

Workbook for Designing, Implementing, and Evaluating a Sharps Injury Prevention Program



A workbook designed for:

- Infection Control & Occupational Health Personnel
- Healthcare Administrators
- Sharps Injury Prevention Committees



WELCOME!

Welcome to the CDC website on Sharps Safety. Here you will find the *Workbook for Designing, Implementing and Evaluating a Sharps Injury Prevention Program*, which has been developed by CDC to help healthcare facilities prevent needlesticks and other sharps-related injuries to healthcare personnel. The *Workbook* is one part of a package of materials that is being made available on this website. Coming soon are posters about preventing needlesticks and an educational slide set that may be used for training healthcare personnel in needlestick prevention.

Thank you for visiting this site. CDC hopes that you will find this information helpful and that you will apply it in your healthcare setting.

TABLE OF CONTENTS

INFORMATION ABOUT THE WORKBOOK

- Introduction
- Overview of the Program Plan
- Information Provided
- How to Use the Workbook
- Target Audience
- Value of the Workbook to Healthcare Organizations

OVERVIEW: RISKS AND PREVENTION OF SHARPS INJURIES IN HEALTHCARE PERSONNEL

- Introduction
- Bloodborne Virus Transmission to Healthcare Personnel
- Cost of Needlestick Injuries
- Epidemiology of Needlesticks and Other Sharps-related Injuries
- Injury Prevention Strategies
- The Need for Guidance

ORGANIZATIONAL STEPS

- Step 1. Develop Organizational Capacity
- Step 2. Assess Program Operation Processes
 - Assessing the *Culture of Safety*
 - Assessing Procedures for Sharps Injury Reporting
 - Assessing Methods for the Analysis and Use of Sharps Injury Data
 - Assessing the Process for Identifying, Selecting, and Implementing Engineered Sharps Injury Prevention Devices
 - Assessing Programs for the Education and Training of Healthcare Personnel on Sharps Injury Prevention
- Step 3. Prepare a Baseline Profile of Sharps Injuries and Prevention Activities
- Step 4. Determine Intervention Priorities
 - Sharps Injury Prevention Priorities
 - Program Process Improvement Priorities
- Step 5. Develop and Implement Action Plans
- Step 6. Monitor Program Performance

OPERATIONAL PROCESSES

Institutionalize a Culture of Safety in the Work Environment

- Introduction
- Strategies for Creating a Culture of Safety
- Measuring Improvements in the Safety Culture

Implement Procedures for Reporting and Examining Sharps Injuries and Injury Hazards

- Introduction
- Develop an Injury Reporting Protocol and Documentation Method
- Develop a Procedure for Hazard Reporting
- Develop a Process for Examining Factors That Led to Injury or “Near Misses”

Analyze Sharps Injury Data

- Introduction
- Compiling Sharps Injury Data
- Analyzing Sharps Injury Data
- Calculating Injury Incidence Rates
- Using Control Charts for Measuring Performance Improvement
- Calculating Institutional Injury Rates
- Benchmarking

Selection of Sharps Injury Prevention Devices

- Introduction
- Step 1. Organize a Product Selection and Evaluation Team
- Step 2. Set Priorities for Product Consideration
- Step 3. Gather Information on Use of the Conventional Device
- Step 4. Establish Criteria for Product Selection and Identify Other Issues for Consideration
- Step 5. Obtain Information on Available Products
- Step 6. Obtain Samples of Devices Under Consideration
- Step 7. Develop a Product Evaluation Survey Form
- Step 8. Develop a Product Evaluation Plan
- Step 9. Tabulate and Analyze the Evaluation Results
- Step 10. Select and Implement the Preferred Product
- Step 11. Perform Post-implementation Monitoring

Education and Training of Healthcare Personnel

- Introduction
- Healthcare Personnel as Adult Learners
- Opportunities for Educating and Training Healthcare Personnel
- Content for an Orientation or Annual Training on Sharps Injury Prevention
- Teaching Tools

REFERENCES

APPENDIX A: TOOLKIT

- A-1 Baseline Program Assessment Worksheet
- A-2 Survey to Measure Healthcare Personnel's Perceptions of a Culture of Safety
- A-3 Survey of Healthcare Personnel on Occupational Exposure to Blood and Body Fluids
- A-4 Baseline Institutional Injury Profile Worksheet
- A-5 Baseline Injury Prevention Activities Worksheet
- A-6 Sharps Injury Prevention Program Action Plan Forms
- A-7 Blood and Body Fluid Exposure Report Form
- A-8 Sharps Injury Hazard Observation and Reporting Forms
- A-9 Sample Form for Performing a Simple Root Cause Analysis of a Sharps Injury or "Near Miss" Event
- A-10 Occupation-Specific Rate-Adjustment Calculation Worksheet
- A-11 Survey of Device Use
- A-12 Device Pre-Selection Worksheet
- A-13 Device Evaluation Form

APPENDIX B: Devices with Engineered Sharps Injury Prevention Features

APPENDIX C: Safe Work Practices for Preventing Sharps Injuries

APPENDIX D: Problem-Specific Strategies for Sharps Injury Prevention

APPENDIX E: Measuring the Cost of Sharps Injury Prevention

- E-1 Sample Worksheet for Estimating the Annual and Average Cost of Needlesticks and Other Sharps-Related Injuries
- E-2 Sample Worksheet for Estimating Device-Specific Percutaneous Injury Costs
- E-3 Sample Worksheet for Estimating a Net Implementation Cost for an Engineered Sharps Injury Prevention (ESIP) Device

APPENDIX F: Glossary

APPENDIX G: Other websites

INFORMATION ABOUT THE WORKBOOK

Introduction

Occupational exposure to bloodborne pathogens from needlesticks and other sharps injuries is a serious problem, but it is often preventable. The Centers for Disease Control and Prevention (CDC) estimates that **each year 385,000 needlesticks and other sharps-related injuries are sustained by hospital-based healthcare personnel** (1). Similar injuries occur in other health-care settings, such as nursing homes, clinics, emergency care services, and private homes. Sharps injuries are primarily associated with occupational transmission of hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV), but they may be implicated in the transmission of more than 20 other pathogens (2-5).

Overview of the Program Plan

An effective sharps injury prevention program includes several components that must work in concert to prevent healthcare personnel from suffering needlesticks and other sharps-related injuries. This program plan is designed to be integrated into existing performance improvement, infection control, and safety programs. It is based on a model of continuous quality improvement, an approach that successful healthcare organizations are increasingly adopting. We can describe this model in a variety of terms, but the underlying concept is that of a *systematic, organization-wide approach for continually improving all processes* (Processes Performance Improvement) *involved in the delivery of quality products and services*. The program plan also draws on concepts from the industrial hygiene profession, in which prevention interventions are prioritized based on a hierarchy of control strategies. The plan has two main components:

- **Organizational steps for developing and implementing a sharps injury prevention program.**

These include a series of administrative and organizational activities, beginning with the creation of a multidisciplinary working team. The steps are consistent with other continuous quality improvement models in that they call for conducting a baseline assessment and setting priorities for development of an action plan. An ongoing process of review evaluates the plan's effectiveness and modifies the plan as needed.

- **Operational processes.** These activities form the backbone of the sharps injury prevention program. They include creating a culture of safety, reporting injuries, analyzing data, and selecting and evaluating devices.

Key Things This Workbook Will Help You Do

- Assess your facility's sharps injury prevention program
- Document the development and implementation of your planning and prevention activities
- Evaluate the impact of your prevention interventions

Information Provided

The *Workbook* includes several sections that describe each of the organizational steps and operational processes. A *toolkit* of forms and worksheets is included to help guide program development and implementation. The *Workbook* also contains:

- A comprehensive overview of the literature on the risks and prevention of sharps injuries in healthcare personnel;
- A description of devices with sharps injury prevention features, and factors to consider when selecting such devices; and
- Internet links to websites with relevant information on sharps injury prevention.

How to Use the Workbook

The *Workbook* presents a comprehensive program for sharps injury prevention. The information can be used to:

- Help healthcare organizations design, launch, and maintain a prevention program, and
- Help healthcare organizations enhance or augment current activities if a program is already in place.

The principles may also be broadly applied to the prevention of all types of blood exposures.

Target Audience

The audience for this information includes healthcare administrators, program managers, and members of relevant healthcare organization committees. However, not all parts or activities will be relevant to every healthcare organization. CDC encourages healthcare organizations to use whatever they find helpful and necessary for their sharps injury prevention program. The sample forms and worksheets in the toolkit may also be adapted according to users' needs. Some sample tools (e.g., those for baseline assessment) are designed to be used only once, whereas others (e.g., healthcare worker surveys) are designed for periodic use.

Value of the Workbook to Healthcare Organizations

This Workbook contains a practical plan to help healthcare organizations prevent sharps injuries. Once implemented, the program will help improve workplace safety for healthcare personnel. At the same time, it may help healthcare facilities meet the worker safety requirements for accrediting organizations, as well as the following federal and state regulatory standards:

- **Joint Commission on Accreditation of Healthcare Organizations (JCAHO)** standards for surveillance of infection, environment of care, and product evaluation;
- **Center for Medicare and Medicaid Services (CMS)** compliance with the *Conditions for Medicare and Medicaid Participation* (<http://www.cms.hhs.gov/cop/default.asp>);
- **Occupational Safety and Health Administration (OSHA)** Bloodborne Pathogens Standard (29 CFR 1910.1030) and its related field directive, *Inspection Procedures for the Occupational Exposure to Bloodborne Pathogens Standard* (CPL 2-2.44, November 5, 1999) requiring use of engineered sharps injury prevention devices as a primary prevention strategy (<http://www.osha.gov/SLTC/bloodbornepathogens/index.html/>);
- **State OSHA plans** that equal or exceed federal OSHA standards for preventing transmission of bloodborne pathogens to healthcare personnel;
- **State-specific legislation** that also requires the use of devices with engineered sharps injury prevention features and, in some cases, specific sharps injury reporting requirements (<http://www.cdc.gov/niosh/topics/bbp/ndi-law2.html>); and
- **Federal Needlestick Safety and Prevention Act** (PL 106-430), (November 6, 2000), which mandates revision of the 1991 OSHA Bloodborne Pathogens Standard to require the use of engineered sharps injury prevention devices. Details may be found at: (<http://www.cdc.gov/sharpsafety/pdf/Needlestick%20Safety%20and%20Prevention%20Act.pdf>).

OVERVIEW: RISKS AND PREVENTION OF SHARPS INJURIES IN HEALTHCARE PERSONNEL

Introduction

Prevention of percutaneous injuries and other blood exposures is an important step in preventing the transmission of bloodborne viruses to healthcare personnel. Epidemiologic data on sharps injury events, including the circumstances associated with occupational transmission of bloodborne viruses, are essential for targeting and evaluating interventions at the local and national levels. The CDC estimates that **each year 385,000 needlesticks and other sharps-related injuries are sustained by hospital-based healthcare personnel; an average of 1,000 sharps injuries per day** (1). The true magnitude of the problem is difficult to assess because information has not been gathered on the frequency of injuries among healthcare personnel working in other settings (e.g., long-term care, home healthcare, private medical offices). In addition, although CDC estimates are adjusted for it, the importance of underreporting must be acknowledged. Surveys of healthcare personnel indicate that 50% or more do not report their occupational percutaneous injuries (6-13).

Bloodborne Virus Transmission to Healthcare Personnel

Injuries from needles and other sharp devices used in healthcare and laboratory settings are associated with the occupational transmission of more than 20 pathogens (2-5, 14-16). HBV, HCV, and HIV are the most commonly transmitted pathogens during patient care (Table 1).

Table 1. Infections Transmitted via Sharps Injuries during Patient Care (PC) and/or Laboratory/Autopsy (L/A)					
Infection	PC	L/A	Infection	PC	L/A
Blastomycosis		✓	Leptospirosis		✓
Cryptococcosis		✓	Malaria	✓	
Diphtheria		✓	M. tuberculosis	✓	✓
Ebola		✓	Rocky Mountain		✓
Gonorrhea		✓	Spotted Fever		
Hepatitis B	✓	✓	Scrub typhus		✓
Hepatitis C	✓	✓	Strep Pyogenes		✓
HIV	✓	✓	Syphilis		✓
Herpes	✓				
References 2-5, 14-16					

Hepatitis B Virus

National hepatitis surveillance provides yearly estimates of HBV infections in healthcare personnel. These estimates are based on the proportion of persons with new infections who report frequent occupational blood contact. CDC estimated that 12,000 HBV infections occurred in healthcare personnel in 1985 (17). Since then, the number has declined steadily, down to an estimated 500 in 1997 (18). The decline in occupational HBV-more than 95%-is due largely to the widespread immunization of healthcare personnel. Although universal precautions also help reduce blood exposures and HBV infections in healthcare personnel (19-21), the extent of their contribution cannot be precisely quantified.

Most healthcare personnel today are immune to HBV as the result of pre-exposure vaccination (22-27). However, susceptible healthcare personnel are still at risk for needlestick exposure to an HBV-positive source. Without postexposure prophylaxis, there is a 6%-30% risk that an exposed, susceptible healthcare worker will become infected with HBV (28-30). The risk is highest if the source individual is hepatitis B e antigen positive, a marker of increased infectivity (28).

Hepatitis C Virus

Before the implementation of universal precautions and the discovery of HCV in 1990, an association was noted between employment in patient care or laboratory work and acquiring acute non-A, non-B hepatitis (31). One study showed an association between anti-HCV positivity and a history of accidental needlestick exposures (32).

The precise number of healthcare personnel who acquire HCV occupationally is not known. Healthcare personnel exposed to blood in the workplace represent 2% to 4% of the total new HCV infections occurring annually in the United States (a total that has declined from 112,000 in 1991 to 38,000 in 1997) (33, CDC, unpublished data). However, there is no way to confirm that these are occupational transmissions. Prospective studies show that the average risk of HCV transmission following percutaneous exposure to an HCV-positive source is 1.8% (range: 0% - 7%) (34-39), with one study indicating that transmission occurred only from hollow-bore needles compared with other sharps (34)

A number of case reports also document occupational HCV transmission to healthcare personnel (40-46). All except two involve percutaneous injuries: one case of HCV and another of HCV and HIV transmission via splash to the conjunctiva (45, 46). One case of HIV and HCV transmission from a nursing home patient to a healthcare worker is suspected to have occurred through a non-intact skin exposure (47).

Human Immunodeficiency Virus

The first case of HIV transmission from a patient to a healthcare worker was reported in 1986 (48). Through December, 2001, CDC had received voluntary reports of 57 documented and 140 possible episodes of HIV transmission to healthcare personnel in the United States (http://www.cdc.gov/ncidod/dhqp/bp_hcp_w_hiv.html).

In prospective studies of healthcare personnel, the average risk of HIV transmission after a percutaneous exposure is estimated to be approximately 0.3% (16).

In a retrospective case-control study of healthcare personnel with percutaneous exposure to HIV, the risk for HIV infection was found to be increased with exposure to a larger quantity of blood from the source person as indicated by a) a device visibly contaminated with the patient's blood, b) a procedure that involves placing a needle directly in the source patient's vein or artery, or c) a deep injury (49). Of the 57 documented cases of HIV transmission to healthcare personnel in the United States, most involve exposure to blood through a percutaneous injury, usually with a hollow-bore needle that was in a blood vessel (vein or artery) (CDC, unpublished data).

The average risk for occupational HIV transmission after a mucous-membrane exposure is estimated to be 0.09% (50). Although episodes of HIV transmission after skin exposures are documented (51), the average risk for transmission has not been precisely quantified but is estimated to be less than the risk of mucous-membrane exposures (52).

Cost of Needlestick Injuries

Although occupational HIV and hepatitis seroconversion is relatively rare, the risks and costs associated with a blood exposure are serious and real. Costs include the direct costs associated with the initial and follow-up treatment of exposed healthcare personnel, which are estimated to range from \$71 to almost \$5,000 depending on the treatment provided (53-55). Costs that are harder to quantify include the emotional cost associated with fear and anxiety from worrying about the possible consequences of an exposure, direct and indirect costs associated with drug toxicities and lost time from work, and the societal cost associated with an HIV or HCV seroconversion; the latter includes the possible loss of a worker's services in patient care, the economic burden of medical care, and the cost of any associated litigation. One study conducted in two hospitals observed that health care personnel who reported a sharps-related injury were willing to pay a median amount of \$850 in order to avoid a sharps injury; this amount increased to over \$1000 when adjusted for patient risk status and working with an uncooperative patient at the time of injury. Study investigators concluded that in order to avoid such outcomes as anxiety and distress, health care personnel were willing to pay amounts similar to the costs of post-exposure evaluation. Therefore, these figures should be considered when estimating the financial burden of sharps injuries (56).

Epidemiology of Needlesticks and Other Sharps-related Injuries

Data on needlesticks and other sharps-related injuries are used to characterize the *who*, *where*, *what*, *when*, and *how* of such events. Aggregated surveillance data from the National Surveillance System for Health Care Workers (NaSH) are used here to provide a general description of the epidemiology of percutaneous injuries. Similar statistics from hospitals participating in the Exposure Prevention Information Network (EPINet) system, developed by Dr. Janine Jagger and colleagues at the University of Virginia, may be found on the International Health Care Worker Safety Center website (<http://www.healthsystem.virginia.edu/internet/epinet/>).

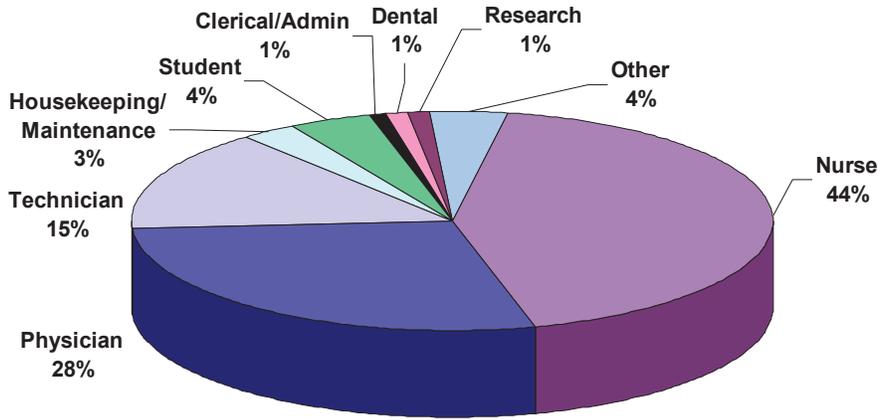
Who is at Risk of Injury?

Data from NaSH show that nurses sustain the highest number of percutaneous injuries. However, other patient-care providers (e.g., physicians, technicians), laboratory staff, and support personnel (e.g., housekeeping staff), are also at risk (Figure 1). Nurses are the predominant occupational group injured by needles and other sharps, in part because they are the largest segment of the workforce at most hospitals. When injury rates are calculated based on the number of employees or full-time equivalent (FTE) positions, some non-nursing occupations have a higher rate of injury (Table 2).

Where, When, and How Do Injuries Occur?

Although sharp devices can cause injuries anywhere within the healthcare environment, NaSH data show that the majority (39%) of injuries occur on inpatient units, particularly medical floors and intensive care units, and in operating rooms (Figure 2). Injuries most often occur after use and before disposal of a sharp device (40%), during use of a sharp device on a patient (41%), and during or after disposal (15%) (CDC unpublished data). There are many possible mechanisms of injury during each of these periods as shown in NaSH data on hollow-bore needle injuries (Figure 3).

Figure 1. Occupational Groups of Healthcare Personnel Exposed to Blood/Body Fluids; NaSH, 6/95 to 12/03 (N=23,197)*



* Missing values not included in the total n.

Table 2. Comparison of the Proportions and Rates of Percutaneous Injuries among Selected Occupations in Reported Studies

Author / Study Period	Nurses	Laboratory	Physicians*	Housekeeping
McCormick & Maki (1975-1979) (57)	45% 9	15% 10	n/a	17% 13/100 Employees
Ruben, <i>et al.</i> (1977-80) (58)	66% 23	10% 12	4% 5	16% 18/100 Employees
Mansour (1984-89) (59)	62% 10	21% 20	7% 2	10% 6/100 Employees
Whitby, <i>et al.</i> (1987-88) (60)	79% 15	2% 4	11% 3	5% 3/100 Employees
McCormick & Maki (1987-88) (61)	58% 20	9% 17	23% 15	11% 31/100 Employees

* Denotes house staff only. The employee/employer relationship with the healthcare organization affects injury rates among physicians.

Figure 2. Work Locations Where Blood/Body Fluid Exposures Occurred; NaSH, 6/95 to 12/03
(N=23,140)*

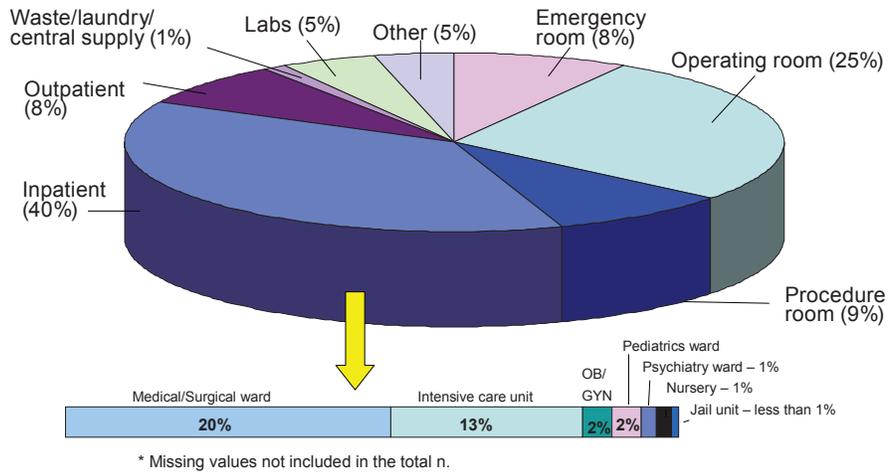
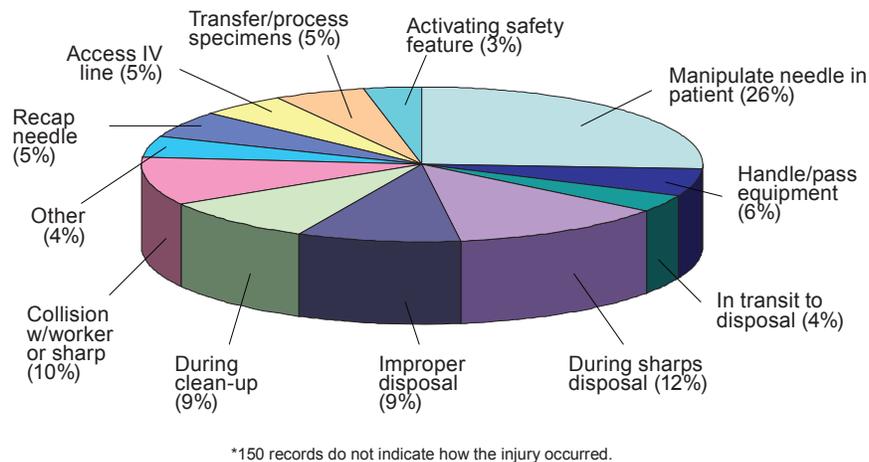


Figure 3. Circumstances Associated with Hollow-Bore Needle Injuries, NaSH 6/95 to 12/03
(n=10,239)*



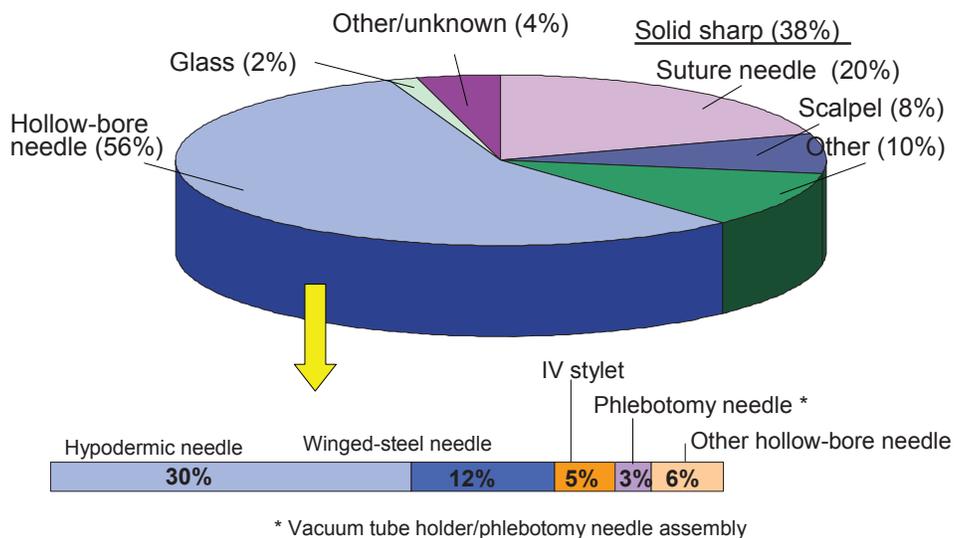
What Devices Are Involved in Percutaneous Injuries?

Although many types of sharps injure healthcare personnel, aggregate data from NaSH indicate that six devices are responsible for nearly eighty percent of all injuries (Figure 4). These are:

- Disposable syringes (30%)
- Suture needles (20%)
- Winged steel needles (12%)
- Scalpel blades (8%)
- Intravenous (IV) catheter stylets (5%)
- Phlebotomy needles (3%)

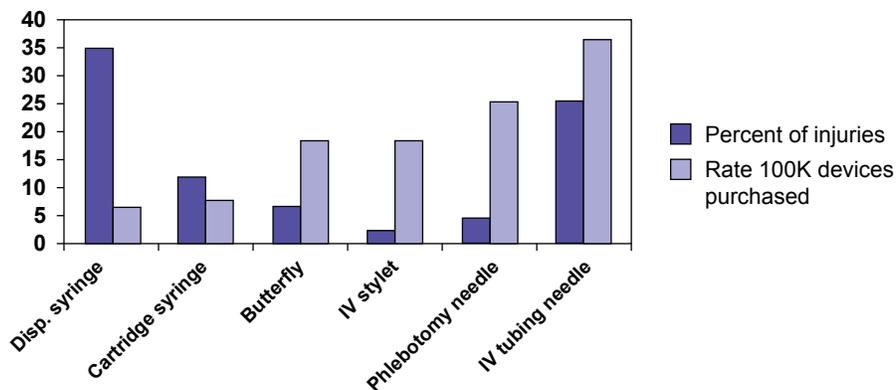
Overall, hollow-bore needles are responsible for 56% of all sharps injuries in NaSH.

Figure 4. Types of Devices Involved in Percutaneous Injuries; NaSH, 6/95 to 12/03 (n=18,708)



Device-related factors also influence percutaneous injury risks. A 1988 article by Jagger et al. (62) demonstrates that devices requiring manipulation or disassembly after use (such as needles attached to IV tubing, winged steel needles, and IV catheter stylets) were associated with a higher rate of injury than the hypodermic needle or syringe.

Figure 5. Injury Risk by Device Type



Jagger et al, NEJM, 1988;319

Importance of Hollow-bore Needle Injuries

Injuries from hollow-bore needles, especially those used for blood collection or IV catheter insertion, are of particular concern. These devices are likely to contain residual blood and are associated with an increased risk for HIV transmission (49). Of the 57 documented cases of occupational HIV transmission to healthcare personnel reported to CDC through December 2001, 50 (88%) involve a percutaneous exposure. Of these, 45 (90%) were caused by hollow-bore needles, and half of these needles were used in a vein or an artery (CDC, unpublished data). Similar injuries are seen in occupational HIV transmission in other countries (63).

Although two scalpel injuries (both in the autopsy setting) caused HIV seroconversions (CDC, unpublished data), solid sharps, such as suture needles, generally deliver a smaller blood inoculum, especially if they first penetrate gloves or another barrier (64). Therefore, these devices theoretically pose a lower risk for HIV transmission. Similar descriptive data are not available for the types of devices or exposures involved in the transmission of HBV or HCV.

Sharps Injuries in the Operating Room

Among NaSH hospitals, the operating room is the second most common environment in which sharps injuries occur, accounting for 27% of injuries overall (CDC, unpublished data). However, the epidemiology of sharps injuries in the operating room differs from that in other hospital loca-

tions. Observational studies of operative procedures have recorded some type of blood exposure to healthcare personnel in 7% to 50% of exposures; in 2% to 15% of exposures, the event is a percutaneous injury-usually from a suture needle (65-69). Aggregate data from nine hospitals on injuries among operating room staff also reflect the importance of suture needles, which in this study account for 43% of the injuries (70).

