

# A Cross-Sectional Survey on Occupational Blood and Body Fluid Exposure Risk in a Tertiary Hospital in East Malaysia

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**Background and Aim:** Healthcare workers (HCWs) routinely experience occupational blood and body fluid exposure (OBBE), including percutaneous injury and splash exposure to non-intact skin. The objective of this study was to determine the prevalence of OBBE and identify associated risk factors.

**Methods:** A cross-sectional study was performed on 334 HCWs at 9 workstations. Data were collected with a self-administered questionnaire that consisted of four parts: socio-demographic variables, work-related information, knowledge about needle stick and sharps injury and splash exposure, and information regarding previous OBBE incidents. The data were analyzed by SPSS version 22.0 software.

**Findings:** The prevalence of OBBE was 25.1% (95% confidence interval: 20.6–30.2), mostly due to percutaneous injuries, which were not reported to authorities. The highest proportions were among nurses and those working in the medical ward. Needle recapping practices were associated with almost a four-times higher risk of OBBE compared to no-recapping practices. HCWs who did not have any infection prevention training had a three-times higher risk of OBBE.

**Conclusion:** Factors associated with OBBE are unsafe work practices, inadequate infection prevention training, and lack of knowledge regarding blood-borne infection. There is a need for more training and increased awareness about the risks of OBBE to reduce unsafe practices.

**Keywords:** occupational blood and body fluid exposure, hospital

## Introduction

Healthcare workers (HCWs) are involved in invasive procedures and regularly deal with patients' body fluids. This puts them at risk of occupational blood and body fluid exposure (OBBE) in their daily work routine. Exposure can occur via percutaneous injury (e.g., needle stick injury [NSI] or sharps injury) and splashes of blood to the eyes, mouth, nose, or non-intact skin. The main concern is the transmission of blood borne infections such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV). Other pathogens such as bacteria, parasites, and yeast can also be transmitted.<sup>1</sup> An estimated 3 million of 35 million HCWs had percutaneous exposures to blood borne pathogen, and of these 37.6% contracted HBV, 39% HCV, and 4.4% HIV/acquired immunodeficiency syndrome (AIDS).<sup>2</sup> Transmission risk increases with the dose of the infectious inoculum, either the volume of blood inoculated (deep needlestick,

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large-bore needle, large surface of nonintact skin exposed) or the number of infective agents (high viral load, bacteremia, or parasitemia) contained in it.<sup>1</sup> Among HCWs, nurses have the highest rate of NSI.<sup>3–5</sup> Many factors contribute to the incidence of OBBE among HCWs, such as poor adherence to standard precautions, needle recapping after procedures, and improper handling of contaminated sharp devices or cleaning instruments.<sup>3,6,7</sup> The reported range of prevalence in NSI or sharps injuries is 20.9% to 31.6%.<sup>6,8,9</sup> One local study reported 378 cases of NSI over 10 years from 1999 until 2008; this was equivalent to 37.8 cases per year, with most instances occurring in hospital settings.<sup>10</sup> The reported cases mostly occurred during intravenous procedures and disposal. Even though awareness interventions are implemented, there remains a need to identify factors associated with OBBE. In 2005, the Malaysian Ministry of Health reported an incidence rate of 4.7 NSI per 1000 HCWs.<sup>11</sup> OBBE reporting is done through the national Sharp Injury and Surveillance (SIS) program. Any injury or exposure should be reported to the location supervisor, and they will immediately refer the affected person to the designated doctor from the medical department for assessment and post-exposure prophylaxis if necessary.<sup>11</sup> The location supervisor needs to notify hospital Occupational Health Unit (OHU) of the incident, and the OHU is responsible for recording the incidence in the SIS and following up with the affected individual at 6 weeks, 3 months, and 6 months. HBV immunization is already administered to all HCWs. Identifying OBBE risk factors will help hospital management develop targeted prevention and action plans to reduce OBBE among its HCWs. This study aimed to determine the prevalence and associated factors of OBBE among HCWs in a tertiary government hospital.

