Transmission-Based Isolation Precautions in the OR:

CRITICAL PRACTICES TO PREVENT THE SPREAD OF INFECTIOUS DISEASES IN THE OPERATIVE SETTING

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This article will introduce surgical technologists to the CDC-recommended precautions to prevent transmission of infectious organisms in the health care setting and delineate the specific practices used in the perioperative setting.

INTRODUCTION

In order to prevent the spread of infectious organisms in the health care setting, one must understand how and where they live, how they are transmitted, and how to interrupt the transmission to patients and health care workers (HCW). This article discusses health care-associated infection (HAI), reviews terminology related to infection prevention, describes organisms responsible for these infections, and reviews best practices to prevent their spread using Standard Precautions and Transmission-Based Isolation Precautions in the OR setting.

A report from the CDC updates previous estimates of health care-associated infections. In American hospitals alone, health care-associated infections account for an estimated 1.7 million infections with annual direct medical costs to hospitals in the range of $28-45 billion, and result in 99,000 associated deaths each year. Catheters and invasive devices are the number one exogenous cause of hospital-associated infections.[1] Published studies estimate that up to 70 percent of HAIs may be preventable.[2] Approximately 290,000 surgical site infections (SSIs) are diagnosed each year and cost between $10,000-25,000 to treat.[3]

LEARNING OBJECTIVES

- Define health care associated infection (HAI)
- List the common infectious organisms found in the health care setting
- Differentiate colonization from infection
- Explain the role of Personal Protective Equipment (PPE)
- Compare and Contrast Standard Precautions (SP) from Transmission Based Precautions (TBP)

SSI is the second most common type of HAI, accounting for 22 percent of all HAIs. Incision is the most common single site of nosocomial infection in surgical patients, accounting for 30-40 percent of all infections in such patients. Each SSI is associated with approximately a week to 10 additional postoperative hospital days.[4,5] Patients who contract an SSI have a risk of death that is between two and 11 times greater than operative patients without an SSI.[6,7] Seventy-seven percent of deaths among patients with an SSI are directly attributable to the SSI.[8]

PREVENTING THE TRANSMISSION OF INFECTIOUS DISEASES

The "chain of infection" is a model that shows each of the conditions for the spread of infectious microorganisms (Figure 1). "All infectious diseases are caused by a microorganism (*eg*, bacteria, virus, mold, fungi, or parasite). For survival, each microorganism sustains itself in a source. The source may be a nonliving host, such as a human or animal, or a nonliving source, such as biohazardous waste or laboratory specimen. To cause a disease, the microorganism must have a portal of exit from the source (*eg*, respiratory tract or spill) and a method of spread."[9] Methods of spread for infectious diseases are airborne, droplet, contact (direct and indirect), bloodborne, vector (insect), and fecal-oral. The microorganism must find its way into a new host via a port of entry. Ports of entry include breaks in skin (cuts, scrapes and needlesticks), exposure of mucous membranes, respiratory tract or oral ingestion. Lastly, the host must be susceptible to the disease. Susceptibility includes current illness, lack of vaccination, immunocompromised state, open incisions or direct transmission during an invasive procedure. To prevent the spread of infection, we must continually break the chain of infection.

