

Occupational Exposure to Needle Stick Injuries among Health Care Workers in a Tertiary care hospital: A KAP study

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Abstract

Background: Needle stick injuries (NSIs) are serious occupational health problem related to accidental exposure of health care workers (HCWs) while involved in patient care services. The percutaneous exposure to potentially contaminated blood and body fluids with blood borne pathogens are responsible for significant prevalence of Hepatitis B, C & HIV infections amongst HCWs. **Methods:** This is a descriptive cross sectional study conducted in hospital settings over a period of one year. 178 HCWs were selected for study using systematic random sampling after proportional allocation for each professional category in the hospital. Collected data was processed on SPSS ver 24. The association between needle stick and associated factors were measured using the odds ratio at a 95% confidence interval. The statistical significance was made at a p-value of less than 0.05. **Results** Total of 62 incidences of sustaining a needle stick injury in a year was recorded amongst 178 HCWs. In this study, statistically significant results with p value less than 0.05 was obtained with association with variables like gender [AOR=1.36 (0.64 - 2.68)], experience in years as HCWs [AOR=1.23 (0.32 - 2.12)], profession [AOR=0.063 (0.001- 0.43)], observance of universal precautions as wearing gloves [AOR=0.33 (0.169 – 0.631)] or any training on PEP or universal precautions [AOR=2.29 (1.320 - 4.696)]. **Conclusion:** NSIs have the potential to affect the health system both directly and indirectly. To lessen the dangers and impacts of NSIs stringent training should coordinate the endeavors toward preparing of health care workers, utilization of wellbeing designed gadgets, and diminishing patient burden per health care workers.

Keywords

Needle Stick Injuries; Percutaneous exposure; Accreditation; Universal Precautions

Introduction

Needle stick injuries (NSIs) is a serious occupational health and safety problem related to accidental exposure of health care workers (HCWs) while involved in patient care services across the world.(1) Injuries sustained from pricks by hypodermic needles, blood collection needles, intravenous (IV) cannulas or needles used to connect parts of IV administration systems are commonest amongst them. The break in skin may leads to percutaneous exposure to potentially contaminated blood and body fluids with blood borne pathogens such as Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human

Immunodeficiency Virus (HIV) responsible for significant prevalence of these infections amongst HCWs.(1,2) According to the World Health Organization's World Health Report, 2 million out of 35 million health-care professionals are exposed to infectious illnesses with blood borne pathogens by percutaneous exposure each year. NSIs are responsible for about 37.6% of Hepatitis B (HBV), 39% of Hepatitis C (HCV), and 4.4 percent of HIV/Acquired Immunodeficiency Syndrome in HCWs throughout the world (2).

There are no national reporting systems for NSIs in India, but a report in 2006 showed that around 63% of the 3–6 billion injections given every year are unsafe. (3) NSIs have the potential to affect the health system both directly and

indirectly. In developing countries with limited human resources for health, there are higher restrictions in the number of available doctors and nurses. NSIs and other health related occupational injuries affect the health services provided by increasing the number of work days lost due to injuries and the emotional distress, which are caused to the HCWs due to NSIs. (4) The Ministry of Health and Family Welfare of the Government of India recommends that the healthcare providers must be made aware of the safety precautions that must be followed for the prevention of NSIs. Adequate training to the healthcare workers to handle the sharp objects is equally vital. (5) In addition, effective reporting systems should be placed in all healthcare facilities for early reporting of cases and immediate actions to be taken to address the issues by providing adequate post exposure prophylaxis (PEP) and treatment. (4,5)

NSIs are although considered as serious medical event but often undergo neglected as well as unreported and therefore non receipt of PEP timely against potential contamination.

Aims & Objectives

To assess the incidence of occupational exposure of NSIs as well as prevalence of the potential working environmental risk factors and to study various KAP variables pertaining to HCWs in a tertiary care hospital in Western India.

