8 SAMPLE INTEGRITY FROM COLLECTION TO TESTING

Course Prerequisites:

- Venipuncture Modules 1 through 7.

Course Goals and Objectives:

Goal

This course will cover complications and special circumstances that may be encountered during venipuncture and the importance and proper use of standard precautions.

Course Objectives

At the completion of this course, the learner will be able to:

- Identify complications associated with blood collection and possible effects on client safety and specimen integrity.
- Describe factors and circumstances that may result in harm to the client or reduce specimen integrity, and appropriate corrective measures.
- Describe the importance of standard precautions in prevention of harm to the client, the phlebotomist, and other healthcare workers.
8 STANDARD PRECAUTIONS

The potential for transmission of human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and other blood-borne pathogens is a concern when collecting or working with blood and body fluids containing blood. This module discusses the risks associated with working with blood products and presents information to reduce the risk of exposure, and procedures to follow when exposure occurs.

Module 8 Objectives

At the end of this module, the learner will be able to:

1. Describe proper hand-washing technique and glove removal.
2. Define and differentiate the terms Universal Precautions and Standard Precautions.
3. Describe proper phlebotomy procedure with respect to both Universal Precautions and Standard Precautions.
4. Define “blood-borne pathogen”, list examples, and describe the means of transmission of blood-borne pathogens in a health care setting.
5. State safety rules that should be followed by the phlebotomist when working in the laboratory or inpatient care areas.
6. Describe the importance of needle-stick follow-up procedures.
7. Outline the post-exposure follow-up procedures.
8. Describe the procedure for cleaning spills involving blood and/or other body fluids.
9. Discuss the main issues targeted in the Blood-borne Pathogen Regulations.
10. Describe practical methods to prevent needle-stick and sharps exposures.
8.1 Introduction to blood-borne pathogens

Figure 8-I: Biohazard Symbol

The potential for transmission of human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and other blood-borne pathogens is a concern for health-care workers who work with blood and body fluids containing blood.

HBV infection is preventable to a large degree through immunization; however, currently there is no vaccine available to prevent HCV and HIV infections. Therefore, primary prevention measures are necessary to prevent occupational exposures to blood and body fluids and reduce the risk of occupationally acquired infections.

Primary prevention measures include government regulations; workplace policies and committees, including an exposure control plan; engineering controls; protective equipment; safety devices; education; and personal and professional practice; and spill and waste management.

8.2 Government regulations

8.2.1 Canada

In Canada, occupational health and safety legislation falls under the Canada Labour Code and is a shared responsibility between the Provinces, Territories and Federal Government. Federal legislation protects employees working in federal government agencies and corporations, as well as inter-provincial and international industries involving transportation, shipping, telephone, broadcasting, banking, etc. In addition, each province or territory has legislation to protect workers in other workplaces.

Occupational Health and Safety (OHS) Committees are a legislated requirement of the Occupational Health and Safety Act in workplaces having 10 or more employees. A safety representative is required in workplaces with less than 10 employees.
OHS Committees include equal numbers of worker elected representatives and employer appointed representatives, and allow for communication between employees and the employer on health and safety concerns, in an effort to reduce workplace accidents and injuries. Committees and representatives identify concerns, make recommendations for corrective action and promote workplace health and safety.

The Hazardous Products Act (administered by Health Canada), and the Controlled Products Regulations are two of the federal regulations developed to protect employees in the workplace. Federal law requires that suppliers provide labels and material safety data sheets (MSDS) with controlled products – products meeting the hazard criteria identified in the above regulations – and that employers ensure that controlled products are labelled properly, MSDS are available to employees, and employees receive education and training on safe storage, handling, use and disposal of controlled products in the workplace.

The Workplace Hazardous Materials Information System (WHMIS) establishes a national standard for the classification of hazardous workplace materials. The regulations establish criteria for acute and chronic health hazards (i.e. mutagenicity, carcinogenicity, embryo and reproductive toxicity, respiratory tract and skin sensitization) related to biohazards and chemical hazards in the workplace.

8.2.2 U.S.A.

In the U.S., occupational health and safety is legislated by the Occupational Safety and Health Act of 1970. The Act created the Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH).

OSHA is part of the Department of Labour, and sets mandatory standards for businesses affecting interstate commerce. OSHA is responsible for developing and enforcing workplace safety and health regulations.

The NIOSH is part of the Centers for Disease Control and Prevention (CDC) in the Department of Health and Human Services, and is overseen by the Secretary of Health and Human Services. The NIOSH is a research agency providing research, information, education, training and recommendations for new or improved occupational safety and health standards. NIOSH recommendations are forwarded to the Secretary of Labour and to the Secretary of Health and Human Services.