FIGURE 1. BREAKING THE CHAIN OF INFECTION

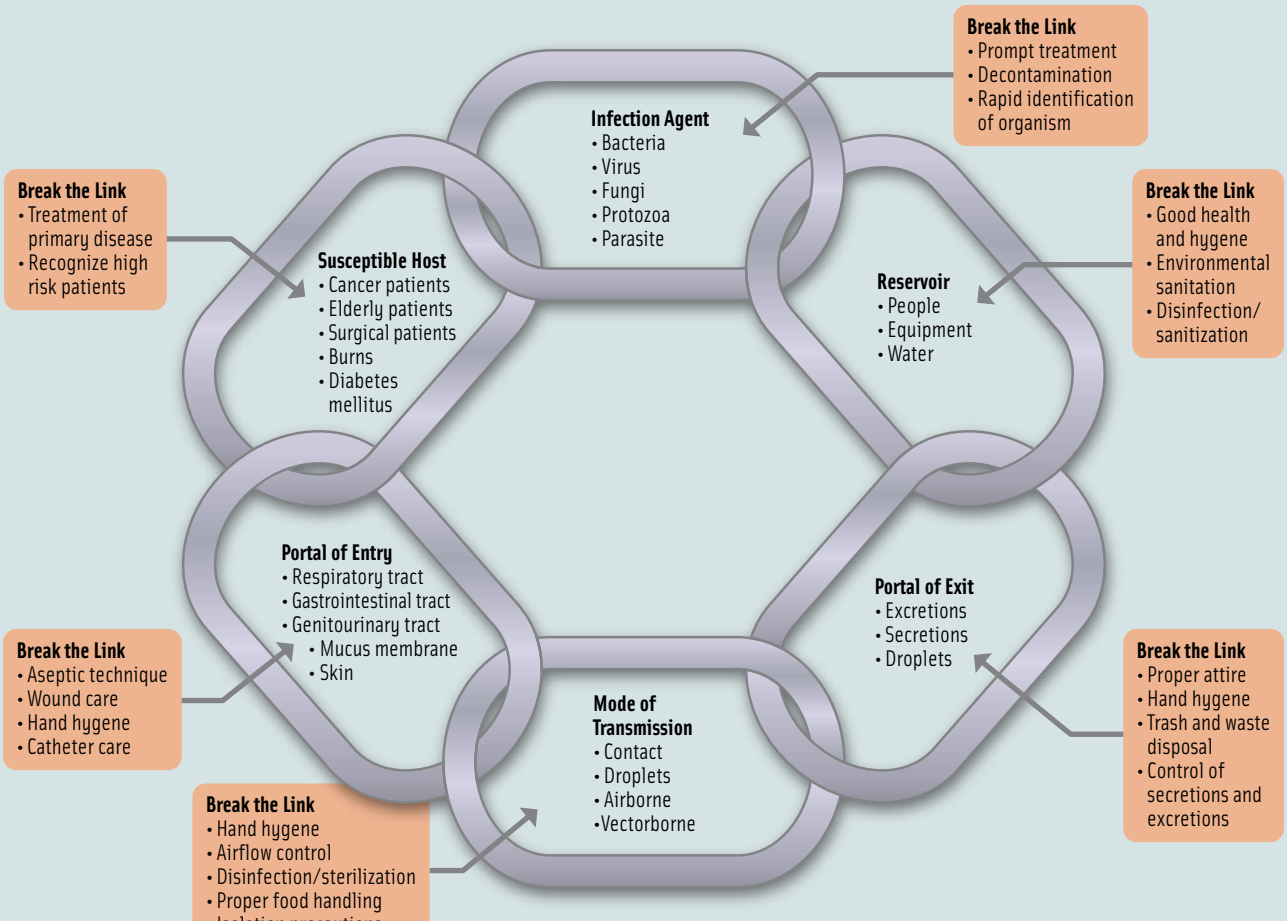


Figure 1 originally appeared in the December 2009 issue of *The Surgical Technologist*

PART I: TERMINOLOGY REVIEW

Agents of Infection

Airborne infectious agents are carried on the air currents for periods of time in sub-micron-sized respiratory droplets. Airborne precautions prevent transmission of infectious agents that remain infectious over long distances when suspended in the air (*eg,* rubeola virus [measles], varicella virus [chickenpox and disseminated zoster/shingles], and *Mycobacterium tuberculosis*). Health care personnel caring for patients on airborne precautions must wear a mask or respirator that is donned prior to entering the room. Whenever possible, nonimmune personnel should not care for patients with vaccine-preventable airborne diseases. Negative-pressure isolation rooms are used to prevent organisms from travelling on air currents outside the room.

Bioaerosols are an airborne dispersion of particles containing whole or parts of biological entities, such as bacteria, viruses, dust mites, fungal hyphae, or fungal spores. Infectious bioaerosols can be generated from human sources (*eg,* coughing, sneezing, talking or singing; during suctioning or wound irrigation), wet environmental sources (*eg*, HVAC and cooling tower water with Legionella) or dry sources (*eg,* construction dust with spores produced by *Aspergillus* spp.).

Blood-borne pathogens (BBP) are pathogenic microorganisms that are carried or transmitted via the blood and fluids that contain blood. This includes HBV, HCV, and HIV.

Colonization describes the presence of microorganisms on or within body sites without infection or immune response, and is a source of potential transmission. In many instances, colonization and carriage are synonymous. Multi-drug-resistant organism (MDRO)-colonized patients are isolated in many institutions to prevent the spread to other patients via HCW hands, clothing and equipment.

