

## Study of behavioral and psychosocial factors relating to needle stick injuries in nursing staff of a tertiary care cancer hospital of Punjab, India

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### ABSTRACT

**Background and Objectives:** Needle stick injury (NSI) is the most dreaded occupational health hazard affecting a health-care worker (HCW) psychologically and physically. The risk of infection post needle stick injury ranges between 1.9% to greater than 40% for HBV infections, 2.7-10% for HCV and 0.2-0.44% for HIV infections. As per National AIDS Control Organisation (NACO) records, nursing staff is at highest risk (43%) followed by physicians (28%). The main objective of this study was to evaluate knowledge of nursing staff about needle stick injuries and to study factors leading to such incidents in their working areas, impart them knowledge regarding the same and fill gaps in knowledge.

**Materials and Methods:** This is a cross-sectional retrospective analysis involving nursing staff and students. p values were calculated using SPSS software.

**Results:** Overall NSI prevalence among nursing staff and students was 51.6% whereas in more exposed and less exposed group was 47.45% and 10.16% respectively (p=0.2056). The most common cause of NSI incident was recapping of needle (38.5%) followed by transferring needle to sharp container (35%).

**Conclusion:** Consequences of NSI are serious and this study has tried to emphasize on the need to study the factors leading to NSI.

**Keywords:** Needle stick injury; HIV; HCV; HBV; Health care worker; Occupational injury

### INTRODUCTION

Needle stick injury (NSI) is the most dreaded occupational health hazard effecting a healthcare work-

er (HCW) psychologically and physically. Handling patient's blood and body fluid comes with lot of risks and if not taken care of, can transmit more than 20 blood borne pathogens like Hepatitis B and C Virus,

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Human Immunodeficiency (HIV), Syphilis etc.

NSI is defined as a penetrating or cut wound in the skin caused by a needle or sharp instrument in the health care setting (1). The risk of infection post needle stick injury ranges between 1.9% to greater than 40% for HBV infections, 2.7-10% for HCV and 0.2-0.44% for HIV infections (2). NSIs have been known to cause approximately 66000 HBV, 16000 HCV and 200-5000 HIV infections annually in HCWs (2). Another problem is underreporting due to lack of awareness and seriousness of situation.

As per Center for Disease Control (CDC) and prevention, only 10% of the NSI injuries are reported to authorities (3). This is more challenging in developing countries where the prevalence of HBV, HCV and HIV is high and puts the HCW at a greater risk of infection acquisition. Another problem is shortage of manpower that has led to inadequate health care worker (HCW) to patient ratio. HCWs do their best to provide best patient care beyond their capacity. The increased work stress leads to negligence in taking proper precautions while handling patients or their infected samples and haste to meet the timelines which eventually leads to mishaps like needle stick injury (NSI), sharp injury, spillage, soiling of clothes, eye splashes, burn injuries and chemical injuries.

Besides being alert, having correct knowledge and attitude while dealing with sharps and needles plays a major role in protecting HCW's from NSI's. As per National AIDS Control Organization (NACO) records, nursing staff is at highest risk (43%) followed by physicians (28%).

Several studies conducted worldwide have emphasized on risk of NSI to HCWs and the need to improve occupational health and safety services in the healthcare systems (4). One of the studies conducted in India has shown that average number of NSIs was 3.85 per HCW (5). As nursing staff is most exposed to sharps so this study was undertaken to study the prevalence of NSI and attitude post needle stick injury in nursing staff working in our tertiary care hospital.

## MATERIALS AND METHODS

A cross-sectional retrospective analysis was conducted among entire nursing staff (n=59) and nursing students (n=36) working in our tertiary care cancer hospital of Punjab. Lectures pertaining to aware-

ness about needle stick injuries as a part of infection control training were conducted over a period of 4 months from July to November 2022.