Injury Prevention Strategies

Historical Perspective and Rationale for a Broad-Based Strategy for Preventing Sharps Injuries

In 1981, McCormick and Maki first described the characteristics of needlestick injuries among healthcare personnel and recommended a series of prevention strategies, including educational programs, avoidance of recapping, and better needle disposal systems (57). In 1987, CDC's recommendations for *universal precautions* included guidance on sharps injury prevention, with a focus on careful handling and disposal of sharp devices (71). Several reports on needlestick prevention published between 1987 and 1992 focused on the appropriate design and convenient placement of puncture-resistant sharps disposal containers and the education of healthcare personnel on the dangers of recapping, bending, and breaking used needles (72-78). Most of these studies documented only limited success of specific interventions to prevent disposal-related injuries and injuries due to recapping (60, 74-77). Greater success in decreasing injuries was reported if the intervention included an emphasis on communication (72, 78).

Universal (now standard) precautions is an important concept and an accepted prevention approach with demonstrated effectiveness in preventing blood exposures to skin and mucous membranes (19, 20). However, it focuses heavily on the use of barrier precautions (i.e., personal protective practices) and work-practice controls (e.g., care in handling sharp devices) and by itself could not be expected to have a significant impact on the prevention of sharps injuries. Although personal protective equipment (e.g., gloves, gowns) provide a barrier to shield skin and mucous membranes from contact with blood and other potentially infectious body fluids, most protective equipment is easily penetrated by needles.

Thus, although strategies used to reduce the incidence of sharps injuries (e.g., rigid sharps disposal containers, avoidance of recapping) a decade or more ago remain important today, additional interventions are needed (79-81).

Current Prevention Approaches

In recent years, healthcare organizations have adopted as a prevention model the *hierarchy of controls* concept used by the industrial hygiene profession to prioritize prevention interventions. In the hierarchy for sharps injury prevention, the first priority is to eliminate and reduce the use

of needles and other sharps where possible. Next is to isolate the hazard, thereby protecting an otherwise exposed sharp, through the use of an engineering control. When these strategies are not available or will not provide total protection, the focus shifts to work-practice controls and personal protective equipment.

Since 1991, when OSHA first issued its Bloodborne Pathogens Standard (82) to protect health-care personnel from blood exposure, the focus of regulatory and legislative activity has been on implementing a hierarchy of control measures. This has included giving greater attention to removing sharps hazards through the development and use of engineering controls. By the end of 2001, 21 states had enacted legislation to ensure the evaluation and implementation of safer devices to protect healthcare personnel from sharps injuries (<http://www.cdc.gov/niosh/topics/bbp/ndl-law2.html>). Also, the federal Needlestick Safety and Prevention Act signed into law in November, 2000 (<http://www.cdc.gov/sharpssafety/pdf/Needlestick%20Safety%20and%20Prevention%20Act.pdf>) authorized OSHA's recent revision of its Bloodborne Pathogens Standard to more explicitly require the use of safety-engineered sharp devices. (<http://www.osha.gov/SLTC/bloodbornepathogens/index.html>)

Alternatives to Using Needles. Healthcare organizations can eliminate or reduce needle use in several ways. The majority (~70%) of U.S. hospitals (83) have eliminated unnecessary use of needles through the implementation of IV delivery systems that do not require (and in some instances do not permit) needle access. (Some consider this a form of engineering control described below.) This strategy has largely removed needles attached to IV tubing, such as that for intermittent (“piggy-back”) infusion, and other needles used to connect and access parts of the IV delivery system. Such systems have demonstrated considerable success in reducing IV-related sharps injuries (84-86). Other important strategies for eliminating or reducing needle use include:

- Using alternate routes for medication delivery and vaccination when available and safe for patient care, and
- Reviewing specimen collection systems to identify opportunities to consolidate and eliminate unnecessary punctures, a strategy that is good for both patients and healthcare personnel.

Engineering Controls. Engineering controls remove or isolate a hazard in the workplace. In the context of sharps injury prevention, engineering controls include sharps disposal containers and needles and other sharps devices with an integrated engineered sharps injury prevention feature. The emphasis on engineering controls has led to the development of many types of devices with engineered sharps injury prevention features (87-92) and there are suggested criteria for the design and performance of such devices (90, 91). These criteria propose that the safety feature should accomplish the following:

- Be an integral part of the device,
- Be simple and obvious in operation,
- Be reliable and automatic,
- Provide a rigid cover that allows the hands to remain behind the needle,
- Ensure that the safety feature is in effect before disassembly and remains in effect after disposal,
- Ensure the user technique is similar to that of conventional devices,
- Minimize the risk of infection to patients and should not create infection control issues beyond those of conventional devices,
- Have minimal increase in volume, relative to disposal,
- Be cost effective.

Moreover, features designed to protect healthcare personnel should not compromise patient care (91-93).

Relatively few published studies systematically assess the effectiveness of safety devices in reducing percutaneous injuries (other than those involving needle-free IV systems), despite the proliferation of these devices (Table 3). Reports that are available show considerable variation in study methodology, measurement of outcomes, and efficacy. Also, there are apparent differences in efficacy by type of device.

Table 3. Effectiveness of devices with sharps injury prevention features and other sharps injury prevention measures

Authors	Study Design and Population	Intervention	Outcome Measure	Results	Comments
Gartner (1992) (84)	Assessment of IV-delivery related PI during six month period post intervention implementation compared to historic data	Interlink IV system ®	Number of IV-delivery related PI	There were two IV-delivery related PI in the six-month period post intervention compared to an average 17 (range 11-26) IV-delivery related PI per six-month period during the previous five years, an 88% reduction.	Of the two injuries during the intervention period, one was immediately post training and the other involved use of a needle with the system
Skolnick (1993) (85)	Assessment of IV-delivery related PI during eight similar months pre- and post-intervention	IV delivery system with blunt cannula access	Number of IV-delivery related PI	The number of IV-delivery related PI declined 72%; from 36 pre-intervention to 10 (72%) during the intervention period	
Yassi et al. 1995 (86)	Assessment of IV-delivery related PI during two similar 12 month period pre- and post-intervention	Interlink IV system ®	Decline in number in IV-delivery related and total PI	The number of IV-delivery related PI declined from 61 to 10 (78.7%); total PI declined 43.4% during the intervention period	

PI = percutaneous injuries

Table 3. Effectiveness of devices with sharps injury prevention features and other sharps injury prevention measures (continued)

Authors	Study Design and Population	Intervention	Outcome Measure	Results	Comments
CDC 1997 (7)	Multi-center pre-post- safety device implementation	<p>Punctur-guard® bluntable phlebotomy needle</p> <p>Venipuncture needle-pro® (hinged needle cover)</p> <p>Safety-Iok® winged steel</p>	Estimated number of PIs* per 100,000 phlebotomies performed with conventional v. safety device	<p>76% reduction in PI rate associated with use of safety device (p<0.003)</p> <p>66% reduction in PI rate associated with use of safety device (p<0.003)</p> <p>23% reduction in PI rate associated with use of safety device (p<0.07)</p>	
Billiet et al. (1991) (94)	Pre-post implementation study comparing two devices prevent phlebotomy PI during six-month and 10-month intervention periods.	<p>Period I (six months) Recapping device (no name provided)</p> <p>Period II (10 months) Saf-T-Click® Shielded Blood Needle Adapter</p>	Change in number of phlebotomy-related PI/ 100 "Lab Liaison Services" employees	<p>Phlebotomy PI rate 10 months pre-intervention was 28/100 employees during 120,000 venipunctures; Period I, 26/100 employees during 120,000 venipunctures; Period II, 5/100 employees during 70,000 venipunctures. An 82% reduction in the total PI rate</p>	Had PI rates per 100,000 venipunctures been reported they would be 9.2 with no intervention, 8.3 with the recapping device and 3.0 with the safety device

Table 3. Effectiveness of devices with sharps injury prevention features and other sharps injury prevention measures (continued)

Authors	Study Design and Population	Intervention	Outcome Measure	Results	Comments
Dale et al. (1998) (95)	Retrospective review of phlebotomy PI rates 1983-1996 and interviews to review timing and nature of prevention measures implemented	One-handed recapping block; single-use tube holders; point-of-use sharps containers; resheathing safety phlebotomy needles; work practice changes; safety awareness program	Decline in PI per 10,000 phlebotomies performed	PI declined from 1.5 to 0.2 per 10,000 venipunctures	Authors believe decrease was correlated with changed in education, practice, and use of safety devices
Jagger (1996) (96)	Three-hospital pre/post implementation study	Safety IV catheter	Change in IV catheter PI rate per 100,000 devices purchased	IV catheter PI rate dropped 84%, from two-year average of 7.5/100,000 conventional IV catheters to 1.2/100,000 safety IV catheters	
Younger et al. (1993) (97)	Three-center study of PI 60 days pre- and post- implementation of safety syringe	3cc Monoject Safety Syringe® with sliding sheath	Rate of PI per 100,000 inventory units of conventional and safety 3cc syringes	Overall rate of PI was 14/100,000 during baseline phase and 2/100,000 during study phase (p= 0.01)	

Table 3. Effectiveness of devices with sharps injury prevention features and other sharps injury prevention measures (continued)

Authors	Study Design and Population	Intervention	Outcome Measure	Results	Comments
McCleary et al. (2002) (98)	Two-year prospective study of a safety needle in 5 hemodialysis centers	MasterGuard Anti-Stick Needle Protector® for hemodialysis	Rate of PI per 100,000 cannulations with the conventional and safety device	PI rate was 8.58/100,000 cannulations v. zero/54,000 cannulations for the safety device (p<0.029)	
Mendelson et al. (2003) (99)	Pre-post implementation study comparing injury rates with two different winged steel needles used for IV access procedures	Safety-Lok used for phlebotomy procedures	Rate of PI per 100,000 devices used with conventional and safety device	PI rate was 13.41 per 100,000 conventional devices v. 6.1 per 100,000 safety devices	
Rogues AM et al. (2004) (100)	Pre-post implementation study comparing two safety devices used for phlebotomy	Safety-Lok winged steel needle and Vacutainer blood collecting tubes used for phlebotomy procedures	Frequency of phlebotomy related PIs	Overall phlebotomy related injuries decreased 48% from the pre-intervention period to the post-intervention period.	
Orenstien et al. (1995) (101)	Twelve month prospective before-and-after trial of safety syringe, needleless IV system	Safety-Lok 3ml safety syringe Interlink IV system	Rate of NSI per 1000 HCW-days	NSI rate was 0.785/1,000 during baseline phase and 0.303/1,000 during study phase (p=0.046)	Similar decrease in NSI control unit; Non-significant decreases in 3 ml syringe-related and IV line-related NSI

In 1998, OSHA published a Request for Information in the *Federal Register* on “engineering and work practice controls used to minimize the risk of occupational exposure to bloodborne pathogens due to percutaneous injuries from contaminated sharps.” There were 396 responses to this request; several respondents provided data and anecdotal information on their experiences with safety devices. (<http://www.osha.gov/html/ndlreport052099.html>)

Research suggests that no single safety device or strategy works the same in every facility. In addition, no standard criteria exist for evaluating safety claims, although all major medical device manufacturers market devices with safety features. Therefore, employers must develop their own programs to select the most appropriate technology and evaluate the effectiveness of various devices in their specific settings.

Work-practice Controls. With the current focus on engineered technology, there is little new information on the use of work-practice controls to reduce the risk of sharps injuries during patient care. One exception is the operating room. Work-practice controls are an important adjunct for preventing blood exposures, including percutaneous injuries, in surgical and obstetrical settings because the use of exposed sharps cannot be avoided. Operating room controls include:

- Using instruments, rather than fingers, to grasp needles, retract tissue, and load/unload needles and scalpels;
- Giving verbal announcements when passing sharps;
- Avoiding hand-to-hand passage of sharp instruments by using a basin or *neutral zone*;
- Using alternative cutting methods such as blunt electrocautery and laser devices when appropriate;
- Substituting endoscopic surgery for open surgery when possible;
- Using round-tipped scalpel blades instead of pointed sharp-tipped blades; and
- Double gloving. (79,102-105)

The use of blunt suture needles, an engineering control, is also shown to reduce injuries in this setting (106). These measures help protect both the healthcare provider and patient from exposure to the other’s blood (107).

Multi-component Prevention Approaches

Experts agree that safety devices and work practices alone will not prevent all sharps injuries (102, 108-112). Significant declines in sharps injuries also require:

- Education,
- A reduction in the use of invasive procedures (as much as possible),
- A secure work environment, and
- An adequate staff-to-patient ratio.

One report detailed a program to decrease needlestick injuries that involves simultaneous implementation of multiple interventions:

- Formation of a needlestick prevention committee for compulsory in-service education programs;
- Out-sourcing of replacement and disposal of sharps boxes;
- Revision of needlestick policies; and
- Adoption and evaluation of a needleless IV access system, safety syringes, and a prefilled cartridge needleless system (111).

This strategy showed an immediate and sustained decrease in needlestick injuries, leading researchers to conclude that a multi-component prevention approach can reduce sharps injuries.

Organizational Factors

The limited successes of implementation of work practice and engineering controls in reducing bloodborne pathogen exposures has led to the examination of organizational factors that could play an important role in reducing occupational exposures. One organization level factor, known as safety culture, has been found to be notably important. Some industrial sectors are finding that a strong safety culture correlates with: productivity, cost, product quality, and employee satisfaction (113). Organizations with strong safety cultures consistently report fewer injuries than organizations with weak safety cultures. This happens not only because the workplace has well-developed and effective safety programs, but also because management, through these programs, sends *cues* to employees about the organization's commitment to safety. The concept of institutionalizing a culture of safety is relatively new for the healthcare industry and there is limited literature on the impact of such efforts. However, a recent study in one healthcare organization linked safety climate (a measure of overall safety culture) with both employee compliance with safe work practices and reduced exposure to blood and other body fluids, including reductions in sharps-related injuries (114). A second study in one healthcare organization, also noted correlations between specific dimensions of safety culture (such as perceived management commitment to safety and job hindrances) and compliance with universal precautions and accidents and injuries (115). Additionally, a recent study examining a statewide sample of healthcare personnel further indicated

that greater levels of management support were associated with more consistent adherence with universal precautions (specifically, never recapping needles), while increased job demands was found to be a predictor of inconsistent adherence (81). Positive safety climate measures have also been associated with increased acceptance of an intravenous catheter safety device in one trial (116).

Several books and articles that provide strategies for improving and measuring safety culture have been published. Also, OSHA has developed an e-learning tool to assist organizations in creating safety cultures. While most of these resources focus on the industrial sector, the principles presented are easily adapted to healthcare settings.

Differences in nurse staffing levels have been attributed to numerous outbreaks of healthcare-associated infections in hospital settings (117, 118). Nurse staffing ratios and nursing organization within hospitals have also been shown to influence hospital nurses' likelihood of sustaining needlestick injuries. One study included 40 inpatient units in 20 general hospitals in areas of high AIDS prevalence showed that nurses in units with low levels of nurse staffing (as well as units with low perceived nurse manager leadership) were more likely to incur needlestick injuries and were more likely to report the presence of risk factors associated with needlestick injuries (119). A later study that examined 22 hospitals with reputations for nursing excellence also demonstrated that nurses in hospitals with the highest hospital-level average day shift patient loads were more likely to sustain a needlestick (120). System analysis strategies, used by many healthcare organizations to improve patient safety, can also be applied to the prevention of sharps-related injuries to healthcare personnel. These strategies include the following:

- Defining "sentinel events" and performing a "root cause analysis" to determine their underlying cause.

Sentinel events are those incidents which necessitate immediate attention and further investigation. Part of that investigation might include a root cause analysis, in which the core issue is addressed, rather than just the symptoms of the problem.

- Applying "failure mode analysis" to a problem pre-event to systematically identify how to prevent it from occurring.

Failure mode analysis involves identifying the steps to complete a task, and the points at which an error or system breakdown might occur in order to learn where prevention measures should be instituted.

Detailed information on these and other systems approaches to patient safety may be found at <http://www.patientsafety.gov>.

Healthcare Personnel Acceptance

Healthcare personnel have difficulties changing long-standing practices. This observation is borne out by studies conducted in the years following implementation of universal precautions, when observed compliance with recommended practices was not satisfactory (13, 121-126). The same holds true for devices with safety features-healthcare organizations have difficulty convincing healthcare personnel to adopt new devices and procedures (111). Psychosocial and organizational factors that slow the adoption of safety practices include:

- Risk-taking personality profile,
- Perceived poor safety climate in the workplace,
- Perceived conflict of interest between providing optimal patient care and protecting oneself from exposure,
- Belief that precautions are not warranted in some specific situations,
- Failure to anticipate the potential for exposure, and
- Increased job demands that cause work to be hurried (80,125).

Personnel most readily **change their behavior** when they think that:

- They are at risk,
- The risk is significant,
- Behavior change will make a difference, and
- The change is worth the effort (127).

Conversely, one study that examined compliance with universal precautions among physicians showed that compliant physicians were more likely to be knowledgeable and have been trained in universal precautions, perceive protective measures as being effective, and perceive an organizational commitment to safety (128).

A few authors have applied research methods and behavior-change models from other disciplines to study the acceptability of infection-control strategies (129, 130). English used an adult learner model to evaluate needle injuries in hospital personnel and found that knowledge of correct procedures, provision of safe equipment, and proper management predicted compliance with needlestick-prevention precautions (129). Others consider the use of the Health Belief Model to help understand the reluctance to adopt preventive behaviors to decrease sharps injuries, and they suggest that cognitive approaches and behavior modification strategies be incorporated into an overall program to prevent sharps injuries (121, 123). Other models, including the Theory of Reasoned Action and the Theory of Planned Behavior, are recommended when considering a theoretical based intervention for improving practice (121). Further research on how these models will affect sharps injury prevention is needed.

The Need for Guidance

According to the authors of the American Hospital Association injury prevention guide (112), facilities that have adopted or are adopting safety technologies find the process to be complex and exacting. Successful **injury prevention programs** require:

- Comprehensive reporting of injuries,
- Meticulous follow-up,
- Thorough education in use of new devices, and
- Accurate evaluation of safety device and program effectiveness.

Also, although most healthcare organizations recognize the need for an interdisciplinary approach to this complex undertaking, "... few are prepared for the difficulties in attempting to change behavior, the complex logistics of supplies and equipment in a modern hospital, or the methodological and analytical rigors of documenting the impact of safety devices" (110).

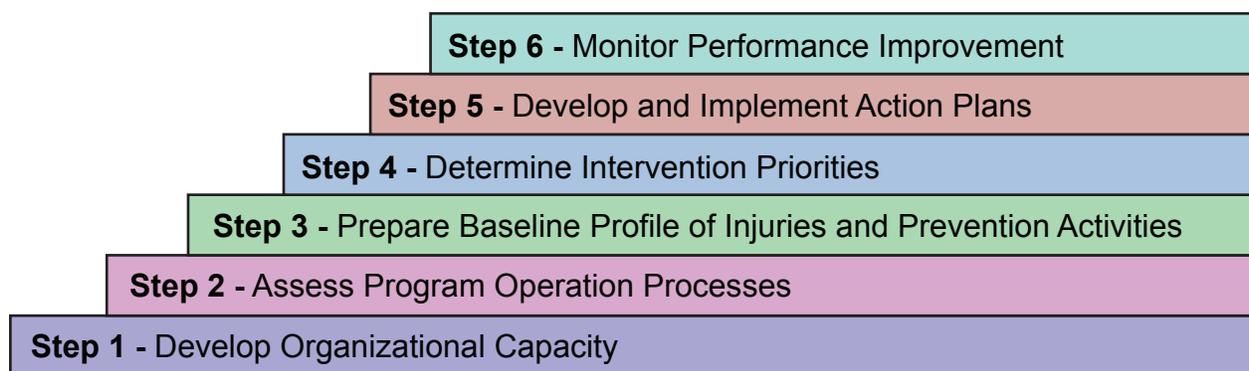
In November 1999, CDC/NIOSH issued the *NIOSH Alert: Preventing Needlestick Injuries in Healthcare Settings* to guide employers and healthcare personnel on strategies for preventing sharps injuries. CDC is providing this workbook, which compliments the CDC/NIOSH Alert, to assist healthcare organizations in their programmatic efforts to improve healthcare personnel safety.

ORGANIZATIONAL STEPS

This section describes a series of organizational steps that are designed to ensure that a sharps injury prevention program:

- Is integrated into existing safety programs,
- Reflects the current status of an institution's prevention activities, and
- Targets appropriate areas for performance improvement.

Although the program focuses on preventing sharps injuries, it is based on principles that can be applied to the prevention of all types of blood exposures.



Step 1. Develop Organizational Capacity

The proposed model is an institution-wide program (i.e., encompassing all aspects of an organization, whether a small private practice or a complex medical center) in which responsibility is held jointly by members of a multidisciplinary leadership team that is focused on eliminating sharps injuries to healthcare personnel.

Representation of staff from across disciplines ensures that needed resources, expertise, and perspectives are involved.

The responsibility and authority for program coordination should be assigned to an individual with appropriate organizational and leadership skills. **Representation from senior-level management is important to provide visible leadership and demonstrate the administration's commitment to the program.** The team should also include persons from clinical and laboratory services who use sharp devices, as well as staff with expertise in infection control, occupational health/industrial hygiene, in-service training or staff development, environmental services, central service, materi-

KEY POINTS Develop Organizational Capacity

- Create an institution-wide program
- Establish a multidisciplinary leadership team
- Involve senior-level management

als management, and quality/risk management, as available. Regardless of the type or size of the organization, a multidisciplinary approach is essential to identify health and safety issues, analyze trends, implement interventions, evaluate outcomes, and make recommendations to other organizational components.

Model for a Leadership Team

Staff Representation	Contributions/Strengths
Administration/Senior Management	Communicate the organization's commitment to worker safety; and Allocate personnel and fiscal resources to meet program goals.
Infection Control/Healthcare Epidemiology	Apply epidemiologic skills to the collection and analysis of data on injuries and healthcare-associated infections; Identify priorities for intervention based on disease transmission risks; and Assess infection control implications of engineered sharps injury prevention devices.
Occupational Health and Safety/Industrial Hygiene ¹	Collect detailed information on reported injuries; Assist in surveying healthcare personnel on underreporting; and Assess environmental and ergonomic factors contributing to sharps injuries and propose solutions.
Risk Control/Quality Management ¹	Provide an institutional perspective and approach to quality improvement; and Help design processes related to the sharps injury prevention program.
Inservice Training/Staff Development	Provide information on current education and training practices; and Identify training needs, and discuss the organizational implications of proposed educational interventions.
Environmental Services	Provide insight on environmental injury risks not captured through percutaneous injury reporting; and Assess the environmental implications of proposed interventions.
Central Service	Provide insight into unique injury risks associated with reprocessing of sharp devices; and Identify logistical issues involved in implementing devices with engineered sharps prevention features.
Materials Management	Help identify products and manufacturers of devices with engineered sharps prevention features; and Provide cost data for making informed decisions.
Labor	Promote injury reporting, safe work habits, and the implementation of prevention priorities among members.
Front-line Clinical and Laboratory Staff	Provide insight into injury risk factors and the implications of proposed interventions; Actively participate in the evaluation of prevention interventions.

¹ Different disciplines often share common areas of expertise. Therefore, these roles should not be viewed as exclusive to one discipline only.

Although the leadership team should include a small core group of clinical staff, other staff from areas such as radiology, anesthesiology, respiratory therapy, surgery, hemodialysis, intensive care, pediatrics, and other units might be invited to participate in a particular discussion or as part of an ad hoc subcommittee.

In this first step, the leadership team should outline how it plans to achieve the goal of injury reduction or elimination. The team should determine which of the facility's standing committees will contribute to the process and how these committees will exchange information. Committees might include:

- Infection Control
- Quality Improvement
- Occupational Health and Safety
- Value Analysis
- Materials Management/Product Evaluation

In some organizations, one of these committees might be charged with oversight of the sharps injury prevention program. However, each committee should become involved in designing the sharps injury prevention program. For example, the Occupational Safety and Health or Infection Control committees might provide monthly reports on sharps injuries. In turn, the leadership team might work with the Occupational Safety and Health or Infection Control committees to improve the quality of information collected to better meet performance improvement goals.

Step 2. Assess Program Operation Processes

The proposed program model includes **five operational processes**, each of which is discussed in detail in subsequent sections of the *Workbook*. These include:

- 1) Institutionalize a culture of safety in the work environment,
- 2) Implement procedures for reporting and examining sharps injuries and injury hazards,
- 3) Analyze sharps injury data for prevention planning and measuring performance improvement,
- 4) Select sharps injury prevention devices (e.g., devices with safety features), and
- 5) Educate and train healthcare personnel on sharps injury prevention.

The team should conduct a baseline assessment of each of these processes to determine where improvements are needed.

KEY POINTS: Program Operation Processes

- Five processes support a sharps injury prevention program
- A baseline assessment of these processes is necessary for effective program planning
- Areas for review include:
 - Assessment of the Culture of Safety
 - Procedures for sharps injury reporting
 - Analysis and use of sharps injury data
 - Systems for selecting, evaluating and implementing safety devices
 - Programs for the education and training of healthcare personnel on sharps injury prevention

Toolkit Resource for This Activity:

Baseline Program Assessment Worksheet (see Appendix A-1)

Assessing the Culture of Safety

This assessment determines how safety, particularly sharps injury prevention, is valued in the organization and what processes are in place to promote a safe work environment for the protection of patients and healthcare personnel. Key elements of an organizational safety culture and suggestions for improving safety awareness are discussed in *Operational Processes, Institutionalize a Culture of Safety in the Work Environment*. As part of a baseline assessment, the team should assess the following:

- Organization leadership's commitment to safety;
- Strategies used to report injuries and to identify and remove injury hazards;
- Feedback systems to improve safety awareness; and
- Methods to promote individual accountability for safety.

The team should also explore the data sources (e.g., written or observational surveys, incident reports) that are used or could be used to measure safety culture performance improvement. As part of the baseline assessment and as a possible mechanism for measuring performance improvement, the team might **consider using the following tool to survey staff about their perceptions of a safety culture** in the organization.

Toolkit Resource for this Activity:

Survey to Measure Healthcare Personnel's Perceptions of a *Culture of Safety* (see Appendix A-2)

Assessing Procedures for Sharps Injury Reporting

Most healthcare organizations have procedures for reporting and documenting employee needlesticks and other percutaneous injuries. The team should assess whether these procedures are adequate for data collection and analysis and determine the data sources that can be used to assess improvements in injury reporting.

As part of the baseline assessment, the team should **consider using the following tool to assess the completeness of sharps injury reporting.** (Although postexposure management is not included in the model for a sharps injury prevention program, the survey tool does include questions that can be used to assess worker satisfaction with the postexposure management process.) Periodic repeat surveys (e.g., every few years) can be used to measure improvements in reporting compliance.

Toolkit Resource for This Activity:

Survey of Healthcare Personnel on Occupational Exposure to Blood and Body Fluids (see Appendix A-3)

Assessing Methods for the Analysis and Use of Sharps Injury Data

Data on sharps injuries need to be analyzed and interpreted so they will be meaningful for prevention planning. This part of the assessment determines how these data are compiled and used in the organization. See *Operational Processes, Analyze Sharps Injury Data*, for a discussion of how to perform simple data analysis.

Assessing the Process for Identifying, Selecting, and Implementing Engineered Sharps Injury Prevention Devices

Because an important goal of this *Workbook* is to provide information and guidance on the implementation of devices with engineered sharps injury prevention features, a model approach for the evaluation of these devices is included in *Operational Processes, Selection of Sharps Injury Prevention Devices*. This baseline assessment considers who is involved and how decisions are made. As with other program functions, it is important to determine the data sources (e.g.,

product evaluation committee reports, lists of manufacturers contacted, device lists) that can be used to measure process improvement. A similar process assessment of methods for identifying and implementing other prevention interventions (e.g., changes in work practices, policies, and procedures) also could be included in this baseline assessment.

Assessing Programs for the Education and Training of Healthcare Personnel on Sharps Injury Prevention

Most healthcare institutions have a plan for providing employee education and training on blood-borne pathogen prevention at the time of hire, as well as on an annual basis. The implementation of a sharps injury prevention program is an opportune time to reassess the quality of these efforts and to identify other education and training opportunities. As with other processes, it is necessary to identify the data (e.g., staff development reports, curriculum changes, training) that can be used to assess improvements in educating and training healthcare personnel.