Although they are distinct agencies, OSHA and the NIOSH are both responsible for ensuring worker safety and health, and often work together to achieve this goal.

The Occupational Safety and Health Review Commission was created to resolve disputes under the Occupational Safety and Health Act. The Commission consists of three qualified members appointed by the President, on the advice and consent of the Senate, one of who is designated to serve as Chairman.
8.3 Standards and guidelines

A series of standards and guidelines have been developed to prevent occupational exposure to blood and body fluid and occupationally acquired infection.

8.3.1 Blood and Body Fluid Precautions

In 1983, the CDC published the Guideline for Isolation Precautions in Hospitals containing a section titled Blood and Body Fluid Precautions. These guidelines recommended precautions for blood and body fluids when patients are known or suspected to be infected with blood-borne pathogens.

8.3.2 Universal precautions

In 1987, the CDC published the document Recommendations for Prevention of HIV Transmission in Health-Care Settings containing a section titled Universal Blood and Body Fluid Precautions. Universal Precautions, as it was commonly referred to, recommended that blood and certain body fluids of all patients be considered potentially infectious for HIV, HBV, and other blood-borne pathogens.

Universal Precautions were to be used in addition to other transmission-specific isolation precautions (i.e. droplet precautions for influenza, airborne isolation for pulmonary tuberculosis, contact isolation for methicillin-resistant Staphylococcus aureus - MRSA).

Universal precautions were intended to prevent percutaneous, mucous membrane, and non-intact skin exposures of HCWs to blood-borne pathogens. Universal precautions should be followed with blood, amniotic fluid, pericardial fluid, peritoneal fluid, pleural fluid, synovial fluid, cerebrospinal fluid, semen, and vaginal secretions, or any body fluid visibly contaminated with blood.

Universal precautions involve the use of protective barriers (gloves, gowns, aprons, masks, or protective eyewear) to reduce the risk of skin or mucous membrane exposure to potentially infectious materials. Universal precautions also recommend precautions to prevent injuries caused by needles, scalpels, and other sharp instruments or devices. The Laboratory Centre for Disease Control (LCDC), a division of Health Canada, and the Canadian Federal Centre for AIDS, published the CDC recommendations later that year.

Because HIV and HBV transmission has not been documented from exposure to other body fluids, universal precautions do not apply to feces, nasal secretions, sputum, sweat, tears, urine, and vomit, unless these substances are contaminated with blood. Universal Precautions also do not apply to saliva, except in the dental setting, where it may be contaminated with blood.
8.3.3 Standard precautions

In 1992, the LCDC recommended that the principles of Universal Precautions be considered the minimum standard of practice for preventing the transmission of blood-borne pathogens.

In 1996, the CDC published new guidelines – Standard Precautions – encompassing the major features of Body Substance Isolation and Universal Precautions to prevent transmission of a variety of organisms in hospitals.

8.4 Blood-borne pathogen (BBP) standard

In 1991, the Occupational Safety and Health Administration (OSHA) issued the Blood-borne Pathogen (BBP) Standard to protect workers from occupational exposure to blood-borne pathogens, including HIV, HBV, and HCV. Although compliance with the BBP Standard has significantly reduced the risk of occupational exposure, the occurrence of accidental sharps injuries continues to be a serious problem.

In the U.S. it is estimated that 600,000 to 800,000 needle stick and other percutaneous injuries occur among health care workers each year.
8.5 Needle-stick Safety and Prevention Act (NSPA)

In 2001, the Needle stick Safety and Prevention Act (NSPA) initiated amendments to the BBP Standard, requiring employers to update their exposure control plans to reflect how employers implement new developments in control technology (i.e., safer devices); solicit input from employees responsible for direct patient care in the identification, evaluation, and the selection of engineering and work practice controls; and, in some cases, to establish and maintain a log of percutaneous injuries from contaminated sharps.

8.6 Workplace policies and committees

Institutional Risk Management programs and Joint Occupational Health and Safety Committees (JOHSC) are essential for ensuring that exposure control plans are developed, initiated, communicated and monitored; exposures are reported (incident reports and employee reporting mechanisms); processes are discussed; policies are developed; and employees are educated on procedural and practice risks, as well as the necessity for exposure and exposure risk reporting.

Prevention of BBP transmission in health care and public service settings requires comprehensive workplace infection prevention and control, and occupational health and education programs to limit exposures, and reduce transmission if exposures occur.

