

Needlestick Injuries among Dental Professionals in Dental Colleges of Rawalpindi, Pakistan

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ABSTRACT:

Objective: This study aimed to assess the knowledge and practices of Needlestick Injuries (NSIs) among dental professionals in various dental hospitals of Rawalpindi.

Study Design and Setting: It was a cross-sectional observational study conducted in four different dental colleges of Rawalpindi from January 2019 to March 2019.

Methodology: By using convenient sampling technique, a total of 252 dental professionals were approached for the data collection through a structured, pretested, self-designed questionnaire. SPSS version 23 was used for data analysis. *P*-value ≤ 0.05 was considered as statistically significant.

Results: Among 252 participants; 36 (14.3%) were dental assistants, 158 (62.7%) were dentists, 38 (15.1%) were postgraduate trainees (PGTs) and 20 (7.9%) were consultant dentists. The mean age \pm SD of participants was 26.9 ± 5.41 . There were 92 (36.5%) male and 160 (63.5%) female participants. Mean knowledge score was best for consultant dentists (85.83 ± 15.74) followed by PGTs (80.70 ± 14.71) and dentists (76.58 ± 15.39) whereas it is lower for dental assistants (65.28 ± 11.87), $p = 0.002$. Practice response has shown that 22 (16%) of the dental assistants have never been vaccinated for Hepatitis B whereas most of the dental assistants have never reported the incident of NSIs to the concerned authorities.

Conclusion: NSIs continue to be a serious occupational hazard in the field of Dentistry. This study concluded that despite the mean knowledge score was highest among consultant dentists, the dental assistants and dentists have lower overall knowledge and practice indicates a need to continuing education on safe injection techniques along with the hands-on programme to prevent NSIs in hospitals.

Keywords: Blood-Borne Pathogens; Clinical Practice; Dental Professionals; Knowledge, Practice, Needlestick Injuries; Risk Factors

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INTRODUCTION:

Needlestick injury (NSI) is an accidental skin pervading stab wound from a hollow-bore needle (or a sharp) contaminated by foreign blood or body fluid. In Medical settings, penetrating skin wounds caused by sharp instruments account as sharp injury.¹ NSI is amongst the leading health care safety issue and an integral common occupational hazard which is being faced by health care professionals around the world. The World Health Organization (WHO) reported that the annual number of NSIs among health care workers (HCWs) is four injuries per person in Africa, the Western Mediterranean, and Asia.²

NSIs are the wounds caused by sharps e.g. blood collection needles, connecting needles of intravenous (IV) sets, hypodermic needles and IV cannulas.³ Healthcare professionals encounter the hazard of NSI that can lead to major infections with blood-borne pathogens such as Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) or Human Immunodeficiency Virus (HIV).⁴ Health personnel working with patients harbouring these viruses are placed at increased risk. It is estimated that 66000 HBV, 16000 HCV, and almost 1,000 HIV infections may have occurred in the year 2000 worldwide among health-care workers due to their

occupational exposure to percutaneous injuries; almost 40% of HBV and HCV, and 4.4% of HIV infections are attributable to occupational exposure to needle-stick/sharps.^{5,6}

The oral cavity contains diverse bacterial flora⁷ along with blood, saliva and oral secretions and norm of using sharp instruments in a dental setting, is a leading risk factor that contributes towards acquiring blood-borne infections.⁸ Dental professionals are at high risk of being infected with various diseases transmitted by blood and body fluids (BBFs) due to frequent exposure to biological materials and patient's body fluids. Needlestick injuries and injuries due to cutting, biting, or splashing incidents are some of the ways dental professionals encounter during their daily activities.⁴ The frequency of needlestick injuries and the high prevalence of blood-borne diseases in the general population have a great impact on the exposure of different infection agent risk among HCWs.

