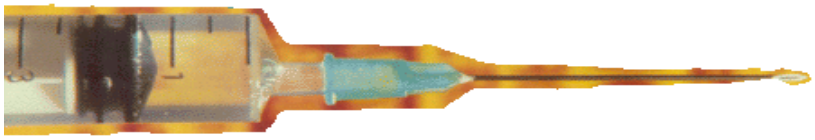
Needlestick Injuries Among Health Care Workers in Washington State, 1996-2000



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Technical Report No. 64-04-2003

April 2003

SHARP
Safety & Health Assessment & Research for Prevention
1-888-66-SHARP

Department of LABOR AND INDUSTRIES

Needlestick Injuries Among Health Care Workers in Washington State, 1996-2000

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Key words: health care workers, needlestick injury, health hazards surveillance, workers' compensation

Acknowledgement: We wish to thank the staff at SHARP for their insightful review and recommendations for this report. We thank Ric Ordos from Washington State Department of Health for his help regarding hospital FTEs in Washington State. We would also like to thank Randy Clark, Scott McGeary and Hieu Pham for their help. This report was supported in part by Cooperative Agreement 1 U01 OH07292-01 from the National Institutes for Occupational Safety and Health (NIOSH). The contents are solely the responsibility of the authors and do not necessarily represent the official views of NIOSH and the Center for Disease Control and Prevention.

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Health care workers are vulnerable to serious health implications such as transmission of human immunodeficiency virus (HIV), hepatitis B virus and hepatitis C virus following needlesticks. We used Washington State workers' compensation claims' databases to characterize work-related needlestick injuries in health care services (SIC 80) and the two major State Fund teaching hospitals that were classified under education services (SIC8221). We obtained all accepted claims filed between 1996 and 2000. We defined a claim as 'needlestick' if the American National Standard Institute (ANSI) source code was '2202' or ANSI associated source code was '22021' or '22025' or '22029' or '22022' or '22020' or the text word search of the workers' compensation report of accident form for specific injury sources contained 'needlestick'. We studied a 5 to 10 line event statement in each of the State Fund accepted claims to categorize types of needlestick injuries. We used occupational class code (CLMOCCPN-3 digit) and standard occupational classification (SOC2K) (6 digit) code to define the job category. Claim incidence rates were calculated by year and are expressed as number of claims / 10,000 FTEs. Trends in incidence rates over time were tested using a Poisson regression model. We combined the rank orders of both frequency and relative risk to create a "Prevention Index" (PI).

Of 3,303 State Fund accepted needlestick injury (NSI) claims, 2700 were in health services sector (SIC 80) and 603 in the two major State Fund teaching hospitals that were classified under education services (SIC 8221). Health care workers in SIC 80 experienced an overall average workers' accepted claims rate of 67 claims per 10,000 FTEs per year, with the rate increasing from 58 claims per 10,000 FTEs in 1996 to 72

claims per 10,000 FTEs in 2000. Trend analysis showed an annual average increase of 5.84% (95% CI=2.74%; 9.06%). In health care services (SIC 80) nurses accounted for the largest number of health care workers involved, with 770 (28%) needlesticks, followed by dental assistants, with 416 (15%), laboratory technicians, with 275 (10%) and medical assistants, with 267 (9%) incidents. These four job categories along with nursing aides and physicians accounted for the majority (78%) of needlestick injuries. Technicians, dental hygienists and dentists sustained a significant proportion (10%) of needlestick injuries as well.

In the two major State Fund teaching hospitals nurses (40%), followed by doctors (28%) sustained the majority (68%) of needlestick injuries. Laboratory workers, technicians and housekeeping staff comprised another major portion (17%) of needlestick injuries. Medical and nursing students were involved in small number of cases (0.8%).

The most common procedure reported to cause such injury in each of the job categories also varied. Among physicians, most of injuries occurred while suturing or doing a surgical procedure. Nurses sustained a needlestick while disposing of a used needle, injecting medicine, recapping a needle, and drawing blood. Dentists sustained needlesticks while recapping a needle or giving a local anesthesia, and their assistants received such injury while recapping a needle or cleaning instruments. Sanitary staff had needlestick injuries while disposing of garbage in the majority of cases. Understanding the occurrence of needlestick injuries in the target population is critical to implementing control measures. This study allowed identification of the locations where the highest number of injuries occur, and the major activities leading to these injuries over a range of years.

Introduction:

Needlestick injuries (NSI) are one of the most common types of occupational hazards for health care workers (HCWs).[1] An estimated 180,000 needlestick and other percutaneous injuries occur among health care workers annually according to Exposure Prevention Information Network (EPINet).[2]

There are more than 20 pathogens transmitted through contaminated needlesticks[3,4,5] but the documentation of the transmission of human immunodeficiency virus (HIV), hepatitis B virus, and hepatitis C virus following needlesticks has increased the level of awareness and concern and prompted new initiatives. According to the Department of Health, Washington State the first case of AIDS in Washington State was diagnosed in 1982 and by the end of December 2002, a cumulative total of 10, 384 cases of AIDS have been reported. Of these people, 5,695 (55%) are known to have died.[6]

Surveillance of health care workers exposed to blood from patients with the human immunodeficiency virus showed a seroconversion rate of 0.42 percent at least 180 days post-exposure.[7] The important risk factors for seroconversion and infection with HIV include 'deep injury', 'injury with a device that was visibly contaminated with the source patient's blood', 'a procedure involving a needle placed in the source patient's artery or vein' and 'exposure to a source patient who died of the acquired immunodeficiency syndrome within two months afterward'.[8] Post-exposure prophylactic treatments are associated with serious health effects and may not be completely effective.[9,10,11]

The risk of pathogen transmission to health care workers through needlestick injuries is estimated to be 6% to 30% for hepatitis B virus and 0.4% to 1.8% for hepatitis

C virus.[2] Hepatitis C is the most common chronic blood-borne disease in the United States, with 3.9 million people currently infected.[12] There is no vaccine available to prevent hepatitis C infection.

