Sharps Injury Rates Reported Among US Workers

National Electronic Injury Surveillance System—Occupational Supplement 2006 to 2020

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Objective: To examine sharps injury (SI) rates among US workers treated in hospital emergency departments. **Methods:** A national probability-based sample of approximately 67 US hospital emergency departments from the National Electronic Injury Surveillance System—Occupational Supplement was used to examine annual national estimates of SI rates (number of injuries/10,000 full-time equivalents) for US workers from 2006 to 2020. **Results:** Among the general US worker population, the 25- to 34-year age group experienced the highest annual SI rate. Health care industry workers experienced SI rates up to 16 times the rate of all US workers. **Conclusion:** Younger age (≤34 years) is associated with increased SI risk. Tailored prevention efforts should be developed to address the specific needs of these workers, especially among health care workers. Continual occupational surveillance will maximize the health and safety of US workers.

Keywords: emergency departments, health care industry, NEISS-Work, occupational exposure, sharps injury

LEARNING OUTCOMES

- By the end of this article, the reader will understand how annual trends in sharps injury incidence differ based on sex, age, and industry.
- By the end of this article, the reader will be able to effectively discuss the non–health care industries most commonly exposed to sharps in the workplace.

The Centers for Disease Control and Prevention defines a sharps injury (SI) as "a penetrating stab wound from a needle, scalpel, or other sharp object that may result in exposure to blood or other body fluids."[1] Despite improvements made over the past few decades to reduce harm related to sharps devices, an estimated 385,000 SIs occur among hospital-based health care personnel annually nationwide.[2,3] Although this number itself is high, the actual number is much likely larger, as an estimated half of SIs are not reported; workers cite busyness at the time of injury, inconvenience, and lack of awareness concerning proper reporting protocol as principal reasons for not reporting these events.[4–7] Further, this figure is limited to SIs among hospital workers in health care settings. In addition to actual risk, the perception of risk upon sustaining an SI can result in severe and prolonged mental distress, including depression, anxiety, and posttraumatic stress disorder.[8,9] Proper sharps handling is shown to greatly reduce staff absence from related psychological and physical burdens of these injuries.[4,10–18] Sharps injuries also generate significant direct and indirect costs due to lost productivity and postexposure diagnostic and prophylactic protocols.[19] These considerations indicate an urgent demand for ongoing and potentially escalated occupational surveillance among at-risk groups.[20]

Although it is commonly thought that SIs are specific to health care settings, the ongoing opioid epidemic in the United States has highlighted how SIs occur not only in health care settings but also among non–health care occupational groups, such as housekeepers, waste haulers, and police officers.[21] Although SIs are most common among US health care workers during patient care services, numerous occupations are frequently exposed to sharps.[21–25] Retail and service providers have installed sharps disposal boxes to protect their workers from SIs.[26,27] Police officers respond to accidental SI cases.[21] Sharps injury exposures affect many US worker groups not commonly studied with respect to this concern.[21,23,24]

Previous studies show that SI rates in the United States are likely further influenced by factors such as age, needle use experience, and sex.[28–32] Currently, there are only two national surveys of occupational SIs: the International Safety Center Exposure Prevention Information Network (EPINet®) and the Association of Occupational Health Professionals in Health care Exposure Survey of Trends in Occupational Practice (EXPO-S.T.O.P.).[33,34] However, these voluntary annual surveys are focused on health care workers and are not nationally representative.[33,34] This article reports nationally representative SI rates of US workers treated in hospital emergency departments (EDs) between the years 2006 to 2020 and compares these rates to those identified as health care industry (HCI) workers within the same data set between the years 2015 and 2018.

METHODS

Data used in this study were from the 2006 to 2020 National Electronic Injury Surveillance System—Occupational Supplement (NEISS-Work[i]), a probability-based sample of approximately 67 US hospital EDs.[35] NEISS-Work estimates the number of nonfatal work-related injuries and illnesses treated in EDs. Each case is assigned a statistical weight based on the probability of selection of the hospital. National estimates are calculated by summing the weights of selected cases. In addition to the demographic and injury variables collected through NEISS-Work, the National Institute for Occupational Safety and Health staff assign source and event codes for each injury using the Bureau of Labor Statistics, Occupational Injury and Illness Classification System (OIICS).[36]

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Ethical considerations and disclosures: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention (CDC). Mention of any company or product does not constitute endorsement by NIOSH, CDC. In addition, citations to Web sites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these Web sites. All Web addresses referenced in this document were accessible as of the publication date.

