



KNOWLEDGE, ATTITUDE AND PRACTICE TOWARDS NEEDLE STICK INJURY AND SIGNIFICANCE OF HBV VACCINATION AT CANCER INSTITUTES: BASIC WORK UP BEFORE IMPLEMENTING EFFECTIVE NSI MANAGEMENT PROTOCOLS

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ABSTRACT

Introduction: Hospital staff directly involved in patient care are at high risk of occupational exposure to Needle stick injury (NSI). Doctors, Nurses and Housekeeping (HK) staff are the most common health care categories affected physically, financially and socially by NSI. The main objective of the study was to determine NSI prevalence and associated risk factors at a cancer setup and evaluate misconceptions and knowledge gap regarding its prevention and management along with HBV vaccination status among various health care categories and hospital administration. **Materials & Method:** A cross sectional questionnaire-based survey was conducted among doctors, nurses, HK staff, technicians, hospital administration, phlebotomists and pharmacists at tertiary care cancer institutes from January 2022 to October 2023. **Results:** The overall prevalence of NSI among surveyed health care staff was 40.58% affecting 29.4% of surveyed staff of which multiple episodes of NSI were commonly observed among doctors and nurses during working at emergency ward, ICU or IPD wards. Majority of doctors and nurses acquired NSI during sample collection and performing procedures, while HK staff got injured during handling and disposal of sharp biomedical waste. Among surveyed staff, 60.2 % were vaccinated for HBV, of which 90% of doctors, 76.5% of nurses, 70.2 % of technicians and only 28.7% of HK staff have completed the vaccination schedule. Among vaccinated staff, 65.8% of them were not aware about their anti-HBsAg titre. **Discussion:** Performance of awareness and training sessions towards handling of NSI and HBV vaccination is suboptimal. Administration and concerned authorities of the hospital need to strengthen these activities with some innovative, practical and user-friendly approaches. Such surveys must be performed by concerned hospital authorities to increase awareness, assess improvement, understand real time deficiencies and implement customized protocols for achieving the safe working environment at health care institutions.

KEYWORDS : Needletick injury, Healthcare worker, knowledge, HCV, HIV, HBV, vaccination

INTRODUCTION

Health Care Workers (HCWs) are the backbone for any functional health care facility. While contributing to the right to health for all, HCWs should also enjoy a healthy and safe working environment to maintain their own health. They even put their own safety or health at risk to have ethical or moral conduct to “do no harm” to the patient. HCWs face a range of occupational risks resulting in health impairments, injuries or illness leading to significant physical, emotional, social, behavioural and financial suffering, indirectly impacting their efficiency in delivering health services to patients. US Occupational Safety and Health Administration (OSHA) estimated a

rate of 3.2% work related injuries /illness for every full time HCW employee[1]. HCWs are at risk of various infections mainly through blood borne, air borne or direct contact route. In occupational health, blood borne pathogens have received more attention worldwide and its transmission mainly occurs through percutaneous or mucocutaneous injuries or sometimes, through exposure to infected blood or body fluids.

A Needle Stick Injury (NSI) is a percutaneous wound caused by any sharp instrument commonly encountered by caregivers while delivering proper health care to patients. In the health care sector,

NSI's are one of the preventable occupational health hazards among HCWs[2]. CDC estimates that every year around 3,85,000 NSI are sustained by HCWs, with an average of 1000 sharp injuries per day[3]. This situation is worsened by gross under reporting of NSI among HCWs. Survey of health care personnel indicates that 50% or more do not report their NSI[4,5]. The emotional impact of such NSI are significant and long lasting, even when a serious infection is not transmitted through such NSI.

NSI commonly occurs while blood drawing, administering intravenous or intramuscular drugs, manipulation of IV access line or any procedure involving sharps which facilitates transmission of blood borne infections. NSI can also occur during needle recapping or improper waste disposal[4]. Lack of access to personal protective equipment or to specific engineered medical devices increases the risk of occupational needle stick injury. Among Housekeeping (HK) staff, a significant amount of NSI occurs due to improper Bio-Medical waste segregation. In addition to it, inappropriate Bio-Medical Waste management has a direct impact on the health of patients, health care providers and environment.

Developing countries rarely monitor or supervise any occupational exposure and its health impact. Sincere, uniform and centralized efforts are required to understand the causes of occupational exposure and appropriate and affordable preventive measures need to be deployed to protect HCW against these occupational hazards. A comprehensive program that assesses and addresses behavioural, institutional and devices related factors contributing to the occurrence of NSI and its management in an institution can be the best strategy to tackle this serious situation. Epidemiological data about sharp injuries and assessment of knowledge pertaining to NSI management is an essential prerequisite to initiate any successful NSI preventive and management program in these fields.