The significant health risk associated with needlestick injuries prompted the Occupational Safety and Health Administration (OSHA) to issue the bloodborne pathogen standard in 1991. Employers are required to implement an exposure control plan for the protection of employees.[13] Despite these measures and development of different medical devices with improved safety measures, NSIs continue to be a major health hazard. At the national level, the Needlestick Safety and Prevention Act was signed into law on November 6, 2000.[14] According to this law, healthcare employers need to provide safety-engineered needles and sharps disposal devices for use in their institutions. OSHA revised its Bloodborne Pathogen Standard, and mandated the use of safety devices and maintenance of a sharps-injury log for recording exposure incidents on April 18, 2001.[15]

Washington State passed its needlestick prevention legislation in August 2001. This standard emphasizes the use of engineering and work practice controls to prevent exposures to bloodborne pathogens.[16] It is expected that this new initiative will result in a significant reduction of needlestick injuries over the years.

In this study, we used the Washington State workers' compensation claims' databases to characterize work-related needlestick injuries among health care workers. Washington State Department of Labor and Industries' claims data have been used successfully in a number of studies looking at injury hazards and industries at risk.[17, 18, 19]

Methods:

In Washington State, employers (except the self-employed) are required to obtain workers' compensation insurance through the Washington State Department of Labor and Industries (L&I) Industrial Insurance System, the State Fund, unless they are able to self-insure. The L&I State Fund covers approximately two-thirds of the workers in Washington State (the remainder work chiefly for the 400 largest employers in Washington State and are covered by their self-insured employers). Most federal workers are not included in the Washington State industrial insurance system. The employer's industry is identified using the Standard Industrial Classification (SIC) coding system. Washington State also uses the Washington Industrial Classification (WIC) system that combines industry and occupation to group workplaces by similar risk of injury for insurance purposes.

The L & I claims management database consists of two major data processing systems. The Medical Information and Payment System (MIPS) receive all billing information generated by provider medical bills. All State Fund claims are also entered into the Labor and Industries Industrial Insurance System (LINIIS). Only those Self-Insured claims resulting in four or more days of lost time (compensable claims) are fully coded in the LINIIS system.

From LINIIS we obtained all accepted workers compensation claim data for health services (SIC 80) filed between January 1, 1996, and December 31, 2000. We also extracted accepted claims data for health services (SIC 80) filed between January 1, 1996, and December 31, 2000 from data archived in October 2001 and added 1,163

accepted claims that were not present in current extraction from LINIIS. Two major State Fund teaching hospitals were classified under education services (SIC 8221). We extracted claims for SIC 8221 filed during the study period (1996-2000).

Accepted claims can be categorized as compensable or noncompensable. The Department of Labor and Industries pays both medical costs and wage-replacement benefits for compensable claims. To qualify as a "compensable" claim, the injury must have resulted in four or more lost working days.

We extracted information on claimants' gender, age, details of the injury and illness as coded using the American Standard Method of Measuring and Recording Injury Experience of the American National Standard Institute (ANSI).[20] The ANSI codes describe the injury or illness by: 1) the body part involved (e.g., code 330 = hand; 340= Finger; 530 = foot), 2) the 'source' of event (e.g., code 2202 = needle, 2700 = infectious agent; 1010 gloves), 3) its' 'nature' (e.g., code 170 = cut; 180 = contact-with-toxic), and its' 'type' (e.g., Code 023=kicked by; 028 = stabbed by; 020 = struck by unsound objects).

We defined a claim as **'**needlestick**'** if the source code was '2202-needle' or associated source code was '22021-needle broken in use' or '22025-needle mishandled' or '22029-needle-other' or '22022-needle slipped' or '22020-needle-unsound' or if a text word search of the workers' compensation report of accident form for specific injury sources found the words 'needle' or 'stick' and 'needlestick'. We restricted our detailed analysis to State Fund claims, as no details were available for Self Insured claims. Self-insurance is permitted if a firm is able to set aside sufficient reserves and meet certain guidelines. Such employers are typically the State's largest Firms.

To define types of needlestick injuries we carefully studied a 5 to 10 line event statement in each of 200 accepted claims for needlestick injuries and classified the injury event into various categories (Table 1).

The principal investigator ascertained type of injury in 1,000 cases. In another 1,759 cases, three fellow staff members assigned the type of injury after training on the above mentioned injury type checklist. We estimated kappa statistics in a random sample of 15% of completed records where the injury type code was assigned by one of the three staff members. [21] We found 89.8%, 92.7% and 94.5% inter-rater agreement with the principal investigator. Principal investigator assigned type of injury code for all needlestick injury claims for the two major State Fund teaching hospitals that were classified under education services (SIC 8221).

We used an occupational class code (CLMOCCPN-3 digit) and 2000 standard occupational classification (SOC2K) (6 digit) code to define the job category. We were able to find job category from medical records for another 116 State Fund claims of needlestick injuries where occupational class code and SOC2K code were missing. We were able to define the job category in the majority (97%) of NSI cases. We summarized the job category as shown in Table 2.

We estimated the total direct cost for the accepted needlestick injury cases from data available from the provider medical bills in the Medical Information and Payment System (MIPS).

Employment information is reported to Labor and Industries by State Fund employers as the number of hours worked by employees for each quarter of the year. These hours are reported by the employers' account. The number of full time equivalent

employees working per year was calculated assuming that each full-time employee works 2,000 hours per year (40 hours per week for 50 weeks per year). We obtained FTEs for the two major State Fund teaching hospitals from the Washington State Department of Health.[22]

Statistical Analysis:

Our detailed analysis focused on State Fund, accepted needlestick injury claims. Descriptive analyses included a frequency of claims by gender, marital status, age groups and job category for all non-missing variables. We calculated accepted needlestick injury claim rates over the study years. Payroll data reported to the workers' compensation system were used to extract the number of hours worked. Number of hours was aggregated to the SIC level and reported separately by year. The size of the firm was categorized into two classes, large accounts were those greater than 7, 980 FTEs in aggregate over the study period and were considered small. Claims' incidence rates were calculated by year and are expressed as number of claims / 10,000 FTEs. Test for trend of incidence rates over time was performed. We used a Poisson regression model to test for evidence of a trend in claims' rates as a function of calendar year. The GENMOD procedure, with a Poisson distribution, was used to evaluate trends over time (using SAS Software Release 8.2, SAS Institute Inc. Cary, NC, USA). We used the following regression model:

$$\text{Ln}(\lambda_{year}) = \beta_0 + \beta_1 (\text{Year}) + \varepsilon$$

Here the λ_{year} is the injury rate for each year and the natural log transformation ensures that the model-based predictions of rates are constrained to be greater than or equal to zero. We estimated the annual percent decrease in injury rate by exponentiating

the coefficients from the fitted model. For example, the estimated coefficient of the accepted claim rate for needlestick injuries in health services (SIC 80) was 0.0568 with a standard error of 0.0153. The $e^{(0.0568)-1*100}$, translates into an annual increase of 5.8% in the accepted claims incidence rate over the study period.