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[i]NIOSH collects NEISS-Work data in collaboration with the Consumer Product Safety Commission (CPSC), which operates the base NEISS hospital system for the collection of data on consumer product–related injuries. The CPSC product-related injury estimates exclude work-related injuries, whereas NEISS-Work estimates include all work-related injuries regardless of product involvement (ie, NEISS and NEISS-Work cases are mutually exclusive).

TABLE 1. National Estimates of Emergency Department–Treated Sharps Injuries Among US Workers, 2006–2020

	Estimated Sharps Injuries (%)	95% CI	Rate*	95% CI
Total	875,900	653,000–1,098,800	4.1	3.1–5.1
Sex				
Male	249,800 (29)	180,600–319,000	2.1	1.5–2.6
Female	626,100 (71)	463,700–788,600	6.8	5.0–8.5
Age group				
≤24 y	133,700 (15)	94,400–172,900	6.0	4.2–7.7
25–34 y	345,400 (39)	242,000–448,800	7.2	5.0–9.3
35–44 y	179,100 (20)	134,700–223,600	3.7	2.8–4.6
45–54 y	133,400 (15)	100,700–166,100	2.6	2.0–3.3
≥55 y	84,300 (10)	61,800–106,900	1.9	1.4–2.4
Disposition				
Treated and released	867,900 (99)	645,900–1,089,900	—	—
Other†	8,400 (1)	5,500–11,400	—	—
Body part injured				
Lower arm	13,200 (2)	8,930–17,400	—	—
Wrist	5,600 (<1)	3,800–7,400	—	—
Knee	2,700 (<1)	1,400–4,000	—	—
Lower leg	5,900 (<1)	3,400–8,300	—	—
Lower trunk	2,000 (<1)	1,100–2,800	—	—
Upper leg	7,600 (<1)	5,200–10,100	—	—
Hand	96,100 (11)	72,000–120,100	—	—
Foot	1,600 (<1)	900–2,400	—	—
All body parts	4,500 (<1)	2,100–6,800	—	—
Finger	716,800 (82)	522,200–911,400	—	—
All other‡	20,500 (2)	13,200–27,700	—	—
Diagnosis				
Contusions, abrasions	7,400 (<1)	3,700–11,200	—	—
Laceration	18,800 (2)	12,100–25,600	—	—
Puncture	676,200 (77)	475,900–876,600	—	—
All other§	173,800 (20)	100,500–247,200	—	—

Rate calculations are for workers 15 years or older.

*Rate per 10,000 full-time equivalents).

†Other dispositions include treated and admitted, treated and transferred to another hospital, held for observation, left against medical advice, and fatalities.

‡Other body parts include internal injuries, shoulder, upper trunk, elbow, ankle, pubic region, head, face, eyeball, upper arm, mouth, neck, toe, and 25% to 50% of the body.

§Other diagnosis include ingested/aspirated foreign object, burns, amputation/crush, concussion, dislocation, fracture, hematoma, dental injury, nerve damage, internal injury, sprain/strain, anoxia, hemorrhage, electric shock, poisoning, and submersion.

CI, confidence interval.

Source: National Electronic Injury Surveillance System—Occupational Supplement (NEISS-Work), 2006–2020.

Cases were identified by selecting event codes related to unintentional needlestick injuries or SIs. For the years 2006 to 2011 (OIICS v1.01), this corresponded to code 3431 "needlesticks." For the remaining years (2012 to 2020, OIICS v2.01), the event code was 5541 "exposure through unintentional needlestick or sharp injury." No additional case identification limited the cases to needlesticks. Each NEISS-Work record contains narrative information on industry. To date, the National Institute for Occupational Safety and Health staff have manually assigned 2017 Bureau of Census Industry Codes[37] for the 2015 to 2018 NEISS-Work data; therefore, all industry-related analyses are restricted to those years. Data for HCI workers were selected using Bureau of Census Industry codes 79 to 82. All estimates and 95% confidence intervals (CIs) were calculated using SAS® 9.4 Proc Survey[38] to incorporate the stratified sample design of NEISS-Work.

