

## Exploration of the incidence and response to needle stick injuries amid undergraduate dental students at University dental Hospital in Jeddah: hazard factors and prevention

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**Abstract. Background:** Hundreds of thousands of healthcare professionals (HCPs) endure vulnerable to fatal viruses throughout the year, including blood-borne pathogens (BBP). Needle stick injuries and sharp injury (NSSI) found to be one of the most common occupational health risks, due to their limited and constrained working area. Dental students are also at risk of such infections and injuries due to accidental infection during their hands-on working exposure. There is barely limited information regarding NSSI among dental students in Jeddah. **Aim:** to report the incidence of Needle stick and sharps injuries (NSSI) in academic year 2015-2016 to find the answer to some questions; Why needle stick and sharp injuries still happen among dental students, and why needle stick and sharp injuries are not reported instantly? As well as to ensure health, safety and to see if it follows faculty Policy which is consistent with international requirements. **Method:** Descriptive cross-sectional study conducted by a questionnaire based methodology. Consisted of twenty-seven questions, of tick box format divided by four sections; demographic items, frequency of sharp injuries, including number and environment, means that caused the injury secondly, reporting approach by monitoring all incidence of NSSI happened. **Results:** Response rate of 96.36% was achieved. From 106 participants (91.7% females & 8.3% males) only 44% always refrain from using a two-hand technique when recap needles. All of the 106 were undergraduates' dental students. 90.7% were Saudi dental students (DS). 66.7% in the age group of 20-22 year. Prevalence of Needle Stick Injury observed was 23.7%. 86.1 % of the undergraduate DS will do the right action immediately after needle prick or sharps injuries. In addition, 49% get their information about health and safety from lectures. **Conclusion:** This study found that percutaneous injuries particularly needle-sticks among dental HCPs continue to occur. The knowledge and awareness of the dental students is inadequate. There is substantial difference in practice and management regarding BMW. There is an excessive necessity for continuing education and training programs to be conducted in dental curriculum.

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**Key Words:** Needle Stick Injury, sharps injuries, Blood Borne Diseases, dental students.

### 1. Introduction

The dental metallic cartridge syringe was presented into dentistry in 1921 and an aspirating plunger was added 36 years later. Since then few modifications have taken place and the dental syringe is such a part of the everyday life of dental practice that all too often it is taken totally for granted [1]

In Saudi Arabia, the hepatitis B and C viruses pose a great threat to the health care professionals (HCP) because of their high prevalence rate (8%-10% and 2%-6%, respectively [2]). Recently, there is a significant increase in the dental teaching hospitals and college; correspondingly, there has been tremendous increase in the amount of dental students who are also at danger due to accidental infection during their practical professional exposure that is why we should give this matter more care. Biomedical waste [BMW] can be defined as "any solid, fluid or liquid waste, including its container and any intermediate product, which is generated. Students as

other health care workers who come into contact with patients' blood and body fluids may be exposed to fatal infections when they perform their clinical activities in the hospital [3].

Data from the World Health Organization has estimated that in developing regions, 40%–65% of Hepatitis B virus and Hepatitis C virus infections in health care workers are attributable to per-cutaneous occupational exposure, nurses experienced needle stick and sharp injuries more frequently than other healthcare workers [4].

Proper handling, treatment and disposal of biomedical wastes are important elements in any health care setting. In Saudi Arabia some published studies about needle stick and sharp injuries showed that there were a reported 116 cases of NSSIs from Assir central hospital during the period from 1996 to 2000 between health care professionals [5,6].

Needle-stick and sharp injuries are defined as an accidental skin-penetrating wound caused by hollow-

bore needles such as hypodermic needles, blood-collection needles, Intra-venous catheter stylets, needles used to connect parts of IV delivery system, scalpels and broken glass [7]. Another definition for NSSIs mean the par literal introduction into the body of healthcare workers, during performance of their duties of blood or other potentially hazardous material by a hollow bore needle or sharp instruments, including, but not limited to, needles, lancets, scalpels, and contaminated broken glass [8].

In the clinical settings, lack of clinical knowledge and inadequate attention to personal safety put students at high risk for occupational exposure to blood-borne pathogens through needle stick injuries and sharps injuries (NSSIs) [9, 10]. So pre-clinical undergraduate students often are prepared for the clinical area with the use of simulations in learning or skills laboratory before treating patients [10].