## Methods and Materials

This cross-sectional study was conducted in a tertiary hospital in Sabah, Malaysia. It has 775 beds with a 73.3% average annual occupancy rate from 2016 to 2018. In 2018, it employed a varied range of professionals including doctors (n=1118), nurses (n=1573), hospital assistants (n=356), lab technicians (n=152), and maintenance technicians (n=35). There was increasing trend of OBBE reported, with 78% more exposures in 2018 compared to 2016 (80 vs. 45, respectively). The calculated sample size of 346 was based on the 23.5% prevalence of NSI,<sup>6</sup> considering a 20% non-response rate, 95% confidence intervals (CIs), and a precision of 0.05.

All workstations in the hospital were identified, and a subset were chosen using stratified random sampling. The nine workstations identified were the emergency department, operating room, medical ward, surgical ward, maintenance station, medical lab, intensive care unit, blood bank, and dental clinic. These places are at a higher risk of OBBE. Sample populations included all staff who worked in the nine workstations including nurses (n=285), doctors (n=67), laboratory technicians (n=20), and maintenance technicians (n=35). A self-administered paper questionnaire was distributed to all staff who worked in the nine workstations and then collected after 3 days. All results were kept anonymous. The questionnaire used in this study consisted of close-ended questions adapted from a previous study.<sup>12</sup> It included questions on sociodemographic variables, work-related information, knowledge about NSI and sharps injury and splash exposure, and information regarding previous OBBE incidents. The purpose of the study was explained to each participant, and written consent was obtained prior to study commencement. It was piloted to 20 clinical staff members in workstations that were not included in the study. All completed questionnaires were entered in IBM SPSS version 22.0. Sociodemographic data are presented as descriptive statistics. Chi-square tests were used to test relationships between categorical variables. All analyses with statistically significant relationships were further analyzed by simple logistic regression to determine the magnitudes of the associations. OBBE was defined as an exposure over the past year that might place healthcare personnel at risk of HBV, HCV, or HIV infection through percutaneous injury, contact of mucous membranes or non-intact skin with blood, tissue, or other body fluids that are potentially infectious. Ethics approval for Queen Elizabeth Hospital was obtained from the ethics committee, and the study was conducted in compliance with the ethical principles outlined in the Declaration of Helsinki and Good Clinical Practice Guideline. This study was approved by the Medical Research and Ethics Committee, Ministry of Health.

## Results

Of 400 questionnaires, 352 were returned, corresponding to an 88% response rate. Eighteen questionnaires were not completed and were thus excluded from the analysis. A total of 334 questionnaires were used for the final analysis. Most respondents were female (mean age of

31 years old), employed as nurses, had a diploma education level, worked in the medical ward, had a service duration of ~5 years, and worked in shifts (Table 1). In

terms of work practices, most respondents did not practice needle recapping, regularly wore personal protective equipment (PPE), had completed infection prevention

**Table 1** Respondent Profiles and Univariate Analysis of OBBE Factors Among HCWs

Factor	Respondent Frequency (%) (N=334)	OBBE (n=84)	Non OBBE (n=250)	$\chi^2$ or t-Test	p
Age		30.52	31.23	0.97	0.33
Sex					
Male	58 (17.3%)	20 (34.5%)	38 (65.5%)	3.25	0.07
Female	276 (82.6%)	64 (23.2%)	212 (76.8%)		
Education level					
<Secondary school	19 (5.6%)	5 (26.3%)	14 (73.7%)		1.00
≥Diploma	315 (94.4%)	79 (25.1%)	236 (74.9%)		
Profession					
Nurse	250 (74.9%)	49 (58.3%)	201 (80.4%)		
Doctor	47 (14.1%)	22 (26.2%)	25 (10.0%)		
Lab technician	23 (6.9%)	7 (8.3%)	16 (6.4%)		
Maintenance technician	14 (4.1%)	6 (7.1%)	8 (3.2%)		
Workstation:					
Emergency department	39 (11.7%)	16 (19.0%)	23 (9.2%)		
Operation room	15 (4.5%)	5 (6%)	10 (4.0%)		
Medical ward	139 (41.6%)	24 (28.6%)	115 (46.0%)		
Surgical ward	75 (22.4%)	14 (16.7%)	61 (24.4%)		
Maintenance station	13 (3.9%)	5 (6.0%)	8 (3.2%)		
Medical lab	19 (5.7%)	7 (8.3%)	12 (4.8%)		
Palliative care unit	13 (3.9%)	8 (9.5%)	5 (2.0%)		
Blood bank	14 (4.2%)	2 (2.4%)	12 (4.8%)		
Dental clinic	7 (2.1%)	3 (3.6%)	4 (1.6%)		
Years of service		5.0	5.8	1.48	0.57
Shift work					
Yes	246 (73.7%)	57 (23.2%)	189 (76.8%)	1.94	0.16
No	88 (26.3%)	27 (30.7%)	61 (69.3%)		
Needle recapping					
Yes	48 (14.4%)	24 (50.0%)	24 (50.0%)	18.39	0.00
No	286 (85.6%)	60 (21.0%)	226 (79.0%)		
Adherence to universal precautions					
No	79 (23.7%)	16 (20.3%)	63 (79.7%)	1.32	0.25
Yes	255 (76.3%)	68 (26.7%)	187 (73.3%)		
Personal protective equipment usage					
Yes	328 (98.2%)	81 (24.7%)	247 (75.3%)		0.17
No	6 (1.8%)	3 (50.0%)	3 (50.0%)		
Infection prevention training					
Yes	287 (85.9%)	62 (21.6%)	225 (78.4%)	13.63	0.00
No	47 (14.1%)	22 (46.8%)	25 (53.2%)		
Knowledge of blood borne infection		18.54	18.25	-1.47	0.19