This prospective cross-sectional survey-based study was undertaken to estimate the prevalence of NSI and its potential risk factors at our tertiary care cancer centre. This study also supported in increasing awareness regarding safe work practices, importance of HBV vaccination and testing for antibody titre against Hepatitis B surface antigen (anti-HBsAg). This survey revealed potential misconceptions and behavioural obstacles among various categories of HCWs for prevention and management of NSI. Input of this survey will assist in designing effective institutional NSI management protocol and act as a baseline data for its evaluation in future.

MATERIALS & METHODS

A prospective cross-sectional survey-based study was conducted from Jan 2022 to Oct 2023 at two cancer units at Varanasi, UP, India Homi Bhabha Cancer Hospital (HBCH) 179 bedded and Mahamana Pandit Madan Mohan Malviya Cancer Centre (MPMCCC), 350 bedded tertiary care cancer hospitals and was approved by Institutional ethics committee with letter number I1000528.

A total of 377 HCWs (Nurse 35.01%, Housekeeping staff 28.65%, Laboratory Technical staff 15.12%, Doctors 13.26%, Administrative staff 3.71%, Phlebotomists 2.92%, Pharmacists 1.33%) have participated, after obtaining informed written consent from them, in the well-structured questionnaire to assess their knowledge and attitude towards prevention and management of NSI within a hospital setup. Participants were identified by a specific code number in subsequent study records and their identity was never revealed at any forum. Participants were requested to answer the questionnaire according to their convenient time and in preferred language, either in English or Hindi. Training regarding handling and prevention of NSI along with HBV vaccination and importance of anti-HBsAg titre was also provided to all participants. Survey conducting team consisted of 5 MD clinical Microbiologists, 2 Infection control nurses (ICN) and 2 Microbiology technical officers. Sample size was determined based on information obtained from a previously published study (4) in which the incidence rate for NSI injury among HCWs was about 57%. The sample size for this study was calculated based on the following formula,

$$\text{Sample size, } n = \frac{\left(z_{1-\alpha/2}\right)^2 p(1-p)}{d^2}$$

Where,

Incidence rate, $p = 57\%$

Margin of Error, $d = 5\%$

$z_{(1-\alpha/2)} = 1.96$ for 95% Confidence Interval

Level of significance, $\alpha = 5\%$

Power = 80%

Therefore, on calculation the sample size is obtained as 377.

Data from the questionnaire was extracted into an excel sheet. All the data were in categories; hence they were represented as numbers and percentages. Fisher's Exact Test was performed to evaluate the relationship between the HCW categories (doctors, nurses, housekeeping staff, and technicians) and all types of NSI details. The statistical analysis was performed using SPSS (version 21).

RESULTS

A total of 377 HCW's of various categories participated in the survey. Overall prevalence of NSI among surveyed population was 40.58% (153/377) with 29.4% (111/377) surveyed staff got affected by NSI event of which Nurse 38.74% (43/111), Doctor 18.92% (21/111), HK staff 18 % (20/111) and technical staff 16.22% (18/111) were the common HCW categories affected by NSI as shown in Table 1. Multiple episodes of NSI were commonly observed among nurses and doctors. Most of the people who experienced NSI in the past were in the age group 25-34 years ($n = 83$) while very few workers of age ≥ 45 years experienced NSI ($n = 2$) as shown in table 2.

As evident from Table 3, the majority of NSI events occurred in morning and afternoon shifts, at IPD ward (64), ICU (19) and Emergency ward (17). Sources of NSI events were identified by almost each HCW category, but 45.8% of nurses and 50% of HK staff were unable to trace the source of NSI. According to the survey, sample collection (44), procedures (40) and handling of sharps (31) were the significant activities with disposable syringe (77) and phlebotomy needle (38) leading to NSI. Among the analysed survey data, the majority of NSI events (81) were not reported to the Hospital Infection Control Committee (HICC) but, surprisingly majority of phlebotomists (6) and pharmacists (2) approached HICC for reporting of NSI. Majority of the HCWs were either not aware about the protocol for NSI reporting (36) or not answered the reason for not reporting to HICC (36).

