

Psychological Effects of Sharps Injuries on Students, Faculty and Staff in a Dental School Setting

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Abstract

Purpose: Dental health care professionals (DHCP) are routinely exposed to occupational hazards, such as sharps, putting them at risk of exposure to blood borne pathogens in addition to experiencing psychological effects post-injury. The purpose of this study was to investigate the psychological effects of sharps injuries for students, faculty, and staff at the University of Minnesota School of Dentistry (UMN SOD).

Methods: A mixed-mode, electronic and paper, research design was used for the 51-item survey. Participants were recruited from the UMN SOD and included students, faculty, and staff. The survey consisted of items from the Perceived Stress Scale (PSS-10) and Modified Patient Health Questionnaire (PHQ-9). Scores were compared between participants who had and those who had not experienced a sharps injury in the past year.

Results: A total of 262 surveys were included in the statistical analysis for a 23.5% response rate. Fifty-six participants (21%) self-reported a sharps injury within the past year. Of those respondents, over half (67%) reported experiencing feelings of anxiety and increased stress (50%) while waiting for blood test results.

Conclusion: A majority of participants who reported a sharps injury felt anxious and/or stressed during the month following the injury. While participants may have experienced overall increased stress and anxiety, these findings were not statistically significant. Further research is needed to assess the psychological effects of sharp injuries in DHCPs.

Keywords: dental health care professionals, sharps injuries, percutaneous injuries, blood borne pathogens, occupational stress

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Introduction

Health care workers (HCW), including dental health care professionals (DHCP), are exposed to sharps injuries, however, the exact incidence is unknown due to underreporting.^{1,2} Sharps injuries place DHCPs at risk of acquiring blood borne infections including hepatitis B and C, and human immunodeficiency virus.³ Even in instances where blood borne pathogens are not acquired, studies have found that HCWs may experience psychological effects following sharps injuries.^{4,5} Sohn found significantly higher HAM-A (Hamilton Anxiety Scale) and BDI (Beck Depression Inventory) scores among HCWs with experience of a sharps injury as compared to those with no experience of a sharps injury.¹

Psychological effects experienced by HCWs post sharps injury may also impact work attendance and family

relationships.⁴ Research by Jeong et al. revealed that following a sharps injury, participants stated that it would be difficult to continue work in a dangerous environment.³ Another study found that despite no seroconversion, participants experienced anxiety and/or stress disorders, which necessitated a prolonged leave of absence.⁵ Regarding family relationships, Gershon et al. found that HCWs may feel the need to alter their sexual practices post sharps injury as a means to reduce their partner's risk of infection presenting challenges for couples who want to start a family.⁶

The occupational hazard of sharps injuries has been recognized in the literature, but there is a gap in the literature regarding the psychological effects of such injuries^{1,4} particularly among DHCPs. The purpose of this study was

to investigate the psychological effects, specifically stress and depression, of sharps injuries for students, faculty, and staff in a dental school setting.

Methods

This study was approved by the University of Minnesota (UMN) Institutional Review Board (STUDY00006142) and took place from May to December 2019. A cross-sectional, descriptive, mixed mode survey design was used to investigate the psychological effects of sharps injuries. A convenience sample of UMN School of Dentistry (SOD) faculty, staff, and students (residents, dental, dental hygiene, and dental hygiene/dental therapy) with UMN emails, received an electronic survey (n=1,113). Students, staff, and faculty who worked and/or attended classes at the UMN SOD met the study inclusion criteria. Survey respondents who indicated never working with sharps in their role at the UMN SOD were excluded from the study and further data analysis.

Participants were provided a cover letter describing the study and consent form prior to beginning the survey. Follow-up emails were sent to all non-responders after two weeks. To increase the response rate, paper surveys were provided to faculty within the UMN SOD to distribute to dental, dental hygiene students and specialty residents. A lead dental assistant distributed paper surveys to staff. Participants were asked not to complete a paper survey if they had already responded to the electronic survey. Participants were given the opportunity to enter their name and email for a chance to receive one of the ten \$40 Target gift card incentives. At the end of the survey, participants were provided with information on the mental health resources available at UMN. Participants could use those resources to self-refer if they felt as though they needed psychological support due to a sharps injury.