Step 3. Prepare a Baseline Profile of Sharps Injuries and Prevention Activities

After assessing program operations, the next step is to develop a baseline profile of injury risks in the institution. This information, along with the information gleaned from the baseline assessment, will be used to develop an intervention action plan.

Toolkit Resource for This Activity:

Baseline Institutional Injury Profile Worksheet (see Appendix A-4)

Toolkit Resource for This Activity:

Baseline Injury Prevention Activities Worksheet (see Appendix A-5)

Using data currently available in the organization and the tools provided in this *Workbook*, develop a **profile of how injuries are occurring and a list of current prevention strategies**. The following questions may help guide the development of this profile, but other questions may be added.

- What occupational groups most frequently sustain sharps injuries?
- Where do sharps injuries most frequently occur?
- What devices are most commonly involved in sharps injuries?

- What circumstances or procedures contribute to sharps injuries?
- What sharps injuries pose an increased risk for bloodborne virus transmission?
- Has the organization taken steps to limit the unnecessary use of needles by healthcare personnel? If so, how has this been done?
- What devices with engineered sharps injury prevention features have been implemented?
- Is there a list of recommended work practices to prevent sharps injuries?
- What communication tools have been used to promote safe sharps handling techniques?
- Is there a policy/procedure for determining the appropriate location of sharps containers?
- Who is responsible for removing/replacing sharps containers?

Step 4. Determine Prevention Priorities

Not all problems can be addressed at once, so healthcare organizations must decide which sharps injury problems should receive priority attention. Baseline information on sharps injuries, along with the weaknesses identified in the assessment of program operation processes, should be used to determine priority areas.

Sharps Injury Prevention Priorities

The following approaches can be used alone or in combination to create a list of initial priorities for intervention:

- Determine priorities based on injuries that pose the **greatest risk for bloodborne virus transmission** (e.g., focus initially on preventing injuries associated with vascular access)
- Determine priorities based on the **frequency of injury** with a particular device (e.g., focus on injuries associated with hypodermic or suture needles)
- Determine priorities based on a **specific problem contributing to a high frequency of injuries** (e.g., focus on sharps handling and/or disposal)

Toolkit Resource for This Activity:

Same as for Step 3 (Appendix A-3).

Program Process Improvement Priorities

Leadership teams might consider selecting one problem in each of the processes or focus only on one of the processes for performance improvement. Give priority to those areas that will have the greatest impact on improving the overall operation of the program.

Step 5. Develop and Implement Action Plans

An intervention action plan provides a road map for charting the course, monitoring progress, and measuring performance improvements in a sharps injury prevention program. Two intervention action plans are proposed:

- The first focuses on implementing and measuring interventions to reduce specific types of injuries.
- The second measures improvements that are the result of the program processes.

Action Plan to Reduce Injuries

Set Targets for Injury Reduction. Based on the list of priorities, set targets for reducing specific types of injuries over a designated period (e.g., six months, one year). These targets should provide reasonable expectations based on the interventions available and the degree to which they are likely to be successful.

Specify Interventions. For each problem targeted for intervention, apply one or more of the following strategies:

- Substitute a non-sharp alternative for performing a procedure
- Implement a device with currently recognized engineered sharps injury prevention features
- Recommend a change in work practice

KEY POINTS Designing Action Plans

- Establish an action plan for reducing injuries
 - Set targets for injury reduction
 - Specify which interventions will be used
 - Identify indicators of performance improvement
 - Establish time lines and define responsibility
- Establish an action plan for performance improvement
 - List priorities for improvement, as identified in the baseline assessment
 - Specify which interventions will be used
 - Identify performance improvement measures
 - Establish time lines and define responsibilities

- Change a policy or procedure
- Provide targeted education of healthcare personnel

The intervention action plan should reflect each strategy used and describe the steps, time line, and responsibility for implementation.

Identify Indicators of Performance Improvement. Indicators are tools for measuring progress; they tell when a goal is reached. It is important to include measures other than simply the number of injuries occurring. It is not possible to accurately interpret changes in frequency over time, these data are dependent on self-reported surveillance data, and which often creates an incentive to suppress reporting of incidents. The following can be used to measure the impact of an intervention on injuries:

- Increases in the number of safety devices being purchased,
- Changes in the frequency of certain types of injuries,
- Frequency of compliance with the use of a newly implemented engineering control, or
- Changes in injury rates, e.g., device-specific or occupational.

Once the indicators are identified, the team will need to decide:

- How frequently indicators will be monitored (e.g., monthly, quarterly, semiannually, annually), and
- How and by whom they will be reported,
- With whom indicators will be shared.

Toolkit Resource for This Activity:

Sharps Injury Prevention Program Action Plan Forms (see Appendix A-6)

Action Plan to Measure Program Performance Improvement

The baseline profile will identify the strengths and weaknesses of the organization's sharps injury prevention activities. With this information, the team can create a list of priorities for performance improvement and then decide how to accomplish the necessary tasks. When writing this part of the action plan, the team should be sure that the areas for process improvement are clear and measurable. To increase the likelihood of success, only a few improvements should be taken on at a time.

Step 6. Monitor Program Performance

The one question asked repeatedly during the assessment of operational processes is: ***What data can be used to measure performance improvement for each process?*** Once identified, data from each of these processes should be used to monitor overall program performance. In addition, as with any planning function, a checklist of activities and a timeline for implementation should be developed to monitor progress. The team should consider developing a monthly or quarterly schedule for reviewing performance improvement. Not all areas targeted for improvement need to be reviewed at each team meeting. By spreading these over the year, the team can spend more time on each issue. If the desired objectives are not being met, the team should redesign the plan accordingly.

KEY POINTS Designing Action Plans

- Develop a checklist of activities
- Create and monitor a time line for implementation
- Schedule periodic reviews for assessing performance improvements

The process of designing, implementing, and evaluating a sharps injury prevention program is continuous. At least once a year, the team should reassess the processes for avoiding injuries.

OPERATIONAL PROCESSES

The following section describes five operational processes that are viewed as essential elements of any sharps injury prevention program. Toolkit resources to assess, implement, or evaluate these processes are included in the appendices.

OPERATIONAL PROCESSES

Institutionalize a Culture of Safety in the Work Environment

Introduction

Many strategies to reduce sharps injuries focus on individual- or job/task-level improvements (e.g., implementing appropriate safety devices, using safe work practices). However, this particular strategy considers sharps injury prevention in the context of a broader organizational perspective of safety, namely institutionalizing a culture of safety to protect patients, personnel, and others in the healthcare environment. The following describes safety culture concepts and discusses why having a culture of safety is important to the success of a sharps injury prevention program.

Safety Culture Concepts. From an organizational perspective, **culture** refers to those aspects of an organization that influence overall attitudes and behavior. Examples include:

- Leadership and management style
- Institution mission and goals
- Organization of work processes

An organizational culture is the accepted norms that each place of work establishes for day-to-day tasks. It is shown to be strongly associated with workers' perceptions of job characteristics and organizational functioning (131, 132).

A **culture of safety** is the *shared commitment of management and employees to ensure the safety of the work environment*. A culture of safety permeates all aspects of the work environment. It encourages every individual in an organization to project a level of awareness and accountability for safety. Employees perceive the presence of a culture of safety based on multiple factors, including:

- Actions taken by management to improve safety,
- Worker participation in safety planning,
- Availability of written safety guidelines and policies,
- Availability of appropriate safety devices and protective equipment,
- Influence of group norms regarding acceptable safety practices, and
- Socialization processes around safety that personnel experience when they first join an organization.

All of these factors serve to communicate the organization's commitment to safety.

Value of Institutionalizing a Culture of Safety to Healthcare Organizations. Most of our knowledge about safety culture comes from organizations within industries that face high intrinsic

hazards, yet perform successfully because they treat safety systematically. Such organizations are termed “high reliability organizations” and are found in the aviation, nuclear power and manufacturing industries as well as parts of the military, where safety climate (employees’ perceptions about the organization’s safety culture) was first studied. Critical determinants of the successful safety programs in early research include:

- Safety is valued as the primary priority, even at the expense of “production” or “efficiency”,
- Unsafe acts are rare despite high levels of production,
- Management is involved in safety programs, with a commitment to safety articulated at the highest levels of the organization and translated into shared values, beliefs, and behavioral norms to all levels,
- High status and rank for safety officers;
- Strong safety training and safety communications programs;
- Orderly plant operations;
- Communication between workers and across organizational levels is frequent and candid,
- An emphasis on recognizing individual safe performance rather than relying on punitive measures (personnel are rewarded for erring on the side of safety even if they turn out to be wrong),
- The response to a problem focuses on improving system performance rather than on individual blame (132-135).

The concept of institutionalizing a culture of safety is relatively new for the healthcare industry and much of the focus is on patient safety. Studies examining safety climate in the context of patient safety have shown that the culture of safety within healthcare organizations is not as developed as that found in high reliability organizations (132,136). However, recent studies in some healthcare organizations link **measures of safety culture** to:

- Employee compliance with safe work practices,
- Reduced exposure to blood and other body fluids, including reductions in sharps-related injuries, and
- Acceptance of newly introduced safer needles devices. (111,113,116)

Safety Culture and Patient Safety. Safety culture is also relevant to patient care and safety. According to an Institute of Medicine (IOM) report, *To Err is Human* (137), medical errors represent one of the nation’s leading causes of death and injury. The report estimates that 44,000 to 98,000 deaths occur

KEY POINTS Factors That Influence a Culture of Safety
<ul style="list-style-type: none"> ■ Management commitment to safety ■ Healthcare personnel involvement in safety decisions ■ Method of handling of safety hazards in the work environment ■ Feedback on safety improvements ■ Promotion of individual accountability

due to medical errors in U.S. hospitals each year. Although the report acknowledges that causes of medical error are multifaceted, the authors repeatedly emphasize the pivotal role of safety culture. Thus, whereas the focus of this *Workbook* is on healthcare personnel safety, strategies related to safety culture also have important implications for the health and welfare of patients. By uniformly applying safety management to both patient and nonpatient groups, a fragmented safety concept is avoided, in which patient safety-related problems are labeled as “errors” that can be prevented while occupational safety-related injuries are “accidents” that cannot be avoided (138).

Strategies for Creating a Culture of Safety

To create a culture of safety, organizations must address those factors known to influence employees’ attitudes and behavior. Organizations must also direct measures to reduce hazards in the environment. Although many factors influence a culture of safety, this *Workbook* emphasizes those that are believed to be the major determinants of a safety culture.

Ensure Organizational Commitment. Organizations can use three important strategies to communicate their involvement in and commitment to safety:

- **Include safety-related statements** (e.g., zero tolerance for unsafe conditions and practices in the healthcare environment) in statements of the organization’s mission, vision, values, goals, and objectives;
- **Give high priority and visibility to safety committees**, teams, and work groups (e.g., occupational health, infection control, quality assurance, pharmacy, and therapeutics), and ensure direct management involvement in the evaluation of committee processes and impact. Patient safety climate surveys have consistently demonstrated that managers often have a more positive view of the safety climate at their facility than do front-line workers (132, 139).
- **Require action plans for safety** in ongoing planning processes. (e.g., an action plan for improving the culture of safety for sharps injury prevention could be one element in an overall safety culture initiative.)

Management can also communicate a commitment to safety indirectly by modeling safe attitudes and practices. Healthcare professionals in positions of **leadership send important messages** to subordinates when they:

- Handle sharp devices with care during procedures,
- Take steps to protect co-workers from injury, and
- Properly dispose of sharps after use.

Similarly, managers should address sharps hazards in a non-punitive manner as soon as they are observed and discuss safety concerns with their staff on a regular basis. This will positively reflect the organization’s commitment to safety and build safety awareness among staff.

Involve Personnel in the Planning and Implementation of Activities That Promote a Safe Healthcare Environment. Involving personnel from various areas and disciplines while planning and implementing activities improves the culture of safety and is essential to the success of such an initiative. Those personnel who participate on committees or teams created to institutionalize safety serve as conduits of information from and to their various work sites. They also legitimize the importance of the initiative in the eyes of their peers.

Encourage Reporting and Elimination of Sharps Injury Hazards. Another strategy for institutionalizing a culture of safety is to create a blame-free environment for reporting sharps injuries and injury hazards. Healthcare personnel who know that management will discuss problems in an open and blame-free manner are more likely to report hazards. Healthcare organizations can also actively look for sharps injury hazards by performing observational rounds and encouraging staff to report *near misses* and observed hazards in the work place. (See *Implement Procedures for Reporting Sharps Injuries and Injury Hazards*.) Once identified, hazards should be investigated as soon as possible to determine the contributing factors, and actions should be taken to remove or prevent the hazard from occurring in the future.

Develop Feedback Systems to Increase Safety Awareness. A number of communication strategies can provide timely information and feedback on the status of sharps injury prevention in the organization. One strategy incorporates findings from hazard investigations, ongoing problems with sharps injuries, and prevention improvements into articles in the organization's newsletter, staff memoranda, and/or electronic communication tools. It is important to communicate the value of safety by providing feedback when the problem is first observed and commending improvements. Another strategy is to create brochures and posters that enhance safety awareness. Such materials can reinforce prevention messages and highlight management's commitment to safety.

Promote Individual Accountability. Promoting individual accountability for safety communicates a strong message about the organization's commitment to a safe healthcare environment. In order for accountability to be an effective tool, all levels in the organization must comply. An organization can promote individual accountability for safe practices in general-and sharps injury prevention in particular-in many ways. One way is to incorporate an assessment of safety compliance practices in annual performance evaluations; for managers and supervisors, this might include evaluating methods used to communicate safety concerns to their subordinates. Organizations might also consider having staff sign a pledge to promote a safe healthcare environment. This could be incorporated into hiring procedures and/or as part of an organization-wide safety campaign.

Measuring Improvements in the Safety Culture

Data from four possible sources can measure how improvements in safety culture affect sharps injury prevention:

- Staff surveys on perceptions of a safety culture in the organization and reporting of blood and body- fluid exposures (Appendices A-2 and A-3),
- Sharps injury reports (Appendix A-7),
- Hazard reports (Appendix A-9-1), and
- Observational hazard assessment reports (Appendix A-9-2).

Each of the above tools can demonstrate changes over time that serve to indicate improvements in the safety culture. For example, decreased frequency of selected circumstances on a blood exposure report form can reflect increased safety consciousness (e.g., improperly discarded sharps, collisions between personnel that result in a sharps injury). Also, periodic (e.g., every few years) personnel surveys on perceptions of safety and exposure reporting are likely to reflect positive changes in the organization's commitment to safety. Hazards will also decrease as problems are addressed and corrected. If no improvements are detected, the sharps injury prevention leadership team should reassess its strategies and revise the performance improvement action plan.

Additional information on implementing a culture of safety is available at the following websites:

Notice: Clicking the link(s) below will leave the CDC Website. We have provided links to these sites because they have information that may be of interest to you. CDC does not necessarily endorse the views or information presented on these sites. Furthermore, CDC does not endorse any commercial products or information that may be presented or advertised on these sites that are about to be displayed.

- <http://www.patientsafety.gov/>
- <http://www.ahrq.gov/clinic/ptsafety/chap40.htm>
- <http://www.ihl.org/IHI/Topics/PatientSafety>
- http://depts.washington.edu/ehce/NWcenter/course_presentations/robyn_gershon.ppt

OPERATIONAL PROCESSES

Implement Procedures for Reporting and Examining Sharps Injuries and Injury Hazards

Introduction

Most healthcare organizations have procedures to report and document employees' exposures to blood and body fluids. In addition, many organizations have or are initiating procedures to identify hazards or *near misses* that could lead to sharps injuries and other adverse events. The latter is a proactive way to intervene to prevent injuries before they happen. Quality data on both reported injuries and injury hazards are important sources of information for prevention planning. Obtaining this information requires that healthcare personnel understand what to report and how to report in addition to being motivated to follow the reporting procedures. Both activities require forms to record relevant data as well as a central repository for the collected information. This section:

- Discusses how to establish an effective process for reporting process and
- Identifies the information that is essential in order to identify risks and plan prevention strategies.

Develop an Injury Reporting Protocol and Documentation Method

Characteristics of a Reporting Protocol. Ev-

ery healthcare organization should have a written protocol that describes where and how healthcare personnel should seek medical evaluation and treatment after an occupational exposure to blood or body fluids, including percutaneous injury. To ensure timely medical treatment, the protocol should encourage prompt reporting and describe procedures for the rapid provision of medical care during all work hours (day, evening, and night shifts). In some cases, this will require designating different places for exposure evaluation and care at different times. The reporting system should ensure that records of exposed employees and non-employees (e.g., students, per diem staff, volunteers) are maintained in a confidential manner. Exposure reports should be maintained in a designated area (e.g., occupational health, infection control) for purposes of follow-up and record keeping. It is important that all staff responsible for treating bloodborne pathogen exposures have been trained in the facility's post exposure protocol, including which baseline tests to conduct, whom to contact to follow-up with the source patient, and where records are maintained (generally in employee health or infection control).

KEY POINTS

- Information on reported injuries and injury hazards is necessary for prevention planning
- Healthcare personnel must understand reporting procedures and be motivated to report exposures

Characteristics of a Report Form. In the past, healthcare organizations typically used one report form to document any type of incident involving a patient or employee (e.g., fall, medication error, sharp injury). Although this type of form may provide descriptive information, it generally does not collect sufficient details to analyze injuries or measure prevention improvement.

Several organizations, including CDC, have developed forms to collect detailed information on sharps injuries reported by healthcare personnel. These forms can serve multiple purposes:

- Collecting descriptive information to help monitor sharps injuries and the impact of prevention interventions,
- Providing information to guide the medical exposure management, and
- Providing documentation for meeting regulatory requirements.

To effectively monitor injuries for sharps injury prevention planning purposes, **minimal data elements** include:

- Unique identification number for the incident; (records shall be maintained in a way that protects the confidentiality of the healthcare worker);
- Date and time of the injury;
- Occupation of the worker;
- Department or work area where the exposure incident occurred;
- Type of device involved in the injury;
- Presence or absence of an engineered sharps injury prevention feature on the device involved;
- Brand of the device
- Purpose or procedure for which the sharp device was being used; and
- When and how the injury occurred.

Regulatory requirements also dictate what information must be collected. **Federal OSHA and some state laws or regulations now require a record of the brand and manufacturer of any device involved in an injury to a worker.** Devices with engineered sharps injury prevention features are designed specifically to prevent injuries to healthcare personnel. Incident reports that involve these devices must include adequate information on these devices to be able to ascertain whether the injury was due to:

- Design flaw,
- Manufacturing defect,

- Device failure,
- Operator error (e.g., failure to activate the safety feature), or
- Other circumstances (e.g., movement of the patient that precluded use of the safety feature).

As with any medical product, if the device or equipment is potentially defective, the lot number and information about the defect should be reported to the Food and Drug Administration (<http://www.fda.gov/cdrh/mdr/>). (Healthcare organizations should also review new OSHA procedures for maintaining a sharps injury log, included in the recently revised Bloodborne Pathogens Standard [CFR 1910.1030 (h)] that took effect on April 18, 2001, and for using OSHA Forms 300 *Log of Work-Related Injuries and Illnesses* and 301 *Injury and Illness Incident Report* that were required for use by January 1, 2002. Both the log and the individual report forms record many kinds of occupational injuries.)

A sample form for recording information on blood and body-fluid exposures is included in the toolkit. This form is similar to those used by hospitals participating in NaSH and EPINet. It demonstrates the level of data that some facilities are collecting and using to monitor blood exposures and the effect of prevention interventions. Healthcare organizations may download and print this form for use in their sharps injury prevention program. (Other organizations may have or may be developing similar forms.) The CDC's National Healthcare Safety Network (NHSN) is available to healthcare facilities that wish to enter exposure data into a web-based reporting system. (<http://www.cdc.gov/ncidod/dhqp/nhsn.html>)

Toolkit Resource for This Activity:

[Blood and Body Fluid Exposure Report Form \(see Appendix A-7\)](#)

Develop a Process for Hazard Reporting

Many organizations take a proactive approach to injury prevention. They seek and identify hazards in the work environment and encourage all personnel to report observed hazards (e.g., improperly discarded sharps), including the occurrence of *near misses*. Individuals who report near misses often self-define the miss, but these may include a hand that slipped while activating the safety feature on a sharp device, but no injury occurred. Information on these hazards can help identify areas needing attention or intervention. A defined process for reporting hazards empowers personnel to take action when there is a risk for a sharps injury. Organizations that are considering implementing a hazard reporting protocol may find the forms provided in the Toolkit useful.

Toolkit Resource for This Activity:

Environmental Rounds Hazard Observation Form and Sharps Injury Hazard Observation Form (see Appendix A-8)

Develop a Process for Examining Factors That Led to Injury or “Near Miss”

While data on needlesticks are important for examining outcomes, it is also very important to examine the processes and systems that have led to these outcomes. There are several quality improvement tools that can assist in analyzing the processes and systems that contribute to sharps injuries or “near misses.” These include:

Process maps or flow charts are used to describe, step-by-step, the process which is being examined, e.g., sharps disposal, phlebotomy.

Fishbone or cause-and-effect diagrams can be used to identify, explore, and graphically display all of the possible contributors to a problem. The “bones” of these diagrams are usually divided into at least four areas of “cause”: 1) people; 2) equipment; 3) environment; and 4) communication.

Affinity diagrams are used so a team may creatively generate multiple issues or ideas and then summarize the natural groupings in order to understand the underpinnings of a problem and identify possible solutions.

The following Websites from non-healthcare settings are useful for individuals who want to learn more about these tools and consider applying them to sharps injury prevention.

- <http://www.literacynet.org/icans/chapter04/index.html>

Root Cause Analysis (RCA) is a process for identifying the basic or causal factors that underlie variations in expected performance. This process is being used widely in healthcare settings to identify factors that lead to adverse patient outcomes or are associated with a “sentinel event” (e.g., medication errors, laboratory errors, falls). The RCA concept also can be applied to sharps injury prevention. For this reason, it is discussed in greater detail than the quality improvement tools mentioned above. RCA is not always feasible for every incident. It is important to prioritize types of incidents for conducting RCA. It may be helpful to utilize sharps injury data or the baseline assessment in determining which incidents should receive further investigation.

The key to the RCA process is asking the question “why?” as many times as it takes to get down to the “root” cause(s) of an event.

- What happened?
- How did it happen?
- Why did it happen?
- What can be done to prevent it from happening in the future?

Root cause analysis focuses on the relationship between the event and the following possible factors:

- Patient assessment
- Staff training or competency
- Equipment
- Work environment
- Lack of information (or misinterpretation of information)
- Communication
- Appropriate rules/policies/procedures-or lack thereof
- Failure of a barrier designed to protect the patient, staff, equipment or environment
- Personnel or personal issues

For each “YES” response, additional questions about why each of these factors occurred leads to a determination of whether it is a “root cause” of the event, and whether there is a need for further action. From this, a team may develop a specific action plan and outcome measures in response to the event investigated. A sample form and completed examples are provided to illustrate the RCA process. This may be a particularly useful approach for those healthcare facilities with very few occupational sharps injuries, in which case a single needlestick might be considered a sentinel event that triggers an investigation.

An RCA event can be investigated by one individual, but it will need to involve the principles associated with the event and a team of individuals who will interpret the findings and assist in developing an action plan. The keys to the success of RCA are:

- Sensitivity to the affected individuals,
- Openness to uncovering the root causes,
- Not assigning culpability, and
- Support for changes that will lead to improved worker safety.

A sample form for performing RCA is provided in the toolkit. An example of a completed form also is provided.

Toolkit Resource for This Activity:

Sample Form for Performing a Simple Root Cause Analysis of a Sharps Injury or “Near Miss” Event (see Appendix A-9)

Resources for additional information on RCA include:

- <http://www.rootcauseanalyst.com>
- <http://www.sentinelevent.com>
- <http://www.jointcommission.org/SentinelEvents/Forms>

OPERATIONAL PROCESSES

Analyze Sharps Injury Data

Introduction

Sharps injury data must be compiled and analyzed if they are to be used for prevention planning. This section describes:

- How to compile data from injury and hazard reports.
- How to perform simple and complex analyses.

Compiling Sharps Injury Data

Data on sharps injuries can be compiled by hand or with a computerized database. The latter facilitates multiple types of analyses (e.g., line lists, frequency lists, cross-tabulations). Alternatively, these facilities might participate in a professional organization's regional or state data collection network that allows several facilities to contribute descriptive data (with confidential individual identifiers removed) on injuries. (Although such networks are not known to be available, it is possible that they will be developed in the future.) The advantage of having small organizations of similar purpose (e.g., medical or dental offices) contribute to a larger data collection pool is so that aggregate data can enhance the understanding of the frequency of sharps injuries and identify unique injury risks associated with these work sites. Small facilities may choose to aggregate data over several years, if the data in each year is not enough to use to determine prevention priorities.

Injury data can be analyzed with very simple statistical tools, such as *frequency distributions* and *cross-tabulation*. Large databases can perform more sophisticated analyses (e.g., multivariate analysis).

Analyzing Sharps Injury Data

The first step in the analysis of data is to generate simple frequency lists, by hand or computer, on the variables that make up the following data elements:

- Occupations of personnel reporting injuries;
- Work locations (e.g., patient units, operating room, procedure room) where reported injuries occur;
- Types of devices (e.g., hypodermic needles, suture needles) involved in reported injuries;
- Types of procedures (e.g., phlebotomy, giving an injection, suturing) during which injuries occur;

- Timing of occurrence of injuries (e.g., during use, after use/before disposal, during/after disposal); and
- Circumstances of injuries (e.g., during use of the device in a patient, while cleaning up after a procedure, as a result of improper disposal of a device).

Once frequencies are tabulated, a cross-tabulation of variables provides a more detailed picture of how injuries occur. This is most easily performed in a computerized database, but it can be done by hand. For example, simple cross-tabulations using occupation and device variables might reveal differences in the types of devices involved in injuries among persons in different occupations. Cross-tabulations can also assess whether certain procedures or devices are more often associated with injuries. The example below shows that nurses are more frequently injured by hypodermic needles and physicians by winged steel needles. Nurses and phlebotomists report the same number of injuries from phlebotomy needles. Armed with this information, it is then possible to seek additional information that might explain these differences in injuries for each occupation.

Example of How to Perform a Cross-Tabulation*				
Types of devices involved in injuries sustained by different occupational groups during (time period being analyzed)				
Occupation/Device	Nurses	Physicians	Phlebotomists	Total
Hypodermic Needle	20	12	2	34
Winged Steel Needle	12	25	1	38
Phlebotomy Needle	8	3	8	19
Scalpel	1	17	0	18
TOTAL	41	57	11	109

Hypothetical example, using a grid with one variable (e.g., occupation) in the horizontal axis and another variable (e.g., device) in the vertical axis shows differences in occupational injuries by type of device. Other variables (e.g., procedure, injury circumstances, etc.) can be cross-tabulated to better understand injury risks.

Calculating Injury Incidence Rates

Injury incidence rates provide information on the occurrence of selected events over a given period of time or other basis of measurement. The calculation of injury incidence rates for specific occupations, devices, or procedures can be useful for measuring performance improvement.

However, many factors, including improved reporting of injuries, can influence changes in incidence rates. Depending on the denominator(s) used, a facility may be viewed favorably or negatively. A recent report compared sharps injury rates in 10 Midwestern facilities that differed

in size and scope of operation. It found considerable variation depending on the selection of the denominator (140). Therefore, the calculation of injury rates should be considered as one of many tools available to monitor sharps injury trends within a facility, but should be used with caution when making inter-facility comparisons.

Calculating injury incidence rates requires reliable and appropriate numerators and denominators. Numerators derive from information collected on the injury report form; denominators must be obtained from other sources (e.g., human resources figures, purchasing records, cost center data). The numerator and denominator must reflect a common opportunity for exposure. For example, when calculating injury incidence rates among nursing personnel, the denominator should ideally reflect only those nurses whose job responsibilities expose or potentially expose them to sharp devices.

Selecting Denominators for Calculating Occupation-specific Injury Rates. Denominators sometimes used to calculate occupation-specific incidence rates include:

- Number of hours worked
- Number of FTE positions
- Number of healthcare personnel

Of these, “number of hours” worked is probably the most accurate and easiest to obtain, especially if part-time and per diem staff are included. Human resources and/or financial departments should be able to provide these numbers. For some complex healthcare organizations (e.g. university teaching centers) and for some occupations (e.g., attending physicians, radiologists, and anaesthesiologists provided through contract), obtaining denominators might be more difficult. If the analysis does not use the same denominator to calculate occupation-specific rates, comparisons among occupational groups are invalid.