Workplace programs should include:

- Education of workers
- Vaccination of people at risk for hepatitis B
- Identification and restriction of moderate and high-risk practices
- Design and use of safer medical devices
- Targeted interventions based on occupation-specific hazards

Employer Responsibilities:

- Development and implementation of exposure control plan and workplace policies to ensure safe work practices
- Development and implementation of effective risk management programs
- Development, implementation and assessment of worker reporting mechanisms
- Assessment and safeguards for moderate and high-risk practices
- Active JOHSC, and opportunities and resources necessary for regular meetings policy development and assessment of policies and practices
- Enforcement of universal precautions and standard precautions, as appropriate for the services provided
- Development, implementation and assessment of programs to educate all workers at risk of exposure
- Vaccination of workers at risk of exposure for hepatitis B
• Ongoing processes to research, procure, and assess the use of safer medical devices
• Provision of post-exposure follow-up programs and medical treatment, as required

Employee Responsibilities

• Report all exposures to occupational health representative, manager, risk management representative, and safety representative, as required
• Notify JOHSC representatives of exposure risks and unsafe work practices
• Follow workplace policies related to safe work practices, universal precautions, and/or standard precautions, as appropriate
• Participation in ongoing worker education programs
• Compliance with workplace HBV immunization programs, as appropriate
• Use, assess, and report on experience with, and effectiveness of, safer medical devices
• Follow-through on post-exposure follow-up processes

8.6.1 Exposure control plan

In the U.S., OSHA requires that a written plan be developed to control exposure to BBP. The Exposure Control Plan should indicate job classifications and procedures that involve potential exposure, indicate the necessary engineering and work practice controls, personal protective equipment, housekeeping, labelling, training and surveillance functions that will be instituted. Plans should be reviewed annually and/or as exposure conditions change.

Training must be provided and documented for workers who perform tasks that involve BBP exposure, both initially, and annually thereafter. Training sessions should include information on:

• BBP and infection transmission
• The institution’s Exposure Control Plan
• Engineering controls, labelling, practices and personal protective equipment
• Information on, and provision of, HBV immunization
• Actions to take during and following exposure incidents

8.6.2 Immunization

Hepatitis B vaccine has been available since 1982, and all workers who have a reasonable chance of exposure to blood or body fluids during performance of their routine work should receive hepatitis B vaccine. The annual number of occupational HBV infections has decreased 95% since 1982 when HBV vaccine became available. The CDC estimated that HCW infected with HBV due to occupational exposure dropped from 10,000 in 1983 to less than 400 in 2001.

Vaccination has been recommended for health-care workers regularly exposed to blood and other body fluids potentially contaminated with HBV, in the regular performance of their work, and should be provided at no charge to the worker.
Vaccine stimulates active immunity against HBV infection and provides over 90% protection for 7 or more years following vaccination. Currently, there is no recommendation for revaccination or booster vaccine following initial immunization.

Ideally, immunization should occur during the worker’s educational training program, and testing for antibodies to the HBV surface antigen (HBsAb) should be performed one to two months following completion of the immunization series to ensure that the worker has developed immunity.

Population based immunization programs are required to reduce the prevalence of HBV among the general population; thereby, reducing the overall (relative) risk of contracting HBV infection, either occupationally or otherwise. The three major groups at risk of HBV infection include heterosexuals with multiple sexual partners, injection drug users, and men who have sex with men. However, it is difficult to gain access to these groups for the purposes of immunization – generally, there is a lack of awareness of the risk and consequences of HBV infection, low initial vaccine acceptance, and compliance with vaccine series completion rates. In addition, infection is acquired rapidly after adopting high-risk behaviours, so that unless individuals are immunized through pre-existing population-based programs such as infant and school immunization schedules, they are often already infected before specific intervention measures for high-risk behaviour groups.

In the U.S., a comprehensive strategy to eliminate HBV transmission was recommended in 1991, and includes:

- Prenatal testing of pregnant women for HBsAg to identify newborns who require prophylactic treatment for the prevention of perinatal infection and to identify household contacts who require immunization
- Routine vaccination of infants and/or school children
- Vaccination of adolescents
- Vaccination of adults at high-risk of infection

Health Canada recently initiated an HBV immunization program in the elementary school system, while in the U.S. HBV vaccination occurs during infancy.

**Hepatitis B Vaccination Schedule**

- Series of 3 vaccine doses given at 0, 1 and 6 months with signed consent of employee
- If second dose is delayed by more than one month, the third dose should be given 5 months following the second dose
- If the third dose is delayed, it should be administered as soon as possible

Poor immune response among public safety workers vaccinated against hepatitis B by the intradermal (ID) route of administration has been reported; therefore, it is recommended that HBV vaccine be administered by the intramuscular (IM) route.
**HCV Vaccine**

There is no vaccine against hepatitis C and no prophylactic treatment after an exposure to prevent infection. As with HCV, there is no vaccine against HIV.

