Infection Control & Hospital Epidemiology (2021), **42**, 1506–1510
doi:10.1017/ice.2020.1411

Concise Communication

Prevalence and associated factors of sharps injuries and other blood/body fluid exposures among healthcare workers: A multicenter study

Xi-Yao Yang MB[1,a], Ruo-Jie Li MPH[1,a], Yi-Le Wu MPH[1], Xiao-Qian Hu MB[1], Xue-Ping Wang MPH[1], Jing-Jing Zhang MD[1] and Li-Qi Yang MB[2]

[1]Department of Hospital Infection Prevention and Control, The Second Affiliated Hospital of Anhui Medical University, Hefei 230601, Anhui, China and [2]The Fourth Affiliated Hospital of Anhui Medical University, Hefei 230022, Anhui, China

Abstract

A multicenter study of sharps injuries (SIs) and other blood or body fluid (OBBF) exposures was conducted among 33,156 healthcare workers (HCWs) from 175 hospitals in Anhui, China. In total, 12,178 HCWs (36.7%) had experienced at least 1 SI in the previous 12 months and 8,116 HCWs (24.5%) had experienced at least 1 OBBF exposure during the previous 12 months.

(Received 27 May 2020; accepted 1 October 2020; electronically published 1 February 2021)

Sharps injuries (SIs) and other blood and body fluid (OBBF) exposures are important occupational hazards for transmission of bloodborne pathogens among healthcare workers (HCWs).[1] The World Health Organization has estimated that SIs resulted in 40% of HBV and HCV infections and 2.5% of HIV infections among HCWs.[2] OBBF exposure through mucosa or skin damaged is another important way that HCWs contract pathogens.[1]

This public health problem is even more severe in developing countries, where the occupational hazards may be underappreciated and poorly prevented.[3] Occupational hazards of HCWs have received increasing attention in China, but few studies have focused on SIs and OBBF exposures across a range of hospitals. In this study, we aimed to assess prevalence and factors associated with SIs and OBBF exposures among Chinese HCWs.

Methods

Setting and study participants

This study was conducted from March to May 2019 in 175 hospitals in Anhui, China. Anhui province is located in eastern China with population >63 million. Survey candidates included HCWs who have directly contacted with patients or medical equipments and materials used for patients, including doctors, nurses, and other technologists (anesthetists, midwives, laboratory personnel, and others).

Definition

An SI was defined as a penetrating skin injury caused by a sharp instrument. OBBF exposure was defined as a splash or direct contact of blood or body fluids onto mucous membranes or non-intact skin.

Questionnaire

A questionnaire comprising 37 questions was developed by referring the previous literature,[4] which contained hospitals' and respondents' characteristics, experiences of SIs and OBBF exposures, reporting and treatment behaviors, and other potential associated factors.

Data collection and procedure

A scanned notification, covering survey purpose and methods, was sent to the target hospitals. The hospital infection management departments then invited eligible participants in their hospitals to voluntarily and anonymously fill out the online questionnaire. Survey generally took 5–10 minutes and had no financial incentives. Study protocol obtained ethics approval from the Research Ethics Committees of the Second Affiliated Hospital of Anhui Medical University.

Statistical analysis

Data were exported to SPSS version 21.0 software (IBM, Armonk, NY) for analysis. Forward stepwise multivariate logistic regression model was applied to explore associated factors. Variables with $P < .05$ were entered and with $P < .10$ were retained. A P value <.05 was considered statistically significant.

Results

Sociodemographic characteristics

Among 33,156 HCWs, 18.6% worked in provincial hospitals, 41.2% worked in municipal hospitals, and 40.2% worked in district

Author for correspondence: Yi-Le Wu, E-mail: wuyilebank@163.com
[a]Authors of equal contribution.

Cite this article: Yang XY, *et al.* (2021). Prevalence and associated factors of sharps injuries and other blood/body fluid exposures among healthcare workers: A multicenter study. *Infection Control & Hospital Epidemiology*, 42: 1506–1510, https://doi.org/10.1017/ice.2020.1411

Table 1. Univariate Analysis of Sharps Injuries (SIs) and Other Blood/Body Fluid (OBBF) Exposures Among 33,156 Healthcare Workers

