Contaminated Sharps Injuries Among Healthcare Workers in Texas: 2009

TEXAS Department of State Health Services

Rick Perry, Governor

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Background

Public Health Significance

The transmission of bloodborne pathogens through contaminated sharps injuries represents a significant public health issue (Moran 2000; Centers for Disease Control and Prevention 2008). It is estimated that close to 385,000 of these injuries occur annually in the United States (US) in hospitals alone, and medical services rendered outside of hospitals are thought to account for significantly more (Centers for Disease Control and Prevention 2008). Many pathogens may be transmitted through blood and other potentially infectious materials in healthcare settings. Among these are three pathogens, the hepatitis B and C viruses (HBV, HCV) and the Human Immunodeficiency Virus (HIV), that receive the most attention (Sepkowitz 1996). Costs associated with exposure incidents such as lab tests, evaluations, immediate and long-term treatments, employee time lost, and anxiety of exposed workers represent a mostly preventable burden on healthcare systems. An investigation of exposure costs in which four hospitals were presented with hypothetical exposure scenarios revealed costs as high as $3,042 per incident; even when sources were determined not to have any infection, hospitals still spent $376 per incident on testing (O'Malley 2007). These figures suggest that contaminated sharps injuries impose an annual financial burden on healthcare systems across the country of anywhere between 145 million and 1.17 billion dollars.

History of Prevention Oriented Regulation

With exposure associated expenses and the health risks to providers and patients in mind, federal and state regulators and professional organizations sought to reduce the rate of injuries involving contaminated body fluids and other potentially infectious materials. The Centers for Disease Control and Prevention (CDC) released a "Guideline for Isolation Precautions in Hospitals" in 1983 that urged caution when interacting with patients infected with bloodborne pathogens (Garner 1983). In 1987, the CDC extended its recommendations and urged caution when interacting with any patient, regardless of if they harbored a transmissible disease (Centers for Disease Control and Prevention

1987). Four years later the Occupational Safety and Health Administration (OSHA) developed its own regulations that required employee education and training on bloodborne pathogen precautions, safety practices, and compliance measures (Occupational Safety and Health Administration 2011). Following passage of the federal “Needlestick Prevention and Safety Act of 2000”, OSHA updated its bloodborne pathogen standard to mandate the implementation of safety-engineered devices when appropriate and the reporting of contaminated sharps injuries (Occupational Safety and Health Administration 2001).

Policy Implementation and Reporting

At present, 25 states subscribe to OSHA’s safety regulations. Facilities that operate within these states are eligible for up to 50% of the costs associated with the implementation of their safety plans (Occupational Safety and Health Administration 2010). Texas is not an OSHA state. This means privately funded facilities in Texas are covered by OSHA while governmental entities, such as publicly funded hospitals and clinics, are not. Texas has instead adopted, by statute, regulation to cover these facilities that mirrors OSHA’s standard, notably implementation of safe workplace practices, use of safety engineered devices, exposure protocols, and reporting measures (Texas Administrative Code 2006; Texas Department of State Health Services 2011). Public health policy in Texas is carried out through local and regional health departments (Texas Department of State Health Services 2011). Texas is divided into 11 public health regions and eight administrative regions. When a blood exposure incident occurs, the chief administrative officer of a covered facility is required to submit a “contaminated sharps injury report form” to the local health authority, or the Department of State Health Services (DSHS) regional office if no local authority exists. After a review for completeness, the form is sent to the DSHS Infectious Disease Control Unit (IDCU) in Austin where it is compiled with other injury reports. Finally the reports are analyzed to better understand the factors surrounding sharps injuries and develop more effective prevention measures (Texas Administrative Code 2006).

Culture Surrounding Sharps Injuries

Injury induced transmission of bloodborne pathogens in hospitals and clinics is a serious risk faced by healthcare professionals. Transmission of infections from patients to doctors, nurses, and technicians through accidental injuries is well documented (Centers for Disease Control and Prevention 2008). Reporting of the exposure circumstances not only provides valuable data to those concerned with improving healthcare safety through policy, but also is critical in settling insurance claims and workman's compensation. Reporting of exposures to potentially infectious materials is mandated both by OSHA's bloodborne pathogen standard and the analogous chapter of the Texas Administrative Code (Texas Administrative Code 2006; Occupational Safety and Health Administration 2011). Despite explicit regulations, the potential to contract serious diseases, and forfeiture of insurance and worker's compensations in the event of infection, many healthcare workers choose not to report contaminated sharps injuries (Doebbeling 2003; Elmiyeh 2004; Makary 2007). One survey of healthcare workers in a general hospital revealed that 49% of those that had experienced sharps injuries failed to report at least one incident (Elmiyeh 2004). Another study, a statewide survey of Iowa's healthcare workers, observed rates of non-reporting among physicians as high as 62% (Doebbeling 2003). A perceived low risk of transmission and being too busy to report were most often cited as the reasons injuries were not formally reported (Elmiyeh 2004). Physicians and those that experience frequent injuries were less likely to report than other healthcare personnel or those that experience injuries less frequently (Doebbeling 2003).

Safety Engineered Devices

One approach to reducing the incidence of sharps injuries is the use of safety-engineered devices. Included among these are retractable hypodermic needles, single-use, pre-filled cartridge syringes, shielded needles, disposable scalpels, and blunt-tip suture needles (The University of Virginia Health System 2003). Implementation of these safer devices was encouraged by passage of the "Needle Stick Safety and Prevention Act", which mandated usage of safer sharps when appropriate (Occupational Safety and Health Administration 2001). A retrospective study examining injuries associated with IV catheters 18 months prior to and following implementation of a safety engineered IV system reported a linear decrease in the rate of associated injuries from 1.9 to 0.2 injuries per 1,000 healthcare workers (Azar-Cavanagh 2007).

Exposure Control Plans

OSHA regulations dictate implementation of a “bloodborne pathogens exposure control plan” in any facility in which there is potential for exposures. There is some flexibility within individual plans, but they are all required to adhere to certain standards and include specific elements. These include, 1) identification of occupations and activities that present risks of exposure, 2) establishing work environments and practices that limit risks to exposure, i.e. includes availability of hand washing stations, sharps disposal bins, and appropriate labeling of specimens and containers, 3) provision of appropriate personal protective equipment to those at risk, at no cost, 4) maintaining a clean work environment, 5) disposing of wastes appropriately, 6) laundering or disposing of soiled garments, 7) making hepatitis B vaccine available to those at risk at no charge, and 8) having a post exposure protocol when occupational exposures do occur (Occupational Safety and Health Administration 2001; Occupational Safety and Health Administration 2003). The post exposure protocol must include source testing when possible, drawing of blood from the exposed to act as a base line, a physician consultation to evaluate risk, a physician opinion, and post exposure prophylactics when appropriate (Occupational Safety and Health Administration 2011). While Texas has opted out of formal OSHA participation and regulation, Texas’ model exposure control plan is explicitly designed to be analogous to that set forth by OSHA. All of OSHA’s precaution standards and key elements are present in Texas’ plan (Texas Administrative Code 2006; Texas Department of State Health Services 2011).

Bloodborne Pathogens of Concern

Many bloodborne pathogens have been implicated in occupationally acquired infections in healthcare personnel; three of the most prominent are HBV, HCV, and HIV (Sepkowitz 1996).