A total of 60.2% (227/377) of surveyed HCW were vaccinated against HBV, but the majority of them were not aware about their anti-HBsAg titre (antibody against hepatitis B surface antigen). Around 65.8% (248/377) surveyed staff were not aware about the significance of anti-HBsAg titres. Around 28.4% (107/377), 16.2% (61/377) and 10.9% (41/377) considers >10 mIU/ml, >100 mIU/ml, >1000 mIU/ml respectively as a protective cut-off for anti HBsAg titre and around 44.5% (168/377) of HCWs were not aware about the concept of protective anti HBsAg titre. Around 41% (155/377) of HCW answered correctly for accurate timing of testing the anti HBsAg titre; 1- 2 months after completion of HBV vaccination. Significant difference (p value 0.001) were observed for knowledge about correct transmissibility order for HBV, HCV and HIV in which only 20.2% (76/377) of HCW answered correct order of transmissibility as $\text{HBV} > \text{HCV} > \text{HIV}$ and majority 71.88% (271/377) gave incorrect answer of which 56% (28/50) were doctors and 71.97% (98/132) were nurses.

DISCUSSION

In this study, the prevalence of NSI among various categories of HCWs during their work tenure was found to be 40.6% (153/377) involving 29.4 % (111/377) of HCWs. Out of which, higher incidence of NSI was observed for Nurse 38.7% (43/111), Doctor 18.9% (21/111), HK staff 18% (20/111) and technical staff 16.2% (18/111). Administration staff 0.9% (1/111) and Pharmacist 1.8% (2/111) were least affected by NSI. The work experience of HCW showed significant differences (p value 0.000) in occurrence of NSI events as, with increasing work experience the number of NSI events decreases.

According to Choudhary DD et al^[6], nurses followed by HK staff, doctors and then technical staff were commonly affected by NSI. Rajut PS et al^[7], and Mohapatra D et al^[8], observed higher NSI prevalence of 65.6 % and 63 % respectively for nurses. Sharma R et al^[9], surveyed doctors, nurses and technical staff and reported a large percentage (79.5%) of staff had NSI in their career. Comparatively lower prevalence in this study might be due to the survey conducted among a wide range of HCW categories. Another reason might be the possibility of underreporting of NSI to HICC; 55.55 % (85/153) of the

NSI events were not reported in this study. Nurses 36.5 % (31/85) and doctors 22.4 % (19/85) were predominant HCW categories not reporting the NSI event. While further analysing the causes for under-reporting of NSI, around 44.7% (38/85) of HCWs were not aware about this protocol and the significance of reporting to HICC and a similar percentage of surveyed participants skipped answering this questionnaire.

As evident from table 3, mainly nurses and doctors have suffered multiple NSI episodes during their work practice. Statistical significant difference (p value 0.0005) was noted for location of NSI events, where the majority of NSI has been observed at IPD wards, Emergency wards and ICU. 67.8% of nurses and 66.7 % of HK staff suffered NSI, while working at IPD and 48.5 % of doctors got NSI at Emergency ward. A study conducted in North India, reported similar findings with IPD ward and ICU as a common location for NSI^[10]. These observations clearly indicate the direct influence of workplace location over incidence of NSI, which may be due to the workload, nature of work, emergency situations and scarcity of working hands. At our cancer set up, majority of NSI events occurred in morning and afternoon shifts, in which 94% doctors and 59.3% nurses got NSI, mainly during sample collection and minor or major procedures, while 87.5% HK staff suffered NSI during handling or disposal of sharps in sharp containers, transportation of hospital biomedical waste for its treatment or while cleaning and disinfection of work place, even 22% (13/59) nurse, 28% (7/25) technicians and 25 % (2/8) phlebotomist also suffered NSI during handling of sharps. Chaudhary DD also observed similar findings, where for doctors and nurses, sample collection along with procedures and for HK staff, cleaning or handling of sharps were the most common activities leading to NSI^[6]. Bharti et al^[11] reported majority of NSI during intravenous procedures during evening shift. According to Moghadam et al^[12] morning shift followed by night shift were the common duty timings involved for NSI event. Significant difference (p value 0.007) was also noted among devices involved in NSI in which disposable syringe was the most common device causing NSI among all categories of HCWs directly involved in patient care, followed by phlebotomy needle among nurses and technical staff mainly involved in sample collection. In our study, for significant number of NSI event (p value 0.002), sources of NSI were identified, but 45.8 % (27/59) nurses, 50 % (12/24) of HK staff, 28% (7/25) technician and 25 % (2/8) phlebotomist were unable to identify the source of NSI. Awareness and supervision for prompt disposal of sharps after its usage in puncture proof container and placement of sharp containers at the most appropriate location of the working area, is the basic and most effective NSI preventive steps in reducing the occurrence of NSI and even identification of source of NSI among HK staff, nurses, technical and phlebotomy staffs is of paramount importance. Identifying sources of NSI plays a crucial role in further management of NSI. To achieve significant reduction in NSI events and for its efficient management, at any health care setup, Infection control nurse (ICN) and HICC must focus on regular analysis of these significant risk factors along with implementation of targeted approach for prevention of NSI.

