Sterile Technique

Introduction

The following proposed Recommended Practices for Sterile Technique is presented for review and comment. This is a DRAFT. These recommended practices are intended as achievable recommendations representing what is believed to be an optimal level of practice. Policies and procedures will reflect variations in practice settings and/or clinical situations that determine the degree to which the recommended practices can be implemented. AORN recognizes the various settings in which perioperative nurses practice, and as such, these recommended practices are intended as guidelines adaptable to various practice settings. These practice settings include traditional operating rooms (ORs), ambulatory surgery centers, physicians’ offices, cardiac catheterization laboratories, endoscopy suites, radiology departments, and all other areas where surgery and other invasive procedures may be performed.

Purpose

These recommended practices provide guidance for establishing and maintaining a sterile field by following the principles and implementing the processes of sterile technique. Aseptic practices prevent microbial contamination. Sterile technique involves the use of specific actions and activities to prevent contamination and maintain sterility of identified areas during an invasive procedure. Implementing sterile technique when preparing, performing, or assisting with invasive procedures is the cornerstone of preventing microbial contamination and maintaining sterility during invasive procedures.

The creation and maintenance of a sterile field can directly influence patient outcomes. All individuals who are involved in invasive procedures have a responsibility to provide a safe environment for patients. Perioperative team members must be vigilant in safeguarding the sterility of the field and ensuring that the principles and processes of sterile technique are followed. Perioperative educators and managers can promote safe perioperative care by providing an environment where team members have the freedom to question and stop unsafe practices without fear of repercussion.

The perioperative registered nurse (RN) uses ethical principles to make clinical decisions and act upon them. Adhering to the principles of and implementing processes for sterile technique is an ethical obligation and a matter of individual conscience. Perioperative team members must understand the professional responsibility to ensure that contamination of the sterile field is remedied immediately, and to make certain that any item for which sterility is in question is not used. Adhering to the principles of and implementing the processes for sterile technique and taking immediate action to protect the patient when breaks in sterile technique occur meets the maxim, “first, do no harm.” The perioperative team serves as the protective intermediary between patients and personnel whose practices do not meet the highest standards of sterile technique. Perioperative nurses have a long-standing reputation of patient advocacy and working together with members of the health care team to provide a safe perioperative environment for patients undergoing invasive procedures.

Evidence Review

A medical librarian conducted a systematic review of the MEDLINE®, CINAHL®, Scopus®, and Cochrane Database of Systematic Reviews for meta-analyses, randomized and nonrandomized trials and studies, systematic and nonsystematic reviews, and opinion documents and letters. Search terms included sterile field, sterile technique, aseptic technique, aseptic practices, surgical drapes, double-gloving, assisted gloving, closed gloving, time-related sterilization, event-related sterilization, surgical attire, protective clothing, sterile supplies, sterile barriers, barrier precautions, body-exhaust suits, space suits, laminar air flow, bowel technique, (glove expansion AND fluids), (glove perforation AND electrosurgery), strikethrough, Spaulding’s criteria, product packaging, and equipment contamination.
The lead author and medical librarian identified and obtained relevant guidelines from government agencies, other professional organizations, and standards-setting bodies. The lead author assessed additional professional literature, including some that initially appeared in other articles provided to the author.

The initial search was confined to 2006 to 2011, but the time restriction was not considered in subsequent searches. The librarian also established continuing alerts on the topics included in this recommended practice and provided relevant results to the lead author.

Articles identified by the search were provided to the project team for evaluation. The team consisted of the lead author, two members of the Recommended Practices Advisory Board, and a member of the Research Committee. The lead author divided the search results into topics and assigned members of the team to review and critically appraise each article using the Johns Hopkins Evidence-Based Practice Model and the Research or Non-Research Evidence Appraisal Tools as appropriate. The literature was independently evaluated and appraised according to the strength and quality of the evidence. Each article was then assigned an appraisal score as agreed upon by consensus of the team. The appraisal score is noted in brackets after each reference citation, as applicable.

The collective evidence supporting each intervention within a specific recommendation was summarized and used to rate the strength of the evidence using the Oncology Nursing Society Putting Evidence into Practice (ONS PEP®) schema. Factors considered in review of the collective evidence were the quality of research, quantity of similar studies on a given topic, and consistency of results supporting a recommendation. The evidence rating is noted in brackets after each intervention.

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**Recommendation I**

Health care workers should use standard precautions when caring for all patients in the perioperative setting.

Standard precautions are the foundation for preventing transmission of infectious diseases. They apply to all patients with a suspected or confirmed infection and across all health care settings (eg, hospital, ambulatory surgery centers, free-standing specialty care sites, interventional sites). Standard precautions include practices for hand hygiene, personal protective equipment (PPE), patient resuscitation, environmental control, soiled patient-care equipment, respiratory hygiene/cough etiquette, sharps safety, and textiles and laundry.

I.a. All personnel in the health care organization should follow established hand hygiene practices.

Hand hygiene is one of the most effective ways to prevent disease transmission and control infections in health care settings.

I.a.1. When a patient who is infected with *Clostridium difficile* is being treated, perioperative personnel should wash their hands with soap and water.

*C difficile* is a spore and is not killed by alcohol-based hand disinfection products.

I.b. Personal protective equipment (PPE) should be worn in the perioperative setting.

The use of PPE protects health care providers’ mucous membranes, airways, skin, and clothing from coming into contact with blood, body fluids.
I.c. The health care provider should use a mouthpiece, resuscitation bag, or other ventilation device during resuscitation.

Use of mouth pieces, pocket resuscitation masks with one-way valves, and other ventilation devices protects the person providing resuscitation from contact with the patient's mouth or oral secretions and potential exposure to transmissible infections.

I.d. The patient should be provided a clean, safe environment.

Hospital surfaces are often contaminated with health care associated pathogens and may be responsible for cross-transmission. Infections have been associated with surface contamination in hospital rooms, and Improved cleaning and disinfection of environmental surfaces can reduce the spread of numerous pathogens (eg, methicillin-resistant *Staphylococcus aureus* [MRSA], vancomycin-resistant *Enterococcus* spp [VRE], norovirus, *C. difficile*, *Acinetobacter* spp). Research has demonstrated that consistently cleaning frequently touched items in the patient care environment (eg, toilet handholds, light switches, door knobs, nurse call devices, bedside rails), infections can be reduced.

I.e. Perioperative personnel should implement sterile technique when preparing, performing, or assisting with invasive procedures.

Exogenous sources for pathogens that may cause a surgical site infection (SSI) include all tools, instruments, and supplies that are brought to the sterile

I.f. All people who enter the health care facility should practice respiratory hygiene and cough etiquette.

Following an outbreak of severe acute respiratory syndrome (SARS) in 2003 the Centers for Disease Control (CDC) expanded its guideline for infection

I.f.1. Respiratory hygiene and cough etiquette should include

- covering the mouth and nose with a tissue when coughing;
- disposing of used tissues quickly;
- performing hand hygiene after coming into contact with respiratory secretions;
- having the person who exhibits signs of respiratory infection wear a surgical mask if he or she is able; and
- separating those who have a respiratory infection from others by more than 3 feet when possible.

I.f.2. Health care organizations should promote proper respiratory hygiene and cough etiquette by

- providing resources and instructions for performing hand hygiene in or near waiting areas,
- placing alcohol-based hand rub dispensers in convenient locations,
- keeping supplies for hand washing where sinks are available,
- offering surgical masks to coughing patients during periods of increased community respiratory infections (eg, as indicated by increased school absences or patients seeking care for such infections), and
- encouraging patients who exhibit signs of respiratory infection to stay at least 3 feet away from others in common areas when possible.
I.f.3. Perioperative nurses should promote compliance with respiratory hygiene and cough etiquette by

- educating health care personnel, patients, and visitors to cover their mouth or nose with tissue or to sneeze or cough into the crook of their arm, especially during seasonal community outbreaks of viral respiratory infections (eg, influenza, adenovirus);
- posting signs at entrances and in strategic places (eg, elevators, cafeterias) within ambulatory and inpatient settings in all languages that are applicable to the population served and that provide instructions for respiratory hygiene and proper cough etiquette; and
- providing products (eg, tissues, surgical masks, no-touch waste receptacles, hand hygiene products) as control measures for minimizing contact with respiratory secretions.

I.g. Perioperative team members should use safe injection practices (eg, one syringe and one needle, complying with sharps safety measures).

Using needles and syringes more than once increases the risk of infection, and unsafe medication injection practices have been implicated in outbreaks of hepatitis B and hepatitis C. The CDC conducted investigations of four large outbreaks in ambulatory surgery facilities and found the need to reinforce safe injection practices. The breaks in infection control practices that were found in these outbreaks were

- reinserting used needles into a multidose vial or solution container (eg, saline bag) and
- using a single needle or syringe to administer IV medication to multiple patients.

Appropriate methods to protect health care workers from exposure to hazardous materials or bloodborne pathogens and to decrease the risk of disease transmission through sharps injuries are specified in US Occupational Safety and Health Administration (OSHA) regulations.

I.h. Reusable health care textiles should be changed and laundered after each patient use or when soiled. Health care textiles should be laundered in a health care-accredited laundry facility.

Health care textiles (eg, gowns, bed linens, surgical attire, privacy curtains, washcloths) may become contaminated by bacteria and fungi during wear or use, and microbes can survive on textiles for extended periods. Contaminated textiles could contaminate the environment or health care providers' hands or clothing.

[Recommended for Practice]

**Recommendation II**

Contact precautions should be used when providing care to patients who are known or suspected to be infected or colonized with microorganisms that are transmitted by direct contact or indirect contact.

Contact precautions are in addition to standard precautions, including PPE (eg, gloves, gowns, masks, face protection) and adequate cleaning and disinfection of patient care equipment and items. Additional contact precautions include flushing mucous membranes and washing skin that is exposed to blood or OPIM, taking special considerations for patient transport, increasing environmental cleaning, and coordinating with an infection preventionist.

Contact with infected patients or contaminated surfaces leads to pathogen transmission 45% of the time, according to a review of 1,022 health care-associated infection outbreaks. Health care providers are at risk of spreading health care-associated infections (eg, S aureus, VRE) through contact, according to a study in which researchers saw positive cultures from imprints.
*C difficile* is known to be transmitted by contact with contaminated people or environmental surfaces, and skin contamination and environmental shedding of the pathogen can persist after symptoms resolve for up to four weeks after therapy. An outbreak of staphylococcal bullous impetigo during a five-month period in a maternity ward was caused by contact with an auxiliary nurse, who was an asymptomatic nasal carrier of the strain. In a study of VRE transmission, researchers cultured the intact skin of 22 colonized patients and sites in the patients' rooms before and after care by 98 health care providers. The health care providers touched 151 VRE-negative sites after touching a VRE-positive site. The researchers found that VRE was transferred via health care providers' hands or gloves 10.6% of the time.

Contact precautions, as part of an overall infection control program, have been shown to decrease MRSA infection and transmission and MDR *Acinetobacter baumannii* infection.

**II.a.** Personal protective equipment should be worn in the perioperative setting as part of contact precautions.

The use of PPE protects health care providers'

**II.a.1.** Perioperative personnel should don PPE upon room entry and discard PPE upon exiting the room when caring for a patient who requires contact precautions.

Donning a gown and gloves when treating a patient who requires contact precautions and discarding them when leaving the patient's room helps contain pathogens, especially those that can be transmitted through environmental contamination (eg, VRE, *C difficile*, norovirus).

Although PPE as part of contact precautions may help contain pathogens, there is some conflicting evidence. One cluster-randomized trial in an intensive care unit (ICU) setting indicated that contact precautions (ie, gloves, gowns, hand hygiene) were not significantly more effective in preventing transmission of MRSA or VRE than universal gloving.

**II.b.** Health care providers must wash their hands and skin with soap and water or flush their mucous membranes with water immediately or as soon as possible after coming into direct contact with blood or OPIM.

Inadvertent exposure to environmental pathogens (eg, *Aspergillus* spp, *Legionella* spp) can cause illness among health care providers, as well as adverse patient outcomes. There is a risk of bloodborne disease transmission from splash injuries during endourology and other minimally invasive procedures, according to a study of 118 procedures performed by five surgeons. The researchers noted that mucocutaneous and transconjunctival exposure are important portals for transmission. In a study of 25 consecutive patients who were undergoing dental surgery for impacted mandibular third molars, investigators concluded that surgeons were exposed to possible bloodborne infections by splashing in nearly 90% of the procedures.

**II.c.** When patient transport is necessary, precautions should be taken to reduce the opportunity for transmission of microorganisms to other patients personnel, and visitors and to reduce contamination of the environment.

**II.c.1.** Patient transport should be limited to essential diagnostic and therapeutic procedures that cannot be performed in the patient's room.

**II.c.2.** When transport is necessary, appropriate barriers should be used on the patient, including a mask and gown and sheets or impervious dressings to cover affected areas if infectious skin lesions or drainage are present. These barriers should
be consistent with the route and risk of transmission.

II.c.3. When a patient who requires contact precautions is transported from one area to another, the nurse should notify the receiving team members that the patient is coming and what precautions should be taken to prevent transmission.

II.d. Enhanced environmental cleaning should be included as part of a program to control the transmission of MDROs.

Environmental reservoirs have been implicated in transmission of VRE and other MDROs. Increased cleaning and disinfection practices, including of frequently touched surfaces (eg, bedrails, charts, bedside commodes, doorknobs), can help control the spread of MDROs. Improved environmental cleaning can reduce the transmission of MDR *A baumannii*, MRSA, VRE, *Acinetobacter* spp, and *C difficile*.

II.d.1. Patient care areas of patients infected with *C difficile* should be cleaned with a 10% bleach solution and allowed to air dry.

Contamination of environmental surfaces contributes to the spread of *C difficile*. *C difficile* is a spore that can survive for months in the environment and is not killed by standard processes for environmental cleaning.

Educating housekeeping personnel on environmental cleaning practices, significantly reduces the amount of contamination, according to a prospective six-week before-and-after study. When housekeeping personnel used 10% bleach solution to disinfect frequently touched surfaces (eg, bed rails, bedside tables, call buttons, telephones, toilet seats, door handles), contamination was significantly reduced from nine rooms with positive cultures before cleaning to two rooms with positive cultures after cleaning.

II.e. All noncritical equipment (eg, commodes, IV pumps, ventilators, computers, personal digital assistants) should be cleaned and disinfected before use on another patient and should be handled in a manner to prevent health care provider or environmental contact with potentially infectious material.

II.e.1. Dedicated noncritical equipment such as stethoscopes, blood pressure cuffs, and electronic thermometers may be used.

II.f. Routine cleaning of environmental surfaces (eg, floors, walls) should be performed according to facility policy and more frequently when necessary.

Surface cleaning and disinfection practices are recommended to manage outbreaks caused by *Acinetobacter* spp, *C difficile*, MRSA, norovirus, and VRE. Cleaning may need to be more thorough or performed more frequently depending on the patient’s level of hygiene, the degree of environmental contamination, and the type of infectious agent (eg, if the infectious reservoir is the intestinal tract).

II.g. An infection preventionist should be consulted for guidance when measures are indicated to prevent the spread of highly transmissible or epidemiologically

II.h. Perioperative nurses should evaluate and manage any negative patient outcomes that may be caused by using contact precautions.

Studies have shown that health care providers are half as likely to enter the rooms of or examine patients who require contact precautions. Patients may experience increased anxiety and depression as well as decreased levels of
satisfaction under isolation precautions.

A systematic review of 15 studies from 1989 to 2008 indicated four adverse outcomes related to contact precautions:

- less patient-to-health care provider contact,
- changes to systems of care that produce delays and more noninfectious adverse events,
- increased symptoms of depression and anxiety, and
- decreased satisfaction with care.

Although the majority of patients believe that contact precautions protect them and others, it is important to carefully consider whether contact precautions are necessary and to communicate the primary function of using contact precautions to the patient.

By educating a patient who requires contact precautions and his or her family members, the perioperative nurse may be able to minimize feelings of isolation, depression, and anxiety. Nurses are in a position to evaluate patients for negative feelings.

**Recommendation III**

Droplet precautions should be used throughout the perioperative environment (ie, preoperative, intraoperative, postoperative) when providing care to patients who are known or suspected to be infected with microorganisms that can be transmitted by large droplets.

Droplet precautions in addition to standard precautions reduce the risk of pathogens that spread through close respiratory or mucous membrane contact (eg, adenovirus, group A streptococcus, influenza, *Neisseria meningitides*, pertussis, rhinovirus). Droplet precautions include donning PPE, considering patient placement to minimize contact with other patients, consulting with an infection preventionist, and placing a mask on the patient and using barriers during transport.

Droplets in exhaled breath (ie, mouth or nose breathing, coughing, talking) may carry microorganisms that can be transmitted over short and long distances, and infected droplets may originate during certain procedures (eg, suctioning, endotracheal induction, cardiopulmonary resuscitation). During the 2003 SARS outbreak in Toronto, Canada, 26 health care providers contracted the virus from seven patients. Researchers concluded that close contact with the ill patients' airways (eg, during intubation, transportation) and failure to prevent exposure to respiratory secretions through infection control practices were associated with transmission.

**III.a.** When a patient believed to have mumps, rubella, or pertussis enters the health care facility, droplet precautions should be implemented and followed, and only healthcare providers with presumptive immunity should be exposed to the patient.

**III.b.** Personal protective equipment should be worn in the perioperative setting as part of droplet precautions.

The use of PPE protects health care providers' mucous membranes, airways, skin, and clothing from coming into contact with blood, body fluids, and OPIM.
III.b.1. Perioperative personnel should don surgical masks when in close contact with a patient who requires droplet precautions.

Masks prevent the transmission of large droplet (ie, greater than 5 microns) and, worn correctly, protect health care providers who are within close proximity of a patient who requires droplet precautions. Masks serve as protection from infectious microorganisms from patient s(eg, respiratory secretions, blood splatter, body fluid).

III.b.2. Health care providers should change PPE and clothing when they are exposed to patient secretions or droplets.

Changing PPE can help prevent cross-contamination of influenza viruses

III.c. Patients who require droplet precautions should be placed in a single-patient room before and after surgery.

Single-patient placement in an isolation room helps prevent the spread of infection from patient to patient. Special air handling and ventilation are not required as a part of droplet precautions

III.c.1. If single patient placement is not possible, the perioperative nurse should collaborate with the facility infection preventionist to establish optimal preoperative and postoperative placement for a patient who requires droplet precautions.

The infection preventionist can help assess and mitigate the risks associated with non-isolation placement options (eg, cohorting, keeping the patient with an existing roommate) to minimize the potential for cross-contamination.

III.c.2. Patients who require droplet precautions should be placed at least three feet away from other patients.

The defined risk area (ie, > 3 feet) around the patient is based on epidemiologic and simulated infection studies.

III.c.3. If possible, draw curtains or close doors.

Curtains and doors help to separate the patients and reduce transmission of infectious organisms.

III.d. When transporting the patient from one area to another, the patient should wear a mask.

Masks prevent possible spread of infectious respiratory secretions from the patient to other individuals.

[Recommended for Practice]

Recommendation IV

Airborne precautions should be used when providing care to patients who are known or suspected to be infected with microorganisms that can be transmitted by the airborne route.
Procedures are performed in the perioperative setting that require access to the airway, therefore special infection-control considerations for preventing transmission of airborne disease are necessary. Airborne precautions in addition to standard precautions for the OR include PPE, respiratory protection, administrative controls, and environmental controls.

Airborne transmission of microorganisms can occur when airborne droplet nuclei or small particles contain infectious agents that remain infective over time and distance. This is specific to particles that are approximately 1 µm to 5 µm and that remain airborne for prolonged periods by normal air currents, which allow them to spread throughout a room or building. The use of airborne precautions can help minimize transfer of diseases that are spread by the airborne route (eg, *Mycobacterium tuberculosis* [TB], rubeola, Varicella zoster).

IV.a. When a patient suspected of measles infection enters the health care facility, all health care personnel should use respiratory protection, regardless of presumptive immunity, when providing care to the patient.

Measles vaccination can fail and is ineffective for preventing measles about 1% of the time. Measles is highly contagious and transmission can occur anywhere from four days before presentation of a rash to four days after the rash resolves.

[Recommended for Practice]

IV.b. When a patient with confirmed or suspected varicella infection enters the health care facility, airborne and contact precautions should be implemented and followed, and only health care providers with evidence of immunity should provide care to the patient.

[Recommended for Practice]

IV.c. Personal protective equipment should be worn in the perioperative setting as part of airborne precautions.

The use of PPE protects health care providers’ mucous membranes, airways, skin, and clothing from coming into contact with blood, body fluids, and OPIM. (See Recommendation VI.)

[Recommended for Practice]

IV.c.1. Perioperative personnel should wear a mask within three feet of a patient who requires airborne precautions.

Some infectious agents (eg, noroviruses, influenza, rhinovirus) are airborne for short distances, such as within a patient room, or during endotracheal intubation. Wearing a surgical mask helps reduce the risk of airborne transmission of infection (eg, Lemierre syndrome).

IV.c.2. Respiratory protective devices worn during care of a patient with TB should be

- certified by the CDC/US National Institute for Occupational Safety and Health (NIOSH) as a nonpowered particulate filter respirator, including a disposable respirator or PAPR with high efficiency filters, and
- available in different sizes and models to accommodate the different facial sizes and characteristics of health care providers.

IV.d. An airborne infection isolation room (AIIR) should be used if available for patients who require airborne precautions, including during surgery and postoperative recovery. Use of special air handling and ventilation systems such as an
AIIR helps prevent the spread of airborne pathogens, particularly TB, rubeola, and varicella zoster, and are recommended during procedures that can generate infectious aerosols (e.g., endotracheal intubation, bronchoscopy, suctioning, autopsy procedures involving oscillating saws). (231)

[Not Yet Rated]

IV.d. If no AIIR is available a portable anteroom system (PAS)-high-efficiency particulate air (HEPA) combination unit may be used.