Extended spectrum beta-lactamase [ESBL]-producing organisms are usually gram-negative rods, such as *Pseudomonas aeruginosa*, *E. coli* and *Klebsiella* pneumonia. They produce an enzyme that deactivates most beta-lactam antibiotics, including penicillin, cephalosporin and aztreonam.[10] Infections with ESBL-producing organisms have been associated with poor outcomes. Most facilities isolate patients infected or colonized with ESBL-producing gram negative rods.

Multidrug-resistant organisms (MDROs) generally refer to bacteria that are resistant to one or more classes of antimicrobial agents and usually are resistant to all but one or two commercially-available antimicrobial agents (*eg,* Methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin-resistant *Enterococcus* (VRE), drug resistant Acinetobacter, or extended-spectrum beta-lactamase [ESBL]-producing or intrinsically resistant gram-negative bacilli such as drug resistant *E. coli*).

Types of Infection

A **health care-associated infection (HAI)** is an infection that develops in a patient who is cared for in any setting where health care is delivered and is directly related to receiving that care. In ambulatory and home settings, HAI applies to any infection that is associated with a medical or surgical intervention. Since the geographic location of infection acquisition is often uncertain, the preferred term is considered to be health care-*associated* rather than health care-*acquired*. Surgical site infections are HAIs.

Nosocomial infection is a term derived from two Greek words, "*nosos*" (disease) and "*komeion*" (to take care of), and refers to any infection that develops during, or as a result of, an admission to an acute-care facility and was not incubating at the time of admission.

An **opportunistic infection** is an infection by a microorganism that normally does not cause disease but becomes pathogenic when the body's immune system is impaired and unable to fight off infection. This occurs in persons with abnormally-functioning immune systems (AIDS patients or transplant patients receiving immunosuppressive drugs).

Precautions

Standard precautions[12] are a group of infection prevention practices that apply to all patients, regardless of diagnosis or presumed infection status. Standard precautions are based on the principle that all blood, body fluids, secretions, excretions (except sweat), nonintact skin, and mucous membranes may contain transmissible infectious agents. OSHA's 1991 rule on occupational exposure to bloodborne pathogens in health care settings mandates these precautions in all health care settings.

Principles:

Standard precautions include the use of personal protective equipment, hand hygiene, respiratory hygiene and safe sharps practices.

Practices:

Touching mucous membranes, nonintact skin and body substances require the use of PPE. In addition, equipment or items in the patient environment likely to have been con-

taminated with blood or body fluids must be handled in a manner to prevent transmission of infectious agents (*eg*, wear gloves for handling, contain heavily-soiled equipment, properly clean and disinfect or sterilize reusable equipment before use on another patient).

Transmission-based precautions are a group of infection-prevention practices used when the routes of transmission are not completely interrupted using standard precautions alone. These organisms are not transmitted through blood and body fluids alone. For some diseases that have multiple routes of transmission (*eg,* SARS), more than one transmission-based precaution category may be used. Consult the *HICPAC/CDC Isolation Guideline* recommended precautions for specific infections.

Principles:

Transmission-based precautions are always used in addition to standard precautions. They include the use of personal protective equipment, hand hygiene and patient isolation practices, and are used to help decrease the potential for HAI in the patient population and protect health care workers during patient care.

Practices:

Touching patients or their environment (regardless of visible soil) always requires the use of personal protective equipment (PPE) such as gowns, gloves and eye protection. In addition, equipment or items in the patient environment must be handled in a manner to prevent transmission of infectious agents (*eg*, wear gloves for handling, contain heavily-soiled equipment, properly clean and disinfect or sterilize reusable equipment before use on another patient).

There are three categories of transmission-based precautions: contact precautions, droplet precautions, and airborne precautions.

Airborne precautions include the use of **airborne isolation rooms (AIIR)**, also known as negative-pressure isolation rooms, which are single-occupancy patient-care rooms used to isolate persons with a suspected or confirmed airborne infectious disease. Air pressure in the room is set as negative to the outside of the room, which means that air flows into the room upon door opening (to keep potential microorganisms in the air inside the room). Environmental factors (higher air exchange rates) are controlled in AIIRs to minimize the transmission of infectious agents that are usually transmitted from person to person by droplet nuclei associated with coughing or aerosolization of contaminated fluids. Operating rooms are not AIIR/negative-pressure rooms. PACU usually has a negative pressure room in which to recover respiratory isolation patients. AIIR room doors must remain closed in order to maintain the pressure differential. If the door remains open, the pressure between the room and the hall will equalize, resulting in the movement of organisms from inside to outside of the room. Barrier precautions are an extension of contact precautions.