### 8.6.3 Protective measures

The implementation of control measures to reduce exposure to BBPs does not replace the need for adherence to general infection-control principles and general hygiene measures (e.g., hand washing) for preventing transmission of other infectious diseases to both worker and client.

### 8.6.4 Engineering controls

Engineering controls involve structural considerations such as ventilation to prevent exposure. It also includes use of biological safety cabinets when working with potentially infectious blood and body fluids, availability of sharps disposal containers, and availability of safer medical devices.

### 8.6.5 Barrier protection

Universal precautions are intended to supplement recommendations for routine infection control, such as hand-washing and using gloves to prevent gross microbial contamination of hands. Protective barriers reduce the risk of exposure to blood and body fluids. Protective barriers include gloves, gowns, masks, and protective eyewear.

### 8.6.6 Gloves

Gloves reduce the incidence of contamination of hands by reducing contact of hands with blood and other body fluids during emergency and medical procedures involving potential exposure (i.e. blood collection). Gloves do not prevent penetrating injuries caused by needles or other sharp instruments.

Gloves should be proper fitting and alternatives to latex should be available for sensitized health-care workers, and for use with sensitized patients, and the type of gloves selected should be appropriate for the task being performed:

- Sterile gloves should be worn during procedures involving contact with normally sterile areas of the body
- Examination gloves are generally adequate for procedures involving contact with mucous membranes, and for other patient care or diagnostic procedures, unless otherwise indicated
• Heavier general-purpose utility gloves (e.g., rubber household gloves) should be used for housekeeping chores involving potential blood contact, and for instrument cleaning and decontamination procedures

**Glove use recommendations:**

Gloves should be worn for performing phlebotomy when the health-care worker has cuts, scratches, or other breaks in his/her skin – it should be noted that breaks in the skin are not always obvious; therefore, it is this author’s opinion that gloves should be worn by all phlebotomists.

Gloves should be worn in situations where the health-care worker judges that hand contamination with blood may occur. For example, when performing phlebotomy on an uncooperative patient – it should be noted that the phlebotomist may not be aware that the patient will be uncooperative until after an exposure; therefore, it is this author's opinion, and the rule in many institutions, that gloves should be worn by all phlebotomists.

Gloves should be worn for performing finger and/or heel sticks on infants and children. Although the guidelines do not specifically indicate this gloves should be worn when performing skin puncture on adults also. The nature of skin puncture involves an increased risk of exposure to blood during collection and subsequent testing. Unlike venipuncture, which, in a perfect world is considered a closed system in that blood passes directly from the vein into a tube vacuum tube connected to a double bevelled needle, exposure still routinely occurs.

Gloves should be worn especially during phlebotomy training. When an individual learns to palpate, select veins, and perform phlebotomy while wearing gloves, there is no reason to eliminate this protective barrier, once trained. Indeed, the excuse most often cited by experienced phlebotomists for not wearing gloves during venipuncture, is lack of sensitivity during vein selection. Because they did not learn the technique wearing gloves, experience in vein palpation and selection while wearing gloves is effective in developing the necessary sensitivity.

Gloves should be changed between patient contacts, and should not be washed or disinfected for reuse. Washing may affect the integrity of the glove permitting penetration of liquids through undetected holes, and disinfection may cause deterioration. Utility gloves may be decontaminated and reused but should be discarded if they show any signs of deterioration (i.e. surface is peeled, cracked or discoloured), or have punctures or tears.
Proper glove removal

1. With the thumb and index finger of one glove, pinch the outside of the other glove near the cuff. Pull the glove off into the palm of the other gloved hand.
2. Place the index finger of the ungloved hand inside the cuff of the gloved hand and push glove off so that outside surfaces of glove are not exposed.
3. Dispose of gloves with contaminated garbage.
4. Wash hands.

8.6.7 Masks and protective eyewear

Masks and protective eyewear or face shields reduces the incidence of contamination of mucous membranes of the mouth, nose, and eyes.

8.6.8 Safety devices

In the U.S. the NSPA requires that health care facilities use safer medical devices in an attempt to reduce the incidence of needle-stick and other sharps injuries. Formation of a sharps injury prevention team can assist in identifying priorities for sharps injury prevention, identification, screening and evaluation of safer medical devices, as well as implementation and assessment of the use of new safer devices for blood collection, injection and emergency response.