Material & Methods

This is a descriptive cross-sectional study conducted in hospital settings over a period of one year from Jul 2020 to Jun 2021. The sample size was determined based on single population proportion formula with 5% marginal error and 95% confidence interval by considering 32% (3,5,6) proportion prevalence of NSIs among HCWs of hospitals in this region. Besides this, by considering correction formula and 10% non-response rate, a total of 178 HCWs were included in this study. Study participants were selected using systematic random sampling after proportional allocation was done for each professional category in the hospital.

All HCWs who were willing to participate were administered a pre designed & tested, self-administered, semi-closed questionnaire to record the responses on variables like source and type of injury; mode and severity of injury; procedure of incident reporting been undertaken, hepatitis B vaccination status, immediate post exposure measures undertaken, status of source of exposure, previous status of HCW of HBV, HCV & HIV positivity. The information assortment was also carried out on various knowledge attitude and practices (KAP) variables pertaining to NSIs. Needle pricks with minute or no blood oozing were categorized as superficial while others penetrating deeper leading to frank bleeding as deep injury. Blood sample of HCWs who had reported NSIs and also of the potential source was simultaneously

withdrawn for baseline HBV, HCV and HIV sero-markers and repeat testing was also done for sero-conversion up to 06 months as per universal precautions guidelines. Besides, study participants were advised on PEP. The participating HCWs were informed about the aim of the study for academic and research purposes. Informed consent was undertaken by all participating HCWs and ethical clearance was undertaken from the hospital ethic review committee at the commencement of the study. Collected data was processed on SPSS ver 24 for statistical analysis.

The key strength of this study is that it has attempted to assess various KAP variables associated with occupational exposure to NSI amongst HCWs in hospital settings for the first time in the study area. The main limitation of the study is probably the response bias from the participants. It is possible that actual compliance to universal precautions (as opposed to self-reported compliance) may be lower than that reported.

Results

Demographic profile of 178 HCWs in a tertiary care hospital setting who consented and self-reported the needle stick injury by potentially infectious material over a period of one year is shown in the (Table 1). Majority (53.3%) were in the age group of 20-40 with mean age of respondents was 27.2 years (SD±5.8) and 74% of them were males. Profession wise 43.8% were nursing staff; 17.6% housekeeping; 16.2% doctors; 13.4% were laboratory technicians and 9% were interns and trainees in various departments. 48% were with experience of less than 5 years as HCWs. Results shows 87.6% and 22.4% were immunized for HBV and HCV respectively.

(Table 2) shows the prevalence of the potential working environmental risk factors related to needle stick injuries. Total of 62 incidences of sustaining a needle stick injury in a year was recorded amongst 178 HCWs participants of the study. Data was obtained specifically from these 62 HCWs and analyzed for key variables for statistical significance. Majority (69.4%) were superficial injury with no blood ooze while 31.6% were deep NSIs with blood ooze from site of skin puncture. Accidental cause (37%) followed by carelessness (24.2%) was quoted as two most important reasons for NSIs in the study. Most of the HCWs reported to be handling stressful situations in emergency department (27.4%) /operation theatre (OT) or intensive care units (ICU) settings (19.4%). Disposal of biomedical waste (22.6%), blood withdrawal for testing (19.4%), injection of drugs (14.5%) were the commonest occasion on sustaining NSIs followed by suturing (13%), IV Canula insertion (13%) recapping (8%) and changing patient linen (6.5%). Approximately 42% HCWs sustained NSIs during working hours on working days, howsoever 29% HCWs reported NSIs during off duty hours on working days. As per study 38% sustained the NSIs during the conduct of invasive procedure while 41% injuries were reported post

procedure. Fatigue (26%) and overcrowding of patients (22.4%) contributed most for getting exposed to NSIs. Availability of sharp box where NSIs was confirmed by 31.5%, existence of protocol to fill incident of NSIs was stated by 60.2%, exposure to training in prevention and treatment of NSIs and universal precautions was confirmed by 51.7% and provision of personal protective equipments (PPEs) was stated by 50.6% HCWs.

