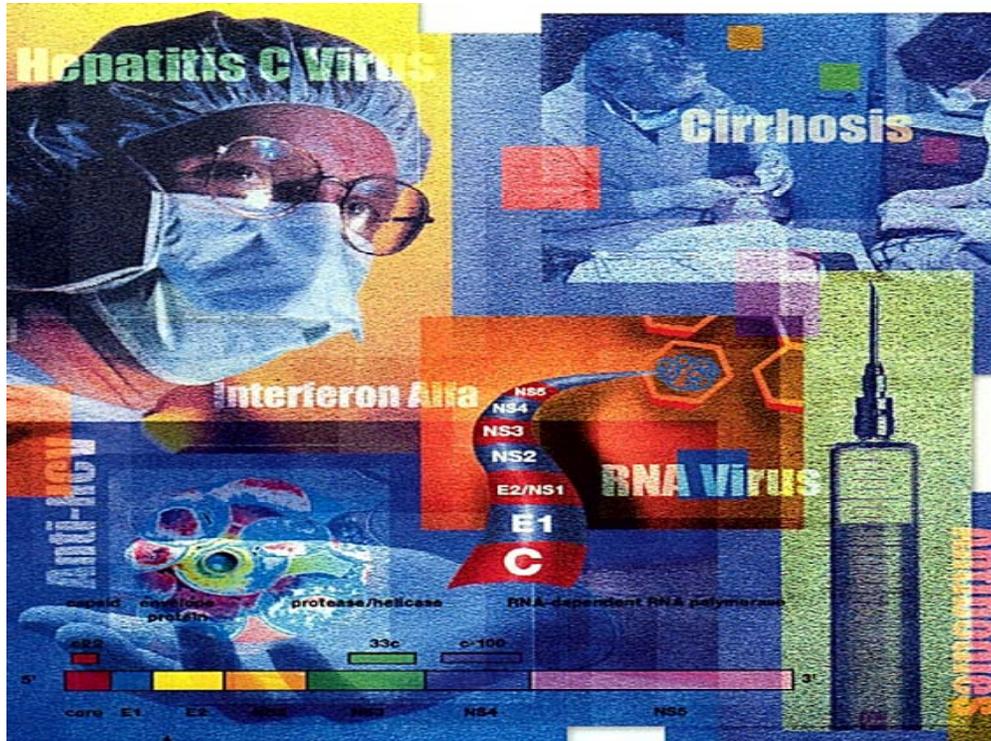


# Infection Control for Health Care Providers



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## **Infection Control: The Chain of Infection**

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Information regarding the mechanisms for disease transmission, and modalities designed to prevent cross-transmission, enable operators to provide quality health care in a variety of settings without fear of infection.

In order for a disease to be transmitted **several consecutive steps must take place**. This sequence is called the “Chain of Infection”. Health care workers can control their environment and prevent disease transmission by breaking the chain at any point. Recommendations by the Centers for Disease Control and Prevention (CDC), the Occupational Health and Safety

Administration (OSHA) Bloodborne Pathogen Standard, the Needlestick Safety and Prevention Act (NSPA) signed into law Nov. 6, 2000, and other regulatory agencies and associations outline the numerous mechanisms designed to break the chain, thereby protecting health care providers from the acquisition of an occupational infection.

## **The Chain of Infection**

**First:** Etiologic agent: Virus, Bacteria or Fungus

**Second:** Reservoir: Man (acute clinical case or carrier), Animal or the Environment

**Third:** Portal of exit: Contact with pathogen, i.e. lesion, blood, body fluids, mucous membranes, contaminated environment surface

**Fourth:** Mode of transmission: i.e. occupational injury, i.e. puncture wound, laceration, splash or indirect contact, i.e. inhalation of infectious droplets (TB, flu)

**Fifth:** Portal of entry: skin, respiratory system, blood stream

**Sixth:** A susceptible host

**Breaking this chain of events at any point will prevent disease transmission.** The following recommendations provide protection for health care providers when working in an environment that is potentially pathogenic.