HBV

Globally, the World Health Organization (WHO) estimates that 350 million persons currently living with a chronic hepatitis B infection (World Health Organization 2008). The CDC reports that persons in the US account for 800,000 to 1,400,000 of these infections (Centers for Disease Control and Prevention 2009). Main routes of HBV transmission are through intravenous needle use, sexual activity, and less often perinatally from mother to child (Levinson 2008). Most of those infected with HBV spontaneously clear the virus on their own, though five percent of those with HBV sustain chronic infections and find themselves at risk for liver damage, cirrhosis, and hepatocellular carcinoma (Levinson 2008). Symptoms of acute HBV infection include fever, anorexia, nausea, jaundice, dark urine, pale feces, and high transaminase levels. Hepatitis B virus is extremely transmissible through blood; it has a seroconversion rate of 37-62% in persons exposed via percutaneous injury (Centers for Disease Control and Prevention 2001). In the event of an HBV exposure, persons are administered hyperimmunoglobulin (high titer, hepatitis B virus surface antigen antibody) and the HBV vaccine in order to confer passive and active immunity respectively. Alpha interferon and antivirals have been shown to mitigate chronic infections by slowing replication, however they do not always cure the disease (Levinson 2008). Currently extremely effective HBV vaccines are available, and both OSHA and Texas' Administrative Code mandate that they be made available to healthcare workers at no cost throughout employment (Texas Administrative Code 2006; Occupational Safety and Health Administration 2011).

HCV

According to the WHO, 130-170 million persons are chronically infected with hepatitis C virus worldwide (World Health Organization 2011). The CDC estimates that 3.2 million persons in the US live with chronic HCV infections (Centers for Disease Control and Prevention 2009). The main route of transmission in the US is injection drug use. Less often HCV is spread sexually, perinatally, through blood transfusions, and in accidental needle stick injuries. Unlike HBV, HCV infection is much more likely to result in chronic hepatitis; approximately 75% of those infected experience disease for at least a year (Levinson 2008). As with hepatitis B infections, chronic hepatitis C increases the risk of liver damage, cirrhosis, and hepatocellular carcinoma (Bouchard 2011). Symptoms of acute HCV infection are jaundice, fever, nausea, fatigue, and vomiting, though many will not present with any overt symptoms. Percutaneous injury sustained by a sharp contaminated with HCV results in seroconversion in 1.8% of incidences (Centers for Disease Control and Prevention 2001). For those exposed to the virus, alpha interferon effectively reduces the chances of developing chronic hepatitis. However, overall treatment options for those with chronic HCV infections are limited. Currently there is no post exposure prophylaxis protocol for HCV exposures. Those with chronic hepatitis C are encouraged to monitor their disease and receive sonograms regularly to detect development of hepatomas early. There is no effective HCV vaccine available.

HIV

Thirty-four million persons are infected with HIV globally (World Health Organization 2011). In the US it is estimated that 1.2 million are currently infected; in 490,000 persons the infection has progressed to AIDS (Centers for Disease Control and Prevention 2011). The main routes of transmission for the virus are through sexual contact, injection drug use, and perinatally from mother to child (Levinson 2008). Acute HIV infection presents with a fever, lethargy, rash of the arms, legs, and trunk, and swollen lymph nodes. Progression of HIV infection to AIDS results in compromised host immunity and frequent and severe secondary opportunistic infections. In occupational healthcare exposures, the rates of transmission in mucocutaneous, non-intact skin, and percutaneous exposures are 0.1%, <0.1%, and 0.3%, respectively (Centers for Disease Control and Prevention 2008). Combinations of antiretroviral drugs designed to inhibit viral replication are effective at reducing viral loads in the body, however there is no cure for AIDS. There is currently no vaccine for HIV (Levinson 2008).

Purpose of Study

The purpose of this study was to analyze and describe contaminated sharps injury data reported to DSHS in 2009. By identifying what occupations are at risk, locations where injuries occur, what devices are involved, and what precaution standards were in place, recommendations can be made to reduce the incidence of contaminated sharps injuries among healthcare workers in Texas.

Methods

Study Population

Data for this study were gathered from “contaminated sharps injury report” forms submitted to DSHS by publicly funded healthcare facilities across the state in 2009. As described in Texas Administrative Code Title 25, Part I, Chapter 96, Rule 101, individuals that sustained contaminated sharps injuries were required to report incidents to their facility’s chief administrative officer. The officer then completed one of two available Contaminated Sharps Injury Report forms and forwarded these forms to their local health authority who finally submitted the forms to the state health department where they were compiled and analyzed.

An incident is considered reportable if a percutaneous injury occurred from a sharp that was contaminated or possibly contaminated with blood or other potentially infectious materials. An injury is considered occupational if it was sustained by an employee while performing work related duties or on location at the work site.

A total of 1,259 occupational sharps injury reports were submitted for the year of 2009. Uncontaminated sharps injuries that occurred before the sharp was used for its intended purpose are not included. Such an incident does not pose a bloodborne pathogen transmission risk. Eleven forms were excluded for having at least 10 questions unanswered. Six forms were excluded for not including the date of the exposure incident and one was excluded for reporting a non-sharps injury. The final sample consisted of 1,241 sharps injury events.

Diverse sharps are represented in this study including disposable syringes, suture needles, surgical scalpels, surgical drills, and glassware items such as capillary tubes, flasks, and laboratory slides. Individual occupations of the injured healthcare workers include, but are not limited to registered nurses, attending physicians, housekeeping staff, school nurses, medical students, and various types of medical technicians.

Data Analysis

Descriptive statistics, counts and percentages, were used to characterize the responses to each question. Variables examined included geographic, temporal, gender and age distributions in addition to the type of sharps Involved.

Data Highlights

Where and when did injuries occur?

The distribution of all 2009 contaminated sharps injuries by public health region is displayed in Figure 1. Contaminated sharps injuries reportedly occurred most often in public health region 3, which accounted for 34% of all injuries and region 6, which accounted for 31% of all injuries.

