Self-reported percutaneous injuries of students and interns at the School of Dentistry in Trinidad: A follow up study of an updated sharps protocol

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ABSTRACT

Objective

To report the results of a survey of all percutaneous injuries that occurred between 2009 – 2014 among students and interns at the dental school in Trinidad and to evaluate compliance with the protocol for the management of percutaneous injuries.

Methods

Data was collected via questionnaires administered to 186 clinical students and interns in 2012 and 2014. Data were analysed using SPSS® 17.0 Statistical software.

Results

A 90% response rate was obtained. Forty-eight persons (29%) reported one or more sharps injuries at the dental school. Of the 76 sharps injuries reported, 55 were percutaneous. Needle sticks and burs accounted for the majority of injuries and mostly occurred while working on patients. There were no significant relationships ($p>0.05$) between sex nor student year with the occurrence of injuries. 76% of the respondents described their concern for contracting blood borne injuries from sharps injuries as "high." After injury, 41% of the respondents followed

the school's protocol for sharps injuries.

Conclusion

The prevalence of percutaneous injuries among students and interns at the UWI dental school in Trinidad is 23% and occur most commonly while working on patients. Compliance with the protocol for percutaneous injuries needs to be improved. The protocol needs to be audited to improve efficiency and reinforced to the students, interns and clinical supervisors during their clinical years.

Key Words: Dental school, Infection Control, Needle stick, Percutaneous, The University of the West Indies, Trinidad

INTRODUCTION

The practice of dentistry involves the use of many sharp instruments and devices that can cause percutaneous injury. This risk of injury is of concern to dentists due to potential cross infection of blood borne pathogens such as Hepatitis B, Hepatitis C and HIV. Dental procedures invariably cause trauma to the oral cavity soft tissues thereby leaving the patient vulnerable to blood-borne pathogen transmission. Dentists receive training to minimize these risks during their undergraduate training and cross infection control is a fundamental and mandatory part of all undergraduate dental curricula.¹⁻³ Despite this training, dental students are at a higher risk for percutaneous injury due to their lack of clinical experience.⁴

The prevalence of percutaneous injuries among dentists worldwide is reportedly high.⁵ A recent review of dental literature on the transmission of pathogens in a dental setting concluded that the risk of transmission of pathogens is unknown and cannot be considered negligible.⁶ This finding coupled with the 1.1% prevalence of HIV-infected persons in Trinidad & Tobago⁷, the economic burden of managing the injury and the post-traumatic stress associated with the injury reinforces the need for dental students to develop proper infection control practices as a matter of habit.^{8, 9} A 2006 study by Smith et.al.¹⁰ showed that 44% of clinical students and interns at the University of the West Indies, School of Dentistry in Trinidad had one or more sharps injuries.

A number of dental schools have looked at the prevalence of percutaneous injuries with a view to review the adequacy of surveillance, level of under-reporting of injuries and to assess whether proper post-injury protocols were being followed. The prevalence of injuries ranged from 12-80%.¹¹⁻²⁰ The authors thought it important to periodically assess the levels of injuries among students in the clinical programme of a dental school.

The dental school's infection control policy is consistent with local and international standards²¹ and is made available to all clinical personnel. Similar to other dental schools, the policy mandates, inter alia, that all students be vaccinated against Hepatitis B and receive training in cross infection control before they begin seeing patients. Doctor of Dental Surgery (DDS) students treat patients under supervision as part of the curriculum from their 3rd year until their final (5th) year. Graduates from the school can undertake an optional year of pre-licensure general dentistry training (internship) which is also offered by the school of dentistry.

The school's clinical protocols recommend the one-hand "scoop" technique for recapping needles. Needles are disposed after the clinical procedure in sharps bins. The school's sharps injury protocol mandates that when a contaminated percutaneous injury occurs, both patient, dental student and supervisor should present to the hospital phlebotomist for pre-test counselling, and HIV and Hepatitis B testing (immediately and at 3 months). They are also provided with anti-Hepatitis B immunoglobulin and post exposure prophylaxis (PEP) antiretroviral drugs for HIV. Post-test counselling is available for both the patient and dentist/student.

Subsequent to the 2006 study by Smith et. al.¹⁰, efforts were made to reduce the incidence of injuries through focused sharps training and a revised protocol was implemented. A new percutaneous injury register was created in 2008 and all clinical staff briefed on the importance of keeping accurate logs of injuries. No assessment of sharps or percutaneous injuries has taken place since. This paper aims to report the results of a survey of all percutaneous injuries that have occurred at the school between 2009 – 2014 amongst clinical students and interns while evaluating compliance with the revised protocol for management of these injuries.