Prevention of NSIs is a challenge faced in nearly every medical/dental workplace. The burden of needlestick injuries can be reduced in dental settings if all the dental professionals from consultants till the dental surgery assistants abide by standard universal precautions against the NSIs. The establishment of an infection control committee that has the responsibility to work out an effective infection control programme and guide the staff of dental setups with postexposure prophylaxis is the need of time and should be an integral part of every dental hospital.⁹ HCWs must undergo follow-up assessments for both the prevention and treatment of acute infection, such as HCV, after being exposed to BBFs. For the prevention of fluid borne infection due to its high prevalence, knowledge regarding universal precautions and safety measures should be well asserted for the prevention of such infections and constant upgrading via programmes and set regimes should be periodically implemented.¹⁰

Occupational hazards such as NSIs faced by HCWs in Pakistan^{11,12,13}, have received significant attention, but current surveillance systems and responsiveness towards safety/preventive measures are insufficient to describe how much they are aware of such injuries as well as the kind of practices being followed in the hospital setup. Despite this, little data have been published that are assessing the knowledge and practices of dental professionals towards NSIs. This study was carried out for assessment of knowledge and practices among dental professionals about NSIs among various dental hospitals of Rawalpindi.

METHODOLOGY:

The study design was cross-sectional observational, conducted in four different dental colleges of Rawalpindi namely; Watim Dental College, Foundation University College of Dentistry, Margalla College of Dentistry and Armed Forces Institute of Dentistry, Rawalpindi over a period of three months (1st January 2019 to 31st March 2019). The ethical committee of Watim Dental College had

approved this study before data collection and ERC number was WDC/PRINCIPAL/2018/1072. The study participants were dental professionals divided into four groups i.e. Group 1: Dental Assistants, Group 2: Dentists, Group 3: Postgraduate Trainees (PGTs) and Group 4: Consultant Dentists.

Based on previous study¹⁴, Convenience sampling technique was used in which a total of 252 dental professionals who gave consent to be a part of the study were informed about the design and purpose of the study. The anonymity of the participants was maintained throughout the study. The data was collected through a self-designed, structured, pretested questionnaire consisting of closed and open-ended questions.

A pilot study was conducted with a random sample of 20 participants to ensure the feasibility and applicability of the questionnaire. The pilot study confirmed the feasibility of the main study. Subsequently, minor changes were done in the questionnaire for effective communication among the participants. Those who participated in the pilot study were excluded from the study. Face and content validity of the questionnaire was assessed by three experts in the field of public health. The reliability of the questionnaire was assessed using Cronbach's alpha (0.84).

The questionnaire was divided into the following sections: demographic data; and NSI knowledge and practice. The demographic section contains information related to age, sex, gender and designation. Knowledge parameters include information of participants knowledge on; any occupational hazards related to dentistry, exposure to infectious diseases by working in the dental profession, hazards of needle stick injuries, diseases that can be transmitted by NSIs, any awareness on NSI protocols, knowledge of universal precaution guidelines, knowledge about post-exposure prophylaxis (PEP) and safety devices to prevent NSIs. Practices parameters include vaccination status, the occurrence of NSIs, source of NSI, post-exposure Hepatitis B and C screening, sequence of events performed after NSI, and reporting of NSI incident to the concerned authorities.

The inclusion criteria include dental professionals consisting of dental assistants, general dentists, post-graduate trainees, and consultant dentists, between the age group of 18 to 60 years. Exclusion criteria include BDS undergraduate students and house officers. An informed consent was obtained from all the study participants before taking their responses.

The knowledge of the NSI was graded using a scoring system, a score of "one" for a "yes" answer and "zero" for "no" or "not sure" answer. This scoring system has been used in the previous study.¹⁵ Scores of each respondent were calculated by adding the scores of all items of the knowledge. The score was converted to percentage and level. Scores for each respondent were summed up and graded as low= <50%, moderate= 50%-79% and high= 80% -100%.

The data was analysed in statistical software (SPSS for windows version 23, SPSS Inc, Chicago, USA) with a

confidence interval of 95%. No discrepancies were found in the data. Descriptive statistics like frequencies and proportions were used to summarize the data. The continuous data of knowledge score was tested for normality by using the Kolmogorov-Smirnov test. As the data were normally distributed, a parametric test; One-way ANOVA was conducted to compare the knowledge scores of needle stick injuries among four groups of dental professionals. A p -value = 0.05 was considered as statistically significant.

RESULTS:

A total number of 252 participants were included in this study. All the participants returned the fully completed questionnaire making a response rate of 100%. The mean age \pm SD of participants was 26.9 ± 5.41 . The minimum age was 19 years and maximum age was 57 years. There were 92 (36.5%) male and 160 (63.5%) female participants. Among 252 participants, 36 (14.3%) were dental assistants, 158 (62.7%) were dentists, 38 (15.1%) were postgraduate trainees and 20 (7.9%) were consultant dentists.