Barrier Precautions include masks, hats, gowns, gloves, eye protection and drapes, which create a protective barrier between health care workers and patients. Barrier precautions are an extension of contact precautions.

Contact Precautions are intended to prevent transmission of infectious agents, most commonly drug resistant organisms, which are spread by direct or indirect contact with the patient or the patient's environment. Contact precautions are used in addition to standard precautions. Health care personnel caring for patients in contact precautions should wear a gown and gloves for all interactions that may involve contact with the patient or potentially contaminated areas in the patient's environment (*eg*, stretcher, linens). Donning PPE before room entry and discarding it before exiting is necessary in order to contain pathogens in the room—especially those transmitted through environmental contamination (*eg*, VRE, C. *difficile*, MRSA, noroviruses/intestinal tract pathogens and RSV).

Droplet Precautions are intended to prevent transmission of pathogens spread through close-respiratory or mucous-membrane contact with respiratory secretions.

A small MRSA colony under an electron microscope. This colony is approximately two microns across.

Because these pathogens do not float on air currents, as with airborne infectious organisms, special air-handling and ventilation are not required to prevent droplet transmission. Infectious agents for which droplet precautions

are indicated include *B. pertussis*, influenza virus, H1N1, adenovirus, rhinovirus, *N. meningitides*, and systemic/invasive group *A. streptococcus* (for the first 24 hours of antimicrobial therapy). Health care personnel must wear a mask (a respirator is not necessary) for close contact (within three feet) with the infected patient. The mask is generally donned upon room entry. Patients on droplet precautions, who must be transported outside of the room, should wear a mask and follow respiratory hygiene/cough etiquette.

The residue of evaporated droplets, which can contain particles approximately three-five microns in size, is usually expelled in an area within three feet of the person, and is deposited in the environment. These infectious droplets remain on the patient, items and equipment (stretcher, bedside table, IV poles etc) and do not float on air currents.

Engineering controls require the removal or isolation of a workplace hazard through technology. AIIRs, a protective environment, safety needle devices and sharps containers are examples of engineering controls.

Hand hygiene is a general term that applies to any one of the following: 1) handwashing with plain (nonantimicrobial) soap and water; 2) antiseptic handwash (soap containing antiseptic agents and water); 3) antiseptic handrub (waterless antiseptic product, most often alcohol-based, rubbed on all surfaces of the hands); or 4) surgical hand antisepsis (antiseptic handwash or antiseptic handrub performed preoperative-

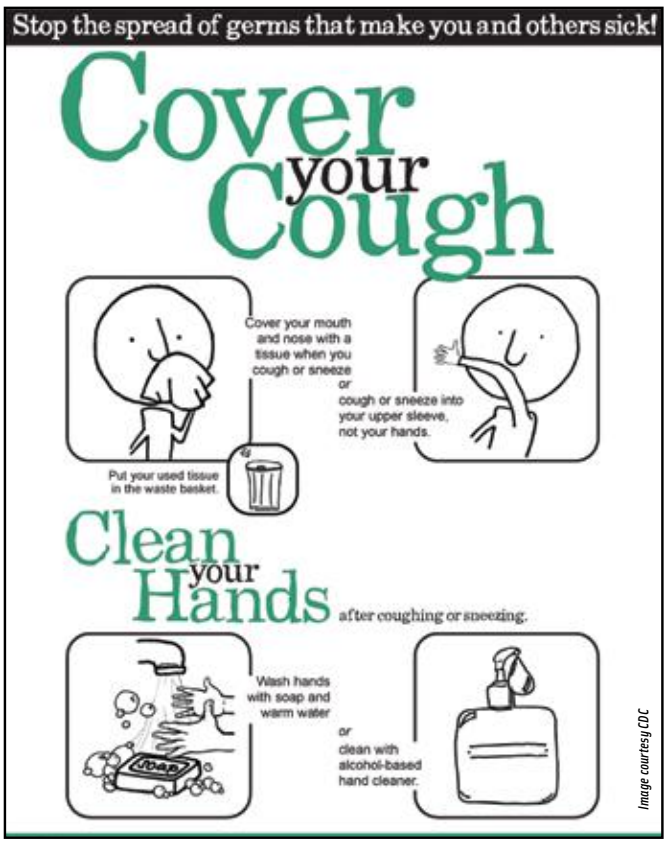
CDC Best Practices for Standard Precautions and Transmission-Based Precautions