Survey instrument

The survey consisted of 51 items including demographic questions, background questions, the Perceived Stress Scale (PSS-10) and Patient Health Questionnaire (PHQ-9). The PSS-10 and PHQ-9 were chosen because they have been used extensively in the literature, have established reliability and validity, and are easy to administer.⁷ Both scales consist of ten Likert-type response questions with a total score range of 0-40 for the PSS-10 and a range of 0-27 for the PHQ-9. A PSS-10 score of 0-13 indicates low stress, 14-26 moderate stress, and 27-40 high stress. A PHQ-9 score of 0-4 indicates minimal depression, 5-9 mild depression, 10-14 moderate depression, 15-19 moderately severe depression, and 20-27 severe depression. There were 21 multiple choice background items, which inquired about experience of a sharps injury in

the past year (if any). If a participant selected that they never work with sharps in their role, they skipped to the end of the survey and their data was excluded from analysis. The survey took an estimated 10-15 minutes to complete.

The survey was piloted among 16 faculty and staff at the UMN SOD. Minor revisions were made to the PHQ-9 to insert “in the last month...” rather than “over the last 2 weeks...” for consistency with the PSS-10 timeframe. One item on the PHQ-9 was modified from “In the last month, how often have you been bothered by thoughts that you would be better off dead or of hurting yourself in some way” to “in the last month, how often have you been bothered by thoughts of hurting yourself in some way.” Cronbach’s alpha was utilized to determine the internal consistency of the PHQ-9 due to the modification. The Cronbach’s alpha score for the first 9 questions of the PHQ-9 was 0.83, which is considered to be strong internal consistency and it can be assumed that the reliability of the PHQ-9 was not affected by the modification.

Data analysis

Demographics, self-reported experience with a sharps injury, stress scores measured by the PSS-10, and the depression score measured by the modified PHQ-9 were analyzed. To test whether there was a difference between mean PSS-10 scores among participants who had experienced a sharps injury and those who had not, a Poisson generalized linear model with robust standard errors using the outcome of PSS-10 score and primary predictor of sharps injury status, with adjustment for the potential confounders of academic status (i.e., student/resident, staff, or faculty) and age, was used. An analogous model was fit to test whether there was a difference in the mean modified PHQ-9 depression scores among participants who had experienced a sharps injury, as compared to those who had not. Both models were also fit with further adjustment for self-reported depression status. For all models, the estimated mean difference in scores (stress or depression) between those who had, versus those who had not experienced a sharps injury, was reported with a 95% confidence interval (CI) (.05 alpha).

Results

Out of 1,113 surveys distributed (electronic and paper) 319 surveys were returned. Thirty-four were excluded from analysis as the participant indicated never working with sharps as part of their work role and six participants responded to both the paper and electronic survey. Of the duplicates, only the most recent responses were included in statistical analysis. Another 17 surveys were excluded due to missing data on the

outcomes of interest (PSS-10 and/or modified PHQ-9) leaving a total of 262 participants who met the inclusion criteria for a 23.5% response rate.

Sample characteristics

The majority of study participants were students (66%), female (69%), single (57%), and Caucasian (84%). Over one-third of the participants reported that the risk of experiencing a sharps injury is worrisome (40%). The majority of participants were familiar with the UMN SOD sharps injury reporting protocol (86%) and nearly all participants self-reported having received the hepatitis B vaccine (99%). Fifty-six (21%) of the respondents experiencing a sharps injury within the past year. Students reported the majority of the sharps injuries (82%) as compared to faculty (7%) and staff (11%). Within the student population, third year dental students were the group with the highest proportion (29%) of sharps injury experience. Sample demographics are shown in Table I.

Characteristics of sharps injuries

Most participants (80%) who reported sharps injuries indicated working with sharps 4 to 7 times per week with 69% experiencing one injury over the past 12 months. Participants indicated that their injuries were due to a lack of concentration (41%), feeling rushed (39%), and a stressful environment (27%). Not all sharps injuries were caused by needle sticks. Other dental instruments, including burs and explorers, accounted for the most injuries (46%), followed by scalpel (27%), needles (21%), and ultrasonic tips (5%). Sixteen percent of the participants indicated that their injury occurred in a preclinical and/or laboratory situation. The majority of participants felt that their most recent sharps injury was avoidable (90%) and

Table I. Sample characteristics and attitudes (n=262)