A pilot study comparing freestanding HEPA filter units placed inside the OR with a novel PAS-HEPA combination unit that was placed outside the OR found that the PAS-HEPA was more effective. The PAS-HEPA unit achieved a downward evacuation of plume, away and toward the main entry door from the sterile field. Comparatively, the portable freestanding HEPA unit inside the OR moved the plume vertically upward and directly into the breathing zone where the surgical team would be during a procedure. Results indicated that the PAS-HEPA system effectively removed more than 94% of an initial release of at least 500,000 submicron particles per cubic foot within 20 minutes after release.

IV.e. When transporting the patient from one area to another, the patient should wear a mask. Patients should be transported directly to the OR room, bypassing the holding area, and at the end of the procedure, transferred directly to an AIIR in the postanesthesia care unit or other part of the hospital.

[Recommended for Practice]

IV.f. After cough-inducing procedures are performed in the OR, sufficient time should be allowed for 99% or more of airborne particles to be removed before sterile supplies are opened for subsequent patients.

Performing cough-inducing procedures such as intubation, extubation, and bronchoscopy increases the likelihood that droplet nuclei will be expelled into the air. For example, by waiting to place another patient in the room, the risk of airborne transmission of TB is reduced. The length of time required to expel more than 99% of airborne contaminants varies by the efficiency of the ventilation or filtration system.

[Recommended for Practice]

IV.g. Elective surgery should be postponed for patients who have suspected or confirmed TB until the patient is determined to be noninfectious. If surgery cannot be postponed, perioperative personnel should follow airborne precautions and consult with an infection preventionist.

Postponement of elective surgery may prevent transmission of TB.

[Recommended for Practice]

IV.g.1. A single use disposable bacterial filter should be placed between the anesthesia circuit and the patient's airway.

Placing a bacterial filter between the anesthesia circuit and the patient's airway prevents contamination of the anesthesia equipment and release of tubercle bacilli into the room. The preferred filter will filter particles 0.3 µm in size in both loaded and unloaded states and will have a filter efficiency of 95% (i.e., filter penetration of < 5%) at the maximum design flow rates of the ventilator for the service life of the filter.

IV.g.2. The patient should be intubated and extubated and placed for recovery in an AIIR. If intubation or extubation must be performed in the OR, a portable, industrial-grade HEPA filter should be used to supplement air cleaning during
intubation or extubation. Following extubation, the OR doors should remain closed until adequate time has passed for ACH to clean 99% of airborne particles from the air.

IV.g.3. Standard cleaning and disinfection procedures should be followed after surgery on a patient who has TB, and should only be performed after the appropriate amount of time for air ventilation (eg, 15 air exchanges per hour for 28 minutes to remove 99.9% of airborne contaminants).

Personal respiratory protective equipment is not necessary for cleaning an OR if the appropriate ventilation time is allowed.

If room cleaning activities begin before the appropriate amount of time for air ventilation, cleaning personnel must wear an N95 mask.

IV.h. Administrative controls should be established to reduce the risk of TB exposure to patients and personnel. Administrative controls should include:

- implementing work practices for managing patients with suspected or confirmed TB;
- ensuring potentially contaminated equipment (eg, endoscopes) is properly cleaned and sterilized or disinfected;
- training and educating health care providers about TB prevention, transmission, and symptoms;
- establishing a TB screening program to screen and evaluate health care providers who are at risk for TB or who might be exposed to *M. tuberculosis*; and
- implementing a respiratory protection program for personnel requiring fit testing and certification to use a N95 respirator mask.

[Recommended for Practice]

IV.i. Environmental controls should be established to prevent the spread of airborne diseases. Environmental controls should include

- controlling the source of infection by using local exhaust ventilation (eg, hoods, tents, booths),
- diluting and removing contaminated air with general ventilation,
- controlling airflow to prevent contamination of air in areas adjacent to the source,
- cleaning the air using HEPA filtration or ultraviolet germicidal irradiation (UVGI),
- using central wall suction units with inline filters to evacuate minimal surgical smoke, and
- using a mechanical smoke evacuation system with HEPA filtration to manage large amounts of surgical smoke.

The CDC recommends environmental controls to prevent the spread of airborne infections (eg, TB) and to minimize exposure to laser plume that may contain infectious material (eg, human papilloma virus).

[Recommended for Practice]

IV.j. An infection preventionist should be consulted to determine necessary supplemental controls for patients requiring
airborne isolation (eg, patient placement).

[Recommended for Practice]

Recommendation V

Health care personnel must follow bloodborne pathogen guidelines when there is a risk of exposure to blood or OPIM.

Bloodborne pathogens are pathogenic microorganisms that are present in human blood and can cause disease (eg, hepatitis B, HIV). Federal and state regulations and organizational standards mandating bloodborne pathogen guidelines are intended to reduce health care provider exposure to bloodborne pathogens and to minimize the risk of infection.

There has been a focus on preventing bloodborne transmission of hepatitis B, hepatitis C, and HIV in particular. These viruses are more easily transmitted parenterally or across mucous membranes.

Methods for preventing bloodborne pathogen exposure include using PPE, implementing work practice and engineering controls, following infection prevention precautions, and establishing and following an infection control plan.

[V.a.  Health care personnel must wear personal protective equipment in the perioperative setting as part of the bloodborne pathogen standard.

The use of PPE protects health care providers' mucous membranes, airways, skin, and clothing from coming into contact with blood, body fluids, and OPIM. Appropriate PPE does not permit blood or OPIM to pass through to or reach the employee's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration that the PPE is used. (See Recommendation VI.)

[Recommended for Practice]

V.a.1. If a garment is penetrated by blood or OPIM, the health care personnel must remove the garment immediately or as soon as possible.

V.a.2. Health care personnel must wear gloves when hand contact with blood, OPIM, mucous membranes, or non-intact skin can be reasonably anticipated; when performing vascular access procedures; and when handling or touching contaminated items or surfaces.

V.a.3. Health care personnel must wear masks in combination with eye protection devices whenever splashes, spray, spatter, or droplets of blood or OPIM may be generated and eye, nose, or mouth contamination can be reasonably anticipated. Eye protection devices include goggles, glasses with solid side shields, and chin-length face shields.

V.a.4. Health care personnel must wear gowns, aprons, and other protective body clothing when exposure to blood or OPIM is anticipated.

V.a.5. Health care personnel must wear surgical caps or hoods and shoe covers or boots when gross contamination can be
reasonably anticipated (eg, orthopedic surgery).

V.b. Food and drink must not be taken into the semi-restricted or restricted areas of the perioperative suite. Food and drink must not be kept in refrigerators, freezers, shelves, or cabinets or on counter tops or work spaces where blood or OPIM are present.

[Recommended for Practice]

V.c. Perioperative personnel must use sharps safety work practice controls.

Work practice controls reduce the likelihood of exposure by changing the method of performing a task to minimize the risk of exposure to blood or OPIM. Work practice controls include

- prohibiting risky handling of needles and sharps,
- prohibiting recapping of needles by a two-handed technique, and
- using a neutral zone or hands free technique for passing sharps.

[Recommended for Practice]

V.c.1. Safety-engineered devices must be used and should be examined and maintained on a regular basis.

Sharps injuries are a contributing factor in the risk of bloodborne pathogen exposure in the OR. The Needlestick Safety and Prevention Act of 2000 mandates the provision of safety-engineered devices in the health care setting to prevent sharps injuries.

According to a study of percutaneous injury surveillance data from 87 US hospitals before and after passage of the act, sharps injuries increased by 6.5% in surgical settings between 1993 and 2006, although rates decreased in other health care settings by 31.6%. Of 31,324 total sharps injuries, 7,186 involved surgical team members, the majority of whom were surgical technologists or nurses. Most injuries were caused by suture needles (43.4%), scalpel blades (17%), and syringes (12%).

Proper use of engineered devices is effective for preventing percutaneous injuries among health care providers. Using engineering controls (eg, needleless systems, self-sheathing needles, sharps with engineered sharps injury protections, sharps storage and disposal containers) provides a safer setting for health care providers by isolating or removing the bloodborne pathogens hazard from the workplace.

V.c.2. Needleless systems or self-sheathing needles should be used.

Needleless systems protect against bloodborne pathogen exposure by eliminating the use of needles for

- the collection or withdrawal of bodily fluids after the initial venous or arterial access is established,
- the administration of medications or fluids, or
- any other procedure involving the potential for occupational exposure to bloodborne pathogens caused by percutaneous injuries from contaminated sharps.
V.c.3. Non-needle sharps with built-in safety features or other mechanisms should be used.

V.c.4. Contaminated reusable sharps must be placed in appropriate containers immediately or as soon as possible after use and until they can be properly reprocessed.

Sharps safety containers should be

- puncture resistant,
- labeled or color-coded in accordance with the bloodborne pathogens standard,
- leakproof on the sides and bottom, and
- meet the requirements for reusable sharps as described in the bloodborne pathogens standard.

V.d. Perioperative RNs should collaborate with pharmacists to procure and store single-dose vials rather than multidose vials.

Reuse of multidose vials of medication has become a concern as a cause of iatrogenic bloodborne pathogen infection. Outbreaks of hepatitis B and C viruses in New York, Oklahoma, and Nebraska were attributed to unsafe injection practices, including contamination of multidose medication vials and reuse of syringes and needles, which led to patient-to-patient transmission.

HIV can be transmitted either parenterally or across mucous membranes. The risk of transmission from mucocutaneous exposure is estimated at 0.03%, and the risk of infection as a result of intact skin exposure is below detection. Health care providers are among at-risk populations for occupational exposure to HIV, and transmission is significantly associated with procedures involving a needle placed in the source patient's blood vessel.

Following fundamental infection-control principles (eg, safe injection practices, appropriate aseptic techniques) helps reduce the risk of bloodborne pathogen transmission.

V.e. Health care organizations must establish an exposure control plan, make it accessible to employees, and review and update it at least annually.

[Not Yet Rated]

**Recommendation VI**

Perioperative personnel must wear personal protective equipment when exposure to blood or OPIM is anticipated.

OSHA requires employers to provide appropriate PPE to health care providers at no cost to reduce the risk of skin and mucous membrane exposure to blood and body fluids or OPIM.

All health care providers are responsible for ensuring the safety of patients, other health care providers, their own family members, and the community. According to the Workers' Family Protection Task Force, there is limited data to quantify household exposures to potentially infectious organisms; however, workers who may not exhibit negative effects from workplace exposure still may expose their family members by taking infectious pathogens home (eg, occupationally acquired hepatitis C or
HIV). Existing standards that require employers and employees to reduce occupational risks (e.g., using PPE, engineering controls) protect the workers’ families as well.

It is the employer’s responsibility to ensure that PPE is available and readily accessible, alternatives are available for employees with allergies, and that personnel use the appropriate PPE. Personal protective equipment includes gloves; gowns; eye protection; masks; and mouthpieces, resuscitation bags, pocket masks, and other ventilation devices.

**VI.a.** Gloves must be worn when hand contact with blood or OPIM, mucous membranes, or non-intact skin can be reasonably anticipated, including when

- performing vascular access procedures;
- coming into direct contact with patients who are colonized or infected with pathogens (e.g., VRE, MRSA, respiratory syncytial virus); and
- handling or touching contaminated patient care items or environmental surfaces.

Gloves help prevent health care providers’ hands from becoming contaminated by patient blood, body fluids, and OPIM. Gloves have been found to protect health care providers' hands from VRE contamination and to reduce the risks of sharps injuries.

[Recommended for Practice]

**VI.a.1.** Examination gloves should be visually inspected upon donning and changed after each patient contact, when a visible defect is noted or a perforation is suspected, and according to organizational policy.

**VI.a.2.** Sterile gloves should be visually inspected immediately upon donning and before contact with sterile supplies or the sterile field.

Gloves may have perforations or tears that occur in the manufacturing process or as gloves are donned.

**VI.a.3.** Sterile gloves should be changed

- after each patient contact;
- when a visible defect is noted;
- when suspected or actual contamination occurs;
- when a suspected or actual perforation occurs;
- after an unintentional electrical shock to the hands from an electrosurgical unit; and
- according to organizational policy.

Breaches in the glove barrier pose a risk for transmission of bloodborne pathogens during surgical procedures. Glove perforation also increases the risk of SSI. Depending on the duration of wear, surgical gloves can develop microperforations that are not immediately recognizable to the wearer. These perforations allow bacteria from the surgical site to pass through to the wearer’s hands. One method for preventing this is to mandate regular glove changes in organizational policy. Changing gloves at regular intervals may decrease the incidence of glove perforation and bacterial contamination during surgical procedures.
VI.a.4. Use of polyvinyl chloride or vinyl gloves should be limited to brief, low-risk exposures.

Research has shown that vinyl and polyvinyl gloves have a higher failure rate in use than nitrile or latex gloves. In a study of 137 procedures, researchers noted higher microbial contamination of the health care providers' hands and a higher frequency of leaks with vinyl gloves compared to latex. Similarly, a study of 886 exam gloves showed vinyl gloves were much more likely to leak than latex (51.3% vs 19.7%) after undergoing a standardized clinical protocol designed to mimic patient care activities. Research also has indicated polyvinyl chloride gloves fail to protect against virus exposure 22% of the time.

Comparisons of different glove types have supported the decreased durability of vinyl and polyvinyl chloride gloves. Researchers evaluated 2,000 gloves (i.e., 800 latex, 800 vinyl, 400 nitrile) and tested them immediately out of the box and after manipulations designed to simulate in-use conditions. Vinyl gloves failed 12% to 61% of the time, whereas latex and nitrile had failure rates of 0% to 4% and 1% to 3%, respectively.

Another comparison involving 5,510 medical examination gloves (1,464 nitrile, 1,052 latex, 1,006 copolymer, 1,988 vinyl) showed that vinyl and copolymer (i.e., polyvinyl chloride) gloves were less effective barriers than latex and nitrile. Results showed 8.2% failure rates for the vinyl and copolymer gloves compared to 1.3% for nitrile and 2.2% for latex.

VI.b. Perioperative personnel should double glove during all invasive procedures.

Glove barrier failure is a common occurrence in the perioperative setting. Glove failures can be caused by punctures, tears by sharp devices, or spontaneous failures. Breaches in the glove barrier pose a risk of transmission of bloodborne pathogens during surgery. Wearing double gloves helps prevent SSI and protect health care providers' hands.

According to a study of 155 surgeons and residents in Canada, double gloving is an effective means to reduce the risk of percutaneous injury. Double gloving also minimizes the amount of blood that is transferred to the health care provider's hands during a needlestick injury, reduces the risk of glove perforation associated with lengthy surgical procedures, and reduces the risk of perforation of the innermost glove.

Double gloving or double gloveing with an indicator glove system may increase the wearer's awareness of a perforation and thereby protect against exposure to bloodborne pathogens during surgery. In one 24-month study, researchers investigated the effects of double gloving with inner indicator gloves and found that the frequency of seeing blood on the hand after surgery was higher with single gloving than double gloving. They also noted that surgical team members were more likely to change their gloves during surgery when they double gloved with an indicator system compared with double gloving alone.

[Recommended for Practice]

VI.b.1. When the invasive procedure is completed, perioperative personnel should remove both pairs of gloves, discard them, and perform hand hygiene.

VI.c. Perioperative personnel must wear fluid-resistant attire during activities that generate splashes, splatters, sprays, or aerosols of blood or OPIM.

The CDC recommends wearing fluid-resistant gowns for all patient contact. Fluid-resistant attire protects health care
providers’ skin from being exposed to blood, body fluids, and OPIM. Laboratory coats or jackets worn over personal clothing are not considered PPE.

[Not Yet Rated]

VI.d. Health care personnel must wear eye protection when splashes, spray, spatter, or droplets of blood or OPIM can be reasonably anticipated.

The CDC recommends eye protection as part of standard precautions and when there is a risk of infectious materials entering the eye. Using eye protection helps prevent exposure to bloodborne pathogens and other diseases (eg, SARS, tuberculosis, N meningitidis) during aerosol-generating procedures, including bronchoscopy, endotracheal intubation, and open suctioning of the respiratory tract.

Infectious diseases can be transmitted through the mucous membranes of the eye (ie, conjunctiva), including adenovirus, herpes simplex, S aureus, hepatitis B, hepatitis C, and HIV. These infectious agents can be introduced directly to the eye by blood splashes or respiratory droplets that are generated during coughing or suctioning or from touching the eyes with contaminated fingers or other objects.

The type of eye protection that is necessary depends on the circumstances of exposure, other PPE that is being used, and personal vision needs; however, regular prescription eyeglasses and contact lenses are not considered eye protection. Appropriate eye protection includes goggles, face shields, and full-face respirators. The CDC recommends selecting eye protection based on other PPE requirements to ensure proper fit and optimal protection.

[Recommended for Practice]

VI.d.1. Goggles should fit snugly, especially at the corners of the eye and across the brow, be indirectly vented, and should have anti-fog properties.

Fitted, indirectly vented goggles with a manufacturer’s anti-fog coating are the most reliable and practical means of protecting health care providers’ eyes from splashes, sprays, and respiratory droplets. They can be fit over prescription glasses. Safety glasses do not provide splash or droplet protection and are not recommended for infection control purposes.

VI.d.2. Face shields should be selected for circumstances where eye protection alone is not sufficient.

Face shields provide protection to the eyes and other areas of the face. Face shields that have crown and chin protection and wrap around the face to the point of the ear allow for the best face and eye protection from splashes and sprays. Although disposable face shields that fit loosely and are made of light-weight films with attached surgical masks are available, these may not provide complete protection.

VI.d.3. Full-face respirators and powered air-purifying respirators (PAPRs) should be selected based on the respiratory hazard in an infection control situation.

Full-face respirators and PAPRs provide highly effective eye protection in addition to respiratory protection. These devices require prescription inserts for health care providers who wear glasses to avoid compromising the seal around the face. Another option for health care providers who wear prescription glasses is a PAPR that is designed with a loose-fitting face piece or with a hood that completely covers the head and neck.
VI.d.4.  Eye protection should be removed by handling only the portion of the equipment that secures the device to the head.

By removing eye protection by the plastic temples, elasticized band, or ties rather than handling the front or sides, health care providers can minimize the risk of contamination of their hands.

VI.d.5.  Non-disposable eye protection should be placed in a designated receptacle for subsequent cleaning and disinfection, and health care providers should be given their own eye protection when possible.

VI.e.  Perioperative personnel must wear surgical masks when splashes, spray, spatter, or droplets of blood or OPIM may be generated and nose or mouth contamination can be reasonably anticipated.

Masks protect the mucous membranes of the nose and mouth, which are susceptible to infectious agents. Masks are used to prevent contact with respiratory secretions or sprays of blood and body fluid as part of standard and droplet precautions.

Splash injuries are common during endoscopic and laparoscopic urologic procedures, which has implications for all minimally invasive procedures, according to a four-month study of 118 endoscopy procedures. The investigators collected 236 masks from surgeons, surgical assistants, and perioperative nurses and analyzed them for blood macroscopically and using forensic techniques. Results indicated 48.5% of the surgeons' masks, 29.5% of the assistants' masks, and 31.8% of the nurses' masks were splashed with blood.

Masks are also used as part of sterile technique to protect patients from exposure to infectious agents that may be carried in the health care provider's mouth or nose. Surgical masks have been shown to reduce bacterial contamination produced by dispersal of organisms from the wearer's upper airway and are believed to protect the surgical site from becoming contaminated. During cataract surgery, for example, there is significantly less bacterial contamination of the surgical site when the surgeon wears a face mask. Visor masks are recommended as a standard practice during oral surgery when high-speed rotary instruments are used because these procedures result in splashing nearly 90% of the time.

The Society for Cardiovascular Angiography and Interventions recommends wearing a mask to protect patients during cardiac catheterization procedure. The Society noted that mask use has become more important with increased use of the catheterization laboratory as an interventional suite with device implantation. Significantly less bacterial contamination of the operative field during cardiac catheterization occurs when health care providers wear full masks compared to no masks, and there is a nonsignificant trend of increased bacterial colony counts when masks are worn below the nose as opposed to above the nose.

The two types of masks available in health care settings are surgical masks and procedure masks. Surgical masks, which are evaluated by the FDA for fluid resistance, bacterial filtration efficacy, differential pressure, and flammability, are appropriate for use as PPE in the perioperative setting.

Whether to wear a mask or respirator depends on disease-specific recommendations, but the CDC notes that it is good practice to don a mask within 6 to 10 feet of a patient or on entry to the patient's room when exposure to an "emerging or highly virulent pathogen" is likely.

[Recommended for Practice]
VI.e.1. Employers should provide masks in a variety of shapes (e.g., molded, non-molded), sizes, filtration efficiency, and method of attachment (e.g., ties, elastic, ear loops).

Providing several varieties may be necessary to meet individual health care providers' needs.

VI.e.2. Perioperative personnel should wear particulate respirators during aerosol-generating procedures involving patients who have tuberculosis, SARS, or avian or pandemic influenza viruses.

Wearing an N95 or higher level respirator when caring for a patient who requires airborne precautions reduces the likelihood of airborne infection transmission.

One review of 21 studies indicated that N95 masks are more protective against influenza and similarly sized particles than surgical masks. However, the investigators noted that additional research is needed to support the WHO guidelines for wearing surgical masks for all patient care and N95 masks for aerosol-generating procedures. In another review of 45 articles, researchers were unable to determine which specific hygienic measurements were most effective in reducing MRSA rates, but they noted that a combination of measures—masks, gloves, gowns, and hand hygiene—are effective together.