MATERIALS AND METHODS

The study is a retrospective survey of all percutaneous injuries at the UWI School of Dentistry at St. Augustine, Trinidad. All registered clinical students and interns at the school were included in the survey.

An anonymous questionnaire was developed which comprised of questions relating to the details and sequelae of the sharps and percutaneous injuries, Hepatitis B immune status, perceived concern about the risk of blood-borne pathogen transmission and self-assessment of the adequacy of instruction of risk management. The criteria for a percutaneous injury was taken from the school's clinic manual as "accidental skin puncture during working hours involving any material involved in a patient's clinical dental care, or contamination of an existing wound or scratch with blood, serum, pleural or ascitic fluid, or a human bite where the skin has been broken." Injuries not adhering to this definition were recorded as "sharps injuries". The questionnaire was validated using face and content validity – that is whether the questions related to the injuries were relevant, reasonable, unambiguous and clear and whether a comprehensive range of questions were adequate for the topic under investigation.²² This was deemed suitable as the questions required simple answers related to a student's injury and the sequelae of the injury. The research did not seek to develop a construct from the data but simply to report it and thus the authors' expertise were deemed sufficient to validate the questionnaire in this respect.²³ The protocol was similar to the 2006 study by Smith et.al. and differed in that this study focused on injuries on the school clinics only instead of clinics and laboratories and surveyed students only instead of students and staff. The study method received approval from The University of the West Indies, St Augustine's Campus Ethics Committee approval number 8.6.2014.erf for 2014 & approval number 1.6.2011.dc for 2011. A pilot of the questionnaire was conducted to check validity and comprehensibility.

Data was collected from a total of 186 clinical students and interns of the UWI dental school at two time periods: 1.) in January 2012 (n=108) and 2.) in September 2014 (n=78). No student or intern answered the questionnaire twice. Students and interns were asked to report injuries during their time in the school of dentistry - which for an intern would date back to their second semester of Year 3 DDS. Therefore, the data collected would have

captured injuries occurring on the school clinics between 2009-2014. The questionnaires were entered into SPSS® 17.0 Statistical software (SPSS Inc. Chicago, Illinois, USA) and statistical analysis of data was performed. To determine relationships between variables Pearson's R correlation was used and p values <0.05 were deemed to be statistically significant.

RESULTS

Response rate

A 90% response rate (n= 167) was obtained. The respondents were in the age range of 20-37 years and 70% (n=116) were female. The number of injuries reported per student year is presented in Table 1. There was no significant relationship between sharps or percutaneous injuries reported and student year or sex ($p>0.05$).

Table 1: Number of sharps and percutaneous injuries reported per student year

Student / Intern	Completed questionnaires (n)	1 or more sharps injuries (n)	Prevalence of sharps injuries (%)	1 or more percutaneous injuries (n)	Prevalence of percutaneous injuries (%)
Year 3	26	3	12	2	8
Year 4	59	14	24	12	20
Year 5	54	20	37	16	30
Intern	28	11	38	9	31
Overall	167	48	29	39	23
p-value		0.050		0.100	

Immune Status

One hundred and sixty-two (99%) of respondents reported having started the Hepatitis B vaccination series with 128 (78%) completing all three shots (Table 2). Fourteen (8%) of respondents reported having their Hepatitis B titers measured. Sixty-one respondents

(37%) reported having an HIV test and 12 (7%) reported donating blood within the 12 months prior to completing the questionnaire. There were no significant relationships between completion of the Hepatitis B vaccination series or knowledge of HIV status with sex or class year of the respondents ($p>0.05$).

Table 2: Hepatitis B vaccination status of students and interns

Hepatitis B vaccines taken	Student			Intern n (%)	Total n (%)
	Year 3 n (%)	Year 4 n (%)	Year 5 n (%)		
None	0 (0)	1 (2)	0 (0)	0 (0)	1 (1)
First only	1 (4)	11 (19)	2 (4)	1 (4)	15 (9)
First and second only	3 (12)	10 (18)	5 (9)	1 (4)	19 (12)
All three	21 (84)	34 (61)	47 (87)	26 (92)	128 (78)
Total	25 (100)	56 (100)	54 (100)	28 (100)	163 (100)

Reported Sharps and Percutaneous injuries.

Forty-eight (29%) respondents reported having one or more sharps injuries while at the dental school; a total of 76 sharps injuries were reported over the 5 year period. Thirty-nine persons (23%) reported having one or more percutaneous injuries: a total of 55 percutaneous injuries (72%) of all sharps injuries) were reported. The prevalence of both sharps and percutaneous injuries increased with student year with the highest prevalence among the interns. (Table 1).

