

Standard and Transmission-Based Precautions

An update for dentistry

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In 1996, the Centers for Disease Control and Prevention (CDC) introduced Standard Precautions, which combined and expanded on the elements of Universal Precautions to create a standard of care designed to protect all health care personnel (HCP) from pathogens that can be spread by blood or any other body fluid, excretion or secretion. Standard Precautions also include three subsets of precautions, known as “Transmission-Based Precautions,” that are based on the routes of disease transmission for a smaller number of patients who are known or suspected to be infected or colonized with highly transmissible or epidemiologically important pathogens. Transmission-Based Precautions are designed to reduce the risk of airborne, droplet and contact transmission and always are used in addition to Standard Precautions. Since the publication of the Guidelines for Infection Control in Dental Health-Care Settings—2003,¹ the CDC has published updated isolation guidelines, which have introduced new elements of Standard Precautions and provided more detailed information about Transmission-Based Precautions.

In this article, I review Standard Precautions, including the new ele-

ABSTRACT

Background. Standard Precautions are the foundation of all infection control programs and include infection control practices that apply to all patients and situations regardless of whether the infection status is suspected, confirmed or unknown.

Methods. The author reviewed Standard Precautions, including two new elements introduced by the Centers for Disease Control and Prevention in 2007: safe injection practices and respiratory hygiene and cough etiquette. Standard Precautions sometimes are referred to as the first tier of precautions because for some diseases and circumstances, transmission cannot be interrupted completely with Standard Precautions alone and it is necessary to use second-tier Transmission-Based Precautions. The author reviewed the three categories of Transmission-Based Precautions—Airborne, Droplet and Contact—with an emphasis on their use in dental health care outpatient settings.

Conclusions and Clinical Implications. Dental health care personnel (DHCP) should update their infection control programs to ensure that safe injection practices and respiratory hygiene and cough etiquette measures are used routinely. In addition, with the emergence of new pathogens, re-emergence of variant organisms and more patients seeking care in ambulatory care facilities, DHCP need to be aware of additional measures to take when treating patients in their offices who are actively infected with certain organisms to protect fully other patients, their staff members and themselves.

Key Words. Infection control; Standard Precautions; Transmission-Based Precautions; Contact Precautions; Droplet Precautions; Airborne Precautions.

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ments applicable to dentistry, and the importance and relevance of Transmission-Based Precautions in dental settings.

STANDARD PRECAUTIONS

Overview. Because patients with blood-borne infections can be asymptomatic or unaware that they are infected, in 1985 the Centers for Disease Control (now the Centers for Disease Control and Prevention) introduced the concept that all blood and body fluids that might be contaminated with blood should be treated as infectious.² Infection control precautions were introduced largely because of the human immunodeficiency virus (HIV) epidemic and were updated and revised across the years. They eventually became known as Universal Precautions and were designed to prevent transmission of HIV, hepatitis B virus (HBV), hepatitis C virus (HCV) and other blood-borne diseases.^{3,4} The Occupational Safety and Health Administration (OSHA) based its blood-borne pathogens standard on the concept of Universal Precautions.⁵

Many fluids, secretions and excretions from patients not covered under Universal Precautions are colonized with organisms (that often are resistant to antimicrobial therapy) before any symptoms of illness become apparent, and they are potential sources of hospital- and community-acquired infections. Therefore, infection control personnel at the Harborview Medical Center, Seattle, and the University of San Diego introduced Body Substance Isolation (BSI) guidelines in 1987. These guidelines concentrate on isolating all moist and potentially infectious body substances (blood, feces, urine, sputum, saliva, wound drainage and other body fluids) primarily by wearing gloves.⁶ Although these guidelines were accepted, there was some confusion regarding which body fluids or substances required HCP to use precautions under Universal Precautions and BSI. Also, it was becoming necessary to address droplet transmission and emerging multidrug-resistant organisms (MDROs) such as *Clostridium difficile* and vancomycin-resistant enterococci; direct or indirect contact transmission of some infectious microorganisms from dry skin or environmental sources (for example, *C. difficile* and vancomycin-resistant enterococci); and airborne transmission of infections across long distances by floating droplet nuclei. CDC expanded the concept of Universal Precautions in 1996 and began using the

term “Standard Precautions,” which was introduced in the Guideline for Isolation Precautions in Hospitals.⁷

