

Introduction to Standard and Transmission-based Precautions

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Disclaimer: Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

Note to Iowa dental professionals: This course complies with the Iowa Dental Board for recertification in the area of infection control standards, as established by the Centers for Disease Control and Prevention (CDC).

Introduction

This course introduces participants to evidence-based information related to (1) the “chain of infection,” (2) Standard and Transmission-base Precautions, (3) factors that affect the quality of an effective infection prevention program, and (4) infection prevention education and training.

Conflict of Interest Disclosure Statement

- Dr. Faddoul reports no conflicts of interest associated with this course.
- Dr. Terézhalmy has done consulting work for Procter & Gamble and has served on the dentalcare.com Advisory Board.

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Overview

The risk of transmission of pathogenic microorganisms in oral healthcare settings is rare, yet healthcare-associated infections do present a potential hazard to oral healthcare personnel and patients alike. This course introduces participants to evidence-based information related to (1) the “chain of infection,” (2) Standard and Transmission-base Precautions, (3) factors that affect the quality of an effective infection prevention program, and (4) infection prevention education and training.

Learning Objectives

Upon completion of this course, the dental professional should be able to:

- Discuss the requisites for the transmission of pathogenic organisms, i.e., the “chain of infection.”
- Discuss the rationale for Standard Precautions and their application in oral healthcare settings.
- Discuss the rationale for Transmission-based Precautions and their application in oral healthcare setting.
- Discuss the requisites for an effective infection prevention strategy related to structure, process, and outcome.

- Discuss the requisites of an infection prevention education and training program for healthcare personnel related to infection prevention.

Introduction

The primary obligation and ultimate responsibility of **healthcare personnel** (HCP) is the timely delivery of quality care, within the bounds of the clinical circumstances presented by patients. The provision of quality care depends on proper diagnosis and treatment planning; and the implementation of preventive, therapeutic, or palliative and supportive strategies in the privacy of a comfortable and **safe healthcare setting**.

The term “healthcare personnel” applies to all paid and unpaid persons who work in a healthcare facility, i.e., any person who has professional or technical training in a healthcare-related field and provides patient care in a healthcare setting or any person who provides services that support the delivery of healthcare.¹ One of the elements of a “safe healthcare setting” is the implementation of strategies that minimize or prevent **healthcare-associated infections** (HAIs).

The term HAI refers to an infection acquired during the delivery of healthcare in any setting, e.g., hospitals, long-term care facilities, ambulatory settings (e.g., dental offices), and home care.¹ It is a broad term that reflects the uncertainty of where a pathogen might have been acquired, especially since patients frequently move among various settings within the healthcare system. The term **nosocomial infection** is reserved for an infection acquired in a hospital setting.

While there are few data on the risk of transmission of pathogenic microorganisms in oral healthcare settings, HAIs do present a potential hazard to oral HCP and patients alike. To prevent or minimize HAIs among oral HCP and patients, oral healthcare facilities, like all healthcare facilities, are mandated to develop a written **infection prevention protocol** predicated on a hierarchy of preventive strategies specific for oral healthcare settings.^{2,3}

Requisites for the Transmission of Pathogenic Organisms

Infection is the invasion and multiplication of microorganisms in body tissues resulting in local cellular injury as a consequence of competitive metabolism, toxin production, and immune-mediated reactions. The “chain of infection,” i.e., the transmission of pathogenic organisms in any setting requires three elements: (1) a source or reservoir of infectious agents, (2) a susceptible host with a portal of entry receptive of the agent, and (3) a mode of transmission for the agent.¹

Sources of Infectious Agents

Pathogens associated with HAIs are derived primarily from human sources, but contaminated objects and environmental sources are also implicated.¹ Human sources include patients, HCP, house hold members, and visitors. A source-individual may have an acute infection, or may be transiently or chronically colonized by pathogenic organisms. It is also important to recognize that the source-individual may be asymptomatic or may be in the incubation (subclinical) phase of infection.

Susceptible Host

Infection is the result of complex interactions between host and pathogenic organisms. While the numbers, pathogenicity, virulence, and antigenicity of organisms are important determinants; the establishment of infection and its severity relate to the state of host defense mechanisms.¹ Some susceptible hosts become colonized but remain asymptomatic. Others progress from colonization to symptomatic disease, either immediately or following a period of asymptomatic latency.

