Needlestick Injuries

What are needlestick injuries?

Needlestick injuries are wounds caused by needles that accidentally puncture the skin. Needlestick injuries are a hazard for people who work with hypodermic syringes and other needle equipment. These injuries can occur at any time when people use, disassemble, or dispose of needles. When not disposed of properly, needles can become concealed in linen or garbage and injure other workers who encounter them unexpectedly.

Needlestick injuries transmit infectious diseases, especially blood-borne viruses. In recent years, concern about AIDS (Acquired Immune Deficiency Syndrome), hepatitis B, and hepatitis C has prompted research to find out why these injuries occur and to develop measures to prevent them. Despite published guidelines and training programs, needlestick injuries remain an ongoing problem.

What are the hazards of needlestick injuries?

Accidental punctures by contaminated needles can inject hazardous fluids into the body through the skin. There is potential for injection of hazardous drugs, but injection of infectious fluids, especially blood, is by far the greatest concern. Even small amounts of infectious fluid can spread certain diseases effectively.

Accidental injection of blood-borne viruses is the major hazard of needlestick injuries, especially the viruses that cause AIDS (the HIV virus), hepatitis B, and hepatitis C.

The risk of infection after exposure to infected blood varies by bloodborne pathogen. The risk of transmission after exposure to HIV-infected blood is about 0.3%, whereas it is estimated to be up to 100 times greater for hepatitis B virus (30%) and could be as high as 10% for hepatitis C virus.

HIV/AIDS

The risk of needlestick transmission of HIV, the virus that causes AIDS, is considerably less than for hepatitis B virus. Several hundred health care workers have been accidentally exposed, mostly through needlestick injuries, to blood from patients infected with the HIV virus. As of June 1999, researchers report that needlestick injuries transmitted HIV to 49 of these health care workers in the United States. Researchers estimate that needlestick injuries involving blood-contaminated with HIV can spread the virus in 0.3 percent of cases. Stated another way, 99.7 percent of needlestick/cut exposures do not lead to infection.

In Canada, the Division of HIV Epidemiology Research, Bureau of HIV/AIDS and STD, Public Health Agency of Canada, Health Canada, has reported one case of occupational transmission of HIV that can be clearly linked to a needlestick injury. There have been two other cases of HIV infection in Canada that have been attributed to possible occupational transmission, both involving laboratory workers.

A possible occupational transmission occurred to a 75 year old Ontario biochemist who had worked in many laboratories with blood and blood products. There were no other risk factors reported.

Another possible occupational transmission occurred to a Quebec laboratory technician in the early 1990s. This case is still under investigation.

Hepatitis B

The risk of transmission of HBV is reduced by immunization against hepatitis B, which is 90% to 95% effective. The risk of transmission of HBV to susceptible HCWs via a needlestick injury varies from 1% to 40%.

Because HBV may survive on environmental surfaces for more than a week, indirect exposure to HBV can occur via contaminated inanimate objects and appears to have been a factor in HBV outbreaks among patients and staff of hemodialysis units.

Hepatitis C

Needlestick injuries may also transmit hepatitis C. The risk factors for hepatitis C virus transmission in occupational settings is 1.8% (range 0% to 7%).

Needlestick injuries have transmitted many other diseases involving viruses, bacteria, fungi, and other microorganisms to health care workers, laboratory researchers, and veterinary staff. The diseases include:

- Blastomycosis
- Brucellosis
- Cryptococcosis
- Diphtheria
- Cutaneous gonorrhea
- Herpes
- Malaria
- Mycobacteriosis
- Mycoplasma caviae
- Rocky Mountain spotted fever
- Sporotrichosis
- Staphylococcus aureus
- Streptococcus pyogenes
- Syphilis
- Toxoplasmosis
- Tuberculosis
Many of these diseases were transmitted in rare, isolated events. They still demonstrate, however, that needlestick injuries can have serious consequences.

How common are needlestick injuries?

Needlestick injuries are far too common hazard. Some hospitals report one third of nursing and laboratory staff suffer such injuries each year.

Available statistics probably underestimate the severity of the problem because many workers do not report their injuries. This makes it difficult to know exactly how serious the problem is or how well prevention programs work.

The following tables, published by the Canadian National Surveillance of Occupational Exposure to the Human Immunodeficiency Virus, Health Canada, provide information on reported needlestick injuries.

Table 1 provides data on the type of exposure by profession. There was a total of 690 reported exposures as of December 2000. Nurses sustained the largest number of exposures (485 or 70% of the total) and needlestick injuries were the most common exposure type (320 or 75% of total).