In this study, overall, 60.2 % (227/377) HCW were vaccinated against Hepatitis B, of which 90% of doctors, 76.5% of nurses, 70.2 % of technicians and only 28.7% of HK staff have completed the vaccinated schedule. Among all categories of HCWs, significant number of HK staff were under process of vaccination 38.9% (42/108) or not vaccinated at all 28.7% (31/108). Although with good HBV vaccination coverage, significant number (p value 0.001) of doctors 87% (39/50), nurses 81.8% (108/132), HK staff 100% (108/108) and technicians 68.4% (39/57) were not aware about their anti-HBsAg titre. Among surveyed HCW, 64% (32/50) doctors, 62.9% (83/132) nurse, 87% (94/108) of HK staff and 40.4% of technical staff were not aware about the significance of testing anti-HBsAg. Our institution has a policy to evaluate the HBV vaccination status of medical staff at the time of joining for all HCWs at occurrences of NSI and provide vaccine, if required to eligible candidate after testing of antibody titre after NSI; which could be the reason for good vaccination coverage among working medical staff. It also highlights the fact, that hospital administration and HICC needs to give special attention to improve vaccination status among HK staffs and create policy to check anti-HBsAg titre of candidates after completing their HBV vaccination schedule. Most of the similar studies have evaluated HBV vaccination status only for doctors and nurses, in which Madhavan A et al^[13] observed adequate immunization in 53.8% doctors and 46.4% nurses after vaccination. In our study, 50 % of doctors (25/50), 44.6 % nurses

(59/132) considers >10 mIU/ml as a protective anti-HBsAg titre and 90.7% of HK staff were not aware about the significance of anti-HBsAg titre. The Ministry of Health and Family Welfare, Government of India also considers anti HBsAg 10 mIU/ml as a protective level against HBV infection^[14]. Healthcare professionals not attaining protective antibody level after HBV vaccination, must be recalled for revaccination or for HBV booster dose. According to WHO, if vaccinated candidate once achieves anti-HBsAg titre of >10mIU/ml, then later in life time their immunological memory T cells protect them against HBV infections, even if their anti-HBsAg titre is < 10 mIU/ml at the time of occurrence of NSI^[15]. Ideal time for testing of anti-HBsAg is after 1-2 months after the last dose of HBV vaccination, which was correctly answered by 68% (34/50) doctors, 41.7 % (55/132) nurses, 73.7% (42/57) of technical staff and only 13% (14/108) of HK staff. This observation again highlights the importance of requiring more attention towards targeted and effective training for HK staff.

According to the survey, training, avoid recapping of sharps and proper disposal of sharp biomedical waste were the most common and HBV vaccination and use of gloves were the least common NSI preventive and awareness measures. On enquiry about frequency of such awareness cum training, around 53.1%, 36.3% and 10.6% surveyed participants suggested to have monthly, half yearly and yearly sessions respectively. As evident from Table 4, doctors were more focused towards understanding prevention and management of NSI, whereas nurses and technical staff were more interested in prevention of NSI and understanding the importance of HBV vaccination and anti-HBsAg titre. HK staff were eager to learn the basic concept of prevention and management of NSI along with the importance of HBV vaccination and the importance of testing anti-HBsAg titre.

However, a very limited number of administrative staff were surveyed in this study. As evident from Table 4, the majority of administration staff were not aware about the basic NSI preventive steps and important facts about HBV vaccination and anti-HBsAg test. Though they are not directly involved in patient care, but still administrative staff must be aware about various strategies to prevent NSI, appropriate management of NSI, importance of HBV vaccination and testing of its antibody level (anti-HBsAg), as they are mainly involved in framing, implementing, coordinating and supervising institutional NSI management protocols.

LIMITATIONS

As the study was conducted at a tertiary care cancer centre, its finding cannot be generalized at regional, state, or national level. This entire study was a questionnaire-based survey of health care staff which was responded by participants based on their level of understanding, which may also be influenced by memory bias or recall bias. However, inclusion of various categories and large number of HCWs in the survey are the strengths of the study.