Modes of Transmission

Pathogens may be transferred from the source to a host by direct or indirect contact transmission and by respiratory transmission. Respiratory transmission may result from inhalation of droplets; or from inhalation of droplet nuclei, i.e., airborne transmission.¹ Droplets and droplet nuclei are generated when people talk, breath, cough, or sneeze; or when water is converted to a fine mist by medical/dental devices, such as high-speed handpieces, ultrasonic instruments, or by lasers and electrosurgical units.¹

Direct contact transmission occurs when pathogens are transferred between individuals without a contaminated intermediate person, object, or environmental surface.¹ For example, when blood or other potentially infectious materials (OPIM) from an infected person enters the body of a susceptible person through direct contact with mucous membrane or breaks in the skin, e.g., when pathogens are transferred from a patient to a HCP during ungloved contact with mucous membrane or skin.

Indirect contact transmission occurs when pathogens are transferred between individuals via a contaminated intermediate person, object, or environmental surface.¹ For example, when the hands of HCP become contaminated and hand hygiene is not performed prior to touching the next patient; when contaminated patient-care items are shared between patients without having been adequately cleaned, disinfected, or sterilized; or in association with contaminated sharps and needlestick injuries.

Droplets are airborne particles of moisture greater than 5 µm, which may contain potentially infectious pathogens.¹ **Respiratory transmission** associated with **droplet inhalation** is generally limited to within 3 feet of the source; but it may also result from physical transfer of pathogens from a body surface, such as the hands contaminated with respiratory secretions; or contact of a susceptible host with contaminated intermediate objects or environmental surfaces.

Droplet nuclei, ranging in size from 1-5 µm, are residuals of droplets that while suspended in air dried out, but may still contain potentially infectious pathogens.¹ In a cool setting, droplet nuclei may remain in the air indefinitely and travel long distances. The risk of respiratory transmission associated with inhalation of droplet nuclei, defined as **airborne transmission**, extends beyond 3 feet of the source. Droplet nuclei may also contaminate intermediate objects or environmental surfaces.

Standard Precautions

In response to the HIV epidemic, Universal Precautions were instituted in the mid-1980s. It stipulated that patients with bloodborne pathogens can be asymptomatic and unaware

that they are contagious; therefore, all blood and body fluids contaminated with blood were to be treated as infectious. The Occupational Safety and Health Administration (OSHA) based its 1991 final rule on Occupational Exposure to Bloodborne Pathogens in Healthcare Settings on the concept of Universal Precautions.²

In 1996, the Centers for Disease Control and Prevention (CDC) expanded Universal Precautions into the concept of Standard Precautions.⁴ Standard Precautions apply not only to contact with blood and body fluids contaminated with blood, but to contact with

all other potentially infectious material (OPIM), i.e., contact with all body fluids, secretions and excretions, nonintact skin, and mucous membranes regardless of suspected or confirmed presence of an infectious agent.

Today, there are two tiers of precautions: Standard and Transmission-based Precautions.^{1,3} Standard Precautions constitute the primary strategy for the prevention of HAIs and apply to the care of all patients in all healthcare settings, regardless of the suspected or confirmed presence of pathogenic organisms (Table 1).^{1,3} When Standard Precautions do not

Table 1. Standard Precautions.^{1,3}

Hierarchy of Strategies	Objectives
Education	Establish the rationale for policies and practices intended to prevent HAIs.
Immunization	Reduce the risk of vaccine preventable HAIs.
Engineering and work-practice controls <ul style="list-style-type: none"> • Personal protective equipment • Hand hygiene • Oral healthcare-specific infection controls measure <ul style="list-style-type: none"> ◦ Treatment room ◦ Laboratory ◦ Radiography • Sterilization and disinfection • Management of biohazards <ul style="list-style-type: none"> ◦ Biopsy specimens ◦ Extracted teeth ◦ Regulated waste • Environmental infection control 	Eliminate or isolate hazards and promote safer behavior in the workplace.
Post-exposure evaluation and follow-ups	Understand policies and practices intended to reduce the risk of post-exposure infection.
Administrative controls	Promote an understanding of policies related to medical conditions and work restrictions.

completely interrupt the transmission of a pathogen, Transmission-based Precautions are implemented.^{1,3}

Periodically, outbreak investigations indicate the need to reinforce existing standards or to implement new precautions.¹ Since these recommendations are considered standards of care; they are added to Standard Precautions. Since 1996, three such recommendations have been promulgated, two of which (respiratory hygiene/cough etiquettes and safe injection practices) apply to oral healthcare settings. The third element emphasizes the use of facemasks when performing lumbar puncture procedures.

The new element related to lumbar puncture procedures was prompted by eight cases of myelography-related streptococcal meningitis.¹ Data from seven cases confirmed that antiseptic skin preparations and sterile gloves were used, but none of the clinicians wore a surgical mask. The evidence warrants the standard use of surgical masks by clinicians performing lumbar punctures.¹ This is relevant in that it illustrates the importance of surgical masks in interrupting respiratory transmission of pathogens.