Thirty-one percent of females and 30% of males reported sharps injuries. Forty-two students (87%) reporting injuries had all 3 Hepatitis-B shots while 13% had not completed the series of shots. There were no significant

relationships ($p>0.05$) in either sharps or percutaneous injuries with sex or class year or immune status of the respondents.

A total of 55 percutaneous injuries were reported between 2009-2014. An examination of the school's clinic sharps injuries register shows that between 2009 - 2014, 53 percutaneous injuries were recorded. Thus, from the results of this study, the reporting rate of percutaneous injuries in the school's clinic sharps register was 98%.

Multiple sharps injuries were reported by 20 persons (42% of sharps-injured persons) while 13 persons (33% of the percutaneous-injured) reported multiple percutaneous injuries. (Table 3)

Table 3: Numbers of respondents (n) reporting one or more sharps injuries and one or more percutaneous injuries

n	Number of sharps injuries reported per respondent	n	Number of percutaneous injuries reported per respondent
28	1	26	1
15	2	11	2
2	3	1	3
3	4	1	4

Table 4 shows the distribution of injuries in relation to the cause. Most injuries ($n=22$) were caused by needles, 10 of which while administering anaesthesia. Burs were the second most common cause of injury. At the time of

injury, all respondents were wearing some form of personal protective equipment (safety goggles and gloves (70%), or gloves only (22%)).

Table 4: List of causes of reported sharps injuries with the frequency (n) and percentage of total sharps injuries reported

Cause of Sharps Injury	n (%)
Needle	22 (29%)
Bur	13 (17%)
Scaler	11 (14%)
Explorer/probe	11 (14%)
Endodontic file	8 (11%)
Surgical Elevator	3 (4%)
Suture Needle	2 (3%)
Endodontic spreader	2 (3%)
Syringe harpoon	2 (3%)
Scalpel	2 (3%)
Total	76 (100%)

Twenty-seven (31%) injuries occurred while operating on a patient, nineteen (22%) during cleaning instruments and seven (8%) during disposal of a sharp instrument. Two injuries (2%) were reported while assisting the operator. Single instances of sterile injuries were reported during setting up of anaesthetic syringes and opening of a sterilized package of instruments. Eighty-two (94%) injuries were reported on the hand while 4 (5%) were on the forearm and 1 (1%) on the arm.

Plastic restorations/fixed prosthodontics were the most common activity being pursued at the time of injury (28 (47%)). Other reported injury related procedures included: oral surgery (9 (15%)), periodontics (9 (15%)), examinations (7 (12%)), endodontics (5 (8%)) and removable prosthodontics (2 (3%)). The majority of injuries involved the hand and fingers (66 (92%)).

Of those who suffered percutaneous injuries, 56% (22) believed they received adequate instructions to reduce the risk of contracting blood-borne diseases. Twenty-nine persons (74%) stated they were aware of the protocol for managing a percutaneous injury and 20 (51%) of the injured persons were aware of their HIV status.

Reporting of percutaneous injuries and assessment of concern of contracting illness from blood borne pathogens.

High or very high concern for contracting blood borne infection was expressed by 124 respondents (76%). The majority of respondents (131(78%)) were aware of the school's protocol for contaminated sharps injury. However, among those respondents who reported injuries, only 16 (41%)) followed the protocol. Twenty-five (64%) of injured persons indicated concern about contracting a blood-borne illness from their injury. When asked why the protocol was not followed, 6 (38%) respondents reported that the injury was caused by a sterile instrument, 5 (13%) stated that it was too time consuming, and one student stated that supervising staff was not present at the time of injury.

In cases where the protocol was followed, 15 persons (94%) reported the injury, 13 (84%) students and 12 patients (75%) had immediate blood samples taken for HIV, and Hepatitis B testing. Four students (25%) and five patients (31%) had follow up blood tests three months post-injury. Six (38%) students received PEP anti-HIV retroviral drugs and one student had HBsAg

antibody administered.

Four (25%) injured respondents stated that following the post-injury protocol went smoothly. Other students reported that supervising staff were not sure of the protocol, they had long waiting periods to have blood samples taken and one patient was hesitant to provide a blood sample. Some students indicated difficulty in obtaining the PEP drugs.

DISCUSSION

A good response rate was obtained for this survey, indicating a very representative dataset of students and interns. No significant differences were observed in injuries between sex, age groups or class year indicating that there was no group that was at higher risk than another.