One-way ANOVA was performed to compare the knowledge scores about needle stick injuries among four groups: (Group 1-Dental Assistants), (Group 2-Dentists), (Group 3-PGTs) and (Group 4-Consultant Dentists). It was revealed that there was a statistically significant difference ($p = 0.002$) present between knowledge scores among these groups. The mean knowledge score was highest among Consultant dentists ($M=85.83$), followed by PGTs ($M = 80.70$), Dentists ($M = 76.58$) and Dental Assistants ($M = 65.28$) as shown in Table I.

The response of the study subjects towards NSI knowledge and practices is presented in Table II and III respectively.

The results showed that the level of knowledge of NSI was low among 22 (8.7%) of participants, moderate among 80 (31.7%) and high among 150 (59.5%) of participants. The designation-wise level of knowledge about NSI is shown in Figure 1.

DISCUSSION:

Health care workers especially doctors, nurses, and dentists are at increased risk of occupational accidental NSI because of their hazardous work environment. Hence the HCWs are at higher risk to acquire bloodborne pathogens like hepatitis B, C, HIV and other diseases.¹⁶ Studies have also shown that HIV and Hepatitis B are among the important diseases transmitted by needle stick injuries.¹⁷ The incidence of NSI is a common occupational hazard among dentists and it is showing an increasing trend.¹⁸ Fifty percent of the dentists in Southern Thailand experienced percutaneous injuries, whereas 42% in the United Arab Emirates had minimal of one percutaneous injury in last year.¹⁹ Another study conducted in Germany signifies that 62% of dentists acquired one needle stick injury at minimal mostly caused by needles, scalpels and surgical devices.²⁰

In this study, among 252 participants, 36 (14.3%) were dental assistants, 158 (62.7%) were dentists, 38 (15.1%) were postgraduate trainees and 20 (7.9%) were consultant dentists. Frequency of needle stick injuries was found out to be 60% among dental assistants, 70% among dentists, 49% among post-graduate trainees and 10% among consultant dentists. The prevalence was high compared to previous studies.^{21,22,23} This high percentage of needle stick injury amongst dental assistants and general dentists in our study can be attributed towards increased patient load in our region owing to our population, however further studies are needed to justify the amount of patient seen by each doctor and if there is any correlation between the incidence of needle stick injury and the number of patients seen per day. Another study conducted by Singh and colleagues indicated the prevalence of 703 per 1000 HCW (70.3%) during a complete working period and 48% of participants experienced the injury prevalence more than once in their career.¹⁰ In another study conducted on HCW of Aga Khan Hospital Karachi, NSI was reported by 45% of the participants during their working tenure.²⁴

In this study, knowledge regarding needle stick injuries was low among 22 (8.7%) of participants, moderate among 80 (31.7%) and high among 150 (59.5%) of participants. The mean knowledge score was highest among Consultant dentists ($M = 85.83$), followed by PG Trainees ($M = 80.70$), Dentists ($M = 76.58$) and Dental Assistants ($M = 65.28$). Low knowledge scores have seen amongst dental assistants in our study warrants that further investigation is required for this group as it has shown contrasting results with studies explained in references. Zafar et.al. study indicate high knowledge among HCWs regarding NSI.²⁴ A recent study has shown that only 21% of the HCWs has adequate knowledge about disease transmission by NSIs.²⁵ In another study conducted in India, a significant proportion of participants had knowledge about infectious diseases transmission through needle stick injuries.³ Pavithran et al. indicates that the majority of dental professionals knew about the transmission of hepatitis B and C along with HIV/AIDS through NSI.⁹

This study signifies that among dental assistants, less than half of them were vaccinated against Hepatitis B, whereas most of the dentists, PGTs, and consultant dentists were vaccinated for it. The cause of under vaccination amongst dental assistants needs to be further investigated. A recent study has shown that about three in ten dental assistants experienced at least one NSI (29.8%, 95% CI 25.6–34.2%). Moreover, lack of adequate knowledge of infection control procedures and disease transmission, non-compliance with infection control protocol of vaccination against hepatitis B virus and attending 12 or a lesser number of patients daily were significantly ($p < 0.05$) associated with increased risk of NSIs.⁸ A study conducted at Aga Khan Hospital, Karachi reported the majority of HCWs vaccinated for Hepatitis B.²⁰