Adjusting Occupation-specific Injury Rates for Underreporting. Although rates can be adjusted for underreporting, this step is not essential, nor is it necessarily useful, particularly for small facilities. For facilities that are interested in adjusting, the most reliable source of information is data from a survey of healthcare personnel in the facility (Appendix A-3). For example, if the survey finds considerable disparities in reporting among occupational groups (e.g., phlebotomists reporting 95% of their injuries and physicians only 10%), then adjustment of occupation-specific rates is appropriate to accurately reflect differences among occupational groups. Guidance for performing these calculations is included in the Toolkit.

Toolkit Resource for This Activity:

[Occupation-Specific Rate-Adjustment Calculation Worksheet \(see Appendix A-10\)](#)

Calculating Procedure- and Device-specific Injury Rates. Procedure- and device-specific injury rates are also useful for defining injury risks and measuring the impact of interventions. Although the frequency of injuries is often higher with some procedures or devices, a calculation of rates can yield a different picture. For example, a 1988 study by Jagger et al. (62) found that, although the highest proportion, or percentage, of total injuries involved the hypodermic needle/syringe, this type of device was also the most frequently used. When injury rates were calculated based on the number of devices purchased, results show that needles attached to IV tubing had the highest rate of injury, followed by phlebotomy needles, IV stylets, and winged steel needles. A later study, conducted in a single hospital, found that while hypodermic needle/syringe injuries were also the highest proportion of hollow-bore needle injuries, injuries involving winged-steel (butterfly type) needles occurred at a higher rate per 100,000 devices purchased (141).

Ideally, the denominators for calculating procedure- and device-specific rates are based on the actual number of procedures performed or devices used. However, it is often difficult to obtain this information. For calculating device-specific injuries, the number of devices purchased or stocked may be used as a surrogate. Information from the medical billing office, using CPT or DRG codes along with information from the purchasing department may be used as the denominator for calculating procedure and device specific rates.

Using Control Charts for Measuring Performance Improvement

Control charts are graphical statistical tools that monitor changes in a particular set of observations over time and in real time. They are now used by many healthcare organizations as a quality improvement tool for a variety of patient-care activities and events, including healthcare-associated infections. They can be applied to the observation of sharps injuries in healthcare personnel. In concept, control charts indicate whether certain events are an exception. Over a period of time, they can also demonstrate performance improvement.

This tool is applicable and useful only to healthcare organizations with a large amount of data on sharps injuries. A minimum of 25 data points is generally needed before it is possible to make a reliable interpretation. A discussion of methods for creating and interpreting control charts is beyond the scope of this *Workbook*. The following Website and references are provided for those who are interested in pursuing this statistical technique: http://www.isixsigma.com/st/control_charts/ (142,143).

Calculating Institutional Injury Rates

In several published studies, investigators calculate institution-wide rates of sharps injuries using a variety of denominators (e.g. number of occupied beds, number of inpatient days, number of admissions). Facility-wide information can help calculate national estimates of injuries among healthcare personnel (1). But at the institutional level, this information has limited use and is dif-

difficult to interpret. It indicates only whether a rate is changing, not why. Also, safety improvements may be masked by improved reporting. For purposes of measuring performance improvement, the basic calculations described above will prove most reliable.

Benchmarking

Benchmarking provides a way for hospitals to measure performance against a pre-determined goal. At the present time there is limited information for sharps injury benchmarking. Data provided by NaSH and others reflects the distribution of sharps injuries by factors such as occupation, device, and procedure, allowing hospitals to note areas where their experience differs. Data are not intended to set a mark, or acceptable level of sharps injuries. More important than measuring performance against other hospitals or national data is comparing data within one facility or group of facilities over time. In this process, identifying significant differences in the data as well as changes in work practice, engineering controls, patient population and volume as well as staffing may help to evaluate the impact of various changes.

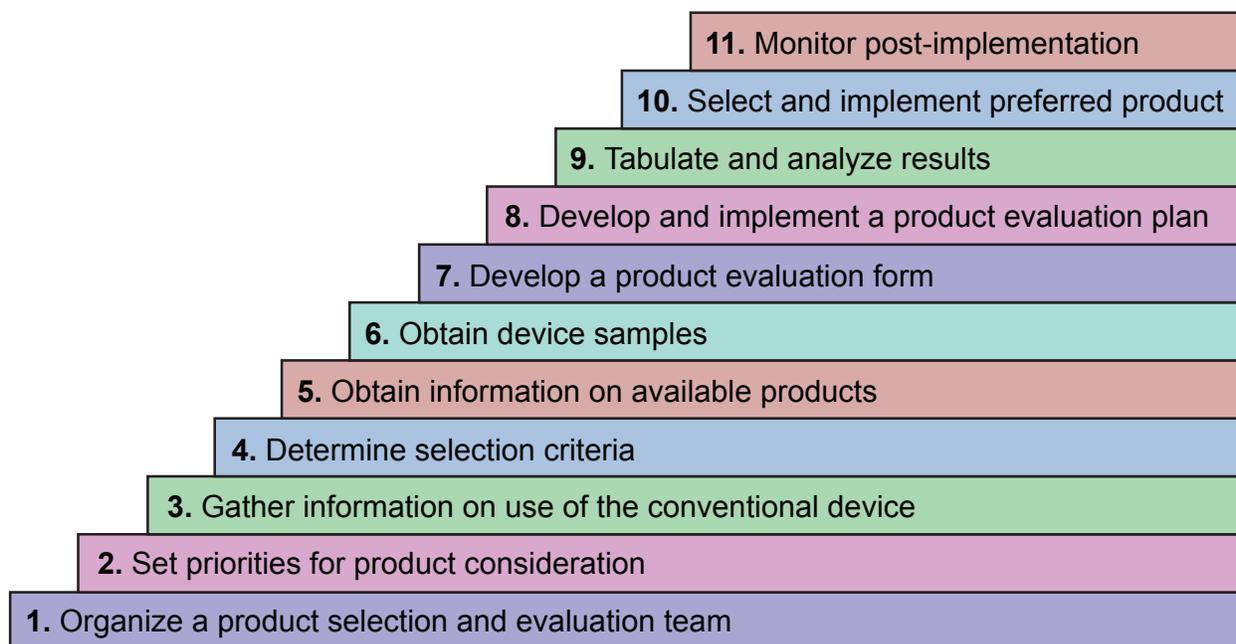
OPERATIONAL PROCESSES

Selection of Sharps Injury Prevention Devices

Introduction

The process of selecting engineered sharps injury prevention devices gives healthcare organizations a systematic way to determine and document which devices will best meet their needs. The selected devices must be acceptable for clinical care and provide optimal protection against injuries. The selection process includes collecting information that will allow the organization to make informed decisions about which devices to implement. The more this process can be standardized across clinical settings, the more information can be used to compare experiences among healthcare facilities.

Key Steps in the Product Evaluation Process



A key feature of the process is an in-use product evaluation. A product evaluation is not the same as a clinical trial. Whereas a clinical trial is a sophisticated scientific process requiring considerable methodological rigor, a product evaluation is simply a pilot test to determine how well a device performs in the clinical setting. Although the process does not need to be complex, it does need to be systematic (93). This *Workbook* outlines an 11-step approach for selecting a product for implementation. The model is most relevant to hospitals, but it can be adapted in other health-care settings. (Guidance for the evaluation of dental devices may be found at <http://www.cdc.gov/OralHealth/infectioncontrol/forms.htm>.)

Step 1. Organize a Product Selection and Evaluation Team

Healthcare organizations should designate a team to guide processes for the selection, evaluation, and implementation of engineered sharps injury prevention devices. Many institutions already have product evaluation committees that may be used for this purpose; others may want to assign this responsibility to a subcommittee of the prevention planning team. To ensure a successful outcome:

- Assign responsibility for coordinating the process,
- Obtain input from persons with expertise in or perspectives on certain areas (e.g., front-line workers), and
- Maintain ties to the prevention planning team.

Key departments and roles to consider when organizing a product selection team include:

- **Clinical departments** (e.g., nursing, medicine, surgery, anesthesiology, respiratory therapy, radiology) **and special units** (e.g., pediatrics, intensive care) have insight into products used by their staff members and can identify departmental representatives to help with product selection and evaluation;
- **Infection control** staff can help identify potential infection risks or protective effects associated with particular devices;
- **Materials management staff** (purchasing agents) have information about vendors and manufacturers (e.g., reliability, service record, inservice support) and can be involved with product purchasing;
- **Central service staff** often know what devices are used in different settings in a facility and can identify supply and distribution issues; and
- **Industrial hygiene staff** (if available) can assess ergonomic and environmental use issues.

Other departments to consult include pharmacy, waste management, and housekeeping.

It is essential that **clinical staff** participate in the evaluation of safety devices. They are the end-users who best understand the implications of product changes. They know the conventional and unconventional ways that different devices are used in clinical care. They can also identify expectations for device performance that will affect product selection.

Step 2. Set Priorities for Product Consideration

The team can use information from the intervention action plan (see *Organizational Processes*) to determine which device types to consider. To avoid unforeseen compatibility problems, teams

should consider only one device type at a time. Consideration of more than one device type might be appropriate if the devices have different purposes (e.g., intravenous catheters and finger/heel-stick lancets). Additional information regarding the number of devices used or purchased may also be helpful in setting priorities.

Step 3. Gather Information on Use of the Conventional Device

Before considering new products for evaluation, healthcare organizations must obtain information on use of the conventional device that it is replacing. Possible sources of information are purchasing and requisition requests. A survey of departments and nursing units might help identify additional issues. Key information to obtain from clinical areas includes:

- Frequency of use and purchase volume of the conventional devices;
- Most commonly used sizes;
- Purpose(s) for which the device is used;
- Other products the device is used with that might pose compatibility concerns;
- Unique clinical needs that should be considered; and
- Clinical expectations for device performance.

If the answers to these questions reveal areas with unique needs, representatives from these areas should be added as ad hoc members of the team.

Toolkit Resource for This Activity:

Survey of Device Use (see Appendix A-11)

Step 4. Establish Criteria for Product Selection and Identify Other Issues for Consideration

Product selection is based on two types of criteria:

- **Design criteria** that specify the physical attributes of a device, including required features for clinical needs and desired characteristics of the safety feature, and
- **Performance criteria** that specify how well a device functions for its intended patient care and safety purposes.

Other issues to consider include:

- **Impact on waste volume.** Some safety features (e.g. extending needle guards added to syringes or single-use blood tube holders) increase the volume of waste and require changes in sharps container use, including container size and frequency of replacement.

- **Packaging.** Changes or differences in device packaging may affect waste volume, ease of opening, and the ability to maintain aseptic technique. Also examine instructional material on or in packaging to determine if it is clear and useful in guiding healthcare personnel through activation of the safety feature.

This *Workbook* includes a tool to help selection teams pre-screen devices using design and performance criteria and the other considerations. This tool also helps facilities document the process to select or reject a particular product.

Toolkit Resource for This Activity:

Device Pre-Selection Worksheet (see Appendix A-12)

Step 5. Obtain Information on Available Products

Potential sources of information on available products with engineered sharps injury prevention devices include:

- **Materials management staff** who have information on product vendors and manufacturers and are also familiar with the service reliability of manufacturers' representatives;
- **Colleagues in other facilities** who can share information on their experiences in evaluating, implementing, or rejecting certain devices.
- **Websites** with lists of manufacturers and products. Some websites include:
<http://www.healthsystem.virginia.edu/internet/epinet/safetydevice.cfm>
http://www.isips.org/safety_products.html
<http://www.premierinc.com/all/safety/resources/needlestick/sharps-lists.jsp>

A comprehensive resource book, "The Compendium of Sharps Safety Technologies", and web site (<http://www.needlesticksafetydevices.com/opportunities.php>) is now available. The book will assist healthcare personnel in selecting and evaluating safer devices. The new reference book, includes extensive descriptions and photos of nearly every available sharps injury prevention device, as of 2005. The Compendium is organized into more than 130 separate categories and is indexed to help healthcare personnel rapidly find and begin evaluation of the precise safety products that they are looking for. A companion website is also available containing the latest information on new safety products.

Peer-reviewed articles in professional journals that describe a facility's experience with a particular type of device and the efficacy of various devices in reducing injuries.

Step 6. Obtain Samples of Devices Under Consideration

Arrangements should be made to contact manufacturers or vendors to obtain samples of products for consideration. Once obtained, look at the devices based on the design and performance criteria and other issues that are important. Consider inviting manufacturers' representatives to present information about their products to the team. Questions for the representatives might include:

- Can the device be supplied in sufficient quantities to support institutional needs?
- Is it available in all required sizes?
- What type of training and technical support (e.g., on-site in-service training, teaching materials) will the company provide?
- Will the company provide free products for a trial evaluation?

Discuss any technical questions related to the product. Based on these discussions, the team should narrow its choices to one or two products for an in-use evaluation.

Step 7. Develop a Product Evaluation Survey Form

The form used to survey healthcare personnel who evaluate the trial device must collect information necessary to make informed decisions for final product selection. Teams should try to use readily available forms. This promotes standardization of the evaluation criteria and enhances the ability to compare responses among different healthcare organizations. If manufacturer-provided forms are used, they should be carefully screened to eliminate potential bias. This *Workbook* includes a generic device evaluation form.

Toolkit Resource for This Activity:

[Device Evaluation Form \(see Appendix A-13\)](#)

Product evaluation forms should be easy to complete and score, as well as relevant to in-use performance expectations for patient care and healthcare personnel safety. The form that is easiest to complete is usually one- or two-pages and allows users to circle or check responses. Use of a graded opinion or Likert-type scale (i.e., strongly agree, agree, disagree, strongly disagree) helps facilitate scoring. A few specific questions (e.g., ease of use, impact on technique, how long it took to become comfortable using the device) should always be asked about any device. Performance questions may be unique to the type of device (e.g., IV catheter, hypodermic syringe/needle), type of safety feature (e.g., sliding shield, retracting needle), or changes in equipment (e.g., single

versus multiple use); these should be added as needed. Additional suggestions for designing or selecting an evaluation form are to:

- **Avoid questions that the product selection and evaluation team can answer.** Unless there is a specific issue, there is no need to include questions that the team can answer about matters such as packaging, impact on waste volume, and training needs.
- **Allow space for comments.** Healthcare personnel should be given an opportunity to comment on a device. Individual comments can provide useful insights and identify areas for further questioning.
- **Include questions about product users.** Unless a product evaluation is confined to a single unit and/or group of staff, information on the respondents (e.g., occupation, length of employment and/or work in the clinical area, training on the new device) is helpful in assessing how different groups react to the new device.

Step 8. Develop a Product Evaluation Plan

Developing a product evaluation plan requires several additional steps, but it is necessary to ensure that the form obtains the desired information and documents the process (128).

- **Select clinical areas for evaluation.** The evaluation does not need to be performed institution-wide, but should include representatives from areas with unique needs. Whenever possible, include both new and experienced staff.
- **Determine the duration of the evaluation.** There is no formula for how long to pilot test a product, although two to four weeks is often suggested (144,146). Factors to consider include the frequency of device use and the *learning curve*, i.e., the length of time it takes to become comfortable using a product. It is important to balance staff interest in the product and the need for sufficient product experience. If more than one device is evaluated as the replacement for a conventional device, use the same populations and trial duration for each product. Make a defined decision on when to abort an evaluation because of unforeseen problems with a device.
- **Plan for staff training.** Healthcare personnel participating in an evaluation must understand how to use the new device properly and what impact, if any, the integration of a safety feature will have on clinical use or technique. Training should be tailored to the audience needs and should include discussion of why the change is being proposed, how the evaluation will proceed, and what is expected of participants. It is important to provide information on the criteria used to evaluate clinical performance and to answer any questions about the interpretation of these criteria.

A team approach, using in-house staff and device manufacturer's representatives, is one effective way to provide training. In-house staff know how products are used in a facility, including any unique applications, but manufacturer's representatives understand the design and use of the safety feature. Give trainees an opportunity to handle the device and ask questions about its use, as well as an opportunity to simulate use of the device during patient care, in order to help reinforce proper use.

Also consider those who might not be able to attend the training (e.g., staff on leave, new students, per diem staff) and how to implement *catch-up* training. One possibility is to identify persons in departments or on nursing units to serve as resources on the devices.

- **Determine how products will be distributed for the evaluation.** Whenever possible, remove the conventional device from areas where the evaluation will take place and replace it with the device under study (128). This approach eliminates a choice of product alternatives and promotes use of the device undergoing evaluation. If the device undergoing evaluation does not meet all needs (e.g., all sizes are not available; the study device can be used for only one purpose and the conventional device has multiple purposes), it may be necessary to maintain a stock of the conventional product along with the product under study. In such instances, provide and reinforce information on the appropriate and inappropriate use of the conventional device. Precede and coordinate staff training with any switch in devices.
- **Determine when and how end-user feedback will be obtained.** Obtain feedback on device performance in two stages. The first stage is informal and occurs shortly after the onset of pilot testing. Members of the evaluation team should visit clinical areas where the device is being piloted and engage in discussions about the device in order to get some preliminary indication of its acceptability for clinical use. These interactions can also reveal problems that might require terminating the evaluation early or providing additional training.

The second stage involves distribution of the product evaluation forms. To avoid recall bias, this should be done as soon as possible after the evaluation period is completed. An active process, such as distributing surveys during unit meetings, may be more reliable than a passive process, where forms are left in the clinical area and filled out at random, and also prevents staff from completing multiple evaluation forms for the same product.

Step 9. Tabulate and Analyze the Evaluation Results

Compile data from the survey forms. Depending on the number of staff involved and survey forms completed, this can be done either by hand or by use of a computerized database. It is useful to score each question in addition to the overall response, particularly if evaluating two or more devices (e.g., hypodermic syringe/needle); responses to each question can be used to compare

devices. In addition, categorize individual comments so they provide a better picture of the clinical experience with the device.

Consider calculating response rates by occupation and clinical area and analyzing data by these variables, if the volume of responses permits. This can help identify differences in opinion that may be influenced by variations in clinical needs.

Several factors can have a positive or negative influence on the outcome of a product evaluation. These include:

- Staff experience with and preference for the conventional device;
- Attitudes toward involvement in the product evaluation process;
- Influence of opinion leaders;
- Staff opinion of product evaluation team members and manufacturers representatives;
- Perceived need for devices with safety features; and
- Patient concerns.

It is possible that one or more of these factors may be influencing opinions if the response of certain groups of personnel to the product change is different from what was expected or differs from other groups in the organization. Meet with these groups to understand their issues; it might provide new insights for the evaluation team.

Step 10. Select and Implement the Preferred Product

The evaluation team should make a product selection based on user feedback and other considerations established by the selection team. Model the process for implementing the selected device after the pilot evaluation process, and coordinate training with product replacement. It may be necessary to implement a product change over several weeks, moving by unit within the hospital.

The team should also consider a back-up plan in case the selected device is recalled or production is unable to meet current demands. Questions to ask include:

- Should a less-preferred product be introduced as a replacement?
- Should the conventional device be returned to stock?
- If the conventional device is still being used for other purposes, should the stock be increased to meet current needs?

These questions are not easy to answer. Furthermore, it is counter to the prevention plan to return to a conventional device once one with a safety feature has been introduced, and it may raise questions among staff. However, in some instances it may be the only option available. Some manufacturers may take back unused devices. It is worth asking the representative that works with the hospital about this option.

Step 11. Perform Post-implementation Monitoring

Once a new device is implemented, assess continued satisfaction with the product through follow-up monitoring and respond to those issues not identified or considered during the evaluation period. In addition, some facilities may wish to assess post-implementation compliance with use of the safety feature. Each product selection team will need to consider the most effective and efficient way to perform post-implementation monitoring.

OPERATIONAL PROCESSES

Education and Training of Healthcare Personnel

Introduction

Another important element of a sharps injury prevention program is the education and training of healthcare personnel in sharps injury prevention. As part of the program planning process, careful thought should be given to how and when training is provided to ensure that those who need training receive it, and that the training is relevant to those who are being trained.

Healthcare Personnel as Adult Learners

Adult learners are very different from child learners. One reason is, unlike children, adults enter the learning process after years of personal experience. Adults have existing knowledge, beliefs, and attitudes that influence what they take from or contribute to a learning opportunity. Adults learn best (i.e., retain and apply the information provided) when:

- The material is relevant to their lives and is something about which they are motivated to learn;
- They learn practical rather than academic knowledge and can apply the information immediately;
- The material builds on their personal experience;
- They are actively involved in the learning process; and
- They are treated with respect.

Unfortunately, much of the education and training of healthcare personnel is more typical of traditional schooling and is provided in the context of meeting regulatory requirements. As such, there is often a resistance or lack of personal motivation to attend lectures or view videotapes or other self-directed teaching tools. In the end, a requirement is met but *learning* may not have taken place.

This *Workbook* provides a reference for those who wish to read more about adult learning theory and teaching methods (130). The remainder of this section discusses various opportunities and methods for training healthcare personnel in order to make it meaningful experience for the learner.

Opportunities for Educating and Training Healthcare Personnel

Perhaps the most obvious opportunity for teaching prevention of sharps injuries is during the initial orientation and annual bloodborne pathogen training required by OSHA. However, there are many other opportunities, including staff training on procedures that involve use of sharps and the introduction of new devices.

Decide exactly what information each of these teaching opportunities will provide. The sharps injury prevention program baseline assessment (see *Organizational Steps, Step 2. Assess Program Operation Processes*), should be a guide for educational planning, including ways to reach students, contractors, per diem staff, and others.

Opportunities for Sharps Injury Prevention Training

- Initial orientation
- Annual bloodborne pathogens training
- Staff development training on procedures
- Introduction of new devices

Content for an Orientation or Annual Training on Sharps Injury Prevention

As mentioned above, adults learn best when the information is relevant to their work. For that reason, it is useful to incorporate local information on sharps injuries and sharps injury prevention in the training. Areas that might be described in the training include the following (if applicable to the group being trained):

A description of injuries reported by the facility's personnel:

- Number of sharps injuries reported in the last year or several years;
- Occupations, devices and procedures involved; and
- The most common ways injuries occur in the facility.

Information on the *hierarchy of controls* and how this concept is applied in the facility:

- Strategies to reduce or eliminate the use of needles (e.g., needle-free IV delivery systems);
- Devices with engineered sharps injury prevention features that have been considered and/or implemented in the facility;
- Introduction of other engineering controls (e.g., rigid sharps disposal containers);
- Work practices that can be used to reduce injury risks; and
- Whether any personal protective equipment is available to reduce injury risks (e.g., Kevlar gloves for surgery and autopsy, leather gloves for maintenance personnel).

Administrative activities designed to decrease sharps injuries:

- Development of a sharps injury prevention team;
- Changes or improvements in exposure reporting procedures; and

- Safety culture initiatives.

If the training is primarily lecture, methods to make the training more interesting might include:

- Presentation of case studies of exposures (protect the confidentiality of workers involved). At the end of the case presentation, the trainer might engage the audience in a discussion of how to prevent the injury.
- Facilitating a discussion of audience perceptions of sharps safety in the facility and suggestions for improvement.

Teaching Tools

Tools to enhance the learning process have evolved over the years, from the simple chalk board to overhead transparencies, paper flip charts, slides, films, and more recently to video- and audio-tapes, teleconferences, computerized and non-computerized self-study programs, interactive video, and other methods. Self-study educational materials enable healthcare personnel to receive training at their own convenience and pace; these are becoming increasingly important. Most healthcare organizations do not have the resources to develop sophisticated educational materials for sharps injury prevention. However, various professional organizations, device manufacturers, and federal agencies (e.g., OSHA, CDC) have materials and staff support that can augment local training for healthcare personnel. As interest in this area grows, it is likely that an increasing number of resources will be available to facilities to use for training. In order to comply with OSHA requirements, there must be an opportunity for employees to ask questions at the time of the training, either in person or by way of a telephone hotline.

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- <http://www.cdc.gov/sharpssafety/>
- <http://www.osha.gov/SLTC/bloodborne pathogens/index.html/>
- <http://www.bd.com/safety/edu/>

REFERENCES

1. Panlilio AL, Orelie JG, Srivastava PU, Jagger J, Cohn RD, Carco DM, the NaSH Surveillance Group; the EPINet Data Sharing Network. Estimate of the annual number of percutaneous injuries among hospital-based healthcare workers in the United States, 1997-1998. *Infect Control Hosp Epidemiol* 2004; 25(7):556-62.
2. Collins CH, Kennedy DA. Microbiological hazards of occupational needlestick and other sharps' injuries. *J Appl Bacteriol* 1987;62:385-402.
3. Pike AM. Laboratory-associated infections: summary and analysis of 3921 cases. *Health Lab Sci* 1976;13:105-14.
4. Alweis RL, DiRosario K, Conidi G, Kain KC, Olans R, Tully JL. Serial nosocomial transmission of *Plasmodium falciparum* from patient to nurse to patient. *Infect Control Hosp Epidemiol* 2004; 25(1):55-9.
5. Wagner D, de With K, Huzly D, Hufert F, Weidmann M, Breisinger S, Eppinger S, Kern WV, Bauer TM. Nosocomial transmission of dengue. *Emerg Infect Dis* 2004; 10(10):1872-3.
6. Roy E, Robillard P. Underreporting of blood and body fluid exposures in health care settings: an alarming issue [Abstract]. In: Proceedings of the International Social Security Association Conference on Bloodborne Infections: Occupational Risks and Prevention. Paris, France, June 8-9, 1995:341.
7. CDC. Evaluation of safety devices for preventing percutaneous injuries among health-care workers during phlebotomy procedures - Minneapolis-St. Paul, New York City, and San Francisco, 1993-1995. *MMWR* 1997;46:21-5.
8. Osborn EHS, Papadakis MA, Gerberding JL. Occupational exposures to body fluids among medical students: a seven-year longitudinal study. *Ann Int Med* 1999;130:45-51.
9. Abdel Malak S, Eagan J, Sepkowitz KA. Epidemiology and reporting of needle-stick injuries at a tertiary cancer center [Abstract P-S2-53]. In: Program and abstracts of the 4th International Conference on Nosocomial and Healthcare-Associated Infections; Atlanta, March 5-9, 2000:123.
10. Perry J, Robinson ES, Jagger J. Needle-stick and sharps-safety survey. *Nursing* 2004; 34(4):43-7.
11. Haiduven DJ, Simpkins SM, Phillips ES, Stevens DA. A survey of percutaneous/mucocutaneous injury reporting in a public teaching hospital. *J Hosp Infect* 1999; 41:151-4.

12. Sohn S, Eagan J, Sepkowitz KA. Safety-engineered device implementation: does it introduce bias in percutaneous injury reporting? *Infect Control Hosp Epidemiol* 2004; 25(7):543-7.
13. Doebbeling BN, Vaughn TE, McCoy KD, Beekmann SE, Woolson RF, Ferguson KJ, Torner JC. Percutaneous injury, blood exposure, and adherence to standard precautions: are hospital-based health care provider still at risk? *Clin Infect Dis* 2003; 37:1006-13.
14. Devereaux HM, Stead WW, Cauthern MG, Bloch BA, Ewing MW. Nosocomial transmission of tuberculosis associated with a draining abscess. *J Infect Dis* 1990;286-95.
15. Shapiro CN. Occupational risk of infection with hepatitis B and hepatitis C virus. *Surg Clin N Amer* 1995;75:1047-56.
16. Bell DM. Occupational risk of human immunodeficiency virus infection in healthcare workers: an overview. *Am J Med* 1997;102(suppl 5B):9-15.
17. CDC. Guidelines for prevention of transmission of human immunodeficiency virus and hepatitis B virus to health-care and public-safety workers. *MMWR* 1989;38(S-6):49.
18. Mahoney FJ, Stewart K, Hu HX, Coleman P, Alter MJ. Progress toward the elimination of hepatitis B virus transmission among health care workers in the United States. *Arch Int Med* 1997;157:2601-5.
19. Wong ES, Stotka JL, Chinchilli VM, Williams DS, Stuart G, Markowitz SM. Are universal precautions effective in reducing the number of occupational exposures among health care workers? *JAMA* 1991;265:1123-8.
20. Fahey BJ, Koziol DE, Banks SM, Henderson DK. Frequency of nonparenteral occupational exposure to blood and body fluids before and after universal precautions training. *Am J Med* 1991;90:145-53.
21. Beekman SE, Vlahov D, McShalley ED, Schmitt JM. Temporal association between implementation of universal precautions and a sustained progressive decrease in percutaneous exposures to blood. *Clin Infect Dis* 1994;18:562-9.
22. Panlilio AL, Shapiro CN, Schable CA et al. Serosurvey of human immunodeficiency virus, hepatitis B virus, and hepatitis C virus infection among hospital-based surgeons. *J Am Coll Surg* 1995;180:16-24.
23. Barie PS, Dellinger EP, Dougherty SH et al. Assessment of hepatitis B virus immunization status among North American surgeons. *Arch Surg* 1994;129:27.