To prioritize industry groups for intervention purposes, frequencies of claims within an industry group as well as the relative risk compared to all industries are important considerations. We combined the rank orders of both frequency and relative risk to create a "Prevention Index" (PI). PI = (Frequency Rank + Incidence Rank) / 2.[23]

Results:

A total of 74,758 workers' compensation claims were filed for work-related injuries and illnesses in health services industry (SIC 80) from January 1, 1996 to December 31, 2000. Of these 72,835 (97.4%) were accepted claims and the majority (52%) of claims were self-insured. Among the hospital (SIC 8062) claims, 96% were self-insured. Of the total accepted claims in health services (SIC 80) 2,962 (4.1%) met the criteria of a needlestick injury (NSI). The majority of the accepted NSI claims (93.2%) were State Fund claims. In this report we describe State Fund accepted claims only. None of the accepted claims was compensable (4 or more days of lost time from work). Fifty-nine cases were not needlestick injuries and were excluded from the analysis. A total of 656 claims out of 11,337 State Fund claims in SIC 8221 met the criteria of needlestick injury. There were 612 accepted claims from the two major State Fund teaching hospitals that were classified under education services (SIC 8221). When we reviewed these claims, 9 were not needlestick injuries. There were a total of 603 total

State Fund accepted needlestick injury claims for the two major State Fund teaching hospitals. Only one of the accepted claims was compensable (4 or more days of lost time from work). All of the accepted claims were closed within about two months after filing the claim, both in SIC 80 (mean 64 days) and teaching hospitals (mean 58 days). In a small number of cases (1.7%) this interval increased beyond one year in both SIC 80 and teaching hospitals.

Health care workers included in health care services (SIC 80) experienced an overall average workers' accepted claim rate of 67 claims/10,000 FTEs per year, with the rate increasing from 58 claims/10,000 FTEs in 1996 to 72 claims/10,000FTEs in 2000 (Figure 1). The NSI rate was higher (70.4 per 10,000 FTEs per year) in large health care facilities (> 7,980 FTEs) as compared to small health care facilities (NSI rate = 44.4 per 10,000 FTEs per year). The reported rate of NSI increased significantly over the study period and trend analysis showed an annual average increase of 5.84% (95% CI = 2.74%; 9.06%). Health care workers in the teaching hospitals experienced an average workers' accepted claim rate of 192 claims/10,000 FTEs per year, with the rate decreasing from 215 claims/10,000 FTEs in 1996 to 166 claims/10,000FTEs in 2000 (Figure 2). Trend analysis showed an annual average decrease of 5.56% (95% CI = -25.43%; 20.33%).

Table 3 shows demographic characteristics of the study population and the number and percentage of NSI by job category. In health care services (SIC 80) nurses accounted for the largest number of health care workers involved, with 770 (28%) needlesticks, followed by dental assistants, with 416 (15%), laboratory technicians, with 275 (10%) and medical assistants, with 267 (9%) incidents. These four job categories along with nursing aides and physicians accounted for the majority (78%) of needlestick

injuries. Technicians, dental hygienists and dentists sustained another significant proportion (10%) of needlestick injuries. A number of employees in health care industries who do not use needles and other sharps as part of their duties, such as support staff, also sustain needlestick injuries.

In teaching hospitals nurses (40%), followed by doctors (28%) sustained the majority (68%) of needlestick injuries. Laboratory workers, technicians and environmental staff comprised another major portion (17%) of needlestick injuries. Medical and nursing students were involved in small number of cases (0.8%).

Table 4 shows proportion of needlestick injuries each year compared to proportion of claims for other conditions in health care services (SIC 80). Some of the industry sectors such as offices and clinics of doctors (MDs) and dentists had sufficient number of needlestick injuries in each year to compare with all other accepted claims.

The number of accepted claims and the corresponding claims' rate in each of the health services industry groups (SIC 80) are presented in Table 5. The number of accepted claims for needlestick injury was the highest for general medical and surgical hospitals (158 per 10,000 FTEs), followed by offices and clinics of dentists (104 per 10,000 FTEs) and offices and clinics of doctors of medicine (87 per 10,000 FTEs). By the prevention index, the latter two workplaces had the first and second highest ranking. These two workplaces contributed to the majority (64%) of claims associated with needlestick injuries.

We also estimated the cost of needlestick injuries. A total cost of $777,978 was incurred due to needlestick injuries in health care services (SIC 80). The mean cost per claim was $310. For a small number of claims (n=45) that were closed after one year of

filing a claim, the mean cost increased to $505 (median $412). The total cost associated with needlestick injuries in the two teaching hospitals was $192,625. The mean cost was $340. In 8 cases the claim was closed after one year and but the mean cost was lower ($223) for these cases.

We also calculated the accepted claims rate for types of needlestick injuries in health services (SIC 80) as well as in the two teaching hospitals as shown in Table 6. In SIC 80, the highest rate of needlestick injuries was associated with improper disposal of used needles. It was followed by needlestick injuries associated with recapping of used needles. Almost 32% of all needlestick injuries were associated with improper disposal and recapping. Another small fraction of disposal related injuries involved housekeeping staff. The so-called "downstream injuries" occurred while handling trash and dirty linen. Another major proportion of injuries (39%) occurred while handling a patient, injecting medicine, blood drawing, suturing, doing a surgical procedure, injecting a local anesthetic, and due to unexpected movement of the patient during a procedure. Some needlestick injuries occurred where sharp devices were inadvertently left in inappropriate places after use such as on procedure tables. Collision with such instruments and bumping fellow workers were reported in 4.7% of injuries in our study. Cleaning procedure trays, cleaning and sterilizing instruments were reported for about 7.6% of needlestick injuries. In the teaching hospitals, the most common circumstances leading to needlestick injury included surgical procedure (15.3%), drawing blood (13.6%), injecting medicine (13.1%), collision (10.5%), suturing, improper disposal (8.1%), and recapping (7.6%). These types accounted for the majority (68%) of needlestick injuries.

