Bloodborne Pathogen Exposure and the Culture of Reporting Sharps Injuries at a Large Academic Institution

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Abstract **Our study objectives were to describe injuries from sharps and gain insight into the culture of injury reporting among healthcare professionals at an academic medical center. We performed a retrospective chart review and analyzed sharps injuries reported in 2021 using chi-square analysis for categorical variables and *t*-tests or analysis of variance (ANOVA) tests for continuous variables. The highest rates of sharps injuries were reported by dental students (6.9%) and resident physicians (3.6%), followed by a smaller percentage of nurses, attending physicians, dental faculty, and medical students ($p < .001$). The majority of injuries were reported to occur while administering an injection and/or working in the dental clinics (39%). The median number of days to report an injury was 0 days for dental students, 2 days for resident physicians ($p < .001$), and 3 days for medical students ($p = .004$). We found that sharps injuries continue to occur in the clinical teaching environment and could reflect procedures that confer a higher risk of injury. Further, our study suggests that there is a stronger culture of reporting among dental students.**

Keywords: needlestick, sharps injuries, reporting culture, dental students, academic medical center

Introduction

Healthcare personnel are at risk for exposure to bloodborne pathogens, including HIV, hepatitis B, and hepatitis C. The greatest exposure risk is due to needlestick and sharps injuries that occur most commonly in surgical specialists and trainees (Ouyang et al., 2017). Frequent use of sharp instruments increases the risk of injury for surgeons and a lack of experience increases the risk for surgical trainees (Dukka et al., 2021). Dental professionals are also at risk due to their frequent use of sharp instruments and the confined anatomy of a patient's oral cavity (Lee et al., 2014).

The culture of reporting at an academic medical center affects the likelihood that a healthcare worker will report an injury and seek help for the injury. Multiple studies have shown that surgeons are likely to underreport injuries; the surgeons cite reasons such as lack of time, perceived minimal risk from the injury, and cumbersome or time-consuming reporting processes (Choi et al., 2017; Hirose et al., 2007; McCarthy & Britton, 2000). Trainees might fail to report injuries due to perceived low risk of the injury, embarrassment, or intimidation by someone at the academic medical center (Bernard et al., 2013).

Our large academic institution maintains a database where students and employees are instructed to report work-related accidents and injuries. Our study's goal was to compare the reported sharps injuries in 2021 across the different healthcare professions in our institution. We sought to describe the type of injury, the role (i.e., job title or training level) of the injured individual, the time the injuries were most likely to occur, and the reporting culture in the different professions.

Methods

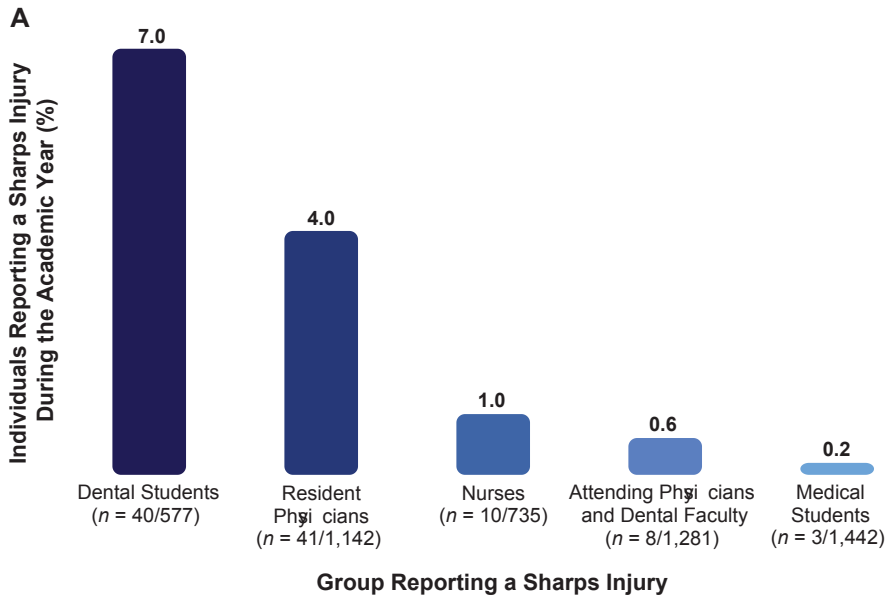
We performed a retrospective chart review and abstracted all sharps injuries reported in 2021 through the Accident Reporting Database maintained by Rutgers Environmental Health & Safety. We included de-identified data from our eight health sciences schools: pharmacy, dental medicine, graduate studies, health professions, nursing, public health, and the two medical schools.