Table I: Comparing the awareness scores of needle stick injuries among dental professionals

Designation	N	Mean \pm SD	F (df1, df2)	p-value
Dental Assistant	36	65.28 \pm 11.87	5.23 (3, 122)	0.002
Dentist	158	76.58 \pm 15.39		
PG Trainee	38	80.70 \pm 14.71		
Consultant Dentist	20	85.83 \pm 15.74		
*One-way ANOVA				

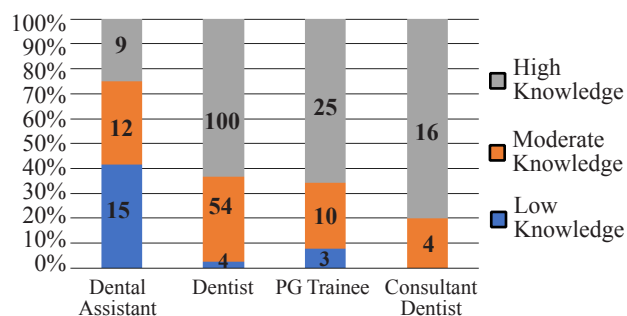
Table II: Responses of the study participants to Needle Stick Injuries knowledge

Knowledge on Needle Stick Injuries among dental professionals	No. of respondents (%)			
	Dental Assistant	Dentist	PG Trainee	Consultant Dentist
Do you think there are any occupational hazards associated with dentistry?				
Yes	7 (19.4)	148 (93.6)	36 (94.7)	20 (100)
No	24 (66.6)	2 (1.2)	--	--
Not sure	5 (13.8)	8 (5.1)	2 (5.2)	--
Do you think working in the dental profession puts you at a higher risk of exposure to infectious diseases				
Yes	6 (16.6)	12 (7.6)	4 (10.5)	12 (60)
No	18 (50)	131 (83)	34 (89.4)	8 (40)
Not sure	12 (33.3)	15 (9.5)	--	--
Do you think needle stick injury is hazardous to health in any way?				
Yes	8 (22.2)	133 (84.1)	36 (94.7)	20 (100)
No	21 (58.3)	25 (15.8)	2 (5.2)	--
Not sure	7 (19.4)	--	--	--
Are you aware of any needle stick injury protocols?				
Yes	12 (33.3)	116 (73.4)	35 (92.1)	20 (100)
No	22 (61.1)	42 (26.5)	3 (7.9)	--
Not sure	2 (5.5)	--	--	--
Are you aware of "Universal Precautions Guidelines"?				
Yes	7 (19.4)	139 (88)	37 (97.3)	20 (100)
No	29 (80.5)	17 (10.7)	1 (2.6)	--
Not sure	--	2 (1.2)	--	--
Diseases that can be transmitted by NSIs are				
Hepatitis B	2 (5.5)	62 (39.2)	2 (5.2)	1 (5)
Hepatitis C	21 (58.3)	12 (7.6)	4 (10.5)	--
HIV/AIDS	4 (11.1)	7 (4.4)	--	--
Tuberculosis	6 (16.6)	3 (1.9)	--	--
All of the above	3 (8.3)	74 (46.8)	32 (84.2)	19 (95)
Knowledge on safety devices to prevent NSIs				
Yes	8 (22.2)	103 (65.2)	29 (76.3)	20 (100)
No	26 (72.2)	55 (34.8)	9 (23.6)	--
Not sure	2 (5.5)	--	--	--
Knowledge on post-exposure prophylaxis in the management of NSIs				
Yes	4 (11.1)	111 (70.2)	37 (97.3)	20 (100)
No	30 (83.3)	44 (27.8)	1 (2.6)	--
Not sure	2 (5.5)	3 (1.9)	--	--

Table III: Responses of the study participants towards practices for the prevention and management of needle stick injuries