Standard Precautions combined and expanded the elements of Universal Precautions and BSI into a standard of care designed to protect HCP and patients from pathogens that can be spread by blood or any other body fluid, excretion or secretion (Table 1).^{1,8} Standard Precautions apply to contact with blood; all body fluids, secretions and excretions (except sweat), regardless of whether they contain blood; nonintact skin; and mucous membranes. While the term “Universal Precautions” still is used in OSHA’s blood-borne pathogens standard and other documents, no operational difference exists in clinical dental practice between Universal Precautions and Standard Precautions, because even when blood is not visible, saliva has been considered a potentially infectious material in dentistry.¹

Standard Precautions are the foundation of a comprehensive infection control program and include a group of infection control practices that apply to all patients, regardless of suspected or confirmed infection status, in any setting in which health care is delivered, including dental settings. Although Standard Precautions apply to all patient encounters, the application of Standard Precautions during patient care is determined by the task being performed and the type of exposure to blood, body fluid or pathogens that is anticipated. In other words, infection control procedures are determined according to the procedure, not the patient. In OSHA terminology, they are performance-based standards because they are applied to the level necessary to provide exposure protection relative to the procedure performed and the given circumstances. For example, only gloves may be needed when obtaining dental radiographs, whereas protective eyewear and

ABBREVIATION KEY. **AIIR:** Airborne infection isolation room. **BSI:** Body Substance Isolation. **CDC:** Centers for Disease Control and Prevention. **DHCP:** Dental health care personnel. **HBV:** Hepatitis B virus. **HCP:** Health care personnel. **HCV:** Hepatitis C virus. **HIV:** Human immunodeficiency virus. **MDROs:** Multidrug-resistant organisms. **MRSA:** Methicillin-resistant *Staphylococcus aureus*. **NIOSH:** National Institute for Occupational Safety and Health. **OSHA:** Occupational Safety and Health Administration. **PPE:** Personal protective equipment. **SARS:** Severe acute respiratory syndrome. **TB:** Tuberculosis.

TABLE 1

Elements of Standard Precautions.*	
ELEMENT	REPRESENTATIVE EXAMPLES
Hand Hygiene	Hand washing or using hand antiseptics or surgical hand antiseptics to reduce potential pathogens on the hands
Using PPE†	Wearing gloves, mask, eye protection with solid side shields and protective clothing to protect the skin and the mucous membranes of the eyes, nose and mouth from exposure to blood or other potentially infectious materials (for example, saliva)
Handling Contaminated Materials or Equipment to Prevent Cross-contamination	Cleaning and heat sterilizing instruments before reuse on patients; cleaning and disinfecting environmental surfaces; using appropriate PPE; and containing heavily soiled items or areas to prevent cross-contamination
Using Engineering and Work Practice Controls	Examples may include, but are not limited to, minimizing or eliminating employee exposure by using sharps containers, not using two hands to recap needles, or not bending or breaking needles before disposal
Respiratory Hygiene and Cough Etiquette	Applying measures at the first point of contact with a potentially infected patient to minimize the transmission of respiratory infections, including influenza, in health care settings
Safe Injection Practices	Using aseptic technique (box) when handling parenteral medications and associated items to avoid contamination of sterile injection equipment and supplies
* For a complete discussion of the elements of Standard Precautions, refer to Kohn and colleagues ¹ and Siegel and colleagues. ⁸	
† PPE: Personal protective equipment.	

BOX

Summary of Centers for Disease Control and Prevention's Recommendations for Aseptic Technique for Parenteral Medications.*

- Do not administer medication from a syringe to multiple patients, even if the needle on the syringe is changed.
- Use single-dose vials for parenteral medications when possible.
- Do not combine the leftover contents of single-use vials for later use.
- If multidose vials are used, cleanse the access diaphragm with 70 percent alcohol before inserting a device into the vial, use a sterile device to access a multiple-dose vial and avoid touching the access diaphragm. Both the needle and syringe used to access the multidose vial should be sterile. Do not reuse a syringe even if the needle is changed.
- Keep multidose vials away from the immediate patient treatment area to prevent inadvertent contamination by spray or spatter.
- Discard the multidose vial if sterility is compromised.
- Use fluid infusion and administration sets (that is, intravenous bags, tubing and connections) for one patient only and dispose of them appropriately.