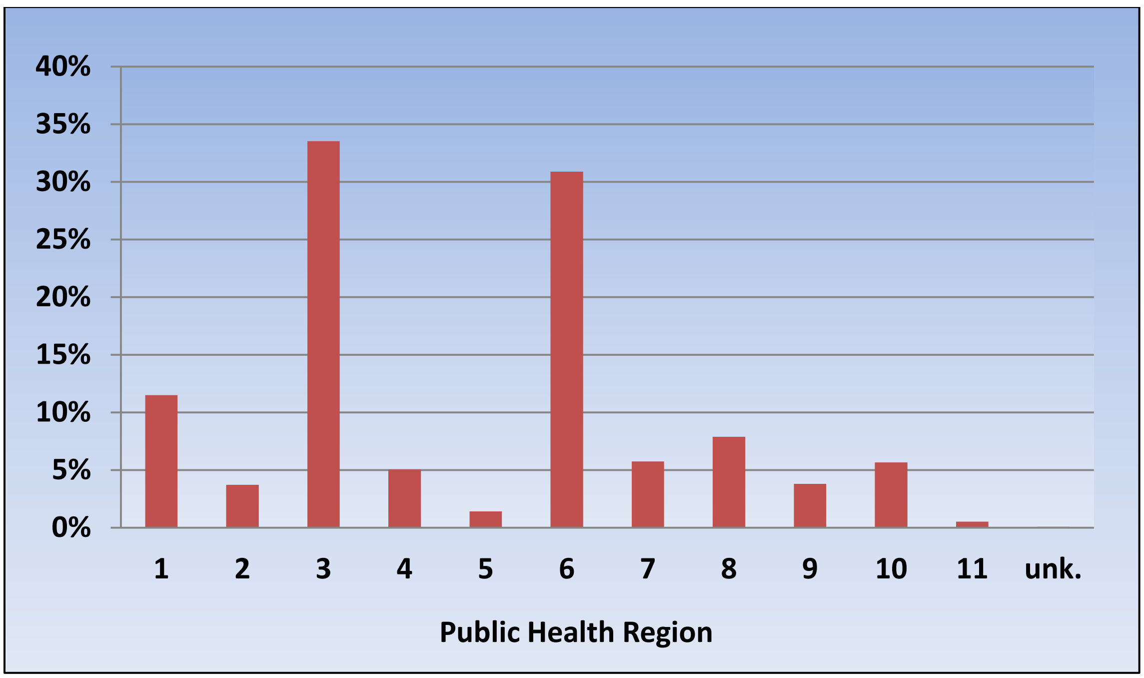

Figure 1Distribution of contaminated sharps injuries by public health region in which they occurred

Regions 3 and 6 encompass Texas' two largest cities, Dallas and Houston respectively. Table 1 presents the distribution of injuries broken down by facility type. Of the reported injuries, 80.8% came from hospitals. The remaining 19.2% occurred within one of the other 12 facility types listed as answer choices on reporting forms.

Facility	Number	Percent
Hospital	1003	80.8%
Clinic	72	5.8%
Correctional Facilities	46	3.7%
Other/Unknown	38	3.1%
School/College	20	1.6%
EMS/Fire/Police	15	1.2%
All others	47	3.8%
Total	1241	100.0%

Table 1Contaminated sharps injuries by facility type in which they occurred

Figure 2 shows the distribution of injuries by when they were reported to have occurred. Almost one half of all injuries, 45%, were sustained between the hours of 7am and 2pm.

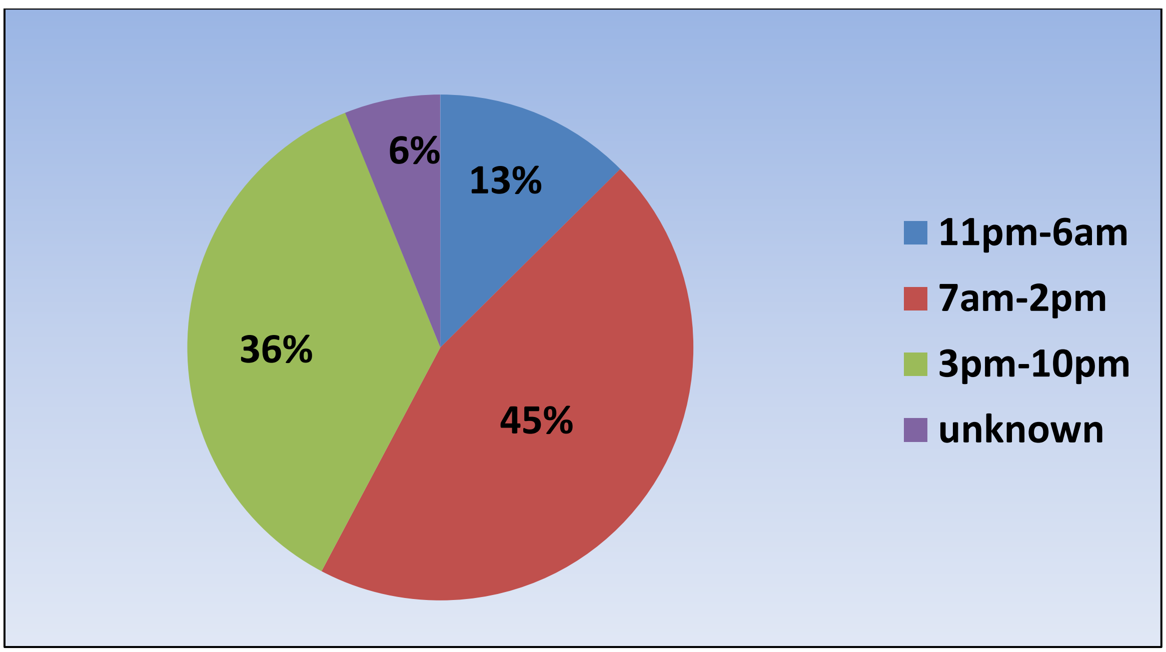

Figure 2 Time of day when reported injuries occurred

It seems likely most procedures, including injections, are carried in the first part of the workday day. Thirty six percent of injuries were sustained between the hours of 3pm and 10pm and 13% of injuries occurred between 11pm and 6am. Time data were not provided on 6% of forms.

Who was injured?

Table 2 shows the five occupations that sustained the most injuries in 2009. Registered nurses sustained more injuries than any other single occupation, accounting for 25.7% of all reported incidents. Interns/residents and doctors received 17.4% and 9.8% of reported injuries, respectively.

Job Type	Number	Percent
Registered Nurse (RN)	319	25.7%
Intern/Resident	216	17.4%
Attending Physician (MD/DO)	122	9.8%
OR/Surgical Technician	95	7.7%
Licensed Vocational Nurse	92	7.4%
All Others	397	32.0%
Total	1241	100.0%

Table 2 Top five occupations injured

Figure 3 breaks down contaminated sharps injuries by gender; two females were injured for every male. This may reflect the predominance of females in nursing careers and the fact that nurses (LVN’s and RN’s) accounted for greater than 30% of all reported injuries.