Commercial blood collection equipment designed to reduce sharps injuries includes:

- Hinged recapping needles (i.e. Eclipse blood collection needle [Becton Dickinson VACUTAINER Systems]; Needle Pro needle protection [SIMS Portex])
- Plastic blood collection tubes
- Retracting needle (i.e. Vanish Point blood collection tube holder [Retractable Technologies, Inc.])
- Self-blunting needle [Puncture Guard blood collection needles [Bio-Plexus, Inc.]]
- Shielded winged infusion needles (i.e. Vacutainer Safety-Lok blood collection set [Becton Dickinson]; Angel Wing Safety Needle System [Kendall Healthcare Products Co.])
- Single use sliding sheath needle and tube holder (i.e. Vacutainer Brand Safety-Lok needle holder [Becton Dickinson]; ProGuard II [Care Medical]; Safe Point Vac, and Safe Point M-D [North American Medical Products]; Saf-T-Clik [MPS Acacia]; Sterimatic Safety Needle [i.e. Sterimatic Ltd.])
- Laser lancet (Lasette [Cell Robotics International, Inc.])
• Retracting lancet (i.e. Single-Let [Bayer Corp.]; Microtainer Brand, Quick Heel, Genie, and Safety Flow lancets [Becton Dickinson]; Haemolance [Chronimed Inc.]; Tenderfoot heel and Tenderlett skin incision devices [International Technidyne Corp.]; Monoject Monoletter safety lancet [Kendall Healthcare Products Co.]; Glucolet 2 [Miles Inc.]; Unistik 2 [Owen-Mumford, Inc.]; Accu-Check Safe-T-Pro [Roche Diagnostics]; Safe-T-Lance Plus [Futura Medical Corp.])

8.6.9 Personal and professional practice

Professional training and education should include safe-work practices, use of universal and/or standard precautions, as is appropriate for the specific professional role; education on blood-borne pathogens and other transmissible diseases; and proper use and disposal of biohazardous sharps.

Personal and professional practice is essential for prevention of blood-borne pathogen transmission between patients, clients and workers, and professional associations and unions should be involved in ensuring worker compliance to safe work practices, and responding to worker safety concerns.

Professional practice should include attention to prevention of sharps injuries (needles, scalpels, suture needles, lancets, etc.) during and after procedures; when cleaning used instruments; and when disposing of used needles.

General practice considerations:

• Needles should not be recapped by hand
• Used needles should not be removed from disposable syringes by hand
• Needles should not be bent, broken, or manipulated in any way outside their intended use
• Used disposable syringes and needles, scalpel blades, and other sharp items should be immediately disposed of in puncture-resistant containers located as close to the area of use as is practical
• Protective barriers appropriate for the procedure being performed and exposure type should be used or worn to prevent exposure to blood, body fluids containing visible blood, and other fluids to which universal precautions apply
• Hands and exposed skin surface should be washed with warm water and soap immediately and thoroughly following contamination with blood, body fluids containing visible blood, or other body fluids
• Hands should be washed after gloves are removed even if the gloves appear to be intact
• Waterless antiseptic hand cleanser should be provided for use in the absence of proper hand-washing facilities
8.6.10 The importance of hand-washing

Hands and other exposed skin surfaces should be washed immediately and thoroughly if contaminated with blood or other body fluids to which universal precautions apply, or potentially contaminated articles.

Hands should always be washed after gloves are removed, even if the gloves appear to be intact. Hand-washing should be completed using the appropriate facilities, such as utility or restroom sinks.

When hand-washing facilities are available, wash hands thoroughly with warm running water and soap. When hand-washing facilities are not available, a waterless antiseptic hand-cleanser may be used. When hands are visibly soiled with blood or other contaminants, hands should be thoroughly washed with soap and running water. Waterless antiseptic hand-cleanser should be provided for use when hand-washing facilities are not available. The manufacturer's recommendations for the product should be followed.

Routine hand-washing:

1. Remove rings and watch
2. Do not allow body or clothing to touch the sink
3. Wet hands under warm running water
4. Apply soap and work up lather. Rub hands together to create friction, loosening dead skin, dirt, and debris
5. Scrub the entire hand including between the fingers and around the knuckles and nails for at least 15 seconds
6. Remove debris under fingernails with an orange stick or pick
7. Rinse hands in a downward motion from wrists to fingertips
8. Re-apply soap and lather again
9. Scrub hands thoroughly as described above
10. Rinse hands in a downward motion from wrists to fingertips
11. Dry hands with a clean paper towel
12. Turn faucet off with another piece of clean paper towel

8.6.11 Spill and waste management

Universal Precautions are not intended to change waste management programs previously recommended for health-care settings. Policies for defining, collecting, storing, decontaminating, and disposing of infective waste are generally determined by institutions in accordance with state and local regulations, but must include the measures stated in Universal Precautions.
Disposable syringes and needles, scalpel blades, and other sharp items should be placed in puncture-resistant containers for disposal; and the puncture-resistant containers should be located as close as practical to the area in which it is used so that they can be immediately disposed of following removal and activation of safety devices. The NSPA prohibits removal of needles from the needle holder or syringe body.