The main attentions when work as health care professionals are; the security of the injection receiver, the protection of the health care worker, and the welfare of the public. One third of all reported sharps injuries in dental practice are due to the use of non-disposable dental syringes with most injuries being sustained during removal and disposal of the disposable needle from the non-disposable plunger. [11]

Percutaneous exposure incident (PEI) is a broad descriptive term that includes needle stick and sharps injuries, as well as cutaneous and mucous exposures to blood and serum. From an occupational viewpoint, PEI represents the most well-organized method for transmitting blood-borne infections from patients to health care workers (HCWs). Therefore, the aim was to report the incidence of Needle stick (NI) and sharps injuries(SI) in academic year 2015-2016 to find the answer to some significant questions; Why needle stick and sharp injuries still occur among dental students nowadays, and why needle stick and sharp injuries not informed promptly ? in order to ensure health, safety and infection control and to see if it follows faculty Policy which is consistent with international requirements.

### Methods

Descriptive cross-sectional survey was approved by the Research Ethics Committee of Faculty of Dentistry of King Abdulaziz University. Dental students consent only taken in case of needle prick or sharp injury. All data were collected, coded, tabulated and subjected to statistical analysis.

Sample size of 106 students surveyed randomly by an online anonymous questionnaire. Data collection implements contained four sections; sociodemographic part and assessment of undergraduate dental student's knowledge and practice

regarding needle stick and sharp injuries and then, report the incidence of NSSI. This study was conducted from September 2015 until July 2016.38 students during this academic year reports NSSI were included in the study.

### Statistical analysis

Data were anonymously coded and entered into statistical software (SPSS software version 22) for analysis. Basic statistics were calculated, including prevalence rates and overall numbers of NSI. NSIs events were calculated as a percentage of all students and as a proportion of all cases. Differences in NSI prevalence by students' year of study were investigated using the chi-square test and the results were considered significant when  $p < 0.05$ . Sample size was calculated at 106 using Fisher's formula. Convenient random sampling was used to select the study population. First self administered questionnaires were used to collect data. Secondly, report on students' injured by needled and or sharps is presented.

### 3. Results:

One-hundred and ten questionnaires were sent on line to all fourth, fifth and sixth year dental students because of their involvement in the clinical procedures. Then one-hundred and six were returned (response rate 96.36%) was achieved. All of the 106 were undergraduates' dental students. 90.7% were Saudi dental students (DS). 66.7% in the age group of 20-22 years. Then the age group of 23-25 years was next by 26% .59.3% were fourth year DS, 14.8% were fifth year DS and 20.4% were sixth year DS as shown in Figure 1. Fortunately, 88.2% attended a training course on Infection control. However, only 55% of them attended a course on risk management. From those who did not attend 55% mentioned that, they did not know if there is one available. 90.2% stated that their CPR license still valid.

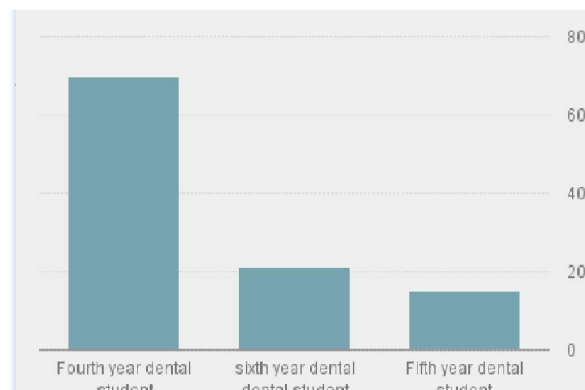
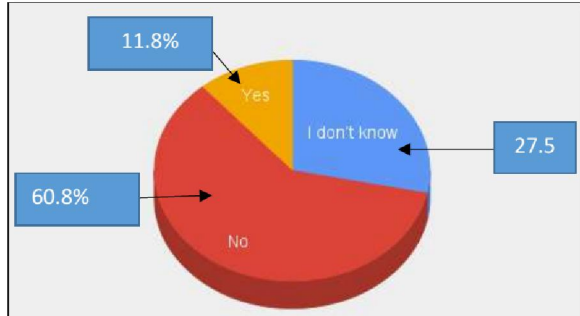


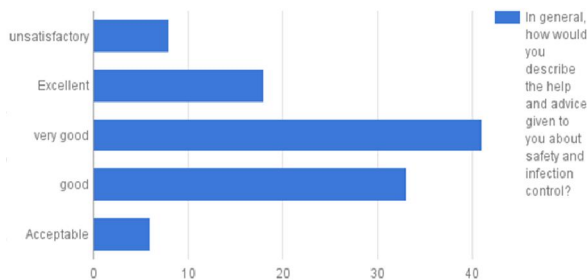
Figure 1: Number of students in each clinical year.