CONCLUSION

HCWs involved in direct patient care are always at high risk of NSI. It is an entirely preventable infectious event with significant emotional impact. Even superficial NSI should not be interpreted as a less serious issue. This study reported the magnitude of NSI in a cancer setup among various categories of HCW along with the associated risk factors and knowledge of health care professionals pertaining to HBV vaccination and testing of anti-HBsAg. Under reporting of NSI and risk factors like increased workload over HCWs, location of work, nature of work at emergency ward should be addressed efficiently to minimize incidences of NSI. Identification of the source of NSI is very crucial in proper management of any NSI. According to the study, doctors and nurses commonly got NSI injuries during sample collection and performing procedures; while HK staff, nurses, technical and phlebotomy staff got injured while handling and disposal of sharps. Significant number of HK staff, nurses and technical staff suffered NSI without an identified source of origin. Institutions must emphasize on increasing awareness and strict supervision for prompt disposal of sharps after their recommended usage and placement of puncture proof sharp containers at the most appropriate and accessible working area. Though the institution is having a training schedule at the time of joining, still HCWs have misconceptions towards prevention of NSI and HBV vaccination. Study also revealed the requirement of special attention while training housekeeping staff as the majority of these staff do not understand the importance of such training and significance of HBV vaccination, requiring innovative

and novel methods for training of HK staff. Governing councils of medical teaching for doctors, nurses and technicians should incorporate practical based training for prevention and management of NSI, significance of HBV vaccination and importance of anti-HBsAg titer test in their curriculum. Institutional administration must be updated with the latest national and international guidelines to make real time amendments and supervise the NSI handling protocol of the institution. HICC should preserve and analyze the records of NSI incidences, its management and follow-up, as this information will assist medical administrators of hospitals to improve health care safety standards for various categories of HCWs. We feel such surveys must be performed at frequent intervals to address, clear misconceptions, motivate HCWs to notify NSI incidence and follow appropriate measures against NSI injury and provide data to policy makers to rectify the deficiencies and real time implementation of optimized strategies to provide a safe working environment to health care professionals.

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Table 1 : Prevalence of NSI among various health care categories

HCW Categories	Total number of participants surveyed	No. of participants suffered NSI Events	No. of NSI event occurred
Doctors	50	21 (42%)	33
Nurse	132	43 (32.6%)	59
HK staff	108	20 (18.5%)	24
Technician	57	18 (31.6%)	25
Phlebotomist	11	06 (54.5%)	08
Pharmacist	05	02 (40%)	02
Administration	14	01 (7.1%)	02
Total	377	111 (29.4%)	153

Table 2 : NSI distribution among various age and health care work experience categories

	Number of NSI happened in the past				p-value
	0 (n = 266)	1 (n = 77)	2 (n = 26)	3 (n = 8)	
Age, years					0.215
≤ 24	50 (18.8%)	6 (7.8%)	4 (15.4%)	2 (25%)	
25 – 34	175 (65.8%)	61 (79.2%)	17 (65.4%)	5 (62.5%)	
35 – 44	39 (14.7%)	9 (11.7%)	4 (15.4%)	1 (12.5%)	
≥ 45	2 (0.8%)	1 (1.3%)	1 (3.8%)	0 (0%)	
Experience, years					0.000
≤ 5	212 (79.7%)	40 (51.9%)	12 (46.2%)	3 (37.5%)	
5 – 10	30 (11.3%)	27 (35.1%)	9 (34.6%)	4 (50%)	
≥ 10	24 (9%)	10 (13%)	5 (19.2%)	1 (12.5%)	

Table 3 : Distribution of NSI events according to variables for its occurrence, management and awareness.

HCW Category	Statistical analysis performed					Statistical analysis not performed		
	Doctors (n-50)	Nurse (n-132)	HK Staff (n-108)	Technician (n-57)	p-value	Phlebotomist (n-11)	Pharmacist (n-05)	Administration (n-14)
NSI Details								
Frequency of NSI among HCWs								
1	11 (22%)	30 (22.7%)	17 (15.7%)	13 (22.8%)	0.394	04 (36.4%)	02 (40%)	00
2	08 (16%)	10 (7.6%)	02 (1.9%)	03 (5.3%)		02 (11.2%)	00	01 (7.1%)
3*	02 (4%)	03 (2.3%)	01 (0.9%)	02 (3.5%)		00	00	00
Location of NSI events								
ICU	03 (9.1%)	08 (13.6%)	08 (33.3%)	08 (32%)	0.0005	00	00	01 (50%)
Emergency Ward	16 (48.5%)	01 (1.7%)	00	00		00	00	00
IPD Ward	08 (24.2%)	40 (67.8%)	16 (66.7%)	00		06 (75%)	02 (100%)	01 (50%)
Phlebotomy	00	00	00	03 (12%)		02 (25%)	00	00