Respiratory Hygiene/Cough Etiquette

Respiratory hygiene/cough etiquette evolved from observations made during the 2003 outbreak of coronavirus (CoV)-associated severe acute respiratory syndrome (SARS).¹ Investigators concluded that transmission of the virus resulted from a failure to implement source-control measures when patients, visitors, and HCP with undiagnosed respiratory tract infections entered healthcare facilities.¹ The new standard requires prompt implementation of source-control measures at the first point of encounter within all healthcare settings (Box A).¹

Respiratory hygiene/cough etiquette is effective in decreasing the transmission of pathogens disseminated in droplets. Source-control measures apply to any person entering a healthcare facility with signs of illness, i.e., coughing, congestion, rhinorrhea, or production of respiratory secretions.¹ In addition, the new standard requires educating HCP, patients, and visitors and the posting of signs with instructions about respiratory hygiene/cough etiquette (Figure 1).

Box A. Respiratory Hygiene/Cough Etiquette.¹

- All patients and visitors with respiratory tract infections should:
 - Turn head away from others and cover mouth and nose during coughing and sneezing.
 - Use tissue paper to contain respiratory secretions and discard it promptly into a no-touch receptacle.
 - Perform hand hygiene after contact with respiratory secretions with soap and water or an alcohol-based hand rub.
 - Wear (when tolerated) a surgical mask when coughing to decrease contamination of the surrounding environment.
 - Observe a spatial separation, ideally greater than 3 feet, in common waiting areas.
- Healthcare personnel with respiratory tract infections should:
 - Avoid direct patient contact, especially with high-risk patients.
 - Observe contact and droplet precautions, i.e., must wear a gown, gloves (perform appropriate hand hygiene), and a surgical mask for all patient interactions.

Safe Injection Practices

Between 2000 and 2004, four large outbreaks of hepatitis B and hepatitis C viral infections among patients in ambulatory care facilities were attributed to either the reinsertion of used needles into multi-dose vials or solution containers; or the use of a single needle/syringe to administer intravenous medications to multiple patients.¹ These unsafe injection practices indicate that some HCP are unaware of, do not understand, or do not adhere to

basic principles of infection control and aseptic techniques.

Safe injection practices in oral healthcare settings include the use of sterile, single-use, disposable needles/syringes for each patient; the use of single-dose vials of therapeutic agents; and administering local anesthetics from a cartridge to a single patient. To ensure that all HCP understand and adhere to recommended practices, principles of infection control and