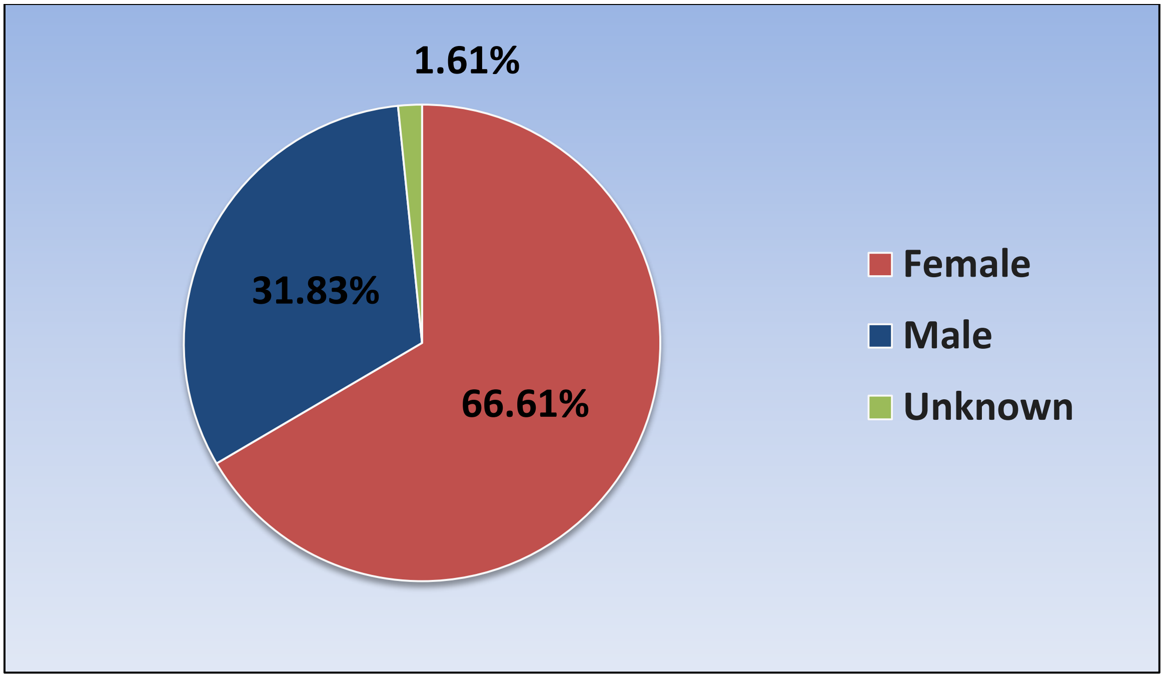

Figure 3 Contaminated sharps injuries sustained by gender

The distribution of injury reports by age is presented in Figure 4. Twenty five to thirty four year olds reported more injuries than any other age group, with 41.5% of injuries. The next two most frequently injured age groups were 35-44 year olds with 17.5% of injuries and 45-55 year olds with 12.7% of injuries.

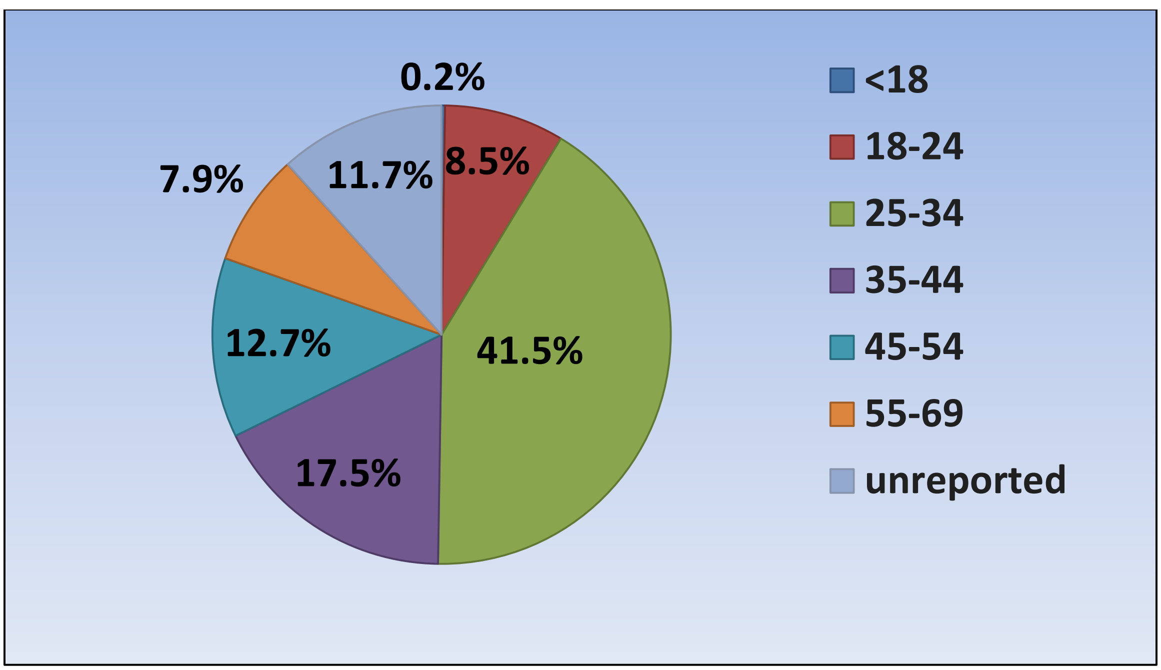

Figure 4 Contaminated sharps injuries by age in years

How did injuries occur and what devices were involved?

Table 3 shows the five most often reported intended uses for sharps devices that went on to cause injuries. Injections and suturing were the two most reported intended uses accounting for 22.3% and 19.7% of all sharps injuries reported respectively.

Original Intended Use	Number	Percent
Injection, SC/ID/IM	277	22.3%
Suturing	244	19.7%
Unknown	151	12.2%
Draw venous blood sample	129	10.4%
Start/Use IV/Central Line	126	10.2%
All others	317	25.2%
Total	1241	100.0%

Table 3 Top five intended uses of sharps

The top five instrument types that caused injury are shown in Table 4. Unsurprisingly the three syringe types combined and suture needles were the devices most often implicated in accidents representing almost one third and over one fifth of all injuries respectively.

Type of Sharp	Number	Percent
Suture needles	262	21.1%
Disposable Syringes/Needles	160	12.9%
Other Syringe/Needles	136	11.0%
IV needles/stylets	120	9.7%
Insulin Syringes	91	7.3%
All Others	472	38.0%
Total	1241	100.0%

Table 4 Top five devices involved in contaminated sharps injuries

What safety precautions were in place at time of injury?

One third of those who reported injuries in 2009 indicated they were injured with a safety-engineered sharp; 19.3% of reporters indicated they did not know if their devices of injury were safety-engineered (Table 5).

Was Device Safety-Engineered?	Number	Percent
Yes	413	33.3%
No	552	44.5%
Don't Know	240	19.3%
Unanswered	36	2.9%
Total	1241	100.0%

Table 5 Safety engineered status of device causing injury

Table 6 shows the activation status of sharps' safety mechanism at the time of injury. Sixty three percent reported that the safety mechanisms on their devices were not activated; 18.2% reported that the mechanism was partially activated, and 8.9% reported that the mechanism was fully activated at the time of injury.

Was the Safety Mechanism Activated?	Number	Percent
No	261	63.2%
Yes, Partially	75	18.2%
Yes, Fully Activated	37	8.9%
Unanswered	21	5.1%
Don't know	19	4.6%
Total	413	100.0%

Table 6 Status of safety mechanism at time of injury

At the time of injury 89.5% of individuals were wearing gloves, 90.7% had completed their hepatitis B vaccine series, 83.4% were up to date on blood borne pathogen training, and 94.7% had a sharps container available nearby (Table 7).

	Wearing Gloves at Time of Injury?		Hepatitis B Vaccinated?		BBP training last 12 months?		Sharps container available?	
	No.	%	No.	%	No.	%	No.	%
Yes	1111	89.5%	1126	90.7%	1035	83.4%	1176	94.7%
No	111	9.0%	51	4.1%	172	13.9%	13	1.1%
Don’t Know	19	1.5%	64	5.2%	34	2.7%	52	4.2%
Total	1241	100%	1241	100%	1241	100%	1241	100.0%

Table 7 Adherence to bloodborne pathogen precautions

How have contaminated sharps injury reports changed over the years?

From 2001 to 2009 the number of contaminated sharps reports received by DSHS fluctuated, but showed an overall downward trend; 31% fewer reports were received in 2009 than 2001 (Figure 5).