Practices for the prevention and management of needle stick injuries among dental professionals	No. of respondents (%)			
	Dental Assistant	Dentist	PG Trainee	Consultant Dentist
When were you last tested for HBV & HCV?				
More than one year	4 (11.1)	68 (43)	22 (57.9)	10 (50)
Within one year	16 (44.4)	82 (51.9)	12 (31.6)	10 (50)
Never	16 (44.4)	8 (5.1)	4 (10.5)	--
Have you ever been vaccinated for Hepatitis B?				
Yes	14 (38.9)	142 (89.9)	36 (94.7)	20 (100)
No	22 (61.1)	16 (10.1)	2 (5.3)	--
When was your last booster dose for Hepatitis B?				
More than one year	8 (22.2)	106 (67.0)	30 (78.9)	16 (80)
Within one year	6 (16.7)	30 (19)	4 (10.5)	4 (20)
Never	22 (61.1)	22 (13.9)	4 (10.5)	--
Have you ever been pricked within dental settings, if yes, then how many times?				
4-6 times	2 (5.6)	10 (6.3)	6 (15.8)	2 (10)
3 or less times	16 (44.4)	76 (48.1)	24 (63.2)	14 (70)
Never	18 (50)	72 (45)	8 (21.1)	4 (20)
What was the level of depth of needle stick injury?				
Superficial/Non-Bleeding	--	40 (25.3)	26 (68.4)	13 (65)
Superficial/Bleeding	6 (16.6)	21 (13.2)	11 (28.9)	7 (35)
Deep/Non-Bleeding	--	1 (0.7)	1 (2.6)	--
Deep/Bleeding	2 (5.5)	4 (2.5)	--	--
Not Known	28 (77.7)	92 (58.2)	--	--
What was the source of a prick?				
Used Instrument	27 (75.0)	87 (55.0)	20 (52.6)	14 (40)
Unused Instrument	5 (13.8)	34 (21.5)	10 (26.3)	4 (20)
Unknown	4 (11.1)	37 (23.4)	8 (21.1)	2 (10)
After needle stick injury did you get tested for HBV and HCV, if yes, then after how many weeks?				
Within 1 week	6 (16.7)	76 (48.1)	8 (21.1)	16 (80)
After 4 weeks	2 (5.6)	4 (2.5)	4 (10.5)	4 (20)
Within 4 months	2 (5.6)	18 (11.4)	8 (21.1)	--
No	26 (72.2)	60 (37.9)	16 (42.1)	--
Did you get your patient tested after needle stick injury?				
Yes	6 (16.7)	86 (54.4)	10 (26.3)	18 (90)
No	30 (83.3)	72 (45.5)	28 (73.7)	2 (10)
What was the sequence of events after needle stick injury?				
Washed with water and bandaged	2 (5.6)	10 (6.3)	4 (10.5)	6 (30)
Washed with water and remained open	4 (11.1)	8 (5.1)	2 (5.3)	2 (10)
Washed under running water and disinfectant	20 (55.5)	28 (17.7)	4 (10.5)	6 (30)
Encouraged bleeding, washed under running water	4 (11.1)	108 (68.3)	16 (42.1)	4 (20)
Did nothing	6 (16.7)	4 (2.5)	12 (31.6)	2 (10)
Are you familiar with post-exposure immunoglobulin injection for HBV?				
Yes	9 (25)	80 (50.6)	26 (68.4)	16 (70)
No	27 (75)	78 (49.4)	12 (31.6)	4 (20)
Did you report the injury to concerned authorities?				
Yes	4 (11.1)	90 (56.9)	27 (71.0)	20 (100)
No	32 (38.8)	68 (43.0)	11 (28.9)	--

Figure 1: Designation-wise level of knowledge about needle stick injuries among dental professionals.



Less than half of the dental professionals in this study did not get tested for HBV and HCV and most of them did not get their patients tested for HBV and HCV after needle stick injury. Previously, a study conducted in India had similar findings, where more than half of HCWs did not get tested for HBV, HCV, and HIV for themselves and their patients after needle stick injury.^{9,26}

Most of the dental professionals in this study get their hands washed after needle stick injury which is comparable to the study done earlier, in which it was observed that most of the HCWs washed their hands and allowed the wound bleeding to lower down the potential viral load after needle stick injury.²⁰ In this study, less than half of dental professionals reported their concerned authorities about the NSI and the results are found to be in agreement with previous studies.^{9,27,28,29} Our study has pointed out the need for a centralized reporting cell to be present at every centre for such injuries as it is lacking in our hospitals.