Injury rates were calculated as the number of injuries per 10,000 full-time equivalents (FTEs). One FTE is equal to 40 hours of work per week for 50 weeks per year, or 2000 working hours. Employment estimates were derived from the US Current Population Survey for workers 15 years or older, and these estimates were based on FTE hours worked in all jobs.[39–41] Rate calculations and percentages were limited to injured workers 15 years or older to align with employment estimates.

Longitudinal changes in the number of annual SIs treated were reviewed to understand how age and sex may impact rates. The disposition (eg, treated and released or hospitalized), injured body part, and diagnosis at time of ED visit were examined in these SI estimates of US workers treated in EDs between 2006 to 2020. The SI rates, disposition, body part injured, and diagnosis at time of visit were analyzed among HCI workers and compared with all workers treated in EDs for the period 2015 to 2018.

RESULTS

Between 2006 and 2020, an estimated 875,900 occupational SIs were treated in US EDs (Table 1). Almost all injured workers (99%) were treated and immediately released from the EDs (Table 2). Seventy-one percent of the total injuries were to female workers. By age group, workers in the 25- to 34-year age range experienced the most injuries (345,400; Table 1). Sharps injuries among all non-HCI workers from 2015 to 2018 most commonly occurred in the following industries: justice, public order, and safety activities (8300); traveler accommodation (3600); colleges, universities, and professional schools, including junior colleges (1700); and pharmacies and drug stores (1300).

"Puncture" was the most common diagnosis among all age groups, with 77% of injuries diagnosed as punctures. Other reportable diagnoses were "lacerations" (18,800) and "contusions, abrasions" (7400; Table 2). The body part most frequently injured was the finger (716,800), followed by the hand (96,100) and the lower arm (13,200).

TABLE 2. National Estimates of Emergency Department-Treated Sharps Injuries Among Health Care Industry Workers, US 2015–2018

	Estimated Sharps Injuries (%)	95% CI	Rate*	95% CI
Total	209,200	137,400–281,000	31.2	20.5–41.9
Sex				
Male	56,300 (27)	35,700–76,900	33.8	21.4–46.2
Female	152,900 (73)	99,800–206,100	30.3	19.8–40.9
Age group				
≤24	34,200 (16)	20,600–47,800	65.7	39.6–91.7
25–34	90,100 (43)	54,800–125,300	54.5	33.1–75.7
35–44	39,400 (20)	25,800–53,000	26.7	17.5–35.9
45–54	26,500 (13)	16,500–36,500	17.4	10.8–23.9
≥55	19,100 (9)	12,100–26,000	12.5	7.9–17.0
Disposition				
Treated and released	207,700 (99)	136,100–279,300	—	—
Other†	1,500‡ (1)	600–2,500	—	—
Body part injured				
Lower arm	2,400 (1)	1,400–3,300	—	—
Hand	15,000 (9)	10,200–19,700	—	—
Finger	149,300 (90)	94,500–204,100	—	—
Diagnosis				
Laceration	7,200 (4)	4,000–10,300	—	—
Puncture	110,000 (63)	54,000–166,100	—	—
All other§	56,400 (33)	29,400–83,500	—	—

Rate calculations are for workers 15 years or older.

*Rate per 10,000 full-time equivalents.

†Other dispositions include treated and admitted, treated and transferred to another hospital, held for observation, left against medical advice, and fatalities.

‡Data are statistically unreliable.

§Other diagnosis include ingested/aspirated foreign object, burns, amputation/crush, concussion, dislocation, fracture, hematoma, dental injury, nerve damage, internal injury, sprain/strain, anoxia, hemorrhage, electric shock, poisoning, and submersion.

CI, confidence interval.

Source: National Electronic Injury Surveillance System—Occupational Supplement (NEISS-Work), 2015–2018.

Other commonly injured body parts included the upper leg (7600), wrist (5600), lower leg (5900), and knee (2700). The finger and hand were the most commonly injured body parts among all age groups.

Male workers experienced 29% of the total estimated SIs with a rate of 2.1 SIs per 10,000 FTEs (Table 1). The rate among females was 6.8 SIs per 10,000 FTEs with an estimated 626,100 total SIs (71%; Table 1). When examined by age group, workers 25 to 34 years experienced 39% of the total estimated SIs. Workers 35 to 44 years experienced 20% of the total SIs, followed by workers 24 years and younger, 45 to 54 years old, and workers 55 years and older (Table 1). Workers aged 25 to 34 years also had the highest estimated SI rate (7.2 SIs per 10,000 FTEs).