	SI Exposure in Past 12 mo			OBBF Exposure in Past 12 mo		
Variable	Yes (%)	No (%)	*P* Value	Yes (%)	No (%)	*P* Value
No.	12,178 (36.7)	20,978 (63.3)		8,116 (24.5)	25,040 (75.5)	
Hospital level						
Provincial	2,352 (38.2)	3,804 (61.8)	.002	1,661 (27.0)	4,495 (73.0)	<.001
Municipal	4,888 (35.7)	8,790 (64.3)		3,333 (24.4)	10,345 (75.6)	
District	4,938 (37.1)	8,384 (62.9)		3,122 (23.4)	10,200 (76.6)	
Gender						
Male	2,110 (34.0)	4,105 (66.0)	<.001	1,756 (28.3)	4,459 (71.7)	<.001
Female	10,068 (37.4)	16,873 (62.6)		6,360 (23.6)	20,581 (76.4)	
Age, y						
>46	892 (26.5)	2,470 (73.5)	<.001	766 (22.8)	2,596 (77.2)	<.001
26–45	9,436 (36.4)	16,497 (63.6)		6,484 (25.0)	19,449 (75.0)	
<25	1,850 (47.9)	2,011 (52.1)		866 (22.4)	2,995 (77.6)	
Degree level						
Associate	3,720 (39.0)	5,820 (61.0)	<.001	2,059 (21.6)	7,481 (78.4)	<.001
Bachelor	7,591 (35.8)	13,625 (64.2)		5,336 (25.2)	15,880 (74.8)	
Master	867 (36.1)	1,533 (63.9)		721 (30.0)	1,679 (70.0)	
Department						
Emergency unit	655 (35.4)	1,197 (64.6)	<.001	503 (27.2)	1,349 (72.8)	<.001
Surgical ward	3,268 (44.5)	4,071 (55.5)		2,202 (30.0)	5,137 (70.0)	
Medical ward	3,498 (36.5)	6,092 (63.5)		2,086 (21.8)	7,504 (78.2)	
CSS	230 (42.4)	313 (57.6)		107 (19.7)	436 (80.3)	
Operating room	841 (45.8)	995 (54.2)		651 (35.5)	1,185 (64.5)	
Delivery room	338 (36.0)	602 (64.0)		336 (35.7)	604 (64.3)	
Other	3,348 (30.3)	7,708 (69.7)		2,231 (20.2)	8,825 (79.8)	
Worried about the exposures						
No	5,795 (42.0)	8,003 (58.0)	<.001	4,259 (30.9)	9,539 (69.1)	<.001
Yes	6,383 (33.0)	12,975 (67.0)		3,857 (19.9)	15,501 (80.1)	
Always followed standard precautions						
No	7,297 (42.0)	10,089 (58.0)	<.001	5,132 (29.5)	12,254 (70.5)	<.001
Yes	4881 (31.0)	10,889 (69.0)		2,984 (18.9)	12,786 (81.1)	
Always checked the patient's bloodborne infections status before risky operation						
No	8618 (39.9)	12,999 (60.1)	<.001	5,729 (26.5)	15,888 (73.5)	<.001
Yes	3560 (30.9)	7,979 (69.1)		2,387 (20.7)	9,152 (79.3)	
Received occupational safety training						
<3 times	6296 (42.6)	8,476 (57.4)	<.001	4,192 (28.4)	10,580 (71.6)	<.001
≥3 times	5882 (32.0)	12,502 (68.0)		3,924 (21.3)	14,460 (78.7)	
Not always conveniently accessed protective equipments when needed						
No	11605 (36.4)	20,252 (63.6)	<.001	7,725 (24.2)	24,132 (75.8)	<.001
Yes	573 (44.1)	726 (55.9)		391 (30.1)	908 (69.9)	

Note. CSS, central sterile supply department.

hospitals. Male participants accounted for 18.7% of participants, and most participants (78.2%) reported their age between 26 and 45 years. Nearly three-quarters (71.2%) had a bachelor's degree or above. Approximately two-thirds were nurses (67.5%), followed by doctors (25.7%), and other medical technologists (6.8%) (Table 1).

https://doi.org/10.1017/ice.2020.1411 Published online by Cambridge University Press

Table 2. Prevalence of Sharp Injuries (SIs) and Other Blood/Body Fluid (OBBF) Exposure Among 33,156 Healthcare Workers

Variable		Frequency, No.	%
SIs exposure			
Ever experienced	Yes	25,774	77.7
Past 12 mo	Yes	12,178	36.7
	1 time	6,904	20.8
	2 times	2,945	8.9
	3 times	1,102	3.3
	≥4 times	1,227	3.7
Sharp material	Syringe needle	7,785	23.5
	Glass	4,495	13.6
	Surgical suture needle	1,907	5.8
	Insulin syringe	724	2.2
	Lancet	681	2.1
	Others	1,888	5.7
OBBF exposure			
Ever experienced	Yes	15,212	45.9
Past 12 mo	Yes	8,116	24.5
	1 time	4,019	12.1
	2 times	1,896	5.7
	3 times	627	1.9
	≥4 times	1,574	4.8
Type of blood/ body fluid	Blood or blood products	5,709	17.2
	Vomit/Sputum	3,423	10.3
	Urine	2,627	7.9
	Cerebrospinal/peritoneal/pleural/ amniotic fluid	1,032	3.1
	Others	1,067	3.2

SIs and OBBF exposures

In total, 12,178 HCWs (36.7%) had experienced an SI in the prior 12 months (Table 2). SIs had occurred among 40.1% of nurses, 32.5% of doctors, and 19.1% of other medical technologists. The device that caused the most SIs was a hypodermic needle (23.5%), followed by glass (13.6%) and surgical suture needle (5.8%).