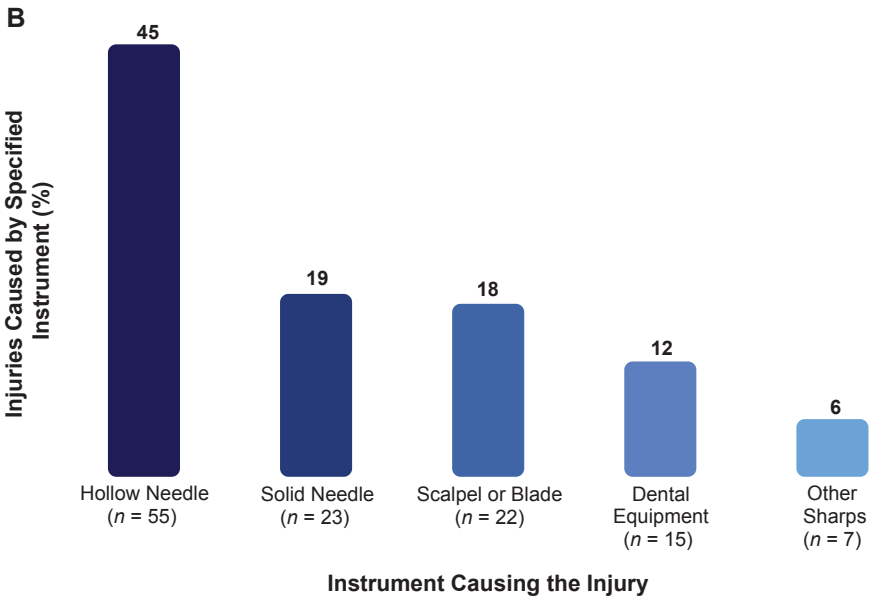
We reviewed the types of injuries and excluded the injuries that did not involve sharp instruments. Examples of non-sharps injuries include splashes, bites, scratches, and contact with blood or bodily fluids without the involvement of a sharp instrument. Additionally, we abstracted demographic information including gender, age, job title or training level, what activity was occurring when the injury was sustained, type of sharp instrument, accident setting, accident timing, and at which school and campus. We tabulated the following:

- role within the university of the person injured,
- type of injury sustained,
- sharp instrument that caused the injury,
- activity at the time of injury,
- time of day the injury occurred, and
- latency to reporting.

FIGURE **1**

Characteristics of Injuries by A) Injuries Reported by Group, B) Instruments Associated With Sharps Injury, and C) Time of Day When the Injury Occurred





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We compared the proportion of injuries across academic programs using a chi-squared analysis. We also performed *t*-tests or analysis of variance (ANOVA) tests for continuous variables. To compare the proportion of injuries in the student/trainee and employee groups, we used the total number of medical students, dental students, resident physicians, nurses, attending physicians, and dental faculty in our system in 2021. Analyses were performed using IBM SPSS Statistics (Version 24). Our study was approved by the Rutgers University Institutional Review Board (protocol # Pro2020000988).

Results

Overall, 122 injuries were reported in 2021. The average age of an injured person was 33 ± 10 years. The majority of injuries were reported by women (58%). The highest rate of needlestick injuries was reported by dental students (6.9%) and resident physicians (3.6%), followed by a lower percentage of nurses, attending physicians, dental faculty, and medical students ($p < .001$); Figure 1A). Further, 8 employees classified as "other" and 12 clinical support staff were not included in the rate analysis because a) employees in these groups belonged to multiple different departments and b) lack of data on the population at risk. Other employees included research assistants/associates and graduate students/fellows. Clinical support staff included medical assistants, dental assistants, dental hygienists, and laboratory personnel.

The majority of injuries were reported to occur in the dental clinics (39%), followed by in-patient settings (16%) and the operating room (9%). Most injuries were caused by hollow needles (45%), followed by solid needles (19%; Figure 1B). Of the hollow needle injuries, the largest proportion (38%) were caused by dental anesthetic needles. The most common activity performed during injury was administering an injection, followed by performing a dental procedure, line placement, biopsy, and suturing (Table 1). Injuries were most likely to occur in the afternoon between 12 and 5 p.m. (Figure 1C). Furthermore, 60% of injuries occurred while the sharp instrument was in active use, versus during cleanup.

Hollow needle injuries were common across professions, accounting for 100% of nurse injuries, 83% of support staff injuries, 50% of attending physician and dental faculty injuries, and 34% of resident physician injuries. The primary source of injury for medical students was solid needles (100%) and for dental students was dental equipment (35%). Of note, the dental equipment that was implicated in most injuries was the dental bur (53%). Less commonly, an explorer,

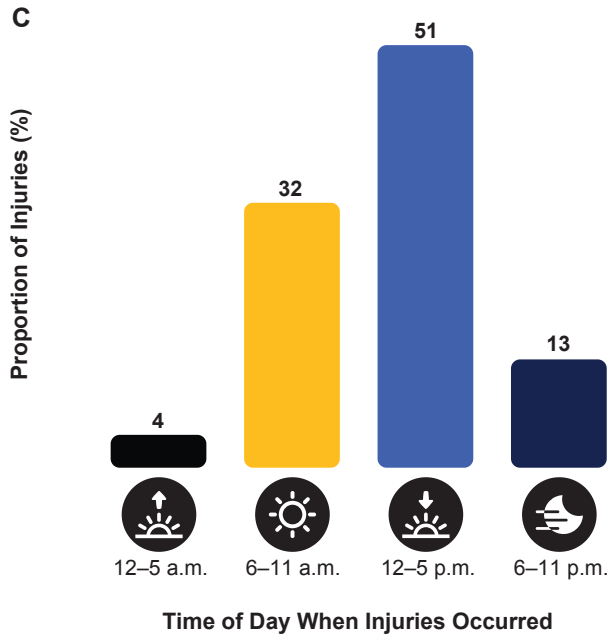
TABLE **1**

Primary Activity Performed During Injury (*n* = 122)

Activity	#	%
Injection	34	28
Dental procedure	20	16
Line placement	19	16
Biopsy or cutting	17	14
Suturing	15	12
Aspirating	5	4
Drawing blood	4	3
Other surgical procedure	4	3
Other nonsurgical procedure	4	3

FIGURE **1** continued

Characteristics of Injuries by A) Injuries Reported by Group, B) Instruments Associated With Sharps Injury, and C) Time of Day When the Injury Occurred



scaler, elevator, or curette was implicated. Other sharps implicated in injuries included staples, scissors, rib spreaders, and unspecified needle types or unknown objects. The median number of days to report an injury was 0 days for nurses and dental students, 2 days for medical residents ($p < .001$), and 3 days for medical students ($p = .004$).

Discussion

Who Gets Injured

Our study describes needlestick injuries at a large healthcare institution as outpatient practices began to reopen in 2021 after the height of the COVID-19 pandemic and elective procedures resumed. The highest rate of injury was reported by dental students, followed by medical residents. This finding is consistent with the medical literature, where trainees reported more needlestick and sharps injuries than more experienced healthcare workers did (Kessler et al., 2011; Lee et al., 2014; Matsumoto et al., 2019). Dental students were less likely to experience an injury as they gained clinical experience (Wood et al., 2006). Similar to our findings, one study showed higher rates of injury in dental students compared with medical or nursing students (McCarthy & Britton, 2000).

The Culture of Reporting

While the lack of trainee experience might increase the risk of injury, we believe that the culture within the dental school contributed to higher reporting rates. This culture is facilitated by a streamlined reporting process and an environment with only a handful of clinical practices, resulting in guidance provided to students, faculty, and staff that is clear and has few variations.

Although it is not possible to determine from our study if the number of reported injuries was a result of more consistent reporting, more needlesticks, or both—there is one major clue that suggests that a streamlined reporting structure plays a large role in enhancing the culture of reporting. This clue is the promptness in reporting. Dental students consistently reported injuries sooner than did resident physicians or medical students.

These findings present opportunities for improvement. While faculty, staff, and medical residents report injuries directly into the database, students rely on supervisors to sign off on injuries and order laboratory tests on the source patient. Even the process of reporting injuries directly into the database might be viewed by some as too cumbersome, resulting in reporting delays or omissions. For students, supervisor sign-off might pose an additional barrier to reporting. Students might hesitate to report injuries due to worry that their clinical practices are too busy to process an injury report, that their supervisor might be unfamiliar with the reporting process, that their injury will be perceived as incompetence and affect their evaluation, or that their injury might be minimized by the supervisor.

Some structural factors also impact reporting. Smaller departments with only a few assigned supervisors to sign off on an injury report could either help streamline the process or create bottlenecks due to staffing shortages or overwork. In contrast, large healthcare systems, affiliate hospitals, and community rotations commonly partner with medical schools and residency programs, which adds variables to the reporting process. A student might not know who to report an exposure to and supervisors are not always aware of the university's reporting procedures.

The suboptimal reporting time (i.e., time lag) presented an opportunity to try a multi-

pronged approach with one of our medical schools. First, we revised the bloodborne exposure lecture that is presented to rising third-year medical students during their transition to clinical rotations. Presentation slides in past years have described what constitutes a bloodborne pathogen exposure and the steps needed to report it. We augmented the presentation with a frank discussion about barriers to reporting, addressed the importance of an injured student using objective criteria to evaluate whether an injury is an exposure, and encouraged students to report when an exposure occurs.

Most Common Injuries

In our study, most injuries were caused by hollow needles and occurred during injection procedures. Solid needles and scalpels/blades were the next most common instruments associated with injuries. This finding is consistent with data obtained from the 2021 Exposure Prevention Information Network (EPINet) Report for Needlestick and Sharp Object Injuries, which reported that sharps injuries were associated with hollow needles (58%) during injection procedures (29%), followed closely by suture needles (21%) during suturing (28%) (International Safety Center, 2021).

For dental students, training procedures—especially administering an injection in a confined space—can help to decrease the rate of injury from sharps. Overall, though, engineering controls and work practices have been shown to be the most effective way of preventing injuries from sharp instruments, regardless of clinic setting. Therefore, training should include the use of safety-engineered devices and accepted safe work practices. Examples include not recapping needles using both hands but instead, using a one-handed scoop technique for recapping needles if necessary. For dental professionals, it is advisable to remove dental burs prior to disassembling handpieces from dental units; for surgical professionals, it is advisable to use instruments instead of fingers for tissue retraction and palpation during suturing and anesthesia administration (Centers for Disease Control and Prevention, 2016). Additionally, training medical residents on proper line placement and encouraging use of available safety-engineered devices can help mitigate injuries.

Timing

The majority of sharps injuries occurred during the afternoon shift between 12 and 5 p.m. This timing is consistent with the literature (Matsumoto et al., 2019). Most employees and students are working a day shift, which typically ends between 4 and 5 p.m. As such, they might be rushing to complete a procedure or be fatigued, therefore increasing their risk of injury.

Improving Reporting Practices

To improve reporting practices, a clearly defined protocol needs to be in place. The protocol should be distributed to each department and should include periodic updates. Several initiatives could improve reporting practices. These initiatives could include training new employees, house staff, and off-cycle hires. Each year, a reminder of reporting procedures for bloodborne pathogen exposure could be incorporated into the clinical health and safety training, with emphasis on the difference between high- and low-risk injuries. The training materials should also make the reporting process easier for students and employees, with an online link or QR code available within the materials. QR codes can be used in multiple healthcare education applications and are relatively easy to use (Karia et al., 2019).

Study Limitations

Our study reviewed self-reported injuries in a database. Underreporting is a primary concern and might have occurred disproportionately across different professions and roles. This limitation negatively affects our ability to compare rates of reporting across professions.

Our data were obtained from the Rutgers University Accident Reporting Database, which has several fields that are free-text entries and are optional, further limiting the utility of the data. As a result, we are working with the IT department to restructure several fields so that the information obtained from the database can better inform preventive measures.

Conclusion

Injuries from sharps continue to occur in academic medical centers, even with the wide availability of safety-engineered devices. Dental students had the highest rate of reported injuries and reported these injuries more promptly than the other health professionals in our study. The higher rate of reporting in the dental school might reflect that the procedures confer a higher risk of injury, a stronger culture of reporting among dental students, or both. Further studies to characterize the culture of reporting work-related sharps injuries among workers (e.g., students, trainees, and employees) in various healthcare fields are needed to better guide targeted measures to improve reporting practices.

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continued on page 18

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