COMPONENT	Standard Precautions (Every Patient)	Transmission Based Precautions (Isolation Patients) *May vary based on facility. *Know your facility's protocol!*
Hand hygiene	After touching blood, body fluids, secretions, excretions and contaminated items. Immediately after removing gloves and between patient contacts.	Same as SP
Gloves	For touching blood, body fluids, secretions, excretions and contaminated items. Use for touching mucous membranes and nonintact skin.	For *all contact* with a patient, patient's environment, and/or equipment in a patient's room. (Contact and droplet only.)
Gown	During procedures and patient-care activities when contact of clothing/exposed skin with blood/body fluids, secretions and excretions is anticipated.	For *all contact* with a patient, patient's environment, and/or equipment in a patient's room. (Contact and droplet only.)
Mask, eye protection (goggles), face shield	During procedures and patient-care activities likely to generate splashes or sprays of blood, body fluids and secretions. Especially during suctioning and endotracheal intubation.	Droplet: Mask with eye protection must be worn within three feet of the patient. Airborne: Respirator (N-95/PAPR) or surgical mask before entering a room. TB always requires a fit-tested respirator. Refer to your facility's requirement for other organisms such as varicella/disseminated zoster.
Patient-care equipment	Handle in a manner that prevents transfer of microorganisms to others and to the environment. Wear gloves if visibly contaminated and perform hand hygiene.	*All contact* with all equipment used on a patient or in a patient's room requires gown and gloves. *All* equipment must be disinfected before leaving the room. (Contact and droplet only.)
Environmental control	Develop procedures for routine care, cleaning, and disinfection of environmental surfaces – especially frequently-touched surfaces in patient-care areas. Standard cleaning with low-level disinfectants for noncritical items such as tables, Mayo, BP cuffs etc.	Organism-specific protocols are required (*eg,* TB, *Clostridium difficile*) for cleaning. TB requires an intermediate-level disinfectant. *Clostridium difficile* requires bleach.
Textiles and laundry	Handle in a manner that prevents the transfer of microorganisms to others and to the environment.	*All contact* with laundry/linen that contacted patient or was in a patient's room requires gown and gloves. (Contact and droplet only.)
Needles and other sharps	Do not recap, bend, break or hand-manipulate used needles. If recapping is required, use a one-handed scoop technique only. Use safety features when available and place used sharps in a puncture-resistant container.	Same as SP
Patient resuscitation	Use a mouthpiece, resuscitation bag or other ventilation devices to prevent contact.	Based on the situation, if time permits, wear gown and gloves. (Contact and droplet only.)

ly by surgical personnel to eliminate transient hand flora and reduce resident hand flora). Hand hygiene is a critical method of preventing infection. Health care workers not cleansing their hands before and after patient/environment contact is the most common mode of transmitting microorganisms to patients.

A **protective environment** is a specialized patient-care area, usually in a hospital, that has a positive air flow relative to the corridor (*ie*, air flows from the room to the outside adjacent space). Other components include the use of scrubbable surfaces instead of materials such as upholstery or carpeting, cleaning to prevent dust accumulation, and prohibition of fresh flowers or potted plants. The operating room is a protective environment.

Respiratory hygiene, and **cough etiquette** are a combination of measures designed to minimize the transmission of respiratory pathogens via droplet or airborne routes in the health care setting. The components of respiratory hygiene/cough etiquette are: 1) covering the mouth and nose during coughing and sneezing; 2) using tissues to contain respiratory secretions with prompt disposal into a no-touch receptacle; 3) offering a surgical mask to persons who are coughing to decrease contamination of the surrounding environment; and 4) turning the head away from others and maintaining spatial separation, ideally more than three feet, when coughing. These measures are targeted to all patients with symptoms of respiratory infection and their accompanying family members or friends beginning at the point of initial encounter with a health care setting.



Source control is the process of containing an infectious agent either at the portal of exit from the body or within a confined space. The term is applied most frequently to containment of infectious agents transmitted by the respiratory route but could apply to other routes of transmission, (*eg*, a draining wound, vesicular or bullous skin lesions). Respiratory hygiene/cough etiquette that encourages individuals to "cover your cough" and wear a mask is a source control measure.

Protective Equipment

A **high-efficiency particulate air (HEPA) filter** is an air filter that removes more than 99.97 percent of particles over 0.3 microns in size (the most penetrating particle size) at a specified flow rate of air.

