational exposure has happened, unlike other studies where a set of questionnaires were given to HCWs to answer by recalling their memory. In the present study, the cumulative OE rate was 23.48% for five

years, nurses in the year 2018-20 and housekeeping staff in 2021-22 were commonly affected followed by interns and Postgraduates. However, the OE rate in each year was around 4-5% which is very much less compared to other studies. The past one-year prevalence of OE in different studies is 17.2%, 32.4%, and 65.3% (Punia et al, 2014; Abere et al, 2020, Mengistu et al, 2021). A large number of trained HCWs (Fig 4) must have contributed to the lower prevalence

of OE in the present study. In other studies highest rate was reported in nurses due to NSI, is in accordance with our study (Chakravarthy et al, 2010; Yoshikawa et al, 2013). Whereas in a few studies physicians had the highest contact (Mekonnin et al., 2018).

NSI (93%) was the commonest mode of OE followed by splash (7%). In contrast with study, splash injury was recorded in (38.4%) by (Mashoto et al, 2013) and (58.5%) by (Yasin et al, 2019). However, in the majority of studies, NSI was the commonest mode of OE (Reda et al, 2010; Mengistu and Tolera 2020; Agrawal et al, 2022).

In the present study, most of the OE (NSI) occurred while picking up biomedical waste by housekeeping staff (28%). This emphasises on proper segregation of biomedical waste at the point of generation which can prevent the majority of NSI. OE also occurred during needle disposal (22%), needle use (18%), blood sampling (13%), recapping (11%) and splash (8%). No other study has emphasized this, as most of the studies were questionnaire-based and housekeeping staff were not included and invariably they will be uneducated to fill out the questionnaire.

The present study shows most of the OE occurred in the wards (42.5%) followed by casualty (17%), diagnostic laboratory (13.5%), ICU (11.1%), OPD (10%), OT (5%), and dialysis (1%). This could be because of the more casual attitude of HCW, thinking that less severe cases were admitted in the ward. More than three fourth CWs were vaccinated (76%) in the year 2022, which is an improvement from 69% in 2018 to 76% in 2022. In the present study, year-wise OE rate is much lower compared to other studies, this may be attributed to the regular training of HCWs on the use of PPE and biomedical waste management, at periodic intervals with attendance of on an average of 92% (Fig 1). This emphasises on the importance of regular training of

HCWs on the use of PPE and BMW management.

The institute has a policy on HBV vaccination for all the HCWs. According to it, within a month of joining for duty, HBV vaccination is given to all health professionals. After the booster dose, anti-HBs titres are checked. If no significant titres, revaccination is recommended with 3 doses. Every month on a fixed day, with prior notice, HBV vaccination is provided to all HCWs free of cost. Despite, complete vaccination rate was 76%. Although there is an improvement from 69% to 76%, from 2018 to 2022, it is statistically not significant. OE has occurred when 80-85% of HCWs had used appropriate PPE. This suggests the need for the development of gloves that are metal-proof.

### Conclusion

During 2018 and 19, nurses were most affected, whereas in 2020, 21, and 22 housekeeping staff were most commonly affected. Over 5 years, needle stick injury (38%) was the commonest OE. Safe workplaces for HCW include good administrative health policies, PPE guidelines, adequate training and BMW management. Strengthening national and international policies is required but individual HCW must take necessary precautions to protect themselves from OE.

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