Limitations must be considered when interpreting findings from this study. The major limitation of our study was time and region-based results i.e. the sample in this study was solicited from only four teaching hospitals in Rawalpindi. Therefore, the results of this study cannot be extrapolated to all the dental professionals in Pakistan. Due to time constraints, the data were collected in a cross-sectional study (NSI incidence rates could not be calculated) using a non-probability sampling method (convenience sampling) which has low weightage in the presentation of results. Another limitation was the recall bias that may have led to inaccurate estimation of the frequency of NSIs and accompanying risk factors. The low education level of the dental assistants' comprehension and understanding of the questionnaire was also time-consuming. Further studies are needed to develop and evaluate interventions for the prevention of NSIs among dental professionals especially dental assistants in Pakistan.

CONCLUSION:

NSIs continue to be a serious occupational hazard in the field of Dentistry. This study concluded that despite the mean knowledge score is highest among consultant dentists,

the dental assistants and dentists have lower overall knowledge and practice indicating a need to conduct awareness programs to reduce the prevalence of NSIs in hospitals. Hospitals need to imply annual faculty awareness programs to keep knowledge of dental health professionals up to date. Also, a centralized reporting cell for reporting such injuries in dental settings is the need of time.

Author Contribution:

Batool Zara: Study design and concept, data analysis, data interpretation and drafting of the initial manuscript,
 Eruj Shuja: Study design and concept, questionnaire design, data collection, analysis and interpretation,
 Nasar Um Min Allah: Data analysis, data interpretation, final drafting and critical revision of the manuscript,
 Muddasar Pervez: Literature search, conception/design of the work,
 Omer Siddiqui: Data collection.
 Sohaib Siddique: Data collection.

REFERENCES:

- Cui Z, Zhu J, Zhang X, Wang B, Li X. Sharp injuries: a cross-sectional study among health care workers in a provincial teaching hospital in China. *Environ Health Prev Med.* 2018;23(1):2.
- Bouya S, Balouchi A, Rafiemanesh H, Amirshahi M, Dastres M, Moghadam MP, Behnamfar N, Shyebak M, Badakhsh M, Allahyari J, Al Mawali A, Ebadi A, Dezhkam A, Daley KA. Global Prevalence and Device Related Causes of Needle Stick Injuries among Health Care Workers: A Systematic Review and Meta-Analysis. *Ann Glob Health.* 2020;86(1):35. doi: 10.5334/aogh.2698.
- 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
- Yasin J, Fisseha R, Mekonnen F, Yirdaw K. Occupational exposure to blood and body fluids and associated factors among health care workers at the University of Gondar Hospital, Northwest Ethiopia. *Environ Health Prev Med.* 2019;24(1):18. doi: 10.1186/s12199-019-0769-9.
- Coppola N, De Pascalis S, Onorato L, Calò F, Sagnelli C, Sagnelli E. Hepatitis B virus and Hepatitis C virus infection in healthcare workers. *World J Hepatol.* 2016;8(5):273-281. doi:10.4254/wjh.v8.i5.273
- Prüss-Ustün A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am J Ind Med.* 2005;48(6):482-490. doi:10.1002/ajim.20230
- Gao L, Xu T, Huang G, Jiang S, Gu Y, Chen F. Oral microbiomes: more and more importance in the oral cavity and whole body. *Protein Cell.* 2018;9(5):488-500.
- AlDakhil L, Yenugadhathi N, Al-Seraihi O, Al-Zoughool M. Prevalence and associated factors for needlestick and sharp injuries (NSIs) among dental assistants in Jeddah, Saudi Arabia. *Environ Health Prev Med.* 2019;24(1):60.
- Pavithran VK, Murali R, Krishna M, Shamala A et al. Knowledge, attitude, and practice of needle stick and sharps injuries among dental professionals of Bangalore, India. *J Int Soc Prev Community Dent.* 2015;5(5):406-412.