The frequency of type of needlestick injury varied according the job category (Table 6). The most common procedure reported to cause such injury in each of the job categories also varied. Among physicians, most of injuries occurred while suturing or doing a surgical procedure. Nurses sustained a needlestick while disposing a used needle, injecting medicine, recapping a needle, and drawing blood. Dentists sustained needlesticks while recapping a needle or giving a local anesthesia, and their assistants received such NSIs while recapping a needle or cleaning an instrument. Sanitary staff received needlestick injuries while disposing of garbage in the majority of the cases.

Discussion:

Needlestick injuries continue to pose a significant risk to health care workers (HCWs). The risk of transmission of HIV after a percutaneous exposure has further added to the urgency of this matter. Assessment of such injuries, at work sites and among individuals in various job categories, is important in identifying specific risk factors for employees. To our knowledge, this is the first study to describe needlestick injuries among health care workers using workers' compensation data.

We report one of the lowest rates for needlestick injuries, both in small hospitals and other workplaces (SIC 80) as well as tertiary care and teaching hospitals. In this study data from the largest hospitals was excluded, as these were self-insured. Carefully designed hospital-based prospective studies of sharps injuries estimated an annual incidence rate of 60 to 187 per 1000 HCWs depending on the year of the study.[24] Parker et al. [25] note a percutaneous injury rate of 34 per 100 occupied beds for non-teaching hospitals for the year 1999. Data from the two major State Fund teaching hospitals estimates higher NSI rates, which might reflect better reporting of incidents. Data

limitations underestimate the actual burden of the problem. According to one estimate between 9% and 45% of workers suffering occupational illness file for workers' compensation benefits.[26] Azaroff et al.[27] details how work-related illness and injuries are underestimated in various occupational health surveillance data.

We noted a significant (P<0.000) increase in needlestick injuries over the study period in SIC 80. One might argue that there was a change in reporting due to increased publicity about the new laws. We compared the proportion of NSIs each year with that of total accepted claims for other conditions (Table 4). There are an increasing proportion of claims attributable to needlesticks in SIC 8011 Offices and Clinics of Doctors of Medicine and SIC 8021 Offices and Clinics of Dentists over the time period of the study (Table 4). This increase in needlesticks is relative to a decline in SIC 8062 General Medical and Surgical Hospitals. The availability and implementation of safer needle devices may differ between these SIC groups and thus explain the difference. However, the availability and subsequent implementation of protocols to identify high risk NSIs in general hospitals may result in a reduction of the number of lower risk NSIs resulting in workers' compensation claim filing. The relationship between each SIC group and the probability of claim filing to the workers' compensation system may differ.

McCormick et al.[24] noted a threefold increase in the annual incidence of needlestick injuries in his 14-year prospective study, which he attributes to better reporting and increased exposure. In the two major teaching hospitals there was a decrease in claims' rate but this decline was not significant (P<0.657). With implementation of new legislation on needle safety in Washington State, it is expected

that the actual burden of needlestick injuries will be better documented through maintenance of injury logs and reporting of all events.

Nurses ranked first, accounting for the largest number of needlestick injuries and our data accord with those of Jagger et al.[2] and McCormick et al.[24] McCormick et al. noted two thirds of all injuries in nursing personnel and EPInet reports 40% of such injuries among nurses (RN/LPN). One of the nurses who became HIV positive from a needlestick injury took a proactive approach to highlight the dangers among fellow nurses.[28] In our study dental assistants ranked 2nd among claims from SIC 80. Physicians including interns and residents occupied the 2nd rank among claims from the two teaching hospitals in accord with other studies carried out in large teaching hospitals in developed as well as developing countries.[2,24,29]

According to the Centers for Disease Control, health-care personnel were defined as persons (e.g., employees, students, contractors, attending clinicians, public-safety workers, or volunteers) whose activities involve contact with patients or with blood or other body fluids from patients in a health-care, laboratory, or public-safety setting.[30] Some managerial and support staff who do not use sharp items in their duties, but share the common environment, are also exposed to needlestick injuries in smaller proportions.

In SIC 80 health care personnel working in general medical and surgical hospitals reported the highest rate of needlestick injuries. By prevention index, health care workers who work in offices and clinics of physicians and dentists assumed the highest priority places for intervention. Large hospitals and hospitals affiliated with teaching institutions have been the focus of investigation and interventions in the majority of

studies. This study underscores the need to draw attention to small health care facilities such as offices of doctors and dentists as well.

Disposal of used needles followed by recapping of needles were the two most important activities when we compared the leading incidents among health care workers in SIC 80 in Washington State throughout the study period. This has great implications for prevention of needlestick injuries in the state. Jagger et al.[31] note that the majority of needlestick injuries occurred while preparing the devices for disposal or during or after disposal, and that one third of all injuries were related to the recapping of devices. It has been argued that there may be little difference in injury rates between health care workers recapping or not recapping needles and that it would cease to be an issue if satisfactory disposal systems were always present at the point of use.[32,33] Hatcher[34] reports the result of "a sharps container quality project" where a multidisciplinary committee reviewed sharps containers, piloted one, found problems, and then piloted and selected another and so on until the desired sharps container was identified. It resulted in a two-thirds reduction in the needlestick injury rate with cost savings of $62,000 per year to the center from prevented needlestick injuries. McCormick et al.[24] noted a two-fold decrease in needlestick injuries after making disposal units available at every bedside. In the two teaching hospitals the pattern was different. We noted a significant proportion (51%) of injuries occurring during a procedure such as injecting medication or drawing blood, performing a surgical procedure, and suturing. It might be due to physical intervention including introduction of recapping devices and availability of better disposal system and educational reinforcement whereby disposal and recapping related injuries decreased. The report of the Council on Scientific Affairs[35] notes that 38% of percutaneous injuries

occur during use and the introduction of safer needle devices, especially in combination with a comprehensive educational and training process, have resulted in significant decline in the incidence of needlestick injuries. Other frequently occurring hazardous activities include the sudden unexpected movement of a patient during a procedure, injury during assembly of needles or cleaning of trays, and collisions with people and instruments laying on the table or concealed in a piece of gauze. Educating the patient, assigning an assistant to help in restraining patients and putting needles in proper disposal boxes after use would eliminate some of these hazards. Some of the activities did not fall in any of the defined categories and we put these in an 'other' category. Some employees, for example, received needlestick injuries while looking for "lost documents in the bin" or "arranging a flower for the patient".

