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What were the changes during the COVID-19 pandemic era concerning occupational risks among health care workers?



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ABSTRACT

Background: Accidental exposure to percutaneous needle stick and sharp injuries (NSSIs) and blood and other body fluids is the unintended contact with risky medical instruments or patient secretions during a medical intervention. During the COVID-19 pandemic, the significance of occupational injuries in healthcare professionals was revealed once again. To assess the occupational injuries, we compared rates, distribution and type of exposure to blood and body fluids and NSSIs of health care workers for 2019 (pre-pandemic era) and 2020 (pandemic era) years, respectively.

Material and methods: Our study included data collected by the 'Hospital Infection Control Committee' for the years 2019–2020. Data collected using the active surveillance method were analyzed retrospectively. **Results:** During 2019 (pre-pandemic period) and 2020 (pandemic period), 112 (27.65%) and 82 (21.4%) NSSIs reported, respectively. Of the exposed HCWs in 2019 (pre-pandemic period), 16.8% (14) were doctor, 53.6% (60) were nurse and 47.4% (14) were intern doctors. In the 2020 (pandemic period), NSSIs were observed most frequently in nurses and cleaning staff, 50.24% and 33.64%, respectively. Concerning the total percentage of exposure to blood and other body fluids, a slight increase was revealed from 1.48% to 2.62% in 2019 and 2020, respectively. A significant decrease in exposure rate was reported among the doctors between the pre-pandemic and pandemic era; 3.6% and 1.19% at 2019 and 2020, respectively. A significant increase in exposure rate was reported among the nurses between pre-pandemic and pandemic era; 0.8% and 6.89%, respectively.

Conclusion: In conclusion, the exposure to NSSIs during the pandemic period decreased; however, there was no severe difference at pre-pandemic and pandemic periods concerning exposure to blood and body fluids. Well-designed training and awareness programs can be effective in preventing exposure to NSSIs and blood and other body fluids and exposure to respiratory acquired viruses.

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Background

Accidental exposure to percutaneous needle stick and sharp injuries (NSSIs) and blood and other body fluids is the unintended contact with risky medical instruments or patient secretions during a medical intervention. It carries the risk of infection by many patient-borne infectious agents. Occupational exposure among healthcare workers (HCWs) has been gaining increasing attention in recent decades worldwide [1–5]. Sharp instrument injuries and blood and body fluids provide routes for transmission of pathogens,

such as hepatitis B virus (HBV), hepatitis C virus (HCV) and HIV (Human Immunodeficiency Virus), which result in blood-borne diseases [6].

The SARS-CoV-2 (Severe Acute Respiratory Syndrome causing Coronavirus) is a single, positive-strand RNA virus that causes severe respiratory syndrome in humans. Coronavirus 2019 disease (COVID-19) started as an infectious disease concomitant with pneumonia and acute respiratory distress syndrome (ARDS) of unknown cause in Wuhan, China, in December 2019 [7]. Compared to SARS-CoV, SARS-CoV-2 human-to-human infection is more readily transmitted and spread to almost all continents leading to the WHO's declaration of a Public Health Emergency of International Concern on January 30, 2020 [8]. Although respiratory droplets are the main routes of transmission, SARS-CoV-2 can also be trans-

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mitted to a healthy person if he happens to have contact with the infected person or any of his belongings, including clothes and body fluids. Given this assessment, HCWs risk their personal health each time they manage patients with COVID-19. Transmission from asymptomatic or presymptomatic patients with SARS-CoV-2 infection may also occur in healthcare settings, particularly in areas with moderate to substantial community transmission.

Since the onset of the COVID-19 pandemic, the risky contact of healthcare professionals with the SARS-CoV-2 virus and the resulting deaths has once again shown the significance of occupational protective equipment. Because of this situation, CDC (Centers for Disease Control and Prevention) has updated 'Healthcare Infection Prevention and Control Recommendations in Response to COVID-19' in healthcare settings. While this guideline especially refers to precautions against diseases transmitted by the respiratory tract that also included recommendations against exposure to blood and body fluids and NSSIs [9].