24. Gruninger SE, Siew C, Chang S-B et al. Human immunodeficiency virus infection among dentists. *J Am Dent Assoc* 1992;123:57.
25. Lettau LA, Blackhurst DW, Steed C. Human immunodeficiency virus testing experience and hepatitis B vaccination and testing status of healthcare workers in South Carolina: implications for compliance with U.S. Public Health Service guidelines. *Infect Control Hosp Epidemiol* 1992;13:336-42.
26. Shapiro CN, Tokars JI, Chamberland ME, and the American Academy of Orthopaedic Surgeons Serosurvey Study Committee. Use of the hepatitis-B vaccine and infection with hepatitis B and C among orthopaedic surgeons. *J Bone Joint Surg* 1996;78A:1791-1800.
27. Cleveland JL, Siew C, Lockwood SA, Gruninger SE, Gooch BF, Shapiro CN. Hepatitis B vaccination and infection among US dentists, 1983-1992. *J Am Dent Assoc* 1996;127:1385-92.
28. Grady GF. Relation of e antigen to infectivity of HBsAg-positive inoculations among medical personnel. *Lancet* 1976;1:492-4.
29. Grady GF, Prince AM, Gitnick GL et al. Hepatitis B immune globulin for accidental exposures among medical personnel: final report of a multicenter controlled trial. *J Infect Dis* 1978;138:625-38.
30. Werner BG, Grady GF. Accidental hepatitis-B-surface-antigen-positive inoculations: use of e antigen to estimate infectivity. *Ann Intern Med* 1982;97:367-9.
31. Alter MJ, Gerety RJ, Smallwood LA et al. Sporadic non-A, non-B hepatitis: frequency and epidemiology in an urban U.S. population. *J Infect Dis* 1982;145:886-93.
32. Polish LB, Tong MJ, Co RL, Coleman PJ, Alter MJ. Risk factors for hepatitis C virus infection among health care personnel in a community hospital. *Am J Infect Control* 1993;21:196-200.
33. Alter MJ. The epidemiology of acute and chronic hepatitis C. *Clin Liver Dis* 1997;1:559-69.
34. Puro V, Petrosillo N, Ippolito G, Italian Study Group on Occupational Risk of HIV and Other Bloodborne Infections. Risk of hepatitis C seroconversion after occupational exposure in health care workers. *Am J Infect Control* 1995;23:273-7.
35. Kiosawa K, Sodeyama T, Tanaka E et al. Hepatitis C in hospital employees with needlestick injuries. *Ann Intern Med* 1991;115:367-9.
36. Mitsui T, Iwano K, Masuko K et al. Hepatitis C virus infection in medical personnel after needlestick accident. *Hepatology* 1992;16:1109-14.

37. Hernandez ME, Bruguera M, Puyuelo T, Barrera JM, Sanchez Tapia JM, Rodes J. Risk of needle-stick injuries in the transmission of hepatitis C in hospital personnel. *J Hepatol* 1992;16:56-8.
38. Sodeyama T, Kiyosawa K, Urushihara A et al. Detection of hepatitis C virus markers and hepatitis C virus genomic-RNA after needlestick accidents. *Arch Intern Med* 1993;153:1565-72.
39. Lanphear BP, Linneman CC, Cannon CG, DeRonde MM, Pendy L, Kerley LM. Hepatitis C virus infection in healthcare workers: risk of exposure and infection. *Infect Control Hosp Epidemiol* 1994;15:745-50.
40. Herbert AM, Walker DM, Davies KJ, Bagg J. Occupationally acquired hepatitis C virus infection [Letter]. *Lancet* 1992;339:305.
41. Jochen B. Occupationally acquired hepatitis C virus infection [Letter]. *Lancet* 1992;339:304.
42. Marranconi F, Mecenero V, Pellizzer GP et al. HCV infection after accidental needlestick injury in health-care workers [Letter]. *Infection* 1992;20:111.
43. Vaglia A, Nicolin R, Puro V, Ippolito G, Bettini C, deLalla F. Needlestick hepatitis C seroconversion in a surgeon [Letter]. *Lancet* 1990;336:1315-6.
44. Heydon J, Faed J. Hepatitis C from needlestick injury [Letter]. *N Z Med J* 1995;108:35.
45. Sartori M, La Terra G, Aglietta, M, Manzin A, Navino C, Verzetti G. Transmission of hepatitis C via blood splash into conjunctiva [Letter]. *Scand J Infect Dis* 1993;25:270-1.
46. Ippolito G, Puro V, Petrosillo N, DeCarli G, Gianpaolo M, Magliano E. Simultaneous infection with HIV and hepatitis C virus following occupational conjunctival blood exposure [Letter]. *JAMA* 1998;280: 28-9.
47. Beltrami EM, Kozak A, Williams IT, Saekhou AM, Kalish ML et al. Transmission of HIV and hepatitis C virus from a nursing home patient to a health care worker. *Am J Infect Control* 2003;31:168-75.
48. Stricof RL, Morse DL. HTLV-III/LAV seroconversion following a deep intramuscular needlestick injury. *N Engl J Med* 1986;314:1115.
49. Cardo DM, Culver DH, Ciesielski CA, Srivastava PU, Marcus R et al. A case-control study of HIV seroconversion in health care workers after percutaneous exposure. *N Engl J Med* 1997;337:1485-90.

50. Ippolito G, Puro V, DeCarli G, the Italian Study Group on Occupational Risk of HIV. The risk of occupational human immunodeficiency virus infection in health care workers. *Arch Intern Med* 1993;153:1451-8.
51. CDC. Update: human immunodeficiency virus infections in health-care workers exposed to blood of infected patients. *MMWR* 1987;36:285-9.
52. Henderson DK, Fahey BJ, Willy M, et al. Risk for occupational transmission of human immunodeficiency virus type I (HIV-I) associated with clinical exposures: a prospective evaluation. *Am J Med* 1990;113:740-6.
53. Jagger J, Bentley M, Juillet E. Direct cost of follow-up for percutaneous and mucocutaneous exposures to at-risk body fluids: data from two hospitals. *Adv Exp Prev* 1998; 3(3):1-3.
54. O'Malley OM, Scott RD, Gayle J, et al. Costs of Management of Occupational Exposures to Blood and Body Fluids. *ICHE* 2007; 28(7):774-82.
55. United States General Accounting Office. Occupational safety: selected cost and benefit implications of needlestick prevention devices for hospitals. GAO-01-60R; November 17, 2000.
56. Fisman DN, Mittleman MA, Sorock GS, Harris AD. Willingness to pay to avoid sharps-related injuries: a study in injured health care workers. *Am J Infect Control* 2002; 30(5):283-7.
57. McCormick RD, Maki DG. Epidemiology of needle-stick injuries in hospital personnel. *Amer J Med* 1981;70:928-932.
58. Ruben FL, Norden CW, Rockwell K, Hruska E. Epidemiology of accidental needle-punctures in hospital workers. *Am J Med Sci* 1983;286:26-30.
59. Mansour AM. Which physicians are at high risk for needlestick injuries? *Am J Infect Control* 1990;18:208-10.
60. Whitby M, Stead P, Najman JM. Needlestick injury: impact of a recapping device and an associated education program. *Infect Control Hosp Epidemiol* 1991;12:220-5.
61. McCormick RM, Meisch MG, Ircink FG, Maki DG. Epidemiology of Hospital Sharps Injuries: A 14-Year Prospective Study in the Pre-AIDS and AIDS Era. *Amer J Med* 1991; 91:3B-301S-7S.
62. Jagger J, Hunt EH, Brand-Elnaggar J, Pearson R. Rates of needlestick injury caused by various devices in a university hospital. *N Engl J Med* 1988;319:284-8.

63. Ippolito G, Puro V, Heptonstall J et al. Occupational human immunodeficiency virus infection in health care workers: worldwide cases through September 1997. *Clin Infect Dis* 1999;28:365-83.
64. Mast ST, Woolwine JD, Gerberding JL. Efficacy of gloves in reducing blood volumes transferred during simulated needlestick injury. *J Infect Dis* 1987;168:1589-92.
65. Gerberding JL, Littell G, Tarkington A et al. Risk of exposure of surgical personnel to patients' blood during surgery at San Francisco General Hospital. *N Eng J Med* 1990;322:1788-93.
66. Panlilio AL, Foy DR, Edwards JR et al. Blood contacts during surgical procedures. *JAMA* 1991;265:1533-7.
67. Popejoy SL, Fry DE. Blood contact and exposure in the operating room. *Surg Gynecol Obstet* 1991;172:480-3.
68. Quebbeman EJ, Telford GL, Hubbard S. Risk of blood contamination and injury to operating room personnel. *Ann Surg* 1992;214:614-20.
69. Tokars JI, Bell DM, Culver DM et al. Percutaneous injuries during surgical procedures. *JAMA* 1992;267:2899-2904.
70. White MC, Lynch P. Blood contacts in the operating room after hospital-specific data analysis and action. *Am J Infect Control* 1997;25:209-14.
71. CDC. Recommendations for prevention of HIV transmission in healthcare settings. *MMWR* 1987;36(Suppl):1-18.
72. Ribner BS, Ribner BS. An effective educational program to reduce the frequency of needle recapping. *Infect Control Hosp Epidemiol* 1990;11:635-8.
73. Ribner BS, Landry MN, Gholson GL, Linden LA. Impact of a rigid, puncture resistant container system upon needlestick injuries. *Infect Control* 1987;8:63-6.
74. Linnemann CC, Jr., Cannon C, DeRonde M, Lanphear B. Effect of educational programs, rigid sharps containers, and universal precautions on reported needlestick injuries in healthcare workers. *Infect Control Hosp Epidemiol* 1991;12:214-9.
75. Sellick JA, Jr, Hazamy PA, Mylotte JM. Influence of an educational program and mechanical opening needle disposal boxes on occupational needlestick injuries. *Infect Control Hosp Epidemiol* 1991;12:725-31.
76. Edmond M, Khakoo R, McTaggart B, Solomon R. Effect of bedside needle disposal units on needle recapping frequency and needlestick injury. *Infect Control Hosp Epidemiol* 1988;9:114-16.

77. Smith DA, Eisenstein HC, Esrig C, Godbold J. Constant incidence rates of needle-stick injury paradoxically suggest modest preventive effect of sharps disposal systems. *J Occup Med* 1991;34:546-51.
78. Haiduven DJ, DeMaio TM, Stevens DA. A five-year study of needlestick injuries: significant reduction associated with communication, education, and convenient placement of sharps containers. *Infect Control Hosp Epidemiol* 1992;13:265-71.
79. Berguer R, Heller PJ. Preventing sharps injuries in the operating room. *J Am Coll Surg* 2004; 199(3):462-7.
80. Ferguson KJ, Waitzkin H, Beekmann SE, Doebbeling BN. Critical incidents of nonadherence with standard precautions guidelines among community hospital-based health care workers. *J Gen Intern Med* 2004; 19_726-31.
81. Vaughn TE, McCoy KD, Beekmann SE, Woolson RF, Torner JC, Doebbeling BN. Factors promoting consistent adherence to safe needle precautions among hospital workers. *Infect Control Hosp Epidemiol* 2004; 25(7):548-55.
82. Occupational Safety and Health Administration, Department of Labor. 29 CFR Part 1910.1030, Occupational exposure to bloodborne pathogens; final rule. *Federal Register* 1991;56:64004-182.
83. Pugliese G, Bartley J, McCormick R. Selecting sharps injury prevention products. In: *Medical device manufacturing and technology*, E Cooper (ed.). London: World Markets Research Centre, 2000, pp. 57-64 .
84. Gartner K. Impact of a needleless intravenous system in a university hospital. *Am J Infect Control* 1992;20:75-9.
85. Skolnick R, LaRocca J, Barba D, Paicius L. Evaluation and implementation of a needleless intravenous system: making needlesticks a needless problem. *Am J Infect Control* 1993;21:39-41.
86. Yassi A, McGill ML, Khokhar JB. Efficacy and cost-effectiveness of a needleless intravenous system. *Am J Infect Control* 1995;23:57-64.
87. ECRI (Emergency Care Research Institute). Needlestick-prevention devices. *Health Devices* 1991;20:154-80.
88. ECRI (Emergency Care Research Institute). Needlestick-prevention devices for IV therapy and IM and subcutaneous medical administration. *Health Devices* 1994;23:316-69.
89. ECRI (Emergency Care Research Institute). Needlestick-prevention. *Health Devices* 1995;24:484-9.

90. ECRI (Emergency Care Research Institute). Needlestick-prevention. *Health Devices* 1999;28:381-408.
91. ECRI (Emergency Care Research Institute). Needlestick-prevention devices. *Health Devices* 2000;29:75-81.
92. ECRI. Sharps Safety and Needlestick Prevention 2001. ECRI (formerly Emergency Care Research Institute), Welwyn Garden City, Herts (Europe Office)
93. Chiarello L. Selection of needlestick prevention devices: a conceptual framework for approaching product evaluation. *Am J Infect Control* 1995;23:386-95.
94. Billiet LS, Parker CR, Tanley PC, Wallas CW. Needlestick injury rate reduction during phlebotomy; a comparative study of two safety devices. *Lab Med* 1991;22:122-3.
95. Dale JC, Pruett SK, Maker MD. Accidental needlestick in the phlebotomy service of the Department of Laboratory Medicine and Pathology at Mayo Clinic Rochester. *Mayo Clin Proc* 1998;1:611-5.
96. Jagger J. Reducing occupational exposures to bloodborne pathogens: where do we stand a decade later? *Infect Control Hosp Epidemiol* 1996;17:573-5.
97. Younger B, Hunt EH, Robinson C, McLemore C. Impact of a shielded safety syringe on needlestick injuries among healthcare workers. *Infect Control Hosp Epidemiol* 1992;13:349-53
98. McCleary J, Caldero K, Adams T. Guarded fistula needle reduces needlestick in hemodialysis. *Nephrology News and Issues* 2002; May:66-72.
99. Mendelson MH, Lin-Chen BY, Solomon R, Bailey E, Kogan G, Goldbold J. Evaluation of a Safety Resheathable Winged Steel Needle for Prevention of Percutaneous Injuries Associated with Intravascular-Access Procedures among Healthcare Workers. *Infect Control Hosp Epidemiol* 2003;24(2):105-112.
100. Rogues AM, Verdun-Esquer C, Buisson-Valles I, Lavaille MF, Lasheras A, Sarrat A, Beaudelle H, Brochard P, Gachie JP. Impact of safety devices for preventing percutaneous injuries related to phlebotomy procedures in health care workers. *Am J Infect Control* 2004;32:441-4.
101. Orenstein R, Reynolds L, Karabaic M, Lamb A, Markowitz SM, Wong ES. Do protective devices prevent needlestick injuries among health care workers? *Am J Infect Control* 1995; 23(6):344-51.
102. Davis MS. Advanced precautions for today's O.R.: the operating room professional's handbook for the prevention of sharps injuries and bloodborne exposures. Atlanta: Sweinbinder Publications LLC, 1999.

103. Lewis JFR, Short LJ, Howard RJ, Jacobs AJ, Roche NE. Epidemiology of injuries by needles and other sharp instruments: minimizing sharp injuries in gynecologic and obstetric operations. *Surg Clin North Am* 1995;75:1105-21.
104. Raahave D, Bremmelgaard A. New operative technique to reduce surgeon's risk of HIV infection. *J Hosp Infect* 1991;18 (Supp A):177-83.
105. Loudon MA, Stonebridge PA. Minimizing the risk of penetrating injury to surgical staff in the operating theatre: towards sharp-free surgery. *J R Coll Surg Edinb* 1998; 43:6-8.
106. CDC. Evaluation of blunt suture needles in preventing percutaneous injuries among health-care workers during gynecologic surgical procedures. *MMWR* 1997;46:25-9.
107. Gerberding JL. Procedure-specific infection control for preventing intraoperative blood exposures. *Am J Infect Control* 1993;21:364-7.
108. Hanrahan A, Reutter L. A critical review of the literature on sharps injuries: epidemiology, management of exposure and prevention. *J Adv Nurs* 1997;25:144-54.
109. Wugofski L. Needlestick prevention devices: a pointed discussion. *Infect Control Hosp Epidemiol* 1992;13:295-8.
110. Zafar AB, Butler RC, Podgorny JM et al. Effect of a comprehensive program to reduce needlestick injuries. *Infect Control Hosp Epidemiol* 1997;18:712-5.
111. Gershon RR, Pearse L, Grimes M, Flanagan PA, Vlahov D. The impact of multifocused interventions on sharps injury rates at an acute-care hospital. *Infect Control Hosp Epidemiol* 1999;10:806-11.
112. American Hospital Association. Sharps injury prevention program: a step-by-step guide. (Pugliese G, Salahuddin M, eds.) Chicago: 1999.
113. Gershon RM, Karkashian CD, Grosch JW et al. Hospital safety climate and its relationship with safe work practices and workplace exposure incidents. *Am J Infect Control* 2000, 28:211-21.
114. Gershon R. Facilitator report: bloodborne pathogens exposure among healthcare workers. *Am J Ind Med* 1996;29:418-20.
115. Grosch JW, Gershon R, Murphy LR, DeJoy DM. Safety climate dimensions associated with occupational exposure to blood-borne pathogens in nurses. *Am J Ind Med* 1999; Suppl(1):122-24.
116. Rivers DL, Frankowski RF, White D, Nichols B. Predictors of nurses' acceptance of an intravenous catheter safety device. *Nurs Res* 2003; 52(4):249-55.

117. Jackson M, Chiarello LA, Gaynes RP, Gerberding JL. Nurse staffing and health care-associated infections: proceedings from a working group meeting. *Am J Infect Control* 2002; 30(4):199-206.
118. Stone PW, Clarke SP, Cimiotti J, Correa-de-Araujo R. Nurses' working conditions: implications for infectious disease. *Emerg Infect Dis* 2004; 10(11):1984-89.
119. Clarke SP, Sloane DM, Aiken LH. Effects of hospital staffing and organizational climate on needlestick injuries to nurses. *Am J Public Health* 2002; 92(7):1115-9.
120. Clarke SP, Rockett JL, Sloane DM, Aiken LH. Organizational climate, staffing, and safety equipment as predictors of needlestick injuries and near-misses in hospital nurses. *Am J Infect Control* 2002; 30(4):207-16.
121. Becker MH, Janz NK, Band J, Bartley J, Snyder MB, Gaynes RP. Noncompliance with universal precautions policy: why do physicians and nurses recap needles? *Amer J Infect Control* 1990;18:232-9.
122. Henry K, Campbell S, Collier P, Williams CO. Compliance with universal precautions and needle handling and disposal practices among emergency department staff at two community hospitals. *Am J Infect Control* 1994;22:129-37.
123. Williams CO, Campbell S, Henry K, Collier P. Variables influencing worker compliance with universal precautions in the emergency department. *Am J Infect Control* 1994;22:138-48.
124. Freeman SW, Chambers CV. Compliance with universal precautions in a medical practice with a high rate of HIV infection. *J Am Board Fam Pract* 1992;5:313-8.
125. Gershon RR, Vlahov D, Felknor SA et al. Compliance with universal precautions among health care workers at three regional hospitals. *Am J Infect Control* 1995;23:225-36.
126. Evanoff B, Kim L, Mutha S et al. Compliance with universal precautions among emergency department personnel caring for trauma patients. *Ann Emerg Med* 1999;33:160-5.
127. Simpkins SM, Haiduven DJ, Stevens DA. Safety product evaluation: six years of experience. *Am J Infect Control* 1995;23:317-22.
128. Michalsen A, Delclos GL, Felknor SA, Davidson AL, Johnson PC, Vesley D, Murphy LR, Kelen GD, Gershon R. Compliance with universal precautions among physicians. *J Occ Env Med* 1997; 39(2):130-7.
129. English JFB. Reported hospital needlestick injuries in relation to knowledge/skill, design, and management problems. *Infect Control Hosp Epidemiol* 1992;13:259-64.

130. Kretzer EK, Larson EL. Behavioral interventions to improve infection control practices. *Am J Infect Control* 1998;26:245-53.
131. Ott JS. The organizational culture perspective. Pacific Grove, California: Brooks/Cole Publishing Company, 1989.
132. Singer SJ, Gaba DM, Geppert JJ, Sinaiko AD, Howard SK, Park KC. The culture of safety: results of an organization-wide survey in 15 California hospitals. *Qual Saf Health Care* 2003; 12:112-8.
133. Roberts KH. Some characteristics of one type of high reliability organization. *Organization Sci* 1990; 1:160-76.
134. Roberts KH, Rousseau DM, La Porte TR. The culture of high reliability: quantitative and qualitative assessment aboard nuclear powered aircraft carriers. *J High Technol Manage Res* 1994; 5:141-61.
135. DeJoy DM, Schaffer BS, Wilson MG, Vandenberg RJ, Butts MM. Creating safer workplaces: assessing the determinants and role of safety climate. *J Saf Res* 2004; 35:81-90.
136. Gaba DM, Singer SJ, Sinaiko AD, Bowen JD, Ciavarelli AP. Differences in safety climate between hospital personnel and naval aviators. *Human Factors* 2003; 45(2):1-13.
137. Institute of Medicine. To err is human: building a safer health system. LT Kohn, JM Corrigan, MS Donaldson, Eds. National Academy Press: Washington, 2000
138. Goodman GR. A fragmented patient safety concept: the structure and culture of safety management in healthcare. *Hosp Topics* 2003; 81(2):22-9.
139. Provonost PJ, Weast B, Holzmüller CG, Rosenstein BJ, Kidwell RP, Haller KB, Feroli ER, Sexton JB, Rubin HR. Evaluation of the culture of safety: survey of clinicians and managers in an academic medical center. *Qual Saf Health Care* 2003; 12:405-10.
140. Babcock H, Fraser V. Needlestick injuries at a 10 hospital system [Abstract]. The Society for Healthcare Epidemiology of America, Eleventh Annual Scientific Meeting, April 1-3, 2001, Toronto, Canada.
141. Patel N, Tignor GH. Device-specific sharps injury and usage rates: an analysis by hospital department. *Am J Infect Control* 1997; 25(2):77-84.
142. Benneyan JC. Statistical quality control methods in infection control and hospital epidemiology, Part I: introduction and basic theory. *Infect Control Hosp Epidemiol* 1998;19:194-214.

143. Benneyan JC. Statistical quality control methods in infection control and hospital epidemiology, Part II: chart use, statistical properties, and research issues. *Infect Control Hosp Epidemiol* 1998;19:265-83.
144. Enger EL, Mason J, Holm K. The product evaluation process: making an objective decision. *Dimens Crit Care Nurs* 1987;6:350-6.
145. Barone-Ameduri P. Equipment trials make sense. *Nurs Manag* 1986;17:43-4.
146. National Institute for Occupational Safety and Health. Selecting, evaluating, and using sharps disposal containers. DHHS (NIOSH) Publication No. 97-111.

APPENDIX A - TOOLKIT

This toolkit contains a variety of sample forms that may be downloaded for use by healthcare organizations in developing or enhancing an organization's sharps injury prevention program. These forms may be adapted as desired to best meet the organization's needs. Each form is linked to a workbook section that describes the context in which use of the form is intended.

- A-1** Baseline Program Assessment Worksheet
- A-2** Survey to Measure Healthcare Personnel Perceptions of a Culture of Safety
- A-3** Survey of Healthcare Personnel on Occupational Exposure to Blood and Body Fluids
- A-4** Baseline Institutional Injury Profile Worksheet
- A-5** Baseline Injury Prevention Activities Worksheet
- A-6** Sharps Injury Prevention Program Action Plan Forms
- A-7** Blood and Body Fluid Exposure Report Form
- A-8** Sharps Injury Hazard Observation and Report Forms
- A-9** Sample form for Performing a Simple Root Cause Analysis of a Sharps Injury or "Near Miss" Event
- A-10** Occupation-Specific Rate-Adjustment Calculation Worksheet
- A-11** Survey of Device Use
- A-12** Device Pre-Selection Worksheet
- A-13** Device Evaluation Form

A-1 Baseline Program Assessment Worksheet

This sample worksheet is designed to help healthcare organizations perform a one-time baseline assessment of activities or processes that support a sharps injury prevention program. Questions related to several program areas are included as a guide for performing this assessment. Once completed, the worksheet can be used as a springboard for discussing program improvements that will lead to a reduction in sharps injuries in healthcare personnel. Healthcare organizations should adapt the worksheet as necessary to meet their program needs.

Workbook Section Link for this Toolkit Product:

Organizational Steps

Step 2. Assess Program Operation Processes

SAMPLE Baseline Program Assessment Worksheet

1. Culture of Safety

Questions	Current Practice	Strategies for Improvement (If Needed)
Leadership Commitment		
What statement(s) in the organization's mission, vision, goals, and/or values reflect that patient and healthcare personnel safety is a priority?		
What strategies does the administration use to communicate the importance of a safe environment for patients and healthcare personnel?		
How has the administration shown support for the introduction of safety interventions (e.g., devices with engineered sharps injury prevention features, sharps disposal containers)?		
Identification and Removal of Sharps Injury Hazards		
What strategies does the organization use to identify hazards in the work environment?		
How are front-line healthcare personnel involved in identifying and removing sharps injury hazards?		

Questions	Current Practice	Strategies for Improvement (If Needed)
Feedback Systems to Improve Safety Awareness		
What strategies are used to document that sharps injury hazards have been corrected? How are workers who identify a hazard informed that corrective action has been taken?		
How has the subject of sharps injury prevention been incorporated into in-service presentations or department/unit meeting discussions? How is this documented?		
Promotion of Individual Accountability		
How is accountability for safety assessed and documented during annual performance evaluations?		
Safety Culture Data Sources		
What data sources (e.g., written or observational surveys, incident reports) are used to measure improvements in the organization's safety culture?		

2. Sharps Injury Reporting

Questions	Current Practice	Strategies for Improvement (If Needed)
<p>Where are copies of the organization's policy/procedure for reporting occupational blood and body fluid exposures located? On what date was the policy/procedure last reviewed? Is this date within the past 12 months?</p>		
<p>What items of information (e.g., name, date, device, procedure, etc.) are collected on the injury report form? How does this list compare to the variables recommended for collection in <i>Workbook</i>? (See <i>Operational Processes, Implement Procedures for Reporting Sharps Injuries and Injury Hazards</i>)</p>		
<p>How has healthcare personnel compliance with the organization's policy for reporting been assessed?</p>		
<p>What data sources are used for monitoring improvements in sharps injury reporting? (e.g., reporting surveys, changes in injury reporting trends)</p>		

3. Sharps Injury Data Analysis

Questions	Current Practice	Strategies for Improvement (If Needed)
How are data on sharps injuries stored (e.g., computerized database, incident log, etc)? Where is the information kept?		
Who compiles, analyzes, and interprets the data? How often is this done?		
What denominator is used to calculate injury rates? How is this information obtained?		
How often are summary reports on injury trends prepared? Who receives copies of this information?		
What committee(s) review(s) the data?		
What data sources (e.g., committee reports) are used to monitor improvement in sharps injury data analysis?		

4. Identification, Selection, and Implementation of Prevention Interventions

Questions	Current Practice	Strategies for Improvement (If Needed)
What committee or group is responsible for evaluating devices with sharps injury prevention features? How are front-line workers involved in this review?		
How is information on current and emerging safety devices obtained? Who is responsible for maintaining this program resource?		
How are priorities determined for what devices will be considered for implementation? Which devices currently have the highest priority?		
How are criteria for assessing the acceptability of a device for patient care and healthcare provider safety determined?		
How are devices evaluated before implementation?		
How are healthcare personnel trained in the use of new devices? Who is responsible for ensuring that this is done, and how is it documented?		
How are other prevention interventions (e.g., work practices, policies/procedures) evaluated?		
What data sources (e.g., changes in procedure, committee reports) are used to monitor improvements in methods used to select and implement new interventions?		

5. Education and Training of Healthcare Personnel on Sharps Injury Prevention

Questions	Current Practice	Strategies for Improvement (If Needed)
How does the organization reach healthcare personnel to provide training?		
What group(s) of workers is not reached as part of the institution's educational efforts?		
How does the organization ensure that students, per diem staff, and contractors receive training on sharps injury prevention?		
How is completion of training documented? Who is responsible for maintaining this information, and where is it located?		
What information on sharps injury prevention is provided at orientation? How and when are healthcare personnel updated on this information?		
How are data on institution-specific risks for injury used to develop a training curriculum?		
How do workers receive <i>hands-on</i> training to learn safe work practices in the handling of sharp devices? Who facilitates this training?		
What training tools are used?		
What data sources (e.g., staff development reports, curriculum changes, training evaluations) are used to measure improvement in the training of healthcare personnel?		