	No sharps injury* (n=206)	Sharps injury* (n=56)	Total* (n=262)
	n (%)	n (%)	n (%)
Role			
Students	126 (61)	46 (82)	172 (66)
First year dental students	17 (8)	6 (11)	23 (9)
Second year dental students	14 (7)	8 (14)	22 (8)
Third year dental students	21 (10)	16 (29)	37 (14)
Fourth year dental students	23 (11)	4 (7)	27 (10)
First year dental hygiene students	17 (8)	4 (7)	21 (8)
Second year dental hygiene students	11 (5)	0 (0)	11 (4)
First year dual degree students	3 (1)	2 (4)	5 (2)
Second year dual degree students	3 (1)	2 (4)	5 (2)
Other	2 (1)	1 (2)	3 (1)
Resident	15 (7)	3 (5)	18 (7)
Staff	38 (18)	6 (11)	44 (17)
Faculty	42 (20)	4 (7)	46 (18)
Age*	28 (25, 43)	26 (24, 30)	27 (25, 37)
Female	144 (70)	36 (64)	180 (69)
Marital status			
Married	86 (42)	11 (20)	97 (38)
Widowed	3 (2)	0 (0)	3 (1)
Divorced	9 (4)	0 (0)	9 (4)
Single	105 (52)	44 (80)	149 (57)
Latino origin	9 (4)	1 (2)	10 (4)
Race†			
Caucasian	173 (86)	47 (87)	220 (84)
African American	7 (4)	2 (3.7)	9 (3)
American Indian or Alaskan native	4 (2)	0 (0)	4 (2)
Asian	20 (10)	6 (11)	26 (10)
Other	8 (4)	1 (2)	9 (3)
Received Hepatitis B vaccine	191 (98)	54 (100)	245 (99)
Risk of sharps injury is worrying	75 (36)	31 (55)	106 (40)
Familiar with sharps injury reporting protocol	177 (86)	49 (88)	226 (86)

* Summaries are median (first quartile, third quartile) or n (percent) where percent is of non-missing data.

† Respondents were able to select more than one category.

indicated that they were familiar with the UMN SOD sharps reporting protocol (88%). However, less than half reported their sharps injury after it occurred (39%). Fifty-three percent self-reported that their reason for not reporting was that the “infection risk was low”. One participant stated that they did not report their most recent injury because they were treated poorly by staff after reporting their first injury and decided that it was not worth the trouble to report sharps injuries.

Following their most recent sharps injury, over half of the respondents (67%) reported feeling anxious and/or stressed in the month following the injury. Of those who reported their sharps injury, the majority felt anxious (67%) and stressed (50%) while waiting for blood test results. However, the majority (82%) felt as though they received adequate support, and they did not feel that their injury negatively impacted personal relationships (96%) or career satisfaction (91%). Characteristics of reported sharps injuries are shown in Table II.

PSS-10 (stress) and modified PHQ-9 (depression) scores

The mean PSS-10 (stress) score for participants who had experienced a sharps injury in the past year was 15 (moderate stress levels), compared to a mean score of 13 (low stress levels) for participants who had not experienced an injury. After adjusting for academic status and age, participants with a sharps injury in the past year had a mean PSS-10 score that was 5.8% higher than participants without a sharps injury (95% CI: 9.1% lower to 23% higher; $p=0.46$). Participants who had experienced a sharps injury in the past year had a mean modified PHQ-9 (depression) score of 4.2, indicative of minimal to mild depression compared to a mean score of 3.7 (minimal depression) for participants who had not experienced a sharps injury. After adjusting for academic status and age, participants who reported a sharps injury in the past year had a mean modified PHQ-9 score that was 6.3% higher than participants without a sharps injury (95% CI: 19% lower to 40% higher; $p=0.66$). PSS-10 (stress) and modified PHQ-9 (depression) scores are shown in Table III.

After adjusting for self-reported depression status, participants with a sharps injury had mean PSS-10 (stress) scores that were 1.2% higher (95% CI: 14% lower to 19% higher; $p=0.88$) and mean modified PHQ-9 (depression) scores that were 2.7% higher (95% CI: 22% lower to 35% higher; $p=0.85$) than those without a sharps injury. Although results indicated higher mean PSS-10 (stress) and mean modified PHQ-9 (depression) scores for participants who experienced a sharps injury in the past year, it was not at a level of statistical significance. PSS-10 (stress) and modified PHQ-9 (depression) scores are shown in Table III.