VI.f. Employers must provide mouthpieces, resuscitation bags, pocket masks with one-way valves, or other ventilation devices in settings in which cardiopulmonary resuscitation (CPR) may have to be performed.

Respiratory droplets are generated during CPR, and if CPR is given to a patient with a transmissible infection, disease transfer is possible. Mouthpieces, resuscitation bags, pocket masks with one-way valves, and other ventilation devices allow care givers to perform CPR without exposing their nose and mouth to oral and respiratory fluids.

[Not Yet Rated]

VI.g. Perioperative personnel must replace PPE and clothing as soon as possible after exposure to blood or OPIM.

Replacing PPE and clothing after exposure to secretions and droplets that contain viruses is effective for preventing cross-infection.

[Recommended for Practice]

VI.h. Perioperative personnel must remove all PPE before leaving the work area and must place used PPE in an appropriately designated area or container for storage, washing, decontamination, or disposal.

[Recommended for Practice]

VI.h.1. Perioperative personnel should stand 3 feet away from the disposal container when removing soiled gloves.

One study of glove removal procedures indicated that when personnel stood 3 feet away from the garbage bin as opposed to 2 feet, there was less contamination on the cover of the bin and the front of the removed gloves. There was no significant difference in hand contamination levels based on distance to the disposal container.
Recommendation VII

Perioperative personnel should take additional action during surgery to prevent the transmission of health care acquired infections.

Several types of infections may be acquired in the perioperative setting and are affected by perioperative care, including SSIs, MDROs, central line-associated blood stream infections, and catheter-associated urinary tract infections. The entire perioperative team is responsible for collaborating to prevent these types of infections.

[Most of this section is covered in detail in other recommended practices. I'm not sure this is in the scope of this one. I would think that covering standard and transmission based precautions and applying those principles to the perioperative setting would be sufficient.]

VII.a. Perioperative team members should adopt a systematic approach for reducing the risk of surgical site infections.

Despite advances in infection control practices (eg, improved OR ventilation, sterilization methods, barriers, surgical technique, antimicrobial prophylaxis), SSI remains a substantial cause of morbidity and mortality among hospitalized patients. SSIs occur in 2% to 5% of US patients who undergo surgery in inpatient facilities for a total of approximately 500,000 SSIs each year, at a cost of up to $10 billion annually. Furthermore, these infections are associated with seven to 10 additional postoperative days per SSI and increase the risk of death by as much as 11 times.

According to the Hospital Infection Control Practices Advisory Committee Guideline, SSI is the third most frequently reported health care-associated infection and accounts for between 14% and 16% of all health care-associated infections in hospitalized patients. Among surgical patients, SSIs account for 38% of health care-associated infections, and 77% of deaths in surgical patients who develop an SSI are related to the infection.

The pathogens that contribute most frequently to SSI include S aureus, coagulase-negative staphylococci, Enterococcus spp, and Escherichia coli, and increasingly include Candida albicans and MRSA. Most SSIs are caused by the patient's endogenous flora (eg, gram-positive cocci, anaerobic bacteria, gram-negative aerobes), but they can also be caused by exogenous sources of pathogens such as members of the surgical team; the OR environment and air; and all tools, instruments, and materials that are brought to the sterile field.

SSI prevention measures (ie, an action or a set of actions taken to reduce the risk of SSI) focus on reducing opportunities for microbial contamination of the patient's tissues or sterile surgical instruments. Specific methods for preventing SSI include adhering to aseptic technique, implementing environmental cleaning protocols, using appropriate barriers and surgical attire, performing proper skin antisepsis and hand hygiene, minimizing traffic in the OR during surgical procedures, using adequate sterilization methods, treating carriers of S aureus preoperatively, and using preoperative antimicrobial prophylaxis.

[Recommended for Practice]

VII.a.1. Perioperative personnel should practice sterile technique.

Sterile technique performed by all perioperative team members is the foundation of SSI prevention. Failure to adhere to the principles of asepsis is independently related to a risk of SSI.
VII.a.2. A clean environment should be maintained.

II.a.3. Perioperative personnel should wear clean surgical attire.

Although few controlled trials have evaluated whether the use of surgical attire has an effect on reducing SSIs, the Hospital Infection Control Practices Advisory Committee recommends the use of barriers (eg, scrub suits, masks, surgical caps, hoods, shoe covers, sterile gloves, gowns, drapes) to minimize the patient's exposure to the skin, mucous membranes, and hair of surgical team members.

Wound infections may result when pathogens that adhere to the hair or scalp (eg, *S aureus*, Group A streptococcus, *Staphylococcus epidermidis*) are released from the hair into the operative air and settle into the surgical incision.

VII.a.4. Preoperative skin antisepsis of the surgical site should be performed.

Antiseptic skin preparation of the surgical site is intended to reduce the risk of postoperative SSI by removing soil and transient microorganisms from the skin; reducing the resident microbial count to subpathogenic levels in a short period and with the least amount of tissue irritation; and inhibiting rapid, rebound growth of microorganisms.

VII.a.5. Perioperative personnel should perform hand hygiene.

Following proper hand hygiene protocols helps reduce the bacterial colony count on perioperative team members' hands and is believed to reduce the risk of SSI. In one study, the introduction of a hand sanitizer with 70% isopropyl alcohol and 0.5% chlorhexidine gluconate and training perioperative team members on its use reduced SSI overall and superficial SSI in particular among patients undergoing neurosurgery.

VII.a.6. Traffic in and out of the OR should be minimized during surgical procedures.

The air in the OR may contain microbe-laden dust, lint, skin squames, or respiratory droplets, and the microbial level in the air is directly related to the number of people who are moving around in the room.

VII.a.7. Perioperative personnel should provide reusable surgical items that are free of contamination at the time of use.

Reusable surgical items should be subjected to cleaning and decontamination, followed by a disinfection or sterilization process.

Inadequate sterilization of surgical instruments can contribute to SSI outbreaks.

VII.a.8. Perioperative nurses should collaborate with medical colleagues to evaluate testing or decolonizing patients preoperatively for carriage of *S aureus* and using preoperative prophylaxis on carriers.

*S aureus* is carried in the nasal nares of 20% to 30% of healthy individuals, and this carriage has been found to be "the most powerful independent risk factor for SSI" in patients undergoing cardiothoracic surgery. Among 135 orthopedic surgeons at a teaching hospital, 1.5% tested positive for MRSA and 35.7% tested positive for methicillin-sensitive *S
Mupirocin ointment may be an effective topical therapy for removing \textit{S. aureus} from the nares of colonized patients and health care providers, and the ointment can lower the risk of SSI when it is used on patients regardless of carrier status. The evidence is conflicting, however. Another study failed to demonstrate an overall reduction in SSI when intranasal mupirocin was administered to carriers of \textit{S. aureus} preoperatively, and the study only showed a trend for decreased health care-associated infections caused by \textit{S. aureus}.

Researchers in the Netherlands found that decontaminating endogenous microorganisms in the nasopharynx and oropharynx with chlorhexidine gluconate reduces health care-associated infection after cardiac surgery.

\textbf{VII.a.9.} Perioperative nurses should verify that preoperative antimicrobial prophylaxis is administered according to the health care organization's policy.

Surgical antimicrobial prophylaxis is a critically timed adjunct therapy intended to reduce the microbial burden of surgical contamination to a level that cannot overwhelm the patient's defenses. The surgeon decides which antimicrobial agent to use by anticipating the surgical wound class for a given procedure. Comparisons of various antibiotics for short-term treatment have been shown to be equally effective against SSI in patients who underwent elective implant surgery and orthopedic surgery. To maximize the benefits of antimicrobial prophylaxis, the Hospital Infection Control Practices Advisory Committee recommends

- using an antimicrobial agent for all procedures or classes of procedures for which use has been shown to reduce SSI rates or for procedures from which incisional or organ-space SSI would be catastrophic;
- using a medication that is safe, inexpensive, and bactericidal with an in vitro spectrum that covers the most probable intraoperative contaminants for the surgery;
- timing the initial dose of the medication so that a bactericidal concentration is established in serum and tissues by the time of the incision; and
- maintaining therapeutic antimicrobial levels in both serum and tissues during the procedure and until a few hours after the incision is closed.

The Society for Healthcare Epidemiology of America/Infectious Diseases Society of America practice recommendations include

- delivering IV prophylaxis within one hour before the incision is made, or two hours for vancomycin and fluoroquinolones;
- using an antimicrobial agent that is consistent with published guidelines; and
- discontinuing use of the antimicrobial agent within 24 hours after surgery, or 48 hours for cardiothoracic procedures in adult patients.

\textbf{VII.b.} To limit or slow the spread of MDROs, perioperative personnel should collaborate with an infection preventionist to determine the best and safest plan for surgical patients who are diagnosed with an MDRO.

MRSA and VRE are not the only MDROs that present an infection prevention challenge. Other MDROs continue to emerge as a public health concern. Carbapenem-resistant enterobacteiraceae has become a serious threat to public health. These organisms have the potential to spread and are associated with high mortality rates, and they often carry genes that cause high levels of resistance to many antimicrobial agents, leaving extremely limited options for treatment.
When MDROs are introduced into a health care setting, several factors determine the likelihood of transmission and persistence of the resistant strain:

- vulnerable patients (i.e., patients in the hospital are more likely to get an infection because their immunity is weakened from the disease state),
- numbers of colonized patients,
- increased antimicrobial use, and
- effect of and adherence to prevention efforts.

Successful approaches to preventing and controlling MDROs are often a combination of strategies, including

- garnering administrative support (e.g., commitment of fiscal and staffing resources, implementation of system changes, expert consultation, laboratory support, adherence monitoring, data analysis);
- following and improving hand hygiene practices;
- using contact precautions until patients are culture negative;
- performing enhanced environmental cleaning;
- managing vascular and urinary catheters;
- preventing lower respiratory tract infection in intubated patients;
- accurately diagnosing infectious etiologies;
- following the recommendations of the CDC Campaign to Prevent Antimicrobial Resistance;
- limiting and carefully selecting antimicrobial agents;
- conducting MDRO surveillance as part of an MDRO control program;
- using active surveillance cultures;
- educating staff members to encourage behavior change through better understanding of MDROs; and
- improving communication about patients with MDROs within and between health care facilities.

Several studies also promote cohorting patients, using designated beds or units, universal screening, and closing units when necessary to control transmission of MDROs.

[Recommended for Practice]

VII.c. Perioperative personnel should implement CDC guidelines to prevent central line infections.

Central line infections cause significant problems for patients and health care facilities in terms of increase length of stay and increased cost. It is a national imperative to eliminate Central line-associated blood stream infection (CLABSI) among patients and the CDC Healthcare Infection Control Practices Advisory Committee (HICPAC) has specific recommendations for all health care providers who insert central catheters which would include anesthesia professionals. It is the perioperative nurses’ responsibility to make sure this evidence based guideline is adhered to promote patient
safety in all perioperative patients.

One study from the United Kingdom demonstrated that 39% of hospital-acquired MRSA bacteremia cases were caused by a central line. The researchers recommended a focus of infection prevention efforts should be on improving insertion and care of central lines.

Intraoperative stopcock contamination increases the rate of patient mortality and patient and provider reservoirs contribute to 30-day postoperative infections, according to a multicenter study. Researchers observed stopcock transmission events in 274 ORs and collected reservoir bacterial cultures. They identified stopcock contamination in 23% of procedures and concluded that although patients, provider hands, and the environment may have contributed to the contamination events, the environment was the most likely source. The researchers recommended designing multimodal programs to target each reservoir in parallel and introducing a comprehensive approach to reducing intraoperative bacterial contamination.

[Recommended for Practice]

VII.d. Perioperative nurses should follow the CDC guidelines for the prevention of catheter-associated urinary tract infections (CAUTI) and the health care organization's policies and procedures for urinary catheter insertion to prevent urinary tract infections.

CAUTI are considered health care-associated infections. They are preventable by following evidence-based recommendations.

One UK study found that 51% of hospital-acquired MRSA bacteremia cases were caused by a urinary catheter. The researchers recommended that a focus of infection prevention efforts should be on improving insertion and care of urinary catheters.

[Recommended for Practice]

VII.d.1. Perioperative personnel should

- insert catheters only for medically indicated conditions;
- use urinary catheters for surgical patients only as necessary as opposed to routinely;
- document the date and time of insertion of a catheter and remove the catheter as soon as possible postoperatively, preferably within 24 hours;
- strictly follow aseptic technique when placing a urinary catheter; and
- allow only trained persons who are familiar with correct aseptic technique and maintenance to insert urinary catheters.

**Recommendation VIII**

Health care personnel should be immunized against vaccine-preventable diseases.
The CDC Advisory Committee for Immunization Practices (ACIP) recommends that health care providers receive immunizations if they come into contact with patients or infectious material from patients that may put them at risk for exposure and possible transmission of vaccine-preventable disease. Including vaccinations as part of an organizational infection control and prevention program reduces the risk of occupationally acquired infections and, therefore, harm to patients from vaccine-preventable diseases.

The CDC recommends vaccinations for health care providers in two categories:

- diseases for which routine vaccination or documentation of immunity is recommended because of risks in the workplace (ie, hepatitis B, seasonal influenza, measles, mumps, rubella, pertussis, and varicella) and
- diseases for which vaccination might be indicated in certain circumstances (eg, meningococcal disease).

VIII.a. Employers must make the hepatitis B vaccination series available to all perioperative employees whose work involves a reasonable risk of exposure to blood or OPIM and must provide post-exposure evaluation and follow-up to all employees who have an exposure incident.

Hepatitis B is highly contagious and is transmitted via percutaneous exposure (eg, needlestick injury) or mucosal exposure to infected blood or body fluids. The risk for acquiring hepatitis B infection from occupational exposure depends on the frequency of percutaneous and mucosal exposure to blood or body fluids that contain the virus. Risks to health care providers from sharps injuries and blood and body fluid exposure has been reduced as a result of widespread hepatitis B vaccination.

Although rare, health care personnel who have hepatitis B or hepatitis C can transmit them to patients.

VIII.a.1. Serologic testing should be repeated after hepatitis B vaccination for health care personnel who are at "high risk" of occupational percutaneous or mucosal exposure to blood or body fluids. If antibody levels are too low (< 10 mIU/mL), the health care provider should be revaccinated and tested again after completing the series.

Performing serologic testing one to two months after the last dose of the vaccine helps determine whether there is a need for revaccination and guides post-exposure prophylaxis in the event of an exposure incident.

VIII.a.2. In the event of blood or body fluid exposure (ie, percutaneous, ocular, mucous membrane, nonintact skin), the need for post-exposure prophylaxis should be evaluated immediately based on the HBsAg status of the source and the health care provider's vaccination history and vaccine-response status.

VIII.b. All health care personnel who have no contraindications should receive annual influenza vaccinations.

Health care providers are exposed to patients who have influenza and are therefore at risk of occupationally acquired influenza and transmitting the disease to patients and other providers.

[Recommended for Practice]
Health care organizations should implement strategies to improve influenza vaccination rates among perioperative personnel. Strategies should include

- establishing evidence-based educational and promotional programs to communicate about the disease and the vaccine;
- capitalizing on the belief in ethical responsibility and protecting patients;
- running a campaign that emphasizes the benefits of vaccination for personnel and patients,
- implementing a vaccine declination policy,
- encouraging senior medical staff members or opinion leaders to get vaccinated,
- removing administrative barriers (eg, costs),
- providing incentives for getting vaccinated,
- providing the vaccine in locations and at times that are easily accessible to health care providers, and
- monitoring and reporting provider vaccination rates.

In January 2007, the Joint Commission began requiring accredited facilities to provide staff members, including volunteers and licensed independent practitioners, with influenza vaccinations and to report coverage levels. As of January 2013, the Centers for Medicare & Medicaid Services will require acute care hospitals to report vaccination rates among providers as part of its hospital inpatient quality reporting program. Despite the fact that annual vaccination has been recommended for health care providers and is a high priority for reducing morbidity associated with the virus in health care settings, vaccination rates among health care providers still need to improve.

According to a survey of 304 health care personnel at a German tertiary care university hospital, concern about adverse effects was a primary reason to avoid vaccination. Health care providers who are less likely to get vaccinated include

- women;
- nurses, technicians, and administrative workers; and
- those who did not receive a vaccine the previous year.

According to a survey conducted across eight university medical centers in the Netherlands, health care providers are more likely to get an influenza vaccination if they

- are older than 40 years of age,
- have a chronic illness,
- are aware of personal risk or the risk of infecting patients,
- trust that the vaccine is effective for reducing the risk of infecting patients,
- believe in the health care provider's responsibility to "do no harm" and ensure continuity of care, and
- have convenient access to the vaccine.

Social pressure for vaccination also increased the likelihood of health care providers getting vaccinated. Health care personnel are more likely to accept the influenza vaccine if they have a desire to protect themselves or patients or have a perception that the vaccine is effective.

Establishing a mandatory vaccination program is feasible and leads to high vaccination rates, as demonstrated
by a five-year study conducted at a tertiary care center in Seattle, Washington. In the first year of the program, 4,588 of 4,703 health care providers (97.6%) were vaccinated, and rates stayed above 98% for the subsequent four years. Of those who declined vaccination, 0.7% did so for religious reasons and were required to wear a mask during influenza season, and less than 0.2% opted to leave the facility. Although 72% of survey respondents at another facility in which mandatory vaccination was implemented reported feeling that the policy was "coercive," more than 90% agreed that the policy was ethically responsible and important for protecting patients and staff members.

VIII.c. Perioperative personnel should have presumptive evidence of immunity to measles, mumps, and rubella, and this information should be documented and readily available in the health care setting.

Presumptive evidence includes written documentation of vaccination with two doses of measles-mumps-rubella (MMR) vaccine administered at least 28 days apart, laboratory evidence of immunity, laboratory confirmation of disease, or birth before 1957.

Measles and mumps are highly contagious and can have serious consequences. Rubella was declared eliminated from the United States in 2004, but there is a risk of resurgence from importation.

Exposure to measles, mumps, or rubella in the health care setting can be expensive and disruptive because of containment measures, necessary personnel furloughs or reassignments, and potential closures.

[Recommended for Practice]

VIII.d. Health care personnel should receive a single dose of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) as soon as feasible upon hire if they have not been vaccinated previously.

Pertussis (ie, whooping cough) is a highly contagious bacterial infection and is transmitted via contact and droplet routes. Pertussis outbreaks in health care facilities can be costly in terms of personnel, testing, treatment, and prophylaxis, but adult vaccination may reduce the disease burden. The Tdap vaccine protects against pertussis and reduces the risk of transmission to patients, other health care providers, family members, and the community.

In October 2010, ACIP recommended that use of the Tdap vaccine be expanded. According to CDC, although there is a high rate of coverage for pertussis vaccination in children, the disease is "poorly controlled in the United States;" among adolescents, Tdap coverage is 56% and among adults, it is less than 6%.

[Recommended for Practice]

VIII.d.1. Health care organizations should establish programs to increase Tdap vaccination, including providing convenient access to the vaccination, giving the vaccination free of charge, and educating health care providers about the benefits of vaccination.

VIII.e. Health care organizations should ensure that all health care personnel have evidence of immunity to varicella, and providers who have no evidence of immunity should receive the varicella vaccine. This information should be documented and readily available in the health care setting.

Varicella is highly infectious and is transmitted via contact, droplet, and airborne routes. Primary infection usually results in lifetime immunity, and the US vaccination program that began in 1995 has led to greater than 85%
declines in varicella incidence, hospitalizations, and deaths.

Despite the reduced incidence, health care-associated transmission is still a risk and the disease can be fatal. Varicella is more likely to spread in hospital settings and long-term care facilities. Varicella exposure among patients and health care providers can disrupt patient care and cost the facility in terms of identifying susceptible patients and staff members, managing those who were exposed, and mandating furloughs for exposed staff members.

[Recommended for Practice]

VIII.e.1. When a patient with confirmed or suspected varicella infection enters the health care facility, airborne and contact precautions should be implemented and followed, and only health care providers with evidence of immunity should provide care to the patient.

VIII.f. Health care organizations should review health care provider vaccination and immunity status at the time of hire and at least annually thereafter.

Regularly reviewing vaccination and immunity status helps ensure that health care providers are up to date with respect to the recommended vaccines.

[Recommended for Practice]

VIII.f.1. All health care personnel should receive baseline TB screening upon hire. Follow-up testing should be performed in the case of exposure to TB.

Recommendation IX

Activities of health care personnel with infections, exudative lesions, and nonintact skin should be restricted when these activities pose a risk of transmission of infection to patients and other health care providers. State and federal guidelines and strategies should be followed for determining the need for work restrictions for health care personnel with bloodborne infections.

Restricting activities of personnel who have transmissible infections reduces transmission between providers and patients depending on the mode of transmission and epidemiology of the disease. Infections that may require restrictions from providing direct patient care, entering the patient's environment, or from handling instruments or devices that may be used during a surgical or invasive procedure include:

- Viral respiratory infections (eg, influenza, respiratory syncytial virus)
- Keratoconjunctivitis or purulent conjunctivitis caused by other microorganisms,
- Acute gastrointestinal illnesses (ie, vomiting or diarrhea with or without nausea, fever, or abdominal pain),
- Identification as an asymptomatic carrier of diphtheria,
- Exudative lesions that cannot be contained (eg, eczema, impetigo, smallpox),
herpes simplex infections of the fingers or hands (ie, herpetic whitlow),

pediculosis,

scabies, and

meningococcal infection (ie, until 24 hours after the start of effective therapy).