Estimated SI rates among males yielded stable results from 2006 to 2020, with a range of 1.5 SIs per 10,000 FTEs in 2018 (95% CI, 0.8 to 2.1) to 2.7 SIs per 10,000 FTEs in 2017 (95% CI, 1.7 to 3.6; Fig. 1). Conversely, the rates among females varied more by year, with rates ranging between a low of 4.2 SIs per 10,000 FTEs in 2018 (95% CI, 2.4 to 6.0) to a high of 8.0 SIs per 10,000 FTEs in 2015 (95% CI, 4.8 to 11.3; Fig. 1). Although rates for both sexes are generally consistent from 2006 to 2017, there is a decrease (40%) of

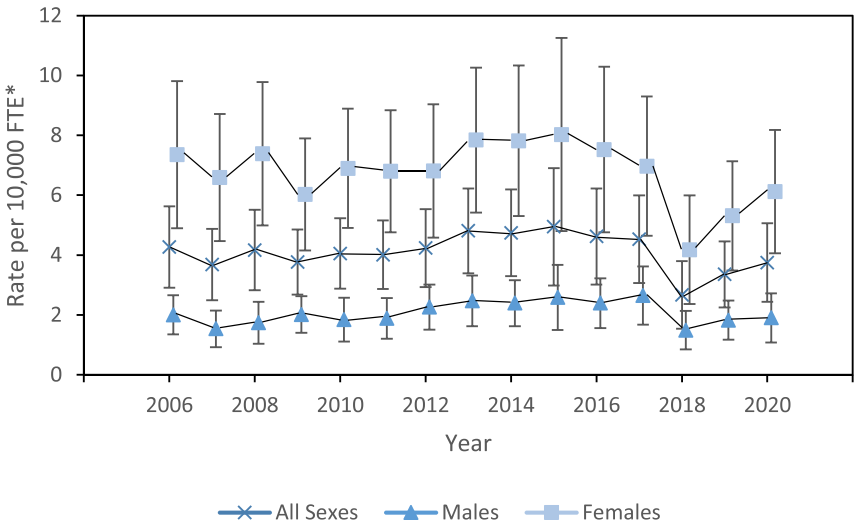

FIGURE 1. Injury rates for work-related sharps injuries treated in hospital emergency departments by sex, United States 2006–2020.

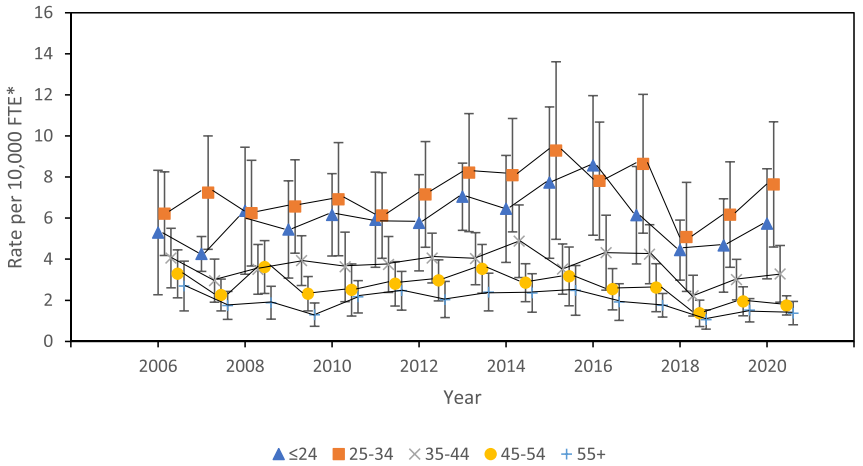

FIGURE 2. Injury rates for work-related sharps injuries treated in hospital emergency departments by age group, United States 2006–2020.

2.8 SIs per 10,000 FTEs among females from 2017 to 2018. Among males, there is a decrease of 1.2 SIs per 10,000 FTEs (42%) from 2017 to 2018. After the initial rate decrease in 2018, incidence of SIs consistently increased incrementally across both sexes. From 2015 to 2018, males in non-HCIs experienced 20,000 SIs, and females had 18,900 SIs. Longitudinal trends by age and sex were not significant for all industry analyses.