### 8.6.12 Cleaning and decontamination of blood spills

If blood splashing is a risk, protective eyewear should be worn along with an impervious gown or apron, which provides an effective barrier to splashes.

Spills of blood and blood-contaminated fluids should be immediately cleaned up using an approved germicide (i.e. household bleach solution). Gloves should be worn, and visible material should be removed first with disposable towels or other appropriate means that protects against direct contact with blood. Hands should be washed following removal of gloves.

Soiled cleaning equipment should be cleaned and decontaminated or placed in an appropriate container and disposed of according to institution’s policy. Plastic bags should be available for removal of contaminated items from the site of the spill.

Disposable impervious shoe coverings should be warn where there is massive blood contamination on floors, and protective gloves should be worn to remove contaminated shoe coverings.

All contaminated equipment, including shoe coverings and gloves should be disposed of in plastic bags that prevent leakage.

Soiled linen can be cleaned in a laundry using normal detergent, but should be handled as little as possible, and to prevent gross microbial contamination of the air and linen-handlers. Soiled linen should be bagged to prevent leakage during transport to the laundry.

Protective work clothing contaminated with blood or other potentially infectious body fluids to which universal precautions apply should also be placed and transported in bags or containers that prevent leakage. Gloves should be worn during bagging, transport, and laundering. Boots and leather goods may be brush-scrubbed with soap and hot water to remove contamination.
8.6.13 Waste Disposal

Waste disposal selection is based on the relative risk of disease transmission and local regulations, which vary widely. In all cases, local regulations should be consulted and followed.

Infective waste should be incinerated or decontaminated before disposal in a sanitary landfill. Provincial regulation often mandates that these items be incinerated.

Sharp items should be placed in puncture-resistant containers. All other blood-contaminated items should be placed in leak-proof plastic bags for transport to an appropriate disposal location for incineration or decontamination. Contaminated materials and debris from emergency response sites should also be disposed of in this manner.

As many as one-third of all sharps injuries are related to the disposal process, and most have been related to factors such as inappropriate sharps disposal practices, inadequate sharps disposal container design, inappropriate sharps disposal container placement, and overfilling of sharps disposal containers. Containers used for disposal should be approved for disposal of biohazardous sharps, and must be closable, puncture-resistant, leak-proof on the sides and bottom, and appropriately labelled or color-coded (i.e. yellow or red).

The Blood-borne Pathogens Standard prohibits removal of the needle from the needle holder unless the employer can demonstrate that no alternative is feasible, or that such action is required by a specific medical procedure. In these cases, needle removal must be accomplished through the use of a mechanical device or a properly performed one-handed technique.

8.6.14 Risk of infection following exposure to blood

Transmission of blood-borne pathogens requires parenteral inoculation (needle-stick injuries and shared needles among IV drug abusers) or direct intimate contact (includes mucous membrane exposure) of blood, blood products, semen or tissues. The risk of contracting HBV from a known positive client in health care settings is much greater than HIV: HBV needle-stick 6-30%, whereas HIV <1%. Hepatitis C transmission rates range from 3-10%. Hepatitis B is transmitted much easier than HIV, due to the number of infectious particles normally found in the blood of infected clients: HBV can be present in concentrations as high as $10^9$ particles/mL, whereas HIV concentrations usually range from $10^0$ to $10^4$ particles/mL. HCV concentrations have been reported ranging from $10^2$ to $10^3$ particles/mL.
The risk of transmission to health care workers is dependent on:

- Type of fluid exposure: blood poses a greater risk than urine, for example
- Volume of fluid – the more fluid, the greater the numbers of viral particles present
- Probability of exposure—dependent on type of work performed
- Route of exposure (efficiency of transmission) – percutaneous inoculation poses the highest risk of infection
- Virus concentration in fluid or tissue (viral load) – virus concentration is related to the type of virus involved (HBV particles normally found in higher numbers than HBV or HIV) and disease progression (the more progressed the disease, the weaker the immune system, and the higher the number of viral particles present)