A micron (µm) is a unit of measure equivalent to one-millionth of a meter. They are also called micrometers and are equal to 0.001 mm.

Personal protective equipment (PPE) is made up of a variety of barriers used alone or in combination to protect mucous membranes, skin and clothing from contact with infectious agents. PPE includes gloves, masks, respirators, goggles, face shields and gowns.

A **procedure mask** covers the nose and mouth and is intended for use in general patient care situations. These masks generally attach to the face with ear loops rather than ties or elastic.

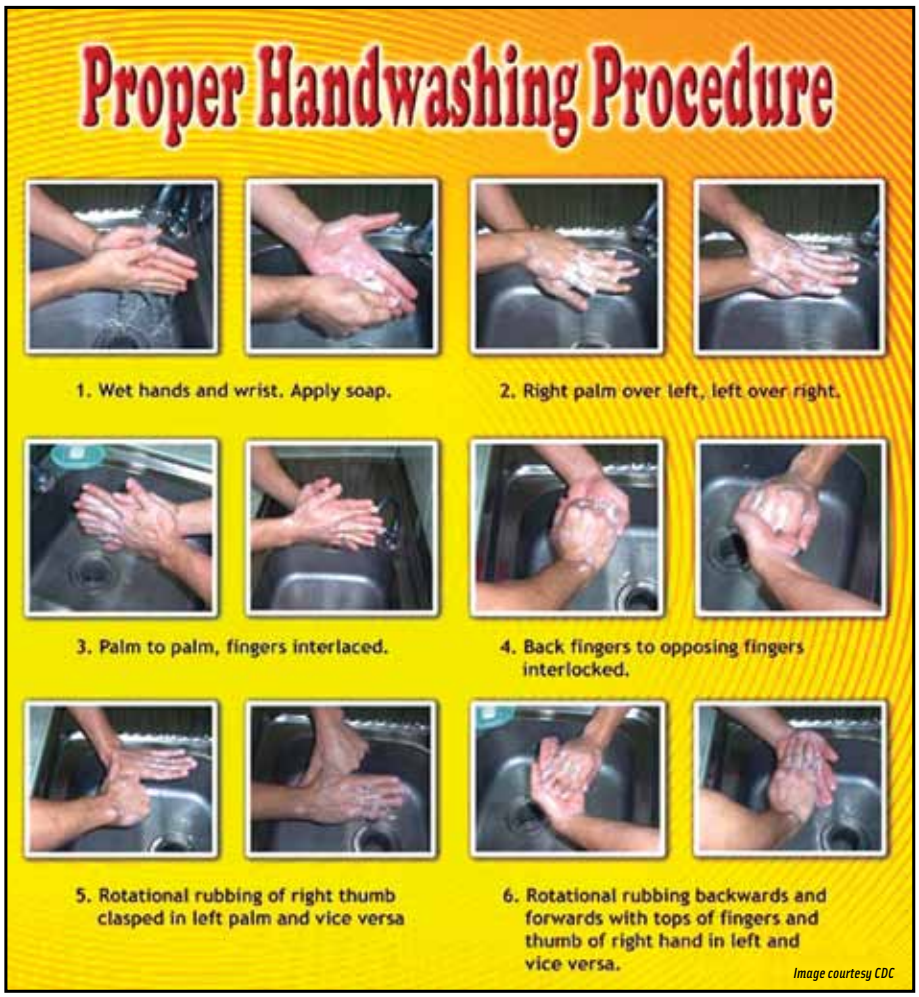
A **respirator** is a personal protective device worn by health care personnel to protect them from inhalation exposure to airborne infectious agents that are less than five microns in size. These include infectious droplet nuclei from patients with *M. tuberculosis,* smallpox, SARS-CoV. The CDC's National Institute for Occupational Safety and Health (NIOSH) certifies respirators used in health care settings. The N95 disposable particulate air purifying respirator and powered air-purifying respirators (PAPRS) with high efficiency filters are the types used most commonly by health care personnel.

Surgical masks are worn over the mouth and nose by operating room personnel during surgical procedures to protect both surgical patients and operating room personnel from transfer of microorganisms and body fluids. Surgical masks also are used to protect health care personnel from contact with large infectious droplets (larger than three

microns in size). Surgical masks do not protect against inhalation of small particles or droplet nuclei and should not be confused with particulate respirators that are recommended for protection against selected airborne infectious agents.