Immune Status

Only 79% completed all three Hepatitis B shots. Other studies reported difficulty in having students^{11, 15} complete the vaccination series. More stringent measures need to be implemented to monitor students' compliance with this aspect of the infection control policy. Pre-vaccination screening would be useful in determining whether an individual may need all three vaccines or a booster while post-vaccination screening would analyze effectiveness of the vaccination series. This would help determine whether anti-Hepatitis B immunoglobulin is necessary after a contaminated percutaneous injury.

Sharps and percutaneous injuries

One or more sharps injuries were reported by 29% of respondents, which in comparison to sharps injuries among dental students of other schools, is on the lower end of the scale. Dental schools in the US and UK reported prevalence of sharps injuries among students of 12.0% and 19.1% respectively. Dental schools in China, Italy, Germany, and Saudi Arabia reported prevalence of 34.0%, 40.0%, 41.8% and 47.6% respectively while schools in New Zealand, Yemen and Iran had prevalence rates as high as 60.2%, 62% and 80% respectively.^{11-14, 16-18}

Of the persons reporting injuries, 42% had multiple sharps injuries and 33% had multiple percutaneous injuries. This suggests that having a sharps injury increases the risk for subsequent injury. Persons who report sharps injuries therefore should be targeted and

given remedial training to reduce the occurrence of multiple sharps injuries.

Similar to our study, needle stick injuries have been reported as the most common sharps injury at other dental schools^{14, 17, 19, 20, 24-27} and among dentists.²⁸ In this study, the majority of injuries occurred during administration of anaesthesia with a single instance occurring during assembling the syringe. This indicates that greater emphasis should be placed on training the students in proper anaesthesia administering techniques.

In contrast to our findings, a meta-analysis of percutaneous injuries conducted by Pereira et. al found that burs were the most common cause of percutaneous injuries.⁵ In this study, the majority of the burs injuries occurred while operating on a patient but the exact mechanism of injury could not be determined. It would be useful to focus attention on risk management with respect to how the handpieces are stored while operating on a patient, analyzing the ergonomics of the delivery system for handpieces and focusing attention on safe practice whilst performing dental procedures using handpieces.

In the 2006 study by Smith et.al. examined injuries of academic staff, dental surgery assistants, students and interns. When the student and intern data were extracted from this paper, it showed that 44% of students and interns reported having had one or more sharps injuries and 13% of students and interns reported one or more percutaneous injuries. Thus the data from this study shows that there was an overall reduction in reported sharps injuries (29% down from 44% in 2006) but a rise in reported percutaneous injuries (23% up from 13% in 2006). The reasons for the latter increase ought to be investigated through a future study. Nevertheless, the school needs to improve training of students on the prevention of sharps and percutaneous injuries and reinforce this training in the clinical years - especially to persons who have had an injury.

Adherence to percutaneous injury protocol

While the majority of respondents were aware of the school's protocol for sharps injuries, only 41% adhered to it. Non-compliance with departmental sharps injury protocols and underreporting of sharps injuries seems to be a common practice among dental students^{13, 16, 18-20, 27} and dental health care workers.²⁸ Given that in this study,

students admitted to not reporting sharps injuries, it is conceivable that underreporting of sharps injuries is still occurring. The 2006 study identified underreporting of injuries as a potential problem as 59% of injured persons followed the school's protocol - which included reporting the injury.¹⁰ Following that study, emphasis was placed on the importance of reporting each injury to both staff and students. This study showed that 98% of all injuries were recorded in the percutaneous register showing an improvement in surveillance.

There appears to be a reduction in the numbers of students (13 to 4) and patients (12 to 5) who present for follow up blood testing three months after injury. This may either reflect complacency of these individuals or may suggest that the process for blood testing is not efficient. The reported long waiting times for blood samples to be collected may serve as a deterrent for persons to have blood samples taken.

Limitations of the study

The results of this study depend on the respondents' recall of the injury and their being honest in their responses. This might be more of a limitation for interns and final year students who may have had an injury up to 3 years and 9 months prior. However, as sharps injuries are usually emotionally traumatic it is a reasonable assumption that respondents would recall the event. The survey provided a snapshot of injuries at the school over a 5 year period.

CONCLUSION

The prevalence of percutaneous injuries among dental students and interns at the UWI dental school in Trinidad is 23%. Multiple injuries appear to be common. The school needs to focus its efforts on reducing injuries while working on patients and provide individual instruction to injured persons when injury occurs. Compliance with the protocol for percutaneous injuries needs to be improved. The protocol needs to be audited to improve efficiency and reinforced to the student, interns and clinical supervisors. Prevalence reporting of percutaneous injuries should be encouraged among all dental schools to evaluate the risk to dental student training and provide an evidence base for more stringent regulation for sharps training and risk reduction among dental students.

Conflicts of Interest : None to declare

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