(Table 3) shows the inputs received on various KAP variables associated with exposure to NSIs. Knowledge Variables: Most (95%) confirmed that NSIs constitute occupational hazard to HCWs and 86.5% were aware about NSIs lead to transmission of blood borne pathogens. Results shows 96% were aware about the knowledge about disposal of sharps as per BMW guidelines and 75.8% were aware about PEP. Universal precaution guidelines were known to 79.2% while 57.3% were aware about needle safety devices. Attitude Variables: Approximately 85% HCWs believes that NSIs are preventable. As per study 48.9% HCWs were disposing sharp box when it was half full; 30.3% when it was 2/3 full; 13% when it was ¾ full and remaining 7.8% were disposing when it was completely full. Just before disposal of sharp box 47% were labeling it properly, 54% assembled it securely, 39% placed it in yellow bag, 23% were locking it up until collection and 38% waited till next box is available for sharp disposal. In situation of finding a used needle on the floor, 29% HCWs were reopening sharp box to keep it, 21% use new box while 37% waited till new box arrives. When there is need of separating a needle from a syringe 15% HCWs used bare hands with caution, 38% used gloved hands, 34% do not separate it with hands while 4% used forceps to do the same. Practice Variables: Results shows that 72% HCWs were wearing gloves while handling needles; 54% of HCWs who had experienced NSIs reported to hospital administration; 78% confirmed that they received the care after injury and 44% suggested that their immune status to blood borne pathogens was tested. Approximately 91% HCWs who were placed on PEP completed their course while 99% affected HCWs confirmed that they washed with water and soap and applied spirit and also had post exposure prophylaxis as the immediate measures on reporting NSIs to the hospital administration.

(Table 4) shows the findings of bivariate logistic regression analysis of key factors associated with NSIs. In this study, statistically significant results with p value less than 0.05 was obtained with association with variables like gender, experience in years as HCWs, profession, observance of universal precautions as wearing gloves or any training on PEP or universal precautions.

Discussion

The present study was carried out to assess the measures of frequency of NSIs as well as prevalence of the potential working environmental risk factors and to study various

KAP variables pertaining to HCWs in a tertiary care hospital in Western India. The study showed that 34.8% respondents HCWs had sustained NSIs at least once during study period. Wide variation reported from various other studies are Coimbatore, Tamil Nadu (6) (28.4%), coastal South India (7) (71.9%), teaching hospital of South India (8) (10.81%), tertiary care hospital in Delhi (9) (79.5%), another study from North India (10) (3.11%) Northwest Ethiopian study (11) (18.7%) and amongst hospital nurses at Iran (12) (76%) where respondents reported needle stick and sharp injury. This may possibly due to difference in socio-demographic characteristics, strictness in safety protocols and training standards.

In the present study, it was found that male HCWs were 1.36 times more likely to face NSIs [AOR=1.36(0.64 - 2.68)] than female HCWs and it was found to be statistically significant. This may be attributable to better adherence to safety protocols by female gender. This is relatively similar with studies done at Northwest Ethiopia (11) and study in North India (13) but contrary to study findings of Bashir et al (6) and Mittal et al (10) where females were found to be more prone while Holla et al (7) does not supports any gender predilection for NSIs.

It was found in our study that HCWs with lesser work experience were more likely to encounter NSIs as compared to more number of years of service [AOR=1.23 (0.32-2.12)]. In our study respondents, maximum HCWs who suffered NSIs were young nursing staff, interns and housekeeping staff [AOR=0.033 (0.001 - 0.43)]. This may be contributed lesser exposure to various medical emergencies, associated job stress to handle and impartial knowledge about universal precautions and PEP. This was also supported by study findings from North India where more than one-third (36.9%) of NSI incidences were found in newly joined academic and nonacademic junior residents (13). In Northwest Ethiopian study (11) health workers who had perceived skill acquisition were 96% times less likely to encounter needle and sharp injury [AOR = 0.04 (0.003, 0.57)] than those who did not have the required skill. Another study which was in United States also showed that lack of skill accounts for 12% occurrence of needle stick injury (14). This may be attributable to expertise gained over years with experience over mistakes and thereby associated learning about safety guidelines. While in a study from coastal South India (7), majority of the needle stick injuries were observed among the health care personnel who had a work experience of five and more than five years and it was found to be statistically significant, which is attributed by researcher to the differences in the composition of study sample.