PART II: COMMON INFECTIOUS ORGANISMS FOUND IN THE HEALTH CARE SETTING

Infectious organisms are transmitted in the health care setting by various modes, such as direct or indirect contact, respiratory secretions and droplets, and through ingestion. One of the most common methods of transmission is through touching surfaces contaminated with bacteria, fungi or viruses and touching either one's self or the patient. Most HAIs are caused by HCWs transferring infectious organisms to patients, due to poor hand hygiene and sloppy practices, and not from patient to patient directly.



Bacteria, Fungi, Parasites and Viruses

Bacteria are single-celled organisms and multiply using cellular division and chromosomal replication. "A group of bacteria is referred to as a colony (you may see the number of bacteria present in a lab specimen result quantified as colony-forming units or CFU). The bacterial cell contains several components: DNA, ribosomes, membrane, and cell wall. Some bacteria may have additional components such as an outer membrane, capsule, flagella, pili, and endospores."[11] These components contribute to the microbe's ability to live, both in the body and in the environment. Bacteria are classified based on their morphological and chemical properties, which is called taxonomy.

Taxonomy of bacteria is based on the "Gram-stain characteristic (gram-positive v. gram-negative), the morphological features (cocci v. bacilli (rods)), and oxygen utilization (aerobic v. anaerobic)." There are other properties used to classify bacteria using laboratory techniques such as coagulase, hemolysis, and enzyme production. Bacteria are named according to genus and species and there are many species under a single genus. For example, *Staphylococcus* is a genus, but there are numerous species of *Staphylococcus.* The two most common species of *Staphylococcus* are: 1) *aureus* (both MRSA and MSSA); and 2) *epidermis* (AKA coagulase negative *Staphylococcus* or CNS).

Fungi tend to infect patients with altered immune systems and are classified into two groups based on their appearance: yeasts and molds. Yeasts are round and reproduce through budding. Molds have tube-like projections called hyphae and reproduce by elongation and fragmentation. Fungi produce spores and are not killed by antibiotics. The more common fungi found in surgical settings are *Aspergillus* (mold that lives in dust and can be spread during construction in the operating room), and *Candida* (yeast that lives in the gastrointestinal tract and can be found on skin).

Parasites are organisms that live in or on another and take advantage of the host. These organisms are classified into three categories: protozoa, flukes/tapeworms, and roundworms. *Pneumocystis carinii* is a protozoan that causes

pneumonia in immunocompromised patients, such AIDS patients; *P. carinii* is also classified as a fungus. *Trichomonas* is a protozoan that causes sexually transmitted diseases.

Viruses don't cause surgical-site infections, but are important to control in health care environments. Viruses need living host cells to grow and reproduce and are not killed by antibiotics. They have RNA or DNA, a protein coat, and sometimes an outer envelope (nonenveloped viruses are harder to kill in the environment). A virus can also lie dormant for years before it begins reproducing. Taxonomy is related to the size, RNA/DNA, the envelope, and the mode of replication. We use vaccines to prevent infection. Live vaccines are called "attenuated" and are weakened to the point that they can trigger our body to produce antibodies but not cause infection. Inactivated vaccines are heated or chemically treated and also trigger our body to produce antibodies without causing infection. Health care workers should be vaccinated against measles, mumps, varicella, influenza and hepatitis before working in a health care environment.

Prions are proteinaceous, infectious particles and have no DNA or RNA. Creutzfeldt-Jakob disease (CJD) is the most common prion we encounter in the operating room. CJD causes spongiform encephalopathy and profoundly affects the neurological system (rapid progression leads to death). CJD is spread through contact with infected tissue and is not killed using standard sterilization methods. It is important to remember that CJD requires special care and handling of instrumentation after use on these patients. Your operating room should have CJD precautions and protocols to follow in the event a CJD patient requires surgery.

Common Multidrug Resistant Organisms (MDROs) in the Health Care Setting

MRSA is a type of staph that is resistant to some of the antibiotics normally used to treat them. Approximately one percent of the general population is colonized with MRSA. One of the most common sites of MRSA colonization is the nose. Colonization may last for a short time or last for years. Infection occurs when the *staphylococcus* bacteria cause disease in the person. MRSA is most often spread by direct (hand) contact with the infected person. Vancomycin-resistant *enterococci* (VRE) is a germ that is typically only carried by some sick people. Therefore, VRE is often found in hospitals and other health care settings. People get VRE by direct contact (touching) with objects or surfaces that are contaminated with VRE. VRE is *not* spread through the air. People at risk for getting VRE are those who:

- have chronic illnesses
- have had recent surgery
- have weakened immune systems
- have recently taken certain antibiotics

In these people, contact with VRE may lead to colonization. People who are colonized with VRE may go on to develop an infection with VRE. The most common infections caused by VRE are urinary tract infections, wound infections and bloodstream infections. The people who are healthy may come in contact with VRE but are at a very low risk of becoming colonized or infected with VRE.