OT	04 (12.1%)	03 (5.1%)	00	01 (4%)		00	00	00
Others **	02 (6.1%)	07 (11.9%)	00	13 (52%)		00	00	00
NSI events in Duty shift								
Morning	16 (48.5%)	29 (49.2%)	08 (33%)	14 (56%)	0.065	02 (25%)	00	00
Afternoon	09 (27.3%)	17 (28.8%)	11 (46%)	11 (44%)		06 (75%)	02 (100%)	00
Night	08 (24.2%)	13 (22%)	05 (21%)	00		00	00	02 (100%)
Identity of source of NSI event								
Identified	29 (87.9%)	32 (54.2%)	12 (50%)	18 (72%)	0.002	06 (75%)	02 (100%)	02 (100%)
Not Identified	04 (12.1%)	27 (45.8%)	12 (50%)	07 (28%)		02 (25%)	00	00
Activities leading to NSI event								
Sample collection	16 (48.5%)	17 (28.8%)	00	11 (44%)	0.0005	04 (50%)	00	02 (100%)
During procedure	15 (45.5%)	18 (30.5%)	00	07 (28%)		02 (25%)	00	00
Administration of medication	00	02 (3.4%)	00	00		00	02 (100%)	00
BMW disposal & transportation	00	00	04 (16.7%)	00		00	00	00
Handling of sharp ***	00	13 (22%)	11 (45.8%)	07 (28%)		02 (25%)	00	00
During cleaning	00	04 (6.8%)	06 (25%)	00		00	00	00
Access IV line	01 (3%)	03 (5.1%)	00	00		00	00	00
Others	01 (3%)	02 (3.4%)	03 (12.5%)	00		00	00	00
Device involved in NSI events								
Disposable syringe	20 (60.6%)	29 (49.2%)	13 (54.1%)	15 (60%)	0.007	02 (25%)	02 (100%)	02 (100%)
Suture Needle	7 (21.2%)	05 (8.5%)	01 (4.2%)	00		00	00	00
Phlebotomy needle	04 (12.1%)	20 (33.8%)	04 (16.7%)	10 (40%)		06 (75%)	00	00
Other	02 (6.1%)	05 (8.5%)	06 (25%)	00		00	00	00
NSI events reported to HICC								
Yes	14 (42.4%)	28 (47.5%)	08 (33.3%)	10 (40%)	0.706	06 (75%)	02 (100%)	00
No	19 (57.6%)	31 (52.5%)	16 (66.7%)	15 (60%)		02 (25%)	00	02 (100%)
Reasons for not reporting NSI events								
Superficial injury	01 (5.3%)	01 (3.2%)	00	00	0.0005	00	00	00
Not aware about reporting	09 (47.4%)	11 (35.5%)	16 (100%)	00		00	00	02 (100%)
Negative viral marker of source	01 (5.3%)	00	00	00		00	00	00
Forgot due to workload	00	01 (3.2%)	00	00		00	00	00
Sharp not contaminated with patient blood	00	05 (16.2%)	00	00		00	00	00
Not attempted	08 (42%)	13 (41.9%)	00	15 (100%)		02 (100%)	00	00

HBV Vaccination status								
Vaccinated	45 (90%)	101 (76.5%)	31 (28.7%)	40 (70.2%)	0.0004	02 (18.2%)	03 (60%)	05 (35.7%)
In process of Vaccination	02 (4%)	23 (17.4%)	42 (38.9%)	11 (19.3%)		07 (63.6%)	00	04 (28.6%)
Incomplete Vaccination	00	00	04 (3.7%)	00		00	00	01 (7.1%)
Not Vaccinated	03 (6%)	08 (6.1%)	31 (28.7%)	06 (10.5%)		02 (18.2%)	02 (40%)	04 (28.6%)
Reason for Incomplete/Not vaccination for HBV								
Forgot vaccination schedule	00	00	02 (5.7%)	00	0.035	00	00	00
Not aware	01 (33.3%)	00	14 (40%)	05 (83.3%)		00	01 (50%)	03 (60%)
Not attempted	02 (66.7%)	08 (100%)	19 (54.3%)	01 (16.7%)		02 (100%)	01 (50%)	02 (40%)
Anti-HBsAg titer (mIU/ml) of HCW								
<10	00	02 (1.5%)	00	02 (3.5%)	0.000	00	00	00
10-100	02 (4%)	01 (0.8%)	00	00		00	00	03 (21.4%)
>100	08 (16%)	16 (12.1%)	00	16 (28.1%)		00	00	01 (7.2%)
Not aware/re member	39 (78%)	108 (81.8%)	108 (100%)	39 (68.4%)		11 (100%)	05 (100%)	10 (71.4%)
Not attempted	01 (2%)	05 (3.8%)	00	00		00	00	00
Reason for not aware about own anti-HBsAg titer								
In-house testing facility not available	03 (7.5%)	05 (4.4%)	03 (2.8%)	07 (17.9%)	0.001	00	01 (20%)	01 (10%)
Not aware about its significance	32 (80%)	83 (73.4%)	94 (87%)	23 (59%)		06 (55.5%)	01 (20%)	09 (90%)
Not vaccinated	00	03 (2.7%)	05 (4.6%)	03 (7.7%)		00	02 (40%)	00
Not attempted	05 (12.5%)	22 (19.5%)	06 (5.6%)	06 (15.4%)		05 (45.5%)	01 (20%)	00
Protective Anti-HBsAg titer								
>10 mIU/ml	25 (50%)	59 (44.7%)	01 (0.9%)	13 (22.8%)	0.0005	01 (9.1%)	02 (40%)	06 (42.9%)
> 100 mIU/ml	09 (18%)	32 (24.2%)	04 (3.7%)	13 (22.8%)		03 (27.3%)	00	00
>100 mIU/ml	09 (18%)	06 (4.6%)	05 (4.6%)	18 (31.6%)		00	02 (40%)	01 (7.1%)
Not aware	07 (14%)	35 (26.5%)	98 (90.7%)	13 (22.8%)		07 (63.6%)	01 (20%)	07 (50%)
After vaccination when to test for anti HBsAg titer								