### 8.6.15 Efficiency of transmission

Blood contains the highest concentration of blood-borne viruses of all body fluids, and is the most important mode of transmission in the health-care setting. Percutaneous injuries are the main source of occupational exposures to blood-borne pathogens. The Canadian Needle Stick Surveillance Network (CNSSN) indicated that during the first 6 months of data collection in 2000-2002, HCWs in 12 participating centres were exposed to 497 known patient sources - 48 of which tested positive for a blood-borne pathogen. HCV accounted for more than half of the blood-borne pathogens, HBV accounted for 15 %, and HIV accounted for 20%. In addition, 3 of the source patients were positive for HIV and HCV.

The risk of infection following exposure to HIV and/or HCV-positive blood is much lower than that for HBV-positive blood, possibly due to higher concentrations of virus in the blood of HBV-infected patients.

The risk of acquiring HBV and HCV infection following mucous membrane exposure (eye, nose or mouth) is currently unknown, but thought to be small. The risk of seroconversion suggestive of acute HIV infection, following mucous membrane exposure is approximately 0.09%.

The risk of HBV and HCV transmissions following exposure to non-intact skin is unknown. HIV transmissions following exposure of non-intact skin to blood have been documented, but the relative risk is currently unknown, although it is expected to be less than the risk following mucous membrane exposure, and far less than that from percutaneous injection.

### 8.6.16 Exposure follow-up

Recommendations concerning the management of health care workers following an occupational exposure to blood-borne pathogens have recently been published as a supplement to the Canada Communicable Disease Report entitled "An Integrated Protocol to Manage Health Care Workers Exposed to Blood-borne Pathogens".
The following list suggests follow-up steps that are required following an occupational exposure to blood-borne pathogens:

- Act
- Report
- Test
- Treat
- Surveillance
- Document

ACT!

Act Immediately!

**Needle-sticks and cuts:**

1. Express (squeeze) fluid from wound, if appropriate (needle-stick)
2. Wash site well with disinfectant soap and water
3. Bandage wound

Splash to mucous membranes

**Nose, mouth or skin:**

- Flush with water

**Eyes:**

- Irrigate with clean water, saline or sterile irrigates

**Report!**

Report the exposure to your immediate supervisor, the occupational health clinic, and risk management.

Your supervisor must complete the appropriate forms for Worker's Compensation in the event that time is missed from work.

Confidential 24-hour service should be available to HCWs in the event of a blood and/or body fluid exposure. Occupational health will counsel the HCW, order blood tests, refer the HCW for treatment as appropriate, investigate and follow-up exposures, and document the incident.
Test!

Follow-up testing should be available to all personnel who are concerned about possible infection through occupational exposure. Recommendations for post-exposure test schedules may vary slightly from one institution to another. Know what your local rules are!

Initial (baseline) testing – all exposures

Once an exposure has occurred, a blood sample should be drawn and tested for HBsAb, if testing has not been performed within the previous 12 months.

Exposed workers should also be tested for antibodies to HCV and HIV.

Testing for HBsAg and antibodies to HCV and HIV should also be performed on the exposure source - consent from the source individual is required before blood samples can be collected and tested. If the source refuses testing, s/he should be considered infectious.

Follow-up testing

Positive exposure source

If the source individual has hepatitis C or is known to be high risk, the worker should be tested for HCV antibody as soon as possible after exposure (baseline).

Workers who initially test negative for HCV antibodies (seronegative) should be retested as early as 6 weeks, then 3 months, 6 months, and possibly 12 months post-exposure exposure, to determine whether seroconversion and transmission has occurred.

Any sudden or severe flu-like illness occurring during the follow-up period should be reported, especially if fever, rash, muscle-aches, fatigue, malaise, or swollen glands are involved.

If the source individual has AIDS, is HIV-positive, or is known to be high risk, the worker should be tested for HIV antibody as soon as possible after exposure (baseline).

Workers who initially test negative for HIV antibodies (seronegative) should be retested as early as 6 weeks, then 3 months, 6 months, and possibly 12 months after exposure, to determine whether seroconversion and transmission has occurred.

Exposed workers should refrain from donating blood and use barrier protection during sexual intercourse during this period of time.

Any sudden or severe flu-like illness occurring during the follow-up period should be reported, especially if fever, rash, muscle-aches, fatigue, malaise, or swollen glands are involved.
Sero-negative source

If the source is known to be negative for HBsAg and antibodies to HCV and HIV, and has no known high-risk behaviours, exposed workers should receive baseline testing, and follow-up testing 3 months later if requested by the worker or recommended by the health-care provider.