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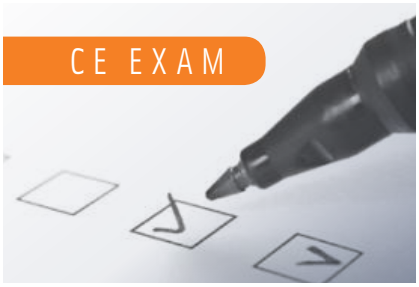

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Transmission-Based Isolation Precautions in the OR: Critical Practices to Prevent the Spread of Infectious Diseases in the Operative Setting

327 **MARCH 2011** 2 CE credits

1. HAIs cost American hospitals ___ per year.
a $15-25 million
b. $28-45 million
c. $10-15 billion
d. $28-45 billion

2. All infectious diseases are caused by a ___.
a. Port of entry
b. Microorganism
c. Chain of infection
d. Vector

3. According to published estimates, ___ or HAIs may be preventable.
a. 70
b. 50
c. 90
d. 30

4. Infectious diseases are spread by ___ methods.
a. Airborne
b. Direct contact
c. Vector
d. All of the above

5. Current illness and lack of vaccination increase ___ of/to disease.
a. Susceptibility
b. Indicators
c. Methods
d. None of the above

6. Infectious agents do not include ___.
a. Fungi
b. Bacteria
c. Infected individuals
d. Protozoa

7. Breaking the "Mode of Transmission" link involves all but ___.
a. Airflow control
b. Isolation precautions
c. Sterilization
d. Aseptic technique

8. ___ is not an airborne infectious agent.
a. HIV
b. Bioaerosols
c. Varicella virus
d. None of the above

9. Microorganisms on or within body sites without infection is/are called ___.
a. Fungal spores
b. Colonization
c. Respiratory droplets
d. Multi-drug-resistant organisms

10. Infections directly related to receiving medical care are called ___.
a. Health care-associated
b. Nosocomial
c. Opportunistic
d. Viral

11. AIDS is an example of a/an ___ infection.
a. HAI
b. Nosocomial
c. Opportunistic
d. Bacterial

12. Blood-borne pathogens include ___.
a. HCV
b. HIV
c. HBV
d. All of the above

13. PPE is not associated with ___.
a. Barrier precautions
b. Contact precautions
c. Droplet precautions
d. Engineering controls

14. Respirators are required PPE when dealing with airborne infectious agents ___.
a. Less than five microns in size
b. Less than seven microns in size
c. More than five microns in size
d. All of the above

15. ___ are worn in general patient care situations.
a. Respirators
b. Procedure masks
c. Surgical masks
d. Eye protection

16. Respirators are required when handling patients with ___.
a. Tuberculosis
b. SARS
c. Smallpox
d. All of the above

17. Containing ones own airborne droplets is a part of ___.
a. Respiratory hygiene
b. Hand hygiene
c. Cough etiquette
d. A & C

18. Organisms that live in or on another and take advantage of the host are ___.
a. Viruses
b. Parasites
c. Protozoa
d. Prions

19. MRSA and Vancomycin-resistant enterococi (VRE) are examples of ___.
a. Airborne infectious agents
b. Prions
c. Multidrug Resistant Organisms
d. All of the above

20. Those who contract VRE typically have ___.
a. Recently had surgery
b. Weakened immune systems
c. Chronic illnesses
d. All of the above

TRANSMISSION-BASED ISOLATION PRECAUTIONS IN THE OR 327 **MARCH 2011** 2 CE credits

NBSTSA Certification No.

AST Member No.

☐ My address has changed. The address below is the new address.

Name

Address

City State Zip

Telephone

	a	b	c	d		a	b	c	d
1	☐	☐	☐	☐	11	☐	☐	☐	☐
2	☐	☐	☐	☐	12	☐	☐	☐	☐
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9	☐	☐	☐	☐	19	☐	☐	☐	☐
10	☐	☐	☐	☐	20	☐	☐	☐	☐

Mark one box next to each number.
Only one correct or best answer can be selected for each question.