### **Universal/Standard Precautions**

Universal/standard precautions are to be utilized in the clinical setting for all blood and body fluids, secretions, excretions, mucous membranes and non-intact skin, all of which must be considered as being potentially infectious (OSHA Standards). Standard precautions are used for most patient care procedures, however, transmission based precautions have been added for specific pathogens. These are to be used in conjunction with Standard Precautions. They include: Contact, Droplet and Airborne Precautions. New elements of the standard include Respiratory Hygiene/Cough Etiquette and Safe Injection Practices.

[http://www.cdc.gov/ncidod/dhqp/gl\\_isolation\\_standard.html](http://www.cdc.gov/ncidod/dhqp/gl_isolation_standard.html)

As an example, a health care provider could **break the chain of Pandemic influenza infection** through utilization of **Airborne Precautions (AP)**. APs are used for patients known or suspected to have microorganisms spread by the airborne route. These small particles (5 microns or smaller) can remain suspended in the air for long periods of time and are spread by air currents within a room or over a long distance. At a minimum, health care providers entering the room of a patient with a known or suspected airborne infection, should be wearing an N95 respirator. Examples of airborne pathogens include: Measles (Rubeola), Varicella (chicken pox), Tuberculosis, Herpes Zoster (shingles), Smallpox and Swine flu.

**Airborne Precautions include:**

- Adequate room ventilation (hospital, air exchange 6-12 times per hour)
- Rooms with monitored negative air pressure in relation to corridor with air exhausted directly outside or have re-circulated air filtered by HEPTA filter
- Ultraviolet lights
- Personal protective attire based upon procedure and anticipated amount of occupational exposure, protective eyewear, gloves, gown, N95 respirator or equivalent
- Tuberculocidal surface disinfectant

**Droplet Precautions** are used for patients known or suspected to have microorganisms transmitted by droplets larger than 5 microns. These droplets may be produced during coughing, sneezing or during certain procedures such as suctioning or bronchoscopy. These particles are propelled a short distance, less than 3 feet, and do not remain suspended in the air.

Any health care provider coming within 3 feet of a patient suspected or known to have a droplet-transmitted infectious disease should wear a surgical mask and eye protection. Prescription eyewear is not considered adequate eye protection. Examples include: Diphtheria, Influenza, Meningococcal meningitis, Mumps, Pertussis, Rubella, Upper respiratory Infections\*\* (Adenovirus, Parainfluenza, Rhinovirus, RSV) and Parvovirus B-19.

**Respiratory Hygiene/Cough Etiquette Standards are recommended for patients on Airborne and/or Droplet Precautions**

- Post signage notifying patients of policies
- Patient screening/diagnosis
- Patient placement (e.g. isolation), encourage coughing persons to sit at least 3 feet away from other persons in common waiting areas /Patient mask
- Instruct the patient to cover the nose/mouth when coughing or sneezing
- Use tissues to contain respiratory secretions and dispose of tissues in the nearest waste receptacle after use
- Provide access to hand sanitizers
- Recommend hand hygiene after contact with respiratory secretions
- Respiratory protection ( N-95 respirator or equivalent), fit- tested for health care workers
- Annual influenza vaccination and TB testing for health care workers routinely exposed to high risk TB patients. Varicella vaccination should be offered to non-immune staff.

[www.cdc.gov/flu/professionals/infectioncontrol/resphygiene.htm](http://www.cdc.gov/flu/professionals/infectioncontrol/resphygiene.htm)

**Contact Precautions** are used for patients known or suspected to have microorganisms that can be spread by direct contact with the patient or by indirect contact with environmental surfaces or patient care equipment. Any health care provider likely to have direct skin-to-skin contact with a patient suspected or known to have a contact transmitted infectious disease should wear, at a minimum, gloves and a fluid resistant gown. Examples include: MRSA, Herpes Zoster, Varicella, Scabies, Hepatitis A, E, C. difficile, Salmonella, etc.