We studied the five leading incident types among the different health care workers. Surgical procedure and suturing were the top two activities for physicians and surgeons who sustained a needlestick injury. Recapping a needle and injecting a local anesthetic were priority activities for dentists while cleaning trays and instruments was one of the priority activities for dental hygienists and dental assistants. Housekeeping staff received the majority of injuries while disposing of garbage and other material. This suggests using different emphases when training employees for different occupations at risk.

The average cost incurred by NSI was low in our study as compared to cost identified from other studies. Jagger et al.[36] estimates an average cost of $405 for needlestick injuries. A single indicator such as direct cost does not capture all the dimensions of injury burden. Burden also includes indirect costs (often borne by the

worker and worker's family as well as the employer and community) such as lost productivity, increased absenteeism, higher employee turnover and recruitment of replacement workers. Needlestick injuries involve psychological morbidity. Fisman et al.[37] estimated the cost of such intangible factors as workers' anxiety and distress among health care workers who reported sharps-related injuries. The crude median amount subjects were willing to pay to avert injury was US $850 and when adjusted for patient risk status (HIV and hepatitis C) the amount increased to $1270. They suggest incorporating these costs into the economic analysis of sharps-injury prevention.

Limitations:

Studies have shown significant under-reporting of needlestick injuries and some of the reasons for under-reporting include lack of awareness of the need to report the injury, the perception that it is not worth reporting, and that the process of reporting is inconvenient and time consuming.[38,39] The problem is further compounded when workers apply for workers' compensation coverage and the definition of an occupational disease may restrict whether the affected qualifies for benefits.[40]

Although the majority of all accepted claims were among the Self-Insured in health care services (SIC 80), only a small fraction of those met our definition of needlestick injuries because only Self-Insured claims resulting in four or more days of lost time (compensable claims) are fully coded in the LINIIS system.

There are several potential limitations to using workers' compensation data to describe the injury and illness rate within a particular industry or risk class. Workers' compensation data may under-report the true number of injuries in this industry since

both a worker and physician must recognize his or her condition as work-related and file a claim with the Washington State Department of Labor and Industries. The worker must also satisfy the state criteria for eligibility to have an injury accepted by the Washington workers' compensation system.[41] We describe the injury rate as a measure of incidence, with claims as the numerator and hours of work as the denominator. If significant numbers of work-related injuries or illness were not reported to the workers' compensation system (e.g., on-site medical care, failure to report) the injury rate presented here would be underestimated. Since SIC 80 injury rates are based on employer reported hours, potential bias in rate estimates could occur if employers over-report or under- report the number of hours worked by their employees.

The case definition of a needlestick injury is sensitive to the ANSI z16.2 coding for type, source and nature of injury claims. Some of the needlestick injury incidents may not have been identified due to coding inconsistencies leading to an underestimation of the number of identified incidents.

We used the workers' description of the event in the workers'compensation report form to define types of needlestick injuries, and we noted that in some of State Fund claims there was no complete description of the incident. The report was limited to sentences like 'it was an accident' or 'got needlestick injury'. We were unable to ascertain the occupation of the involved person in many cases. We were unable to identify specific devices or source patient status with respect to infectious diseases of intent.

Conclusion:

In summary, the burden of the problem we identified could be just the tip of the iceberg and the keeping of a needlestick injury log as required under the new OSHA standards in health care facilities might help us to further clarify the extent of the problem. The Washington State Bloodborne Pathogens and Recordkeeping rules require employers to document needlestick injuries. Understanding the occurrence of needlestick injuries in the target population is critical to implementation of control measures. This study allowed identification of employees at highest risk of exposure, namely nurses and dental assistants, and the locations where the highest number of injuries occur and the major activities leading to these injuries over a range of years.

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Table 1. Types of needlestick injuries based on employee's statement of the event

Type	Statement of the accident
1) Recapping	'Poked right thumb while recapping needle'
	'While recapping needle tip broke through the plastic hub'
	'While trying to remove used needle from syringe the cap dislodged and I poked it into my right palm'
2) Disposing	'Putting used needle in sharps container needle bounced back poking me in the hand'
	'Changed butterfly and placed in sharps container butterfly coiled back and caused dirty needlestick'
	'I was putting needle in sharps container and another needle from inside the container popped out and stuck my right thumb'
3) Injecting medicine	'I was giving an immunization and after pulling out the needle poked my left pinky finger'
	'Employee was giving a patient a shot and it went through the patients skin into her finger'
4) Drawing blood	'While drawing patients' blood the needle slipped forcefully from her vein and stuck my left finger'
	'Puncture from needle while doing blood draw'
5) Patient movement	'Unexpected patient movement caused me to prick left index finger'
	'Flushing IV line patient jerked and I was poked'
6) Cleaning Trays/instruments	'I was cleaning instruments in the sterilization room and the cover to the needle came off and I was stuck with a contaminated needle'
	'Dental assistant was cleaning a tray when a needle that was used on a patient accidentally stuck in right middle finger'
7) Assembling / preparing	'Pricked finger while grabbing syringe'
	'While loading a needle onto a needle holder the needle turned and poked my thumb'
8) An accident	'It was an accident' no other details
9) Suturing	'Sewing up a wound of a patient stuck myself with the needle'
10) Injecting local anesthetic	'Needlestick to finger while injecting local anesthesia'
11) Surgical procedure	'Stuck middle finger with needle during C section'
12) Other	'Planting flower for a patient and poked by a used needle'
	'Injured by a used needle while searching lost documents in the bin'
13) Garbage disposal	'Picked garbage sack up uncapped needle in sack poked'
	'Was working with soiled linen and poked by dirty needle'
14) Collision with workers /instruments	'I had just given a heparin injection when another resident bumped into me causing me needlestick'
	'A used needle left in a cotton ball pricked my palm'
15) Lancet	'Removing lancet from auto let after blood sugar test and got needlestick'

Table 2. Job Category by Occupational Class Code (CLMOCCPN) and Standard Occupational Classification (SOC2K).