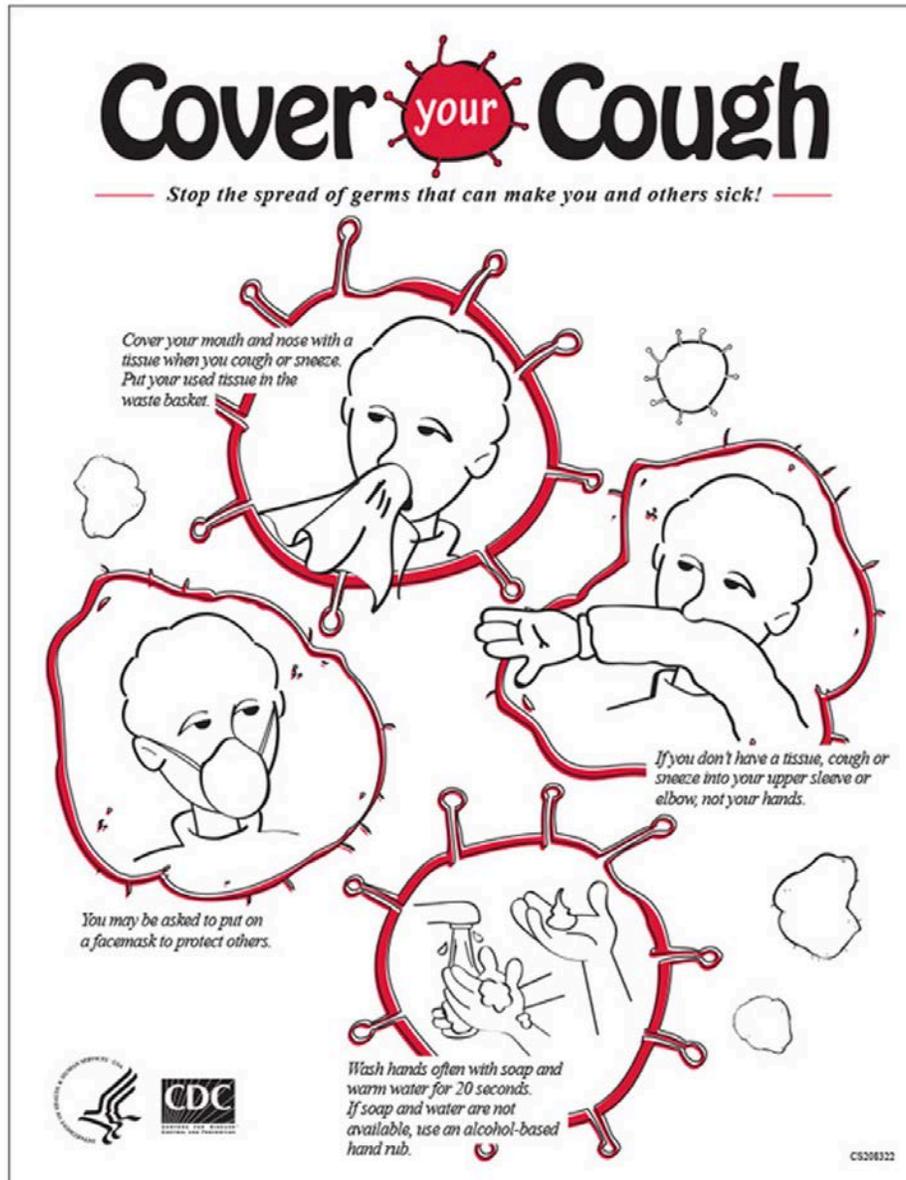


Figure 1. Respiratory Hygiene/Cough Etiquette Poster. Cover your Cough.

Image source: The Centers for Disease Control and Prevention

Box B. Aseptic Technique Practices for Parenteral Medications.^{1,3}

- All medications, whether in single-dose cartridges, ampules, vials, prefilled syringes, or multi-dose vials should be handled with aseptic techniques to prevent contamination.
- Single-dose cartridges, ampules, vials, or prefilled syringes should be used for parenteral medications whenever possible.
- The leftover contents of single-dose cartridges, ampules, vials, or prefilled syringes should be discarded; and never combined with medications for use on another patient.
- Medications from single-dose cartridges, ampules, vials, or prefilled syringes should not be administered to multiple patients, even if the needle is changed.
- If necessary to use a multi-dose vial, its access diaphragm should be cleansed with 70% alcohol before inserting a sterile device into the vial.
- A multi-dose vial should be discarded if sterility is compromised.
- Always use a sterile, single-use, disposable needle and/or syringe for each patient.
- All fluid infusion and administration sets (e.g., IV bags, tubing, and connections) are single-patient use items and must not be used on multiple patients.
- Aseptic technique should be used when preparing IV infusion and administration sets, and entry into or breaks in the tubing should be minimized.

aseptic techniques must be reinforced in training programs and incorporated into institutional policies (Box B).^{1,3}

Transmission-based Precautions

When Standard Precautions do not completely interrupt the transmission of a pathogen, Transmission-based Precautions are implemented.¹ These precautions may be applied empirically, predicated on clinical signs and symptoms of infection, until the suspected pathogen is either identified or the infectious status of the patient is ruled out. Transmission-based Precautions include: (1) contact precautions, (2) droplet precautions, and (3) airborne precautions associated with droplet nuclei.¹

Transmission-based Precautions should remain in effect for limited periods of time, i.e., while the risk for transmission of the infectious agent persists or for the duration of the illness.¹ For most infectious diseases, this time period reflects known patterns of persistence or shedding of pathogens related to the natural history of the

infectious process and its treatment.¹ For some diseases, Transmission-based Precautions remain in effect until culture or antigen-detection tests become negative.¹

In patients with congenital, acquired, or therapeutic immunosuppression and in those with chronic debilitating diseases viral shedding can persist for prolonged periods of time and transmission of pathogenic organisms may occur during apparent asymptomatic periods; therefore, the duration of contact, droplet, or airborne precautions may extend for many weeks or even months.¹ Finally, it may be prudent to assume that patients with multidrug-resistant organisms remain permanently colonized.¹

Contact Precautions

Contact precautions are intended to prevent transmission of pathogens spread by contact with an infected person, contaminated objects, or environmental surfaces.¹ In the waiting room, greater than 3 feet of physical separation is recommended between infected and other

patients.¹ HCP must wear a gown and gloves for all interactions with the patient. The gown and gloves should be donned upon entering and removed before exiting the dental treatment room (DTR).¹