In total, 8,116 (24.5%) HCWs had experienced an OBBF exposure during the previous 12 months (Table 2). OBBF exposure prevalence among doctors (28.0%) was higher than among nurses (24.3%) and other medical technologists (12.6%). Exposure to OBBFs involved blood or blood products (17.2%), vomit/sputum (10.3%), and urine (7.9%).

Factors associated with SI and OBBF exposure

As shown in Table 3, multivariate analysis showed that HCWs working in municipal and district hospitals were less likely to experience an OBBF exposure. Female HCWs were at higher risk of experiencing an SI and at lower risk of OBBF exposure. SIs were more frequent in those aged <45 years and OBBF exposures were more frequent in those aged 26–45 years. In terms of departments, HCWs working at in the operating room, the central sterile supply department, and the surgical ward were 1.5 times more likely to experience an SI than those working in the emergency unit. Also, HCWs working in the delivery room and operating room had significantly higher risk of OBBF exposure. HCWs with a bachelor degree or above were at lower risk of SI and at higher risk of OBBF exposure. In addition, SIs and OBBF exposures were consistently higher among HCWs who could not always conveniently access protective equipment when needed, and they were significantly lower among HCWs who worried about exposures, those who always followed standard precautions, those who always checked a patient's bloodborne infections status before risky procedures, and those who received the safety guidelines ≥3 times.

Discussion

This study indicated a high prevalence of SIs and OBBF exposures in the previous 12 months among HCWs. This finding is in line with a meta-analysis showing that the 12-month prevalences of SIs and OBBF exposures were 36.0% and 18.2%, respectively, in African countries.[5] But the prevalence of SIs was lower in that study than in a Chinese multicenter survey that reported 71.3% prevalence among HCWs during the previous year in Fujian province.[6] Similar to previous studies,[7–9] nurses experienced the highest proportion of SIs and doctors reported the highest rate of OBBF exposure.

Multivariate analysis indicated that HCWs working in municipal and district hospitals were less likely to experience an OBBF exposure. HCWs in provincial hospitals were more likely to treat more complex diseases, which might increase exposure risk. Female HCWs were at increased risk of SI and at decreased risk of OBBF exposure. This finding might be partly due to the difference in gender distribution among nurses (97.9% women) and doctors (41.3% women), which could be proven our findings that nurses experienced higher proportions of SIs and doctors experienced higher proportions of OBBF exposure. Notably, both age and degree level, related to practice activities and experiences, were predictors of SI and OBBF exposure, as expected. This finding highlights the importance of exposure prevention and management. Similar to other studies,[7,8] SI and OBBF exposure risks differed in different departments. The types of medical procedures carried out in the workplace determine the risks.[10] In addition, adherence to standard precautions and self-protection awareness were important factors for preventing occupational exposure. Nevertheless, only 48% and 35% HCWs always followed standard precautions and checked the patient's bloodborne infections status before risky procedures, respectively, which indicates that unsafe practices often still exist. In addition, approximately half of HCWs (45%) received occupational safety training <3 times. Taking occupational safety training ≥3 times was a significant protective factor. These findings indicate that safety training was further needed. Notably, HCWs who could not always conveniently access protective equipments when needed were more likely to experience SIs and OBBF exposure. These findings emphasize that providing adequate protective equipment is effective for preventing occupational exposure.[10]

This study has several limitations. First, information on exposures was collected retrospectively, which might have led to recall bias. Second, although the sample size was large enough, participation may have been influenced by the voluntary nature of the

https://doi.org/10.1017/ice.2020.1411 Published online by Cambridge University Press

Table 3. Multivariate Associations Between Sharp Injuries (SIs) and Other Blood/Body Fluids (OBBFs) Exposure and Covariates