Most of them 56% did not know the emergency number in the Dental Hospital. All of the students vaccinated against Hepatitis B; nevertheless only 54.9% returned to check their antibodies. Only 11.8% have had received a hard or soft copy about needle stick protocol and more than 60.8 % have not had received anything or they did not know about it as shown in Figure 2.

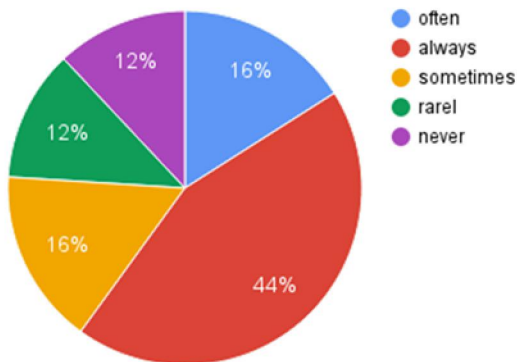


**Figure 2: whether students received a copy about needle stick and sharp injuries' protocol.**

Regarding the number of students who read the infection control Policy for The Faculty of Dentistry determined by Infection Control (IC) Committee of King Abdulaziz University were only 37.3%.



**Figure 3: Students' rating the help and advice given about safety and infection control.**

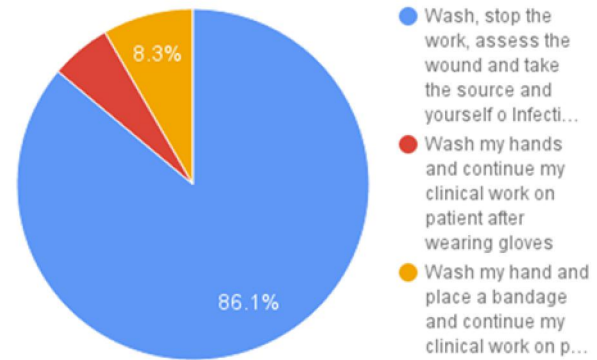


**Figure 4: The count of students who refrain from using a two-handed technique when recap needles**

In addition, 49% get their information about health and safety from lectures and only 7.8% got that information from dentists or colleagues. Only 17.6% rated the advice regarding safety and IC as excellent. Besides, 41.2% rated it as very good and 33.3% rated the information given as good. However, 8% rated it as unsatisfactory as shown in Figure 3.

Unexpectedly, Only 44% always refrain from using a two-hand technique when recap needles, and 12% never and rarely refrain from this recapping techniques as shown in Figure 4.

Thankfully, 86.1 % of the undergraduate DS will do the right action immediately after needle prick or sharps injuries; by stopping the work, wash, assess the wound, take the source and went to infection control office then to hospital to test both the student and the source as shown in Figure 5. In addition, 79% of students were aware of taking post-exposure prophylaxis after accidental NSSI.



**Figure 5: Action Taken by students in case of NSSIs.**

94.1% dispose sharps into sharp containers, 4% sometimes and less than 2% often they put sharps into their designated places. Only 16.7% always wash their hands before donning gloves. While 85.8% wash hands after removing gloves as shown in Figure 6.

100% agreed that Guidelines are necessary for a correct application of procedures, while 69% need more sources to get information and training to inform them about safety as well as up to date guidelines.

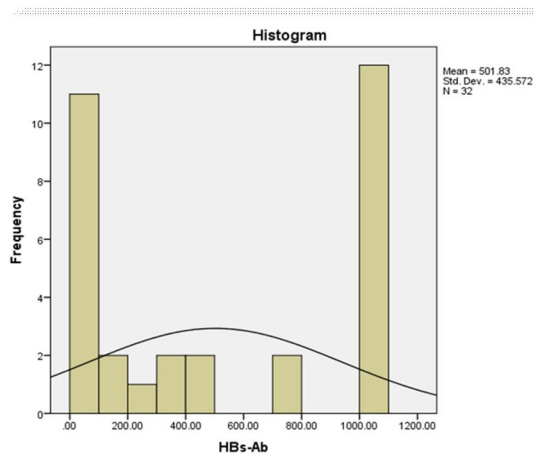
During the whole academic year, the second part of te study was started by close supervision and monitoring at the infection control office for all the cases presented there including dental students' attitude toward infection control and the safety in the clinical areas. Then every case of needle pricks or sharps injurues were reported and followed from the beginning to the end.