A-2 Survey to Measure Healthcare Personnel Perceptions of a Culture of Safety

This sample survey will help healthcare organizations measure how their employees perceive safety. The questions are designed to provide a picture of the *culture of safety* as it generally applies to healthcare personnel safety and to assess safety culture from the perspective of sharps injury prevention.

Healthcare organizations that choose to administer this survey should feel free to adapt the form to their needs, including changing categories of occupational groups to more closely reflect those within an organization.

The survey form is intended to protect the anonymity of responders. If the number of healthcare personnel in one or more of the occupational groups included is small (e.g., phlebotomy team, IV team) then these groups should be removed from the form and combined with another occupational group (e.g., nursing staff, laboratory staff).

Both an overall score and scores for individual items can be tallied, either by hand or computer. The overall score provides a general picture of the organization's safety culture, and individual scores can be used to identify specific strengths and weaknesses in areas that influence the culture of safety. A form for summarizing responses is also included.

Workbook Section Link for this Toolkit Product:

Organizational Steps

- Step 2. Assess Program Operational Processes
 - Assess the Culture of Safety

SAMPLE Survey to Measure Healthcare Personnel's Perceptions of a Culture of Safety

The Sharps Injury Prevention Program at _____ is conducting an anonymous, voluntary survey of staff to assess how well we are doing in promoting safety in our healthcare organization. Please answer the following questions and return this form to _____. Your responses are important and will be used to guide future improvements in our overall safety program.

Please circle the number that most closely reflects your agreement or disagreement with each of the following statements.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1. The safety of workers is a priority in this healthcare organization.	1	2	3	4	5
2. Safety issues are an ongoing agenda item for discussion during staff meetings.	1	2	3	4	5
3. The organization encourages and rewards the recognition and reporting of errors and hazardous conditions.	1	2	3	4	5
4. Personal accountability for safety is assessed during annual performance evaluations.	1	2	3	4	5
5. Hazardous problems are quickly corrected once they are brought to management's attention.	1	2	3	4	5
6. Sharps containers are available where and when I need them to dispose of needles and other sharp devices.	1	2	3	4	5
7. Employees and management work together to ensure the safest possible healthcare environment for patients and personnel.	1	2	3	4	5
8. Safety training is part of staff development orientations and programs.	1	2	3	4	5
9. The organization provides devices to prevent needlestick injuries.	1	2	3	4	5
10. I would not fear being criticized or reprimanded for reporting a sharps injury that I sustained.	1	2	3	4	5

What best describes your occupation/work area? (Check one.)

- | | |
|---|--|
| <input type="checkbox"/> Nursing staff
<input type="checkbox"/> Non-Surgical medical staff
<input type="checkbox"/> Surgical medical staff
<input type="checkbox"/> Phlebotomy team
<input type="checkbox"/> IV team
<input type="checkbox"/> Laboratory staff
<input type="checkbox"/> Technician
<input type="checkbox"/> Dental staff
<input type="checkbox"/> Clerical/Administrative staff | <input type="checkbox"/> Transport Service
<input type="checkbox"/> Central Supply staff
<input type="checkbox"/> Maintenance/Engineering staff
<input type="checkbox"/> Housekeeping/Laundry Services
<input type="checkbox"/> Other Staff
<input type="checkbox"/> Security
<input type="checkbox"/> Medical student
<input type="checkbox"/> Other student |
|---|--|

Comments:

SAMPLE Survey to Measure Healthcare Personnel's Perceptions of a Culture of Safety

SUMMARY REPORT

Date survey initiated: _____ Date of report: _____
 Number of forms distributed: _____ Number returned: _____
 Response rate: _____ %

Method of Distribution

- | | |
|--|---|
| <input type="checkbox"/> Inserted in pay envelopes
<input type="checkbox"/> Distributed via department heads
<input type="checkbox"/> Included in organization's newsletter
<input type="checkbox"/> Meetings | <input type="checkbox"/> Mailed to _____
<input type="checkbox"/> Left in key locations for staff to pick up
<input type="checkbox"/> Other |
|--|---|

Safety Culture Score

Highest possible score = 50
 Total mean score (sum of mean scores): _____

Individual Item Scores	Mean Score	%1	%2	%3	%4	%5
1. Commitment to safety						
2. Feedback on safety						
3. Promotion of hazard reporting						
4. Personal accountability						
5. Hazard correction						
6. Availability of sharps containers						
7. Employee/management collaboration on safety						
8. Safety training						
9. Provision of safer technology						
10. Non-punitive reporting environment						

Individual Item Scores	Mean Score	%1	%2	%3	%4	%5
1. Commitment to safety						
2. Feedback on safety						
3. Promotion of hazard reporting						
4. Personal accountability						
5. Hazard correction						
6. Availability of sharps containers						

7. Employee/management collaboration on safety						
8. Safety training						
9. Provision of safer technology						
10. Non-punitive reporting environment						

Comments:

A-3 Survey of Healthcare Personnel on Occupational Exposure to Blood and Body Fluids

This survey helps assess reporting of occupational exposure to blood and body fluids by your healthcare personnel as well as the efficiency of your organization's postexposure management system. The survey has two sections: Part A assesses healthcare personnel's knowledge of procedures for reporting exposures and the frequency of under-reporting. Part B addresses personnel's experience with the care system after reporting an exposure.

Information from this form can be used to identify problems with either exposure reporting or the care received after an exposure. It also may help identify areas for improvement through education, procedure revision, and/or system changes.

It is anticipated that an organization will administer this survey as part of a baseline assessment and periodically thereafter (e.g., every few years). The survey could target either all personnel or only those at risk for occupational exposure to blood and body fluids.

Healthcare organizations that choose to administer this survey should feel free to adapt the form to their needs. For example, the period of time for recalling exposures can be changed from 12 months to 3 or 6 months. Likewise, organizations may want to exclude Part B and focus only on exposure reporting.

The survey form is intended to protect the anonymity of responders. If the number of healthcare personnel in one or more of the occupational groups included is small (e.g., phlebotomy team, IV team) then these groups should be removed from the form and combined with another occupational group (e.g., nursing staff, laboratory staff).

Items can be tallied either by hand or computer. If analysis by occupational group is desired, computer entry may be more efficient. A form for summarizing responses is included.

A sample letter to those personnel who will be completing the survey also is included. It is important that the confidentiality of the survey be emphasized in order to ensure the collection of accurate information and encourage participation.

Workbook Section Link for this Toolkit Product:

Organizational Steps

- Step 2. Assess Program Operational Processes
 - Assess Sharps Injury Reporting

SAMPLE Cover Letter

Dear (staff member, healthcare worker, employee),

[Name of organization] is conducting a survey to assess our program for reporting and managing occupational exposures to blood and body fluids. Your feedback on this program is important and will help identify improvements to better serve our workforce.

It will only take a few minutes to complete the attached form. **All of your responses are confidential.** Once they are collected, there will be no way to connect your name with the survey you complete. Your responses will be combined with others in order to determine how we can improve our services.

If you need help completing this survey or have any questions, please ask _____
_____. When you have completed the survey, please return it to _____
_____. Thank you in advance for providing this information.

SAMPLE Survey of Healthcare Personnel on Occupational Exposure to Blood and Body Fluids

If you have questions or problems completing this form, please ask for help.

1. Which of the following best describes your occupation/work area? (*Check one.*)

- | | |
|--|--|
| <input type="checkbox"/> Nursing staff | <input type="checkbox"/> Transport Service |
| <input type="checkbox"/> Non-Surgical medical staff | <input type="checkbox"/> Central Supply staff |
| <input type="checkbox"/> Surgical medical staff | <input type="checkbox"/> Maintenance/engineering staff |
| <input type="checkbox"/> Laboratory staff | <input type="checkbox"/> Housekeeping/Laundry Services |
| <input type="checkbox"/> Dental staff | <input type="checkbox"/> Other Staff |
| <input type="checkbox"/> Phlebotomy team | <input type="checkbox"/> Security |
| <input type="checkbox"/> V team | <input type="checkbox"/> Medical student |
| <input type="checkbox"/> Technician | <input type="checkbox"/> Other student |
| <input type="checkbox"/> Clerical/Administrative staff | |

2. Which shift do you usually work? 1st 2nd 3rd

Part A. Reporting Occupational Exposures

The following questions are about exposures to blood or body fluids, including injuries from sharp objects such as needles or blood or body fluid contact to the eyes, mouth, or skin.

3. Does our organization have a procedure/protocol for reporting exposures to blood and body fluids?

- No Yes Don't know

If yes, are you familiar with how to report these exposures?

- No Yes

4. Who would you contact first if you were injured by a needle or sharp object, or if you were exposed to blood or body fluid?

- Supervisor
 Occupational/employee health
 Infection Control
 Emergency room
 Personal physician
 Don't know
 Would not contact anyone
 Other (please explain _____)

5. In the past 12 months, have you been injured by a sharp object, such as a needle or scalpel that was previously used on a patient?

- No Yes Don't know if the object was previously used on a patient

If yes, how many contaminated sharps injuries did you sustain during this time period? _____
For how many of these exposures did you complete/submit a blood/body fluid exposure report? _____

6. In the past 12 months, did blood or body fluids come in direct contact with your eyes, mouth, or skin?

- No Yes

If yes, how many blood/body fluid exposures did you sustain during this time period? _____
For how many of these exposures did you complete/submit a blood/body fluid exposure reports? _____

Please go to the next page.

7. If you had an exposure that you did not report, please indicate the reasons for not reporting:
(Check all that apply.)

- I did not have time to report
- I did not know the reporting procedure
- I was concerned about confidentiality
- I thought I might be blamed or get in trouble for having the exposure
- I thought the source patient was low risk for HIV and/or hepatitis B or C
- I thought the type of exposure was low risk for HIV and/or hepatitis B or C
- I did not think it was important to report
- Other (please explain _____)

Part B. Postexposure Experience

Please answer the following questions **only if you had an exposure to blood or body fluids that you reported** to a supervisor or health official.

8. Where did you go to receive care after you were injured by a needle or other sharp object, or were exposed to blood or body fluid?

- Employee/occupational health service
- Infection control
- Emergency room
- Personal physician
- Outpatient clinic
- Other (please explain _____)
- Did not receive care

9. If you received treatment for your injury or splash, please circle the number that best describes your experience with the health service where you received care.

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
1. I was seen in a timely manner.	1	2	3	4	5
2. I was given sufficient information to make a decision about postexposure treatment.	1	2	3	4	5
3. My questions were answered to my satisfaction.	1	2	3	4	5
4. I was encouraged to call or come back if I had any concerns.	1	2	3	4	5
5. Staff made me feel that it was important to report my exposure.	1	2	3	4	5
6. I did not feel rushed during my visit.	1	2	3	4	5
7. The place where I received treatment was convenient for me.	1	2	3	4	5

10. Please add any additional comments below.

THANK YOU FOR COMPLETING THIS SURVEY.

Responses by Occupation*

Occupational Group	# Responses	Number eligible to respond	Response rate (%)	Number/% reporting a percutaneous injury (PI)	Total # PI exposures (range per person)	Total/% PI reported	Number/% reporting a Mucous Membrane (MM) exposure	Total # MM exposures (range per person)	Total/% Skin and MM exposures reported
Surgical/medical staff									
Nursing staff									
Laboratory staff									
Dental staff									
Maintenance staff									
Housekeeping/ laundry staff									
Technician									
Other									
Not identified									

*This table summarizes data from Questions 1, 5 and 6

Part B. Postexposure Experience

Number/Percent

7. Location where follow-up care was received:

Occupational/employee Health	_____ / _____ %
Infection control	_____ / _____ %
Emergency room	_____ / _____ %
Personal physician	_____ / _____ %
Outpatient clinic	_____ / _____ %
Other	_____ / _____ %
No care received	_____ / _____ %

8. Postexposure care experience

Highest possible score per survey = 35

Mean score (total of all items / number of respondents): _____

Range: _____ (lowest total score) to: _____ (highest total score)

Individual Item Scores	Mean Score	%1	%2	%3	%4	%5
Seen in a timely manner						
Given sufficient information						
Questions answered satisfactorily						
Encouraged to call/come back with concerns						
Made to feel exposure was important						
Did not feel rushed						
Location was convenient						

COMMENTS:

A-4 Baseline Institutional Injury Profile Worksheet

This worksheet is designed to help healthcare organizations organize baseline data on sharps injuries and identify priorities for intervention. Data elements include the occupations of injured healthcare personnel, devices associated with injuries, injury rates, and injury circumstances. This worksheet is **not** designed to lead organizations to conclusions about prevention activities. Rather, the intent is to use the worksheet as a discussion tool for setting priorities for intervention.

Information for this worksheet is based on data collected in Appendix A-7, the *Sample Blood and Body Fluid Exposure Report Form*. Facilities that are not using a similar form may not have information on specific categories included in this worksheet. In that situation, the categories should be modified to reflect information currently collected by the facility.

Workbook Section Link for this Toolkit Product:

Organizational Steps

Step 3. Prepare a Baseline Profile of Sharps Injuries and Prevention Activities

SAMPLE Baseline Sharps Injury Profile Worksheet

The goal of this worksheet is to organize sharps injury data for the purpose of identifying immediate priorities for intervention.

How many injuries have been reported?

Year	# Injuries

What are the three most common occupational groups that have reported injuries in the *past year*?

Occupational Group	# Injuries	Occupational Injury Rate* (optional)

What are the five most common work locations where injuries occur in the *past year*?

Location	# of Injuries	% of Injuries

What are the five most common devices that contribute to injuries in the *past year*?

Device	# of Injuries	% of Injuries

In the *past year*, what proportion of injuries that occurred due to the following circumstances?

Circumstance	# of Injuries	% of Injuries
Manipulating needle in patient		
Manipulating needle in IV line		
Suturing		
Recapping		
Discarding sharp into container		
Discarding sharp improperly		
During clean-up		
Other		

Circumstance	# of Injuries	% of Injuries
Manipulating needle in patient		
Manipulating needle in IV line		
Suturing		
Recapping		
Discarding sharp into container		
Discarding sharp improperly		
During clean-up		
Other		

Circumstance	# of Injuries	% of Injuries
Manipulating needle in patient		
Manipulating needle in IV line		
Suturing		
Recapping		
Discarding sharp into container		
Discarding sharp improperly		
During clean-up		
Other		

In the *past year*, what proportion of injuries occurred during the following procedures?

Procedure	# of Injuries	% of Injuries
Insertion of an intravenous catheter		
Phlebotomy		
Arterial blood puncture		
Giving an injection		

Based on this assessment, what are the top 5 priorities we should address?

- 1. _____

- 2. _____

- 3. _____

- 4. _____

- 5. _____

A-5 Baseline Injury Prevention Activities Worksheet

This worksheet is intended as a method for documenting the implementation of specific injury prevention interventions. The focus is on engineered sharps injury prevention devices, but other strategies are included as examples. Healthcare facilities may modify this form to suit specific needs.

Workbook Section Link for this Toolkit Product:

Organizational Steps

Step 3. Prepare a Baseline Profile of Current Sharps Injuries and Prevention Activities

SAMPLE Baseline Injury Prevention Activities Worksheet

1. What engineered sharps injury prevention devices have been implemented in the facility?

Conventional Device Type	Name/Manufacturer of Safety Device Implemented	Implementation Year	Scope of Use*
Hypodermic needle/syringe			
Intravenous delivery system			
Intravenous catheter			
Winged steel (butterfly-type) needle			
Vacuum tube/phlebotomy needle assembly			
Blood gas kit			
Finger/heel stick lancet			
Surgical scalpel			
Suture needle			
Hemodialysis needle			
Glass blood collection tube			
Glass capillary tube			
Other:			
Other:			

*Hospital-wide (HW) or Selected Areas only (SA)

2. What other sharps injury prevention devices have been implemented?

Purpose of Other Types of Injury Prevention Devices	Name/Manufacturer of Safety Device Implemented	Implementation Year	Scope of Use*
Huber needle removal			
Cut- or puncture-resistant barrier (e.g., surgical gloves)			
Intravenous catheter securement			
Blood bank segment sampling			
Surgical sharps handling (e.g., magnetic pads, neutral zone trays)			
Other:			
Other:			

* Hospital-wide (HW) or Selected Areas only (SA)

3. Where in the facility are sharps collection containers placed?

- Each patient room Medication carts Each procedure room
 Soiled utility rooms Laundry Laundry Other

4. Is the facility using any communication tools to promote safe handling of sharps? If so, what are they?

5. Other prevention activities?

A-6 Sharps Injury Prevention Program Action Plan Forms

These forms are designed to help organizations develop and implement action plans to track and measure their prevention interventions. The first form is specifically designed for prevention initiatives, such as implementation of devices with sharps injury prevention features or changes in work practice. The second form is focused on programmatic changes that will lead to system improvements (e.g., healthcare personnel education and training, reporting procedures). Healthcare organizations should use these tools freely and modify them to meet their program needs.

A sample form showing how to complete the first action plan form is included. The numbers on this sample form are fictional and should not be used for comparison purposes.

Workbook Section Link for this Toolkit Product:

Organizational Steps

Step 5. Develop and Implement Action Plans

SAMPLE Sharps Injury Prevention Program Action Plan: Prevention Initiatives

Problem:	Disposal-related sharps injuries				
Outcome Goal:	Reduce to zero the number of injuries associate with sharps disposal				
Beginning Measure:	18 disposal-related injuries from 1/01/00 to 12/31/00				
Post Intervention Measure:					
Problem	Baseline # Injuries/ time period±	Prevention Strategies£	Implementation* Status/Date	# Injuries Post Intervention	Comments
Needlesticks among laundry workers due to needles left in laundry, chiefly IV catheter stylets.	3/year	A - Memo to all department heads asking them to review sharps disposal with staff	C 2/3/01	1/1/01 - 4/1/01 One sharp reported in laundry since intervention; no injuries to laundry staff	Additional sharps containers were placed in laundry area
		A - Meeting with laundry workers asking them to be alert to problem and to encourage reporting of sharps found in laundry, discuss what to do with sharps if found, and identification of laundry source if known	C 2/5/01		
		E - Implementation of safer IV catheters	P 4/1/01		
Needlesticks associated with overfilled sharps containers in ER and ICU	6/year	A - Site evaluation of sharps containers in ER and ICU	C 3/6/01	1/1/01 - 4/1/01 Two injuries due to overfilled sharps reported, one in ICU, one in other unit	Problem associated with pick-up frequency Frequency of pick-up not a problem. Staff reluctant to enter rooms when procedures are going on
		WP/ET - Review procedures for collection of sharps containers with housekeeping	C 3/15/01		
Injuries with butterfly needles during disposal	7/year	A - Set up meeting with housekeeping and nursing staff to discuss possible solutions	P 4/1/01	1/1/01 - 4/1/01 Three butterfly injuries reported	
		A - Investigate incidents to determine whether injuries involved front or boot end butterfly needles	IP 4/1/01		
		E - implement safer butterfly devices	IP 4/1/01		
Other improper disposal injuries	2/year	A - In hospital newsletter discuss safe ways of handling butterfly needles	P 4/1/01		
		A - Address through injuries to laundry workers described above			

* Pending (P) In Progress (IP) Completed (C)

± Year, Quarter, Month

£ Describe then code by type of intervention: A= Administrative, E = Engineering, WP = Work Practice, ET = Education/Training

SAMPLE Sharps Injury Prevention Program Action Plan: Prevention Initiatives

Problem:	
Outcome Goal:	
Beginning Measure:	
Post Intervention Measure:	

Problem	Baseline # Injuries/ Time Period [±]	Prevention Strategies [£]	Implementation * Status/Date/ Person Responsible	Post Intervention # Injuries/Time Period [±]	Comments

* Pending (P) In Progress (IP) Completed (C)

[±] Year, Quarter, Month

[£] Describe then code by type of intervention: A= Administrative, E = Engineering, WP = Work Practice, ET = Education/Training

SAMPLE Sharps Injury Prevention Program Action Plan: Process Improvement

Process of Concern *	Problem	Action Items	Status/Date	Outcome

* Safety culture, sharps injury reporting, education, etc.

A-7 Blood and Body Fluid Exposure Report Form

The following form was developed to aid healthcare organizations in collecting information on occupational exposures to blood and body fluids. Information on exposure characteristics (e.g., exposure location, type of exposure, device involved, and procedure being performed) can be analyzed for better prevention planning. The first page of this form meets the information requirements for completing an OSHA sharps injury log. It may not be possible to complete all information at the time of the exposure or during the initial consultation with the exposed employee. It is important to add the information after further investigation.

Workbook Section Link for this Toolkit Product:

Operational Processes

Implement Procedures for Reporting Sharps Injuries and Injury Hazards
Characteristics of a Report Form

SAMPLE Blood and Body Fluid Exposure Report Form

Facility name: _____

Name of exposed worker:

Last: _____ First: _____ ID #: _____

Date of exposure: ____/____/____ Time of exposure: ____:____ AM PM (Circle)

Job title/occupation: _____ Department/work unit: _____

Location where exposure occurred: _____

Name of person completing form: _____

Section I. Type of Exposure *(Check all that apply.)*

- Percutaneous (Needle or sharp object that was in contact with blood or body fluids)**
(Complete Sections II, III, IV, and V.)
- Mucocutaneous** *(Check below and complete Sections III, IV, and VI.)*
 Mucous Membrane **Skin**
- Bite** *(Complete Sections III, IV, and VI.)*

Section II. Needle/Sharp Device Information

(If exposure was percutaneous, provide the following information about the device involved.)

Type of device: _____ Unknown/Unable to determine

Brand/manufacturer: _____ Unknown/Unable to determine

Did the device have a sharps injury prevention feature, i.e., a "safety device"?

- Yes No Unknown/Unable to determine

If yes, when did the injury occur?

- | | |
|--|---|
| <input type="checkbox"/> Before activation of safety feature was appropriate | <input type="checkbox"/> Safety feature failed after activation |
| <input type="checkbox"/> During activation of the safety feature | <input type="checkbox"/> Safety feature not activated |
| <input type="checkbox"/> Safety feature improperly activated | <input type="checkbox"/> Other: _____ |

Describe what happened with the safety feature, e.g., why it failed or why it was not activated: _____

Section III. Employee Narrative

Describe how the exposure occurred and how it might have been prevented:

NOTE: This is not a CDC or OSHA form. This form was developed by CDC to help healthcare facilities collect detailed exposure information that is specifically useful for the facilities' prevention planning. Information on this page (#1) may meet OSHA sharps injury documentation requirements and can be copied and filed for purposes of maintaining a separate sharps injury log. Procedures for maintaining employee confidentiality must be followed.

Section IV. Exposure and Source Information

A. Exposure Details: (Check all that apply.)

1. Type of fluid or material (For body fluid exposures only, check which fluid in adjacent box.)

- Blood/blood products
 Visibly bloody body fluid*
 Non-visibly bloody body fluid*
 Visibly bloody solution
 (e.g., water used to clean a blood spill)

*Identify which body fluid

- | | | |
|--|--------------------------------------|--|
| <input type="checkbox"/> Cerebrospinal | <input type="checkbox"/> Urine | <input type="checkbox"/> Synovial |
| <input type="checkbox"/> Amniotic | <input type="checkbox"/> Sputum | <input type="checkbox"/> Peritoneal |
| <input type="checkbox"/> Pericardial | <input type="checkbox"/> Saliva | <input type="checkbox"/> Semen/vaginal |
| <input type="checkbox"/> Pleural | <input type="checkbox"/> Feces/stool | <input type="checkbox"/> Other/Unknown |

2. Body site of exposure. (Check all that apply.)

- Hand/finger Eye Mouth/nose Face Arm Leg
 Other (Describe: _____)

3. If percutaneous exposure:

Depth of injury (Check only one.)

- Superficial (e.g., scratch, no or little blood)
 Moderate (e.g., penetrated through skin, wound bled)
 Deep (e.g., intramuscular penetration)
 Unsure/Unknown

Was blood visible on device before exposure? Yes No Unsure/Unknown

4. If mucous membrane or skin exposure: (Check only one.)

Approximate volume of material

- Small (e.g., few drops) Large (e.g., major blood splash)

If skin exposure, was skin intact? Yes No Unsure/Unknown

B. Source Information

1. Was the source individual identified? Yes No Unsure/Unknown

2. Provide the serostatus of the source patient for the following pathogens.

	Positive	Negative	Refused	Unknown
HIV Antibody	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HCV Antibody	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HbsAg	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. If known, when was the serostatus of the source determined?

- Known at the time of exposure
 Determined through testing at the time of or soon after the exposure

Section V. Percutaneous Injury Circumstances

A. What device or item caused the injury?

Hollow-bore needle

- Hypodermic needle
 - Attached to syringe
 - Attached to IV tubing
 - Unattached
- Prefilled cartridge syringe needle
- Winged steel needle (i.e., butterfly^R type devices)
 - Attached to syringe
 - Attached to IV tubing
 - Unattached
- IV stylet
- Phlebotomy needle
- Spinal or epidural needle
- Bone marrow needle
- Biopsy needle
- Huber needle
- Other type of hollow-bore needle (type: _____)
- Hollow-bore needle, type unknown

Suture needle

- Suture needle

Glass

- Capillary tube
- Pipette (glass)
- Slide
- Specimen/test/vacuum
- Other: _____

Other sharp objects

- Bone chip/chipped tooth
- Bone cutter
- Bovie electrocautery device
- Bur
- Explorer
- Extraction forceps
- Elevator
- Histology cutting blade
- Lancet
- Pin
- Razor
- Retractor
- Rod (orthopaedic applications)
- Root canal file
- Scaler/curette
- Scalpel blade
- Scissors
- Tenaculum
- Trocar
- Wire
- Other type of sharp object
- Sharp object, type unknown

Other device or item

- Other: _____

B. Purpose or procedure for which sharp item was used or intended.

(Check one procedure type and complete information in corresponding box as applicable.)

<ul style="list-style-type: none"> <input type="checkbox"/> Establish intravenous or arterial access (Indicate type of line.) <input type="checkbox"/> Access established intravenous or arterial line (Indicate type of line <u>and</u> reason for line access.) <input type="checkbox"/> Other specimen collection <input type="checkbox"/> Injection through skin or mucous membrane (Indicate type of injection.) <input type="checkbox"/> Obtain blood specimen (through skin) (Indicate method of specimen collection.) <input type="checkbox"/> Suturing <input type="checkbox"/> Cutting <input type="checkbox"/> Other procedure <input type="checkbox"/> Unknown 	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p style="text-align: center;">Type of Line</p> <p>___ Peripheral ___ Arterial ___ Central ___ Other</p> </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"> <p style="text-align: center;">Reason for Access</p> <p>___ Connect IV infusion/piggyback ___ Flush with heparin/saline ___ Obtain blood specimen ___ Inject medication ___ Other: _____</p> </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"> <p style="text-align: center;">Type of Injection</p> <p>___ IM injection ___ Epidural/spinal anesthesia ___ Skin test placement ___ Other injection ___ Other ID/SQ injection</p> </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"> <p style="text-align: center;">Type of Blood Sampling</p> <p>___ Venipuncture ___ Umbilical vessel ___ Arterial puncture ___ Finger/heelstick ___ Dialysis/AV fistula site ___ Other blood sampling</p> </div>
---	---

C. When and how did the injury occur? (From the left hand side of page, select the point during or after use that most closely represents when the injury occurred. In the corresponding right hand box, select *one or two* circumstances that reflect how the injury happened.)

During use of the item

Select one or two choices:

- Patient moved and jarred device
- While inserting needle/sharp
- While manipulating needle/sharp
- While withdrawing needle/sharp
- Passing or receiving equipment
- Suturing
- Tying sutures
- Manipulating suture needle in holder
- Incising
- Palpating/Exploring
- Collided with co-worker or other during procedure
- Sharp object dropped during procedure

After use, before disposal of item

Select one or two choices:

- Handling equipment on a tray or stand
- Transferring specimen into specimen container
- Processing specimens
- Passing or transferring equipment
- Recapping (missed or pierced cap)
- Cap fell off after recapping
- Disassembling device or equipment
- Decontamination/processing of used equipment
- During clean-up
- In transit to disposal
- Opening/breaking glass containers
- Collided with co-worker/other person
- Sharp object dropped after procedure
- Struck by detached IV line needle

During or after disposal of item

Select one or two choices:

- Placing sharp in container:
 - Injured by sharp being disposed
 - Injured by sharp already in container
- While manipulating container
- Over-filled sharps container
- Punctured sharps container
- Sharp protruding from open container
- Sharp in unusual location:
 - In trash
 - In linen/laundry
 - Left on table/tray
 - Left in bed/mattress
 - On floor
 - In pocket/clothing
 - Other unusual location
- Collided with co-worker or other person
- Sharp object dropped
- Struck by detached IV line needle

Other (Describe): _____

Unknown

Section VI. Mucous Membrane Exposures Circumstances

A. What barriers were used by the worker at the time of the exposure?

(Check all that apply.)