After 1st dose	02 (4%)	13 (9.8%)	28 (25.9%)	03 (5.3%)	0.0005	03 (27.3%)	00	00
After 2nd dose	05 (10%)	16 (12.1%)	24 (22.2%)	09 (15.7%)		01 (9.1%)	01 (20%)	00
1-2 month after last dose of vaccination	34 (68%)	55 (41.7%)	14 (13%)	42 (73.7%)		01 (9.1%)	03 (60%)	06 (42.9%)
During NSI event	00	05 (3.8%)	00	00		00	00	00
Not aware	07 (14%)	34 (25.8%)	36 (33.3%)	03 (5.3%)		05 (45.4%)	01 (20%)	08 (57.1%)
Not attempted	02 (4%)	09 (6.8%)	06 (5.6%)	00		01 (9.1%)	00	00
Infection transmissibility order among HBV, HCV & HIV (Correct order: HBV > HCV > HIV)								
Correct	16 (32%)	34 (25.8%)	03 (2.8%)	10 (17.5%)	0.001	07 (63.6%)	04 (80%)	02 (14.3%)
Incorrect	28 (56%)	95 (72%)	84 (77.8%)	47 (82.5%)		04 (36.4%)	01 (20%)	12 (85.7%)
Not aware	00	00	20 (18.5%)	00		00	00	00
Not attempted	06 (12%)	03 (2.2%)	01 (0.9%)	00		00	00	00
NSI Preventive & Awareness measures								
Training	22 (44%)	56 (42.4%)	61 (56.5%)	28 (49.1%)	0.001	05 (45.5%)	02 (40%)	07 (50%)
Avoid recapping of needles	01 (2%)	03 (2.3%)	06 (5.6%)	00		00	00	00
Training & avoid recapping of needles	06 (12%)	10 (7.5%)	03 (2.8%)	05 (8.8%)		03 (27.3%)	00	00
Proper sharp waste management	01 (2%)	28 (21.4%)	12 (11.1%)	02 (3.5%)		00	00	00
Training & careful sharp handling	06 (12%)	18 (13.6%)	01 (0.9%)	07 (12.3%)		02 (18.2%)	01 (20%)	05 (35.7%)
Training & HBV vaccination	01 (2%)	04 (3%)	01 (0.9%)	05 (8.8%)		01 (9%)	02 (40%)	00
Gloves use & careful sharp waste handling	08 (16%)	01 (0.8%)	07 (6.5%)	02 (3.5%)		00	00	00
Not attempted	05 (10%)	12 (9%)	17 (15.7%)	08 (14%)		00	00	02 (14.3%)

*- Surveyed staff with multiple NSI had maximum 3 NSI exposures in work experience

**- Other locations: Hemodialysis unit, Labour room, CSSD, Blood bank, Laboratory & Radiology

***- Handling of sharps: Handover of sharps or picking of sharps from the site of usage or disposal of sharps in sharp container

Table 4: Preference for NSI preventive and awareness measures knowledge among various HCW categories

Topics Preferences	Doctor (50)			Nurse (132)			HK Staff (108)			Technicians (57)		
	1 st	2 nd	3 rd	1 st	2 nd	3 rd	1 st	2 nd	3 rd	1 st	2 nd	3 rd
Prevention of NSI	35	11	04	55	31	37	38	43	26	26	24	07

Management of NSI	04	26	20	19	63	41	30	36	41	05	23	29
HBV vaccination & Anti-HBsAg Titer	11	13	26	49	29	45	39	28	40	26	10	21
Not attempted : Nurses (9) , HK staff (1)												

REFERENCES

1. Hospitals - Patient Care Unit - Needlestick/Sharps Injuries | Occupational Safety and Health Administration [Internet]. [cited 2024 Jul 10].