**Inclusion criteria.** 1) All nursing staff (regular as well as contractual) employed in the hospital, 2) All nursing students enrolled in the course who are serving in patient areas

**Exclusion criteria.** 1) HCWs not willing to participate in the study, 2) Already trained HCWs.

Sample size calculation was done as per the Cochrane's formula ( $n = (z)^2 \times p(1-p)/d^2$ ), assuming z as 1.96 at 95% Confidence Interval. The precision (d) was calculated as 20% prevalence in previous studies (46-60%). Taking 53% as average prevalence and computing with Cochrane formula with p (53), q (47) and d (10) a sample size of 95 was calculated.

All participants (n=95) were divided in batches of 4-5 and their email IDs were noted. An anonymous questionnaire in form of Google form was circulated to access their socio-demographic details like gender, age, sex, years of experience, area of posting, knowledge about NSI, its awareness, prevention and management regarding the same. The questionnaire also included some psychosocial questions like precipitating factors leading to NSI, activity being done. Some questions regarding their knowledge about NSI related infections were also there which were discussed in the training class conducted post filling the form where they were imparted knowledge regarding various risk factors for NSI, their implications and diseases associated with it, role of Hepatitis B vaccine in health care and knowledge about protective tires, occupational exposures, various blood borne infections (BBI's) spread by needles and sharps, reporting of incidents and it's management and the role of periodic screening of their blood against various BBI's spread by NSI. Hands on training regarding handling the needles, sharps, infected samples, secretions and patients during day-to-day work. The results were noted in excel format and analysis was undertaken. Odds ratio and p values were calculated using the Graph pad software after constructing 2x2 contingency Table.

## RESULTS

A total of 95 nursing staff and nursing students working in our tertiary care hospital were enrolled in

the study. They were enrolled in batches to attend a weekly lecture on awareness of needle stick injuries and management. Prior to class a questionnaire was mailed to them in form of Google form.

The results were analyzed after completion of classes for whole Nursing staff (Table 1). 59/95 (62%) of staff were contractual (12/59) and regular (47/59) employees of the hospital and 36/95 (38%) consisted of nursing students. Overall NSI prevalence among Nursing staff and students was 51.6% (Table1).

Out of 95 staff enrolled, 59 (62%) were nursing officers and 36 (38%) were nursing students. The mean age of nursing staff was 31 years consisting of 26 males and 33 females. Their area of work was ward (40/59), ICU (4/59) and OPD (15/59) (Table 1). The mean years of experience were 6 years.

Whereas, the mean age of nursing students was 25.1 years and average experience of 3.05 years was calculated. All were females. Overall risk prevalence in the group was 15/36 (44%) (Table 1). The ones who were not exposed to sharps did not report an NSI event. The two groups were compared for various parameters.

45/59 (76.3%) nursing officers were posted in critical areas like (wards, emergency, ICU, OT) where the daily risk of NSI was higher as compared to other

group (14/59) posted in OPDs and radio diagnosis department, infection control and administrative wings who were less exposed to sharp on routine basis. Overall prevalence of NSI in Nursing staff was 58% (34/59). 28/45 (62%) nursing officers of high exposure group reported more than one NSI incident ( $p=0.0398$ ) in their career whereas in less exposed group the 6/14 (42.8%) reported to have NSI incident. The overall prevalence was more in participants with daily sharp exposure as compared to those with less exposure. More exposed and less exposed group showed prevalence of 47.45% and 10.16% respectively. The relation was found to be statistically insignificant ( $p=0.2056$ ), however the more exposed group was definitely at risk (OR= 2.1961; CI= 0.6496-7.4240;  $z=1.266$ ). However, the results were contrasting in nursing student group when exposed (31/36; 86%) and non exposed (5/36;14%) groups were compared. The Odds ratio was 11.71 (95% CI= 0.5966-229.84,  $Z=1.62$ ). The relation was statistically insignificant ( $p=0.105$ ).