## OSHA Bloodborne Pathogen Exposure Control Plan

OSHA is dedicated to employee safety in the workplace. They have developed numerous standards designed to protect the workforce. The Bloodborne Pathogen Standard was developed specifically to protect employees in the health care setting (29 CFR 1910.1030). It states employers must establish an **Exposure Control Plan (ECP)**; which contains an overview of the protocols designed to eliminate or reduce occupational exposure. The following guidelines by OSHA the CDC and others establish a framework for safety.

**Exposure Determination-** Identification of employees who have occupational exposure to blood and/or body fluids, for the purpose of education, vaccination and other measures necessary to protect them from the acquisition of a bloodborne or airborne pathogen

**Engineering Controls-**Methods used to control a hazard. Items include: needless systems, safety needles, sharps containers, waste containers and biological safety cabinets. A schedule must also be established for evaluation of all items to assure that they remain in good working order.

### Criteria for contaminated needles states they must:

Never be bent, broken or recapped by hand

Placed in appropriate containers as soon as feasible

Reusable sharps that are contaminated with blood or body fluids are not stored or handled in a manner that requires health care providers to reach into containers

### Criteria for Safety Needles: Centers for Disease Control and Prevention

Built- in safety control to reduce needlestick injuries before, during or after use

Provides a barrier between the hands and the needle after use

Allows or requires the workers hands to remain behind the needle at all times

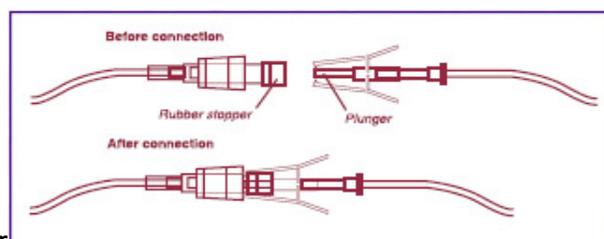
Have safety features integral to the device itself, rather than an accessory

Be in effect prior to assembly and remain in effect after disposal to protect downstream workers

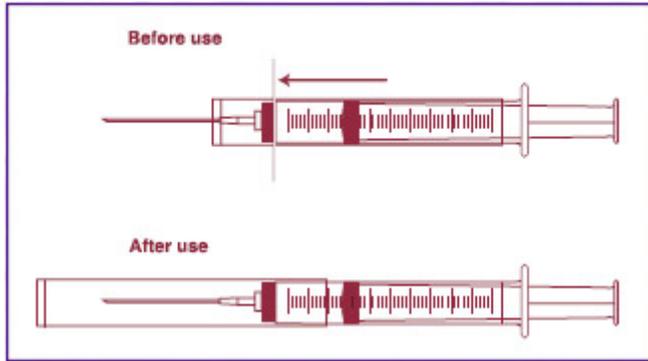
Be simple and easy to operate

Not interfere with the delivery of patient care

Examples include: needless IV connectors, self re-sheathing needles, or blunted surgical needles.



Needleless IV Connector



**Self-Re-sheathing Needle**

[www.cdc.gov](http://www.cdc.gov) How to Prevent Needlestick Injuries: Answers to Some Important Questions

The Needlestick Safety and Prevention Act recommends that facilities evaluate safety devices and document their evaluation. Attachment 1 is a sample “Safe Sharp Evaluation” Tool developed by the CDC Institutes of Oral Health that can be utilized in most settings.

**Criteria for sharps containers states:**

- Proper labeling or color coding
- Maintained upright throughout their use
- Replaced routinely and not allowed to be overfilled
- Be puncture resistant and have leak proof sides and bottoms
- Located as close as possible to the location where the sharps are used
- Closed prior to shipping to prevent

\*\* Research from the CDC indicates that approximately 83% of injuries from hollow bore needles are potentially preventable by utilization of these criteria.

**Work Practice Controls**-Procedures that reduce the likelihood of exposure, i.e. prohibiting the bending, breaking or manually recapping a needle.

**Handwashing**

Contaminated hands are the primary vector for the spread of infections in all health care settings. Each year in the U.S. approximately 99,000 die as the result of healthcare-associated infections (HAI). On average, 1.7 million people develop a HAI annually, making it one of the leading causes of death in the U.S., behind cardiovascular disease and cancer. The total economic burden of HAIs are estimated to be as high as \$45 billion each year. Recently developed policies now make hospitals partially responsible for the financial burden of these infections, creating the need to increase compliance with prescribed hand hygiene protocols.