To assess the effects of these strict regulations of infection prevention and control recommendations concerning occupational exposure, we have analysed exposure to blood and body fluids and NSSIs reported through active surveillance of health care workers at our hospital for the last two years; 2019 (pre-pandemic era) and 2020 (pandemic era) respectively.

Material and methods

A retrospective study was conducted among HCWs at Sisli Hamidiye Etfal Training and Research Hospital, a 600-bed tertiary care hospital in Istanbul, Turkey, who experienced occupational exposure to blood and/or body fluids and NSSIs between January 1–December 31, 2019 and January 1–December 31, 2020, reported to the hospital infection control registration system by active surveillance. The target population was HCWs who worked at this medical center. Data were extracted from the registration records, including age, sex, hospital unit, sources and circumstances of exposure, job classification. Our study relied on the careful review of these collected data.

Professions of the participants were categorised as a doctor, nurse, cleaners and medical waste collectors, interns (practical nurses and students) and others (laboratory technician, nursing assistants, laboratory attendants, mortuary attendants, ward orderlies, ambulance driver and other paramedical staff). The injuries were stratified according to the type of exposure and distribution according to job classification. Surgeries were classified as major and minor surgery. Major surgery is any invasive operative procedure in which a more extensive resection is performed, e.g., a body cavity is entered, organs are removed, or normal anatomy is altered. In general, if a mesenchymal barrier is opened (pleural cavity, peritoneum and meninges), the surgery is considered major. Minor surgery is any invasive operative procedure in which only skin or mucus membranes and connective tissue is resected.

Occupational exposure is defined as HCWs exposure through accidentally to the patient's blood or other body fluids and tissues or direct contact with mucous membranes and disintegrated skin. These injuries can be in the form of NSSIs stab wounds or direct exposure to blood and other body fluids.

Our hospital's occupational health and safety unit provides annual training for the HCWs to prevent NSSIs and exposure to blood and other body fluids routinely. During the pandemic era, the unit provided the training more frequently online. The training topics include 'Healthcare-associated infections, Hand Hygiene, preventing NSSIs, COVID-19 pandemic personal protective equipment use and protection measures.' Special personal protective equipment, such as respirators, face shields, gloves and gowns supported by the Turkish Ministry of Health was used to prevent the

Table 1

Comparison of the demographic characteristics of HCWs who are at risk of occupational exposure to NSSIs and blood and/or body fluids during the study period.

Characteristics	Year 2019	Year 2020	p Value*
Sex			
Female (%)	56.5%	55.7%	0.48
Male (%)	43.5%	44.3%	
Mean age, years	39 ± 9.17	37 ± 9.20	0.17
20–30 years	262 (6.46%)	832 (21.08%)	<0.00001
30–40 years	2312 (57.08%)	1374 (36%)	<0.00001
40 < years	1476 (36.4%)	1611 (42.2%)	<0.00001
Profession (n)			
Doctor	831	835	
Nurse	1119	1015	
Cleaning staff	476	535	
Intern	295	143	0.5
Others	1329	1288	
Total	4050	3816	
Educational status % (n)			
Below diploma*	11.75% (476)	13.2% (535)	0.002
Diploma**	27.03% (1095)	26.2% (1000)	0.41
Degree and above***	61.02% (2479)	56.32% (2281)	0.2
Surgical techniques (%)			
Major surgery (%)	35,564 (43.76%)	15,970 (59.37%)	<0.00001
Minor surgery (%)	45,689 (56.24%)	10,927 (40.6%)	
Total surgery	81,253	26,897	
NSSIs distribution (%)			
Surgery wards	59 (52.5%)	33 (40.3%)	
Internal medicine wards	53 (47.5%)	49 (59.7%)	0.11
Male %	39.83%	36.9%	
Female %	60.2%	63.1%	0.72

Bold values are significant statistically.

* Have educational status with no certification on a specific skill.

** Trained on a specific subject and certified with that specific skill, but with the educational status of below bachelor of science/art.

*** Includes those who holds a bachelor of science/art, PhD, and above.

SARS-COV-2 transmission and other occupational exposures during this period.