* Source: Kohn and colleagues.¹(pp31,32,46)

clothing, gloves and masks are necessary when placing restorations.

Update. In 2007, CDC updated and expanded the 1996 Guideline for Isolation Precautions in Hospitals⁷ with the 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Health Care Settings.⁸ The 2007 isolation guideline introduced several new elements of Standard Precautions. The new additions—safe injection practices and respiratory

hygiene and cough etiquette—focus on protection of patients, as well as that of HCP.

In 2006, CDC also published a comprehensive review and recommendations for prevention of transmission of MDROs.⁹ Like the 2007 isolation guideline, this guideline addresses a variety of health care settings, not only hospitals. Even though this document is a separate publication, it is considered a part of CDC's 2007 isolation guidelines.

Safe injection practices. Across the years, the results of various infectious disease outbreak investigations indicated that reuse of syringes or the use of single-dose medication

vials or bags of saline solutions for multiple patients caused numerous transmissions of HBV and HCV. These findings led to increased attention to aseptic technique during the handling of parenteral medications.^{8,10} The conclusions of the investigations stated that these transmissions could have been prevented if HCP had adhered to basic principles of aseptic technique for the preparation and administration of parenteral medications. Safe handling of parenteral medications, including dental local anesthetics, and fluid infusion systems is required to prevent health care-associated infections among patients. These recommendations were included

in the special considerations section of the Guidelines for Infection Control in Dental Health-Care Settings—2003¹ (Box). Although these safe injection practices and associated recommendations are not new, they are considered elements of Standard Precautions.

Respiratory hygiene and cough etiquette. The recommendation for respiratory hygiene and cough etiquette grew out of observations during the 2003 outbreaks of severe acute respiratory