### Table 1

<table>
<thead>
<tr>
<th>National Surveillance of Occupational Exposure to HIV: Exposure Types by Occupational Group (as of 31 December, 2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Needlestick</td>
</tr>
<tr>
<td>Surgical instrument wound</td>
</tr>
<tr>
<td>Mucous membrane</td>
</tr>
</tbody>
</table>

Skin contact:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)Intact</td>
<td>6</td>
<td>40%</td>
<td>1%</td>
<td>1</td>
<td>7%</td>
<td>3%</td>
<td>0</td>
<td>0%</td>
<td>0%</td>
<td>2</td>
<td>14%</td>
<td>3%</td>
<td>2</td>
<td>14%</td>
<td>5%</td>
<td>4</td>
<td>29%</td>
</tr>
<tr>
<td>b)Non-intact*</td>
<td>60</td>
<td>67%</td>
<td>12%</td>
<td>5</td>
<td>6%</td>
<td>15%</td>
<td>1</td>
<td>1%</td>
<td>4%</td>
<td>12</td>
<td>13%</td>
<td>21%</td>
<td>5</td>
<td>6%</td>
<td>12%</td>
<td>7</td>
<td>8%</td>
</tr>
<tr>
<td>c)Unknown</td>
<td>34</td>
<td>79%</td>
<td>7%</td>
<td>3</td>
<td>7%</td>
<td>9%</td>
<td>0</td>
<td>0%</td>
<td>0%</td>
<td>2</td>
<td>5%</td>
<td>3%</td>
<td>0</td>
<td>0%</td>
<td>0%</td>
<td>4</td>
<td>9%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>485</td>
<td>34</td>
<td>27</td>
<td>58</td>
<td>42</td>
<td>44</td>
<td>690</td>
<td>100%**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of total injuries</td>
<td>70%</td>
<td>5%</td>
<td>4%</td>
<td>8%</td>
<td>6%</td>
<td>6%</td>
<td>100%**</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

* Previous tables had a separate heading called 'Open Wound Contamination' which has now been combined with 'Nonintact Skin Contact' exposures.
** Percentages in the table have been rounded.

A = number of injuries
B = % of this type of injury for this worker category compared with all workers' injuries of this type
C = % of this type of injury compared with all injuries for this category of worker

Healthcare workers (HCWs) in Canada exposed to human immunodeficiency virus (HIV) have been the subject of surveillance since September 1985. In January 2000, an integrated project combined the existing HIV occupational sharp exposure database with a hepatitis B virus (HBV) and hepatitis C virus (HCV) database held by the Bloodborne Pathogens/Nosocomial and Occupational Infections Division (BBP/NOID). The goal of the new Canadian Needle Stick Surveillance Network (CNSSN) is to monitor HCW's occupational exposures to blood or body fluids and follow subsequent seroconversions to bloodborne viruses (HBV, HCV, HIV).

This report presents the first year of surveillance data (1 April, 2000 to 31 March, 2001) from the CNSSN.

Table 2 summarizes the frequency and rates of exposure by job title, with exposure events listed in descending order of frequency. Nurses accounted for 52% of all exposures. However, the nurse's exposure rate per 100 FTEs was only 4.88, a rate much lower than that observed among phlebotomists (42.78), medical residents (20.97), nuclear medical technicians (13.59), sterilization attendants (12.14), or medical specialists (10.06).

### Table 2

<table>
<thead>
<tr>
<th>Annual exposure rates* based on the number of full-time equivalents (FTEs), by job title - Canadian Needle Stick Surveillance Network, 1 April, 2000 to 31 March, 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job title</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Registered nurse**</td>
</tr>
<tr>
<td>MD (resident)</td>
</tr>
<tr>
<td>MD (specialist)</td>
</tr>
<tr>
<td>Phlebotomist</td>
</tr>
</tbody>
</table>
A summary of exposures due to 1,214 percutaneous injuries is presented in Table 3. Sixty-two percent of injuries were caused by five categories of devices that included: (removed all hollow-bore) needles used for drawing arterial/venous blood (14%) or inserting intravenous/arterial lines (7%), needles for percutaneous injection (23%), suture needles (12%), or scalpel blades (7%). Three-quarters of the injuries involved broken skin with moderate bleeding, and 5% involved deep cuts with or without bleeding. About 43% of the 1,196 reported injuries occurred during use of the device, 33% after its use (but, before its disposal) and 12% were related to disposal (information was missing and unknown for 12% of the exposures).