Work restrictions for health care personnel with bloodborne infections who provide direct patient care depends on several factors including circulating viral burden and category of clinical activities.

[This is a good section and should be included]

IX.a. An employee health nurse, infection preventionist, or physician should assess any health care provider with an infection, exudative lesions, or nonintact skin before he or she is allowed to return to work providing direct patient care or handling medical devices that are used in surgical or other invasive procedures.

Medical clearance is necessary before health care providers who have an infection, exudative lesions, or nonintact skin can return to work with patients or other health care providers.

[Recommended for Practice]

IX.b. Health care personnel should report exposures as soon as they occur and infections as soon as the disease process is noted.

Early self-reporting of exposures and infections helps prevent transmission to patients and other health care providers. Health care providers can be encouraged to self-report exposures or infections when the facility policies are designed to prevent judgement or penalty (eg, loss of wages, benefits, job status) for self-reporting.

[Recommended for Practice]

IX.c. The health care organization should have a written policy regarding health care personnel who have a potentially transmissible infection. The policy should establish responsibility for reporting the condition, work restrictions, and guidelines for clearing the employee for work after an illness that required a restriction.

[Recommended for Practice]

**Recommendation X**

Perioperative personnel should receive initial and ongoing education and competency validation of their understanding of the principals of infection prevention and the performance of standard, contact, droplet, and airborne precautions for prevention of transmissible infections and MDROs.

Education and competency assessment are prerequisites for ensuring standard and transmission-based precautions are understood and followed. Ongoing development of knowledge and skills and documentation of personnel participation is a regulatory and accreditation requirement for both hospitals and ambulatory settings.
Initial and ongoing education on infection prevention practices facilitate the development of knowledge, skills, and attitudes that affect safe patient care. Periodic education programs provide the opportunity to reinforce the principles of infection prevention, the necessary precautions to take when providing care to a patient who has a transmissible infection (eg, standards, contact, droplet, airborne), and the actions to take when a health care provider has a transmissible infection.

Competency assessment measures individual performance; provides a mechanism for documentation; and verifies that perioperative personnel have an understanding of infection prevention, MDROs, and facility policies. Every nurse is responsible for being personally accountable for maintaining competency validation.

There are no universally accepted or mandated ways to perform or validate competency, and strategies differ between states. Some states mandate specific topics that affect public health (eg, bioterrorism) or that are specific to certain areas of nursing. The goal of competency strategies are to reassure the public that nurses have the knowledge, skills, and judgment to provide safe and effective care.

Education and competency assessment topics specifically related to infection prevention include all of the prevention methodologies that are presented in this document, including

- standard precautions;
- contact precautions;
- airborne precautions;
- droplet precautions;
- MDROs;
- transporting patients on infection precautions;
- MRSA;
- N95 respirators/PAPRs;
- bloodborne pathogens;
- double gloving;
- sharps safety;
- perioperative considerations to prevent CLABSI, CAUTI, SSIs, and CRE; and
- Surgical Care Improvement Project (SCIP) measures.

X.a. Education, training, and competency validation should address

- standard precautions;
- contact precautions;
- airborne precautions;
- droplet precautions;
- MDROs;
- transporting patients on infection precautions;
- MRSA;
- N95 respirators/PAPRs;
- bloodborne pathogens;
- double gloving;
- sharps safety;
- perioperative considerations to prevent CLABSI, CAUTI, SSIs, CRE; and
- SCIP measures.

Standard precautions are used for all patients in the perioperative setting, and transmission-based precautions can be modified depending on local conditions and patient characteristics (Table 1). Including each topic in education and training helps ensure appropriate follow-through in the event of a suspected or identified case of infection. Understanding the scientific premise of these precautions allows health care providers to follow and modify the precautions safely based on identified changes, resources, and health care setting.

Table 1. Guide for Perioperative Personnel Caring for Patients with Transmissible Infections

<table>
<thead>
<tr>
<th>Type of precaution</th>
<th>Type of organism/disease</th>
<th>Transport</th>
<th>Unscrubbed Personnel*</th>
<th>Holding area</th>
<th>Environmental measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>Draining abscess, infectious wounds, <em>Clostridium difficile</em>, acute viral, methicillin-resistant <em>Staphylococcus aureus</em> (MRSA), vancomycin-resistant Enterococci (VRE), vancomycin-intermediate/resistant <em>S aureus</em> (VISA/VRSA), extended-spectrum beta-lactamase (ESBL), resistant pneumonia, influenza, and chicken pox</td>
<td>Cover or contain the infected or colonized areas of the patient’s body.</td>
<td>Wear gloves whenever touching the patient’s skin or items that are in close proximity to the patient.</td>
<td>Hold the patient in a single patient room if possible; otherwise keep ≥ 3 ft separation between patients.</td>
<td>Clean the room (eg, OR, AIIR) immediately after patient use. Focus on frequently touched surfaces.</td>
</tr>
<tr>
<td>Disease/Condition</td>
<td>Precautions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Droplet</strong></td>
<td>- Instruct the patient to wear a mask and follow respiratory hygiene and cough etiquette.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Hold the patient in a single patient room if possible; otherwise keep ≥ 3 ft separation between patients.</td>
<td><strong>Routine</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Standard precautions plus the following:</td>
<td>- Wear a mask upon entry into the room.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- The transporter is not required to wear a mask.</td>
<td>- Draw a privacy curtain between beds to minimize the opportunity for close contact.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Airborne</strong></td>
<td>- Instruct the patient to wear a mask and follow respiratory hygiene and cough etiquette.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Place the patient in an airborne infection isolation room (AIIR) if possible.</td>
<td>- Standard precautions plus the following:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cover and contain affected skin lesions.</td>
<td>- Wear a fit-tested N95 or higher level respirator that is approved by the National Institute for Occupational Safety and Health.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- The transporter is not required to wear a mask.</td>
<td>- Provide at least six (existing facility) or 12 (new construction/renovation) air changes per hour.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* "unscrubbed personnel" include anesthesia professionals, circulating RN, and preoperative and postanesthesia care personnel.
Infection control professionals should modify or adapt this table according to local conditions and special patient considerations.

Reference


[Effectiveness Not Established]

X.b. Health care personnel who are occupationally exposed to blood or OPIM must receive training before assignment to tasks where occupational exposure may occur and at least annually thereafter, and when changes to procedures or tasks affect occupational exposure.

Employers are responsible for providing training on bloodborne guidelines at no cost to the employee during working hours. Employers are also responsible for ensuring employees participate in the training program and for offering materials in appropriate languages and at appropriate literacy levels.

Providing the basis for the prevention of bloodborne pathogen exposure may instill an understanding of the processes that need to be followed and thereby prevent disease transmission. Education and training efforts are equally important in promoting awareness of hazards and acceptance of safe work and material-handling procedures in the workplace. Educating employees on safe work practices (eg, using PPE) can help protect staff members, their family members, and the community from take-home transmissions.

[Recommended for Practice]

X.b.1. Employee education must include

- an explanation of the modes of transmission of bloodborne pathogens and an explanation of the employer's exposure control plan;
- an explanation of the use and limitations of methods for reducing exposure (eg, engineering controls, work practices, PPE); and
- information on the hepatitis B vaccine, its efficacy and safety, the method of administration, and the benefits of vaccination.

X.c. Perioperative personnel should receive education and competency evaluation on preventing the spread of MDROs as part of the health care organizations’ infection prevention program. Education should include

- instruction on mechanisms of infection transmission,
- case-based scenarios for managing infected patients,
- participatory decision-making exercises about the implementation of precautions in addition to standard precautions, and
practice in the use of PPE for patients who require additional precautions.

Implementing a mandatory, organization-wide infection-control program can significantly improve the rate of health care-associated MRSA infections.
[Effectiveness Not Established]

X.d. Perioperative personnel should participate in programs to educate health care personnel about the importance of being immunized against epidemiologically important pathogens.

Programs that deliver educational and promotional messages about the benefits of vaccination can improve vaccination rates among health care personnel.
[Effectiveness Not Established]

X.e. Health care personnel should be educated on the benefits of reporting infections, exudative lesions, and nonintact skin in a timely manner and on related work restrictions.

Institutional policies and procedures that guide work restrictions because of infections are designed to protect patients. Health care providers have an ethical responsibility to promote their own health and well being, and a responsibility to remove themselves from care situations if it is clear that there is a significant risk to patients despite appropriate preventive measures.
[Recommended for Practice]

X.f. Health care personnel should receive education and training on the facility emergency preparedness plan.

It is important for health care personnel to be prepared to respond to threats of intentionally released pathogens and to treat patients who are exposed to biological agents.
[Recommended for Practice]

X.g. Perioperative personnel should participate in educational programs to improve infection control practices.

Surgical teams at a large UK teaching hospital implemented a "clean practice protocol" that improved adherence to overall infection control practices from 63% to 89% in three months, as demonstrated by undisclosed infection-control audits held before and after the education protocol. The protocol combined the use of a reminder poster and auditing several surgical units for activities related to hand decontamination, correct use of gloves, instrument cleaning, garment contamination, and notes contamination. After the audits and education, hand decontamination and the correct use of gloves and aprons improved significantly.
[Effectiveness Not Established]

**Recommendation XI**

Documentation should reflect activities related to infection prevention.
Documentation is a professional medicolegal standard. Documentation related to infection prevention is applicable at the systems level and the patient care level. At the systems level, documentation serves as a basis for monitoring compliance, measuring performance, maintaining employee records, and logging exposure incidents. At the patient care level, documentation facilitates continuity of patient care through clear communication and supports collaboration between health care team members.

XI.a. Employers must maintain training records related to bloodborne pathogens for three years. The records must include

- training dates,
- content or a summary of the training,
- names and qualifications of trainer(s), and
- names and job titles of trainees.

[Recommended for Practice]

XI.b. All incidents of occupational exposure to blood or OPIM must be documented. Documentation should include

- the route of exposure;
- the circumstances associated with the exposure;
- the source individual's serological status, if known;
- the employee’s name and social security number;
- the employee’s hepatitis B vaccination status and other relevant medical information for both individuals, including vaccination dates and any medical records related to the employee’s ability to receive vaccinations;
- results of all related examinations, medical tests, and post-exposure evaluation and follow-up procedures;
- a licensed health care professional’s written opinion; and
- a copy of the information provided to the employee.

Documenting each exposure incident provides a record of the incident, what follow-through was taken, and the current status of the incident. [Recommended for Practice]

XI.b.1. Employers must maintain a sharps log to document all percutaneous injuries from contaminated sharps and must maintain the log in such a way that injured employees’ identification remains confidential. At a minimum, a sharps injury log must include

- the type and brand of device involved in the incident,
- the department or work area where the exposure incident occurred, and
- an explanation of how the incident occurred.

XI.b.2. Documentation related to exposure incidents must be maintained for the employee’s duration of employment plus 30 years.
XI.c. Records and results of TB screening should be maintained for each employee in the employee's health record. If an employee has symptoms of TB disease, the symptoms should be recorded in the employee health record or medical record.

[Recommended for Practice]

XI.d. Vaccination records should be maintained for each employee. All employee vaccinations should be documented in the employee health record. Records of any vaccinations administered during employment should include

- the type of vaccine given;
- the date on which the vaccine is given;
- the name of the vaccine manufacturer and the lot number;
- any documented episodes of adverse reactions to a vaccination;
- the name, address, and title of the person who administered the vaccination; and
- the edition and distribution date of the language-appropriate Vaccine Information Statement provided to the employee at the time of vaccination.

Accurate vaccination records make it possible to quickly identify health care personnel who are susceptible to infection during an outbreak and can reduce costs and disruptions to health care operations.

[Recommended for Practice]

XI.d.1. Each employee's immunity status for vaccine-preventable diseases, including documented disease, vaccination history, and serology results, should be recorded in the employee's record.

XI.d.2. The health care organization should use a secure computerized system to manage vaccination records for health care personnel.

Computerized systems allow records to be retrieved easily and as needed.

XI.e. Wound class should be documented according to the CDC Surgical Wound Classification system at the conclusion of the procedure.

The surgical wound classification system has been shown to be a predictor of the relative probability that a wound infection will occur. In addition, the classification allows for comparison of wound infection rates associated with different surgical techniques, surgeons, and facilities. The comparison may be useful for research and may also serve to alert infection prevention personnel to wounds at increased risk for infection, enabling health care providers to implement appropriate surveillance and preventative measures.

The definitions of the four CDC wound classifications are

- Class 1—Clean wounds: These are uninfected operative wounds in which no inflammation is encountered, and the respiratory, alimentary, genital, or uninfected urinary tracts are not entered. In addition, clean wounds are primarily closed, and, if necessary, drained with closed drainage (eg, Jackson-Pratt). Operative incisional wounds that follow nonpenetrating (blunt) trauma should be included in this category if they meet the criteria.
Class 2—Clean-contaminated wounds: These are operative wounds in which the respiratory, alimentary, genital, or urinary tract is entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered (eg, spillage from gastrointestinal tract).

Class 3—Contaminated wounds: These include open, fresh, accidental wounds, operations with major breaks in sterile technique (eg, procedure performed with unsterile instruments) or gross spillage from the gastrointestinal tract, and incisions in which acute, nonpurulent inflammation is encountered.

Class 4—Dirty or infected wounds: These include old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.

[Recommended for Practice]

XI.e.1. Perioperative nurses should consider using educational tools to assist in accurately identifying surgical wounds.

The AORN Surgical Wound Classification Decision Tree can help perioperative nurses accurately identify surgical wounds (Figure 1).

**Figure 1. AORN Surgical Wound Classification Decision Tree.**

XI.f. Breaks in sterile technique should be documented per organization policy in consultation with infection prevention personnel.

Thoughtful assessment, collaboration with the surgeon and surgical team members, and the application of informed clinical judgment is required when determining whether contamination resulting from a break in sterile technique is significant enough for an infection to occur and the wound classification to be changed.

[Effectiveness Not Established]

XI.g. Results of documented surveillance should be shared with perioperative personnel.

Sharing documented surveillance can help to reduce morbidity and mortality. Monitoring performance helps in assessing the effectiveness of quality improvement interventions, and sharing surveillance strategies and results helps in identifying best practices for implementing evidence-based guidelines for preventing health care-associated infections.

Surveillance of both process measures and the infection rates to which they are linked are important for evaluating how effective infection prevention efforts are and identifying what needs to be changed. Surveillance is an ongoing, systematic collection, analysis, interpretation, and dissemination of data based on infections occurring in the health care facility.

[ Likely to be Effective]
Recommendation XII

Policies and procedures for the prevention and control of transmissible infections and MDROs should be developed, reviewed periodically, revised as necessary, and readily available within the practice setting.

Policies and procedures assist in the development of patient safety, quality assessment, and performance improvement activities. Policies and procedures establish authority, responsibility, and accountability within the facility. They also serve as operational guidelines that are used to minimize patient risk factors for complications, standardize practice, direct perioperative personnel, and establish continuous performance improvement programs.

XII.a. Policies and procedures should be developed to guide, support, and monitor adherence to standard and transmission-based precautions, including systems that should be used to collect, analyze, and communicate information related to transmissible infections.

Definitive policies and procedures as part of an overall administrative strategy can demonstrate a commitment to preventing transmissible infections by incorporating infection control into the organizational objectives for patient and occupational safety. Policies and procedures that guide and support patient care, treatment and services are an accreditation requirement for both hospitals and ambulatory settings.

[Recommended for Practice]

XII.a.1. Policies and procedures should be developed and implemented to address specific perioperative interventions to prevent SSIs, MDROs, CLABSI, and CAUTI.

XII.b. Policies and procedures designed to eliminate or minimize health care personnel exposure to blood and OPIM must be developed and implemented.

A written bloodborne pathogen plan that is consistent with federal, state, and local rules and regulations and that governs occupational exposure to bloodborne pathogens, is reviewed periodically, and is readily available in the practice setting promotes safety with medical devices and blood and body fluids.

[Recommended for Practice]

XII.c. Policies should be developed in accordance with federal and state guidelines and should be consistent with existing impaired-provider and disability guidelines to define work restrictions for health care providers who have infections, exudative lesions, and nonintact skin. The policies should include whether the employee

- has a viral burden above the recommended threshold for the relevant virus,
- has a medical condition or conditions that result in an inability to perform assigned tasks,
- has documented untoward events (eg, having transmitted HBV, HCV, or HIV),
- refuses or is unable to follow recommended guidelines to prevent transmission of infectious diseases, or
- is unable to perform regular duties, assuming that reasonable accommodation has
been offered for the disability.

[Recommended for Practice]

XII.d. A comprehensive vaccination policy for all health care personnel should be developed and implemented. The vaccination policy should include a method to assure that

- all health care personnel are up to date with recommended vaccines
- health care personnel vaccination and immunity status is reviewed at the time of hire and at least annually thereafter, and
- necessary vaccines are offered to employees in conjunction with routine annual disease-prevention measures (eg, influenza vaccination, TB testing).

[Not Yet Rated]

XII.e. Policies and procedures should be developed based on federal and state guidelines to define emergency response to threats of intentionally released pathogens (eg, anthrax, botulism, plague, smallpox).

Establishing policies and procedures for emergency preparedness guide health care providers in responding to intentionally released pathogens and treating patients who are exposed to biological agents.

[Recommended for Practice]

XII.f. Policies and procedures should include processes for initial education, training, ongoing competency validation, and annual review for issues dealing with infection transmission.

Policies and procedures assist in the development of activities that support patient safety, quality assessment, and the establishment of guidelines for continuous performance improvement. Standardizing processes for performance expectations between perioperative settings facilitates continuity of care and reduces the risk of error when personnel rotate between areas.

[Effectiveness Not Established]

Recommendation XIII

Perioperative team members should participate in a variety of quality improvement activities to monitor and improve the prevention of infections and MDROs.

Quality assurance and performance improvement programs assist in evaluating the quality of patient care and the formulation of plans for corrective actions. These programs provide data that may be used to determine whether an individual organization is within benchmark goals and, if not, identify areas that may require corrective actions.

XIII.a. Process monitoring should be a part of every perioperative setting as part of an overall infection prevention program. Process monitoring should include

- hand hygiene compliance,
standard and transmissible infection precaution compliance,
- influenza vaccinations for personnel and patients,
- environmental cleaning,
- central line and urinary catheter insertion practices, and
- SCIP measures.

[Effectiveness Not Established]

XIII.a.1. Perioperative nurses should assess and monitor cleaning and disinfection practices.

Monitoring cleaning and disinfection practices to ensure adherence can help control transmission of MDROs and other pathogens that may be residing in the environment. The information obtained from assessments can be used to develop focused administrative and educational interventions that incorporate ongoing feedback to the environmental services staff, to improve cleaning and disinfection practices in health care institutions.

Compliance and adjunct monitoring after terminal cleaning can help prevent cross contamination of areas that have or have had patients with MDROs.

XIII.a.2. Perioperative nurses should participate in quality improvement initiatives that promote understanding of and adherence to the principles of sterile technique.

XIII.a.3. A quality improvement program for the use of indwelling urinary catheters and central lines should be developed and implemented.

Monitoring the use of indwelling catheters can reduce CAUTI.

Quality improvement initiatives in which various strategies are “bundled” together may improve compliance with evidence-based recommended practices and reduce the incidence of CLABSI.

XIII.a.4. A quality improvement program for the use of indwelling catheters should be developed and implemented.

XIII.b. Quality indicators should be developed to measure improvement in the control and transmission of infectious diseases, including MDROs. Quality indicators for measuring the provision of safe patient care with regard to transmissible infections in the perioperative setting should include

- rate of SSIs,
- selection of antibiotics appropriate for surgery,
Quality indicators are measurable and demonstrate that facilities are using specific interventions to provide safe patient care. According to the Agency for Healthcare Research and Quality (AHRQ), "An adequate quality indicator must have sound clinical or empirical rationale for its use. It should measure an important aspect of quality that is subject to provider or health care system control." The AHRQ quality indicators are one response to the need for multidimensional, accessible quality measures that can be used to gauge performance in health care. The quality indicators are evidence based and can be used to identify variations in the quality of care provided on both an inpatient and outpatient basis.

XIII.b.1. Perioperative personnel who contract an infection or have a communicable disease should report them to the designated responsible person.

Prompt reporting enables employers to provide timely and confidential evaluation, intervention, testing, or appropriate prophylaxis.

XIII.b.2. All exposure incidents (eg, needle sticks, blood exposures) must be reported according to the health care organizations' policy and based on the OSHA Bloodborne Pathogen Standard.

Documenting all exposure incidents provides the employer with feedback regarding the circumstances of employee exposures. This information can be used to focus efforts on decreasing or eliminating specific circumstances or routes of exposures.

XIII.b.3. Perioperative nurses should contribute to ongoing surveillance of proper use of PPE.

By monitoring the proper use of PPE, perioperative nurses can contribute to community safety by helping limit take-home transmissions of infectious and toxic agents. NIOSH has recommended expanding current surveillance programs to gather data on take-home transmissions. For example, building on the existing NIOSH Sentinel Event Notification Surveillance for Occupational Risks programs for lead and pesticides, which would require prioritizing toxic agents and targeting surveillance in areas where workplace exposure is relatively common.

The NIOSH Task Force recommends, at a minimum,

- developing surveillance programs to document the effectiveness of control measures being used, including an assessment of the feasibility and effectiveness of alternative measures;
- assessing the performance of existing protective clothing (eg, single-use disposable clothing, clothing that can be laundered) as barriers for chemical, biological, thermal, and physical hazards;
- assessing the use and acceptance of PPE by workers;
- researching and developing new types of materials for protective clothing and gloves, including evaluating performance and characteristics; and
- measuring to ensure that protective clothing is made available and designed to fit the growing number of minority and female workers.
XIII.c. Rates of transmissible infections and MDROs should be monitored, documented, and reported to the designated infection preventionist and quality assurance improvement manager and any other personnel deemed appropriate by the health care organization. Surveillance should include monitoring

- use of standard precautions, contact precautions, droplet precautions, and airborne precautions; and
- outbreak specific pathogens (eg, *N meningitides*);
- isolation precautions for MDROs, surveillance practices, and practitioner adherence;
- bloodborne pathogen exposures;
- use of PPE; and
- health care personnel immunization rates.