Existing literature undoubtedly, suggest that the most pertinent factor that affects needle stick and sharp injury are judicious implementation of universal precautions and personal prophylaxis. This study documents that HCWs applying universal precautions especially wearing gloves before patient care services at all times were 33% times

less likely to sustain NSIs as compared those being careless about same. [AOR=0.33 (0.169 - 0.631)]. The study from coastal South India (7,13) showed that needle stick injuries were more among health care personnel who were unaware of universal precautions. The proportion of needle stick injuries was more among health care personnel and this can be reduced by training the workers regarding universal precautions and making sure that they are adhering to these norms.

Another important factor affecting NSIs is the prevalence of environmental stress related to task in hand. Job related stress as associated to time of injury (during procedure), department the HCWs was functioning (emergency dept), reason for getting exposed documents the same. (Figure 1) This is comparable to study done at Northwest Ethiopian study (11) where health workers who had job related stress were 7.3 times more likely to face needle stick and sharp injury than those who did not have job related stress. Injuries were most commonly reported from emergency wards and ICUs (48.1%). In emergency wards, most of the time HCWs carry out the procedures on an urgent basis, and the pressure of immediate patient care increases the chances of NSIs.(6,8,9,10,13).

Regarding common mode of NSIs, in this study disposal of biomedical waste (22.6%), blood withdrawal for testing (19.4%), injection of drugs (14.5%) were the commonest occasion on sustaining NSIs followed by suturing (13%), IV Canula insertion (13%) recapping (8%) and changing patient linen (6.5%). While Recapping and post use disposal of needles have been reported as the most common action during which HCW sustain NSI (34.0–65%) amongst other hospitals of North India. (8-12) In our study, most of the injuries occurred (85%) during procedures rather than recapping (11.3%) and sharp disposal (3.7%) (13). Other studies supporting job related stress as an important factor (6,14-17) In the present study, 99% HCWs who sustained NSIs during study period reported washing the injury site with water and soap and applied spirit and reported for post exposure prophylaxis. Cleaning the injury site with soap and water was the most frequently used first-aid measure following exposure in over 62.4% of HCWs injured. The correct method of washing the injury site was practiced by 71.3% of physicians while other HCWs showed poor knowledge about immediate action following exposure. (6,8,13) These differences may be due to lack of active surveillance or under-reporting or both since the present study is based on self-reporting only. While no NSI can be regarded as 'could not have been prevented' as nearly 85% of study sample answered, but according to 11% may not be practically feasible to avoid their occurrence altogether although, their occurrence can be minimized to a large extent.

This study shows that observance of universal precautions protocols, 96% were knowledgeable about correct

disposal of sharps as per BMW guidelines although attendance to any organized training on prevention was confirmed only by 51.7%. This may be due to acquired knowledge from the environment and developed understanding while on the job. 85% were aware that NSIs are preventable if appropriate PPE are utilized, 72% HCWs confirmed wearing gloves while handling needles, 91% followed the PEP protocol completely under guidance. In this institute there is an integrated approach to prevention and raising awareness on the subject. In a review article where the fourteen studies reviewed, nine evaluated a double-gloving method, one evaluated the effectiveness of blunt needle, and one evaluated a blood borne pathogen educational training program. Ten studies reported an overall reduction in glove perforations for the intervention group (15-22). In conclusion, this review suggests that both safeguard interventions and educational training programs are effective in reducing the risk of having needle stick injuries. However, more studies using a combination of both safeguards and educational interventions in surgical and nonsurgical settings are needed for improving outlook on subject.

Increasingly, health-care facilities are applying for the National Accreditation Board for Hospitals and Health care Providers (NABH) and Joint Commission International (JCI) accreditation. (3,20,21,22) All accrediting bodies give emphasis on the implementation of NSI protocols and occupational safety of the HCW. Thus, policies and processes are clearly established in such NABH and JCI accredited facilities. However, there may be occasional lapses as there has to be a systemic change in the behavior of every HCW to prevent NSI, report NSI and follow-up after an NSIs.