2. Spruce L. Back to Basics: Sharps Safety. *AORN J.* 2016;104(1):30-36. doi:10.1016/j.aorn.2016.04.016

3. Panlilio AL, Orelie JG, Srivastava PU, Jagger J, Cohn RD, Cardo DM; NaSH Surveillance Group; EPINet Data Sharing Network. Estimate of the annual number of percutaneous injuries among hospital-based healthcare workers in the United States, 1997-1998. *Infect Control Hosp Epidemiol.* 2004 Jul;25(7):556-62. doi: 10.1086/502439. PMID: 15301027.

4. Radha R, Khan A. Epidemiology Of Needle Sticks Injuries Among the Health Care Workers of a Rural Tertiary Care Hospital -A Cross-sectional Study. *Nat J Community Med [Internet].* 2012 Dec. 31 [cited 2024 Aug. 16];3(04):589-94. Available from: <https://njcmindia.com/index.php/file/article/view/1774>

5. Centers for Disease Control and Prevention (CDC). Evaluation of safety devices for preventing percutaneous injuries among health-care workers during phlebotomy procedures--Minneapolis-St. Paul, New York City, and San Francisco, 1993-1995. *MMWR Morb Mortal Wkly Rep.* 1997;46(2):21-25.

6. Choudhury D D, Sonawane J P, Chowdhary A, The study of prevalence of needle stick and sharp injuries among healthcare workes in tertiary care hospital, Navi Mumbai. *IP Int J Med Microbiol Trop Dis* 2021;7(4):227-231

7. Aziz, S., Akhter, A., Akhter, K., Kachroo, M., & Khan, Z. A. (2023). Prevalence of needle stick injury and its associated factors among nursing staff working at a tertiary care hospital of North India. *International Journal of Research in Medical Sciences*, 11(10), 3755–3762. <https://doi.org/10.18203/2320-6012.ijrms20233032>

8. Mohapatra D, Gupta V, Malik JS. A Study on needle sticks injury among nursing staff of a tertiary care hospital of Haryana. *ADJR.* 2014.

9. Sharma R, Rasanias S, Verma A, Singh S. Study of Prevalence and Response to Needle Stick Injuries among Health Care Workers in a Tertiary Care Hospital in Delhi, India. *Indian J Community Med.* 2010;35(1):74-77. doi:10.4103/0970-0218.62565

10. Goel V, Kumar D, Lingaiah R, Singh S. Occurrence of Needlestick and Injuries among Health-care Workers of a Tertiary Care Teaching Hospital in North India. *J Lab Physicians.* 2017;9(1):20-25. doi:10.4103/0974-2727.187917

11. Bharti PP, Singh NP, Bajpai PK, Rani V, Jain PK, Khan A. Prevalence of needle stick injuries, its associated factors and awareness among nursing staff at tertiary care hospital of North India. *Indian J Community Health.* 2022;34(1):54-9.

12. Moghadam SJ, SeyedAlinaghi S, Dadras O, Ali Z, Mojtahedi SY, Amini F, Mohammadifrouzeh M. Determinants of Needle Stick Injuries Among Healthcare Providers at a Tehran University Hospital in 2016: A Descriptive Report. *Infect Disord Drug Targets.* 2020;20(5):743-747. doi: 10.2174/1871526519666191009153027. PMID: 31595856.

13. Madhavan A, Asokan A, Vasudevan A, Maniyappan J, Veena K. Comparison of knowledge, attitude, and practices regarding needle-stick injury among health care providers. *J Family Med Prim Care.* 2019;8(3):840-845. doi:10.4103/jfmpe.jfmpe.103_19

14. national-laboratory-guidelines.pdf [Internet]. [cited 2024 Jul 10]. Available from: https://nvhcp.mohfw.gov.in/common_libs/national-laboratory-guidelines.pdf

15. World Health Organization. The immunological basis for immunization series: module 22: hepatitis B [Internet]. Geneva: World Health Organization; 2011 [cited 2024 Jul 10]. (Immunological basis for immunization series, module 22). Available from: <https://iris.who.int/handle/10665/77755>