Surveillance is a critical component of any MDRO control program because it allows for the detection of newly emerging pathogens, helps identify epidemiologic trends (eg, single patient, clusters of patients), and measures the effectiveness of interventions. Surveillance is important for follow-up with health care personnel who may have an infection or be colonized.

[Recommended for Practice]

XIII.d. Perioperative nurses should participate in surveillance programs for SSI.

Routine review and interpretation of SSI rates may help detect significant increases or outbreaks and identify areas where additional resources might be needed to improve SSI rates.

A successful surveillance program includes using epidemiologically sound infection definitions, surveillance methods, stratification of SSI rates according to risk factors associated with SSI development, and data feedback. Using consistent and standardized definitions as part of an SSI surveillance program helps ensure accurate interpretation and reporting. The CDC's National Nosocomial Infections Surveillance system has developed standardized surveillance criteria for defining SSIs.

Knowing what patient and surgery characteristics may influence the risk of SSI allows the surveillance team to stratify surgeries, makes surveillance data more comprehensible, and allows for targeted prevention measures. According to the Hospital Infection Control Practices Advisory Committee, patient characteristics that may be associated with an increased risk of SSI include diabetes, cigarette smoking, systemic steroid use, obesity (ie, > 20% ideal body weight), extremes of age, poor nutritional status, and perioperative transfusion of certain blood products. Surgery characteristics that affect SSI incidence include preoperative antiseptic showering, preoperative hair removal, skin prep practices, preoperative hand/forearm antisepsis, management of infected or colonized perioperative team members, and antimicrobial prophylaxis.

[Recommended for Practice]

XIII.d.1. Perioperative nurses should implement and record the measures related to SCIP initiatives according to the health care organizations’ policy.

As a national quality improvement initiative, SCIP is supported by more than 10 national organizations with the goal of improving surgical outcomes and significantly reducing surgical complications. SCIP measures are part of the Joint Commission's accountability measures.

One study that involved SCIP initiatives showed the importance of following these standard guidelines to
decrease the number of patients who experience an SSI. Perioperative nurses can take an active role in implementing SCIP measures and reporting data to identify areas where improvements can be made.

XIII.d.2. The choice of which procedures to monitor should be made jointly by surgeons and infection prevention personnel. SSI surveillance should target high-risk procedures.

XIII.d.3. When a cluster of SSIs involves an unusual organism, a formal epidemiologic investigation should be conducted.

Outbreaks and clusters of SSIs that involved unusual organisms (eg, *Clostridium perfringens*, *Legionella pneumophila*, *Legionella dumoffii*, *Nocardia farcinica*, *Pseudomonas multivorans*, *Rhizopus oryzae*, *Rhodococcus bronchialis*) have been attributed to contaminated adhesive dressings, elastic bandages, colonized surgical personnel, tap water, and disinfectant solutions.

XIII.e. Perioperative nurses should contribute to creating a culture of safety. A culture of safety is created through:

- management initiatives to improve patient and health care personnel safety,
- health care personnel participation in safety planning,
- availability of appropriate PPE for the identified tasks,
- influence of the groups norms regarding appropriate safety practices, and
- the facility’s socialization process for new hires.

A culture of safety has a direct effect on transmission prevention. [Likely to be Effective]

**Glossary**

**Airborne infection isolation room** - A single patient room that supplies negative air pressure relative to surrounding area, 12 air exchanges per hour, and the air is exhausted directly to the outside or recirculated through HEPA filtration before return.

**Airborne precautions** - Precautions that reduce the risk of an airborne transmission of infectious airborne droplet nuclei (ie, small particle residue 5 microns or smaller). Airborne transmission refers to contact with infectious airborne droplet nuclei that can remain suspended in the air for extended periods of time or infectious dust particles that can be circulated by air currents.

**Direct contact** - Person-to-person contact resulting in physical transfer of infectious microorganisms between an infected or colonized person and a susceptible host.

**Exposure incident to pathogens** - Exposure via specific eye, mouth, or other mucous membranes; nonintact skin; or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee’s duties.
Indirect contact - Contact of a susceptible host with a contaminated object (e.g., instruments, hands).

Isolation gown - Gowns used as specified by standard and transmission-based precautions to protect the health care provider's arms and exposed body areas and prevent contamination of clothing with blood, body fluids, and other potentially infectious material.

Procedure mask - A mask that 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. Unlike surgical masks, procedure masks are not regulated by the US Food and Drug Administration.

Surgical mask - A device worn over the mouth and nose by perioperative team members during surgical procedures to protect both the surgical patient and perioperative team members from transfer of microorganisms and body fluids. Surgical masks are also used to protect health care providers from contact with large infectious droplets (>5 mcm in size). According to draft guidance issued by the Food and Drug Administration on May 15, 2003, surgical masks are evaluated using standardized testing procedures for fluid resistance, bacterial filtration efficiency, differential pressure (air exchange), and flammability to mitigate the risks to health associated with the use of surgical masks. These specifications apply to any masks that are labeled surgical, laser, isolation, or dental or medical procedure.

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Recommendation I

Perioperative personnel should implement practices that reduce the spread of transmissible infections when preparing or working in the OR or procedure rooms and performing or assisting with operative or other invasive procedures.

Protecting patients and safeguarding health care providers from potentially infectious agent transmission is a key focus of perioperative nurses. Hand hygiene has been recognized as a primary method of decreasing health care-associated infections. Surgical attire and personal protective equipment (PPE) are worn to support cleanliness and hygiene, promote patient and health care provider safety, and aid in preserving the integrity of the sterile field within the perioperative environment.

I.a. Perioperative personnel entering invasive procedure rooms for any reason (eg, stocking supplies, bringing procedural supplies and equipment into clean rooms) should wear clean

- scrub attire, including a freshly-laundered or single-use, long-sleeved warm-up jacket snapped closed with the cuffs down to the wrists, and
- low-lint surgical head covers or hoods that cover all hair, including sideburns and the nape of the neck, and scalp skin.

Surgical attire helps contain bacterial shedding and promotes environmental cleanliness. Head coverings and hoods minimize microbial dispersal by containing hair and scalp skin.

[Recommended for Practice]
I.a.1. Perioperative personnel entering invasive procedure rooms should cover all facial hair and hair at the neckline.

I.b. Perioperative personnel should perform hand hygiene before entering invasive procedure rooms and areas where sterile supplies have been opened.

Following regular hand hygiene practices helps prevent transmission of infection and reduces health care-associated infections for patients and health care personnel.

[Recommended for Practice]

I.c. Perioperative personnel should wear a clean surgical mask that covers the mouth and nose and is secured in a manner to prevent venting when open sterile supplies are present and when preparing, performing, or assisting with

- central venous catheter (CVC) insertion, peripherally inserted central catheters (PICCs), and guidewire exchange;
- regional anesthesia; or
- high-risk spinal canal procedures (eg, myelogram, lumbar puncture, spinal anesthesia).

A clean surgical mask helps protect the patient and procedure site from microbial contamination by organisms carried in the provider’s mouth or nose.

Researchers studied the effectiveness of surgical masks in reducing the dispersal of bacterial contamination from the upper airways of 25 volunteers. The volunteers were asked to speak directly at an agar plate for five minutes. A surgical mask was applied and the volunteer was instructed to speak at the agar plate for three additional periods of five minutes each. The results showed a marked reduction in the bacterial contamination of the agar plates while the volunteers were wearing surgical masks.

In a study investigating the possibility that surgical masks increase vertical shedding of bacteria from the face during facial movement, volunteers were asked to speak for 20 minutes while moving their heads from side to side without a surgical mask for the first five minutes and then with a surgical mask for three additional five-minute periods. A blood agar plate was positioned 30 cm below the volunteers’ faces. The results showed a statistically significant reduction in the number of colony forming units on the agar plate when the volunteers were wearing surgical masks. The researchers recommended wearing a surgical mask, particularly when the perioperative team member’s face is in close proximity to the procedural site and when the need for speaking during the procedure is anticipated.

In a prospective, randomized, controlled trial of 221 patients, researchers assessed the need for surgical masks during cataract surgery. Patients were randomly assigned to group A, in which the surgeon wore a clean surgical mask, or group B, in which no face mask was worn. A settle plate was secured adjacent to the patient’s head on the operative side within the sterile field during all procedures. The results showed a significant reduction of bacterial organisms falling on the operative side when the surgeon wore a surgical mask.

In a study exploring the relationship between the use and position of a surgical mask during 30 cardiac catheterization procedures, researchers obtained bacterial samples within the draped, operative site adjacent to the femoral artery. Surgical masks were either not worn by perioperative team members, or worn in positions above and below the nose. The number of bacterial colonies recovered when no mask was worn was significantly greater than when a surgical mask was worn. Mask placement below the nose also was associated with a higher colony count than when the mask was worn above the nose. The researchers voluntarily discontinued the study after 30 patients in the interest of patient safety because of the high bacterial count associated with not wearing surgical masks.

Surgical masks are effective in limiting the dispersal of oropharyngeal droplets and are recommended by the Centers for
The American Society of Regional Anesthesia and Pain Medicine recommends the use of surgical masks during regional anesthesia as a method to reduce the likelihood of site contamination from microorganisms that may be present in the upper airway of providers.

Oropharyngeal flora was found to be the source of contamination in a number of reported cases of bacterial meningitis following lumbar puncture, spinal and epidural anesthesia, and intrathecal chemotherapy.

In 2004, the CDC investigated eight instances in which patients contracted meningitis after procedures that involved placing a catheter or injecting material into the spinal canal or epidural space. The cases involved blood or cerebrospinal fluid contaminated with streptococcal species or other pathogens consistent with oropharyngeal fluid. None of the clinicians wore surgical masks during the procedures. Equipment and products used during these procedures were excluded as sources of contamination. In June 2007, the Healthcare Infection Control Practices Advisory Committee (HICPAC) reviewed the cases and determined there was sufficient evidence to warrant the wearing of a surgical mask by the individual placing a catheter or injecting material into the spinal or epidural space.

In September 2008, three cases of bacterial meningitis in postpartum women were reported to the New York State Department of Health. Two additional cases of meningitis were reported to the Ohio Department of Health in May 2009. All of the patients had received intrapartum spinal anesthesia. The investigators concluded that the New York incidents were associated with a single anesthesiologist. The anesthesiologist reported wearing a surgical mask; however, personnel reported that the presence of unmasked visitors in the procedure area was common. The Ohio incidents were found to be associated with a second anesthesiologist who did not wear a surgical mask. The findings underscore the need for adherence to aseptic practices and the wearing of surgical masks during spinal procedures.

[Recommended for Practice]

**Recommendation II**

Surgical gowns, gloves, and drape products for use in the perioperative setting should be evaluated and selected for efficacy and safety before purchase or use.

Quality, cost containment, and patient and worker safety are primary concerns of perioperative RNs as they participate in evaluating and selecting medical devices and products for use in practice settings.

II.a. Surgical gowns, gloves, and drape products for use in the perioperative setting should be evaluated and selected according to:

- product-specific requirements;
- procedure-related requirements;
- end-user requirements and preferences;
- patient-related requirements;
- environmental considerations;
- compliance with federal, state, and local regulatory agencies; and
- compliance with standards-setting bodies.
Product-specific requirements include the criteria required for surgical gowns, gloves, and drape products used within the health care organization, such as contractual agreements, or compatibility with new or existing products.

Procedure-related requirements define what is necessary for the procedure where the surgical gowns, gloves, and drape products will be used, such as resistance to penetration by blood and other body fluids, or the presence of adhesive apertures.

End-user requirements, such as the degree of protection from blood and body fluids, and preferences, such as comfort, vary depending on how the surgical gowns, gloves, and drape products are used.

Patient-related requirements are specific to drape products and define the ability of the product to meet the needs of the individual patient, such as being large enough to accommodate the size of the patient or the ability to conform to patient contours.

Environmental considerations, such as the potential for recycling or reprocessing, reduce waste, conserve resources, and decrease costs without compromising quality of care.

Mandatory Occupational Safety and Health Administration (OSHA) regulations require that PPE such as surgical gowns and gloves do not permit blood or other potentially infectious material (OPIM) to "pass through to or reach the employee's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time which the protective equipment will be used." (1910.1030(d)(3)(i))

Surgical gowns and drape products are surgical devices, and as such are regulated by the US Food and Drug Administration (FDA). Failure of these devices is subject to medical device reporting requirements according to the Safe Medical Devices Act of 1990, as amended in March 2000 and MedWatch: The FDA Safety Information and Adverse Event Reporting Program.

The American National Standards Institute (ANSI) and Association for the Advancement of Medical Instrumentation (AAMI) standard PB70:2003/(R)2009, "Liquid barrier performance and classification of protective apparel and drapes intended for use in health care facilities," establishes a common system of classification and specifies labeling requirements for manufacturers of protective apparel and drapes used in health care facilities. The classification system is based on standardized test methods for determining liquid barrier performance and compliance.

The implementation of consistent classification and labeling requirements by the manufacturer aids in evaluation and selection of the most appropriate protective products for the health care organization.

[ Likely to be Effective ]

II.a.1. Surgical gowns, gloves, and drape products used during invasive procedures should provide effective barriers and be resistant to tears, punctures, and abrasions.

Tears, punctures, and abrasions may allow for the passage of microorganisms, particulates, and fluids between sterile and unsterile areas and expose patients and perioperative personnel to microbial contamination and bloodborne pathogens.

II.a.2. Seams and points of attachment of surgical gowns should minimize liquid penetration and passage of potential contaminants.
Wicking or pressure on a seam or point of attachment may cause liquid transfer between sterile and unsterile surfaces and one or both sides may become contaminated.

II.a.3. Surgical gowns, gloves, and drape products used during invasive procedures should be non-abrasive, and non-toxic.

Products that are abrasive and contain chemicals and other toxic materials may damage the skin and injure patients and perioperative personnel.

II.a.4. Barrier materials used for surgical gowns and drape products should be as lint-free as possible.

Lint particles are disseminated into the environment where bacteria attach to them. Bacteria-carrying lint may settle in surgical sites and wounds and may increase postoperative patient complications.

II.a.5. Surgical gowns and drape products should be functional and flexible.

Gowns and drape products that do not adequately perform and are unable to conform to the user’s body, patient’s contour, or equipment may be difficult to use and may not provide protection from contamination by blood and body fluids.

II.b. Perioperative personnel should select surgical gowns, gloves, and drape products for the procedure according to the barrier performance class of the product and the anticipated degree of exposure to blood, body fluids, and OPIM.

Surgical gowns and drapes are labeled by the manufacturer with the level of performance determined by the barrier properties of the area of the gown or drape where direct contact with blood, body fluids, and OPIM is most likely to occur.

[Recommended for Practice]

II.b.1. Surgical gowns with increased barrier capability as indicated on the product label should be worn during procedures with potential for exposure to blood, body fluids, or OPIM.

Surgical gowns, gloves, and drape products are used to establish a barrier that minimizes the passage of microorganisms, body fluids, and particulate matter between sterile and unsterile areas.

II.b.2. Surgical gloves with barrier capability should be worn during invasive procedures with the potential for exposure to blood, body fluids, or OPIM.

Surgical gloves are worn to protect patients and perioperative team members from transmission of pathogens. The process of surgery subjects gloves to mechanical stresses (eg, twisting, pulling, stretching) and exposure to fluids, fats, and other chemical substances (eg, methyl methacrylate) that may affect the integrity of the glove barrier. The barrier properties of surgical gloves may be affected by the strength of the glove material and also may be compromised by the hand and finger movements and other tasks (eg, holding retractors) required during invasive procedures.

In a study evaluating and comparing the barrier performance characteristics of latex, vinyl, and nitrile gloves under simulated use conditions, researchers tested a total of 2,000 gloves (800 latex, 800 vinyl, 400 nitrile) from seven
different manufacturers. The gloves were purchased specifically for the study, taken directly from the packages, and immediately tested. A comparative baseline was established by leak-testing 100 gloves of each brand and type. The study gloves were consistently manipulated in a manner simulating patient care activities for a period of 20 minutes. The results showed that the barrier performance of latex and nitrile gloves is comparable, and both materials are much less susceptible to material breakdown and leakage than vinyl.

To compare the frequency of glove defects in latex and nonlatex surgical gloves during routine surgery, researchers collected gloves at the end of 2318 surgical procedures. They tested a total of 6,386 gloves used by 101 surgeons and residents representing 15 surgical services. Six brands of nonlatex and two brands of latex gloves were tested. The results showed that both latex and nonlatex gloves performed adequately during routine surgical use; however, nonlatex surgical gloves had a higher rate of defects than latex gloves. The data also indicated that nonlatex gloves were nearly twice as likely to fail when used in certain high-risk surgical specialties (eg, oral, plastics, dental, cardiac) that require fine motor movement, increased hand dexterity, or contact with hard surfaces and sharp bone.

II.c. Perioperative personnel should select surgical gowns of sufficient size and adequate sleeve length.

When a gown is of insufficient size or sleeve length to cover the perioperative team member's body, it may restrict movement, increase the potential for the scrubbed team member's unsterile skin or clothing to contact the sterile field, or fail to provide adequate coverage to prevent the scrubbed team member from exposure to blood, body fluids, or OPIM.

When a gown is of excessive size or sleeve length, the extra gown material may inadvertently brush against unsterile objects and surfaces.

[Effectiveness Not Established]

II.c.1. Surgical gowns should be large enough to adequately wrap around the perioperative team member's body and completely cover the back.

In one study evaluating various combinations of surgical attire, the addition of a wrap-around gown reduced environmental microbial contamination by 51% when compared with scrub attire worn without a gown.

II.c.2. Surgical gowns should be selected so the lower sleeves and gown cuffs

- conform to the shape of the wearer's arms,
- are short enough to allow gloves to fully cover the cuffs and mate properly with the lower sleeves, and
- are of sufficient length to prevent the gown cuffs from pulling out of the gloves when the wearer's arms are extended.

**Recommendation III**

Perioperative personnel should implement sterile technique when donning and wearing sterile gowns and gloves.
Implementing sterile technique when donning and wearing surgical gowns and gloves reduces the risk of wound contamination and surgical site infections that may result from direct contact of surgical team members’ skin or clothing with the sterile field.

III.a. Perioperative team members should perform a surgical hand scrub before donning a sterile gown and gloves.

Surgical hand antisepsis decreases transient and resident microorganisms on the skin which may reduce health care-associated infections. Prevention of health care-associated infections is a priority of all health care providers. Health care-associated infections can result in untoward outcomes such as escalating cost of care, increased morbidity and mortality, and longer length of stay, as well as the pain and suffering a patient may experience. Hand hygiene, hand washing, and surgical hand scrubs are the most effective way to prevent and control infections and represent the least expensive means of achieving both.

[Recommended for Practice]

III.b. Scrubbed team members should don a sterile gown and gloves in a sterile area away from the main instrument table and in a manner to prevent contamination of surgical attire.

Donning gowns and gloves in a separate area may help prevent contamination of the main instrument table by droplets from the scrubbed team member’s wet hands. Donning gowns and gloves in a separate area also may reduce the risk of contamination of the main instrument table from potential contact with the unprotected skin and clothing of the scrubbed team member as they don sterile gown and gloves.

In a non-experimental, two part study with a small sample size, researchers cultured water droplets from 15 surgeons’ arms after a five-minute standardized surgical hand scrub with 10% povidone-iodine followed by thorough rinsing with tap water. The water droplets from each of the surgeons’ arms were collected and cultured. Pathogenic and environmental bacteria were recovered from the water droplets from the surgeons’ scrubbed arms. In the second part of the study, the wrapping paper from two different brands of gloves was investigated for permeability and bacterial penetration. The paper packaging was found to be permeable. The researchers concluded that pathogenic bacteria could be transferred from the surgeons’ arms to the gloves by water dropped on the glove packaging during the gowning and gloving process, and this represented a theoretical source of wound contamination.

[Effectiveness Not Established]

III.b.1. Sterile gloves should not be opened directly on top of the sterile gown that has been opened for donning by the scrubbed team member.

When the gown is retrieved, droplets from the scrubbed team member’s wet hands may drip onto the glove wrapper and contaminate the sterile gloves.

III.b.2. The scrubbed team member’s hands and arms should be completely dry before donning a sterile gown.

Droplets from the scrubbed team member’s wet hands and arms may drip onto the gown or gown wrapper and contaminate the sterile gown.

III.b.3. Only the inside of the sterile gown should be touched when it is picked up for donning by the scrubbed team member.
Touching only the inside of the gown when picking it up prevents the scrubbed team member's hands from contaminating the front of the gown.

III.b.4. The sterile glove wrapper or gloves should not be touched until the sterile gown has been donned.

After donning the sterile gown, the scrubbed team member's hands are covered by the impervious gown sleeves, which prevents the scrubbed team member's unprotected hands from contaminating the glove wrapper and gloves.

III.c. The front of a sterile gown should be considered sterile from the chest to the level of the sterile field.