Discussion

This survey assessed the psychological effects, stress and depression, of sharps injuries for students, staff, and faculty at the UMN SOD. While the low response rate hindered the ability to detect statistically significant differences in stress and depression scores between students, staff, and faculty who had or had not experienced a sharps injury, there was clinical significance to the findings. Participants who had experienced a sharps injury in the past year reported feelings of anxiousness and/or stress during the month following their injury. Of those who reported their injury after it occurred, the majority felt increased levels of anxiety and stress while waiting for blood test results, which were similar to findings of previous studies.^{1,8}

Nearly half of the participants in the current study indicated that the risk of experiencing a sharps injury is a worrisome occupational risk, with females and students identifying this risk more frequently, similar to an international study of Polish health care workers.⁹ When looking at the predominately female group of dental hygiene students in this study, there were only 4 sharps injuries reported as compared to 28 who did not report any injuries. Perhaps gender plays a role in this finding. Because women find the risk of experiencing a sharps injury to be worrisome, they may be more careful to prevent these injuries. However, when comparing the participants who had experienced a sharps injury to those who had not, participants who had experienced an injury were more worried about the risk of future injuries. Fear of the possibility of repeated sharps injuries among HCWs has been reported in the literature.³ Studies have found that HCWs may be even more worried if the sharps injury involved a high-risk patient or if the infection status of the source patient was unknown.^{3,10} In this study, three of the participants whose most recent sharps injury involved a high-risk patient all self-reported experiencing anxiety while waiting for blood test results.

In addition to the increased levels of anxiety among HCWs and students regarding the risks associated with a sharps injury, individuals with less experience also report higher incidence of sharps injuries due to lack of inexperience along with multiple encounters with patients.¹¹ The participants in this study with the highest incidence of sharps injuries were students, with third year dental students reporting the most injuries. Third year dental students are just beginning clinical encounters with patients and may be more prone to sharps injuries due to their lower skills. When comparing first year dental hygiene students to second year dental hygiene students, the first-year students reported four injuries, whereas second year students had none. First year dental hygiene students complete a local anesthesia and pain management

Table II. Characteristics of sharps injury (n=56)

	Sharps injury n (%)		Sharps injury n (%)
Frequency of sharps use		Cause of most recent sharps injury*	
Rarely	2 (4.0)	Unfamiliar technique	13 (23.0)
Once per week	3 (5.0)	Patient moved their head/body	4 (7.0)
2-3 times per week	6 (11.0)	Injured by a third party (i.e., another provider)	2 (4.0)
4-7 times per week	45 (80.0)	Tiredness	3 (5.0)
Number of sharps injuries during the past year		Lacking concentration	23 (41.0)
1	38 (69.0)	Feeling rushed	22 (39.0)
2	10 (18.0)	Stressful environment	15 (27.0)
3	5 (9.0)	Unsafe instrument placement	10 (18.0)
4	-	Accidental	2 (4.0)
5	1 (2.0)	Not being careful	1 (2.0)
>5	1 (2.0)	Other	2 (4.0)
Timing of most recent sharps injury		Type of injury for most recent sharps injury	
Within the past month	16 (29.0)	Needle	12 (21.0)
Within the past 1-6 months	25 (45.0)	Scalpel	15 (27.0)
Within the past 6-12 months	14 (25.0)	Ultrasonic tip	3 (5.0)
Feelings during the month following most recent sharps injury*		Other dental instrument	26 (46.0)
Scared	12 (21.0)	Most recent sharps injury involved a high-risk patient	
Depressed	2 (4.0)	3 (6)	
Stressed	16 (29.0)	Reported most recent sharps injury	
Anxious	21 (38.0)	22 (39.0)	
Upset	10 (18.0)	Received adequate support after reporting**	
Fine	32 (57.0)	18 (82.0)	
Most recent sharps injury negatively impacted personal relationships		Time to receive blood test results[§]	
Yes, slightly	2 (4.0)	<1 month	17 (94.0)
No	53 (96.0)	1-6 months	1 (6.0)
Most recent sharps injury decreased career satisfaction		Feelings while waiting for blood test results***	
Yes, slightly	5 (9.0)	Scared	5 (28.0)
No	51 (91.0)	Depressed	1 (6.0)
Most recent sharps injury was avoidable		Stressed	9 (50.0)
44 (90.0)		Anxious	12 (67.0)
Setting or situation of most recent sharps injury		Upset	3 (17.0)
While setting up/before seating the patient	6 (11.0)	Fine	5 (28.0)
During use of the sharp	25 (45.0)	Reason for not reporting sharps injury**	
After use of the sharp	15 (27.0)	Takes too much time	6 (18.0)
Research use	1 (2.0)	Infection risk was low	18 (53.0)
During preclinic/lab	9 (16.0)	Not familiar with the reporting protocol	4 (12.0)
		Other	19 (56.0)

* Respondents were able to select more than one category.