**Figure 6: Frequent of washing hands before and after wearing gloves**

**Table 1: Characteristics of the 38 Study Samples (Doctor, dental students, Board trainee and Dental assistants)**

Variables	N	Min	Max	Median	Mean	±SD
<b>HBs-Ab</b>	32	6.07	1000.00	399.93	501.83	435.6
		<b>Count</b>			<b>%</b>	
<b>Total</b>		38			100.0	
<b>Year</b>	4th	8			21.1	
	5th	12			31.6	
	6th	11			28.9	
	Board	2			5.3	
	DA	1			2.6	
	Intern	3			7.9	
	Droctor	1			2.6	
<b>Year</b>	4th	8			21.1	
	5th	12			31.6	
	6th	11			28.9	
	Others	7			18.4	
<b>Gender</b>	Male	9			23.7	
	Female	29			76.3	
<b>HBsAg</b>	Negative	38			100.0	
<b>HCV</b>	Negative	38			100.0	
<b>HIV</b>	Negative	38			100.0	



**Figure 7: The frequency distribution of the HBs-AB**

This study was analyzed using IBM SPSS version 22. A simple descriptive statistics was used to define the characteristics of the study variables through a form of counts and percentages for the categorical and nominal variables while continuous variables are presented by mean and standard deviations. To establish a relationship between categorical variables, this study used chi-square test. These tests were done with the assumption of normal distribution. Lastly, a conventional p-value <0.05 was the criteria to reject the null hypothesis. Summary of the characteristics of the sample monitored shown in Table 1.

The 5<sup>th</sup> year students were the most group have had injuries then, the sixth followed by the fourth year’s students. The rest were divided between board trainees 5.3%, Interns 7.9%, Dental assistants 2.6%

and finally doctors 2.6%. The histogram Figure 7 depicts the frequency distribution of the HBs-AB measure of the 32 samples. The histogram shows a non-normal distribution (Non-normal bell curve). We can visually tell that 11 of 32 samples have 100 or less HBs-AB and 12 of 32 with 1000. Therefore, the purpose of this is just to roughly assess the probability distribution of HBs-AB by illustrating the frequencies of observations transpiring in certain ranges of values. Female were injured more than the male (76.3%, 23.7%) respectively as shown in Figure 8.

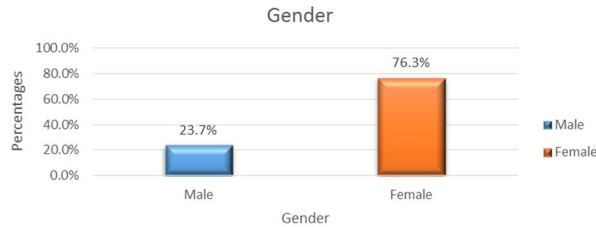


Figure 8: Gender distribution

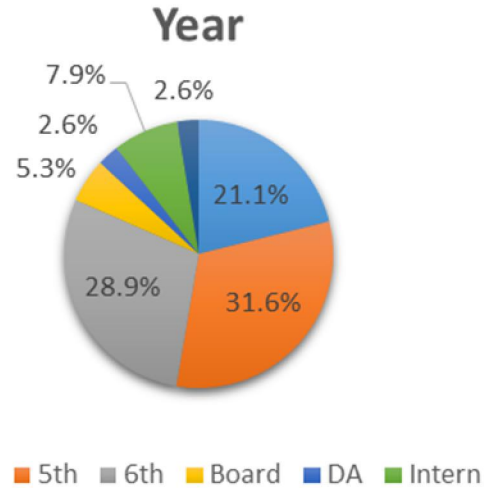


Figure 9: Percentage of HCWs who got injuries by needles or sharps in one academic year.

Table 2: Percentage of male and female in each year was injured

Variables	Total	Gender		p-value
		Male	Female	
Total	38	9(23.7%)	29(76.3%)	N/A
Year	4th	4(50.0%)	4(50.0%)	0.179
	5th	1(8.3%)	11(91.7%)	
	6th	2(18.2%)	9(81.8%)	
	Others	7	2(28.6%)	

Only 23.7% of the respondents had suffered NSSI. Of those who had suffered NSSI, 39% of the incidents occurred when administering local anaesthesia, while 13% were during scaling, 19% when recapping needles, while the rest when collect instruments and return them to Central Sterilization Department (CSD). Those 23.7% had reported the NSSI. The reasons for not reporting when asked were limited time (21%) or the fear of consequences of cross-infection (32%).