In a study evaluating the most sterile areas of surgical gowns, researchers obtained samples from 50 surgical gowns at the end of 29 spinal procedures. The samples were taken at six-inch increments beginning at the neck of the gown and ending at the bottom of the gown. An additional 50 gowns were swabbed immediately after donning and before entering the sterile field to serve as negative controls. When compared with the negative controls, the contamination rates of the gowns worn during the procedures were lowest in the section between the chest and the operative field. Bacterial growth was highest in the areas above the chest and below the operating room table. The researchers theorized that the increased levels of bacterial growth in the areas above the chest were likely related to microbial shedding from the scrubbed team member's head or mask, whereas the portion of the gown below the operating table was likely contaminated by direct contact with unsterile objects below the level of the operative field. The researchers concluded the front of the gown between the chest and the sterile field to be the area of greatest sterility.

[Effectiveness Not Established]

III.c.1. The neckline, shoulders, and underarms of the surgical gown should be considered contaminated because they are areas of friction and may not provide effective microbial barriers.

III.c.2. The surgical gown back should be considered unsterile.

The back of the gown cannot be constantly monitored and may come in contact with an unsterile surface without notice.

III.d. Gown sleeves should be considered sterile from two inches above the elbow to the cuff, circumferentially.

Gown sleeves two inches above the elbow to the cuff are adjacent to the area of the gown that is considered sterile (ie, the front of the gown from the chest to the level of the sterile field). Circumferential sterility of the gown sleeves is necessary because the scrubbed team member's arms move across the sterile field.

[Effectiveness Not Established]

III.d.1. Sleeve cuffs of the surgical gown should be considered contaminated when the scrubbed team member's hands pass beyond the cuff.

Sleeve cuffs are not impervious and could allow for microbial transfer from the scrubbed team member's hand.

III.d.2. Sleeve cuffs should be completely covered by the sterile gloves and should not be exposed.
Permeable sleeve cuffs that are not completely covered by the sterile gloves may allow for microbial transfer and contact from the scrubbed team member's arms to the patient, and for contact with blood and body fluids from the patient to the scrubbed team member.

III.e. The closed assisted gloving method should be used to glove team members during initial gowning and gloving for operative or other invasive procedures.

The risk for glove cuff contamination increases when open assisted gloving is used. In a blinded, randomized study comparing contamination of the inside of the glove cuff during open and closed assisted gloving, two surgeons were gloved 20 times after covering their fingers and hands with a fluorescent powder. One surgeon was gloved by the closed assisted method and the other by the open assisted method. The results showed that open assisted gloving led to significantly greater glove cuff contamination than the closed assisted gloving method.

[Effectiveness Not Established]

III.e.1. During closed assisted gloving, the gown cuff of the team member being gloved should remain at or beyond the fingertips. The glove to be donned should be held open by a scrubbed team member, and the team member being gloved should insert his or her hand into the glove with the gown cuff touching only the inside of the glove.

III.e.2. Open assisted gloving, where the team member's gown sleeve is pulled up so that the gown cuff is at wrist level, leaving the fingers and hand exposed, should not be used.

III.f. Scrubbed team members should wear two pairs of surgical gloves, one over the other, during invasive procedures with the potential for exposure to blood, body fluids, or OPIM.

To provide an effective sterile barrier and prevent microbial transfer from surgical team members' hands to the patient, and to protect surgical team members from blood, body fluids, and OPIM from the patient, surgical gloves must be intact and without perforations. Wearing two pairs of gloves helps to reduce glove perforations.

A systematic review of 31 randomized controlled trials measuring glove perforations found that the addition of a second pair of surgical gloves significantly reduced perforations to the inner glove. Triple gloving, knitted outer gloves, and glove liners also significantly reduced perforations to the inner glove. More inner glove perforations were detected during surgery when perforation indicator systems were used.

The CDC, the American College of Surgeons (ACS), and the American Academy of Orthopedic Surgeons (AAOS) support double-gloving during invasive procedures.

[Recommended for Practice]

III.f.1. When double gloves are worn, perforation indicator systems should be used.

A perforation indicator system is a double gloving system comprising a colored pair of surgical gloves worn beneath a standard pair of surgical gloves. When glove perforation occurs, moisture from the surgical field seeps through the perforation between the layers of gloves allowing the site of perforation to be more easily seen.
A meta-analysis of five randomized, controlled trials with a combined sample size of 582 gloves showed significantly fewer perforations detected by scrubbed team members wearing standard double gloves compared with scrubbed team members using perforation indicator systems. When wearing standard double gloves, 21% of perforations were detected by the scrubbed team member. When wearing perforation indicator systems, 77% of perforations were detected.

III.g. Scrubbed team members should inspect gloves for integrity after donning, before contact with the sterile field, and throughout use.

Careful inspection of glove integrity after donning and before contact with the sterile field may reveal holes and defects in the unused product that may have occurred during the manufacturing or donning process and could allow for the passage of microorganisms, particulates, and fluids between sterile and unsterile areas.

Careful inspection of glove integrity throughout the procedure may prevent unnoticed glove perforation. Unnoticed glove perforation during operative or other invasive procedures may present an increased risk for bloodborne pathogen transmission to perioperative team member related to prolonged exposure to blood, body fluids, or OPIM, and also may expose the patient to an increased risk for wound infection related to transfer of microorganisms from the hands of surgical team members.

To investigate the frequency of undetected glove perforation, researchers studied glove perforations from 24 thoracoscopic and 23 open thoracotomy procedures and found that unnoticed glove perforation occurred in 25% of the gloves worn by the primary surgeon, and in 12% of all gloves worn during the procedures.

[Effectiveness Not Established]

III.h. Surgical gloves worn during invasive surgical procedures should be changed

- after each patient contact; [Recommended for Practice]
- when suspected or actual contamination occurs; [Effectiveness Not Established]
- after touching surgical helmet system hoods and visors; [Effectiveness Not Established]
- after adjusting optic eyepieces on the operative microscope; [Effectiveness Not Established]
- immediately following direct contact with methyl methacrylate; [Effectiveness Not Established]
- when gloves begin to swell, expand, and become loose on the hands as a result of the material's absorption of fluids and fats; [Effectiveness Not Established]
- when a visible defect or perforation is noted or when a suspected or actual perforation from a needles, suture, bone, or other event occurs; and [Recommended for Practice]
- every 90 to 150 minutes. [Likely to be Effective]

Failure to change gloves after each patient contact may lead to transmission of microorganisms from one patient to another. Sterile gloves that have contacted unsterile items may transfer microorganisms or other unsterile particulates to the sterile field.

Surgical helmet systems consists of an unsterile reusable helmet with a built-in ventilation fan covered with a single-use disposable sterile visor mask hood. The unsterile helmet is donned before the surgical hand scrub is performed. The sterile
visor mask hood that covers the unsterile helmet, is applied during the gowning and gloving process.

In a study to evaluate the sterility of the surgical helmet system during six hip arthroplasty and 14 knee arthroplasty procedures, researchers sampled the hoods at 30-minute intervals during and at the end of the procedures. Although the small sample size was a limitation of the study, the results showed that 80% of the hoods were contaminated intraoperatively. The hoods were contaminated within 30 minutes of use and showed heavy growth of coagulase-negative *Staphylococcus aureus*. The researchers recommended avoiding direct contact with the surgical helmet hood system during surgical procedures or changing gloves if contact does occur.

In another study evaluating microbial contamination of the surgical helmet system, researchers tested hoods used in 61 hip arthroplasty and 41 knee arthroplasty procedures. Samples were collected immediately after the hood was placed over the helmet and at the conclusion of the procedure. The contamination rate was 47%. The organisms found included coagulase-negative staphylococci, Micrococcus, methicillin-susceptible *S aureus*, and methicillin-resistant *S aureus*. The researchers recommended changing gloves if the hood or visor is touched or adjusted during the procedure.

Researchers conducted a study to assess the contamination rates of sterile microscope drapes used during spine surgery. The study included 25 surgical spine procedures requiring the use of the operative microscope. The microscope drapes were swabbed immediately after application as negative controls. Postoperatively, the microscope drapes were sampled in seven different places. When compared with the negative controls, all of the sampled areas were found to be contaminated with bacteria. Four of the seven areas, including the shafts of the optic eyepieces, were found to have significant contamination rates. The regions above the eyepieces and the overhead portion of the drape also were contaminated. The researchers recommended avoiding contact with the upper portion of the drape and changing gloves after adjusting the optic eyepieces.

Studies have demonstrated that surgical gloves are permeable to methyl methacrylate. The amount of permeation depends on the type of glove and the duration of time it is worn.

Researchers studied the effectiveness of the barrier provided by latex surgical gloves and found that latex is subject to hydration (ie, the absorption of fluid molecules). The rate of hydration is highly variable and depends on the properties of the individual glove product, the amount of perspiration from the scrubbed team member’s hand, and the amount of body fluid exposure during the procedure. Hydrated gloves showed increased permeability and porosity and a significant reduction of electrical and mechanical resistance. The researchers concluded that latex is an effective barrier; however, the combined effects of the mechanical and biological stress to which the glove is subjected require careful monitoring by the user, with glove change initiated before the competence of the glove is lost.

Surgical gloves that are intact and without defects or perforations provide an effective sterile barrier and may prevent microbial transfer from perioperative team members’ hands to the patient, and also to protect the perioperative team members from transfer of blood, body fluids, and OPIM from the patient.

In a study measuring the concentration of bacteria passing through glove punctures under surgical conditions, 128 outer and 122 inner gloves used by surgical team members during 20 septic laparotomy procedures were tested. The rate of outer glove perforation averaged 15%; however, nearly 82% of the perforations went undetected. The frequency of perforation was directly correlated with the length of time the gloves were worn for both inner and outer gloves. Direct bacterial passage from the patient through a glove puncture occurred in almost 5% of all gloves worn. The researchers recommended strict glove changing every 90 minutes.

In a study measuring bacterial translocation through puncture holes in surgical gloves, 98 outer and 96 inner gloves worn by surgical team members during 20 consecutive surgical laparotomy procedures were examined. Ten outer gloves and
one inner glove were perforated; however, seven of the perforations were detected because of the indicator glove system worn by surgical team members. Bacterial migration was demonstrated in five of the outer gloves and one of the inner gloves. The frequency of perforation increased with the length of time the gloves were worn. The researchers recommended double gloving and a change of gloves at least every 90 minutes.

In another prospective study, researchers from one facility collected 898 consecutive pairs of surgical gloves used during all general surgery procedures during a nine-month period. There was a positive correlation between the rate of perforation and the duration of time the gloves were worn. Gloves worn for 90 minutes or less showed a perforation rate of 15%. Gloves worn for 91 to 150 minutes showed a perforation rate of 18%, while gloves worn longer than 150 minutes showed a perforation rate of 24%. There was no significant difference in the perforation rates of gloves worn by surgeons, first assistants, or scrub persons. Undetected perforations were found in 19% of the gloves worn by all team members. The researchers recommended that surgeons, first assistants, and scrub persons directly assisting at the operative field change gloves after 90 minutes of surgery.

The AAOS recommends changing the outer pair of gloves at least every two hours to prevent skin exposure from perforations that may occur in the gloves with use over time.

[Not Yet Rated]

III.h.1. Perioperative team members should develop and implement a strategy for changing gloves during surgical and other invasive procedures and for identifying appropriate precautions to prevent microbial contamination and transmission of bloodborne pathogens.

The unique and critical factors associated with the immediate situation require thoughtful assessment and the application of informed clinical judgment.

Published literature does not provide conclusive evidence as to whether the outer gloves only or both the inner and outer gloves should be changed, or whether a surgical hand scrub should be performed each time gloves are changed. If the outer glove is contaminated by contact with an unsterile item (eg, surgical helmet hood), it may be sufficient to change only the outer gloves; however, if an outer glove has been perforated, the potential exists that the inner glove also may be perforated. In this case, the safest practice for both patient and surgical team member may be to remove gown and gloves, perform a surgical hand scrub, and don a clean gown and gloves.

III.i. Perioperative team members who must change their sterile gloves during an operative or other invasive procedure should use the assisted gloving method.

When using the assisted gloving method, one scrubbed team member touches only the outside of the new sterile glove when applying the glove to another scrubbed team member's hand.

Researchers evaluated glove donning techniques for microbial contamination by comparing open, closed, and assisted gloving techniques. After applying an ultraviolet luminescent cream to the tips of each of the fingers on both hands, 13 individuals were observed donning surgical gowns and gloves 20 times each. Contamination of the front and back cuff areas of the gown was noted in all 20 donning procedures using the open gloving method. Contamination of the back cuff areas of the gown was noted in all 20 donning procedures using the closed gloving method. No contamination of any areas of the gown was noted when using the assisted gloving method.

[Effectiveness Not Established]
If possible, the unscrubbed team member should remove the glove to be changed from the sterile team member without altering the position of the glove cuff (ie, pulling the cuff down over the scrubbed team member's hand).

**Recommendation IV**

IV.a. Perioperative team members should place sterile drapes on the patient, furniture, and equipment in the sterile field and should handle them in a manner to prevent contamination.

In a study evaluating bacterial penetration of disposable, non-woven drapes used during total hip arthroplasty, six brands of drapes were tested after 30 and 90 minutes. The results showed that bacterial penetration was time dependent. Most of the drapes remained impenetrable or allowed passage of fewer than 100 colony forming units at 90 minutes; however, none of the drapes tested were completely impenetrable, and certain brands were more resistant to bacterial penetration than others.

In another study considering the effects of moisture and physical stress on surgical draping materials, researchers found that materials differ dramatically in their ability to resist bacterial penetration.

In a randomized controlled trial comparing the use of maximal sterile barrier precautions (ie, sterile gown, sterile gloves, surgical cap, full body drape) with the use of only sterile gloves and a small drape during CVC insertion, results showed that maximal sterile barrier precautions led to fewer episodes of catheter colonization and catheter-related bloodstream infections. One program that included using maximal sterile barriers during CVC insertion in 103 intensive care units in Michigan resulted in a 66% decrease in infection rates.

The CDC recommends maximum sterile barrier precautions, including the use of a full body drape, during the placement of CVCs, PICCs, and guidewire exchanges.

[Recommended for Practice]

IV.a.1. Unsterile equipment (eg, microscopes) should be covered on the top, bottom, and sides with sterile barrier materials before being introduced to or brought over a sterile field. Sterile barrier material also should be applied to the portion of the equipment that will be positioned immediately adjacent to the sterile field.

IV.a.2. Sterile drapes should be handled as little as possible.

Rapid movement of draping materials creates air currents on which dust, lint, and other particles can migrate.

[IV.a.3. Draping materials should be held in a controlled manner that prevents the sterile drape item from inadvertently coming into contact with unsterile surfaces.

[IV.a.4. During draping, gloved hands should be shielded by cuffing the drape material over the gloved hands.

Keeping the gloved hands beneath the cuff of the draping material may protect gloves from contact with unsterile items or areas.
Researchers tested 275 outer and inner gloves that were used during 10 total hip replacements for microbial contamination. The results indicated that contamination occurred most frequently on the outside of the gloves that were used exclusively for draping.

IV.a.5. Surgical drapes should be placed in a manner that does not require scrubbed team members to lean across an unsterile area and prevents the front of the surgical gown from contacting an unsterile surface.

IV.a.6. Sterile drapes should be placed from the surgical site to peripheral areas.

IV.a.7. The portion of the surgical drape that establishes the sterile field should not be moved after it has been positioned.

IV.a.8. Only the top surface of a sterile, draped area should be considered sterile. Items that fall below the sterile area should be considered contaminated.

IV.b. Surgical equipment (eg, tubing, cables) should be secured to the sterile drapes with nonperforating devices.

Perforation of barrier materials may provide portals of entry and exit for microorganisms, blood, and OPIM.

[Effectiveness Not Established]

IV.c. The upper portion of the C-arm drape should be considered contaminated.

In a prospective study evaluating the sterility of 25 C-arm drapes used during spinal surgery, researchers obtained samples postoperatively from five different locations on a standard, fluoroscopic C-arm drape. The researchers also sampled the drapes preoperatively immediately after they were applied to establish a negative control. The results found that bacterial contamination was present at all sampled locations; however, the samples at the top of the C-arm had the greatest degree of contamination when compared with the negative controls (ie, 56% at the top and 28% at the upper front of the receiver). Lower rates of contamination were observed on the lower front, receiver plate, and mid-portion of the C-arm drape (ie, 12% to 20%), but these were not considered significant. The researchers recommended the top portion of the C-arm drape be considered unsterile, and suggested that avoiding contact with these areas may decrease the risk of postoperative infection.

[Effectiveness Not Established]

IV.d. Plastic adhesive incise drapes should not be used.

In a systematic review of seven randomized, controlled studies involving 4,195 patients, researchers concluded there was no evidence to support the use of plastic adhesive incise drapes as a method for reducing infection, and that there was some evidence that infection rates may be increased. A meta-analysis of five studies included in the review, which included 3,082
participants, compared plain plastic adhesive incise drapes with no drape and showed a significantly higher number of patients developed a surgical site infection when the adhesive incise drape was used. There was no effect on surgical site infection rates according to a meta-analysis of two additional studies, including 1,113 participants, which compared iodine-impregnated plastic adhesive incise drapes with no drape. The researchers theorized that the patient's skin is not likely to be a primary cause of surgical site infection if it is properly disinfected, and they concluded that attempting to isolate the skin from the surgical wound is of no benefit and may create increased moisture and bacterial growth under adhesive drapes.

[Not Recommended for Practice]

IV.e. Perioperative personnel should perform a surgical hand scrub and don sterile gown and gloves before holding extremities during skin preparation and draping.

In a randomized, controlled trial that involved 29 patients who were undergoing total hip or knee replacements, researchers collected air samples from a position representing the location of instrument tables during orthopedic surgery. Samples were collected during skin preparation and draping and 10 minutes after incision. In the control group of 11 patients, an unscrubbed, ungowned team member held the extremity during skin preparation and draping. In the study group of 18 patients, a scrubbed and gowned team member held the extremity during skin preparation and draping. The results showed that bacterial air counts were 2.4 times higher during skin preparation and draping than during the procedure because of the increased activity of personnel. However, the bacterial air counts were 4.4 times greater during skin preparation and draping when an unscrubbed, ungowned team member held the extremity. The researchers recommended that a scrubbed and gowned team member hold extremities during skin preparation and draping.

[ Likely to be Effective]

IV.e.1. Scrubbed and gowned team members holding extremities during skin preparation and draping should change into a clean gown and gloves before assisting in the procedure.

Recommendation V

A sterile field should be prepared for patients undergoing invasive surgical procedures.

Preparing a sterile field for patients undergoing invasive surgical procedures reduces the risk of microbial contamination and is a cornerstone of infection prevention. Failure to adhere to aseptic practices during invasive procedures has been associated with surgical site infections.
V.a. The sterile field should be prepared in the location where it will be used and should not be moved.

Moving the sterile field from one location to another increases the potential for contamination.

[Effectiveness Not Established]

V.b. The sterile field should be prepared as close as possible to the time of use.

The potential for bacterial growth and contamination increases with time because dust and other particles present in the ambient environment settle on horizontal surfaces. Particulate matter can be stirred up by personnel movement and can settle on opened sterile supplies.

There is no specified amount of time that opened sterile supplies in an unused room can remain sterile. The sterility of an opened sterile field is event-related.

[Recommended for Practice]

V.c. Sterile supplies should be opened for only one patient at a time in the OR or other procedure room.

Opening sterile supplies for multiple patients in a single OR or other procedure room increases the risk of cross contamination.

[Effectiveness Not Established]

V.d. One patient at a time should occupy the OR or other procedure room.

Concurrent procedures performed on multiple patients in the same OR or other procedure room at the same time may expose patients to a variety of hazards and increase the risk of contamination and infection.

Infectious diseases may be transmitted by airborne, contact, and droplet methods. The risk of cross contamination may be increased when two sterile fields, two surgical teams, and two open surgical wounds are confined to a single OR or other procedure room.

[Recommended for Practice]

V.e. Perioperative personnel should perform a surgical hand scrub and don a sterile gown and gloves before setting up sterile supplies.

Surgical hand antisepsis decreases transient and resident microorganisms on the skin, which may reduce health care-associated infections.

Donning a sterile gown and gloves before setting up sterile supplies minimizes the potential for wound contamination and reduces patient risks for surgical site infections that may result from contact with perioperative team members’ skin or clothing.

[Recommended for Practice]

V.f. Only sterile items should come in contact with the sterile field.
The creation and maintenance of a sterile field may influence patient outcomes.

Using sterile items during surgical invasive procedures minimizes the risk of infection and provides the highest level of assurance that procedural items are free of microorganisms.

[Recommended for Practice]

V.g. Sterile fields and instrumentation used during procedures that involve both the abdominal and perineal areas should be kept separate and should not be used interchangeably.

The perineal area has a higher microbial count than the abdominal area. Meticulous sterile technique is required during gynecologic laparoscopic procedures when transurethral instruments and catheters are passed to prevent infections of the urinary tract. These infections are the most common type of health care-associated infection reported to the National Healthcare Safety Network (NHSN).

The defense system of the peritoneum also may be negatively affected by the pneumoperitoneum used in laparoscopic procedures. The mechanical distension changes the peritoneal microstructure, allowing passage of bacteria to the bloodstream, lungs, and kidneys. This is important because intra-abdominal infections often begin in the peritoneal cavity. Systemic response coupled with the amount of tissue damage and the duration of the procedure may potentially lead to a higher risk for infection.

[Effectiveness Not Established]

V.h. Isolation technique should be used during bowel surgery.

Isolation technique, also known as bowel or contamination technique, is implemented to reduce the potential for microorganisms that exist within the bowel to be transferred into the abdominal cavity, tissues of the abdominal wall, and the surgical site. Isolation technique includes

- no longer using instruments or equipment that have contacted the inside of the bowel or the bowel lumen after the bowel lumen has been closed,
- using clean instruments to close the wound, and
- either removing contaminated instruments and equipment from the sterile field or placing them in a separate area that will not be touched by members of the sterile team.