Descriptive data were presented as number, mean ± SD, or median (IQR) as appropriate. Depend on the active surveillance method, the formula: 'Number of events/total number of HCWs working in health care areas) × 1000' was used to calculate the rate of NSSIs and exposure to blood and other body fluids. In univariate analysis, the differences between the groups were examined by using the Student's t-test for parametric data and Mann-Whitney U test for nonparametric data. In addition, the cross-tables method with chi-square or Fisher's exact test was applied for the univariate analysis of categorical data.

This study was approved by the Ethics Committee of the Health Science University Sisli Hamidiye Etfal Education and Research Hospital in Istanbul, Turkey.

The Hospital Infection Control Committee database system was used for data entry and management. Analysis of the data was performed using the Prism 9.0 software (GraphPad Software, CA) and the descriptive statistics.

Results

Descriptive results

The demographic characteristics of the HCWs who are at risk of occupational exposure to NSSIs and blood and/or body fluids during the study period are shown in Table 1. Although 56.5% of healthcare workers were women in 2019, 55.7% were women in 2020 (p = 0.48). The mean age of the HCWs was 39 ± 9.17 years for 2019 and 37 ± 9.20 for 2020 (p = 0.17). While the rate of personnel in the 20–30 age group with less experience was 6.46% in 2019, this rate increased to 21.08% in 2020. While the rate of personnel

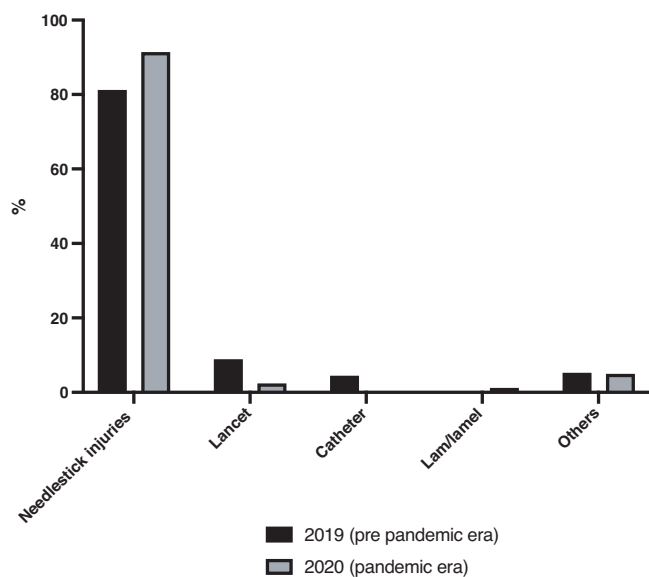


Fig. 1. Type of percutaneous needle stick and sharp injuries (%).

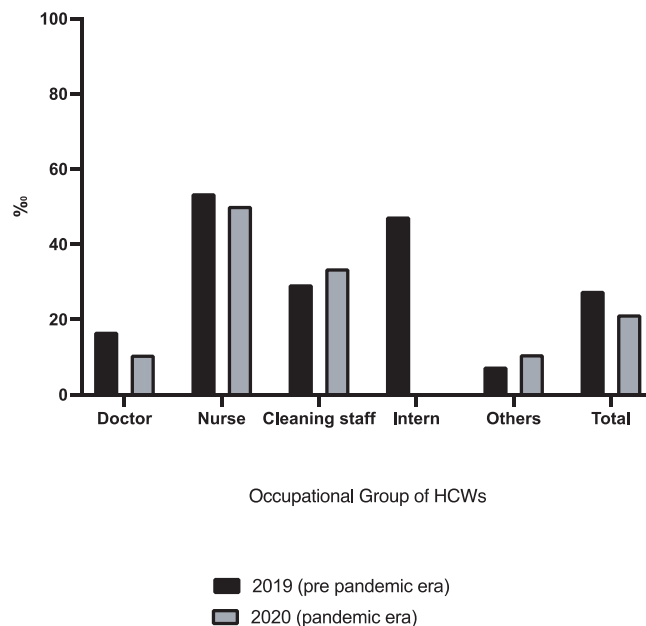


Fig. 2. Rates of percutaneous needle stick and sharp injuries (%).

between the ages of 30–40 was 57.08% in 2019, it was observed that this rate decreased to 36% in 2020 ($p < 0.00001$).