Droplet Precautions

Droplet precautions are intended to prevent the transmission of pathogens spread by droplets through close respiratory or mucous membrane contact with respiratory secretions. The risk of inhalation is generally limited to within 3 feet of the source. In the waiting room, a ≥ 3 foot physical separation is recommended between infected and other patients.¹ HCP must wear a surgical mask for close contact with the patient. The mask should be donned upon entering and removed before exiting the DTR.¹

Airborne Precautions

Airborne precautions are intended to prevent the transmission of pathogenic organisms spread by droplet nuclei, i.e., to prevent the transmission of infectious agents that remain suspended in air for long periods and travel long distances from the source such as the rubeola virus, the varicella virus, and *Mycobacterium tuberculosis*.¹ Airborne precautions consist of a three-level hierarchy of (1) administrative controls, (2) environmental controls, and (3) respiratory-protection controls.^{1,5,6}

Primary objectives of **administrative controls** are to identify and isolate; and ultimately, to either refer the patient with a suspected or confirmed airborne infectious disease to a facility with an airborne infection isolation room (AIIR); or to return the patient home, as deemed medically/dentally appropriate.^{5,6} A high index of suspicion and rapid implementation of administrative controls are essential to prevent or interrupt the transmission of airborne pathogens.

When reviewing medical histories (initial and/or periodic updates), including a review of organ systems; all patients should be routinely asked about (1) their history of exposure to infectious pathogens, (2) any medical conditions that may increase their susceptibility to infectious diseases, and (3) any signs and symptoms of infectious disease.⁵ Ideally, the medical history should be elicited from patients in their primary language.

Provisional diagnosis of an airborne infectious disease should be considered for any patient with signs and symptoms of respiratory tract infection. Patients with suspected or documented airborne infectious disease should be isolated from other patients in a private room with the door closed and instructed to observe strict respiratory hygiene/cough etiquette. HCP should wear at least a surgical mask, but preferably an N95 disposable respirator (see respiratory-protection controls below).⁵

Patients with suspected or confirmed airborne infectious disease requiring urgent dental care must be promptly referred to an oral healthcare facility with an AIIR (see environmental controls below); and while performing procedures on such patients, HCP must use at least an N95 disposable respirator (see respiratory-protection controls below). Routine dental care should be postponed until a physician either rules out infection or confirms that the patient is no longer infectious.⁵

The second level of hierarchy in airborne precautions is the use of **environmental controls**. Environmental controls are physical or mechanical measures (as opposed to administrative measures) intended to prevent the spread and reduce the concentration of infectious droplet nuclei less than 5 μm in diameter in ambient air. As noted above, patients with a suspected or confirmed airborne infectious disease requiring dental care must be treated in an AIIR.^{1,5,6}

AIIRs minimize the transmission of infectious agents by droplet nuclei. AIIRs are engineered to (1) provide negative pressure in the room so that air flows under the door gap into the room; (2) have an 6-12 air change rate per hour (ACH), i.e., the volume of the air in the room is changed 6-12 times per hour; and (3) direct exhaust of air from the room to the outside of the building or recirculate air in the room through a high efficiency particulate air (HEPA) filter.^{1,6,7}

Administrative and environmental controls reduce the number of areas in which exposure to airborne pathogens might occur, thus, minimizing the number of persons exposed. However, administrative and environmental control measures do not eliminate the risk of

exposure in limited areas. The third level of the hierarchy in Transmission-based Precautions is **respiratory-protection controls**, i.e., the use of respiratory equipment in situations that pose a high risk for exposure to droplet nuclei.^{1,5}

Oral HCP providing dental care to a patient with suspected or confirmed airborne infectious disease must use a respirator with N95 or higher filtration capacity to prevent inhalation of infectious particles that are less than 5 µm in diameter.^{1,5} N95 disposable respirators are non-powered, air-purifying, particulate-filter respirators. The N-series respirators are available with filtration efficiencies of 95% (N95), 99% (N99), and 99.7% (N100).⁷

Fundamental Elements of an Effective Infection Prevention Strategy

The dentist has primary responsibility for compliance with infection prevention guidelines. However, an Infection Prevention Coordinator (IPC) may be assigned to coordinate the program.^{1,3} The IPC should be knowledgeable to (1) develop and maintain the infection prevention protocol; (2) provide an explanation of its contents upon request; and (3) monitor the effectiveness of the program over time to ensure that the criteria are relevant, the procedures are efficient, and the practices are successful.^{1,3}

Infection prevention strategies should be appropriate for the setting and extend to all aspects of the clinical process. As the protocol deviates from optimal design and implementation, the quality (value, outcome) of the program decreases at an accelerated rate. Information from which inference can be drawn about the quality of infection control/exposure control practices may be classified under three headings: structure, process, and outcome.¹⁻³

Structure

Structure refers to the attributes of the healthcare setting. This includes the (1) availability of material resources (e.g., sterilization area and equipment), (2) human resources (e.g., number and qualification of personnel), and (3) organizational resources (e.g., the timely availability of post-exposure evaluation and follow-up). Structure affects the amenities of the healthcare setting, which

may be either conducive or inimical to good infection control/exposure control practices.

Process

Process refers to what is actually being done to prevent or minimize HAIs. It includes (1) compliance with establishment of standards, i.e., the hierarchy of preventive strategies based on knowledge derived from well conducted trials, extensive observations, or in the absence of such data it should reflect the best informed, most authoritative opinion available; (2) the development and execution of activities intended to meet those standards; and (3) continuous monitoring of compliance.

Outcome

Outcome refers to the impact infection prevention strategies have on (1) enhanced knowledge, (2) changed behavior, and (3) improved health of HCP and patients. Because so many factors influence outcome, it is not possible to know with absolute certainty the extent to which an observed outcome is attributable to an antecedent structure or process. However, outcome assessment does provide a mechanism to monitor performance (compliance).

Infection Prevention Education and Training

Compliance with Standard and Transmission-based Precautions is significantly improved when HCP understand the rationale for written policies and practices. Infection prevention education and training is mandated prior to initial assignment of HCP to tasks in which exposure to blood and OPIM may occur and at least annually thereafter.^{2,3} It is intuitive that infection prevention education should start during training in the health professions. Education and training has been related to a decrease in HAI.

The objectives of the infection prevention education training program are to instruct HCP regarding (1) the risk of HAIs; (2) preventive strategies; (3) post-exposure evaluation and follow-up; and (4) administrative controls. The program shall reflect current best practice recommendations made by federal, state, and local agencies and professional organizations.

OSHA requires that documentation of participation in each infection prevention education training program be maintained for 3 years.^{2,3}

Basic Expectations for Safe Care

A Summary of Infection Prevention Practices in Dental Settings: Basic Expectations for Safe Care published by the CDC in 2016 includes an Infection Prevention Checklist for Dental Settings ([Appendix A](#)).⁸ The Infection Prevention Checklist, Section I: Policies and Practices provides a tool to monitor institutional compliance with administrative measures (Section I.1) and infection prevention

education training (Section I.2) that fulfill basic expectations for safe care (Box C).⁸

Summary

Standard Precautions, at times augmented with Transmission-based Precautions, provide a hierarchy of preventive strategies to eliminate or minimize HAIs in all healthcare settings. Creating and maintaining a safe work-environment is predicated on the commitment and accountability of all HCP. Participation in education and training programs provides the background and the rationale for understanding elements of an effective infection control/exposure control program.

**Box C. Administrative Measure and Infection Prevention
Education Training Compliance: Checklist for Oral Healthcare Settings.**

*Institutional Compliance With Policies And Practices Related To
Administrative Measures And Infection Prevention Education And Training*

<hr/>	<hr/>	<hr/>
Name of Institution Evaluated	Name of Observer	Date of Observation

Elements to be Assessed	Compliance/ Competency	Notes/Areas for Improvement
<ul style="list-style-type: none"> In compliance with evidence-based recommendations made by federal, state, and local agencies and professional organizations, written, current, infection prevention policies and procedures specific for the dental setting are available. 	<input type="checkbox"/> Y <input type="checkbox"/> N	
<ul style="list-style-type: none"> Infection prevention policies and procedures are updated at least annually or according to state or federal requirements. 	<input type="checkbox"/> Y <input type="checkbox"/> N	
<ul style="list-style-type: none"> At least one individual trained in infection prevention is assigned responsibility to coordinate the program. 	<input type="checkbox"/> Y <input type="checkbox"/> N	
<ul style="list-style-type: none"> Supplies necessary for adherence to Standard Precautions are readily available. 	<input type="checkbox"/> Y <input type="checkbox"/> N	
<ul style="list-style-type: none"> Facility has system of early detection and management of potentially infectious persons at the point of patient encounter – elements described under respiratory hygiene/cough etiquette. 	<input type="checkbox"/> Y <input type="checkbox"/> N	
<ul style="list-style-type: none"> HCP, including those employed by outside agencies available by contract and volunteers, receive job or task-specific infection prevention education and training: <ul style="list-style-type: none"> Upon hire Annually When new tasks or procedures affect the HCP's occupational exposure According to federal and state requirements 	<input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> Y <input type="checkbox"/> N	
<ul style="list-style-type: none"> Infection prevention education and training records are maintained in accordance with federal and state requirements. 	<input type="checkbox"/> Y <input type="checkbox"/> N	