The distal ileum is an area of transition between the small populations of bacteria in the proximal small intestine and the large numbers of bacteria and anaerobic microorganisms in the large bowel. Only small numbers of bacteria are normally present in the duodenum and proximal jejunum. Excessive colonization of bacteria in the small bowel is prevented by the destructive action of gastric acid and bile, digestion by proteolytic enzymes, and bacterial clearance by intestinal peristalsis. Some gastrointestinal disorders that require surgical repair may be associated with an increase in the number of bacteria in the upper gastrointestinal tract (eg,
obstruction, diverticula, fistula) and may warrant the implementation of isolation technique.

In a study evaluating contamination of surgical instruments that have contacted bowel mucosa and whether isolation technique decreases contamination of the abdominal wall and peritoneal cavity, researchers compared contamination levels of instruments used during procedures involving the large bowel (ie, cecum, ascending, transverse, descending, and sigmoid colon, rectum) with contamination levels of instruments used during procedures involving the small bowel (ie, duodenum, jejunum, ileum). Researchers cultured the needle drivers used to grasp the needles that perforated mucosa when the bowel was anastomosed and the tissue forceps that were used to grasp the edge of the bowel during anastomosis from 20 procedures involving the large bowel. The same two types of instruments from 10 procedures involving the small bowel also were cultured. The study results found that instruments that come into contact with the bowel lumen during bowel resection surgery become contaminated if they are not isolated, which increases the potential for contamination of the peritoneal cavity and abdominal wall from bowel organisms. The total number of organisms isolated was greater for the large bowel than for the small bowel, and the proportion of anaerobic organisms was greater in the large bowel group.

In a prospective study assessing the risk factors for surgical site infection during gastrointestinal surgery, researchers conducted surveillance of 941 patients in 27 hospitals and found the overall infection rate was 15.5%; the incidence of infection after gastric surgery was 8%; and the incidence of infection after small bowel, colorectal, appendectomy, and stoma surgeries was as high as 20% to 30%. Researchers found that strict adherence to sterile technique and minimal blood loss were associated with a lower incidence of surgical site infection.

[Effectiveness Not Established]

V.h.1. Isolation technique should begin when the gastrointestinal tract is transected and end when the anastomosis is closed.

V.h.2. The health care organization should develop and implement a standardized procedure for isolation technique.

A standardized procedure for isolation technique (ie, following the same patterns and processes each time) assists in achieving accuracy, efficiency, and continuity among perioperative team members. Studies of human error have shown that many errors involve a deviation from routine practice.

V.h.3. Isolation technique should be implemented using
either a single setup or a dual setup.

Single setup:

- Prepare one setup for the procedure, including anastomosis and closure.
- Before transection of the bowel, place clean sterile towels or a wound protector around the surgical site.
- Segregate all contaminated instruments and other items that have contacted the bowel lumen to a designated area (eg, Mayo stand, basin).
- Refrain from touching the sterile back table while the bowel is open.
- When the anastomosis is complete, remove the contaminated instruments, towel drapes, wound protector, and any other potentially contaminated items (eg, electrosurgical pencil, suction, light handles) from the sterile field, or place them in a separate area that will not be touched by perioperative team members.
- Irrigate the wound and apply moist counted sponges or towels to protect the tissue.
- Initiate team communication announcing the change to clean closure.
- One scrubbed team member should remain at the sterile field while all other team members change into clean gowns and gloves.
- The scrubbed team member who remained at the field should remove the moist counted sponges or towels and then change into a clean gown and gloves.
- Initiate accounting procedures.
- Apply clean light handles.
- Apply clean drapes to cover the existing drapes, which may be soiled with bowel contents.
- Secure a clean electrosurgical pencil and suction to the field.
- Proceed with wound closure only clean
instrumentation and other items.

Dual setup:

- Prepare one setup for the procedure and one for the closure.
- Before transection of the bowel, place clean sterile towels or a wound protector around the surgical site.
- When the anastomosis is complete, remove the contaminated instruments, towel drapes, wound protector, and any other potentially contaminated items (eg, electrosurgical pencil, suction, light handles) from the sterile field or return all contaminated instruments and other items to the procedure setup that will not be touched by perioperative team members.
- Irrigate the wound and apply moist counted sponges or towels to protect the tissue.
- Initiate team communication announcing the change to clean closure.
- One scrubbed team member should remain at the sterile field while all other team members change into clean gowns and gloves.
- The scrubbed team member who remained at the field should remove the moist counted sponges or towels and then change into a clean gown and gloves.
- Initiate accounting procedures.
- Apply clean light handles.
- Apply clean drapes to cover the existing drapes, which may be soiled with bowel contents.
- Secure a clean electrosurgical pencil and suction to the field.
- Proceed with accounting procedures followed by wound closure using only instrumentation and other items from the closure setup.

V.i. Isolation technique should be used during procedures involving resection of metastatic tumors.
The use of isolation technique is a primary precaution to prevent the potential spread of cancer cells to other regions within the body. There have been reports of local and distant implantation of tumor cells associated with the use of instrumentation used for both resection and closure or reconstruction.

In one reported case, a 52-year-old man underwent a subtotal resection of a metastatic gliosarcoma in the right frontal region, a second surgery four months later, and a third surgery with complete resection five months after that. The dural defect that occurred as a result of the total resection was reconstructed using a tensor fascia lata graft from the right leg. Two months later, the patient presented with subcutaneous masses in the frontal and right temporal scalp and in the right upper leg in the area where the donor graft was taken. Pathologic examination of the excised masses verified the presence of cells identical to the primary tumor mass. The patient died two months later with multiple subcutaneous masses in the scalp. Implantation of tumor cells by the use of contaminated surgical instruments used for tumor resection is believed to be the cause of the development of local and distant recurrences.

In another reported case, a 42-year-old man underwent sublabial transrhinoseptal incomplete resection of a clival chondroid chordoma and postoperative proton beam radiotherapy that resulted in stabilization of the residual tumor remnant. The patient experienced a painless loosening of an upper incisor 31 months later. Computerized tomography revealed a bone defect between the 11th and 12th teeth. Curettage biopsy and pathological examination showed a chondroid clival chordoma resembling the initial chordoma. The patient underwent two additional resections for intracranial recurrences and died at the age of 49 from infectious complications. Seeding during resection is believed to be the cause of the recurrence. The authors recommend removing resection instrumentation before closure and abundantly rinsing the surgical field.

In another case, a 37-year-old woman who was diagnosed at age 10 with a low-grade oligoastrocytoma underwent craniotomy with surgical resection of the tumor at the time of diagnosis. The patient underwent a second craniotomy and surgical resection of the tumor followed by chemoradiation for progression of the tumor. Seven months later, the patient noticed an area of thickening in the scalp incision and underwent resection of the scar for what was believed to be poor wound healing. Pathological examination of the skin from the scalp revealed fibrosis and subcutaneous fat necrosis with chronic inflammation and foreign body giant cell reaction; however, the deep aspect of the subcutaneous tissue showed clusters and
infiltrating cords of atypical cells morphologically similar to those of the resected tumor. The development of subcutaneous scalp involvement is believed to be from tumor implantation and seeding during surgical resection.

[Effectiveness Not Established]

**Recommendation VI**

Items introduced to the sterile field should be opened, dispensed, and transferred by methods that maintain the sterility and integrity of the item and the sterile field.

Sterile items that are not opened, dispensed, and transferred by methods that maintain sterility and integrity may contaminate the sterile field.

[It would be good to see a recommendation in this section that only members of the department surgical team are to open supplies to the scrubbed team. Vendors have no place opening supplies to the field when the RN in the room is responsible for observing and monitoring the sterile field.]

VI.a. Perioperative team members should inspect sterile items for proper packaging and package integrity, processing, and inclusion of a sterilization indicator immediately before presentation to the sterile field.

Inspecting items before presentation to the sterile field helps verify that conditions required for sterility have been met and helps prevent microbial contamination that might occur if the integrity of the container has been breached and the item is placed on the sterile field.

Sterility is event-related and depends on maintenance of the integrity of the package. The sterility of an item does not change with the passage of time but may be affected by particular events (eg, amount of handling) or environmental conditions (eg, humidity).

In a study of time-related contamination rates of sterilized dental instruments, researchers removed 25 sterilized examination mirrors from their packages and tested them for aerobic and anaerobic microbial contamination immediately after sterilization and at 31, 60, 90, and 124 days. Researchers found no contamination on any of the items at any time point.

In another study that evaluated whether storage time has any effect on the susceptibility of sterile packages to contamination under deliberate bacterial exposure, researchers prepared 700 packages containing six porcelain cylinders using four different types of packaging, including one cloth wrap, one paper wrap, and two peel pouches (ie, 175 of each packaging type). As a control group, 100 packages (ie, 25 of each packaging type) were immediately opened and tested for contamination. The outside of the remaining packages were deliberately contaminated with *Serratia marcescens* and opened at intervals of seven, 14, 28, 90, and 180 days. The packages were handled weekly and transferred from one container to another. The results showed no growth in the interior of any of the packages. Researchers concluded that
the packages were able to protect the contents for up to six months, even with external contamination.

Researchers tested 7,200 sterile packages to examine the effect of time on internal package sterility. The packages were tested immediately after sterilization and at monthly intervals during a 12-month period after storage in cabinet drawers in 24 different dental procedure rooms. No evidence of increased contamination over time was found for any of the packages. The researchers concluded that a 12-month or longer storage period is acceptable for sterile packages.

To evaluate the sterility of packaged items in a variety of environmental conditions, researchers distributed 152 wrapped and packaged items to five different areas within a single hospital. Every three months over a two-year period, a number of items were removed from their packaging and tested for sterility. All of the tested items were found to be sterile. The results of this study demonstrated that unless the packaging is damaged, properly wrapped or packaged and sterilized items remain sterile. The researchers also concluded that although the study was conducted during a two-year period, there is no reason to suggest that this should be considered as a time limit for sterility.

[Recommended for Practice]

VI.a.1. Perioperative team members should inspect the sterilization indicator in the sterile package to verify the appropriate color change for the sterilization process used.

VI.a.2. If an expiration date is provided, perioperative team members should check the date before the package is opened and the contents are delivered to the sterile field.

VI.a.3. Items should not be used after the labeled expiration date.

VI.b. Items should be delivered to the sterile field in a manner that prevents unsterile objects or people from leaning or reaching over the sterile field.

Microorganisms are shed from the skin of perioperative personnel. Maintaining distance from the sterile field decreases the potential for contamination when items are passed from unsterile to sterile areas.

[Recommended for Practice]

VI.c. Sterile items should be presented directly to the scrubbed team member or placed securely on the sterile field.

Items tossed onto a sterile field may roll off the edge, create a hole in the sterile drape, or cause other items to be displaced, leading to contamination of the sterile field.

[Effectiveness Not Established]

VI.c.1. Heavy items or items that are sharp and may penetrate the sterile field should be presented directly to the scrubbed team member or opened on a separate clean, flat, dry surface.

VI.d. Perioperative personnel should open wrapped sterile supplies by opening

- the farthest wrapper flap,
• each of the side flaps, and
• the nearest wrapper flap.

Opening the wrapper flap that is farthest away first prevents contamination that might occur from passing an unsterile arm over sterile items.
[Effectiveness Not Established]

VI.d.1. Wrapper edges should be secured when supplies are opened and presented to the scrubbed team member or sterile field.

Wrapper edges are considered contaminated. Securing the loose wrapper edges helps prevent them from contaminating sterile areas or items.

VI.d.2. Instrument tray wrappers should be visually inspected for moisture and integrity before the contents are placed on the sterile field.

VI.e. Peel pouches should be presented to the scrubbed team member or opened onto the sterile field by pulling back the flaps without touching the inside of the package or allowing the contents to slide over the unsterile edges of the package.

Touching the inside of the package or allowing the contents to slide over the unsterile edges may contaminate the contents of the package.
[Effectiveness Not Established]

VI.f. Rigid sterilization containers should be inspected and opened on a clean, flat, and dry surface.

Opening rigid sterilization containers on a clean, flat, and dry surface facilitates removing sterile items from their containers without contaminating the items or sterile field.
[Effectiveness Not Established]

VI.f.1. Perioperative team members should verify that external locks are intact before opening rigid sterilization containers.

Ensuring container locks are intact helps to verify there has not been a breach of the container seal.

VI.f.2. Perioperative team members should verify that the external indicator has changed as appropriate before opening rigid sterilization containers.

Checking for the appropriate indicator change verifies that the container has been through the sterilization process and reduces the potential for opening items that have not been sterilized.
VI.f.3. The lid of the rigid sterilization container should be lifted up and toward the person opening the container and away from
the container.

Lifting the lid up and toward oneself and away from the container helps to prevent potential contamination from contact
between the unsterile lid and the sterile inner rim, contents, and inside of the container system, and also helps to prevent
the unscrubbed person from leaning over the sterile contents of the container.

VI.f.4. Rigid sterilization container filter(s) should be inspected for integrity and the container contents considered contaminated
if the filter is damp or dislodged, or has holes, tears, or punctures.

VI.f.5. The scrubbed team member should avoid contacting the unsterile surfaces of the table or container while lifting the inner
basket(s) out and above the container. Before the instruments are placed on the sterile field, the internal indicator should
be examined for the appropriate color change and the outer basket inspected for debris or other contamination.

VI.g. Sterile solutions (eg, normal saline) and medications should be transferred to and handled on the sterile field using sterile

transparency.

Transferring and handling medications and solutions on the sterile field poses increased risks for contamination of the
medication, solution, sterile field, and surgical site because medications and solutions are removed from their original
containers, stored on the sterile field, and passed from a scrubbed team member to a licensed practitioner for
administration. Using sterile technique helps prevent microbial contamination of the sterile field or medication.

[ Likely to be Effective ]

VI.g.1. Medications and solutions should be visually inspected immediately
before transfer to the sterile field and should not be used if the expiration
date has passed or if there is any indication that the medication or solution
has been compromised (eg, discoloration, particulate formation).

Compromised and outdated medications and solutions may be
contaminated or have reduced effectiveness.

VI.g.2. Sterile transfer devices (eg, sterile vial spike, filter straw, plastic catheter)
should be used when transferring medications to the sterile field.

Transfer devices are designed to reduce the potential for contamination of
the sterile field by minimizing splashing and spilling and the need to reach
over the sterile field.

VI.g.3. When solutions are dispensed to the sterile field, the entire contents of the
container should be poured slowly into a labeled solution receptacle that
is placed near the sterile table’s edge or held by a scrubbed team
member.

The entire contents of the container are poured slowly to avoid splashing.
Splash-backing may cause strike-through and splash-back from unsterile
surfaces to the sterile field.
Placing the solution receptacle near the edge of the sterile table or having the scrubbed team member hold the receptacle reduces the potential for contamination of the sterile table and allows the unscrubbed team member to pour fluids without leaning over the sterile field.

VI.g.4.

The edge of the container should be considered contaminated after the contents have been poured.

VI.g.5.

The cap should not be replaced on opened medication or solution containers and any remaining fluids should be discarded.

The sterility of the contents of opened medication or solution containers cannot be ensured if the cap is replaced.

Reuse of open containers may contaminate solutions from drops contacting unsterile areas and then running back over container openings.

VI.g.6.

Medications and solutions should be dispensed to the sterile field as close as possible to the time they will be used.

VI.g.7.

Stoppers should not be removed from vials for the purpose of pouring medications unless specifically designed for removal and pouring by the manufacturer.

VI.g.8.

A syringe and needle should be used only once to administer a medication to a single patient; however, the same syringe and needle may be reused when administering incremental doses to a single patient is an integral part of a single procedure.

Using needles and syringes more than one time may increase the risk of infection.

VI.g.9.

Unused, opened irrigation or IV solutions should be discarded at the end of the procedure.

Irrigation and IV containers and supplies are considered single-use. Using surplus volume from any irrigation or IV solution containers or supplies for more than one patient increases the risk of cross contamination.

Recommendation VII

A sterile field should be constantly monitored to ensure sterility is maintained.
The sterile field is subject to unrecognized contamination by personnel, vectors (e.g., insects), or breaks in sterile technique if left unobserved.

VII.a. Once created, a sterile field should not be left unattended until the surgical or other invasive procedure is completed.

Observation increases the likelihood of detecting a breach in sterility.

[Effectiveness Not Established]

VII.a.1. The doors to the OR or other procedure room should not be taped closed or otherwise secured as an alternative to monitoring the sterile field.

VII.b. When there is an unanticipated delay, a sterile field that has been prepared and will not be immediately used may be covered with a sterile drape.

To evaluate the contamination rate of sterile trays that have been opened in a controlled OR environment and the effect of traffic on the contamination rate, researchers opened 45 sterile trays in a positive air-flow OR and randomly assigned them to one of three groups:

- Trays were opened and left uncovered in a locked OR.
- Trays were opened and left uncovered in an OR with single-person traffic flowing in and out every 10 minutes from an unsterile corridor.
- Trays were opened, immediately covered with a sterile surgical towel, and left in a locked OR.

All trays were opened using sterile technique and were exposed for a total of four hours. Cultures of the trays were taken immediately after they were opened and every 30 minutes during the exposure period. The contamination rates for the uncovered trays were 4% at 30 minutes, 15% at 60 minutes, 22% at two hours, and 30% at four hours. The covered trays had no contamination during the exposure period. The researchers recommended covering sterile trays that are not immediately used with a sterile towel to minimize exposure to environmental contaminants.

[Effectiveness Not Established]

VII.b.1. The health care organization should develop a standardized procedure in collaboration with infection prevention personnel for covering sterile fields to delineate the specific circumstances when sterile fields may be covered and to specify the length of time a sterile field may be covered.

Standardized procedures (i.e., following the same patterns and processes each time) assist in achieving accuracy, efficiency, and continuity among perioperative team members. Studies of human error have shown that many errors involve a deviation from routine practice.

VII.b.2. When sterile fields are covered, they should be covered in a manner that allows the cover to be removed without bringing the part of the cover that was below the sterile field above the sterile field.

Removing the cover from the sterile field may result in a part of the cover that was below the sterile field being drawn above the sterile field which may allow air currents to draw microorganisms and other contaminants (e.g., dust, debris) from an unsterile area (e.g., floor).
and deposit them to sterile areas.

VII.b.3. Instruments on the sterile field may be covered during periods of increased activity.

Researchers found that covering instruments after setup during periods of increased activity and bacterial dispersal (eg, patient transfer to the procedure bed, skin preparation) reduced instrument contamination by shortening the overall exposure time and shielding the instruments from bacterial dispersal.

VII.c. Perioperative personnel should observe for, recognize, and immediately correct breaks in sterile technique when preparing, performing, or assisting with surgical or other invasive procedures and should implement measures to prevent future occurrences.

Breaks in sterile technique may expose the patient to increased microbial contamination. The risk for infection increases with increased amounts of microbial contamination. Preventing, observing for, recognizing, and taking immediate corrective action for breaks in sterile technique may prevent or reduce microbial contamination and help minimize the risk of surgical site infection.

[Recommended for Practice]

VII.d. When a break in sterile technique occurs, corrective action should be taken immediately unless the patient's safety is at risk. When a break in sterile technique cannot be corrected immediately, corrective action should be taken as soon as it is safe for the patient.

The greater the length of time until the break in sterile technique is recognized, the more complex and difficult the containment becomes and the more likely that full containment may not be possible.

[Effectiveness Not Established]

VII.e. If organic material (eg, blood, hair, tissue, bone fragments) or other debris (eg, bone cement, grease, mineral deposits) is found on an instrument or item in a sterile set, the entire set should be considered contaminated.

Organic and inorganic material that remains on a surgical instrument may be transferred to the surgical wound or other areas of the body, which increases the risk for surgical site infection or other postoperative complications.

Sterilization or high-level disinfection can only be achieved if all surfaces of an item have contacted the sterilizing agent or disinfectant under the appropriate conditions and for the appropriate amount of time. Organic materials and other debris may act as barriers that interfere with the sterilization or high-level disinfection process or may combine with and deactivate the sterilant or disinfectant. If organic material or other debris is found on an instrument that has been through the sterilization or high-level disinfection process, there is no way to ensure that the sterilant or high-level disinfectant made contact with all surfaces of the item and with other items in the set. Sterility or high-level disinfection may not have been achieved; therefore, the sterility of the entire set is in question.
VII.e.1. If organic material or other debris is found on an item in a sterile set, perioperative team members should take corrective actions immediately. Corrective actions at a minimum, should include

- removing the entire set and any other items that may have come in contact with the contaminated item from the sterile field and
- changing the gloves of any team member who may have touched the contaminated item.

Additional corrective actions may be required subject to thoughtful assessment and the application of informed clinical judgment based on the specific factors associated with the individual event.

VII.f. If an instrument in a sterile set is found assembled or clamped closed, the entire set should be considered contaminated.

Sterilization or high-level disinfection can only be achieved if all surfaces of an instrument have contacted the sterilizing or disinfecting agent under the appropriate conditions and for the appropriate amount of time. If an instrument has not been correctly disassembled, or is clamped closed before sterilization or high-level disinfection, there is no way to ensure that the sterilant or high-level disinfectant made contact with all surfaces of the item and with other items in the set. Sterility or high-level disinfection may not have been achieved; therefore, the sterility of the entire set is in question.

VII.f.1. If an instrument in a sterile set is found assembled or clamped closed, perioperative team members should take corrective actions immediately. Corrective actions at a minimum, should include

- removing the entire set and any other instruments that may have come in contact with the contaminated instrument from the sterile field, and
- changing the gloves of any team member who may have touched the contaminated item.