There is minimal overlap in SI rates when grouping by age (Fig. 2). Among all age groups, workers 25 to 34 years of age experienced the highest rates of SIs every year, with the exception of 2008 and 2016. In 2016, workers 24 years or younger experienced the highest rate of SIs with 8.6 SIs per 10,000 FTEs (95% CI, 5.2 to 11.9). After workers aged 25 to 34 years, the next group with the highest rate of SIs comprised those 24 years or younger. Workers aged 35 to 44 years had the third highest rate, followed by those aged 45 to 54 years and workers aged 55 or older. Rates were relatively unstable among workers 34 years or younger, as indicated in Figure 2.

An examination of SIs by industry for the years 2015 to 2018 found that 84% of SIs occurred in the HCI. Sharps injuries most commonly occurred in the following industries: hospitals (157,300); nursing care facilities and skilled nursing facilities (9900); offices of dentists (9000); other health care services (8900); outpatient care centers (8100); and home health care services (5000). Between 2015 and 2018, men working in the HCI experienced 56,300 SIs, and women had 153,000 SIs. Female workers in the HCI incurred 73% of reported SIs in this industry (Table 1). However, male subjects working in the HCI consistently experienced higher SI rates each year from 2015 to 2018 when compared with their female counterparts (Fig. 3). The rates among female and male workers decreased sharply from 2017 to 2018 (Fig. 3).

Sixty-three percent of SIs among workers in the HCI were diagnosed as "punctures" (Table 2). "Punctures" and "lacerations" were the most common injury diagnoses among both the US worker population and HCI workers. The body part most frequently injured by HCI workers was the finger, followed by the hand and lower arm.

When examining rates among HCI workers by age, workers 24 years or younger experienced approximately 65.7 SIs per 10,000 FTEs; workers in the 25- to 34-year age group followed with 54.4 SIs per 10,000 FTEs (Table 1). Those aged 35 to 44 years experienced less than half this rate, followed by the age groups 45 to 54 years and 55 years and older. Workers 24 years or younger consistently experienced almost double the SI rate of the total HCI worker population (Fig. 4). Health care industry workers in the age groups 24 years or younger and 25 to 34 years experienced the highest annual rates of SIs compared with all other HCI worker age groups from 2015 to 2018 (Fig. 4). Although total SI rates decreased by almost half from 2015 to 2018, HCI workers had 16.7 SIs per 10,000 FTEs in 2018 (95% CI, 8.9 to 24.4) compared with the US worker population rate

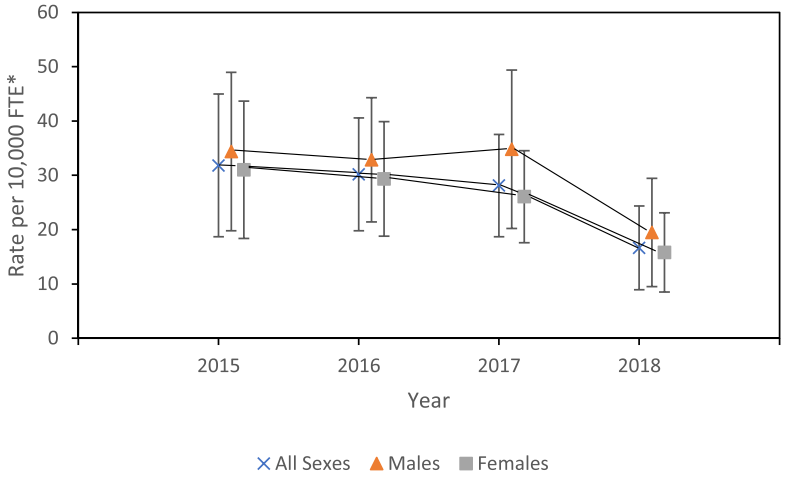

FIGURE 3. Injury rates for work-related sharps injuries among health care industry workers treated in hospital emergency departments by sex, United States 2015–2018.