Job Category	CLMOCCPN	SOC2K
Physician & Surgeon	084, 087	291061,291062, 291064, 291069, 291065
Nurse	095, 207	292061, 291111
Dentist	085	291021, 291022, 291029
Dental Hygienists	204	292021
Dental Assistants	445	319091
Laboratory Technicians	203	292012, 519081
Nursing Aides	447	311012, 311011
Medical Assistants	106, 446	291071, 319092,
Technicians & Technologists	205, 206, 208, 223, 224 225, 235, 889, 678	292032, 292034, 292055, 292099
Therapist	098, 103, 105	291122, 291124
Managerial Staff	015, 019, 020	119111, 119199
Support Staff	174, 175, 243, 303, 313 319, 327, 336, 357, 365 373, 379, 389, 467, 469	434071, 434171, 435021, 435081, 439061
Environmental & House keeping	449, 453, 748	372011, 372012, 516011
All Other	All other	All other
Occupation not reported	999	999
Non-Classifiable	999999	999999

Table 3. Characteristic of the Health Care Workers with Needlestick Injury, Washington State, 1996-2000

Characteristic	SIC 80 (n = 2,700) N (%)	State Fund 2 Major Teaching (SIC 8221) Hospitals (n = 603) N (%)
Gender		
Female	2,238 (82.9)	410 (67.9)
Male	462 (17.1)	193 (32.1)
Marital status		
Married	1,392 (51.6)	264 (43.8)
Unmarried	1,308 (48.4)	339 (56.2)
Age*, y		
< 26	473 (17.9)	49 (08.4)
26-35	765 (29.1)	240 (41.3)
36-45	800 (30.4)	164 (28.3)
46-55	486 (18.5)	100 (17.2)
> 55	108 (04.1)	28 (04.8)
Occupation/Job category		
Nurse	770 (28.5)	239 (39.6)
Dental Assistant	416 (15.4)	8 (01.3)
Lab Technician	275 (10.2)	34 (05.6)
Medical Assistant	267 (09.9)	7 (01.2)
Nursing Aides	228 (08.4)	4 (00.7)
Physician (MD)	220 (08.2)	171 (28.4)
Technicians	120 (04.4)	37 (06.1)
Dental Hygienist	102 (03.8)	0
Dentists	54 (02.0)	7 (01.2)
Support Staff	46 (01.7)	11 (01.8)
Housekeeper/laundry worker	34 (01.3)	33 (05.5)
Managerial staff	29 (01.1)	7 (01.2)
Therapist	11 (00.4)	5 (00.8)
Other	45 (01.7)	5 (00.8)
Occupation not reported	64 (02.4)	30 (04.8)
Occupation non-Classifiable	19 (00.7)	0
Students (Medical/Nursing)	0	5 (00.8)

*Number in this category did not add to total due to missing observations.

Table 4. Proportion (%) of Total and Needlestick Injury (NSI) State Fund Accepted Claims by SIC and Year
Washington State, 1996-2000 (# NSI>25)

SIC_DESCRIPTION	Year 1996 Tot	NSI	Year 1997 Tot	NSI	Year 1998 Tot	NSI	Year 1999 Tot	NSI	Year 2000 Tot	NSI	Year 1996-2000 Total	NSI
8011 Offices and Clinics of Doctors of Medicine	16.9	15.9	18.6	19.0	20.1	19.8	22.4	22.3	21.9	22.9	5,097	1,135
8021 Offices and Clinics of Dentists	16.6	13.1	17.5	14.4	21.3	22.1	22.2	25.1	22.3	25.6	2,417	593
8062 General Medical and Surgical Hospitals	22.2	22.6	20.9	23.4	22.8	25.0	18.7	16.1	15.3	12.9	887	124
8071 Medical Laboratories	20.4	19.9	21.6	19.9	18.3	19.9	16.6	17.5	22.0	22.8	799	166
8051 Skilled Nursing Care Facilities	24.1	19.3	21.6	18.7	19.6	19.0	18.3	22.3	16.4	20.6	13,430	368
8082 Home Health Care Services	23.2	23.4	19.2	18.7	19.4	31.3	17.9	14.1	20.2	12.5	1,636	64
8059 Nursing and Personal Care Facilities, NEC	19.4	10.5	22.8	31.6	18.0	12.3	18.9	31.6	20.8	14.0	2,565	57
8099 Health & Allied Services	16.9	3.8	20.1	23.1	18.0	15.4	20.5	30.8	24.4	26.9	283	26
8049 Offices and Clinics of Health Practitioners	18.9	6.4	21.8	31.9	20.1	27.7	15.4	14.9	23.7	19.5	682	47
8063 Psychiatric Hospitals	19.8	17.5	21.5	17.5	22.1	22.5	19.0	25.0	17.6	17.5	2,852	40
8093 Specialty Outpatient Facilities	15.5	21.3	18.4	4.3	21.0	17.0	20.9	23.4	24.1	34.3	832	47

Comment [db1]: This table is not intuitive; you may want to present the rate for non-nsi claims and rate for nsi claims and test for a difference in trend/slope. Of course we are limited by too few data points…
You also might consider restricting to nsi claims > 100; there is too much variability with too few claims.