Additional corrective actions may be required subject to thoughtful assessment and the application of informed clinical judgment based on the specific
Scrubbed team members should step away from the sterile field while sneezing. After sneezing, the perioperative team member should remove his or her sterile gown and gloves, discard his or her mask, wash his or her hands, apply a clean surgical mask, perform a surgical hand scrub, and don a clean gown and gloves.

In a prospective study of orthopedic surgeons assessing the potential for contamination of the sterile field from sneezes by perioperative team members who are wearing a mask, researchers showed that although surgical masks significantly reduced bacterial counts after sneezing, they did not eliminate the potential for contamination of the surgical site. The researchers recommended that, if possible, perioperative team members distance themselves from the surgical site while sneezing and that they change into a clean gown and gloves after sneezing.

[Effectiveness Not Established]

Recommendation VIII

All personnel moving within or around a sterile field should do so in a manner that prevents contamination of the sterile field.

Airborne contaminants and microbial levels in the surgical environment are directly proportional to the amount of movement and the number of people in the OR or other procedure room.

VIII.a. Scrubbed team members should remain close to the sterile field and touch only sterile areas or items.

Walking outside the periphery of the sterile field or leaving the OR or other procedure room in sterile attire increases the potential for contamination.

[Effectiveness Not Established]

VIII.a.1. Scrubbed team members should not leave the sterile field to retrieve items from the sterilizer.

VIII.a.2. Scrubbed team members should wear protective devices (eg, lead aprons) that reduce radiological exposure so they are not required to leave the sterile field when x-rays are taken.

I.b. Scrubbed team members should keep their hands and arms above waist level at all times.

Keeping the hands and arms above waist level allows the perioperative team member to see them constantly.
Contamination may occur when a perioperative team member moves his or her hands or arms below waist level.

[Effectiveness Not Established]

VIII.b.1. Scrubbed team member’s arms should not be folded with the hands in the axilla.

The axillary area has the potential to become contaminated by perspiration, allowing for strike-through of the gown and potential contamination of the gloved hands. The axillary area of the gown is an area of friction and is not considered an effective microbial barrier.

VIII.c. Scrubbed team members should avoid changing levels and should be seated only when the entire procedure will be performed at that level.

When the scrubbed team member changes levels, the unsterile portion of his or her gown may come into contact with sterile areas.

To evaluate whether the surgical field could be contaminated by a perioperative team member stepping on and off of a footstool, researchers sprinkled starch powder on the portion of the drape below the level of the sterile field. A surgeon wearing a surgical gown made contact with the drape, and then stepped on and off a 6 inch (15 cm) footstool twice. The contamination level rose 6 inches (15 cm) with each movement. The researchers recommended that scrubbed team members reduce the number of times they step on the footstool.

[Effectiveness Not Established]

VIII.d. When changing position with each other, scrubbed team members should turn back to back or face to face while maintaining distance from each other, the sterile field, and unsterile areas.

Contamination of sterile gowns and gloves and the sterile field may be prevented by scrubbed team members maintaining distance from each other and the sterile field when changing position, and by establishing patterns of movement that reduce the risk of contact with unsterile areas.

[Effectiveness Not Established]

VIII.e. Unscrubbed personnel should face the sterile field on approach, should not walk between sterile fields, and should maintain a distance of at least 12 inches from the sterile field at all times.

Contamination of the sterile field may be prevented by unscrubbed team members maintaining distance from and establishing patterns of movement around the sterile field that reduce the risk of contact with sterile areas.

[Effectiveness Not Established]

VIII.f. Conversations in the presence of a sterile field should be kept to a minimum.

Microorganisms are transported on airborne particles including respiratory droplets.

Researchers studied the role of conversation in the OR by using small spherical particles of human albumin ranging in size from 10 to 35 micrometers in diameter to simulate particles that carry bacteria. Approximately 300,000 albumin particles were sprayed on the faces and in the nostrils beneath the surgical masks of the study participants. The participants read aloud continuously for periods of five, 10, 20, 30, 40, 50, and 60 minutes from a position 30 cm above a water bath
simulating a surgical wound. The researchers collected particles from the water bath and processed them after each reading session. The results of the study showed that the longer the period of conversation, the greater the number of particles in the simulated wound. The effects of both time and conversation were found to be significant. The researchers concluded that conversation contributes to airborne contamination of surgical wounds.

[Effectiveness Not Established]

VIII.g.

The number and movement of individuals involved in a surgical or other invasive procedure should be kept to a minimum. Bacterial shedding increases with activity. Air currents can pick up contaminated particles shed from patients, personnel, and drapes and distribute them to sterile areas.

Researchers conducted a prospective, observational study in three pediatric ORs. During a two-week period, surgeons, anesthesia professionals, and perioperative team members were observed during 14 surgical procedures. A medical student observer recorded parameters including the

- minimum and maximum number of personnel in the room during the procedure,
- number of personnel in the procedure room at each 30-minute interval, and
- number of personnel changes during the procedure.

There was a positive correlation between the length of the surgery and the number of personnel changes during the procedure, and a statistically significant increase in the number of personnel during spine procedures and procedures greater than 120 minutes. The researchers also noted a trend toward increased numbers of personnel during the middle of the procedure, especially during longer procedures. It was observed that personnel frequently entered the OR to check on the progress of the procedure, ask questions, or process paperwork. The researchers noted that these factors, in combination with frequent changes in personnel for breaks and shift changes, were a cause of distraction during the procedure, which could potentially lead to errors. Although this study was limited by its small sample size, the results support the need to limit the number of people and distractions in the OR during surgical or other invasive procedures.

In a study evaluating whether the behaviors and numbers of operating room personnel can predict the density of airborne bacteria at the surgery site, researchers measured the number of airborne particulates and viable bacteria during 22 joint arthroplasty procedures with a range of five to 12 team members in the OR. The results indicated a relationship between the number and activity of team members present in the periphery of the OR and the number of particulates and colony forming units at the surgical site. The researchers recommended minimizing the number of team members who are present during the procedure.

As part of a non-experimental study with two phases, researchers examined the levels of environmental contamination in ORs without personnel and the effect of unscrubbed persons on environmental contamination. The ORs without personnel showed a mean of 13.3 colony forming units per square foot per hour. When five persons wearing scrub suits, shoe covers, hoods, and masks were present, the number of colony forming units increased significantly to 447.3 per square foot per hour. The researchers concluded that people are the major source of environmental contamination in the OR.

In response to an unexplained increase in surgical site infections at one facility, an observational study was conducted to monitor and record behaviors in the OR. Researchers theorized that the number of door openings increased in direct proportion to procedure length, but also had an exponential relationship with the number of team members in the OR. They randomly selected and audited 28 procedures in multiple services (eg, cardiac, orthopedic, neurosurgery, plastic, general). Data collection included the

- number of people entering and exiting the procedure room,
Researchers found that the number of door openings in some spinal procedures was as high as one door opening per minute, and there was an average rate of 40 door openings per hour during total joint procedures. With such high numbers of door openings, researchers noted that it was conceivable the door to the OR could remain open for as long as 15 to 20 minutes per hour. The greatest number of door openings occurred during the preincision period, and the most frequent reason for the door opening was requests for information. Personnel entering and exiting the room for breaks accounted for approximately 25% of door openings across every specialty. Retrieving and delivering supplies accounted for approximately 20% of door openings, and the RN circulator was responsible for 37% to 50% of door openings. The cumulative effect of increased door openings is the potential for increased numbers of microorganisms and other contaminants in the air and the surgical site. The researchers also noted that frequent door openings are distracting and have the potential to lead to errors.

In another study of door openings, researchers used an electronic door counter and computer software to calculate and analyze the number of door openings during 46 cardiac procedures. Perioperative team members were blinded to the study. The total number of door openings was 4,273. After adjusting for procedure length and the time required for the door to close, it was found that the door to the OR was open approximately 11% of every hour. A direct correlation was found between the length of the procedure and the frequency of door openings. The data also indicated a trend toward surgical site infections with increased frequency of door openings and patients of advanced age. The researchers hypothesized that increased numbers of personnel and door openings are a distraction to the surgical team and may lead to surgical errors.

**[Recommended for Practice]**

**Recommendation IX**

Perioperative team members should receive initial and ongoing education and competency validation on their understanding of the principles and performance of the processes of sterile technique.

It is the responsibility of the health care organization to provide initial and ongoing education and to evaluate the competency of perioperative team members to deliver safe care to patients undergoing surgical or other invasive procedures.

Initial and ongoing education of perioperative personnel on the principles and processes of sterile technique facilitates the development of knowledge, skills, and attitudes that affect safe patient care.

Periodic education programs provide the opportunity to reinforce the principles and processes of sterile technique and to introduce relevant new equipment or practices.

Competency validation measures individual performance and provides a mechanism for documentation, and may verify that perioperative personnel have an understanding of the principles and processes of sterile technique.

[As an educator, I believe this issue begins with administration understanding the volume of practice competences there are for the surgery dept and actually give the surgical unit an educator that can educate and evaluate instead of having them also be staffing an OR. Just a thought.]
IX.a. Perioperative team members should receive education and competency validation that addresses specialized knowledge and skills related to the principles and processes of sterile technique.

Specialized knowledge includes empirical knowledge (eg, technical understanding), practical knowledge (eg, clinical experience), and aesthetic knowledge (eg, patient advocacy).

Ongoing development of knowledge and skills and documentation of personnel participation is a regulatory and accreditation requirement for both hospitals and ambulatory settings.

[Recommended for Practice]

IX.a.1. Education regarding the principles and processes of sterile technique may include a review of the policies and procedures for

- surgical attire;
- hand hygiene, including surgical hand scrubs;
- prevention of transmissible infections;
- preparation of ORs or other procedure rooms;
- selection and evaluation of surgical gowns, gloves, and drape products;
- assistance with surgical or other invasive procedures;
- proper use of sterile gowns and gloves, including double gloving;
- proper use of sterile drape products;
- the need for sterile items during surgical or other invasive procedures;
- preparation of a sterile field for patients undergoing surgical or other invasive procedures;
- isolation technique;
- how to introduce items to the sterile field, including the transfer of medications and solutions;
- how to maintain a sterile field, including recognition and correction of breaks in sterile technique;
- movement within and around a sterile field, including the need to avoid changing levels at the sterile field;
- the number of people who are permitted in the procedure room; and
- invasive procedure documentation, including documentation of breaks in sterile technique.

IX.b. Perioperative personnel should receive education that addresses human factors related to the principles and processes of sterile technique.

Human factors includes the interpersonal and social aspects of the perioperative environment (eg, coordination of activities, teamwork, collaboration, communication). Effectively implementing the principles and processes of sterile technique requires that perioperative personnel demonstrate not only procedural knowledge and technical proficiency, but also demonstrate the ability to anticipate needs, coordinate a multitude of activities, work collaboratively with other team members, and communicate effectively.

In a synthesis of the literature on perioperative nursing competency published between 2000 and 2008, researchers identified two domains of perioperative competency:
specialized knowledge, described as familiarity with standards and guidelines of perioperative practice, and
human factors, described as interpersonal and social team interactions.

The researchers recognized teamwork and communication as important aspects of patient safety and indicators of perioperative competency.

In a qualitative, focus group study exploring the perceptions of perioperative nurses on competency, researchers identified three themes:

- Technical and procedural knowledge--the vast knowledge, psychomotor skills, and situational awareness required for competency in the perioperative setting.
- Communication skills--the need for communication and team building skills, collegial support, and the ability to decipher and share complex clinical information.
- Managing and coordinating flow--the ability to anticipate needs, organize and prioritize resources, manage conflicts, and grasp the full perspective of the situation.

The findings of the study highlight the importance of human factors as a competency requirement for perioperative nurses.

In a review of the literature exploring the cognitive and social skills used by scrub persons, researchers identified communication, teamwork, and situational awareness as the most valuable and relevant skills.

- Communication is vitally important because of the need to listen and interpret what is being said, to clarify any issues that are unclear, and to convey critical information accurately. The need to communicate using eye contact and nonverbal cues and to speak up when necessary while working at the sterile field was recognized as a required skill for the scrub person.
- Teamwork is an important skill because of the need for scrub persons to share information to aid the team and to establish good working relationships between team members.
- Situational awareness is an important skill that includes the ability of scrub persons to anticipate the actions of the surgeon and to make decisions regarding the need for additional supplies or actions that must be taken, and to anticipate future requirements of the procedure.

[Effectiveness Not Established]

IX.c. Relative to the principles and processes of sterile technique, the perioperative RN should

- participate in ongoing educational activities;
- identify personal learning needs;
- seek experiences to acquire, maintain, and augment personal knowledge and skill proficiency;
- share knowledge and skills;
- communicate pertinent information to perioperative team members;
- contribute to a healthy work environment by using appropriate and courteous verbal and nonverbal communication techniques; and
- develop and implement conflict resolution skills to manage difficult behavior, promote positive working relationships, and advocate for patient safety.

Education, collegiality, and collaboration are standards of perioperative nursing and a primary responsibility of the perioperative RN who practices in the perioperative setting.

[Likely to be Effective]
Recommendation X

Documentation reflecting activities related to sterile technique should be recorded in a manner consistent with the health care organization's policies and procedures.

Documentation of nursing activities serves as the legal record of care delivery. Documentation of nursing activities is dictated by health care organization policy and regulatory and accrediting agency requirements and is necessary to inform other health care professionals involved in the patient's care. Highly reliable data collection is not only necessary to chronicle patient responses to nursing interventions, but also to demonstrate the health care organization's progress toward quality care outcomes.

X.a. Significant or major breaks in sterile technique that are not immediately corrected should be documented per organizational policy in consultation with infection prevention personnel.

Perioperative documentation that accurately reflects the patient experience is essential for the continuity of outcome-focused nursing care and for effective comparison of realized versus anticipated patient outcomes.

Effective management and collection of health care information that accurately reflects the patient's care, treatment, and services is a regulatory and accreditation requirement for both hospitals and ambulatory settings.

[Recommended for Practice]

[This is so absolutely necessary!! Things like this are hardly ever documented on an Unusual Occurrence report that could serve to document what happened, what was done to mitigate the risk to the patient, and what effect it had on the patient at the time. It would also allow us to review the incident if the patient were to get a SSI and need continued treatment.]

[documentation... such as quality reporting. ]

Recommendation XI

Policies and procedures for the implementation of sterile technique should be developed, reviewed periodically, revised as necessary, and readily available in the practice setting.

Policies and procedures assist in the development of patient safety, quality assessment, and performance improvement activities. Policies and procedures establish authority, responsibility, and accountability within the organization. Policies and procedures also serve as operational guidelines that are used to minimize patient risk for injury or complications, standardize practice, direct perioperative personnel, and establish continuous performance improvement programs.

XI.a. Policies and procedures regarding the implementation of sterile technique should be developed.

Policies and procedures that guide and support patient care, treatment, and services is a regulatory and accreditation requirement for both hospitals and ambulatory settings.
XI.a.1. Policies and procedures regarding the principles and processes of sterile technique may include

- surgical attire;
- hand hygiene, including surgical hand scrubs;
- prevention of transmissible infections;
- preparation of ORs or other procedure rooms;
- selection and evaluation of surgical gowns, gloves, and drape products;
- performance of or assistance with surgical or other invasive procedures;
- proper use of sterile gowns and gloves, including double gloving;
- proper use of sterile drape products;
- the need for sterile items during surgical or other invasive surgical procedures;
- preparation of a sterile field for patients undergoing surgical or other invasive procedures;
- isolation technique;
- how to introduce items to the sterile field, including transfer of medications and solutions;
- how to maintain a sterile field, including recognition and correction of breaks in sterile technique;
- movement within and around a sterile field, including the need to avoid changing levels at the sterile field;
- the numbers of people who are permitted in the ORs or other procedure rooms; and
- invasive procedure documentation, including documentation of breaks in sterile technique.

[Excellent!]

Recommendation XII

Perioperative personnel should participate in a variety of quality assurance and performance improvement activities that are consistent with the health care organization’s plan to improve understanding and compliance with the principles and processes of sterile technique.
Quality assurance and performance improvement programs assist in evaluating and improving the quality of patient care and the formulation of plans for corrective actions. These programs provide data that may be used to determine whether an individual organization is within benchmark goals and, if not, to identify areas that may require corrective actions.

XII.a. Quality improvement activities for sterile technique should include monitoring for understanding of the principles and compliance with the processes of sterile technique.

Collecting data to monitor and improve patient care, treatment, and services is a regulatory and accreditation requirement for both hospitals and ambulatory settings.

[Recommended for Practice]

XII.a.1. Process monitoring for activities related to sterile technique may include monitoring compliance for

- surgical attire;
- hand hygiene, including surgical hand scrubs;
- prevention of transmissible infections;
- preparation of ORs or other procedure rooms;
- selection and evaluation of surgical gowns, gloves, and drape products;
- performance of or assistance with surgical or other invasive procedures;
- proper use of sterile gowns and gloves, including double gloving;
- proper use of sterile drape products;
- the need for sterile items during surgical or other invasive procedures;
- preparation of a sterile field for patients undergoing surgical or other invasive procedures;
- isolation technique;
- how to introduce items to the sterile field, including transfer of medications and solutions;
- how to maintain a sterile field, including recognition and correction of breaks in sterile technique;
- movement within and around a sterile field, including the need to avoid changing levels at the sterile field;
- the number of people who are permitted in the OR or other procedure room; and
- invasive procedure documentation, including documentation of breaks in sterile technique.

XII.a.2. The quality assurance and process improvement program for sterile technique should include

- periodically reviewing and evaluating activities to verify compliance with or identify the need for improvement,
- identifying corrective actions directed toward improvement priorities, and
- taking additional actions when improvement is not achieved or sustained.

Reviewing and evaluating quality improvement activities may identify failure points that contribute to errors in sterile technique and help define actions for improvement and increased competency. Taking corrective actions may improve patient safety by enhancing understanding of the principles and compliance with the processes of sterile technique.
XII.b. Perioperative RNs should participate in ongoing quality improvement activities related to sterile technique by

- identifying processes of sterile technique that are important for quality monitoring (eg, double gloving);
- developing strategies for compliance;
- establishing benchmarks to evaluate quality indicators;
- collecting data related to the levels of performance and quality indicators;
- evaluating practice based on the cumulative data that are collected;
- taking action to improve compliance; and
- assessing the effectiveness of the actions taken.

Participating in ongoing quality improvement activities is a standard of perioperative nursing and a primary responsibility of the perioperative RN who is engaged in practice in the perioperative setting.

[ Likely to be Effective ]

Glossary

**Aseptic** - The absence of all pathogenic microorganisms. Synonym: sterile.

**Aseptic practices** - Patterns of behavior and processes that are implemented to prevent microbial contamination.

**Assisted gloving** - Technique used when changing a contaminated glove. One scrubbed team member assists another to don a new sterile glove by touching only the outside of the new sterile glove when applying the glove to another scrubbed team member's hand.

**Barrier material** - Material that minimizes or retards the penetration of microorganisms, particulates, and fluids.

**Closed assisted gloving** - Technique for donning sterile gloves during which the gown cuff of the team member being gloved remains at or beyond the fingertips. The glove to be donned is held open by a scrubbed team member, while the team member being gloved inserts his or her hand into the glove with the gown cuff touching only the inside of the glove.

**Closed gloving** - Technique used when donning surgical gloves. The scrubbed team member dons the gloves without assistance by keeping his or her hands inside the gown sleeves.

**Colony forming unit** - A measure of the number of viable bacterial cells in a sample.

**Event-related sterility** - Concept that the sterility of an item does not change with the passing of time but may be affected by particular events (eg, amount of handling), or environmental conditions (eg, temperature, humidity).

**Isolation technique** - Instruments and equipment that have contacted the inside of the bowel, or the bowel lumen, are no longer used after the lumen has been closed. Clean instruments are used to close the wound. The contaminated instruments and equipment are either removed from the sterile field or placed in a separate area that will not be touched by members of the sterile team. Synonyms: bowel technique, contamination technique.
Open assisted gloving - Technique for donning sterile gloves during which the gown sleeve of the team member being gloved is pulled up so that the gown cuff is at wrist level, leaving the fingers and hand exposed. The glove to be donned is held open by a scrubbed team member, while the team member being gloved inserts his or her hand into the glove without touching the outside of the glove.

Open gloving - Technique used to don sterile gloves without assistance. The cuff of each glove is everted to allow the team member to don sterile gloves by touching only the inner side of the glove with ungloved fingers and the outer sterile side of the glove with gloved fingers.

Perforation indicator system - A double gloving system comprising a colored pair of surgical gloves worn beneath a standard pair of surgical gloves. When a glove perforation occurs, moisture from the surgical field seeps through the perforation between the layers of gloves, allowing the site of perforation to be more easily seen.

Sterile - The absence of all living microorganisms. Synonym: aseptic.

Sterile field - The area surrounding the site of the incision or perforation into tissue, or the site of introduction of an instrument into a body orifice that has been prepared for an invasive procedure. The area includes all working areas, furniture, and equipment covered with sterile drapes and drape accessories, and all personnel in sterile attire.

Sterile technique - The use of specific actions and activities to prevent contamination and maintain sterility of identified areas during a surgical or other invasive procedure.

Surgical hand scrub - Antiseptic hand wash or antiseptic hand rub performed preoperatively by perioperative personnel to eliminate transient bacteria and reduce resident hand flora.

Surgical helmet system - An unsterile, reusable helmet with a built-in ventilation fan covered with a single-use, disposable sterile visor mask hood. The unsterile helmet is donned before the surgical hand scrub is performed. The sterile visor mask hood that covers the unsterile helmet is applied during the gowning and gloving process.

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