**Abbreviations:** HCW, healthcare worker; OBBE, occupational blood and body fluid exposure.

training, and adhered to universal precautions. There were 84 respondents who had been exposed to blood and body fluids at work, and the prevalence of OBBE was 25.1% (95% CI: 20.6–30.2). Overall, 87% of these incidents were due to percutaneous injury and the remaining were splash exposures. Almost half of the respondents did not report OBBE events. Most OBBE were among nurses and HCWs working in the medical ward. There was a significant statistical association between OBBE with needle recapping, training on infection prevention, and better knowledge of blood borne infection. Other factors such as gender, age, education level, years of service, shift work, adherence to universal precaution, and PPE use were not significantly associated with OBBE. In an additional analysis, respondents who practiced needle recapping were almost four times more likely to have OBBE compared to respondents who did not practice needle recapping (adjusted odds ratio [AOR] =4.17, 95% CI: 2.09–8.33; Table 2). Notably, respondents who did not attend any infection prevention training had a three-fold higher risk of OBBE compared to those who attended the training (AOR=2.95, 95% CI: 1.50–5.79). Knowledge of blood borne infection was significantly associated with OBBE (AOR=1.22, 95% CI: 1.00–1.49).

## Discussion

This study showed that the prevalence of OBBE among HCWs in a tertiary hospital was 25.1%. The rate was similar to those reported in other Malaysian hospitals.<sup>6,8</sup> The majority of the cases (85.7%) involved percutaneous injuries, with fewer cases of splash exposure (14.3%). Percutaneous injuries were associated with ampoule and syringe needle usage. These occurred during waste handling and collection, sudden patient movement, while opening the needle cap, were accidental injuries caused by the carelessness of a colleague, and injuries due to improper needle disposal. Fortunately, these were superficial skin injuries, and the individuals were

immunized against HBV. A Tunisian study also found that the primary mechanism of blood and body fluid exposure was accidental NSI among health staff and trainees. The authors concluded that a higher severity of blood exposure accidents was linked to the lack of safe behaviors to mitigate risk.<sup>13</sup> Existing control measures for OBBE prevention include monthly training, standard operating procedure implementation, and PPE use. Most incidents were not reported to an authority. This suggests a likely higher prevalence of OBBE than the reported data suggest. The reasons for this are as follows: the needle that injured these individuals was never used in a patient, individuals were busy with work, the sharp objects were used on patients who had no infectious disease of concern, and—possibly the reason of greatest concern—individuals did not know how to report the incidence. Another group revealed that the major reason for individuals not reporting their injuries to an authority was that the subjects felt it to be unnecessary. Failure to see the importance of reporting and a lack of mandatory reporting are possible reasons for not disclosing OBBE, and the importance of reporting needs to be emphasized.<sup>14</sup> In this study, half of the exposures affected nurses. This is comparable to other studies where nurses frequently experienced OBBE.<sup>4,5,15</sup> Nurses have frequent contact with patients and perform most of the procedures such as blood collection, intravenous line insertion, and medication administration. In France, nurses and nursing students accounted for 4587 (60%) exposures, followed by nurses' aides and clinicians; most were related to NSI.<sup>16</sup> Overall, occupational exposure among HCWs in tertiary hospitals occur most often in the medical ward, followed by the emergency department, surgical ward, and other places. A study in Sabah reported similar results, with a higher occurrence in the medical and surgical wards.<sup>10</sup> Another study reported that most occupational accidents due to NSIs occurred in the emergency unit.<sup>17</sup> Medical and surgical wards perform numerous risky procedures, such as