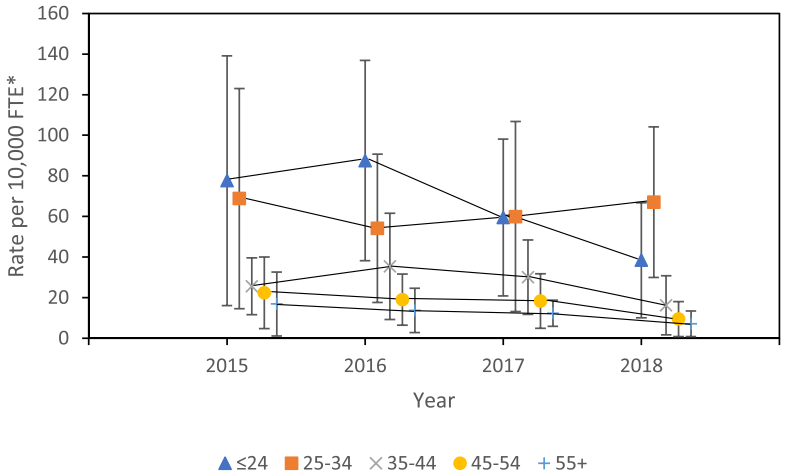

FIGURE 4. Injury rates for work-related sharps injuries among health care industry workers treated in hospital emergency departments by age group, United States 2015–2018.

of 2.7 SIs per 10,000 FTEs (95% CI, 1.5 to 3.8). Sharps injury rates for individual non-HCIs were not reportable.

Tables 1 and 2 indicate that estimated percentages of SIs between HCI workers and non-HCI workers do not vary significantly when examined by sex and age. Both groups experience SIs most commonly in the 25- to 34-year age group compared with other age groups. Female workers are more than two-thirds likely than male workers to experience an SI in both HCIs and non-HCIs. Further, HCI workers are more likely than non-HCI workers to sustain an SI in the finger than any other body part (90% vs 82%), although both groups experience SIs most commonly in the finger. The predominant diagnosis for both groups is puncture, and approximately 99% of HCI workers and non-HCI workers are treated and immediately released from the ED.

DISCUSSION

This study examined the longitudinal trends of SIs among US workers by age and sex from 2006 to 2020. By examining which worker subgroups are at increased risk of sustaining an SI across all industries and specifically the HCI, it is possible to develop interventions targeted at these subgroups, which may then reduce the greatest staff absence from related psychological and physical burdens of these injuries.[4,10] Interventions targeted at subgroups may also directly reduce employer and employee costs associated with lost productivity and postexposure diagnostic and prophylactic protocols.[19]

Female workers experienced higher rates of occupational SIs that were treated in US EDs compared with their male counterparts. This finding was consistent across the years 2006 to 2020. Female workers experienced approximately 4 to 5 SIs per 10,000 FTEs more than male workers each year, indicating that worker sex may be relevant when developing injury interventions associated with SIs. However, when analyzing injury rates for the HCI only, the opposite was true; male workers experienced higher annual SI rates than female workers. Health care employers commonly follow protocols regarding SIs, so male and female workers likely have close SI rates within the HCI. However, female workers tend to seek care more often,[42,43] leading to the high SI rate among female workers compared with male workers in the general working population.

Annual SI rates varied across all industries by age as well. Workers aged 25 to 34 years experienced the highest SI rates compared with other age groups, and workers 55 years or older consistently experienced the lowest annual SI rates. Among HCI workers, those 24 years or younger had almost double the rate of the total worker population. It is likely that HCI workers within this age group take greater risks in daily work duties due to attitude and perception of risk.

The results of this study are comparable to other national sharps surveillance systems for health care workers. One such study, EXPO-S.T.O.P., depicts the urgent need for aggressive SI-reduction strategies.[34] EXPO-S.T.O.P. blood exposure survey results show SI rates in 2016 were 2.8 per 100 nurse FTEs and 2.7 per 100 nurse FTEs in 2017.[34] The most recent SI rates recorded by EXPO-S.T.O.P. match rates from the early 2000s and continue to rise year-by-year.[34] Among low exposure hospitals in the EXPO-S.T.O.P. data set, one-to-one interactive education and sharp safety are provided to ensure the safety of new hires.[44] Mandatory SI safety review is required on an annual basis, and low-exposure workplaces emphasize management involvement and employee health to commit to a goal of zero exposures.[44] These methods seem to reduce occupational SI risk in comparison to high-exposure settings.[44]

EPINet, a second health care worker sharps surveillance study, provides sharp object injury data in health care settings as comparison data for individual facility progress.[33] This study found that approximately 70% of needlestick injuries and SIs occur among nurses and doctors, with a rise in needlestick and sharp object injuries among both teaching and nonteaching roles from 2015 to 2017.[33] The EPINet SI rate drops dramatically from 2017 to 2018.[33]