Outputs obtained from nursing staff and nursing students were compared and the results were tabulated (Table 2). Few observations were made by comparing the groups. Maximum incidence of NSI was in age

**Table 1.** Sociodemographic analysis of staff included in study

Sociodemographic character		Nursing staff (n= 59)	NSI+ (n=34)	Nursing students (n=36)	NSI+ (n=15)
Age (Years)	20-25	0	0	23	7/23
	26-30	30	20/30	11	8/11
	31-35	24	13/24	0	0
	36-40	5	1/5	2	0
Experience (Years)	1-3	17	9/17	18	5/18
	4-6	17	12/17	16	10/16
	7-9	16	8/16	2	0
	10-12	9	5/9	0	0
Nature of service	Regular	47	31/47	-	-
	Contractual	12	4/12	-	-
Daily sharp exposure	Yes	45	28/45	31	16/31
	No	14	(6/14)	5	0
Practice of routine viral marker testing	Yes	41	-	26	12/26
	No	18	-	10	-
Frequency of viral marker testing	Once/year	36/41		21/26	7/21
	Twice/year	5/41		5/26	5/5
H/O NSI Management and awareness training	Yes	33	19/33	28	10/28
	No	26	15/26	8	5/8

**Table 2.** Risk behavior and staff awareness analysis

Sno	Parameter		NSI Event		Total n	p value	OR	CI
			Present	Absent				
1.	Daily sharp exposure	Present	44	32	76	0.045	2.97	1.0227 - 8.6782
		Absent	6	13	10			
2.	NSI Awareness training undergone	Present	29	32	61	0.291	0.63	0.2717- 1.4812
		Absent	20	14	34			
3.	Regular employment	Yes	30	16	46	0.033	4.218	1.1215 - 15.8704
		No	4	9	13			
4.	HBV Vaccine	Taken	46	39	85	0.16	2.75	0.6664 -11.3657
		Not Taken	3	7	10			
5.	Ward duty	Yes	17	12	29	0.77	1.17	0.4194 - 3.2450
		No	17	14	31			
6.	ICU duty	Yes	13	13	26	0.362	0.69	0.2201- 1.7412
		No	21	13	34			
7.	OPD duty	Yes	4	1	5	0.29	3.33	0.3497- 31.7751
		No	30	25	55			

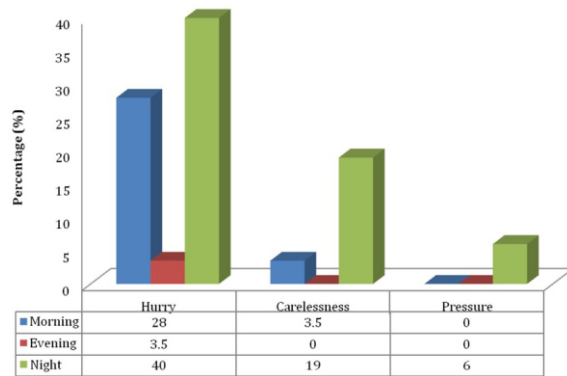
group 26-30 years in both groups. Highest incidence of NSI was seen in staff having 4-6 years of experience. This might be attributed to the fact that after completion of 3 years training period under observation the staff worked independently under pressure leading to NSIs. Out of regular and contractual staff, the regular staff had inflicted more NSI events. The p values were found to be significant (p= 0.026). This observation might be explained due to more years of services and relatively more responsibility being given as compared to other group.

Majority of NSI incidents occurred during night duty shifts (65%), followed by morning (31.5%) shift. The most common aggravating factor was hurry (35%) to complete the task (Fig. 1). The most common cause of NSI incident was recapping of needle (38.5%) followed by transferring needle to sharp container (35%). Working in hurry was seen most common factor in this incident too.

The HCW were evaluated about post NSI measures taken. About 31.5% pressed the injured site post NSI event followed by cleaning with plain water (30%). Only 28% followed the correct measure of washing with soap and water (Fig. 2).

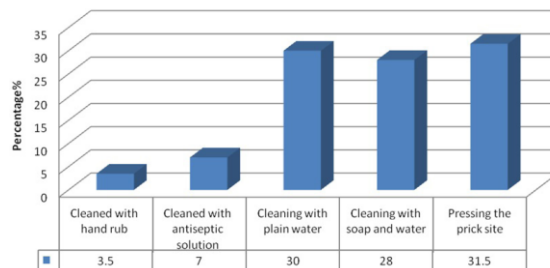
Approximately 73/95 (76.8%) nursing staff enrolled was vaccinated at time of joining the hospital. 7/95 (7.36%) were vaccinated in childhood and were not aware of their anti HBs titers. Voluntary viral marker testing was taken up by 74/95 (78%) once a year. 49/95 (52%) HCWs were aware of the diseases spread by hematological route and NSIs. Only 34/95 (36%)

**Behavioural factors leading to NSI**



**Fig. 1.** Behavioral factors leading to NSI

**Measures taken post NSI**



**Fig. 2.** Post NSI measures

HCWs had the knowledge about protective titers of the Hepatitis B vaccine.

The study also evaluated the reasons for not reporting NSI incident (Fig. 3). Most common cause was



**Fig. 3.** Reasons for not reporting NSI incident

less motivation followed by fear of losing job.

## DISCUSSION

NSI's are a serious occupational hazard which may contribute to various BSI (Blood Stream Infections) like Hepatitis B, Hepatitis C, HIV. The present study has tried to evaluate the prevalence of NSI incidents in nursing professionals working in the hospital and study a few psychosocial factors contributing to NSI. The overall NSI prevalence in our study is 51.6% (49/95) which is higher than that reported from 2 Indian studies by Bhargava et al. (44%) and Sardesai et al. (45%) (6, 7). Bharti et al. and Gupta et al. reported a prevalence of 66.7% and 69% respectively (3, 8). Approximately 11.5% nursing staff reported more than one NSI event in their life. Sharma et al. reported a higher percentage (79.5%) of HCWs inflicting more than one NSI in their life time (5).

In a metanalysis conducted by Xu et al. global NSI prevalence was found to be 35% (95% Confidence interval (CI): 28-43%) in nursing staff with a higher incidence in Asia (39.7%; 95% CI: 31.7-47.7%) (9). In another study conducted by Mengistu et al. 1009 and 2201 participants were involved to determine 1-year and throughout career prevalence, respectively (13). The prevalence of NSI ranged from 19.9% to 54.0% in previous 1 year and overall prevalence throughout career was found to be 64.1% (10). Out of 95 nursing professionals 62% were nursing officers and 38% were students enrolled in nursing courses who were rotated for training purposes. 29% of the nursing officers gave history of more than 1 needle stick injury incident in their life time.

The highest NSI prevalence was found in age group of 26-30 years (29%) which is similar to findings of

Gupta et al. 71% (20-29 years) and Dille et al. (77.2%; 20-29 years) (2, 3). Nursing officers (34/49; 69%) reported more NSI events than nursing students (15/49; 31%) unlike the findings by Gupta et al. in which nursing students (58%) inflicted more NSIs than Nursing officers (42%) (3). The main reason for our observation is that Nursing officers are working in frontline areas and the students were involved in assisting and learning which involves less risk.

Psychological and physical factors like hurry, carelessness, fatigue have known to have a role in such events. Majority of incidents were reported in staff working in night shift (65%). Moghadam et al. reported majority of the NSIs to have occurred in the morning shift (50.9%) followed by night shift (36.4%) (11). Garus-Pakowaska et al. reported that most injuries occurred during the morning shifts from 7 a.m.–1 p.m. (n = 18) (12). Bharti et al. reported that maximum (33.6%) NSI incidents occurred during evening time and occurred during intravenous procedure (35%) (8). Recapping of needle (38.5%) was the most common predisposing factor leading to NSI incident followed by I/V drug administration (26%). Gupta et al. reported venipuncture of needle (52.8%) followed by recapping (27.5%) as the major factor causing NSI (3). However, Bhargava et al. (60%) and Sharma et al. (34%) reported recapping as most common causative factor for NSI (5, 6). Qadire et al. also reported recapping (59%) as major event leading NSI (13). Berhan et al. studied Ethiopian HCWs and inferred recapping as major event causing NSI (14). Dille et al. in a similar study found HCWs who recapped needles were 21.3 times more likely to face needle stick and sharp injury with an AOR = 21.3 (2). In another study conducted by Khabour et al. in 234 clinical lab workers in Saudi Arabia, it was observed that 24% had experienced a needle stick injury out of which 49% reported that they always recap needle after use, whereas 15% reported doing that most of the times (15). We educated our HCWs about the risks involved in recapping the needle and to follow proper precautions while handling unsheathed needles.

49/95 (51.55) HCWs reported picking up a stray needle from floor or outside the waste box which is a risk factor for NSI incident. No one had inflicted NSI in this act. The reason given was non proximity of sharp disposal box to the working area. Alsabaani reported 24% disposal related NSI (1). As a result, a policy was framed to have essential sharp disposal container in working trolley as well as near nursing

station. Ishak et al. concluded in his study that 7% of NSI were associated with needles found in inappropriate places like table/tray (3%), bed (1%) and others (3%) (16).

Majority of NSI incidents were observed in nursing staff having 4-6 years (70.5%) of experience and there was a decreasing trend with increase in years of experience. A similar inference was made by Bharti et al. in their study in which nursing staff had 1.66 times higher chances of needle stick injury than those who had working experience more than 10 years (8). Dille et al. also had same inference (0-5 years, 75.1%) (2).

The questionnaire also catered to the knowledge of HCWs regarding various BSI and vaccination against HBV. Only 47.5% of HCWs were aware of diseases spread due to NSI. Approximately 8% knew about prophylactic vaccines available. Similar conclusions were formed in a study by Sardesie et al. where it was seen that only 21% of the HCWs knew about the diseases transmitted by NSI, only 30% of Class IV workers were aware of Hepatitis B vaccination and none of them were vaccinated (7). Sharma et al. observed that only 64.4% of HCWs had correct knowledge of transmission of various diseases by NSI (5). In the study by Bhargava et al. it was seen that 76% of HCWs had correct knowledge of relative transmissibility of HCV and HBV and 80% had correct knowledge about proper first aid after NSI (6). Madhavan et al. assessed HCW's knowledge and inferred that, 70% of HCWs had correct understanding of the term NSI, 63% knew standard precautions require for prevention, 88% knew correctly the diseases spread by NSIs, 82% had correct knowledge about the proper protocol of sharp disposal and only 50% knew the correct authorities to be reported in case of a prick (17). These findings call for a need to reinforcement of basic knowledge about BBI, their consequences, prevention, and management.

Only 74/95 (77.8%) HCWs were aware of the regular viral marker testing and got themselves tested at regular intervals. In a study undertaken by Sharma et al. in a tertiary care hospital in Uttarakhand, they found that, only 51.3% of HCW's completed follow-up for 6 months and were found non-reactive for viral markers (5). 70% of Nursing staff were vaccinated against Hepatitis B. Vaccination rate of HCWs in a study done by Sardesai et al. study was also 70%. Sharma et al. in their study found that only 48% of HCWs were vaccinated (18). The vaccination

prevalence in a study conducted by Berhan et al. was 63.1% (14).

When asked about the practices followed post NSI accident, only 28% Nursing staff could answer the correct procedure to wash with soap and water. 31.5% gave history of pressing the prick site which is actually contraindicated. Whereas the score was good in a study done by Qadire et al. who documented 38.6% students knowing the correct procedure to follow (13).

42% of Nursing staff who inflicted a NSI did not report the incident due to non guidance and lack of motivation by coworkers whereas 26% of them feared of losing their job. Only 47.3% subjects in a study conducted by Alsabaani et al. reported NSI incident and only 2/3 of participants cared if they inflicted NSI (1). Only half of injuries were reported to health authorities (1).

## CONCLUSION

NSI are to be dealt seriously especially as it poses risk to all healthcare workers. Indian hospitals cater to lot of patients and HCWs are over worked because of heavy patient load leading to haste in work and causing mishaps like NSI's. Teaching and training are required for awareness of health care workers. Infection control team should emphasize during training sessions the risks involved in recapping needle, improper Biomedical waste segregation, importance of relevant Personal Protective Equipment (PPE), importance of following protocols. Duty timings should be planned keeping in mind the health of health care professionals. PPE should be made available to all HCWs as per the requirement. The study has emphasized on certain behavior characteristics responsible for Needle stick injuries and will send message to HCW s too practice caution while working and prevent NSI.

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