Table 3
Summary of exposures due to percutaneous injuries - Canadian Needle Stick Surveillance Network, 1 April, 2000 to 31 March, 2001

<table>
<thead>
<tr>
<th>Percutaneous injury device and purpose for the use of device</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needles for blood drawing</td>
<td>174</td>
<td>14</td>
</tr>
<tr>
<td>Needles for inserting intravenous/arterial line</td>
<td>87</td>
<td>7</td>
</tr>
<tr>
<td>Needles for injecting percutaneously</td>
<td>276</td>
<td>23</td>
</tr>
<tr>
<td>Needles used for manipulating an intravenous line</td>
<td>32</td>
<td>3</td>
</tr>
<tr>
<td>Lancets or other device for taking sample from finger, heel or ear</td>
<td>35</td>
<td>2</td>
</tr>
<tr>
<td>Needles for obtaining tissue or organic fluid except blood</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Suture needles for suturing</td>
<td>140</td>
<td>11</td>
</tr>
<tr>
<td>Scalpel blades for surgery</td>
<td>80</td>
<td>7</td>
</tr>
<tr>
<td>Other surgical instruments (razor, scissors, retractors, metal wire, etc.)</td>
<td>68</td>
<td>6</td>
</tr>
<tr>
<td>Glass (vial, tube, pipette, glass object)</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>Others (other devices, other/unknown purposes)</td>
<td>264</td>
<td>22</td>
</tr>
<tr>
<td>Unknown devices</td>
<td>19</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>1,214</td>
<td>100</td>
</tr>
</tbody>
</table>

Depth of injury

| Superficial (scratch without bleeding)                      | 184    | 15 |
| Moderate (broken skin with bleeding)                       | 901    | 74 |
How do needlestick injuries occur?

A needlestick injury is the result of an accident with a needle. Several studies show that needles cause injuries at every stage of their use, disassembly, or disposal. But there is disagreement as to why the accidents are so common among health care workers or why simple solutions fail to solve the problem.

Nursing and laboratory staff usually experience 30 to 50 percent of all injuries during clinical procedures. Equipment design, nature of the procedure, condition of work, staff experience, recapping, and disposal have all been mentioned as factors that influence this occurrence.

**Equipment Design**

Safer innovative devices using protected needle devices or needle-free systems with self-sealing ports would alleviate many of these injuries. There is accumulating evidence suggesting that syringes with safety features reduce needlestick injuries.

**Nature of Procedure**

Critical situations during clinical procedures include:

- withdrawing a needle from a patient, especially if staff attend to bleeding patients while disposing of the needle.
- having the device jarred by a patient.
- pulling a needle out of the rubber stopper of a vacuum tube which can jab the hand in a rebound reflex.

Injuries commonly occur when workers try to do several things at the same time, especially while disassembling or disposing of needles.

**Conditions of Work**

Work conditions that might contribute to an increase in the number of needlestick injuries include:

- staff reductions where nurses, laboratory personnel and students assume additional duties.
- difficult patient care situations.
- working at night with reduced lighting.

**Staff Experience**

New staff or students tend to have more needlestick injuries than experienced staff.

**Recapping**

Recapping can account for 25 to 30 percent of all needlestick injuries of nursing and laboratory staff. Often, it is the single most common cause.

It is extremely dangerous to hold a needle in one hand and attempt to cover it with a small cap held in the other hand. Injuries occur three different ways:

- the needle misses the cap and accidentally enters the hand holding it.
- the needle pierces the cap and enters the hand holding it.
- the poorly fitting cap slips off of a recapped needle and the needle stabs the hand.

Several agencies have recommended that workers avoid recapping needles before disassembly or disposal. Despite this, some health care workers have continued the practice even when informed of the dangers. In some cases, inappropriate training or force of habit may be responsible. In a recent study, however, workers gave the following reasons for recapping despite knowing about the potential hazards:

- to protect themselves when disassembling a non-disposable needle device with an exposed contaminated needle.
- to protect themselves from exposed needles when several items were carried to a disposal box in a single trip.
- to store a syringe safely between uses if its contents were to be administered in two or more doses at different times.
- to protect other people in crowded conditions on the way to the disposal box.

Guidelines from the Laboratory Centre for Disease Control recommend that workers do not recap (or bend or cut) needles but dispose of them directly into approved, puncture-proof containers.

**Disposal**

Needlestick injuries commonly occur when workers dispose of needles. They occur when staff use special containers for needles and sharps. They also occur when needles are disposed of improperly in regular garbage or lost in the workplace.

**Special Containers**

Up to 30 percent of needlestick injuries of nursing and laboratory staff occur when workers attempt to dispose of needles using sharps containers. Accidents occur at every step:

- while carrying the needle to the disposal container, especially when the needle is uncapped and mixed with other trash.
- while placing the needle into the disposal container, especially if the container is overfilled.
- while emptying disposal containers instead of sealing them for disposal.