Among the respondents who had experienced NSSI, nine were males and twenty-nine were females with statistical significance between the two genders  $p=0.0481$ . All the respondents recorded inadequate knowledge on the modes of prevention of NSSI.

**4. Discussion**

This cross-sectional study examined the prevalence of NSSI and distributed to undergraduates dental students. A survey is frequently the best method to obtaining the knowledge. Representativeness in this study was the undergraduate dental students who are the population of interest. Therefore, the reader assess the study findings with declaration that the sample of respondents reflects fundamentals of the population

with extent and depth.[12]. E-mail surveys integrating multimode methods may yield response rates as high as 70%.[13]. In this study the response rate was 96.36%.

Much concern has been expressed in the literature about the overlooked reporting of injuries happening in the dental teaching setting.[14,15] Although the survey was conducted at the King Abdulaziz dental college, the results may not be generalized to all kingdom dental colleges since there are several differences in the training and teaching programs.

All the studies were done involving dental students; 89.23% of the students had correct knowledge about NSI and 91.55% of the students had adequate level of awareness regarding its management in one of the studies nearly similar to our results, which showed 86.1% knew what to do in case of NSSI. Also, 89% of students in one of the studies were aware of taking post-exposure prophylaxis after accidental NSI., in our result it was 79%. 95% of students' destroyed needles in puncture-resistant containers. Favorably with that in other reports in term of incidence and circumstances around needle-stick injuries.[16,17,18]

It is estimated that the risk of contracting hepatitis B infection due to NSI is 100 times higher than contracting HIV. The prevalence of occupational HIV is 0.3% after parenteral exposure as to 0.09% after mucosal exposure [19].

Dental Health Care Professionals (DHCPs) should be familiar also with the grading of controls that categorizes and ranks prevention strategies [20].

For bloodborne pathogens, engineering controls that eradicate or separate the hazard (e.g., puncture-resistant sharps containers or needle-retraction devices) are the main policies for protecting DHCP and patients. Where engineering controls are not available or appropriate, work-practice controls that result in safer behaviors (e.g., one-hand needle recapping or not using fingers for cheek retraction while using sharp instruments or suturing), and use of personal protective equipment (PPE) [21]. The risk of developing serologic evidence of HBV infection was 37%-62% [22]. By comparison, the risk of developing clinical hepatitis from a needle contaminated with HBsAg-positive, HBeAg-negative blood was 1%-6%, and the risk of developing serologic evidence of HBV infection, 23%-37%. [23]. Unexpectedly, in this study only 44% always refrain from using a two-hand technique when recap needles, and 12% never and 12% rarely refrain from this recapping techniques, this showed that it is an attitude which is very dangerous and need to be eradicate immediately.

Prevention and measures such as the introduction of safety syringes, although costly, have been shown to reduce needle stick injuries dramatically.[24]. Working closely with the manufacturers will enable changes to the design to be introduced so improving the product even further. Occupational blood exposures have been progressively falling and this figure can be further improved by the introduction of safety syringes not only into dental schools but also in the community dental services and general dental practice.[23]

Current investigation showed that fifth and fourth year dental school students are the most frequent students of reporting NSSIs as compared to six-year dental students. This may reflect the cautious approach of the sixth year dental students. Because their knowledge and experience towards safety and infection control which is taught to them. Accordingly, it was improving, as they get older and matured scientifically.

In this regard, the literature's NSSI figures should be approached cautiously as many authors do not limit the definition of NSSIs to the needle puncture but include any parental contact to non-intact skin, eye or mucous membrane. That happened during this study when a fifth year dental students wanted to adjust his face mask while his foot was still pressing

the foot paddle and the hand piece was rotating in the same hand which he was using to adjust the mask. That resulted in a lower lip injury by the bur and was painful.

37.3% read the infection control Policy for The Faculty of Dentistry determined by Infection Control (IC) Committee, which is very low. 55% of the students who did not attend risk management course mentioned that, they did not know if there is one available, which means there was a problem in communications, in advertising for courses and seminars as well as the number and the timing of courses might play a big role in this low percentages of attendance.

Low compliance between students, especially in reporting of injuries, may be somewhat explained by the perception that they are unimportant and pose no danger to them and this may be due dental students doing their own risk assessment and did not got enough information, workshops, seminars or even leaflet. Other reason, could be the full clinical schedule and students more concerned with completing of their clinical requirement. However, when the possible for blood or body fluid contact exists, the risk of exposure to blood-borne pathogen is high. The importance of properly reporting all NSSIs to the proper the system must first be endorsed throughout the faculty of each institution many times before it can be expected to be respected by the student and staff.