- Gloves
 Goggles
 Eyeglasses
 Face Shield
 Mask
 Gown

B. Activity/Event when exposure occurred (Check one.)

- Patient spit/coughed/vomited
 Airway manipulation (e.g., suctioning airway, inducing sputum)
 Endoscopic procedure
 Dental procedure
 Tube placement/removal/manipulation (e.g., chest, endotracheal, NG, rectal, urine catheter)
 Phlebotomy
 IV or arterial line insertion/removal/manipulation
 Irrigation procedure
 Vaginal delivery
 Surgical procedure (e.g., all surgical procedures including C-section)
 Bleeding vessel
 Changing dressing/wound care
 Manipulating blood tube/bottle/specimen container
 Cleaning/transporting contaminated equipment
 Other: _____
 Unknown

Comments: _____

A-8 Sharps Injury Hazard Observation and Report Forms

Healthcare organizations that collect information on sharps injury hazards in the work environment may find the following forms useful. The first form (A-8-1) is for organizations that perform systematic environmental rounds and provides a means for documenting specific sharps injury hazards observed in the course of conducting rounds. The second form (A-8-2) is for use by individual workers who observe a sharps injury hazard in the work environment or is reporting a “near miss” event. The form provides a means for documenting the observation and communicating the problem to administrative personnel. Healthcare organizations may download these resources and adapt them as necessary to meet their organization’s needs.

Workbook Section Link for this Toolkit Product:

Operational Processes

Implement Procedures for Reporting Sharps Injuries and Injury Hazards

(Name of Healthcare Organization)

**A-8-1 SAMPLE Sharps Injury Hazard Observations
During Environmental Rounds**

Date: _____

Time: _____

Facility Location: _____

Name of Observer(s):	

Were any sharps injury hazards identified during the observation?

Yes

No

If yes, what category of hazard was observed? (Check all that apply.)

Improperly discarded sharp object

Overfilled sharps container

Sharp penetrating through container

Improper handling of a sharp device

Other: _____

Describe what was observed. If more than one hazard was identified, number and describe each one separately.

Reviewed by: _____

Committee on: _____

(Name of Healthcare Organization)

**A-8-2 SAMPLE Sharps Injury Hazard Observation or “Near Miss”
Event Report Form**

Date: _____

Time: _____

Location in facility where hazard was observed:			
Building	Department/Unit	Floor	Room #

Description of the hazard or “near miss” event:

Name of person reporting: _____ Phone: _____

Do you wish to be notified of how this problem is addressed?

- Yes No

Send report to: _____

(For Use by Safety Office)

Date received: _____

Method of investigation: _____ Phone call to: _____

On-site inspection: _____

Disposition: _____

Was the person who reported this observation notified that it has been addressed?

- Yes No

A-9 Sample Form for Performing a Simple Root Cause Analysis of a Sharps Injury or “Near Miss” Event

This form was developed to assist healthcare organizations determine the factors that may have contributed to a reported sharps injury (A-7) or a situation where a sharps injury could have occurred (“near miss”) (A-8-2). The methods for performing a root cause analysis are discussed in operational process *Implement Procedures for Reporting and Examining Sharps Injuries and Injury Hazards*. Use of this form will assist healthcare organizations identify whether one factor or a combination of factors contributed to the problem. Healthcare organizations may adapt this form as needed.

The key to the RCA process is asking the question “why?” as many times as it takes to get down to the “root” cause(s) of an event.

- What happened?
- How did it happen?
- Why did it happen?
- What can be done to prevent it from happening in the future?

Use of this form and the trigger questions provided will help determine whether and how one or more of the following was a contributing factor: patient action, patient assessment, training or competency, equipment, lack of or misinterpretation of information, communication, availability and use of specific policies or procedures, healthcare personnel issues, and/or supervisory issues.

SAMPLE Form for Performing a Simple Root Cause Analysis of a Sharps Injury or “Near Miss” Event

Description of Event Under Investigation

Event: Date ___/___/___ Time _____ AM PM **Weekday:** _____

Location: _____

Details of how the event occurred: _____

Contributing Factors	If “YES”, what contributed to this factor being an issue?		Is this a root cause of the event?		If YES, is an action plan indicated?	
	YES	NO	YES	NO	YES	NO
Issues related to patient assessment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Issues related to staff training or staff competency?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Equipment/device?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Work environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of or misinterpretation of information?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communication?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Appropriate rules/policies/procedures or lack thereof?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Failure of a protective barrier?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Personnel or personal issues?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Supervisory issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Root Cause Analysis Action Plan

Risk Reduction Strategies	Measure(s) of Effectiveness	Responsible Person(s)
Action item #1		
Action item #2		
Action item #3		
Action item #4		
Action item #5		

SAMPLE Trigger Questions for Performing a Root Cause Analysis of a Blood or Body Fluid Exposure

1. Issues related to patient assessment
 - Was the patient agitated before the procedure?
 - Was the patient cooperative before the procedure?
 - Did the patient contribute in any way toward the event?
2. Issues related to staff training or staff competency
 - Did the healthcare worker receive training on injury prevention technique for the procedure performed?
 - Are there training or competency factors that contributed to this event?
 - Approximately how many procedures of this type has the healthcare worker performed in the last month/week?
3. Issues related to the device
 - Did the type of device used contribute in any way to this event?
 - Was a “safety” device used?
 - If not, is it likely that a safety device could have prevented this event?
4. Work environment
 - Did the location, fullness or lack of a sharps container contribute to this event?
 - Did the organization of the work environment (e.g., placement of supplies, position of patient) influence the risk of injury?
 - Was there sufficient lighting?
 - Was crowding a factor?
 - Was there a sense of urgency to complete the procedure?
5. Was a lack of or misinterpretation of information contribute to this event?
 - Did the healthcare worker misinterpret any information about the procedure that could have contributed to the event?
6. Communication
 - Were there any communication barriers (e.g., language) that contributed to this event ?
 - Was communication in any way a contributing factor in this event?
7. Appropriate policies/procedures
 - Are there existing policies or procedures that describe how this event should be prevented?
 - Were the appropriate policies or procedures followed?
 - If they were not followed, why not?
8. Worker issues
 - Did being right or left handed influence the risk?
 - On the day of the exposure, how long had the worker been working before the exposure occurred?
 - At the time of the exposure, could factors such as worker fatigue, hunger, illness, etc. have contributed?
9. Employer issues
 - Did lack of supervision contribute to this event?

A-10 Occupation-Specific Rate-Adjustment Calculation Worksheet

The data analysis section of this *Workbook*, *Operational Processes, Analyze Sharps Injury Data*, discusses the adjustment of occupation-specific injury rates based on levels of compliance with injury reporting policies. This worksheet helps facilitate computation of this adjusted rate. Organizations that have surveyed healthcare personnel (Appendix A-3) to determine compliance with reporting occupational exposures to blood and body fluids can use these data to adjust injury rates.

Workbook Section Link for this Toolkit Product:

Operational Processes

Analyze Sharps Injury Data

Calculating Injury Incidence Rates

SAMPLE Occupation-Specific Rate-Adjustment Calculation Worksheet

Occupational Group: _____

Calculate the percentage of unreported injuries for the occupation:

1. From **the reporting survey**, record the number of injuries these workers say they sustained _____.
2. Record the number of injuries these workers say they reported _____.
3. Subtract #2 from #1 to obtain the number of unreported injuries _____.
4. Divide #3 by #1 and multiply by 100 to obtain _____%, the percentage of unreported injuries in this occupation.

Adjust the number of injuries for the occupation of interest:

5. From **facility-wide injury data**, record the number of injuries reported by the occupation during the period being analyzed (e.g., previous year) _____.
6. Multiply #4 by #5 to obtain the number of unreported injuries for the occupation _____.
7. Add #5 and #6 to obtain the adjusted number of injuries for the occupation that should be used for adjusting the occupation-specific injury incidence rate _____.

Note: Additional adjustments in the calculation may be necessary if the time periods in the reporting survey and facility-wide data are different (e.g., if the reporting survey asks only for injuries in the last six months and facility-wide data are for one year).

A-11 Survey of Device Use

This tool is designed to help product evaluation teams or committees determine how devices are used in their healthcare organization. Department heads, nursing units, or their designees should complete this form. The example uses a hypodermic needle/syringe. The form will need slight modification if used for other types of devices, but the questions will be similar, if not the same. The information from this survey helps product evaluation teams identify the device-specific issues they must consider when selecting substitute products.

Workbook Section Link for this Toolkit Product:

Operational Processes

Selection of Sharps Injury Prevention Devices

Step 3. Gather Information on Use of the Conventional Device

SAMPLE Cover Memo

TO: Heads of all departments and nursing units
FROM: (Name of workgroup)
DATE:
SUBJECT: Survey of device use

The elimination of percutaneous injuries associated with the use of (Type of Device) is a priority of your Sharps Injury Prevention Program Committee. Currently, this type of device accounts for _____% of our sharps injuries each year. One prevention strategy under consideration is the replacement of our conventional (Type of Device) with a device or devices with safety features.

We want to ensure that all areas of the organization that might be affected by the decisions of this committee have input into the decision-making process. Our first step is to conduct an organization-wide survey to identify users of the current device and their unique needs. Please complete the attached survey, and return it to _____ by _____. If you have any questions about the survey or the plans of the committee, you may call _____.

Survey of Device Use
(Example: Hypodermic Needle/Syringe)

Department/Nursing Unit	Person Completing Form	Phone

1. Does your department/nursing unit use hypodermic needles and syringes?

- Yes (Go to next group of questions.) No (Stop here and return this form.)

2. Does your department/nursing unit obtain this device from the facility's central supply area?

- Yes No (Complete information on reverse side of this page at bottom.)

3. For which of the following procedures does your department/nursing unit use this device?

- | | |
|--|--|
| <input type="checkbox"/> Give injections | <input type="checkbox"/> Withdraw medication |
| <input type="checkbox"/> Collect blood or other specimen | <input type="checkbox"/> Irrigate |
| <input type="checkbox"/> Access parts of an intravenous system | |

Other: 1. _____ 2. _____ 3. _____

4. Does your department/nursing unit ever use a syringe without an attached needle?

- Yes No

If yes, please list these uses:

1. _____ 2. _____ 3. _____

5. What syringe sizes are used in your department/nursing unit?

(Check all that apply.)

- | | | | |
|---------------------------------------|--|---------------------------------------|-------------------------------|
| <input type="checkbox"/> 1 cc Insulin | <input type="checkbox"/> 1 cc Tuberculin | <input type="checkbox"/> 3 cc | <input type="checkbox"/> 5 cc |
| <input type="checkbox"/> 10 cc | <input type="checkbox"/> 20 cc | <input type="checkbox"/> Other: _____ | |

6. Is the hypodermic needle/syringe used with other equipment where compatibility might be a concern when considering other devices?

- Yes (Please explain.) No

7. Does your department/nursing unit need to be able to change needles after drawing medication?

- Yes No

8. Does your department/nursing unit have any purposes or needs associated with the hypodermic needle/syringe that you consider unique from other hospital areas?

- Yes (Please explain.) No

Comments: _____

Additional information on product supply source: (From question #2)

Name of device manufacturer: _____

Name of supplier: _____

Approximate number of devices stocked: _____

A-12 Device Pre-Selection Worksheet

This worksheet will help product evaluation teams or committees discuss and determine relevant criteria when considering a particular sharps injury prevention device. The form may be completed individually or collectively. The worksheet should help determine whether a device merits further consideration, including in-use evaluation and, if so, identify questions that should be asked during the evaluation.

A variety of factors for consideration are included, and space is provided for others to be added as necessary. Each factor should be assessed for its relevance and importance for the device in question. Committees may want to use this tool before looking at a category of devices (e.g., intravenous catheters) in order to decide which criteria are important.

A tool for compiling information after completing this worksheet is not included. Once completed, the team may wish to summarize the responses to document why a particular device was accepted or rejected for further evaluation.

Workbook Section Link for this Toolkit Product:

Operational Processes

Selection of Sharps Injury Prevention Devices

Step 4. Establish Criteria for Product Selection and Identify Other Issues for Consideration

SAMPLE Device Pre-Selection Worksheet

Type of Device: _____ Brand: _____ Manufacturer: _____

Clinical Considerations	Does this consideration apply to this device?		If Yes, what is the level of importance?		
	No	Yes	High	Med	Low
Device use will require a change in technique (compared to conventional product).					
Device permits needle changes.					
Device permits reuse of the needle on the same patient during a procedure (e.g., local anesthesia).					
Device allows easy visualization of flashback.					
Device allows easy visualization of medication.					
Other:					
Comment:					

Procedural Implications for Healthcare Provider

Other Considerations	Does this consideration apply to this device?		If yes, what is the level of importance		
	No	Yes	High	Med	Low
Patient Considerations	Device is latex free.				
	Device has potential for causing infection.				
	Device has potential for causing increased pain or discomfort to patients.				
	Other:				
	Comment:				
Scope of Device Use Considerations	Device can be used with adult and pediatric populations.				
	Specialty areas (e.g., OR, anesthesiology, radiology) can use the device.				
	Device can be used for all the same purposes for which the conventional device is used.				
	Device is available in all currently used sizes.				
	Other:				
Comment:					

Safety Considerations	Does this consideration apply to this device?		If yes, what is the level of importance		
	No	Yes	High	Med	Low
Method of Activation	The safety feature does not require activation by the user.				
	The worker's hands can remain behind the sharp during activation of the safety feature.				
	Activation of the safety feature can be performed with one hand.				
	Other:				
	Comment:				
Characteristics of the Safety Feature	The safety feature is in effect during use in the patient.				
	The safety feature permanently isolates the sharp.				
	The safety feature is integrated into the device (i.e., does not need to be added before use).				
	A visible or audible cue provides evidence of safety feature activation..				
	The safety feature is easy to recognize and intuitive to use.				
	Other:				
	Comment:				

Other Considerations		Does this consideration apply to this device?		If yes, what is the level of importance		
		No	Yes	High	Med	Low
Availability	The device is available in all sizes currently used in the organization.					
	The manufacturer can provide the device in needed quantities.					
Services Provided	The company representative will assist with training.					
	Product materials are available to assist with training.					
	The company will provide free samples for evaluation.					
	The company has a history of being responsive when problems arise.					
Comment:						
Practical Considerations	The device will not increase the volume of sharps waste.					
	The device will not require changes in the size or shape of sharps containers.					
	Other:					
	Comment:					

A-13 Device Evaluation Form

This form was developed to collect the opinions and observations of healthcare professionals regarding a device with an engineered sharps injury prevention feature. Use of this form will help healthcare organizations make final decisions about the acceptability of a product based on its usefulness and safety features.

This form is designed for use with multiple types of devices. Space is provided to insert product-specific questions that may be of special interest. Non-relevant questions can be removed (for example, questions regarding importance of hand size and whether the person is right- or left-handed).

To use this form for product evaluation, select staff who represent the scope of users who will use or handle the device. Decide on a reasonable testing period – e.g., two to four weeks. Make sure staff are trained on the correct use of the device and encourage them to provide informal feedback during the evaluation period. Product evaluation forms should be completed and returned to the test coordinator as soon as possible after the evaluation period has ended. *Note: not all questions will be applicable to all staff. If a question does not apply to a staff member's experience, the question should be left blank.*

A sample letter to staff who will be completing the form is included. To gain accurate information and encourage participation from employees, emphasize that this is a confidential questionnaire and that the information provided will assist in determining the acceptability of this product.

In reviewing the completed forms, recognize that some items are more important than others. If necessary, meet with groups of workers who were involved with the evaluation to determine which criteria are most important to them. You will need to balance this feedback with the safety and practical considerations before determining whether or not to adopt the new device.

Tally questions by hand or computer to identify device-specific strengths and weaknesses. A form for summarizing responses is also included and provides a simple method for compiling the results. For more complex analyses, enter the responses into a data analysis program such as EpiInfo, Microsoft Excel, or SPSS for Windows.

Workbook Section Link for this Toolkit Product:

Operational Processes

Selection of Sharps Injury Prevention Devices

Step 7. Develop a Product Evaluation Survey Form

SAMPLE Cover Letter

Date

Dear (e.g., staff member, healthcare worker, employee):

(Name of organization) is conducting a survey to evaluate a device with an engineered sharps injury prevention feature. Your feedback on this product is important in order to identify safer devices that allow us to better serve our workforce.

Please complete the attached form, which will only take a few minutes. All of your responses are confidential. Once they are collected, there is no connection between your name and the survey you complete. Your responses will be combined with others in order to determine the acceptability of this new device.

If you need help completing this survey or have any questions, please ask _____. When you have completed the survey, please return it to _____. Thank you in advance for providing this information.

SAMPLE Device Evaluation Form

Product: [Filled in by healthcare facility]

Date: _____

Department/Unit: _____

Position/Title: _____

1. Number of times you used the device.

- 1-5
 6-10
 11-25
 26-50
 More than 50

2. Please mark the box that best describes your experiences with the device. If a question is not applicable to this device, do not fill in an answer for that question.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Patient/Procedure Considerations					
a. Needle penetration is comparable to the standard device.	1	2	3	4	5
b. Patients/residents do not perceive more pain or discomfort with this device.	1	2	3	4	5
c. Use of the device does not increase the number of repeat sticks of patient.	1	2	3	4	5
d. The device does not increase the time it takes to perform the procedure.	1	2	3	4	5
e. Use of the device does not require a change in procedural technique.	1	2	3	4	5
f. The device is compatible with other equipment that must be used with it.	1	2	3	4	5
g. The device can be used for the same purposes as the standard device.	1	2	3	4	5
h. Use of the device is not affected by my hand size.	1	2	3	4	5
i. Age or size of patient/resident does not affect use of this device.	1	2	3	4	5
Experience with the Safety Feature					
j. The safety feature does not interfere with procedural technique.	1	2	3	4	5
k. The safety feature is easy to activate.	1	2	3	4	5
l. The safety feature does not activate before the procedure is completed.	1	2	3	4	5
m. Once activated, the safety feature remains engaged.	1	2	3	4	5
n. I did not experience any injury or <i>near miss</i> of injury with the device.	1	2	3	4	5

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Special Questions about this Particular Device					
[To be added by healthcare facility]	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
Overall Rating					
Overall, this device is effective for both patient/ resident care and safety.	1	2	3	4	5

3. Did you participate in training on how to use this product?

- No (Go to question 6.) Yes (Go to next question.)

4. Who provided this instruction? (Check all that apply.)

- Product representative Staff development personnel
 Other _____

5. Was the training you received adequate?

- No Yes

6. Was special training needed in order to use the product effectively?

- No Yes

7. Compared to others of your gender, how would you describe your hand size?

- Small Medium Large

8. What is your gender?

- Female Male

9. Which of the following do you consider yourself to be?

- Left-handed Right-handed

10. Please add any additional comments below.

THANK YOU FOR COMPLETING THIS SURVEY

Please return this form to: _____

APPENDIX B - Devices with Engineered Sharps Injury Prevention Features

Devices with Engineered Sharps Injury Prevention Features

Introduction

This section describes various ways safety features have been incorporated into the most commonly used conventional needles and other sharp devices to protect healthcare personnel from injury. Factors to consider during device selection, including concerns for patient safety, are provided to help guide the decision-making process. **Information provided in this section is intended to help healthcare organizations make informed product choices and does not reflect CDC endorsement or disapproval of any product.** Healthcare organizations are also encouraged to look to other literature on these devices.

Definition of an “Engineered Sharps Injury Prevention Device”

This term has been defined by the OSHA and refers to:

- "A physical attribute built into a needle device used for withdrawing body fluids, accessing a vein or artery, or administering medications or other fluids, which effectively reduces the risk of an exposure incident by a mechanism such as barrier creation, blunting, encapsulation, withdrawal or other effective mechanisms;

or

- A physical attribute built into any other type of needle device or into a non-needle sharp, which effectively reduces the risk of an exposure incident."

These engineering modifications generally involve one of the following strategies:

- Eliminate the need for a needle (substitution);
- Permanently isolate the needle so that it is never poses a hazard; or
- Provide a means to isolate or encase a needle after use.

Another type of engineering control is the rigid sharps disposal container that comes in a variety of shapes and sizes. Although not discussed in this *Workbook*, these containers are an important strategy for reducing the risk of sharps injuries and an essential element in a comprehensive sharps injury prevention program. The National Institute for Occupational Safety and Health has published guidance on the selection of sharps containers (www.cdc.gov/niosh/sharps1.html) (147).

Other products have also been developed to promote safer work practices, such as needle recapping devices and IV line stabilizers. These products can have an important role in prevention. For example, fixed needle recappers (i.e., permanently or temporarily attached to a surface) that facilitate safe recapping when a needle must be reused on the same patient during a procedure (e.g., providing local anesthesia) might be considered when no acceptable alternative is available. Also, devices used to stabilize an intravenous or arterial line that provide an alternative to suturing are likely to reduce percutaneous injuries to healthcare providers as well as improve patient care by reducing site trauma and inadvertent line removal and the need to reinsert another catheter. Information on these products is not included in this *Workbook*.

Concept of “Active and Passive” Safety Features

The majority of safety features integrated into devices are active, i.e., they require some action on the part of the user to ensure that the needle or sharp is isolated after use. With some devices, activation of the safety feature can be done before the needle is removed from the patient. However, for most devices, activation of the safety feature is performed following the procedure. The timing of activation has implications for needlestick prevention; the sooner the needle is permanently isolated, the less likely a subsequent needlestick will occur.

A passive safety feature is one that requires no action by the user. A good example of such a device is a protected needle used to access parts of an IV delivery system; although a needle is used, it is never exposed (i.e., unprotected) and does not rely on the user to render it safe.

Few devices with passive safety features are currently available. Many devices currently marketed as self-blunting, self-resheathing, or self-retracting imply that the safety feature is passive. However, devices that use these strategies generally require that the user engage the safety feature.

Although devices with passive safety features are intuitively more desirable, this does not mean that a safety feature that requires activation is poorly designed or not desirable. In certain situations it is not practical or feasible for the device or for the procedure to have a passive control. Therefore, **whether a safety feature is active or passive should not take priority in deciding the merits of a particular device**. The relevance of this information is most important for the training of healthcare personnel in the correct use of a modified device and motivating compliance in using the safety feature.

The following websites provide information on the various safety devices that are currently available.

Notice: Clicking the links below will leave the CDC Website. We have provided links to these sites because they have information that may be of interest to you. CDC does not necessarily endorse the views or information presented on these sites. Furthermore, CDC does not endorse any commercial products or information that may be presented or advertised on the site the sites that are about to be displayed.

A list of Devices Designed to Prevent Percutaneous Injury and Exposures to Bloodborne Pathogens in the Health Care Setting has been developed by the University of Virginia's International Health Care Worker Safety Center. <http://www.healthsystem.virginia.edu/internet/epinet//safetydevice.cfm>

The Premier Safety Institute has information on the evaluation of several safety devices products by organization members. www.premierinc.com

A Needlestick Prevention Device Selection Guide is sponsored by ECRI, an independent non-profit health services research agency. www.ecri.org

APPENDIX C - Safe Work Practices for Preventing Sharps Injuries

Work practices to prevent sharps injuries are typically presented as a list of specific practices to avoid (e.g., recapping used needles) or to use (e.g., disposing in appropriate sharps disposal containers). As data on the epidemiology of sharps injuries has shown, the risk of a sharps injury begins at the moment a sharp is first exposed and ends once the sharp is permanently removed from exposure in the work environment. Therefore, to promote safe work practices, healthcare personnel need to have an awareness of the risk of injury throughout the time a sharp is exposed and use a combination of strategies to protect themselves and their co-workers throughout the handling of the device. The following is a suggested list of practices that reflect this concept and can be adapted as necessary to any healthcare environment.

Work Practices to Prevent Sharps Injuries Throughout the Use and Handling of a Device

Before the beginning of a procedure that involves the use of a needle or other sharp device:

- Ensure that equipment necessary for performing a procedure is available within arms reach.
- Assess the work environment for adequate lighting and space to perform the procedure.
- If multiple sharps will be used during a procedure, organize the work area (e.g. procedure tray) so that the sharp is always pointed away from the operator.
- Identify the location of the sharps disposal container; if moveable, place it as close to the point-of-use as appropriate for immediate disposal of the sharp. If the sharp is reusable, determine in advance where it will be placed for safe handling after use.
- Assess the potential for the patient to be uncooperative, combative, or confused. Obtain assistance from other staff or a family member to assist in calming or restraining the patient as necessary.
- Inform the patient of what the procedure involves and explain the importance of avoiding any sudden movement that might dislodge the sharp, for successful completion of the procedure as well as prevention of injury to healthcare personnel.

During a Procedure That Involves the Use of Needles or Other Sharp Devices:

- Maintain visual contact with the procedure site and location of the sharp device.
- When handling an exposed sharp, be aware of other staff in the immediate environment and take steps to control the location of the sharp to avoid injury to oneself and other staff.
- Do not hand-pass exposed sharps from one person to another; use a predetermined neutral zone or tray for placing and retrieving used sharps. Verbally announce when sharps are being placed in a neutral zone.
- If the procedure necessitates reusing a needle multiple times on the same patient (e.g., giving local anesthesia), recap the needle between steps using a one-handed technique or a fixed device that enables one-handed recapping.
- If using an engineered sharps injury prevention device, activate the safety feature as the procedure is being completed, observing for audio or visual cues that the feature is locked in place.

During Clean-up Following a Procedure:

- Visually inspect procedure trays, or other surfaces (including patient beds) containing waste materials used during a procedure, for the presence of sharps that may have been left inadvertently after the procedure.
- Transport reusable sharps in a closed container that has been secured to prevent the spillage of contents.

During Disposal:

- Visually inspect the sharps container for hazards caused by overfilling.
- Make sure the sharps container being used is large enough to accommodate the entire device.
- Avoid bringing the hands close to the opening of a sharps container; never place hands or fingers into a container to facilitate disposal of a device.
- Keep the hands behind the sharp tip when disposing the device.
- If disposing of a sharp with attached tubing (e.g., winged steel needle), be aware that the tubing can recoil and lead to injury; maintain control of the tubing as well as the needle when disposing the device.

After Disposal:

- Visually inspect sharps containers for evidence of overfilling before removal. If a sharps container is overfilled, obtain a new container and use forceps or tongs to remove protruding devices and place them in the new container.
- Visually inspect the outside of waste containers for evidence of protruding sharps. If found, notify safety personnel for assistance in removing the hazard.
- Keep filled sharps containers awaiting final disposal in a secure area.

Improperly Disposed Sharps:

- If an improperly disposed sharp is encountered in the work environment, handle the device carefully, keeping the hands behind the sharp at all times.
- Use a mechanical device to pick up the sharp if it cannot be performed safely by hand.

APPENDIX D - Problem-Specific Strategies for Sharps Injury Prevention

The following is a table of problems that are often associated with sharps injuries. These particular problems are often complex, and factors related to their occurrence must be explored to identify appropriate interventions. Healthcare organizations may wish to use this table as a spring-board for discussion and as an example of how to approach the investigation of sharps injuries.