**Improper Disposal**

Virtually all needlestick injuries of domestic and portering staff are from needles that have either been lost in the workplace or thrown into regular garbage. Janitors and garbage handlers can also experience needlestick injuries or cuts from "sharps" when handling trash that contains needles or scalpels. Most investigators find it difficult to understand why this situation occurs. Some
attribute the problem to forgetfulness or lack of motivation or training on the part of people who work with and dispose of needles. Others feel that inconvenient disposal systems contribute to these incidents.

Maintenance staff have also experienced needlestick injuries when they have been cleaning ducts or other areas with their hands and have found hidden needles and syringes. These injuries have usually happened when they are reaching into areas where they cannot see and were not wearing leather gloves.

How can needlestick injuries be prevented?

Preventing needlestick injuries is the most effective way to protect workers from the infectious diseases that needlestick accidents transmit. A comprehensive needlestick injury prevention program would include:

- **Employee Training.**
- **Recommended guidelines.**
- **Safe recapping procedures.**
- **Effective disposal systems.**
- **Surveillance programs.**
- **Improved equipment design.**

**Employee Training**

To reduce needlestick injuries, an effective program must include employee training. Workers need to know how to properly use, assemble, disassemble, and dispose of needles. Workers need to understand the risks associated with needlestick injuries and know the proper means to prevent them. Specifically, the training programs should address:

- risk of injury.
- potential hazards.
- recommended precautions for use and disposal of needles.
- procedures for reporting injuries.
- the importance of hepatitis B vaccination where appropriate.

**Recommended Guidelines**

The Laboratory Centre for Disease Control's Bureau of Communicable Disease Epidemiology reviews, publishes, and updates guidelines to protect staff from exposure to all blood-borne disease-causing agents.

The following guidelines deal specifically with needle safety:

- Needles, scalpels blades and other sharp instruments--workers should consider these as potentially infectious and handle them with care to prevent accidental injuries.
- Disposable needles and syringes, scalpels blades, and other sharp items--workers should place these in puncture-resistant containers located near the area of use. They should avoid overfilling the containers because accidental needlestick injuries may occur.
- Recapping--Workers should not recap needles by hand or purposely bend, break, or remove them from disposable syringes or otherwise manipulate them by hand.

**Safe Recapping Procedures**

In situations where recapping is considered necessary, develop safe approaches which workers can follow. Workers should never move an exposed needle tip towards an unprotected hand.

*Single-Handed Scooping*

Recapping can be safe when people lay the cap on a flat surface and scoop it onto the tip of a syringe held in one hand. They must keep the free hand away from the sheath and well behind the exposed needle.

*Recapping Devices*

Several devices are available for recapping needles safely. Some devices permit single-handed recapping by parking a needle cap on a flat surface. Other devices are designed to protect the hand that holds. Other cap during two-handed recapping procedures. As yet, most products have not received independent testing and the two-handed recapping process remains a cause for concern. Recapping devices require further investigation. They may provide a practical solution for situations where recapping is considered necessary.

**Disposal**

An effective system for disposing of used needles is crucial to preventing needlestick injuries. Having disposal containers readily available can greatly reduce the concern for recapping needles.

Workers should place needles in wide-mouth, puncture-proof containers. Locate disposal containers specifically where needles are used to make safe disposal possible without recapping. Replace the containers before they are completely filled. Make sure they are sealed, collected, and disposed of in accordance with local regulations for biomedical waste.

All staff should report every incident in which they find needles left at the bedside or thrown into the regular garbage.

**Surveillance**

There is still a serious lack of information about the various factors that cause accidents with needles. Surveillance programs that provide in-depth analysis of needlestick accidents are an important tool for obtaining this information. The goals of these programs should include:

- determining the rate of needlestick injuries.
- investigating the factors that cause the injuries.
- ensuring that injured workers receive proper treatment.
- identifying areas in which the prevention program needs improvement.
- eventually providing practical strategies for dealing with the problem.
The Division of HIV Epidemiology Research, Bureau of HIV/AIDS and STD, LCDC maintains a program to monitor occupational exposure to HIV-infected blood and body fluids among health care workers.

Continued Innovation

There is a need for further investigation and innovation to develop means for preventing needlestick injuries. These investigations should aim:

- to identify the types and designs of needle instruments that are potentially capable of causing needlestick injuries.
- to understand better how needle devices are normally handled in the workplace and how they cause injuries.
- to find methods that eliminate the need to move hands towards the tips of contaminated needles, or to manually disassemble contaminated needle equipment.

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