Adapted from: Centers for Disease Control and Prevention. Summary of Infection Prevention Practices in Dental Settings: Basic Expectations for Safe Care. 2016. <https://www.cdc.gov/oralhealth/infectioncontrol/pdf/safe-care2.pdf>

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: www.dentalcare.com/en-us/professional-education/ce-courses/ce535/start-test

- 1. The term “healthcare personnel” applies to all paid and unpaid persons who _____.**
 - a. have professional training in a healthcare-related field and provide patient care in a healthcare setting
 - b. have technical training in a healthcare-related field and provide patient care in a healthcare setting
 - c. provide services that support the delivery of healthcare
 - d. All of the above.
- 2. The term nosocomial infection refers to an infection acquired during the delivery of healthcare in _____.**
 - a. hospitals
 - b. long-term care facilities
 - c. ambulatory settings, e.g., oral healthcare settings
 - d. home care settings
- 3. The “chain of infection,” i.e., the transmission of infectious agents in healthcare settings requires a _____.**
 - a. source or reservoir of infectious agents
 - b. susceptible host with a portal of entry receptive of the agent
 - c. mode of transmission for the agent
 - d. All of the above.
- 4. All of the following statements are correct with respect to the source or reservoir of infectious agents responsible for HCIs EXCEPT which one?**
 - a. Pathogens associated with HAIs are derived primarily from human sources, but contaminated objects and environmental sources are also implicated.
 - b. Human sources include patients and HCP, but not house hold members and visitors.
 - c. A source individual may have acute infection, or may be transiently or chronically colonized by pathogenic organisms.
 - d. The source individual may be asymptomatic or may be in the incubation phase of infection.
- 5. Which of the following statements is correct with respect to infection in a susceptible host with a portal of entry receptive of the agent?**
 - a. The numbers, pathogenicity, virulence, and antigenicity of organisms are important determinants of infection.
 - b. The establishment of infection and its severity relate to the state of host defense mechanisms.
 - c. Some susceptible hosts become colonized but remain asymptomatic, others progress from colonization to symptomatic disease, either immediately or following a period of asymptomatic latency.
 - d. All of the above.
- 6. Pathogens may be transferred from the source to a host by _____.**
 - a. direct or indirect contact transmission
 - b. respiratory transmission, i.e., inhalation of droplets
 - c. airborne transmission, i.e., inhalation of droplet nuclei
 - d. All of the above.

- 7. All of the following statements are correct with respect to droplet nuclei (airborne transmission) EXCEPT which one?**
- a. Droplet nuclei are airborne particles ranging from 1-5 μm that may contain potentially infectious pathogens.
 - b. The risk of inhalation of droplet nuclei is generally limited to within 3 feet of the source.
 - c. Droplet nuclei are residuals of droplets that, while suspended in air dried out and in a cool environment may remain suspended in air indefinitely.
 - d. Transmission of droplet nuclei may result from contact of a susceptible host with contaminated intermediate objects or environmental surfaces.
- 8. Which of the following precautions apply to the care of all patients in all healthcare settings, regardless of the suspected or confirmed presence of an infectious agent and constitutes the primary strategy for the prevention of healthcare-associated infections?**
- a. Universal Precautions
 - b. Standard Precautions
 - c. Transmission-based Precautions
 - d. All of the above.
- 9. Which of the following statements is correct with respect to respiratory hygiene/cough etiquette?**
- a. Respiratory hygiene/cough etiquette evolved from observations during the 2003 widespread outbreak of coronavirus (CoV)-associated severe acute respiratory syndrome (SARS).
 - b. The transmission of SARS-CoV resulted from a failure to implement simple source control measures when patients, visitors, and HCP with undiagnosed respiratory tract infections entered healthcare facilities.
 - c. The transmission of SARS-CoV highlighted the need for prompt implementation of source control measures at the first point of encounter within healthcare settings.
 - d. All of the above.
- 10. Which of the following statements is correct with respect to source control measures?**
- a. Turning the head away from others and covering the mouth and nose during coughing and sneezing.
 - b. Using tissues to contain respiratory secretions and their prompt disposal into a no-touch receptacle.
 - c. Performing hand hygiene after contact with respiratory secretions with soap and water or an alcohol-based hand rub.
 - d. All of the above.
- 11. HCP who have a respiratory infection should avoid direct patient contact, especially with high risk patients; and must observe contact and droplet precautions, i.e., must wear a gown, gloves (perform appropriate hand hygiene), and a surgical mask for all patient interactions.**
- a. True
 - b. False
- 12. Between 2000 and 2004, four large outbreaks of hepatitis B and hepatitis C viral infections among patients in ambulatory care facilities were attributed to either the reinsertion of used needles into multi-dose vials or solution containers; or the use of a single needle/syringe to administer intravenous medications to multiple patients.**
- a. True
 - b. False