Conclusion

NSIs stay a significant wellbeing concern to health care workers especially in our mushrooming tertiary care hospitals with high-patient burden. To lessen the dangers and impacts of NSIs training should coordinate the endeavors toward preparing of health care workers, utilization of wellbeing designed gadgets, and diminishing patient burden per health care workers as these means may probably help the prevailing circumstances. Prevention of NSIs still stays as the best way to prevent potentially contamination with blood borne pathogens in health care workers. It should be an integral part of prevention programs in the work place, and training of HCWs regarding safety practices indispensably should be strengthened and upgraded.

Recommendation

It is recommended that every hospital should develop a multi-pronged strategy to deal with NSIs. Besides health promotion, there should be setting up of an adequate surveillance mechanism and facilities for prompt response and immediate treatment of NSIs. Policy strategies to reduce/avoid NSI-associated disease burden must include

vaccination against HBV, PEP for HBV, HCV and HIV, reduction in invasive procedures, injections, substitution of equipment to using safer devices and proper disposal techniques (needles/sharps).

Authors Contribution

All authors have contributed equally.

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Tables

TABLE 1 DEMOGRAPHIC PROFILE OF HEALTH CARE WORKERS (HCWS)

		N (178)	%
AGE GROUP (In Yrs)	< 20	16	9.0
	20-40	95	53.3
	40-60	38	21.3
	>60	29	16.4
GENDER	MALE	132	74
	FEMALE	46	26
PROFESSION	DOCTORS	29	16.2
	INTERNS/ TRAINEE	16	9.0
	NURSING STAFF	78	43.8
	LAB TECHNICIANS	24	13.4
	HOUSEKEEPING STAFF	31	17.6
EXPERIENCE IN YRS AS Hcws	<5ys	86	48
	6-10 Yrs	67	37.6
	>10yrs	25	14.4
IMMUNISATION PROFILE	Hbsag	156	87.6
	HCV	22	22.4
	HIV	Nil	Nil

TABLE 2: WORKING ENVIRONMENT RISK FACTORS RELATED TO NSIS (N=178)

		N	%
Sustained A Needle Stick Injury in Last 01 Year	Yes	62	34.8
	No	116	65.2
Type Of Injury	Superficial (No Blood Ooze)	43	69.4
	Deep (With Blood Ooze)	19	31.6
How Did the Most Recent Incident Happen	Poor Disposal	11	17.7
	Accident	23	37
	Carelessness	15	24.2
	Cannot Remember	09	14.6
Which Dept Were You Working When the Injury Was Sustained	Wards During Bedside Care	05	8.0
	Emergency Dept	17	27.4
	Ot/Icu	12	19.4
	Laboratory	10	16.2
Mode Of Needle Stick Injury	Waste Disposal	18	29
	Suturing	08	13
	Iv Canula Insertion	08	13
	Injection Of Drugs	09	14.5
	Blood Withdrawal	12	19.4
	Recapping	05	8.0
	Biomedical Waste Disposal	14	22.6
	Changing Patient Linen Or Clothing	04	6.5
When Was the Injury Sustained	Any Other Answer	02	3.0
	Monday To Friday 09:00 To 17:00	26	42
	Monday To Friday 17:00 To 09:00	18	29
	Weekend	08	13
	Holiday Duty	06	9.6
	On Call	02	3.2
Time Of Occurrence of Needle Stick Injury	Any Other Answer	02	3.2
	Before Procedure	05	8.0
	During Procedure	37	38
	After Procedure	12	41
	Not Related To Any Procedure	08	13
Job Related Stress Contributing to NSIs	Fatigue	16	26
	Rushed	11	18
	Overcrowding	14	22.4
	Non-Cooperation From Patient	08	13
	Lack Of Skill	03	4.6
	Lack Of Assistance	04	6.5
Was There a Sharp Box In The Area Where The Injury Was Sustained	Negligence To Ppe/Pep	06	9.5
	Yes	56	31.5
Does Protocol to Fill in An Incident Report Exists	No	122	68.5
	Yes	107	60.2
Any Training in Prevention and Treatment of NSIs Or Universal Precautions	No	71	39.8
	Yes	92	51.7
Provision Of PPE from NSIs	No	86	48.3
	Yes	90	50.6
	No	88	49.4