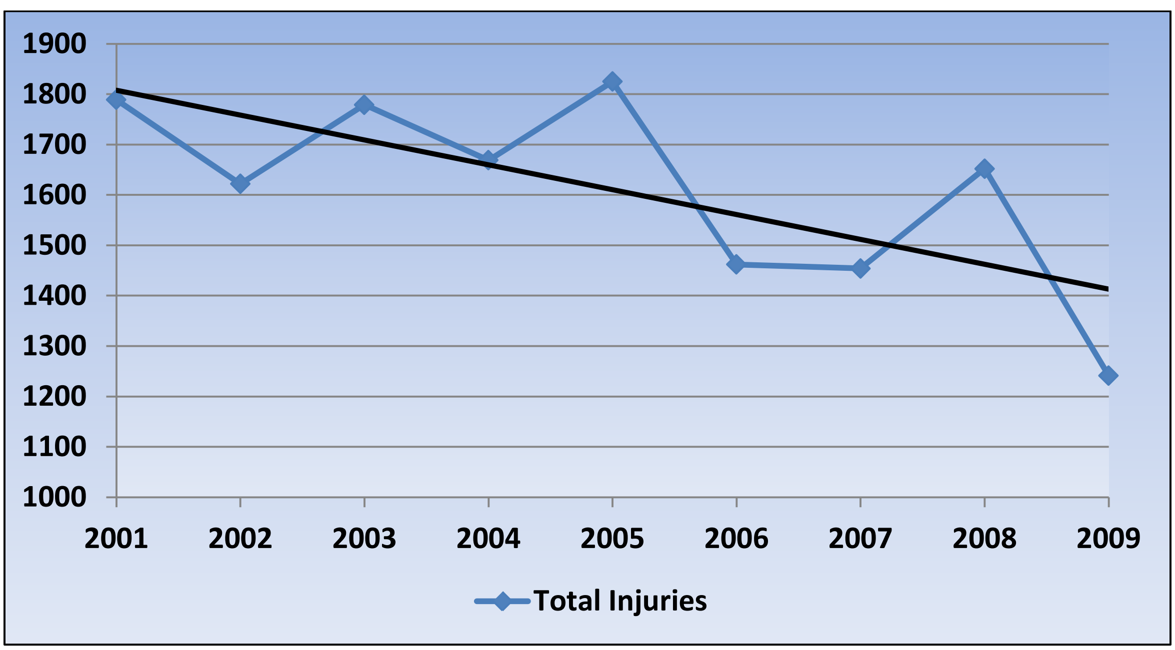

Figure 5 Number of sharps injury reports: 2001-2009

Figure 6 shows the top five facility types in which sharps injuries were reported to have occurred over the same 9-year period. Hospitals reported approximately 80% of injuries every year. No other facility type accounted for more than 10% of injuries over this time period.

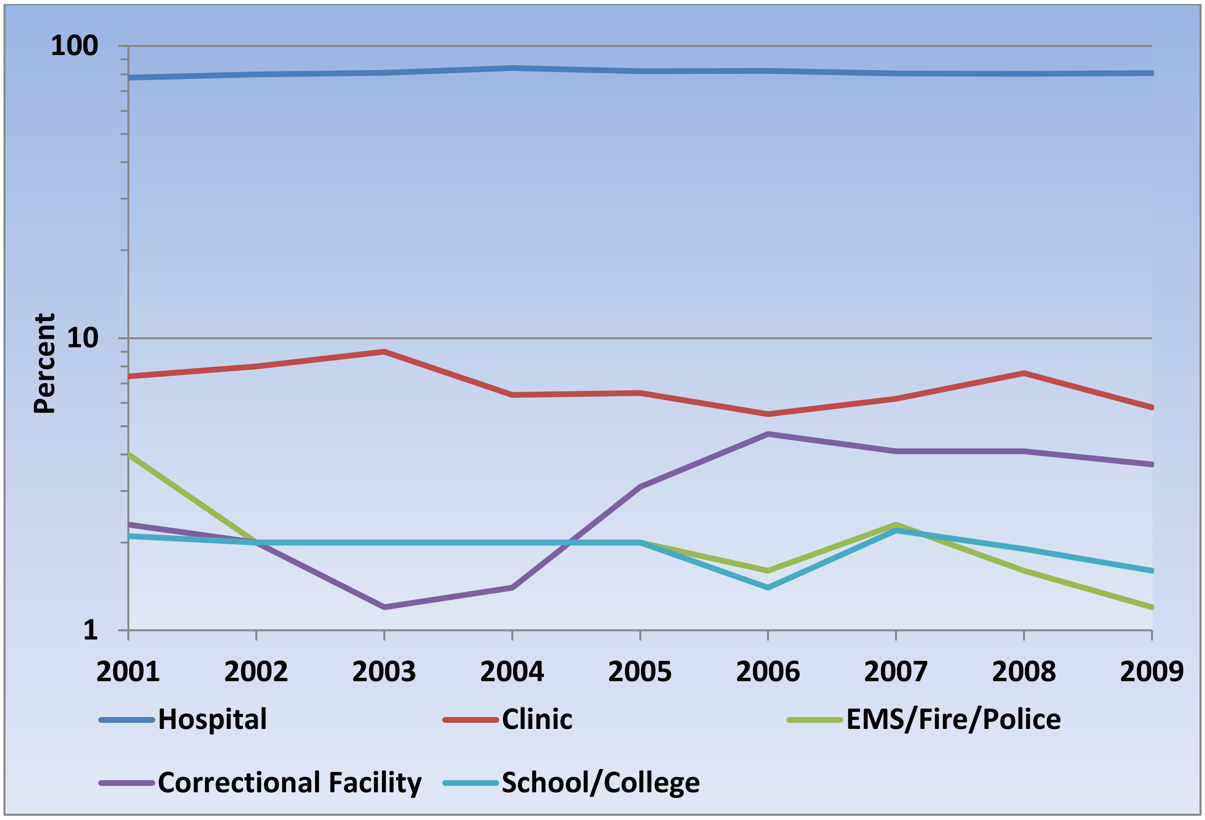

Figure 6 Distribution of sharps injuries by facility type: 2001-2009

Figure 7 presents the distribution of reported sharps injuries among the top reporting occupations. Registered nurses accounted for less than 25% of injuries reported from 2003 to 2008, but surpassed the 25% mark in 2009. Physicians and interns/residents showed trends in opposite directions; physician reports decreased over time while intern and resident reports of injury increased.

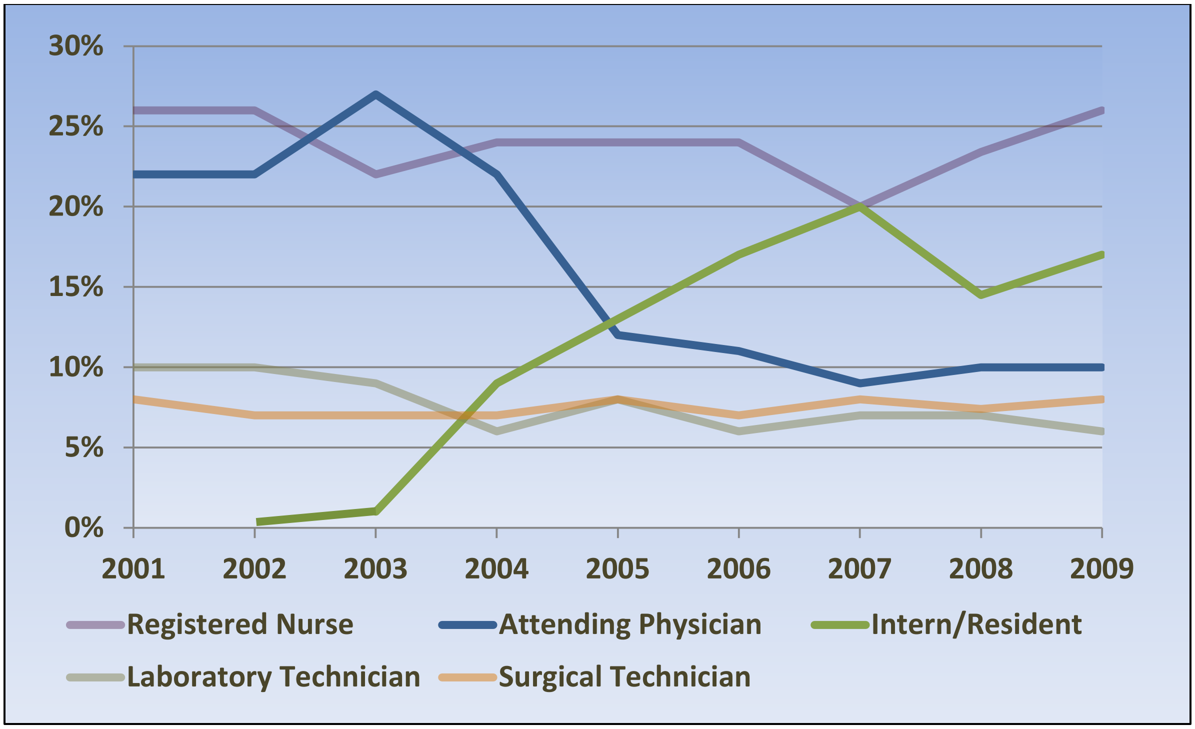

Figure 7 Occupations reporting the greatest proportion of sharps injuries: 2001-2009

It should be noted the intern/resident occupation category was added in 2002. Injuries to laboratory technicians and OR/surgical technicians were fairly constant over time accounting for between 5% and 10% of injuries each year.

How has the implication of safety-engineered devices changed over the years?

As with the distribution of injuries across facility types, the breakdown of injuries by the type of device remained fairly stable over the years (Figure 8). Syringes and suture needles were the devices that healthcare workers injured themselves with most often and were implicated in about half of all injuries every year.

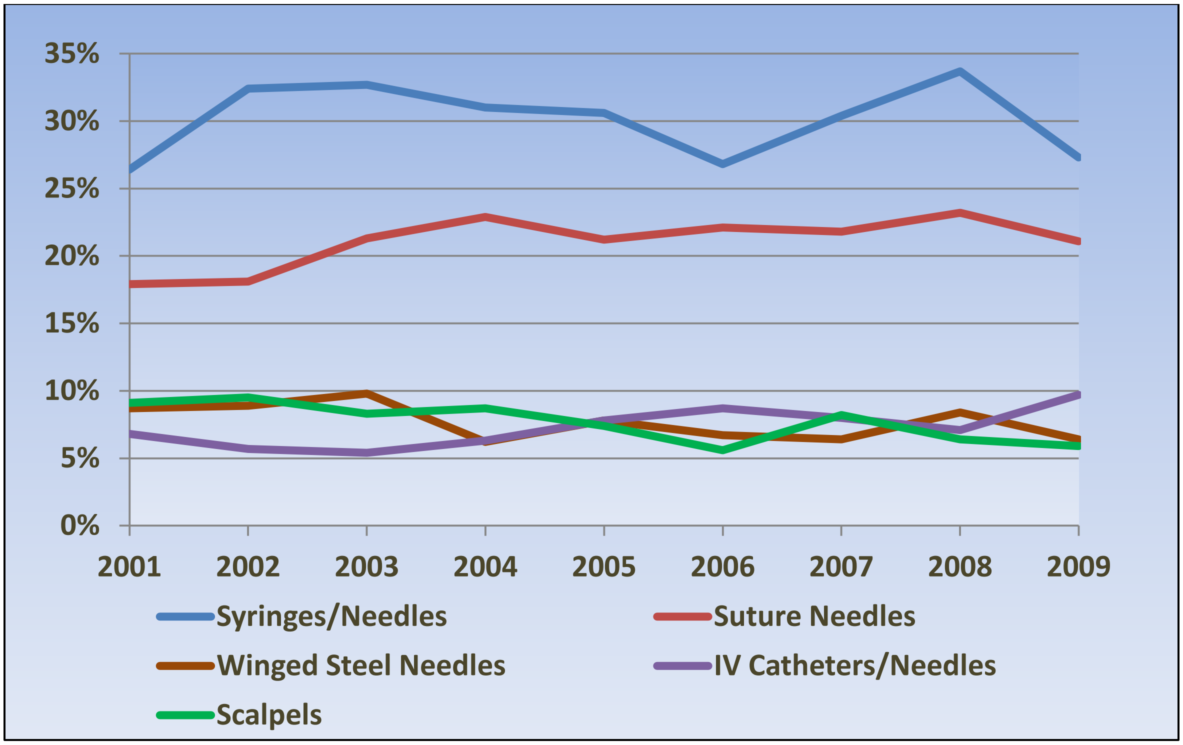

Figure 9 depicts injury trends by safety-engineered status. A linear decrease in the proportion of injuries from non-safety engineered devices is found with a corresponding increase in the proportion of injuries from safety engineered and unknown devices.

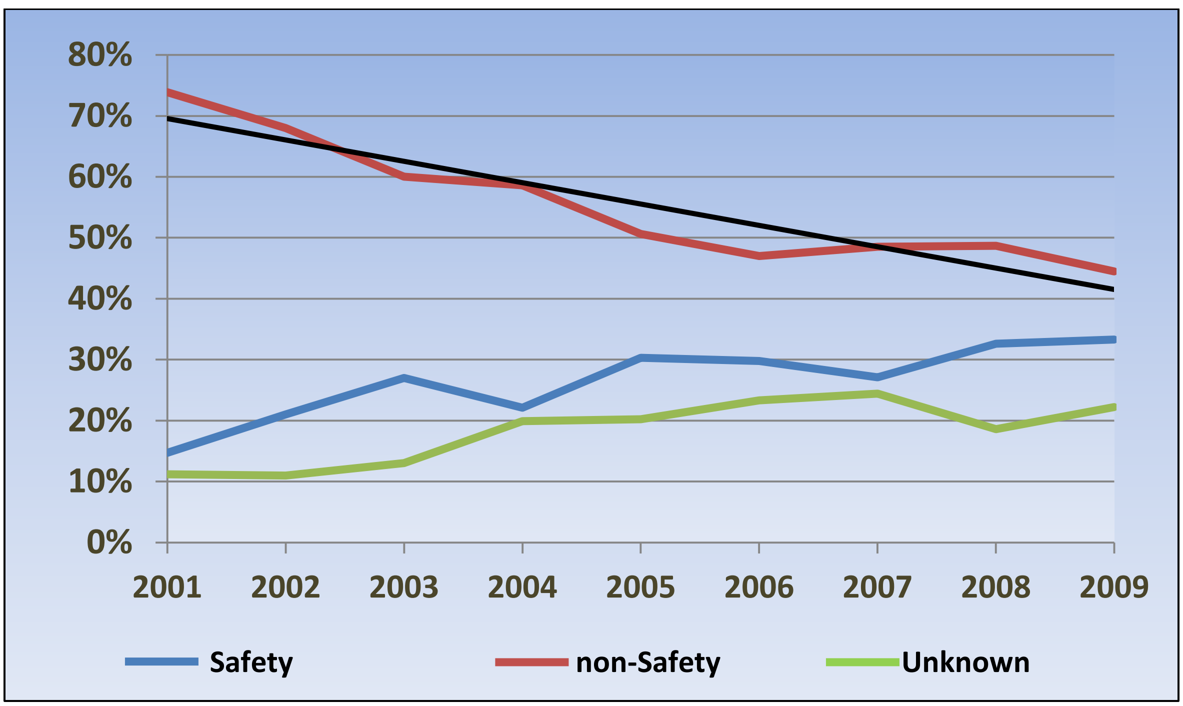

Figure 8 Injury by safety engineered status: 2001-2009

Limitations

The greatest limitation of this study was its limited scope. The bloodborne pathogen control rules found in Chapter 96 of the Texas Administrative Code state that reporting applies only to governmental entities; private healthcare facilities fall under OSHA's regulation and do not report their injuries to DSHS. Consequently, this study only had access to information about injuries that occurred in publicly funded facilities. A second limitation of this study was related to injury reporting. It is well established that under-reporting is a widespread and significant issue in sharps injury surveillance, and it would be unreasonable to suspect that this study was an exception to the phenomenon (Mangione 1991; Doebbeling 2003; Elmiyeh 2004). A third limitation was the lack of a clear denominator to establish rates and effectively compare data. Additionally, ambiguous and sometimes illogical answer choices, such as claiming to be injured after the activation of the safety mechanism on a device that reportedly lacked any safety mechanism, were uninformative. Finally, the use of paper forms and a manual entry database imposes an unavoidable element of human error. Many of the forms were not completely filled out. Therefore, this report likely underestimates the total number of sharps injuries that occurred in governmental entities during 2009 and does not fully characterize the reported injuries.

Discussion

As an occupational group, registered nurses reported the largest proportion of contaminated sharps injuries accounting for a quarter of all injuries in 2009. Perhaps reflecting gender disparity within nursing, about 2 females were injured for every 1 male. By age, younger healthcare workers had more injuries than older healthcare workers. There were 60% fewer injuries reported by 35-44 year olds than by 25-34 year olds, and every subsequent ten-year age cohort reported approximately 30% fewer injuries than the one before it. It is not entirely clear whether this phenomenon is a result of the age distribution of those involved in healthcare, higher rates of adherence to reporting protocol by younger professionals or safer practices by older professionals. The hand was almost exclusively the site of injury (Appendix Table 5). This is consistent with previous annual contaminated sharps injury reports by DSHS (Texas Department of

State Health Services 2011). Hands are likely injured most often because they are involved in the manipulation and use of the sharp.

Analyses of where and when sharps injuries occurred revealed that Texas' most densely populated public health regions, regions 3 and 6, containing Dallas and Houston respectively, reported 3-4 times as many injuries as any of the other regions. About 80% of these reports were generated from hospitals. More injuries occurred between 7am and 2pm than during any other 8-hour period of the day.

Injection and suturing were most often cited as the intended uses of the sharps that caused injury. Combined these procedures were involved in about 40% of all injuries, and, syringes and suture needles were the sharps types in about two thirds of all injuries. While progress has been made in the engineering of safer syringes, such as syringes with auto-retracting needles, they remain as the top cause of injuries. Suture needles' design simplicity, essentially a curved hook with a loop for suture, limits its potential for safety- engineering. One approach is to blunt suture needlepoints; this has proven to be effective at reducing injury rates (Centers for Disease Control and Prevention 2007).

It's concerning that 54% of the study population either reported that they were injured with a device that was not safety engineered, or that they didn't know whether or not the device had safety engineering. When devices did possess safety features, slightly less than a third of healthcare workers were injured while attempting to activate safety mechanisms or after activation. These data suggest deficiencies in healthcare workers' ability to use devices correctly, a lack of proper training on the devices, or a defective design. A more positive finding was that, despite being injured, healthcare professionals by and large adhered to the bloodborne pathogen precautions such as hepatitis B vaccination, recent exposure risk training and the use of gloves. About 90% compliance was reported in these areas.

Analyses of injury reporting trends over the years demonstrated both positive and negative findings. Encouragingly, an overall downward trend in the number of contaminated sharps injury reports submitted to DSHS from 2001 to 2009 was found. This may reflect a true decrease in injury incidence rather than increased reporting non-compliance. Though not inherently positive, the increasing proportion of injuries since 2001 attributed to safety-engineered devices may reflect increased adoption of devices with safety features. It seems unlikely that safety engineered devices have become less safe over the years. Less encouraging were the findings that both the distribution of injuries by facility type and by device type has remained remarkably steady. Over the 9 years of surveillance, hospitals' accounted for 80% of all reported injuries. Syringes of various types and suture needles were responsible for 30% and 20% of all injuries respectively. Any successful efforts targeting syringes and suture needle injuries in hospitals are not reflected in the distribution of state data. Perhaps novel intervention strategies to augment or replace policies that have yet to show any effect are needed. Intra-departmental injury tracking to improve awareness, regular meetings to review each contaminated sharps injuries and continued efforts in device engineering represent possible approaches.

To improve sharps injury reporting in Texas, three possible changes to present practices are offered. Firstly, redefining or eliminating all together ambiguous and overlapping answer choices would allow for more specific descriptions of the contexts in which sharps injuries occur. Secondly, implementation of a common denominator such as injuries per occupied bed, per device use, or per healthcare worker would facilitate comparisons and better indicate progress or change. Finally and most importantly, Texas' contaminated sharps injury surveillance program would greatly benefit from the use of a web based electronic submission/reporting submission process. This would not only eliminate human error associated with manual data entry, but also opens up the potential for immediate form revisions, real-time tracking of report submissions, and the dis-allowance of contradictory answer choices.

Appendix

Table 1. Injuries by Facility Type		
Facility	**Number**	**Percent**
Hospital	1003	80.82
Clinic	72	5.80
Correctional Facility	46	3.71
Other/Unknown	38	3.06
School/College	20	1.61
EMS/Fire/Police	15	1.21
Residential Facility	10	0.81
Home Health	9	0.73
Laboratory	9	0.73
Dental facility	7	0.56
Outpatient	7	0.56
Medical Examiner Office/Morgue	4	0.32
Hospice	1	0.08
Total	**1241**	**100.00**

Table 2. Injuries by Work Area		
Work area	**Number**	**Percent**
Surgery/Operating room	196	28.91
Patient/Resident Room	114	16.81
Emergency Department	74	10.91
Other/unknown	50	7.37
Critical Care Unit	48	7.08
Laboratory	30	4.42
Medical/Outpatient Clinic	27	3.98
Medical/Surgical Unit	27	3.98
L & D/Gynecology Unit	25	3.69
Procedure room	23	3.39
Dental Clinic	17	2.51
Infirmary	8	1.18
Radiology Department	8	1.18
Floor, not Patient/Resident Room	6	0.88
PACU	6	0.88
School Clinic	4	0.59
Pediatrics	3	0.44
Ambulance	3	0.44
Nursery	2	0.29
Service/utility area	2	0.29
Blood Bank Center/Mobile	2	0.29
Seclusion room/psychiatric unit	2	0.29
Autopsy/Pathology	1	0.15
Total	**678**	**100.00**

There were 563 records that did not specify work area.

Table 3. Injuries by Occupation		
Occupation	**Number**	**Percent**
Registered Nurse	319	25.71
Intern/resident	216	17.41
Attending Physician (MD/DO)	122	9.83
OR/Surgical Technician	95	7.66
Licensed Vocational Nurse	92	7.41
Phlebotomist/Venipuncture/IV Team	64	5.16
Aide (e.g. CAN, HHA, orderly)	40	3.22
Other/Unknown	32	2.58
Medical Student	32	2.58
Housekeeper/laundry	30	2.42
Other tech	19	1.53
Respiratory Therapist/Technician	17	1.37
Dental assistant/technician/hygienist	17	1.37
EMT/Paramedic	16	1.29
Fellow	15	1.21
Radiologic technician	14	1.13
Nursing student	14	1.13
clinical lab technician	14	1.13
Dentist	12	0.97
Dental Students	11	0.89
CRNA/NP	9	0.73
Student	8	0.64
Physician Assistant	7	0.56
Central supply	7	0.56
Law Enforcement Officer	6	0.48
Researcher	4	0.32
Physical Therapist	3	0.24
Maintenance staff	3	0.24
Nurse Midwife	2	0.16
Firefighter	1	0.08
Total	**1241**	**100.00**

Table 4. Injuries by Gender		
Gender of Worker	**Number**	**Percent**
Female	826	66.61
Male	395	31.83
Unknown	20	1.61
Total	**1241**	**100.00**

Table 5. Area of the Body Injured		
Body Area	**Number**	**Percent**
Hand	1193	96.13
Arm	27	2.18
Leg/Foot	6	0.48
Torso (front or back)	6	0.48
Face/Head/Neck	3	0.24
Unknown	6	0.48
Total	**1241**	**100.00**

Table 6. Injuries by Sharp Type		
Sharp Type	**Number**	**Percent**
Suture needles	262	21.11
Disposable Syringes/Needles	160	12.89
Other Syringe/Needles	136	10.96
IV needles/stylets	120	9.67
Insulin Syringes	91	7.33
Winged steel needle	79	6.37
Scalpel	73	5.88
Other/Unknown	63	5.08
Blood tube holder/needle	36	2.90
Lancet	24	1.93
Blood Gas Syringe	23	1.85
Tuberculin Syringes	20	1.61
Pre-filled cartridge syringe	19	1.53
Skin Hooks/Retractors	16	1.29
Dental Instruments	16	1.29
Wire	15	1.21
Scissors	14	1.13
Unattached hypodermic needle	12	0.97
Epidural/Spinal needles	11	0.89
Drill bit/burrs	11	0.89
GlassTubes/slides/vials	7	0.56
Electrocautery devices	7	0.56
Staples/steel sutures	6	0.48
Forceps	5	0.40
Razors	4	0.32
Trocar	4	0.32
Pins	4	0.32
Towel clips	3	0.24
Total	**1241**	**100.00**

Table 7. Injuries by Original Intended Use of Sharp		
Original Intended Use	**Number**	**Percent**
Injection, SC/ID/IM	277	22.32
Suturing	244	19.66
Unknown/other	231	18.61
Draw Venous Blood Sample	129	10.39
Start IV or Set Up Heparin Lock (IV catheter or winged set-type needle)	93	7.49
Cutting	77	6.20
Obtain a Body Fluid or Tissue Sample (urine/CSF/amniotic fluid/other fluid, biopsy)	35	2.82
Finger Stick/Heel Stick	31	2.50
Dental Procedure	30	2.42
Draw Arterial Blood Sample	23	1.85
Other Injection into (or aspiration from) IV Injection Site or IV Port (syringe)	15	1.21
Drilling	9	0.73
Remove Central Line/Porta Catheter	8	0.64
Electrocautery	7	0.56
Heparin or Saline Flush	6	0.48
Dialysis	5	0.40
Contain a Specimen or Pharmaceutical (glass item)	5	0.40
Connect IV Line (intermittent IV/piggyback/IV infusion/other IV line connection	5	0.40
Draw arterial blood sample from a line	5	0.40
Wiring	3	0.24
Tattoo	3	0.24
Total	**1241**	**100.00**

Table 8. When and How the Injury Occurred		
Sharps Use	**Number**	**Percent**
Between Steps of a Multistep Procedure (carrying, handling, passing/receiving instrument)	255	20.55
Unknown/Other	182	14.67
Patient Moved During the Procedure	104	8.38
Suturing	85	6.85
Activating safety device	76	6.12
Found in an Inappropriate Place (eg. table, bed, linen, floor, trash)	74	5.96
Miscellaneous	74	5.96
Interaction with Another Person	66	5.32
Use of Sharps Container	65	5.24
Unsafe practice	62	5.00
Disassembling Device or Equipment	60	4.83
Recapping	49	3.95
Laboratory Procedure/Process	27	2.18
Accident/Slipped	15	1.21
Preparation for Reuse of Instrument (cleaning, sorting, disinfecting, sterilizing, etc.)	15	1.21
Device malfunctioned	13	1.05
Use of IV/Central Line	10	0.81
Device Pierced the Side of the Disposal Container	5	0.40
Cutting	4	0.32
Total	**1241**	**100.00**

Table 9. Safety Engineered Protection		
Did the device have engineered sharps injury protection?	**Number**	**Percent**
Yes	413	33.28
No	552	44.48
Don't know	240	19.34
Unanswered	36	2.90
Total	**1241**	**100.00**

Table 10. Protective Mechanism Activation		
Was the protective mechanism activated?	**Number**	**Percent**
Yes, Fully Activated	37	8.96
Yes, Partially	75	18.13
No	264	63.94
Don't know	19	4.61
Unanswered	18	4.36
Total	**413**	**100.00**

Table 11. When During Device Activation Did Injury Occur		
The injury occurred	**Number**	**Percent**
Before activation.	55	13.32
During activation.	184	44.55
After activation.	96	23.24
Unknown	78	18.89
Total	**413**	**100.00**

Tables 10 and 11 include only cases that indicated the device had safety engineered protection.

Table 12. Was the injured person wearing gloves		
Wearing gloves	**Number**	**Percent**
Yes	1111	89.52
No	111	8.94
Unknown	19	1.53
Total	**1241**	**100.00**

Table 13. Was the injured person vaccinated for Hepatitis B		
Vaccinated for HBV	**Number**	**Percent**
Yes	1126	90.73
No	51	4.11
Unknown)	64	5.16
Total	**1241**	**100.00**

Table 14. Was a sharps container available for disposal		
Sharps container available	**Number**	**Percent**
Yes	1176	94.76
No	13	1.05
Unknown	52	4.19
Total	**1241**	**100.00**

Table 15. Injured person receive exposure control training within last 12 months		
Training last 12 months	**Number**	**Percent**
Yes	1035	83.40
No	172	13.86
Unknown	34	2.74
Total	**1241**	**100.00**

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