Table 5. Prevention Index Ranking of Health Services Classes (SIC 80), Washington State, 1996-2000

SIC_DESCRIPTION	HOURS	COUNT	AVG. ANNUAL RATE Per 10,000 FTEs (95% CI)	COUNT RANK	RATE RANK	PREV INDEX
8011 Offices and Clinics of Doctors of Medicine	261,037,511	1,135	87.0 (75.9,97.4)	1.0	3.0	2.0
8021 Offices and Clinics of Dentists	113,292,720	593	104.7 (70.5,136.7)	2.0	2.0	2.0
8062 General Medical and Surgical Hospitals	15,639,238	124	158.6 (103.4,216.2)	5.0	1.0	3.0
8071 Medical Laboratories	41,080,058	166	80.8 (70.0,92.3)	4.0	4.0	4.0
8051 Skilled Nursing Care Facilities	132,830,673	368	55.4 (45.8,66.0)	3.0	6.0	4.5
8082 Home Health Care Services	34,434,300	64	37.2 (17.7,58.4)	6.0	10.0	8.0
8059 Nursing and Personal Care Facilities, NEC	30,658,977	57	37.2 (17.7,75.8)	7.0	9.0	8.0
8099 Health & Allied Services	12,030,267	26	43.2 (14.8,70.2)	11.0	7.0	9.0
8092 Kidney Dialysis Centers	1,833,107	6	65.5 (-23.7,155.2)	13.5	5.0	9.3
8052 Intermediate Care Facilities	3,702,960	8	43.2 (-81.5,240.9)	12.0	8.0	10.0
8049 Offices and Clinics of Health Practioners	35,653,413	47	26.4 (9.2,43.2)	8.5	12.0	10.3
8063 Psychiatric Hospitals	25,302,129	40	31.6 (24.1,39.4)	10.0	11.0	10.5
8093 Speciality Outpatient Facilities	38,951,834	47	24.1(8.3,39.6)	8.5	13.0	10.8
8072 Dental Laboratories	9,347,544	6	12.8 (-16.1,42.5)	13.5	16.0	14.8
8031 Offices and Clinics of Doctors of Osteopathy	1,875,594	2	21.3 (-38.6,81.5)	18.5	14.0	16.3
8069 Specialty Hospitals	5,883,294	3	10.2 (-8.6,28.7)	16.0	17.0	16.5
8043 Office and Clinics of Podiatrists	2,330,717	2	17.2 (-31.9,67.9)	18.5	15.0	16.8
8041 Offices and Clinics of Chiropractors	14,684,230	3	4.1 (-3.3,10.5)	16.0	18.0	17.0
8042 Office and Clinics of Optometrists	15,961,566	3	3.8 (-3.1,10.5)	16.0	19.0	17.5

Table 6. Circumstances of Needlestick Injury (NSI) Among Health Care Workers Washington State

NSI	Rate (per 10,000 FTE per year)			
	SIC 80	State Fund 2 Major Teaching Hospitals		
Total	N (%)	Overall Rate	N (%)	Overall Rate
Improper disposal	506 (18.7)	12.7	49 (8.1)	17.1
Recapping	366 (13.6)	9.2	46 (7.6)	16.1
Injecting medicines	256 (9.5)	6.4	79 (13.1)	27.6
Drawing blood	298 (11.0)	7.5	82 (13.6)	28.7
Unexpected patient movment	161 (5.9)	4.0	6 (1.0)	2.1
Cleaning trays, instruments	199 (7.4)	5.0	15 (2.5)	5.2
Preparing, assembling needle	116 (4.3)	2.9	25 (4.2)	8.7
Suturing	116 (4.3)	2.9	55 (9.1)	19.2
Injecting local anesthetics	86 (3.2)	2.2	15 (2.5)	5.2
Doing surgical procedures	139 (5.1)	3.5	92 (15.3)	32.2
Garbage disposal, And handling dirty linens	71 (2.6)	1.8	31 (5.1)	10.8
Collision, bumping	127 (4.7)	3.2	63 (10.5)	22.0
Lancet	58 (2.1)	1.5	7 (1.2)	2.4
Other	89 (3.3)	2.2	2 (0.3)	0.7
No details mentioned	112 (4.1)	2.8	36 (10.5)	12.6
Total needlestick injuries	2,700		603	

Table 7. Five Most Frequent Procedures of Needstick Injury by Job Category, Washington State, 1996-2000

Job Category	Circumstances	Health Services (SIC 80) N (%)	State Fund 2 Major Teaching Hospitals (SIC 8221) Circumstances	N (%)
Physician/Surgeon				
1)	Surgical procedure	74 (33.6)	Surgical procedure	81 (47.4)
2)	Suturing	61 (27.6)	Suturing	37 (21.6)
3)	Blood drawing	14 (06.4)	Collision	11 (06.4)
4)	Injecting a local anesthetic	14 (06.4)	Injecting medicine	8 (04.7)
5)	An accident, no details given	11 (05.1)	An accident, no details given	8 (04.7)
All other		46 (20.9)	All other	26 (15.2)
Nurse				
1)	Improper disposal of used needle	190 (24.7)	Injecting medicine	59 (24.7)
2)	Injecting medicine	143 (18.6)	Blood drawing	46 (19.3)
3)	Re-capping a needle	85 (11.0)	Re-capping a needle	25 (10.5)
4)	Blood drawing	80 (10.4)	Improper disposal of used needle	24 (10.0)
5)	Un-expected patient movement	58 (07.5)	Collision	21 (08.8)
All other		214 (27.8)	All other	64 (26.8)
Dentist				
1)	Re-capping a needle	14 (25.9)	Suturing	3 (42.9)
2)	Injecting a local anesthetic	13 (24.1)	Injecting a local anesthetic	2 (28.5)
3)	Surgical procedure	6 (11.1)	Surgical procedure	1 (14.3)
4)	Injecting medicine	5 (09.3)	An accident, no details given	1 (14.3)
5)	An accident, no details given	4 (07.4)		
All other		12 (22.2)		
Dental Higenist			Non	
1)	Re-capping a needle	27 (26.5)		
2)	Injecting a local anesthetic	21 (20.6)		
3)	Cleaning trays/instruments	16 (15.7)		
4)	Injecting medicine	11 (10.8)		
5)	Assembling needles	9 (08.8)		
All other		18 (17.6)		

Table 7 (continued). Five Most Frequent Procedures of Needstick Injury by Job Category, Washington State, 1996-2000