A sharp decline in the SI rate from 2017 to 2018 was also seen in the data reported here, but it is not clear from the data itself what led to the decrease. However, it is important to note that this trend is not unique to NEISS-Work, even though EPINet uses average daily census for rate calculations instead of FTEs.[33] These rates increase slightly in 2019 and again in 2020, possibly because health care workers are facing longer hours, staff shortages, and organizational inexperience due to an increased need for inoculations in the United States resulting from the COVID-19 pandemic.[45] Mass vaccination programs oftentimes used nonhospital settings and lacked adequate sharps handling training, contributing to the rate increase.[45] However, it is likely that non-HCI workers may have avoided or delayed care at hospitals post-SI due to COVID-19 exposure concerns.[46]

Although federally mandated standards such as Occupational Safety and Health Administration's (OSHA's) Bloodborne Pathogens Standard (29 CFR 1910.1030) training have been implemented to decrease SI risk, many settings outside health care do not receive adequate guidance on how to address SI prevention and response.[21] This impacts the safety of non-HCI workers around sharp devices.[21] Further, health care workplaces may have difficulty complying with federal standards.[47] One systematic review of employer comments on OSHA citations found increased difficulties with employer recordkeeping compared

with the 1990s.[20] Although OSHA inspections for high-risk employers occur more frequently, they do not capture daily workplace procedures and cannot ensure consistent compliance over time.[20] Results suggest an ongoing need for employer-directed occupational surveillance and Bloodborne Pathogens Standard enforcement.[20] Standard employer enforcement of topics such as sharps disposal, injury reporting, and SI logging will continue to deter SIs in the workplace and concerns regarding recordkeeping.[10,20,32]

Hospitals and medical environments should continue to provide necessary protection from SIs, including closable, puncture-resistant, and clearly marked sharps containers and safety-engineered needles.[4,10,11,17,48,49] Although these protections could not be assessed in this study, they are important safety measures to consider. Explicit guidelines on the proper use of personal protective equipment and appropriate needle use protocols will increase workers' self-efficacy in handling needles in the workplace.[17,49]

Although NEISS-Work provides robust occupational injury data, this study has several limitations that may lead to underreporting. The completeness of NEISS-Work data relies on the patient relaying the work-relatedness of their injury and medical records capturing this information. Patients or ED staff may omit details that would associate the injury with the patient's workplace.[50] It is also possible that patients could leave out the work-relatedness of their injury for several reasons, including fear of employer reprisals, lack of management responsiveness after prior reports, wanting to use their own health insurance, and a desire not to lose their job.[50,51] The reported SI rate of the HCI may be higher as health care facilities might have policies in place where workers must be seen after an SI; other industries and smaller businesses, by comparison, may not have these policies. Cost might also be a deterrent for workers in some other jobs. In addition, rates for reporting SIs in the US are exceptionally low, with estimates varying between 18% and 70%, likely based on industry and year of evaluation.[18] Inconvenience, busyness at time of injury, and lack of proper reporting protocol awareness are substantial causes of concern in SI reportability.[4–7]

Further, NEISS-Work does not capture injuries that did not present to the ED, so this study did not account for injuries where the level of severity did not warrant ED treatment. These injuries may have been treated in outpatient clinics or other health care settings. The time of day that injuries occurred is unknown and may prove helpful in future analyses when determining likelihood of ED presentation. Separately, the ability to conduct industry-specific trend analyses was limited by the lack of complete industry coding in NEISS-Work. Coded occupation data that would better describe the affected populations were not available. Finally, the longer-term outcomes of SIs reported in this study are unknown, including whether each SI resulted in disease.

This study has several strengths. Despite limitations related to the NEISS-Work data set, its sample size is relatively stable from year to year, providing a unique opportunity to assess progress toward the reduction of SI rates at the national level. In addition, the data set includes narrative descriptions, which provide additional information on the causes of SIs among US workers. These descriptions can be valuable in producing targeted efforts to reduce the burden of SIs nationally, including by examination of body parts injured and diagnosis classification.

CONCLUSION

Data on similarities and differences among different ages and sexes are useful in developing tailored prevention efforts that address the specific needs of each group. Further research is needed to determine the causality of increased SI rates among HCI workers 34 years or younger compared with other age groups. Continual federal occupational surveillance efforts will maximize the health and safety of US workers. As the need for inoculations increases, SI rates are likewise expected to increase, indicating an urgent need for standardized SI education among all at-risk occupations, especially among young HCI workers.

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