The World Health Organization (WHO) recently conducted a study on hand hygiene protocols utilized by health care providers. The results indicated that only about 50% of health care workers around the world are complying with the “WHO’s 5 Moments for Hand Hygiene” before patient care. The five moments of hand hygiene are as follows:

1. Before touching a patient
2. Before clean/aseptic procedures

3. After body fluid exposure/risk
4. After touching a patient
5. After touching patient surroundings

Cheng VCC, Tai JWM, Ho SKY, Chan JFW, Hung K, Ho P and Yuen K. Introduction of an electronic monitoring system for monitoring compliance with Moments 1 and 4 of the WHO "My 5 Moments for Hand Hygiene" methodology. BMC Infectious Diseases 2011, 11:151doi:10.1186/1471-2334-11-151.

### **CDC's Guideline for Hand Hygiene in Health-Care Setting**

The guideline maintains that hand hygiene should be performed when hands are contaminated with proteinaceous material, or are visibly soiled with blood or other body fluids. In such cases, hands should be washed with a non-antimicrobial soap and water, or with an antimicrobial soap and water. In all other clinical situations, routine decontamination should be performed on hands that are not visibly soiled by using an alcohol-based handrub.

Hands should be decontaminated **before**:

- Each patient contact
- Inserting urinary catheters, peripheral vascular catheters or other invasive devices not requiring surgery
- Eating, drinking or handling food
- **Preparing and administering medications or injections**
  - Donning sterile gloves when inserting a central intravascular catheter

• Hands should be decontaminated **after**:

- Each patient contact
- Contact with body fluids or excretions, mucous membranes, non-intact skin and wound dressings
- Contact with inanimate objects in a patient's immediate vicinity
- Removing gloves or other personal protective equipment
- Handling objects contaminated with blood or other potentially infectious materials
- Using the toilet, blowing your nose, or covering a sneeze or cough

#### **To these recommendations the CDC adds:**

- Natural nails should be clean, short and have rounded edges
- Artificial fingernails or extenders **should not be worn** while in direct contact with patients at high risk for infection.
- Gloves should be worn if there is a possibility of contact with blood or other potentially infectious materials, mucous membranes and other non-intact skin.
- Hand hygiene should always be performed following patient care and subsequent glove removal.

\*Healthcare workers who have exudative lesions/weeping dermatitis or open sores should cover wounds, if possible, and refrain from direct patient care until the condition resolves

#### **Guidelines for Technique: Handwashing with soap and water**

- Wet the hands with water, apply soap and rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands and fingers.

- Rinse and dry thoroughly with a disposable towel. Avoid use of hot water, as it may increase the risk of dermatitis.
- Use that towel to turn off the faucet before disposing.

### **Decontamination with an alcohol-based handrub**

- Apply the handrub to the palm of one hand. Follow manufacturer's recommendations regarding the amount of product to use.
- Rub the hands together, covering all surfaces of the hands and fingers until the hands are dry.

**Surgical hand antisepsis** should be performed before donning sterile gloves in advance of performing a surgical procedure. Antimicrobial soap or an alcohol-based hand rub may be used.

### **Surgical hand antisepsis using antimicrobial soap**

- Scrub hands and forearms for the duration recommended by the manufacturer (typically 2-6 minutes) before donning sterile gloves. Longer scrub times are not necessary.

### **Surgical hand antisepsis using a hand rub**

- Pre-wash the hands and forearms.
- Follow manufacturer's instructions for using the rub.
- Allow hands and forearms to dry thoroughly before donning sterile gloves.

CDC. Guideline for Hand Hygiene in Health-Care Settings. Morbidity and Mortality Weekly Report, Oct. 25, 2002. Vol. 51, No. RR-16.RR-16.

Hand Hygiene in Health-Care Settings, Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Centers for Disease Control and Prevention, 2002.

### **Personal Protective Equipment (PPE): OSHA's Bloodborne Pathogen Standard**

- Used when employees are exposed to blood or other potentially infectious materials (OPIM)
- Provided at no cost to employees, in appropriate sizes and in hypoallergenic alternatives
- PPE prevents blood or OPIM from contaminating employee's street clothing, skin, undergarments, eyes or mouth
- Readily available, conveniently located without having to ask for it or have another employee retrieve it
- Inspected, repaired or replaced as needed
- Contaminated PPE and garments contaminated with blood are removed ASAP and prior to leaving the work area
- Contaminated PPE is placed in designated area or container
- Single use gloves are replaced when contaminated or non-functional and are never washed or decontaminated for reuse
- Utility gloves are discarded when deteriorated
- Masks and eye protection are worn when a splash to the eyes, mouth, or mucous membranes is reasonable anticipated

-Gowns, aprons and other protective body clothing are worn when dictated by the exposure situation

**Vaccinations: Hepatitis B vaccination will:**

- Be made available to all employees with occupational exposure within 10 days of hire and following training
- Be provided at no charge, and at a reasonable place and time
- Employees who decline the Hepatitis B vaccination are required to sign the waiver
- Employees who decline the Hepatitis B vaccination may request it at a later date

## Vaccines: Primary Prevention

**Recommended Adult Immunization Schedule**  
**UNITED STATES - 2010**  
Note: These recommendations must be read with the footnotes that follow containing number of doses, intervals between doses, and other important information.

**Figure 1. Recommended adult immunization schedule, by vaccine and age group**

VACCINE	AGE GROUP	19-26 years	27-49 years	50-59 years	60-64 years	≥65 years
Tetanus, diphtheria, pertussis (Td/Tdap) <sup>a,c</sup>		Substitute 1-time dose of Tdap for Td booster; then boost with Td every 10 yrs				Td booster every 10 yrs
Human papillomavirus (HPV) <sup>a,c</sup>		3 doses (females)				
Varicella <sup>a,c</sup>		2 doses				
Zoster <sup>a</sup>					1 dose	
Measles, mumps, rubella (MMR) <sup>a,c</sup>		1 or 2 doses			1 dose	
Influenza <sup>a,c</sup>		1 dose annually				
Pneumococcal (polysaccharide) <sup>a,d</sup>		1 or 2 doses				1 dose
Hepatitis A <sup>a,c</sup>		2 doses				
Hepatitis B <sup>a,c</sup>		3 doses				
Meningococcal <sup>a,c</sup>		1 or more doses				

<sup>a</sup>Covered by the Vaccine Injury Compensation Program.   
For all persons in this category who meet the age requirements and who lack evidence of immunity (e.g., lack documentation of vaccination or have no evidence of prior infection)   
Recommended if some other risk factor is present (e.g., on the basis of medical, occupational, lifestyle, or other indications)   
No recommendation

Report all clinically significant postvaccination reactions to the Vaccine Adverse Event Reporting System (VAERS). Reporting forms and instructions on filing a VAERS report are available at [www.vaers.hhs.gov](http://www.vaers.hhs.gov) or by telephone, 800-822-7967. Information on how to file a Vaccine Injury Compensation Program claim is available at [www.hrsa.gov/vaccinecompensation](http://www.hrsa.gov/vaccinecompensation) or by telephone, 800-338-2382. To file a claim for vaccine injury, contact the U.S. Court of Federal Claims, 717 Madison Place, N.W., Washington, D.C. 20005; telephone, 202-337-6400. Additional information about the vaccines in this schedule, extent of available data, and contraindications for vaccination is also available at [www.cdc.gov/vaccines](http://www.cdc.gov/vaccines) or from the CDC-INFO Contact Center at 800-CDC-INFO (800-232-6243) in English and Spanish, 24 hours a day, 7 days a week. Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

\*3 Doses of HPV vaccine now approved for males ages 9-26 years. **Note\*\*\* Only 1** seasonal flu vaccine recommended for HCW, unless a wild strain emerges.