Job Category	Circumstances	Health Services (SIC 80) N (%)	State Fund 2 Major Teaching Hospitals (SIC 8221) Circumstances	N (%)
Dental Assistant				
1)	Re-capping a needle	136 (32.7)	Re-capping a needle	3 (37.5)
2)	Cleaning trays/instruments	97 (23.3)	Cleaning trays/instruments	2 (25.0)
3)	Improper disposal of used needle	38 (09.1)	Assembling needles	2 (25.0)
4)	Collision	28 (06.7)	An accident, no details given	1 (12.5)
5)	Assembling needles	24 (05.8)		
All other		93 (22.4)		
Laboratory Technicians				
1)	Blood drawing	96 (34.9)	Blood drawing	17 (50.0)
2)	Improper disposal of used needle	89 (32.4)	Improper disposal of used needle	9 (26.4)
3)	Un-expected patient movement	34 (12.4)	Collision	2 (05.9)
4)	Re-capping a needle	20 (07.3)	Re-capping a needle	2 (05.9)
5)	Assembling needles	7 (02.6)	Assembling needles	2 (05.9)
All other		29 (10.4)	All other	2 (05.9)
Nursing Aides				
1)	Improper disposal of used needle	48 (21.1)	Injecting medicine	1 (25.0)
2)	Blood drawing	26 (11.4)	Assembling needles	1 (25.0)
3)	Injecting medicine	22 (09.7)	Collision	1 (25.0)
4)	Collision	18 (07.9)	Other	1 (25.0)
5)	Un-expected patient movement	16 (07.0)	-	
All other		98 (42.9)	-	
Medical Assistant				
1)	Improper disposal of used needle	65 (24.3)	Improper disposal of used needle	2 (28.6)
2)	Injecting medicine	29 (10.9)	Cleaning trays/instruments	2 (28.6)
3)	Blood drawing	29 (10.9)	Injecting medicine	1 (14.3)
4)	Re-capping a needle	27 (10.1)	Injecting medicine	1 (14.3)
5)	Unexpected patient movement	28 (08.2)	Suturing	1 (14.3)
All other		95 (35.6)		

Table 7 (continued). Five Most Frequent Procedures of Needstick Injury by Job Category, Washington State, 1996-2000

Job Category	Circumstances	Health Services (SIC 80) N (%)	State Fund 2 Major Teaching Hospitals (SIC 8221) Circumstances	N (%)
Technician/Technologist				
1)	Improper disposal of used needle	23 (19.1)	Collision	13 (35.1)
2)	Blood drawing	21 (17.5)	Blood drawing	8 (21.6)
3)	Re-capping a needle	15 (12.5)	Improper disposal of used needle	5 (13.5)
4)	Cleaning trays, instruments	11 (09.2)	Re-capping a needle	4 (10.8)
5)	Injecting medicine	8 (06.7)	Surgical procedure	2 (05.4)
All other		42 (35.0)	All other	5 (13.5)
Therapist				
1)	Blood drawing	3 (27.3)	Collision	2 (40.0)
2)	Collision	2 (18.2)	Injecting medicine	1 (20.0)
3)	Injecting medicine	1 (09.1)	Re-capping a needle	1 (20.0)
4)	Un-expected patient movement	1 (09.1)	Suturing	1 (20.0)
5)	Cleaning trays, instruments	1 (09.1)		
All other		3 (27.2)		
Managerial Staff				
1)	Improper disposal of used needle	4 (13.8)	Surgical procedure	3 (42.9)
2)	Blood drawing	4 (13.8)	Collision	2 (28.5)
3)	Assembling needles	3 (10.3)	Injecting medicine	1 (14.3)
4)	Other	3 (10.3)	Accident, no details	1 (14.3)
5)	Accident, no details	3 (10.3)		
All other		12 (41.5)		
Support Staff				
1)	Improper disposal of used needle	9 (19.6)	Collision	5 (45.4)
2)	Re-capping a needle	7 (15.2)	Improper disposal of used needle	1 (09.1)
3)	Blood drawing	5 (10.9)	Blood drawing	1 (09.1)
4)	Assembling needles	5 (10.9)	Assembling needles	1 (09.1)
5)	Un-expected patient movement	3 (06.4)	Cleaning trays, instruments	1 (09.1)
All other		17 (37.0)	All other	2 (18.2)
Sanitory Staff				
1)	Garbage disposal	25 (73.6)	Garbage disposal	29 (87.9)
2)	Improper disposal	3 (08.8)	Improper disposal	3 (09.1)
3)	Assembling needles	3 (08.8)	Collision	1 (03.0)

4)	Lancet	3 (08.8)

Figure 1. State Fund Accepted Claims Incident Rate for Needlestick Injuries (n = 2700) Among Health Care Workers (SIC 80), Washington State, 1996-2000

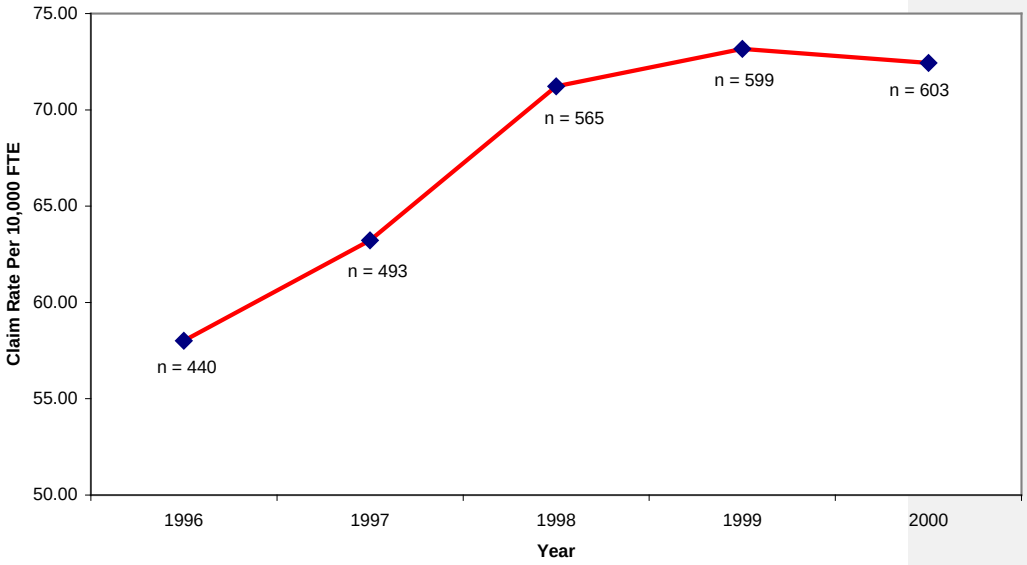

Figure 2. State Fund Accepted Claims Incident Rate for Needlestick Injuries (n=603) Among Health Care Workers, Two Major State Fund Teaching Hospitals (SIC8221), Washington State, 1996-2000