TABLE 3: KAP OF HCW PERTAINING TO EXPOSURE TO NEEDLE STICK INJURIES (NSIS)

Variables	Yes N (%)	No N (%)		
Does Nsis Constitute Occupational Hazards To Hcws	169 (95%)	09 (5)		
Does Nsis Lead To Transmission Of Blood Borne Pathogens	154 (86.5%)	24 (13.5)		
Knowledge About Disposal Of Sharps As Per Bmw Guidelines	171 (96%)	07 (4)		
Do You Know About Pep	135 (75.8%)	43 (24.2)		
Do You Know About Universal Precautions Guidelines	141 (79.2%)	37 (20.8)		
Do You Know About Needles Safety Devices (Double Glove Technique And Blunt Needle)	102 (57.3%)	76 (42.7)		
			N	%
Are Nsis Preventable	Yes	152	85	
	No	126	15	
When Do You Dispose Of Sharps Box	½ Full	87	48.9	
	2/3 Full	54	30.3	
	¾ Full	23	13.0	
	Completely Full	14	7.8	
What Do You Do With Sharp Box Just Before Disposal	Label Properly	82	47	
	Assemble And Secure Box	96	54	
	Put It In Yellow Bag	69	39	
	Lock Up Untill It Is Collected	41	23	
	Wait Till Next Box Is Available	67	38	
	Any Other Answer	60	34	
What Do You Do If You Find A Used Needle On The Floor	Reopen Box To Keep It	51	29	
	Use New Box	37	21	
	Wait Until New Box Is Available	66	37	
	Any Other Answer	24	13	
If You Need To Separate A Needle From A Syringe	Bare Hands With Caution	26	15	
	Gloved Hands	67	38	
	Never Separate	60	34	
	Use Forceps	16	9	
	Any Other Answer	09	4	
Were U Wearing Gloves Everytime While Handling Needles (N=178)	Yes	127	72	
	No	51	28	
Did U Reported Nsis To Adminstration (N=62)	Yes	33	54	
	No	29	46	
Did U Received Care After Injury (N=62)	Yes	48	78	
	No	14	22	

Variables	Yes N (%)	No N (%)
Was Infection Immune Status Checked After Injury (N=62)	Yes 27	44
	No 35	56
Did U Followed The Pep Protocol Completely (N=62)	Yes 56	91
	No 06	9
Immediate Measures Undertaken After Nsis (N=62)	Nothing 01	2
	Washed With Water 06	10
	Washed With Water And Soap 16	26
	Applied Spirit 07	12
	Post-Exposure Prophylaxis 56	91

Variables	Yes N (%)	No N (%)
	Washed With Water And Applied Spirit 20	32
	Washed With Water And Soap And Applied Spirit 24	38
	Washed With Water And Soap And Applied Spirit And Post-Exposure Prophylaxis 61	99

TABLE 4: BIVARIATE & MULTIVARIATE LOGISTIC REGRESSION OF FACTORS ASSOCIATED WITH NSIS

Variable	Response	Reported NSIs		AOR(95%CI)	p value
		Yes	No		
Gender	Male (132)	48	84	1.36 (0.64 -2.68)	0.023
	Female (46)	14	32		
Experience in years as HCWs	<5ys (86)	42	44	1.23 (0.32-2.12)	0.001
	6-10 yrs (67)	14	53		
	>10yrs (25)	06	19		
Profession	Doctors (29)	04	25	0.063 (0.001- 0.43)	0.04
	Interns/ trainee (16)	06	10		
	Nursing staff (78)	29	49		
	Lab technicians (24)	10	14		
	Housekeeping staff (31)	13	18		
Wearing Gloves	Yes (127)	33	94	0.33 (0.169 – 0.631)	0.0009
	No (56)	29	27		
Any Training on PEP or Universal Precautions	Yes (92)	23	69	2.29 (1.320-4.696)	0.0024
	No (86)	39	47		

Figures

FIGURE 1 REASON FOR GETTING EXPOSED TO NSIS