	SIs Exposure in Past 12 mo		OBBF Exposure in Past 12 mo	
Variable	AOR (95% CI)	*P* Value	AOR (95% CI)	*P* Value
Hospital level				
Provincial	. . .		1.00	
Municipal	. . .	. . .	0.92 (0.85–0.99)	.019
District	. . .	. . .	0.89 (0.82–0.96)	.002
Gender				
Male	1.00		1.00	
Female	1.18 (1.11–1.26)	<.001	0.88 (0.82–0.95)	<.001
Age, y				
>46	1.00		1.00	
26–45	1.64 (1.50–1.78)	<.001	1.13 (1.03–1.23)	.011
<25	2.57 (2.32–2.85)	<.001	1.08 (0.96–1.21)	.188
Degree level				
Associate	1.00		1.00	
Bachelor	0.89 (0.84–0.94)	<.001	1.12 (1.05–1.20)	.001
Master	0.87 (0.78–0.96)	.007	1.25 (1.12–1.41)	<.001
Department				
Emergency unit	1.00		1.00	
Surgical ward	1.54 (1.38–1.71)	<.001	1.15 (1.02–1.29)	.023
Medical ward	1.07 (0.96–1.19)	.237	0.75 (0.67–0.84)	<.001
CSS	1.56 (1.27–1.90)	<.001	0.79 (0.62–1.00)	.050
Operating room	1.78 (1.56–2.04)	<.001	1.66 (1.44–1.92)	<.001
Delivery room	1.06 (0.90–1.26)	.495	1.75 (1.47–2.08)	<.001
Other	0.84 (0.76–0.93)	.001	0.72 (0.64–0.81)	<.001
Worried about the exposures				
No	1.00		1.00	
Yes	0.68 (0.65–0.71)	<.001	0.61 (0.58–0.64)	<.001
Always followed standard precautions				
No	1.00		1.00	
Yes	0.73 (0.70–0.77)	<.001	0.65 (0.61–0.69)	<.001
Always checked patients' blood-borne infections status before risky operation				
No	1.00		1.00	
Yes	0.81 (0.77–0.86)	<.001	0.85 (0.80–0.90)	<.001
Received occupational safety guidelines				
<3 times	1.00		1.00	
≥3 times	0.68 (0.65–0.71)	<.001	0.76 (0.72–0.80)	<.001
Not always conveniently accessed protective equipments when needed				
No	1.00		1.00	
Yes	1.32 (1.17–1.48)	<.001	1.30 (1.14–1.47)	<.001

Note. AOR, adjusted odds ratio; CSS, central sterile supply department.

online survey. Finally, differences in exposure risks were investigated for common departments and could not be further classified due to insufficient information.

In conclusion, these results reflect the high prevalence of SIs and OBBF exposures among HCWs in Anhui, China. These findings imply that regular epidemiological surveillance, and strengthening occupational safety education and training are essential for HCWs. Prevention and control measures could be implemented on basis of these identified associated factors.

https://doi.org/10.1017/ice.2020.1411 Published online by Cambridge University Press

Acknowledgments. The authors thank all of the healthcare workers who participating in this study.

Financial support. No financial support was provided relevant to this article.

Conflicts of interest. All authors report no conflicts of interest relevant to this article.

References

1. Beltrami EM, Williams IT, Shapiro CN, Chamberland ME. Risk and management of blood-borne infections in health care workers. *Clin Microbiol Rev* 2000;13:385–407.
2. World Health Organization. *The World Health Report:* 2002*: Reducing Risks, Promoting Healthy Life.* Geneva: World Health Organization; 2002.
3. Tanaka M, Katayama F, Kato H, *et al.* Hepatitis B and C virus infection and hepatocellular carcinoma in China: a review of epidemiology and control measures. *J Epidemiol* 2011;21:401–416.
4. Yasin J, Fisseha R, Mekonnen F, Yirdaw K. Occupational exposure to blood and body fluids and associated factors among healthcare workers at the University of Gondar Hospital, northwest Ethiopia. *Environ Health Prev Med* 2019;24:18.
5. Auta A, Adewuyi EO, Tor-Anyiin A, *et al.* Healthcare workers' occupational exposures to body fluids in 21 countries in Africa: systematic review and meta-analysis. *Bull WHO* 2017;95:831–841F.
6. Chen L, Zhang M, Yan Y, *et al.* Sharp object injuries among health care workers in a Chinese province. *AAOHN J* 2009;57(1):13–16.
7. Huang SL, Lu Q, Fan SH, *et al.* Sharp instrument injuries among hospital healthcare workers in mainland China: a cross-sectional study. *BMJ Open* 2017;7(9):e017761.
8. Alamgir H, Cvitkovich Y, Astrakianakis G, Yu S, Yassi A. Needlestick and other potential blood and body fluid exposures among healthcare workers in British Columbia, Canada. *Am J Infect Control* 2008;36: 12–21.
9. Alemayehu T, Worku A, Assefa N. Sharp injury and exposure to blood and body fluids among healthcare workers in healthcare centers of eastern Ethiopia. *Int J Occup Environ Med* 2016;7:172–180.
10. Yoshikawa T, Wada K, Lee JJ, *et al.* Incidence rate of needlestick and sharps injuries in 67 Japanese hospitals: a national surveillance study. *PLoS One* 2013;8(10):e77524.

https://doi.org/10.1017/ice.2020.1411 Published online by Cambridge University Press