**Table 2** Multivariate Analysis of OBBE Factors Among HCWs

Factor	Adjusted Odds Ratio	(95% Confidence Interval)	p
Needle recapping	4.17	(2.09–8.33)	<0.05
Did not attend training	2.95	(1.50–5.79)	<0.05
Age	0.97	(0.87–1.08)	>0.05
Total years in service	0.99	(0.89–1.10)	>0.05
Knowledge scoring	1.22	(1.00–1.49)	<0.05
Standard precaution adherence	0.54	(0.28–1.04)	>0.05

**Abbreviations:** HCW, healthcare worker; OBBE, occupational blood and body fluid exposure.

intravenous line insertion, central line insertion, and surgical procedures, which would explain the higher prevalence of OBBE was higher in these departments. Emergency and intensive care staff had the highest relative rates compared with maintenance staff, and nurses and laboratory staff were more exposed than physicians. Prompt prevention and training need to be efficiently devised and precisely focused.<sup>18</sup> For example, needle recapping practices are associated with an almost four-time higher risk of sharps injury compared to not recapping. These were likely related to inadequate knowledge and inability to identify the danger of the practice.<sup>1,6,12</sup> An assessment of workplace layout identified that sharps disposal container distance from the procedure setting might contribute to needle recapping. Proper planning before the procedure such as placing a reachable sharp bin for disposal will help prevent NSI. In a survey of licensed paramedics, most needle/lancet sticks involved non-safety devices. The authors suggested that blood exposure could be reduced through increased use of safety devices and PPE, improved engineering and design, increased compliance with universal precautions, and a need for techniques that avoid blood exposure while treating uncooperative or combative patients.<sup>19</sup> However, there was no retractable needle used in the studied hospital. This issue should be considered to help minimize OBBE risk. Diminishing the frequency with which nurses recap needles, increasing the precautions they take, reducing use of temporary nursing personnel, and implementing organizational changes may lower the risk of nurses being injured.<sup>20</sup> Staff training on infection prevention also plays an important role in mitigating OBEE risk. HCWs who did not have any infection prevention training had a three-fold higher risk of OBBE. Inadequate training was also cited as a risk factor in other studies.<sup>3,21</sup> Continuous and more frequent training and education programs for staff are needed to increase awareness and improve practices in handling needles and sharps. Frequent hospital administration messages through phone or email to all staff could highlight the importance of safe sharps handling and disposal to further increase awareness. Training will improve HCW knowledge and awareness and help them to implement these tools into their practice with a new ability to identify the dangers of OBBE, including HBV, HCV, and HIV infection. HBV vaccination produces immunity against infection,<sup>22</sup> so completing the vaccination series is important to develop protection against HBV. Lack of awareness and insufficient monitoring of HBV immunity among HCWs both contributed to lower HBV vaccination completion. A system and procedure to monitor HBV

immunity status is important to ensure adequate infection protection. Therefore, a rigorous approach including more training sessions, continuous communication on the risk of OBBE, and the need to comply with standard precautions to the staff through various platforms should be implemented. In summary, busy hospitals, unsafe work practices, and a lack of resources contributed to the high prevalence of OBBE in this study. Increased resource allocation and ensuring sustainability will promote safe work practices among HCWs. In conclusion, the prevalence of OBBE among HCWs in a tertiary hospital was 25.1%. The factors associated with OBBE were unsafe work practice, inadequate infection prevention training, and lack of knowledge regarding blood borne infection. There is a need for more training and increased awareness of the risks of OBBE to reduce unsafe practices.

## Limitations

The study findings cannot be generalized to all HCWs, as the study was performed in one tertiary hospital that has more resources than smaller hospitals.

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## Disclosure

The authors report no conflicts of interest in this work.

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