While the number of total surgeries were 81,253 during 2019 (pre-pandemic period), 26,897 surgeries were performed in 2020 (pandemic period). During 2019 (pre-pandemic period) and 2020 (pandemic period), 35,564 (43.76%) and 15,970 (59.37%) major surgery were performed, respectively (Table 1) ($p < 0.00001$).

Of the 4050 HCWs, 1119 (27.62%) were nurses, 1329 (32.81%) were other healthcare professionals (e.g., drivers, technicians and health assistants) and 831 (20.51%) were physicians in 2019 (pre-pandemic period).

Of the 3816 HCWs at our hospital during the 2020 (pandemic period), 1015 (26.59%) were nurses, 1288 (33.75%) were other healthcare professionals (e.g., drivers, technicians and health assistants), and 835 (21.88%) were physicians. When HCWs were compared concerning education levels, 61.2% and 56.32% of the personnel had a bachelor's degree in science/art, doctorate and a higher degree in 2019 and 2020, respectively ($p = 0.2$). The rate of personnel below the diploma level was 11.75% and 13.2% in 2019 and 2020, respectively ($p = 0.002$) (Table 1).

Percutaneous needle stick and sharp injuries (NSSIs)

During 2019 (pre-pandemic period) and 2020 (pandemic period), 112 (27.65%) and 82 (21.4%) NSSIs reported, respectively ($p = 0.09$) (Table 2). Eighty-one (81.25%) of the exposed personnel had needlestick injuries, 10 (8.9%) had sharp instrument injuries for 2019 (pre-pandemic period). Ninety-one (91.4%) of the exposed personnel had needlestick injuries, two (2.4%) had sharp instrument injuries for 2020 (pandemic period) (Fig. 1). Of the exposed HCWs in 2019 (pre-pandemic period), 16.8% (14) were doctor, 53.6% (60) were nurse and 47.4% (14) were intern doctors. In the 2020 (pandemic period), NSSIs were observed most frequently in nurses and cleaning staff, 50.24% and 33.64%, respectively (Table 1, Fig. 2). When we examine the causes of injury events at 2019, the rates of injury observed while performing and terminating the medical intervention were observed as 44% and 43%, respectively, and these are the most common causes of NSSIs. In 2020, the same causes of injury stood out as the most common causes.

Our findings showed that 39.83% of all HCWs were men, and 60.2% were women for NSSIs in 2019 (pre-pandemic period). 36.9%

of all HCWs were men and 63.1% were women for NSSIs at 2020 (pandemic period) ($p = 0.11$). The mean ages for NSSIs were 30 ± 9.72 for 2019 and 31 ± 9.89 for 2020.

Occupational exposure to blood and other body fluids

Table 3 presents the annual reported number of occupational exposure to blood and other body fluids. A decrease of exposure rate was reported among the doctors between pre-pandemic and pandemic era; 3.6% and 1.19%, respectively although it isn't meaningful statistically ($p = 0.61$). A significant increase in exposure rate was reported among the nurses between pre-pandemic and pandemic era; 0.8% and 6.89%, respectively ($p = 0.055$). Concerning the total percentage of exposure, a slight increase was revealed from 1.48% to 2.62%, respectively ($p = 0.38$). Cleaning staff rate of exposure to blood and other body fluids was at the same ratio during the following years (Table 3, Fig. 3).

Training results for 'occupational NSSIs and exposure to blood and other body fluids'

HCWs were trained routinely and the training focused on preventing 'NSSIs and exposure to blood and other body fluids' by occupational health and safety unit officer. Training in infection control was performed in our hospital in 2019 and 2020, respectively. As compared, the number of professionals with an infection prevention control curriculum or program for HCWs increased from 2675 HCWs in 2019–4104 in 2020, and the number of weekly periodical training numbers increased from four in 2019 to eight in 2020.

Discussion

NSSIs and exposure to blood and other body fluids are frequent yet preventable occupational hazards among HCWs. According to recent World Health Organization estimates, approximately two million NSSI cases are reported annually, but this number could be an underestimation as many cases of NSSIs are not reported, especially in developing countries [10,11].

Table 2
Comparison of pandemic era percutaneous needle stick and sharp injuries (NSSIs) with pre-pandemic era.

Occupational group of HCWs	Year 2019				Year 2020				p Value*
	Number of employed HCWs	Number of events	Number of HCWS exposed to the events	(Number of events/total number of HCWS working in health care areas) × 1000	Number of employed HCWs	Number of events	Number of HCWS exposed to the events	(Number of events/total number of HCWS working in health care areas) × 1000	
Doctor	831	14	14	16.8	835	9	9	10.7	0.39
Nurse	1119	60	60	53.6	1015	51	51	50.24	0.80
Cleaning staff	476	14	14	29.4	535	18	18	33.64	0.83
Intern	295	14	14	47.4	143	0	0	0	NC**
Others	1329	10	10	7.52	1288	14	14	10.8	0.48
Total	4050	112	112	27.65	3816	82	82	21.4	0.09

* Significant at p <0.05

** NC: 'Not calculated' because of the countless value of 2020.

Table 3
Comparison of pandemic era occupational exposure to blood and other body fluids with pre-pandemic era.

Occupational group of HCWs	Year 2019				Year 2020				p Value*
	Number of employed HCWs	Number of events	Number of HCWS exposed to the events	(Number of events/total number of HCWS working in health care areas) × 1000	Number of employed HCWs	Number of events	Number of HCWS exposed to the events	(Number of events/total number of HCWS working in health care areas) × 1000	
Doctor	831	3	3	3.6	835	1	1	1.19	0.61
Nurse	1119	1	1	0.8	1015	7	7	6.89	0.055
Cleaning staff	476	1	1	2.1	535	1	1	1.86	0.53
Intern	295	0	0	0	143	1	1	6.99	NC**
Others	1329	1	1	0.75	1288	0	0	0	NC**
Total	4050	6	6	1.48	3816	10	10	2.62	0.38

* Significant at p <0.05.

** NC: 'Not calculated' because of the countless value of 2019–2020.

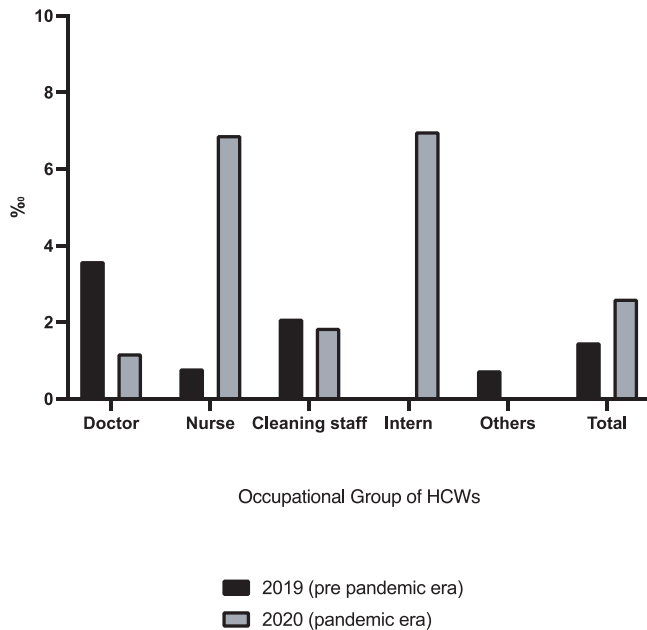


Fig. 3. Rates of occupational exposure to blood and other body fluids (%).

The results of our study showed that needlestick and sharp injuries among HCWs still occurred in daily practice despite the development and implementation of strict guidelines for preventing such exposure in healthcare settings. While the annual incidence of NSSIs was 27.65% for 2019, it was 21.4% for 2020. Although the total numbers are observed to have decreased despite not significant statistically, it has been shown that the strict regulations taken during the pandemic period have not been suffi-

cient to prevent these events completely concerning NSSIs. While NSSIs decreased in HCWs, such as doctors and nurses during the pandemic era, during an increase was revealed in cleaning staff.

Our results are in the same range compared with other studies. A review from United States estimated the incidence of NSI between 23 and 103 injuries per 1000 HCWs for studies that relied on the active surveillance system and a similar UK study auditing 15 National Health Service occupational health departments reported rates between 9 and 44 NSIs per 1000 HCWs per year [12,13].

NSSIs injuries were observed with the highest rate in the nurse group. Nurses had accidents more often than physicians. This result is contrary to some papers in both developed and less developed countries, usually reporting that physicians are more prone to injuries involving exposure to blood [14,15]. However, there are studies with findings consistent with our findings, which have shown that nurses have the highest rate of accidents in comparison to all other categories of health care providers [16]. Given that more interventional procedures, such as blood tests, are performed, especially during the pandemic period, this may explain that this risk is higher in the nurse group.

Our results also revealed that increasing the use of protective equipment does not fully protect concerning NSSIs. This study helps identify potential risk factors and gaps in the current preventive strategies implemented and may serve as a roadmap for future changes in preventive medicine at the institution. As a result, continuous staff training, supervision with the 'Hospital Infection Control Committee' and the availability of preventive protocols appear as interventions to be implemented to minimize risks for HCWs.

Similar to other reports, needlestick injuries were more common than mucocutaneous exposure [17]. Such exposures mostly occurred during venipuncture and intravenous administration of

drugs. Depends on the observation data of the Hospital Infection Control Committee, recapping is the most common problem leading to needlestick injuries. These results are similar to the output of other studies.

As a result of the comparison of contact rates with blood and body fluids, it was observed that there were no severe differences between pre-pandemic and pandemic periods. The rates in developing countries are generally higher than rates in developed countries due to insufficient staff and long working hours, lack of experience and educational programs, and lack of safety equipment and suboptimal standard precautions compliance [18–22].

The most striking point is that while the contact rates into the doctor group were higher in the pre-pandemic period, it was observed that these rates decreased during the pandemic period. It has been observed that the reduction of elective surgical interventions during the pandemic period and the decrease in the expose of doctors at the most important risk group are directly proportional. Nurses and cleaning staff rates did not decrease during this period although all of the staff used special protective equipment like gowns, masks, face shields and gloves. It has been determined that the personnel do not act very carefully during some procedures performed after venipuncture, and they may come into contact with blood and body fluids during this time. Nurses were the occupational group with the highest incidence of injuries, as reported similarly in other studies [23,24]. This may be attributed to contact with sharp devices directly and frequently in their daily duties. Therefore, training programs on the prevention of such injuries among nurses seem necessary and beneficial [25].

In our study, the interns have less exposure to blood and body fluids in their work than other profession groups do. This is inconsistent with the finding in previous studies that students are at risk of exposure to blood and body fluids [26]. Due to institutional, legal responsibilities, interns are not allowed to perform interventional procedures on patients alone. Allowing them to work with a professional in invasive procedures that need to be in contact with patients helps ensure the prevention of occupational risk exposure.

This study had some limitations. The data used were collected with active surveillance and this system depends on the health professional's self-report. Therefore, only included information from HCWs might only capture those who were well-versed in the significance of reporting occupational risk exposures. Because of this, these data may not be representative of all cases that took place within the timeframe set for data collection. Also, the results of this survey require confirmation using data collected from a larger sample size with multicenter research. This study has not documented exposures of respiratory acquired viruses like SARS-COV-2, which is very important concerning hospital-acquired infection risk during the pandemic.

Conclusion

Despite the limitations of this study, it reveals that the exposure to NSSIs during the pandemic period decreased. The procurement of personal protective equipment by the Turkish Ministry of Health, organising well-designed training and awareness programs at the beginning and during the COVID-19 pandemic period by the 'Hospital infection control committee' has been extremely beneficial in reducing risky occupational exposures. These educational programmes should also focus on the significance of exposure to respiratory acquired viruses and reporting risky occupational exposures.

Ethical approval

This study was approved by the Ethics Committee of the Health Science University Sisli Hamidiye Etfal Education and Research Hospital in Istanbul, Turkey.

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Competing interests

None declared.

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