Problem-Specific Strategies for Sharps Injury Prevention		
Problem	Problem Assessment	Possible Prevention Strategies
Recapping injuries	<ul style="list-style-type: none"> • Are recapping injuries associated with certain devices or procedures? • Are there certain locations where recapping injuries appear to be occurring? If so, what is different about these locations? • Is there a need to recap certain needles? • Are point-of-use needle disposal containers available so HCWs do not need to recap? • Is it likely that a device with a safety feature would prevent or deter recapping? 	<ul style="list-style-type: none"> • Implement device(s) with sharps prevention features • Install sharps disposal containers in more convenient locations • Establish a policy/procedure for safe recapping when necessary for the procedure being performed • Reinforce recommendations concerning recapping during annual BBP education

Problem-Specific Strategies for Sharps Injury Prevention

Problem	Problem Assessment	Possible Prevention Strategies
Injuries during specimen transfer	<ul style="list-style-type: none"> • How are specimens being collected? • Is there an alternative means to perform specimen collection that would avoid the need for specimen transfer? • Is there a way to avoid the need for needles during specimen transfer? Would this create another hazard? 	<ul style="list-style-type: none"> • Revise procedures for specimen collection • Purchase new specimen collection devices with safety features • Educate staff on safe means for collecting specimens
Downstream injuries (i.e., injuries to housekeepers, laundry, and maintenance workers, and/or injuries associated with improper disposal of sharp devices)	<ul style="list-style-type: none"> • Where are these injuries occurring? • Is there any pattern by occupation, location, or device? • Are sharps disposal containers available in all locations? • Are they appropriate for all needs? • Are they being used? If not, why not? 	<ul style="list-style-type: none"> • Inform the organization as a whole (or area if problem is localized) of the problem and send written communication (e.g., memo, newsletter article) • Informal meeting with key staff • Encourage reporting of improperly disposed needles and other sharps, regardless of whether injuries occur

Problem	Problem Assessment	Possible Prevention Strategies
<p>Injuries during sharps disposal</p>	<ul style="list-style-type: none"> • Where are these injuries occurring? • Is there any pattern by occupation, location, or device? • Does there appear to be a problem with the sharps disposal container being used? If so, is it the type of container? Location (e.g. height, proximity) of the container? • If a single type of device is involved, what is it about the device and/or the disposal container that contributes to the problem? 	<ul style="list-style-type: none"> • Change the position of the sharps container • Change the type of sharps container • Reeducate staff about disposal hazards and provide instruction on safe practices

APPENDIX E — Measuring the Cost of Sharps Injury Prevention

Introduction

One of the processes associated with implementing a sharps injury prevention program is measuring the economic impact of prevention interventions, particularly as the latter contribute to a reduction in sharps injuries. This section discusses various costs that may be attributed to injuries and interventions and provides guidance on how to perform simple calculations that healthcare organizations can use to measure economic impact. These include methods to:

- Assess the economic impact of injuries on the healthcare organization; and
- Estimate the cost of implementing various devices with engineered sharps injury prevention features, including any reductions in cost that may be realized as a result of preventing injuries.

Method for Calculating the Cost of Needlesticks/Sharps Injuries

The calculation of needlestick/sharps injury costs described here is viewed from the perspective of **direct and indirect costs** incurred by the healthcare organization to manage an exposed healthcare worker. For this reason, several types of costs are ignored. One type is fixed costs that may be associated with a needlestick prevention program, such as surveillance, administration, and building space, as these are not directly related to an individual needlestick event. Also ignored are costs that may be associated with seroconversion. Fortunately, seroconversion after an occupational exposure is a relatively rare event. When it does occur, the healthcare associated costs of treating the healthcare worker are often borne by a third party payer, e.g., workers' compensation or a health insurance plan, and not the healthcare organization, although there are exceptions. Costs associated with any legal liability or change in compensation premiums also are not included. There are certain indirect **intangible costs** that also are not part of this calculation, such as any pain and suffering or societal impact resulting from an exposure or seroconversion. While all of these costs are important aspects of sharps injuries, they are difficult to quantify economically. However, it is important to acknowledge their importance whenever there is any discussion or presentation of information on the cost of sharps injuries in a healthcare organization.

Toolkit Resource for This Activity:

Sample Worksheet for Estimating the Annual and Average Cost of Needlesticks and Other Sharps-Related Injuries (see Appendix E-1)

Direct costs

There are two direct costs that are generally borne by a healthcare organization when a sharp injury occurs. These are:

- Cost of baseline and follow-up laboratory testing of an exposed healthcare worker and testing the source patient, and
- Cost of postexposure prophylaxis (PEP) and other treatment that might be provided.

However, if there are complications, such as side effects from PEP, these can add additional costs to managing needlestick injuries. Depending on how workers' compensation is arranged, some of these costs may be diverted to a third party payer. For this reason, it is important to determine what costs are borne by the organization when calculating the cost of a needlestick injury. Individuals in risk management may be able to assist in determining this information.

In certain circumstances, other direct costs may need to be considered. For example, if occupational exposures are managed through a contract with another provider, there may be a fee for each event or visit. Ultimately, any unique costs will need to be determined as part of the process of identifying costs associated with needlestick injuries.

Laboratory Testing Costs

Laboratory costs should reflect the unit cost to the hospital of each test. If testing is performed outside the facility, the amount that the facility is charged to have the work performed should be used. Laboratory costs include those associated with routine baseline and follow-up antibody testing of exposed employees for HIV, HCV, and HBV. Antibody testing of employees exposed to HIV is recommended a minimum of three times during the follow-up period, but some organizations follow employees for a year; HCV antibody testing of exposed employees is usually performed once, at four-six months after the exposure.

In addition to employees, source patients are usually tested for HIV, HCV, and HBV if their serostatus is not known at the time of the exposure. If a facility pays directly for testing a source patient, the cost should be included in the calculation of needlestick costs. However, if such testing is charged to the patient or a third party, this cost is excluded from the cost estimate.

Other laboratory costs are associated with preventing and managing the side effects of postexposure prophylaxis (PEP). These include baseline and follow-up testing to monitor toxicity (e.g., blood count, renal profile, and hepatic profile) and may include pregnancy testing as well.

Cost of Postexposure Prophylaxis (PEP)

Most of the cost of postexposure drugs will be for HIV PEP. However, there may be times when hepatitis B immune globulin is provided. The cost to the institution's pharmacy to purchase each drug (not what it would charge a patient) should be the basis for determining cost. For each drug prescribed for PEP, a daily cost (based on the recommended daily dose) should be calculated. If the institution does not have PEP drugs on-site, then charges to the facility from outside pharmacies should be used.

Costs Associated with Preventing PEP Side Effects

The cost of preventing adverse treatment effects generally includes the cost to the facility pharmacy of any antimotility and antiemetic agents prescribed. If prescriptions are filled through an off-site pharmacy, then charges to the facility should be used.

Indirect costs that may be considered

Whenever a sharps injury occurs, time and wages normally associated with assigned responsibilities are diverted to receiving or providing exposure-related care. These are indirect costs and include:

- Lost productivity associated with the time required for reporting and receiving initial and follow-up treatment for the exposure;
- Healthcare provider time to evaluate and treat an employee; and
- Healthcare provider time to evaluate and test the source patient, including obtaining informed consent for testing if applicable.

More than one provider is often involved in managing a single exposure. For example, supervisors may initially assess the exposure and assist in completing the necessary report form; infection control personnel may assess transmission risks and perform other initial and follow-up services; the patient's physician may be called to obtain consent for source testing; and occupational health personnel have administrative and clinical duties associated with the exposure. For some individuals (e.g., occupational health and infection control), this is part of their job responsibilities and for this reason is not considered a diversion of personnel resources.

It is not necessary to include diverted time and wages in the calculation of needlestick injury costs. However, it can be an insightful exercise and draws attention to such events in terms of resource utilization. Information is included in the tools provided for performing this calculation.

Approaches to calculating or estimating the average and annual cost of needlestick injuries

Although several discrete costs associated with needlestick injuries have been identified, not all of these costs are incurred with every exposure. For example, if a source patient's serostatus is known, or the patient is unavailable, testing of that individual may not be performed. Likewise, follow-up testing of an employee is generally not performed if the source has no bloodborne virus infection. Furthermore, the need for PEP is based on the nature and severity of the exposure, and not all healthcare personnel receive PEP or may only take an initial dose until source testing results are available. Many scenarios can be described.

For many facilities, it may not be possible to determine a cost for each exposure. For this reason, other options for estimating these costs can be used.

- Calculate the cost of a sample of exposures based on the type of injury (e.g., low, medium, or high risk). That information can be used to identify the range of costs for a single sharp injury and then project the annual cost to the facility based on the number of injuries that occur.
- Use information on testing and postexposure costs from examples provided in this *Workbook* or other published reports to arrive at a high and low cost of injuries. This information can be used as described above to project the annual cost to the facility for these events.

This can be powerful information for communicating the importance of preventing these injuries to management.

Estimate the cost of injuries associated with specific devices

As leadership teams evaluate which devices with engineered sharps injury prevention features will be considered as priorities for implementation, one factor that can guide decisions is the cost of injuries with certain types of devices. This is a fairly simple calculation that involves listing the number of reported injuries caused by each device in the previous year and multiplying that by the average cost of a needlestick/sharps injury as derived from the previous calculation.

Toolkit Resource for This Activity:

Sample Worksheet for Estimating Device-Specific Percutaneous Injury Costs (see Appendix E-2)

Compare the cost of conventional devices to devices with safety features

This type of economic analysis can help determine how the cost of implementing a device with safety feature might be offset by reductions in injury costs. This type of analysis should be viewed as one of several tools that can be used to inform decisions, but should not be the determining factor in deciding whether to implement devices with safety features or which device(s) to implement.

The following are the two categories of costs that are considered in the calculation of a cost-effectiveness ratio:

- Projected costs of implementing the prevention intervention, i.e. device with safety feature, and
- Cost savings resulting from a reduction in needlestick/sharps injuries.

Step 1. Estimate the projected costs associated with purchasing and implementing a device with safety features.

Two values must be determined to make this calculation. The first is the direct purchase cost of both the conventional and replacement device; the other is the indirect cost of implementation (e.g., training, stock rotation). It is not necessary to estimate the indirect costs of implementation. However, when discussing or presenting information on device implementation, these costs should be acknowledged.

A. Determine the direct cost of purchasing a new device

This calculation is made by determining the difference in unit cost of a conventional device and a comparable device with safety feature (this could result in a cost increase or decrease) and multiplying that figure by the projected yearly purchase volume to arrive at the annual direct cost of implementation (assuming each device cost and number of devices used remains stable).

Toolkit Resource for This Activity:

[Sample Worksheet for Estimating a Net Implementation Cost for an Engineered Sharps Injury Prevention Device \(see Appendix E-3\)](#)

B. Consider the indirect costs associated with implementation

This calculation is more complex because it involves identifying the time costs of individuals who are involved in the activities required to implement a new device. Some organizations may decide not to perform this calculation because of its complexity. However, identifying these costs

can provide considerable insight into the impact of making product changes. Time and wage costs that should be considered include time for:

- Inventory changeover and replacement of conventional devices with the new devices;
- Training healthcare providers in the use of the new device; and
- Pre-selection device evaluation.

Organizations may identify other indirect costs associated with making product changes and should include these in this calculation. A total implementation cost is derived by adding the direct and indirect costs (if calculated).

Step 2. Calculate the projected cost savings resulting from a reduction in injuries.

The formula for calculating the projected cost savings resulting from a reduction in injuries after implementation of a device with safety feature is:

Projected Cost Savings =

$$\begin{matrix} \text{(injuries with} & \times & \text{(projected percent} & \times & \text{(the average cost of a needlestick} \\ \text{conventional} & & \text{reduction in injuries} & & \text{injury to the healthcare facility (as} \\ \text{device)} & & \text{with safety feature)} & & \text{calculated on Toolkit resource 15))} \end{matrix}$$

It is necessary, therefore, to estimate a proportionate reduction in injuries associated with implementation of a particular device. This can be done in two ways. One is to use published efficacy data on the same or similar device from studies in the literature. The other is to examine institutional data and, based on the injury circumstances, determine what proportion of injuries might be prevented with a new device.

Step 3. Calculate the net implementation cost.

The net implementation cost is the implementation cost minus the cost savings realized through fewer injuries with a device. (If the unit cost of the replacement device is actually less than the unit cost of the conventional device, then the only implementation costs are indirect.)

E-1 Sample Worksheet for Estimating the Annual and Average Cost of Needlesticks and Other Sharps-Related Injuries

This sample worksheet is designed to assist healthcare organizations in estimating the annual and average cost to their organization of needlesticks and other sharps injuries. The tool follows a stepwise method for identifying each cost associated with the management of an exposed individual. The calculation ignores certain fixed costs that may be associated with a needlestick prevention program, such as surveillance, administration, and building space; and it does not consider the cost of seroconversion.

SAMPLE Worksheet for Estimating the Annual and Average Cost of Needlesticks and Other Sharps Related Injuries

Step 1. Time Costs for Initial Reporting, Assessing, and Treating Exposed Healthcare Personnel	Annual Cost			
A. Cost of exposed employee lost time				
a. Average work time lost for initial assessment _____ (Hours/Minutes)				
b. Average hourly salary of professional nurse* \$ _____				
c. Number of injuries reported in previous year _____ (a x b x c = Annual cost employee lost time) ⇨ \$ _____				
*Since this group of healthcare professionals is the most frequent recipient of needlestick injuries, using an average hourly salary provides a reasonable surrogate for estimating work time lost. However, healthcare organizations can estimate this more precisely by using salary figures from specific occupational groups that sustain occupational exposures.				
B. Cost of healthcare provider time to evaluate and treat exposed employee				
a. Average professional time required for initial exposure assessment _____ (Hours/Minutes)	Annual Cost			
b. Average hourly salary of practitioner who manages exposures \$ _____				
c. Number of injuries reported in previous year _____ (a x b x c = Annual cost provider time) ⇨ \$ _____				
C. Cost of other providers' time involved in initial assessment				
Supervisor _____	a. Average Time Spent (Hours/Min) _____	b. Average Hourly Salary \$ _____	c. # Reported Injuries _____	Annual Cost (a x b x c) \$ _____
Infection control _____	_____	\$ _____	_____	\$ _____
Occupational health* _____	_____	\$ _____	_____	\$ _____
Other _____	_____	\$ _____	_____	\$ _____
(Add annual cost together to get total other provider annual cost) ⇨ \$ _____				
*Administrative time (e.g., recording, notification)				
D. Cost of healthcare provider time to evaluate source patient				
a. Average professional time required for initial source assessment and counseling and testing _____ (Hours/Minutes)				
(Consider people who counsel the patient, assess the medical record, and draw blood)				
b. Average hourly salary of practitioner who evaluates source \$ _____				
c. Number of source patients assessed in previous year _____ (a x b x c = Annual cost provider time) ⇨ \$ _____				

Step 2. Determine the cost of baseline and follow-up laboratory testing.

A-1. Cost of baseline employee testing

Type of Test	Cost/Test	# Employees Tested*	Annual Cost/Test	Annual Cost
HIV antibody	\$ _____	X _____ =	\$ _____	
Hepatitis C antibody	\$ _____	X _____ =	\$ _____	
Hepatitis B antibody	\$ _____	X _____ =	\$ _____	
(Add together annual cost of each test to arrive at total annual cost of baseline testing)				\$ _____

*Can be obtained directly or by estimating the proportion of exposed employees tested

A-2. Cost of follow-up employee testing.

Type of Test	Cost/Test	# Employees Tested*	Annual Cost/Test	Annual Cost
HIV antibody	\$ _____	X _____ =	\$ _____	
Hepatitis C antibody	\$ _____	X _____ =	\$ _____	
HCV PCR	\$ _____	X _____ =	\$ _____	
ALT	\$ _____	X _____ =	\$ _____	
Other	\$ _____	X _____ =	\$ _____	
(Add together annual cost of each test to get total annual cost of follow-up testing)				\$ _____

*Add actual or estimated number of tests performed at 6 weeks, 12 weeks, 6 months (also 1 year if follow-up is extended)

B. Source patient testing (If the healthcare facility does not pay directly for testing the source patient, do not include in cost estimates)

Type of Test	Cost/Test	# Patients Tested*	Annual Cost/Test	Annual Cost
HIV antibody	\$ _____	X _____ =	\$ _____	
Hepatitis C antibody	\$ _____	X _____ =	\$ _____	
Hepatitis B profile	\$ _____	X _____ =	\$ _____	
(Add together annual cost of each test to get total annual cost of source testing)				\$ _____

*Can be obtained directly or by estimating the proportion of exposed employees tested

Step 3. Determine the cost of postexposure prophylaxis (PEP) and preventing and monitoring for drug side effects.

A. Cost of PEP

Drugs used for HIV PEP

<u>Drugs used for HIV PEP</u>	<u>Cost/Day</u>	<u># Doses Dispensed in Previous Year*</u>	<u>Annual Cost</u>
Zidovudine (AZT) (600 mg q.d.)	\$ _____	X _____	\$ _____
Lamivudine (3TC) (300 mg q.d.)	\$ _____	X _____	\$ _____
Combivir (AZT/3TC) (2 tab/day)	\$ _____	X _____	\$ _____
Indinavir (Crixivan) (2400 mg/day)	\$ _____	X _____	\$ _____
Nelfinavir (Viracept) (2250 mg/day)	\$ _____	X _____	\$ _____
Didanosine (Videx) (400 mg/day)	\$ _____	X _____	\$ _____
Stavudine (Zerit) (80 mg/day)	\$ _____	X _____	\$ _____
Other PEP drug	\$ _____	X _____	\$ _____

Annual Cost

B. Cost of other postexposure agents used to prevent virus transmission

Hepatitis B Immune Globulin	\$ _____	X _____	\$ _____
Other: _____	\$ _____	X _____	\$ _____

Annual Cost

(Add together annual cost of each drug to get total annual cost of PEP) ⇨ \$ _____

*Count only doses prescribed for PEP

C. Cost of preventing and monitoring PEP side effects

<u>Cost/Prescription in Previous</u>	<u># Prescriptions Issued</u>	<u>Annual Cost</u>
Antimotility prescription	X _____	\$ _____
Antiemetic prescription	X _____	\$ _____

<u>Type of Test</u>	<u>Cost/Test</u>	<u># Employees Tested*</u>	<u>Annual Cost</u>
Complete blood count	\$ _____	X _____	\$ _____
Renal profile	\$ _____	X _____	\$ _____
Hepatic profile	\$ _____	X _____	\$ _____

Annual Cost

(Add together each annual cost to obtain total annual cost of preventing and monitoring PEP side effects) ⇨ \$ _____

*Also can use actual number of tests performed if that information is available

D. Cost of employee lost time because of drug side effects

a. Average number of work days lost because of drug side effects _____

b. Average hourly salary of professional nurse* \$ _____

c. Number of workers who lost time because of drug side effects** (a x b x c = Annual cost employee lost time) ⇨ \$ _____

* Since this group of healthcare professionals is the most frequent recipient of needlestick injuries, using an average hourly salary provides a reasonable surrogate for estimating work time lost. However, healthcare organizations can estimate this more precisely by using salary figures from specific occupational groups that sustain occupational exposures.

** An alternative method for performing this calculation is to obtain the total number of days lost due to drug side effects and multiply that by the average hourly salary.

Step 4. Calculate total estimated annual and average injury costs.

Total annual cost of percutaneous injuries \$ _____ (Sum of all right hand column values)

Average cost of percutaneous injuries \$ _____ (Total annual cost ÷ annual # injuries)

E-2 Sample Worksheet for Estimating Device-Specific Percutaneous Injury Costs

The following sample worksheet is designed to assist in assessing the economic impact of injuries associated with specific types of needles and other sharp devices. Completion of this worksheet requires knowledge of the average cost of a needlestick injury in a facility (See Appendix E-1 *Worksheet for Estimating the Annual and Average Cost of Needlesticks and Sharps-Related Injuries*). When the worksheet is completed, the facility will have a picture of the cost impact of specific types of devices that can be used for considering priorities for intervention.

SAMPLE Worksheet for Estimating Device-Specific Percutaneous Injury Costs

Device Type	# Injuries in Previous Year	Cost of Injuries Associated with Device*
Hypodermic needle/syringe	_____	\$ _____
Phlebotomy needle	_____	\$ _____
Winged steel needle	_____	\$ _____
Intravenous catheter stylet	_____	\$ _____
Cartridge-type syringe/needle	_____	\$ _____
Suture needle	_____	\$ _____
Scalpel	_____	\$ _____
Lancets	_____	\$ _____
Other device: _____	_____	\$ _____
Other device: _____	_____	\$ _____
Other device: _____	_____	\$ _____
Other device: _____	_____	\$ _____

* Average cost of percutaneous injuries (Appendix E-1) multiplied by the number of injuries with the device.

E-3 Sample Worksheet for Estimating a Net Implementation Cost for an Engineered Sharps Injury Prevention (ESIP) Device

This sample form was developed to assist healthcare organizations in determining how much the projected costs for purchasing and implementing a specific device will be offset by injury reductions. Completion of this worksheet requires knowledge of the average cost of a needlestick injury in a facility (See Appendix E-1 *Worksheet for Estimating the Annual and Average Cost of Needlesticks and Other Sharps-Related Injuries*).

SAMPLE Form for Calculating an Estimated Implementation Cost of an Engineered Sharps Injury Prevention (ESIP) Device

Device Type: _____

Step 1. Calculate the projected cost savings resulting from a reduction in injuries.		
Line 1. Number of injuries in the previous year associated with the conventional device	\$	_____
Line 2. Projected annual number of injuries that will be avoided with the ESIP device	\$	_____
a. Estimated percent (%) reduction in injuries with the ESIP		_____
b. Multiply by the number in line 1 above to arrive at the projected number of avoided injuries		_____
Line 3. Average cost of a needlestick injury	\$	_____
Line 4. Projected cost savings in injuries avoided using the ESIP (line 2b x line 3)		⇨ \$ _____
Step 2. Estimate the projected costs associated with implementing the ESIP.		
Line 5. Unit cost of the conventional device	\$	_____
Line 6. Unit cost of the ESIP to which it is being compared	\$	_____
Line 7. Cost difference (line 6 – line 5)	\$	_____
Line 8. Projected annual purchase volume of the ESIP device		_____
Line 9. Projected annual increase or decrease in cost associated with purchasing the ESIP (line 7 x line 8)	\$	_____
Line 10. Indirect costs of implementation (if calculated)*	\$	_____
Line 11. Total implementation cost (line 9 + line 10 [if calculated])		⇨ \$ _____
Step 3. Calculate the net implementation cost of the ESIP.		
Line 12. Net implementation costs (line 11 – line 4)		⇨ \$ _____

* Inventory changeover, healthcare personnel training, and device evaluation

APPENDIX F – GLOSSARY

Administrative Controls: A method of controlling employee exposures through enforcement of policies and procedures, modification of work assignment, training in specific work practices, and other administrative measures designed to reduce the exposure. (OSHA)

Bloodborne pathogens: Pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV). (OSHA)

Continuous quality improvement: A systematic, organization-wide approach for continually improving all processes involved in the delivery of quality products and services.

Control Chart: A statistical tool used to track an important condition over time and to watch for changes in both the average value and the variation.

Culture of Safety/Safety Culture: The shared commitment of management and employees to ensure the safety of the work environment.

Engineering Controls: In the context of sharps injury prevention, means controls (e.g., sharps disposal containers; safer medical devices, such as sharps with engineered sharps injury protections and needleless systems) that isolate or remove the bloodborne pathogens hazard from the workplace. (OSHA)

EPINet: The Exposure Prevention Information Network developed by Dr. Janine Jagger at the University of Virginia in 1991 to provide standardized methods for recording and tracking percutaneous injuries and blood and body fluid contacts.

Engineered Sharps Injury Prevention Device: (See Safety Device)

Exposure:

1. Exposure Incident/Event means a specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee's duties. (OSHA)
2. Occupational Exposure means reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties. (OSHA)

Failure Mode Analysis: A technique to find the weaknesses in designs before the design is realized, either in prototype or production.

Forcing Function: A safety design feature that prevents improper use of the device (e.g., valves on intravenous administration sets that disallow needle access).

Hierarchy of controls: Concept used by the industrial hygiene profession to prioritize prevention interventions. Hierarchically these include administrative controls, engineering controls, personal protective equipment and work practice controls

Hollow-bore needle: Needle (e.g., hypodermic needle, phlebotomy needle) with a lumen through which material (e.g., medication, blood) can flow.

NaSH: The National Surveillance System for Health Care Workers systematically collects information important to prevent occupational exposures to healthcare personnel through collaboration between CDC and participating hospitals. Surveillance of blood and body fluid exposures is one of several modules that is part of NaSH.

NHSN: The National Healthcare Safety Network (NHSN) is a secure, internet-based surveillance system that integrates patient and healthcare personnel safety surveillance systems managed by the Division of Healthcare Quality Promotion (DHQP) at CDC.

Near miss/close call: An event or situation that could have resulted in an accident, injury or illness, but did not, either by chance or through timely intervention.

Needlestick: Penetrating stab wounds caused by needles.

Percutaneous: Effected or performed through the skin.

Personal Protective Equipment (PPE): Specialized equipment worn by an employee to protect against a hazard.

Phlebotomy: The letting of blood for transfusion, pheresis, diagnostic testing, or experimental procedures.

Recapping: The act of replacing a protective sheath on a needle. The OSHA Bloodborne Pathogens Standard prohibits recapping needles unless the employer can demonstrate that no alternative is feasible, or that such action is required by a specific medical or dental procedure. (OSHA)

Root cause analysis: A process for identifying the basic or contributing causal factors that underlie variations in performance associated with adverse events or close calls.

Safety Device/Sharps with Engineered Sharps Injury Protections (ESIPS): a nonneedle sharp or a needle device used for withdrawing body fluids, accessing a vein or artery, or administering medications or other fluids, with a built-in safety feature or mechanism that effectively reduces the risk of an exposure incident. (OSHA)

Seroconversion: The development of antibodies in the blood of an individual who previously did not have detectable antibodies, following exposure to an infectious agent.

Sharps: Any object that can penetrate the skin including, but not limited to, needles, scalpels, broken glass, broken capillary tubes, and exposed ends of dental wires.

Sharps Injury: An exposure event occurring when any sharps penetrates the skin.

Solid Sharp: A sharp that does not have a lumen through which material can flow, e.g., suture needle, scalpel.

Standard Precautions: An approach to infection control recommended by the Centers for Disease Control and Prevention since 1996. Standard precautions synthesizes the major features of universal precautions and applies to blood and all moist body substances, not just those associated with bloodborne virus transmission. Standard precautions is designed to prevent transmission of infectious agents in the healthcare setting to patients and healthcare personnel.

Toyota Production System: A technology of comprehensive production management invented by the Japanese. The basic idea of this system is to maintain a continuous flow of products in factories in order to flexibly adapt to demand changes.

Universal Precautions: An approach to infection control that treats all human blood and other potentially infectious materials as if they were infectious for HIV and HBV or other bloodborne pathogens.

Work practice controls: Actions that reduce the likelihood of exposure by altering the manner in which a task is performed (e.g., visual inspection of a sharps container for hazards before attempting disposal).

APPENDIX G - Other websites

The following are websites that may provide additional guidance for a sharps injury prevention program. This is not an exhaustive list and new sites will be added as they become known.

Government websites

Centers for Disease Control and Prevention

<http://www.cdc.gov/sharpssafety>
<http://www.cdc.gov/niosh/topics/bbp/>
<http://www.cdc.gov/niosh/topics/bbp/safer/>
http://www.cdc.gov/OralHealth/infection_control/forms.htm

Occupational Safety and Health Administration

<http://www.osha.gov/SLTC/bloodbornepathogens/index.html>

Food and Drug Administration

<http://www.fda.gov/cdrh/devadvice/index.html>.

GAO report on costs of safer needle devices

<http://www.gao.gov/new.items/d0160r.pdf>.

Other

Premier Safety Institute

<http://www.premierinc.com/all/safety/resources/needlestick/>

International Healthcare Worker Safety Center

<http://www.healthsystem.virginia.edu/internet/epinet/>

Training for the Development of Innovative Control Technologies

<http://www.tdict.org/>

International Sharps Injury Prevention Society

<http://www.isips.org/>

National Alliance for the Primary Prevention of Sharps Injuries

<http://www.nappsi.org/safety.shtml>

American Nurses Association

<http://www.needlestick.org/>

Service Employees International Union

www.seiu.org

ECRI

<http://www.ecri.org/>

California list of safer devices

<http://www.dhs.ca.gov/ohb/SHARPS/disclaim.htm>.

Root Cause Analysis

<http://www.va.gov/ncps/tools.html>

<http://www.rootcauseanalyst.com/>

<http://www.sentinel-event.com/>

<http://www.asq.org/pub/qualityprogress/past/0704/qp0704rooney.pdf>

<http://jcaho.com/accredited+organizations/ambulatory+care/sentinel+events/forms+and+tools/framework+.htm>

Healthcare Failure Mode and Effect Analysis

<http://www.va.gov/ncps/HFMEA.html>

Creating a Culture of Safety

<http://www.va.gov/ncps/vision.html>

<http://www.patientsafety.gov/>

<http://www.ahrq.gov/clinic/ptsafety/chap40.htm>

<http://www.med.umich.edu/patientsafetytoolkit/culture.htm>

<http://www.ihl.org/IHI/Topics/PatientSafety/>

http://depts.washington.edu/ehce/NWcenter/course_presentations/robyn_gershon.ppt