** Respondents who reported

*** Respondents who went through blood testing

Table III. PSS-10 (stress) scores and modified PHQ-9 (depression) scores

	No sharps injury* (n=206)	Sharps injury* (n=56)
	n (%)	n (%)
PSS-10 score	13 (6.8)	15 (6.8)
PSS-10 stress assessment		
Low stress (0-13)	110 (53.0)	26 (46.0)
Moderate stress (14-26)	90 (44.0)	26 (46.0)
High stress (27-40)	6 (3.0)	4 (7.0)
Modified PHQ-9 score	3.7 (3.9)	4.2 (3.3)
PHQ-9 depression assessment		
No to minimal depression (0-4)	144 (70.0)	36 (64.0)
Mild depression (5-9)	48 (23.0)	17 (30.0)
Moderate depression (10-14)	10 (5.0)	3 (5.0)
Moderately severe depression (15-19)	2 (1.0)	-
Severe depression (20-27)	2 (1.0)	-

Summaries are mean (standard deviation) or n (percent) where percent is of non-missing data.

course where they complete multiple injections on student partners. Lack of experience with the administration of local anesthesia may increase students' likelihood of experiencing sharps injuries, a finding that was also identified in surgeons in training.¹¹

The majority of sharps injuries in this study were reported by students with lack of concentration, feeling rushed, and stressful environment identified as the most common perceived causes. Students have busy schedules and may rush from lecture to clinic, creating a stressful transition to the clinic environment and put them at risk of experiencing a sharps injury. Additionally, even though the majority of the participants were familiar with the sharps injury reporting protocol, fewer than half reported their sharps injury. This finding regarding underreporting is consistent with the literature.^{1,2,8,12} Underreporting of sharps injuries occurs for a variety of reasons including the time involved to make a report and perceived low risk of infection,¹³ the most common reason for not reporting a sharps injury by participants in this study. Participants may have felt this way because their injury occurred in preclinic/lab and did not involve a real patient. The misperception that instruments used in preclinic/lab are sterile, may have led to inappropriate post-exposure management.¹³ Health care workers may also fear the social consequences of reporting a sharps injury. Reasons for nonreporting include concerns that the injury will be considered an indication of poor work performance and fears that they will be blamed for their injury.³ One participant in the current study stated that they had been treated poorly by staff after reporting a previous injury, which influenced them in deciding not to report their most recent injury.

It is critical to educate dental and dental hygiene students about sharps injuries and the necessary steps to take if they experience a sharps injury.

However, results from this study showed that not all sharps injuries are reported. Students may not alert faculty or staff that they experienced a sharps injury in a preclinic or clinic session. Even if students do not alert faculty or staff, students have been taught to report their injury to the quality and compliance officer at the UMN SOD. However, students are busy and may not follow through with the reporting process particularly if no one else has been informed of their injury.

Students and other DHCPs should be made aware that psychological effects may occur after experiencing a sharps injury. Individuals reporting a sharps injury at the UMN SOD are provided with mental health resources at the UMN. In the current study, most (82%) of those who reported their injury felt as though they received adequate support after reporting. Non-reporting of a sharps injury may leave the individual without any access to the support and resources available to them. Results from this study also demonstrated the need to educate faculty and staff regarding how to appropriately respond to students reporting a sharps injury. Being treated poorly or in a punitive manner may have a detrimental impact and lead to non-reporting in the future. If the sharps injury can be considered a learning experience, the possibility of a second injury may be reduced. Also, if students do not report their sharps injuries, this behavior may be carried over into clinical practice as licensed providers. Enhancing the education provided to DHCPs regarding sharps injuries may increase health promotion and disease prevention.

This study had limitations. A significant limitation was that the surveys were not coded to identify and eliminate duplicate responses, potentially impacting the validity of the response rate and results. Some duplicates were only incidentally identified by respondents who completed both the paper and electronic surveys. Second, there was a low response rate, which may have impacted the representativeness of the study sample and the generalizability of the results. The low-response rate also impacted

the statistical power of the study, which may have been why there was no statistically significant difference in stress and depression scores between the groups of participants. This was a retrospective study which is subject to recall bias. There were also confounding variables that could not be controlled for such as stressors related to work and/or family. Lastly, using scales that ask about stress and depression symptoms in the past month may not have been the best way to identify symptoms that occurred greater than one month ago. Further research is needed with larger sample sizes to assess the psychological effects of sharps injuries over a longer period of time. Interviews and use of surveys with qualitative questions may produce more insightful information in this area.

Conclusion

Sharps injuries, common occupational hazards for DHCPs, have been shown to have psychological effects among health care workers. Results of this study of DHCPs and students demonstrated increased stress and anxiety levels during the month following a sharps injury. Further research in larger populations is needed to assess the extent of the psychological effects of sharps injuries.

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