Only 23.7% of the respondents had suffered NSSI. Of those who had suffered NSI, 39% of the incidents occurred when administering local anesthesia, while 13% were during scaling, 19% when recapping needles, while the rest when collect instruments and return them to Central Sterilization Department (CSD). Those 23.7% had reported the NSSI, nearly similar to results [25,26,27].

There was statistical significance between the two genders ( $p=0.0481$ ). nine were males and twenty nine were females. It can be explained as female more aware in reporting and taking post exposure action better than male. Most of the respondents recorded inadequate knowledge on the modes of prevention of NSSI.

Scaling and administration of local anesthesia had the highest incidence of NSSI. Nearly 50% of them got their information from lectures. Therefore, more bulk need to be on this path of delivering information.

Only 17.6% rated the advice regarding safety and IC as excellent. Dental students as having been associated with incidences of NSI cited the lack of skill and knowledge about the procedure and lack of education and accompaniment. These issues and others may have perhaps donated to the reduced levels

of information on NSI preventive measures among dental students as well. Against this background, concerted efforts are needed to improve the knowledge and practices of dental students on personal protective measures against NSI[28]. The recapping of needles has been prohibited under the Occupation Safety and Health Administration (OSHA) blood-borne pathogen standard.[21,29] However, needle-sticks and other blood contacts continue to occur, which is a concern because percutaneous injuries pose the greatest risk of transmission.

Work-practice controls for needles and other sharps include placing used disposable syringes and needles, scalpel blades, and other sharp items in suitable puncture-resistant containers located as close as possible to where the items were used [30-32]. In addition, used needles should never be recapped or otherwise [33]. In addition, used needles should never be recapped or otherwise manipulated by using both hands, or any other technique that involves directing the point of a needle toward any part of the body [34]. A one-handed scoop technique, a mechanical device designed for holding the needle cap to facilitate one-handed recapping, or an engineered sharps injury protection device (e.g., needles with re-sheathing mechanisms) should be employed for recapping needles between uses and before disposal [30,31].

DHCP should never bend or break needles before disposal because this practice requires unnecessary manipulation. For procedures involving multiple injections with a single needle, the practitioner should recap the needle between injections by using a one-handed technique or use a device with a needle re-sheathing mechanism. Passing a syringe with an unsheathed needle should be eluded because of the likely for injury.

Thankfully, 86.1 % of the undergraduate DS will do the right action immediately after needle prick and 79% of students were aware of taking post-exposure prophylaxis after accidental NSSI.

Hand hygiene (e.g., hand washing, hand antiseptics, or surgical hand antiseptics) substantially reduces potential pathogens on the hands and is considered the single most critical measure for reducing the risk of transmitting organisms to patients and HCPs [35,36]. However, in this study only 16.7% always wash their hands before donning gloves. While 85.8% wash hands after

## Conclusion

This study found that percutaneous injuries particularly needle-sticks among dental HCPs continue to occur. The knowledge and awareness of the dental students is inadequate, although there is considerable variation in practice and management of NSI among different studies.

Study year, and when the injury took place during administration of local anesthesia (LA) and recapping conventional syringe or clearing work surface or during disposal are factors play a major role in NSSI.

The College of Dentistry publishes and distributes comprehensive guidelines encompassing practical procedures aimed at prevention of sharps injuries. The guidelines advise that general precautions are taken for any procedure that could involve contact with blood or other body fluids.

There is considerable variation in practice and management regarding BMW. There is a great need for continuing education and training programs to be conducted in dental teaching.

Despite a comprehensive educational program and training for dental students, knowledge of inoculation injuries and associated issues remained inadequate. The findings of this study confirm that dental students experience NSIs but are not likely to report them, thus it is important that the principles of infection control training and reporting of all NSIs continue to be emphasized throughout undergraduate dental education in ever year at induction weeks.

It is not only a legal necessity but also a social responsibility. The results of this study revealed that post-exposure management was completely inadequate especially the reporting of occupational exposures.

Reasons given by the students in this study centered on fear of stigmatization and judgement. Needle-stick injury is a matter of modern concern as evidences suggest it being a route of spread of certain possibly harmful diseases. We can no longer risk with our careers, our economics or our health by failing to report needle-stick injury.

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