Source unknown unidentified or refuses to be tested

If the source is unknown, decisions regarding follow-up testing should be based on the individual risk, in consultation with the healthcare provider.

Serologic testing should be made available to workers concerned that they have been infected with HIV.

Treatment!

HBV negative source

If the source individual is negative for HBsAg, and the worker has not been vaccinated, HBV vaccination should be initiated to provide protection against future exposures.

HBV immunized worker

If the HCW has received 3 HBV vaccine doses and demonstrates antibodies to HBV (within past year), no further action is necessary.

If the HCW has received 2 HBV vaccine doses and demonstrates antibodies to HBV, resume vaccination schedule.

If HBV antibody levels are inadequate, the exposed worker should receive prophylactic treatment - one dose of vaccine and one dose of HBIG within 48 hours of exposure.
Non-immunized worker

Non-immunized workers should receive prophylactic treatment - HBV vaccine and HBIG within 48 hours of exposure.

If the worker has not been immunized, or has only been partially immunized, and is non-immune (i.e. HBsAb negative), a single dose of hepatitis B immune globulin (HBIG) is recommended within 48 hours of exposure, and if the worker has not previously received HBV vaccine or completed the vaccine schedule, immunization should be resumed or continued.

HBV prophylactic treatment

HBV vaccines are 70%-88% effective when given within 1 week after HBV exposure (optimally within 24 hours of exposure).

Hepatitis B immune globulin (HBIG), a preparation of immunoglobulin with high levels of antibody to HBV (anti-HBs), provides temporary passive protection following exposure to HBV.

HBIG alone or in combination with vaccine is effective in preventing HBV infection in approximately 90% of cases.

HBV infection during pregnancy can cause severe illness in the mother and chronic infection in the newborn. HBV vaccine and HBIG therapy is safe for use during pregnancy and while breast-feeding, and should be administered following exposure to HBV infected blood.

Effective prophylactic HBV treatment has been reported in the perinatal setting; although data has not been published specifically on outcomes in HBV exposed pregnant workers.

HCV prophylactic treatment

Currently, HCV vaccine is not available (vaccine development has been problematic due to the rapid mutation rate and multiple genotypes).

Immune globulin and antiviral agents (interferon with or without ribavirin) are not recommended for post-exposure prophylaxis (PEP) of hepatitis C. Clinical trials have not been conducted to adequately assess post-exposure use of antiviral agents (interferon +/- ribavirin) for prevention of HCV infection, and FDA-approval does not extend to prophylactic treatment.
Following exposure to an HCV-positive source, the HCV status of the exposed worker should be determined initially, and follow-up testing performed as early as 6 weeks post-exposure, and then again at 3 months, 6 months and 12 months to determine whether seroconversion and transmission has occurred.

**HIV prophylactic treatment**

Although drugs for the treatment of existing HIV infection have been approved by the FDA, they have not been approved as prophylactic treatment to prevent infection; however, physicians may prescribe any approved drug if it is their professional judgment that use of the drug is warranted.

Results from a small number of studies suggest that the use of some antiretroviral drugs after certain occupational exposures may reduce the chance of HIV transmission. Therefore, post-exposure prophylaxis (PEP) may be recommended by physicians depending on the specific circumstance and risk of transmission.

PEP is not recommended when there is no risk of transmission, because the drugs used to prevent infection may have serious side effects.

Pregnancy should not rule out the use of post-exposure treatment, if it is warranted. The potential benefits and risks associated with the use of anti-HIV drugs should be discussed with the healthcare provider in order that the individual can make an informed decision about prophylactic treatment.

**Worker refusal**

If worker refuses to follow OH polices following exposure to blood-borne pathogens, he/she must sign a waiver indicating that he/she is aware of the consequences of exposure to HBV, HCV and HIV, and does not wish to comply with follow-up protocols.

**Documentation**

Exposed individuals should complete an incident report, report to risk management and complete Workmen’s Compensation (or local equivalent) documents, as required.

The circumstances of exposure should be recorded, including the activity during which the worker was exposed, work practices and protective equipment that were used, and a description of the source of exposure.
Surveillance

As discussed previously, following baseline testing, seronegative workers should be tested at 6 weeks and 3 months, and possibly up to 12 months after exposure to determine whether seroconversion and transmission has occurred.

During this follow-up period (most infected individuals are expected to seroconvert within the first 6-12 weeks after exposure), any acute febrile illness, especially those with symptoms of fever, rash, or lymphadenopathy should be reported to the occupational health practitioner.
REFERENCES:


