Occupational Injuries and Infection Risk Among Senior Medical Students: A Four-Year Retrospective Study

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Research Article

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Abstract

Background

Workplaces present health and safety risks, especially for healthcare workers, such as medical students, who face a variety of hazards. Despite acquiring skills during medical school, medical faculty students, especially those engaged in patient-related practices, face increased injury risks due to factors such as lack of knowledge, insufficient practice, and high workload. This study investigated the prevalence and characteristics of occupational injuries among final-year medical students of Uludag University Faculty of Medicine.

Methods

A cross-sectional study analyzed injuries from January 1, 2019, to December 31, 2022. Data were collected from records, including demographic details, injury specifics, and students' post-injury attitudes.

Results

In this period, 395 senior students experienced 456 injuries, with prevalence rates of 33.9%, 20.7%, 22.6%, and 30.4% from 2019 to 2022, respectively. The majority (60.7%) were female, and injuries were most common in the Emergency Department (64.9%), predominantly affecting the Hand/Finger (87.7%). Of the 395 students, three were HbsAg positive, 13 anti-HbS negative, one anti-HCV positive, and one anti-HIV positive. Considering the potential window period, only 18% of students gave control blood after 456 injuries.

Conclusion

The study focuses on the prevalence and characteristics of occupational injuries among senior medical students. The findings indicate that healthcare workers require better training, increased awareness of injury prevention, and regular screening for bloodborne diseases. Conducting blood tests after the appropriate window period is crucial to ensure early diagnosis and treatment following an injury.

Introduction

The workplace environment, working conditions, and individual characteristics create employee health and safety risks. Depending on these factors, sickness, injury, and death may occur in employees.[1]

The International Labor Organization (ILO) defines an occupational accident as "an unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work, which results

in one or more workers incurring a personal injury, disease or death.” Occupational injury is defined as “any personal injury, disease or death resulting from an occupational accident.” [2]

Health workers encounter biological (e.g., hepatitis, HIV, tuberculosis, and SARS), physical (e.g., slip, noise, radiation), psychosocial (e.g., violence, shift work), chemical (e.g., anesthetic smoke and latex), and ergonomic (e.g., improper posture, repetitive movement, and heavy lifting) hazards during working hours. [1] Thus, diseases and injuries are common in the health sector and deserve special attention.

Having skills and experience is critical to preventing injuries. Physicians acquire various skills in medical school. Medical faculty students, who still need to gain complete skills and experience, are an essential risk group regarding injuries. [3]

Medical faculty students start patient-related practices from the fourth grade. The final-year students are expected to perform risky procedures, such as bloodletting, catheter insertion, suturing, ECG recording, blood glucose measurement, dressing, assisting in cardiopulmonary resuscitation, and patient preparation. However, other factors such as lack of knowledge, insufficient practice, haste, and workload in this period increase the likelihood of students having work injuries. Sharp objects such as needlesticks cause most accidents experienced by healthcare workers in hospitals. According to a report published by the World Health Organization in 2003, 3 million of 37 million healthcare workers have experienced sharps and stab wounds in the last year.[4] Healthcare workers who experience sharps and needlestick injuries must be evaluated regarding infectious diseases. However, it is impossible to detect infected people with screening tests during the "window period," defined as the time interval between the entry of the infectious agent into the body and the body reaching a measurable level of antibodies.[5] Therefore, in the case of sharps injuries and/or contact with body fluids, the possibility of the source being in the window period should not be ignored.

The root of these issues should first be determined to prevent injuries in medical students. Although many studies have been conducted on needlestick injuries in medical students, studies on all injuries are limited. To our knowledge, our study is the first in the literature to evaluate the possibility of infection by considering the window period in addition to injuries.

This study was conducted to evaluate injuries and related practices in medical students in the Faculty of Medicine at Bursa Uludag University.

Material and Methods

This cross-sectional descriptive study retrospectively examined the injuries suffered by senior students of the Faculty of Medicine, which occurred in the three years between January 1, 2019, and December 31, 2021, at Bursa Uludag University Medical Faculty Hospital. The data were taken from the Occupational Health and Safety Unit records and Bursa Uludag University Medical Faculty Hospital electronic record system. In addition to the demographic characteristics of the injured student in the present study, the

service and place of the injury, the work carried out at the time of the accident, the time of the injury, and the examinations performed concerning infectious diseases after the injury were evaluated.

Anti-HBs, HbsAg, Anti-HCV, and Anti-HIV are requested immediately after work injuries at Uludag University Medical Faculty Hospital. Considering these tests, the window period was accepted as 59 days for Hepatitis B, 70 days for Hepatitis C, and 16 days for HIV.[6]

Data were recorded with IBM SPSS Statistics 26 and Microsoft 365 Excel and evaluated with frequency percentage calculation methods, Pearson chi-square test, and Fisher's exact test.

Ethical Aspect of This Research

Before this study, ethical approval was obtained from the Uludag University Faculty of Medicine Clinical Research Ethics Committee. (2021-7/15) All authors followed the rules of the Declaration of Helsinki and signed each page.

Results

Between January 1, 2019, and December 31, 2022, 395 senior students were injured 456 times at Uludag University Faculty of Medicine Hospital. One student was injured four times, seven were injured three times, 44 were injured twice, and 343 were injured once. The prevalence of work injuries was 33.9% in 2019, 20.7% in 2020, 22.6% in 2021, and 30.4% in 2022. Women reported 60.7% (277) of the injuries, 86.1% (393) of injuries occurred in Internal Medicine Units, 12.9% (59) in Surgical Medicine Units, and 0.9% (4) in general areas (Table 1).

Table 1
Distrubution of Variables (%)

	Total (n = 456)	2019 (n = 142)	2020 (n = 96)	2021 (n = 91)	2022 (n = 127)	
Sex						
Female	277 (60.7)	93 (65.5)	57 (59.4)	48 (52.7)	79 (62.2)	p = 0,237
Male	179 (39.3)	49 (34.5)	39 (40.6)	43 (47.3)	48 (37.8)	
Citizenship						
Turkish Citizen	420 (92.1)	131 (92.3)	89 (92.7)	86 (94.5)	114 (89.8)	p = 0,630
Non-Turkish Citizen	36 (7.9)	11 (7.7)	7 (7.3)	5 (5.5)	13 (10.2)	
Place for Injury						
Emergency Service	296 (64.9)	92 (64.8)	76 (79.1)	53 (58.2)	75 (59.1)	p < 0,001
Internal Medicine	44 (9.6)	24 (16.9)	3 (3.1)	8 (8.8)	9 (7.1)	
General Surgery	44 (9.6)	8 (5.6)	14 (14.6)	12 (13.2)	10(7.9)	
Pediatry	12 (2.6)	4 (2.8)	2 (2.1)	5 (5.5)	1 (0.8)	
Pulmonology	21 (4.6)	4 (2.8)	1 (1.0)	1 (1.1)	15 (11.8)	
Cardiology	20 (4.4)	5 (3.5)	-	6 (6.6)	9 (7.1)	
Obstetrics and Gynecology	15 (3.3)	1 (0.7)	-	6 (6.6)	8 (6.3)	
General Areas	4 (0.9)	4 (2.8)	-	-	-	
Work during Injury						
Bloodletting	242 (53.1)	85 (59.9)	46 (47.9)	41 (45.1)	70 (55.1)	p < 0,001
Suturing	93 (20.4)	27 (19.0)	28 (29.2)	19 (20.9)	19 (15.0)	
Blood Glucose Checking	56 (12.3)	15 (10.6)	18 (18.8)	12 (13.2)	11 (8.7)	
Administering Treatment	21 (4.6)	6 (4.2)	-	8 (8.8)	7 (5.5)	
Sampling from the Catheter Tubing	13 (2.9)	3 (2.1)	-	4 (4.4)	6 (4.7)	

* Free time, eye wash, heel blood check, tampon-making

† Urine, glass, blunt injury

	Total (n = 456)	2019 (n = 142)	2020 (n = 96)	2021 (n = 91)	2022 (n = 127)	
Inserting a Urinary Catheter	14 (3.1)	-	1 (1.0)	3 (3.3)	10 (7.9)	
Others*	12 (2.6)	2 (1.4)	3 (3.0)	4 (4.4)		
No Information	5 (1.1)	4 (2.8)	-	-	1 (0.8)	
Incident causing injury						
Contact with sharp material	395 (86.6)	123 (86.6)	85(88.5)	78(85.7)	109 (85.8)	p = 0,468
Facial contact with blood	46 (10.1)	17 (12.0)	8 (8.3)	8 (8.8)	13 (10.2)	
Body contact with blood	7 (1.5)	2 (1.4)	2 (2.1)	1 (1.1)	2 (1.6)	
Facial contact with body fluid	5 (1.1)	-	1 (1.0)	2 (2.2)	2 (1.6)	
Blunt injury	2 (0.4)	-	-	2 (2.2)	-	
No Information	1 (0.2)	-	-	-	1 (0.8)	
Device Causing Injury						
Needle / Lancet	308 (67.5)	98 (69.0)	58 (60.4)	62 (68.1)	90 (70.9)	p = 0,066
Suture Needle	76 (16.7)	21 (14.8)	25 (26.0)	15 (16.5)	15 (11.8)	
Blood	51 (11.2)	19 (13.4)	10 (10.4)	9 (9.9)	13 (10.2)	
Other†	16 (3.5)	-	3 (3.1)	5 (5.5)	8 (6.3)	
No Information	5 (1.1)	4 (2.8)	-	-	1 (0.8)	
Injured Body Part						
Hand / Fingers	399 (87.7)	125 (88.0)	86 (89.6)	79 (86.8)	109 (86.5)	p = 0,721
Face / Eyes	51 (11.2)	17 (12.0)	9 (9.4)	10(11.0)	15 (11.9)	
Lower Extremity	4 (0.9)	-	1 (1.0)	2 (2.2)	1 (0.8)	
* Free time, eye wash, heel blood check, tampon-making						
† Urine, glass, blunt injury						

For four years, the prevalence of contact with sharp material injuries in senior students was 24.8%. Of the injuries, 86.6% (395) were caused by "contact with sharp material," 10.1% (46) by facial contact with

blood, 1.5% (7) by body contact with blood, 1.1% (5) by facial contact with body fluids, and 0.4% (2) by blunt trauma.

Ninety-six (21.1%) injuries occurred between 00:00–07:59 hours, 177 (38.8%) between 08:00–15:59 hours, and 183 (40.1%) injuries occurred between 16:00 and 23:59 hours. (Fig. 1) The median of 456 accidents was 13:40 (min 00:00, max 23:48). Of the 296 injuries experienced in the Emergency Service, 61 (20.6%) occurred between 00:00 and 07:59, 103 (34.8%) were between 08:00 and 15:59, and 132 (44,6%) were between 16:00 and 23:59. Of the 160 injuries experienced in departments other than the emergency department, 35 (21.9%) occurred between 00:00 and 07:59, 74 (46.2%) were between 08:00 and 15:59, and 51 (31.9%) were between 16:00 and 23:59. Injuries in the emergency department were more frequent in each time zone compared to other departments. (p = 0,02)

In 92.1% (420) of the injuries, control blood was drawn immediately after the injury to evaluate infectious diseases. Of 395 senior students with occupational injuries in 4 years, 13 were anti-HBS negative, three were HbsAg positive, one was anti-HCV positive, and one was anti-HIV positive. Of the 13 students with negative anti-Hbs, 5 were not Turkish citizens. AntiHbS positivity was accepted as > 10 IU/L, and the median AntiHbs value of 362 senior students was 612.28. (min. 0.45 max. 1000). The Anti-HbS result of 14 interns in 2019 was not found as a value but as positive. (Fig. 2).

A total of 106 (23.2%) of 456 injuries were referred to the Workplace Health and Safety Unit within 90 days, and 85 (18.6%) had a second blood test to evaluate Hepatitis B, C, and HIV after a median of 54 (min. two max. 317) days after the injury. While there was a significant difference in the number of applications to the Workplace Health and Safety Unit between the years ($p < 0.001$), there was no significant difference ($p = 0.46$) in the number of second blood tests. (Fig. 3)

In 2019, “Work Accident Investigation Reports” recorded 84 out of 142 injuries and 10 out of 127 injuries in 2022. However, to our knowledge, there are no investigation reports about occupational accidents for accidents that occurred in 2020 and 2021. According to the question “Causes of accident” in the occupational accident investigation report, the most common cause of injury suffered by interns is “Carelessness/haste” (Fig. 4)

Discussion

This study investigated the epidemiological characteristics of work injuries experienced by Uludag University Faculty of Medicine senior students and the post-injury infection risk application.

The prevalence of stab wounds among medical school students has been reported as 50% in Israel[7], 13.8% in Australia[8], 59% in England[9], 24% in France[10], 30% in Missouri, United States[11], and 58.2% in Mexico[12]. The studies in the literature were conducted by applying a questionnaire to the students, and in our research, officially recorded injuries were considered. Given that the students did not report all the injuries they experienced [13],[14], it can be assumed that what we calculated may be lower than the

actual injury prevalence. The different frequencies of injuries between the years we examined can be attributed to the specific circumstances of the COVID-19 pandemic in 2020 and 2021.

To our knowledge, there is no study in the literature on the attitudes of healthcare workers to giving blood after work injuries. The fact that the interns could give control blood outside the Uludag University Medical Faculty Hospital is one of the disadvantages of our study. However, they are less likely to give blood to the busy schedule of senior medical students. Our investigation has revealed that most healthcare professionals who have experienced a work-related injury do not take a control blood test because of the window period. Consequently, informing about the window period of post-injury diseases and re-testing for Hep B, C, and HIV after the proper time for the test type will aid in the early diagnosis and treatment.

In two separate meta-analyses published by Kuricka et al. on the window-period risk of HIV and Hepatitis C in high-risk donors (1-injecting drug users, 2-man-to-male sexual partners, 3-sex workers, 4-hemophilia patients, 5-sexual partners between 1st and 4th substance 6-HIV-infected blood contact 7- prisoners), the window-period risk of HIV with ELISA testing ranged from 0.09–12.1 per 10,000 donors.[15] The window-period risk of Hepatitis C with ELISA testing ranged from 0.26 to 300.6 per 10,000 donors.[16]

In 85 (18.6%) of the 456 work injuries in our study, interns had a second blood test performed at Bursa Uludag University Medical Faculty Hospital to evaluate hepatitis B, C, and HIV. To our knowledge, there is no study in the literature on the attitudes of healthcare workers to donate blood after work injuries. One of the disadvantages of our research is the possibility that the interns may have been given control blood outside the Uludag University Medical Faculty Hospital. However, it is low due to the intense working tempo of the senior medical students. Our study shows that most interns who experience work injuries do not give control blood, considering the window period. Therefore, informing about the window period of post-injury diseases and screening for Hep B, C, and HIV a second time after the appropriate time for the test type will help in early diagnosis and treatment.

Injuries are most common in obstetrics-gynecology, with 44.7% in Peru[17] and 27.7% in Washington University[18]. A total of 54.6% in Palestine[19], 42.6% in Iran[20], 70,2% in Korea[21] were most common in the Emergency Department. In our study, it was observed that the most common injuries were in the Emergency Department. This can be attributed to the high number of patients admitted to the Emergency Service, the riskier procedures such as suturing wounds, injections, and bloodletting in the Emergency Service, and the fact that working there is more stressful than other services.

When the literature on the procedure during which injuries occur is examined, the findings showed that 57,7% in Germany[13], 45,2% in Mexico[12], 44,6% in Iran[20] and 55,8% in Korea[21] most frequently during blood draw; 42% in USA[9], 46% and 52% in Canada [22],[23] 33,5% in Palestine[19], 58% in France[10] and 34,6% in Brazil.[24] It was most common during the suturing procedure. The findings in our study are compatible with the literature. Increasing the intensity of practical lessons in which medical school students learn practices such as bloodletting, suturing, and dressing, providing simulation training

to improve students' practical skills, and providing students with injury-reducing behaviors such as the one-hand method can reduce the number of injuries.

In a study conducted with University of Texas Medical School students, it was stated that most injuries occurred between 06:00 and 17:59. Nevertheless, when analyzed according to the number of working students, the probability of injury was 1.5 times higher between 18:00 and 05:59.[25] In our study, advanced statistical analyses could not be performed since data on the number of active intern physicians at hourly intervals and the total number of risky events could not be obtained. Injuries are more common between 16:00 and 23:59. It is not surprising that injuries occur in the time zone when outpatient services are not provided. The patient density in the Emergency Department is the highest.

Injuries experienced by interns, consistent with the literature[20, 22], were the most common hand/finger injuries. In our study, the cause of injury was carelessness/rush, which is compatible with the literature.[9, 24, 26] Busy schedules, lack of sleep, low number of personnel, limited resting opportunities of intern physicians, and pressure of health workers in charge of the department may have caused hasty behavior and, therefore, carelessness. In this regard, being more understanding of resident physicians and faculty members toward intern physicians who lack experience and arranging working conditions to ensure the safety of intern physicians may be among the measures to reduce the number of injuries.

In various studies conducted in Turkey, HBs-Ag, anti-HBS, anti-HCV, and anti-HIV positivity percentages of physicians were reported as 77–100% for anti-HBs, 0–3.8% for HBsAg, 0–0.3% for anti-HCV and 0% for Anti-HIV.[27–32] Hepatitis B vaccine was included in the expanded vaccination program in Turkey in 1998, and vaccination of unvaccinated children started in 2006. The Anti-HBs rate, which has increased compared to 2003, shows that the immunization service in our country is appropriate and correct. In one student, the control blood taken immediately after the injury produced a positive anti-HCV result. Infectious Diseases followed up with the student who learned anti-HCV positivity, and his treatment was provided. The positive Anti-HIV result of one intern was evaluated as false positive due to further tests. Our study reveals that health workers should be screened periodically for diseases transmitted by blood and body fluids.

Conclusion

In conclusion, our study showed that medical school students at risk of injury due to lack of experience should be provided with more detailed and frequent training on interventional procedures and methods to prevent injuries. Warning signs about work injuries should be posted in sections where injuries occur frequently. Another issue that should be remembered is that health workers are in the high-risk group of diseases due to biological accidents. Therefore, health workers should be frequently reminded to report their occupational injuries and give control blood at least 70 days after the injury due to the window period.

Declarations

Availability of data and materials

The datasets generated and/or analysed during the current study are available in the 10.17632/xfsdp6f2tm.2 repository.

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Contributions

The design and planning of the study was carried out by MG. The data collection, analysis and interpretation was carried out by MG. The draft of the study was prepared by MG and finalized by AT. All authors read and approved the final manuscript.

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Ethics declarations

Ethics approval and Consent to Participate:

The study was carried out at Uludag University Faculty of Medicine. In this retrospective study, the committee exempted the requirement for informed consent for participation. In order to safeguard patient confidentiality, all personal information has undergone encryption and de-identification. Ethical approval was obtained from the Uludağ University Faculty of Medicine Clinical Research Ethics Committee. Approval number: 2011-KAEK-26/322; Date: 10/06/2021. All authors followed the rules of the Declaration of Helsinki and signed each page of the Declaration. All methods were performed in accordance with the ethical standards set forth in the Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent for Publication:

Not applicable

Competing interests:

The authors declare that they have no competing interests

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Figures

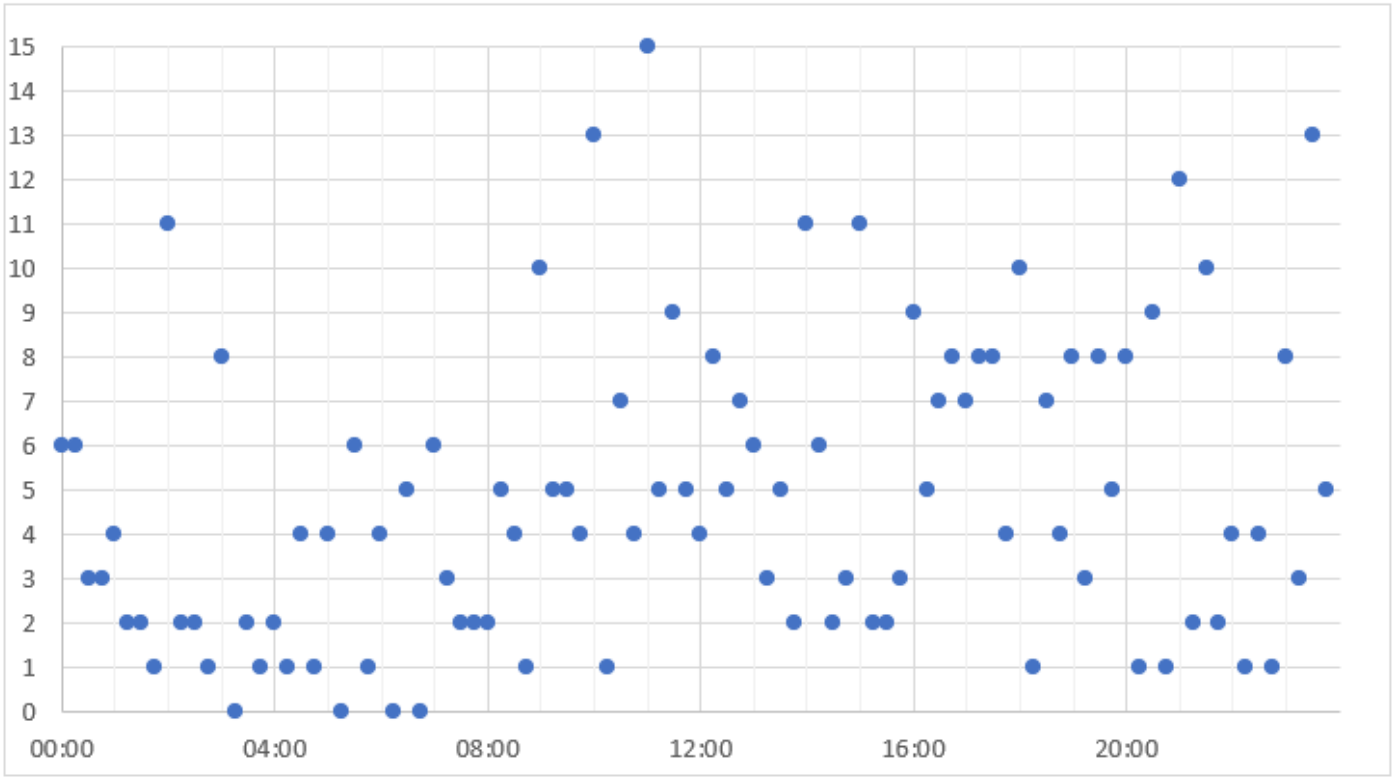

Figure 1

Distribution of Injuries by Hours

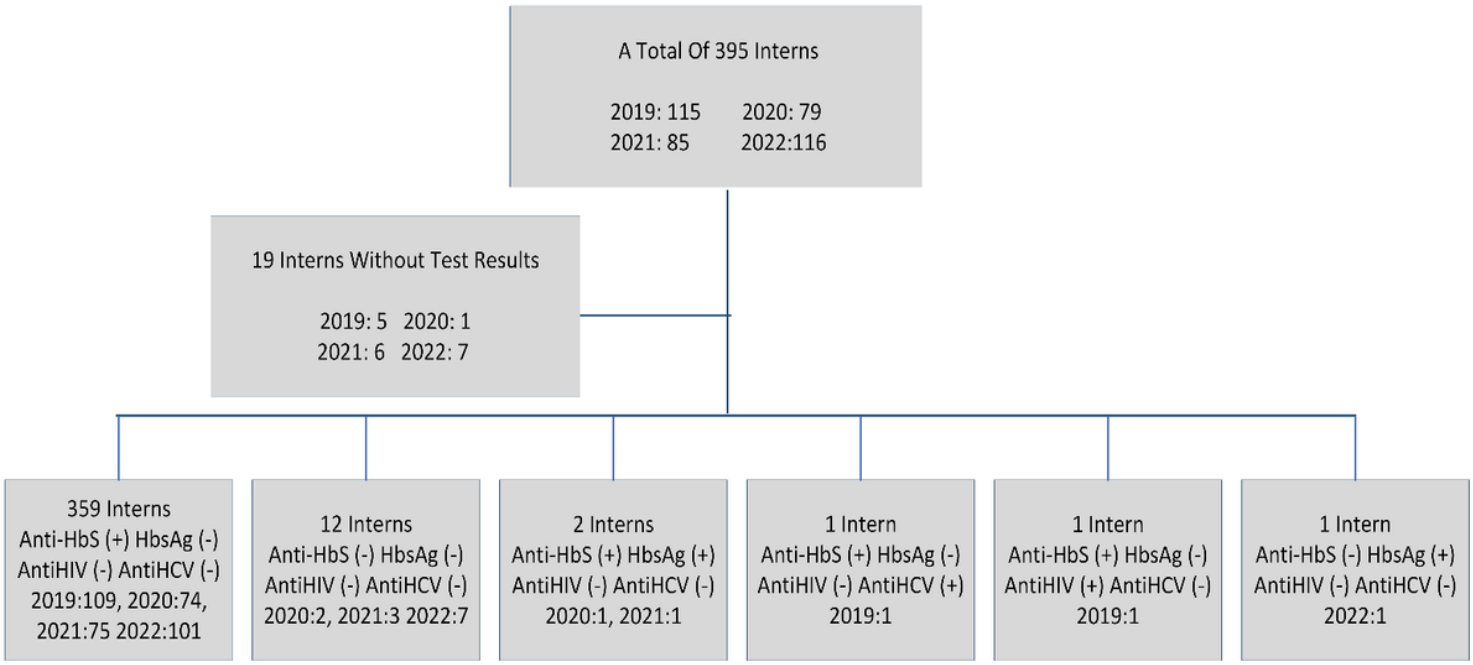

Figure 2

Blood Results after Occupational Injuries

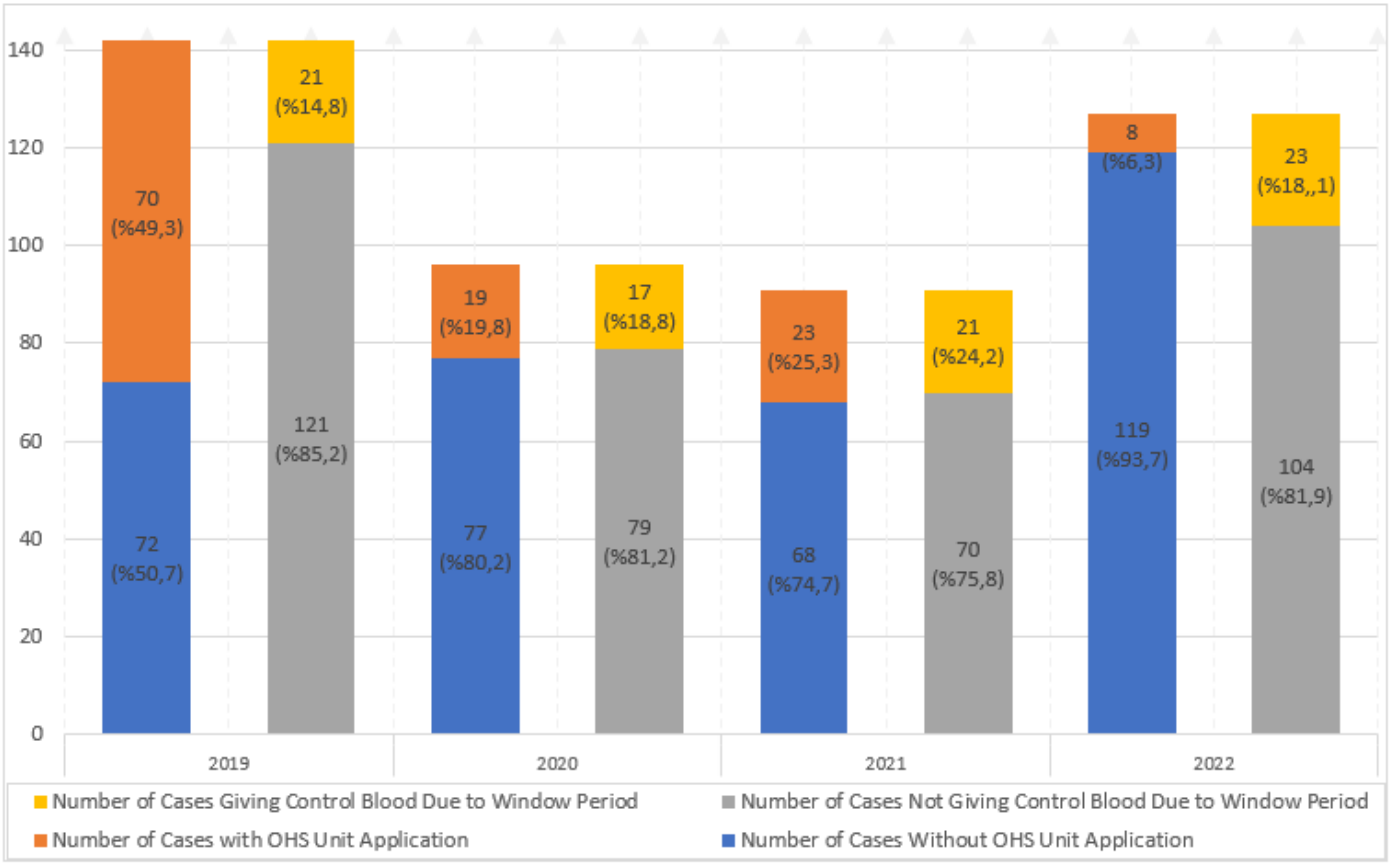

Figure 3

Attitudes of Intern Physicians after Work Injury

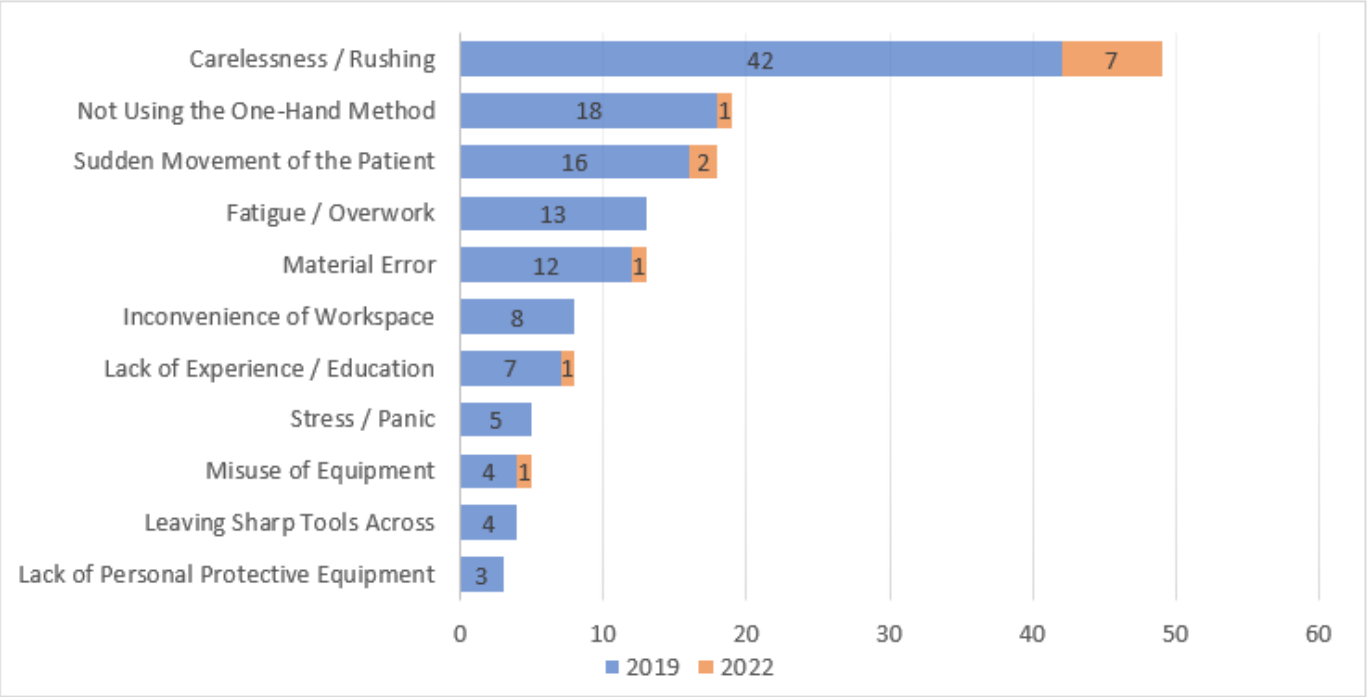

Figure 4

Causes of 94 Work Injuries According to Intern Physicians