- 13. Which of the following statements are correct with respect to safe injection practices?**
- The leftover contents of single-dose cartridges, ampules, vials, or prefilled syringes should be discarded; and never combined with medications for use on another patient.
 - Medications from single-dose cartridges, ampules, vials, or prefilled syringes should not be administered to multiple patients, even if the needle is changed.
 - Always use a sterile, single-use, disposable needle and/or syringe for each patient.
 - All of the above.
- 14. Which of the following statements is correct with respect to transmission-based precautions?**
- Transmission-based precautions are implemented empirically until the suspected pathogen is either identified or the infectious status of the patient is ruled out.
 - There are three categories of transmission-based precautions; contact precautions, droplet precautions, and airborne precautions related to droplet nuclei.
 - Transmission-based Precautions should remain in effect for limited periods of time, i.e., while the risk for transmission of the infectious agent persists or for the duration of the illness.
 - All of the above.
- 15. Which of the following precautions are intended to prevent the prevent transmission of pathogens spread by direct or indirect contact with an infected patient, or a contaminated object, or an environmental surface?**
- Contact precautions
 - Droplet precautions
 - Airborne precautions
 - All of the above.
- 16. Which of the following controls apply to airborne precautions?**
- Administrative controls
 - Environmental controls
 - Respiratory-protection controls
 - All of the above.
- 17. Which of the following reflect/represent the primary objective(s) of administrative controls?**
- Identification of the patient with a suspected or confirmed airborne infectious disease.
 - Isolation of the patient with a suspected or confirmed airborne infectious disease.
 - Either the referral of the patient with a suspected or confirmed airborne infectious disease to a facility with an airborne infection isolation room (AIIR); or the return of the patient home, as deemed medically/dentally appropriate.
 - All of the above.
- 18. Which of the following statements is correct with respect to airborne infection isolation rooms (AIIRs)? AIIRs _____.**
- are engineered to provide negative pressure in the room so that air flows under the door gap into the room
 - have an air changes per hour rate of 6-12 ACH
 - direct exhaust of air from the room to the outside of the building or recirculate air in the room through a high efficiency particulate air (HEPA) filter
 - All of the above.

- 19. All of the following statements are correct with respect to respiratory-protection controls EXCEPT which one?**
- Oral HCP providing dental care on a patient with suspected or confirmed airborne infectious disease must use a respirator with N95 or higher filtration capacity to prevent inhalation of infectious particles that are less than 5 μm in size.
 - Respiratory-protection controls reduce the number of areas in which exposure to airborne pathogens might occur, thus, minimizing the number of persons exposed.
 - N95 disposable respirators are non-powered, air-purifying, particulate-filter respirators.
 - The N-series respirators are available with filtration efficiencies of 95% (N95), 99% (N99), and 99.7% (N100).
- 20. All of the following statements are correct with respect to the office Infection Prevention Coordinator (IPC) except which one? The IPC shall _____.**
- be knowledgeable to develop and maintain the office infection control/exposure control protocol
 - provide both access to and an explanation of its contents upon request
 - have overall responsibility for compliance with infection control guidelines
 - monitor the effectiveness of the program over time to ensure that the criteria are relevant, the procedures are efficient, and the practices are successful
- 21. Which of the following statements is correct with respect to fundamental elements needed to prevent the transmission of pathogens in healthcare settings?**
- Infection prevention strategies should be appropriate for the setting and extend to all aspects of the clinical process.
 - As the protocol deviates from optimal design and implementation, the quality (value, outcome) of the program decreases at an accelerated rate.
 - Information from which inference can be drawn about the quality of infection prevention practices may be classified under three headings: structure, process, and outcome.
 - All of the above.
- 22. All of the following statements related to infection prevention education and training are correct EXCEPT which one?**
- Compliance with Standard and Transmission-based Precautions is significantly improved if HCP understand the rationale for written policies and practices.
 - Participation in an infection prevention education and training program is mandated on a onetime basis, i.e., prior to initial assignment of HCP to tasks in which exposure to blood and OPIM may occur.
 - The objectives of the infection prevention education and training program are to enlighten HCP regarding (1) the risk of HAIs, (2) preventive strategies, (3) post-exposure evaluation and follow-up and (4) administrative controls.
 - The program shall reflect current best practice recommendations made by federal, state, and local agencies and professional organizations.

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