10. Singh B, Paudel B, Kc S. Knowledge and Practice of Health Care Workers regarding Needle Stick Injuries in a Tertiary Care Center of Nepal. *Kathmandu Univ Med J.* 2015;13(51):230-233.
11. Mahmood H, Awan J, Chaudhry A. Frequency of needle stick injury among dental care personnel in Islamabad Dental Hospital. *Pak Oral Dent J.* 2018;38(2):234-236.
12. Ali I, Hameed F, Maqbool A, Kazim M, Aslam MA, Siddiqui S, Hafeez N. Incidence of Needle Stick Injury among The Dental Students and Dental House Officers of Bhitai Medical and Dental College, Mirpur Khas. *Ann Jinnah Sindh Med Univ.* 2019;5(1):26-30.
13. Pervaiz M, Gilbert R, Ali N. The prevalence and underreporting of needlestick injuries among dental healthcare workers in Pakistan: a systematic review. *Int J Dent.* 2018;2018:9609038. doi:10.1155/2018/9609038
14. Qazi AR, Siddiqui FA, Faridi S, Nadeem U, Umer NI, Mohsini ZS, Edhi MM, Khan M. Comparison of awareness about precautions for needle stick injuries: a survey among health care workers at a tertiary care center in Pakistan. *Patient Saf Surg.* 2016;10(1):19. doi: 10.1186/s13037-016-0108-7.
15. Alwabr GM. Assessment of knowledge about standard precautions and nosocomial infection among nurses working in hospitals of Sana'a city, Yemen. *Int J Caring Sci.* 2017;10:169-175.
16. Bhardwaj A, Sivapathasundaram N, Yusof M, Minghat A, Swe K, Sinha N. The Prevalence of Accidental Needle Stick Injury and their Reporting among Healthcare Workers in Orthopaedic Wards in General Hospital Melaka, Malaysia. *Malays Orthop J.* 2014;8(2):6-13.
17. Gheshlagh RG, Aslani M, Shabani F, Dalvand S, Parizad N. Prevalence of needlestick and sharps injuries in the healthcare workers of Iranian hospitals: an updated meta-analysis. *Environ Health Prev Med.* 2018;23(1):44.
18. Moodley R, Naidoo S, Wyk JV. The prevalence of occupational health-related problems in dentistry: A review of the literature. *J Occup Health.* 2018;60(2):111-125.
19. Alzahem AM, Van der Molen HT, Alaujan AH, et al. Stress management in dental students: a systematic review. *Adv Med EducPrac.* 2014; 5: 167-176.
20. Bârlean L, Dănilă I, Săveanu I, Balco C. Occupational health problems among dentists in Moldavian Region of Romania. *Rev Med Chir Soc Med Nat Iasi.* 2013; 117 (3): 784-788.
21. Angadi N, Davalgi S, Vanitha SS. Needle stick injuries and awareness towards post exposure prophylaxis for HIV among private general practitioners of Davangere city. *Int J Community Med Public Health* 2016;3:335-339.
22. Fullerton M, Gibbons V. Needle stick injuries in a healthcare setting in New Zealand. *New Zealand Med J* 2011;124:33-39.
23. Vaz K, McGrowder D, Alexander-Lindo R, Gordon L, Brown P, Irving R. Knowledge, awareness and compliance with universal precautions among health care workers at the university hospital of the West Indies, Jamaica. *Int J Occup Med Environ Health.* 2010;1:171-181.
24. Zafar A, Aslam N, Nasir N, Meraj R, Mehraj V. Knowledge, attitude and practices of health care workers regarding needle stick. *J Pak Med Assoc.* 2008; 58(2):57-60.
25. Sardesai RV, Gaurkar SP, Sardesai VR, Sardesai VV. Awareness of needle-stick injuries among health-care workers in a tertiary healthcarecenter. *Indian J Sex Transm Dis AIDS.* 2018;39(2):107-110.
26. Prabhu A, Rao AP, Reddy R, Sugumaran K, Mohan G, Ahmed S. Needle safety awareness among dental nurses. *Workplace Health Saf.* 2014;62:243-248.
27. Salekar S, Motghare DD, Kulkarni MS, Vaz FS. Study of needle stick among health care workers at a tertiary care hospital. *Indian J Public Health.* 2010;54:18-20.
28. Jan S, Akhund T, Akhtar MJ, Shaik JM. Needle stick injuries among dental health care providers: A survey done at Hyderabad and Karachi. *Pak Oral Dent J.* 2014;34:339-343.
29. Huang S-L, Lu Q, Fan S-H, Zong Z-Y, Hou T-Y, Chen B-Y, et al. Sharp instrument injuries among hospital healthcare workers in mainland China: a cross-sectional study. *BMJ Open.* 2017;7(9):e017761.