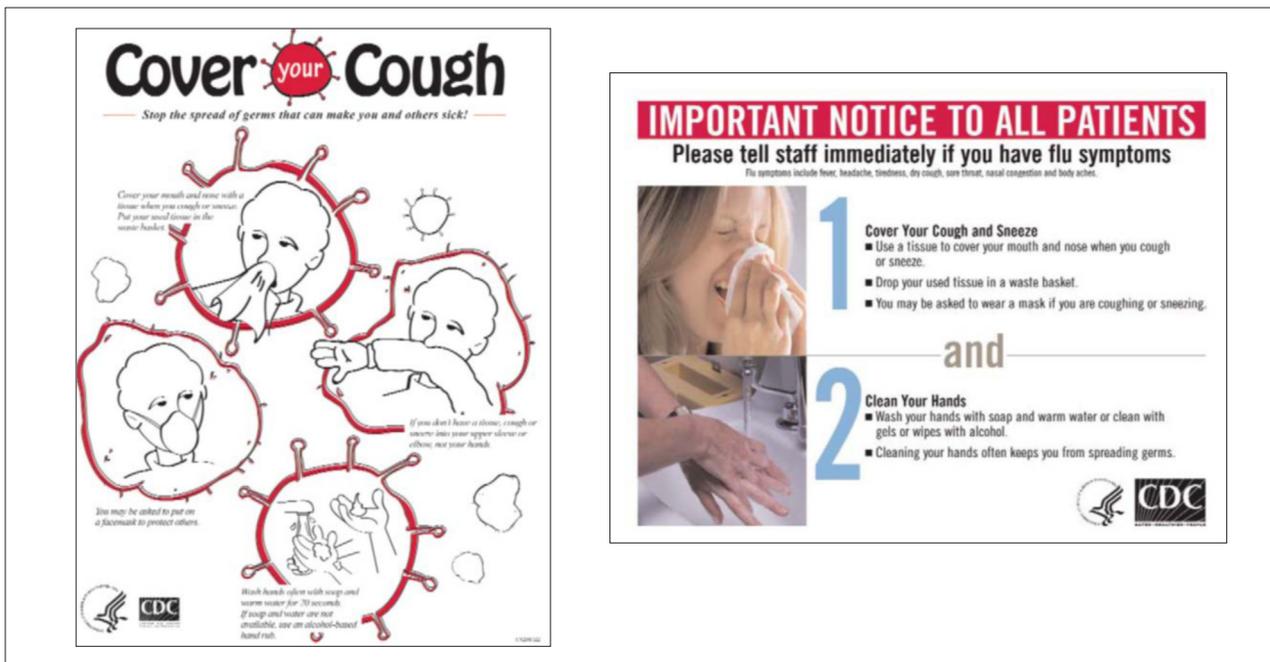


Figure. Centers for Disease Control and Prevention posters with tips to prevent the spread of germs from coughing and a notice for patients to report influenza symptoms, emphasizing covering coughs and sneezes and hand hygiene. These posters are available at “www.cdc.gov/flu/protect/covercough.htm” and “www.cdc.gov/ncidod/dhqp/pdf/Infdis/RespiratoryPoster.pdf”, respectively.

syndrome (SARS), in which failure to implement simple source-control measures with patients, visitors and HCP with respiratory symptoms may have contributed to SARS coronavirus transmission. Respiratory hygiene and cough etiquette are a combination of infection control measures designed to minimize the transmission of respiratory pathogens via droplet or airborne routes in health care settings. These measures apply not only to SARS, but also to any respiratory illness—such as influenza, respiratory syncytial virus and whooping cough—and are targeted at all patients with symptoms of respiratory infection and their accompanying family members or friends. These infection control measures begin at the point of the patient’s initial encounter with a health care setting, such as the reception area in the dental office. The primary components of respiratory hygiene and cough etiquette are as follows:

- covering the mouth and nose during coughing and sneezing;
- using tissues to contain respiratory secretions and promptly disposing of them;
- offering a surgical mask to people who are coughing to decrease contamination of the surrounding environment;
- performing hand hygiene after contact with respiratory secretions;

- turning the head away from others and maintaining spatial separation, ideally more than three feet, when coughing.⁸

Respiratory hygiene and cough etiquette measures are considered a component of Standard Precautions and should be practiced routinely in dental settings. Posters that promote these measures are available, at no charge, from CDC’s Web site (Figure). These posters can be downloaded, printed and placed in waiting areas or at reception desks to increase awareness of the importance of respiratory hygiene and cough etiquette. Dental office staff members should ensure that tissues, receptacles for used tissue disposal and hand hygiene agents (for example, alcohol-based hand-rub dispensers or soap and disposable towels if sinks are available) are available to patients, visitors and staff members so they can comply with respiratory hygiene and cough etiquette.

TRANSMISSION-BASED PRECAUTIONS

In some circumstances, patients have a documented infection or are suspected of having an infection with specified highly transmissible pathogens for which Standard Precautions cannot interrupt completely airborne or droplet transmission or transmission by contact with dry skin or contaminated surfaces. A second tier of precau-

tions, referred to as Transmission-Based Precautions, is necessary to prevent the potential spread of these diseases. There are three categories of Transmission-Based Precautions: Airborne, Droplet and Contact.^{7,8} More than one Transmission-Based Precaution category may apply at a time because some diseases are transmitted via multiple routes, and Transmission-Based Precautions sometimes are recommended for use on an empiric, temporary basis until a diagnosis can be made. When used alone or in combination, Transmission-Based Precautions always should be used in addition to Standard Precautions.

CDC's 2007 isolation guideline addresses the changing patterns of health care delivery, as well as those of emerging and evolving pathogens such as SARS and community-associated methicillin-resistant *Staphylococcus aureus* (MRSA).⁸ A primary difference in this guideline from previous CDC isolation precautions is the inclusion of recommendations for a broader spectrum of health care delivery settings than found in the previous guidelines for hospitals only. Specifically, CDC makes recommendations for ambulatory care settings that include dental offices.

Challenges may exist when adapting Transmission-Based Precautions to dental offices rather than to inpatient facilities. For example, dental office staff members may not be able to identify patients with infections immediately, patients frequently remain in common waiting areas for prolonged periods and treatment rooms may be turned around quickly with limited cleaning.⁸

Transmission-Based Precautions were mentioned in CDC's 2003 infection control guidelines for dental health care settings,¹ but not to any great extent. The same is true for dental infection control textbooks and journal articles; the main focus generally is on Standard Precautions. This may be because patients usually do not seek routine dental outpatient care when they are acutely ill with diseases that require Transmission-Based Precautions.¹ Nonetheless, a general understanding of precautions for diseases transmitted via all routes is important, because some dental health care personnel (DHCP) are hospital based or work part time in hospital settings, patients infected with these diseases might seek urgent treatment at outpatient dental offices, and DHCP

might become infected with these diseases.¹ Also, recently, several diseases requiring precautions beyond Standard Precautions (for example, MRSA or 2009 H1N1 influenza) have received extensive media coverage, and some dental professionals have inquired why there were not specific infection control recommendations to cover these conditions in ambulatory care dental settings.

The purpose of infection control procedures is to interrupt the spread of diseases. Therefore, applying Standard Precautions and, if indicated, the additional measures of Transmission-Based Precautions, is essential in preventing disease transmission.

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Categories. The names of the three categories of Transmission-Based Precautions—Airborne, Droplet and Contact—mirror their modes of disease transmission. Some diseases have multiple routes of transmission and require using more than one Transmission-Based Precautions category.⁸ In Table 2,^{8,9} I present examples of diseases requiring Transmission-Based Precautions in addition to Standard Precautions. I also present recommendations for duration of the precautions

because, unlike Standard Precautions that are used for every patient, Transmission-Based Precautions typically remain in effect only while there is risk of the infectious agent being transmitted or for the duration of the illness.⁸ DHCP will notice that, in some instances primarily with Contact and Droplet Precautions, the recommended precautions do not differ much from the infection control practices they normally use. For example, DHCP routinely wear gloves, protective eyewear, masks and gowns because they frequently are exposed to blood and blood-contaminated saliva during dental procedures, and OSHA requires them to wear personal protective equipment (PPE). On the other hand, nurses or physicians may not always wear a complete ensemble of PPE for all patient interactions.

Below, I summarize the recommendations for PPE, patient placement and patient transport for those treating patients in hospitals and for those treating patients in ambulatory care or outpatient settings such as a dental office or a hospital-based outpatient clinic. I emphasize the differences between recommendations for inpatient

TABLE 2

Select conditions and diseases requiring Transmission-Based Precautions.*†

DISEASE/CONDITION	CONTACT PRECAUTIONS	DROPLET PRECAUTIONS	AIRBORNE PRECAUTIONS	DURATION OF PRECAUTIONS
<i>Clostridium difficile</i>	X‡	NA§	NA	DI¶
Herpes Simplex (Mucocutaneous, Disseminated or Primary, Severe)	X	NA	NA	Until lesions are dry and crusted
Influenza Human (Seasonal)	NA	X	NA	Five days, except DI in people who are immunocompromised
2009 H1N1 Influenza	X	X	X	Seven days from symptom onset or until the resolution of symptoms, whichever is longer
Head Lice (Pediculosis)	X	NA	NA	U# four hours
Measles (Rubeola)	NA	NA	X	Four days after onset of rash, except DI in people who are immunocompromised
Methicillin-Resistant <i>Staphylococcus aureus</i>	X	NA	NA	Unresolved issue
Mumps	NA	X	NA	U nine days
Pertussis	NA	X	NA	U five days
Rubella	NA	X	NA	U seven days after onset of rash
Severe Acute Respiratory Syndrome	X	X	X	DI plus 10 days after resolution of fever, provided respiratory symptoms are absent or improving
Smallpox (Variola)	X	NA	X	DI until all scabs have crusted and separated (three-four weeks)
Tuberculosis (Confirmed Pulmonary or Laryngeal)	NA	NA	X	Discontinue precautions only when the patient receiving effective therapy is improving clinically and has three consecutive sputum smears negative for acid-fast bacilli collected on separate days
Varicella Zoster (Chicken Pox)	X	NA	X	Until lesions are dry and crusted

* Transmission-Based Precautions always are used in addition to Standard Precautions.
† Sources: Siegel and colleagues⁸ and Siegel and colleagues.⁹
‡ X: Use or apply the precaution.
§ NA: Not applicable.
¶ DI: Duration of illness (with wound lesions, DI means until wounds stop draining).
U: Until time specified in hours or days after initiation of effective therapy.

(hospital) and ambulatory care settings. Special or additional procedures for cleaning and disinfecting environmental surfaces or instrument processing, which are available in CDC's 2003 infection control guidelines for dental health care settings,¹ are not indicated after treating patients requiring Transmission-Based Precautions. It is beyond the scope of this article to review specific diseases; however, I mention some briefly as examples.

Contact Precautions. Contact is the most common mode of transmission.⁸ Infections are spread directly when disease-causing microorganisms pass from an infected person to a healthy person via direct physical contact with blood or body fluids. Examples of direct contact in health

care settings are touching, contact with oral secretions or contact with body lesions. Infectious microorganisms also can be transferred indirectly via a contaminated intermediate object or person. Contaminated hands frequently are cited as a significant source of indirect contact transmission.¹¹ Other modes of indirect contact transmission include percutaneous injuries sustained via a contaminated needle or other sharp object and instruments, surfaces and equipment that are not properly cleaned and disinfected or sterilized between patients.^{8,12,13}

Contact Precautions are intended to prevent transmission of infectious agents that are spread by direct or indirect contact with the patient or the patient's environment. Examples of conditions

requiring Contact Precautions include, but are not limited to, herpes simplex (mucocutaneous, disseminated, or primary or severe) and MRSA. Recurrent oral herpetic lesions only require Standard Precautions.⁸ CDC's MDROs guideline covers patients colonized or infected with MDROs, such as MRSA.⁹ Contact Precautions are recommended for inpatients known to be infected or colonized with MDROs and for patients in ambulatory care settings who have uncontrolled wound drainage or other syndromes representing increased risk of contact transmission.⁹

PPE. HCP caring for patients requiring Contact Precautions should wear protective clothing and gloves whenever contacting the patient or potentially contaminated areas surrounding the patient. To contain pathogens, PPE should be donned when HCP enter the room. This is distinctly different from Standard Precautions, for which protective clothing is worn only if contact with blood or body fluid is anticipated. Also, to prevent environmental contamination outside of the treatment room, PPE should be removed in a manner that prevents contamination of underlying clothing and skin and discarded before exiting the room, and hand hygiene should be performed.^{8,9}

In ambulatory care clinics, such as a dental clinic, Contact Precautions are indicated only for patients who have uncontrolled wound drainage or other syndromes representing increased risk of contact transmission. Strict enforcement of Standard Precautions, including wearing gloves and protective clothing when contact with uncontrolled secretions and other potentially infectious body fluids is anticipated, is considered adequate in most situations to prevent the transmission of MRSA and other MDROs.^{9,14}

Patient placement. In acute care hospitals, it is preferred that each inpatient is placed in a single-patient room to limit the opportunities for transmission. In some cases, cohorting (grouping patients infected or colonized with the same infectious agent together in one area to limit further transmission) may be acceptable after assessing the risks associated with this type of patient placement. In dental care settings, place patients requiring Contact Precautions in a treatment room or operator as soon as possible after they arrive at the dental office to limit the number of people exposed in the waiting area.⁸

Patient transport. Transporting patients should be limited as much as possible to reduce opportu-

nities for disease transmission to staff members and other patients. If a patient in any health care setting must be transported to another area in the facility or office, all infected or colonized areas of the patient's body should be contained or covered.⁸

Droplet Precautions. Droplet Precautions should be followed to prevent the transmission of pathogens spread through close respiratory or mucous membrane contact with respiratory secretions. Person-to-person transmission can occur when an infected person coughs, sneezes or talks and generates large-particle droplets (> 5 micrometers). Blood and saliva frequently spatter during dental treatment, and disease transmission may occur if these fluids from an infected patient contact unprotected broken skin or mucous membranes.^{8,12,13} Generally, special ventilation requirements are not required to prevent droplet transmission because these pathogens do not remain infectious across long distances in a health care facility. Three feet is considered the definition of a "short distance"; however, the results from some studies have shown that droplets traveled six feet or more with emerging and highly virulent pathogens (for example, SARS or smallpox).⁸ Technically, droplet transmission is considered a form of contact transmission because some infectious agents transmitted via this route also may be transmitted by direct or indirect contact.⁸

Influenza is a contagious respiratory illness caused by influenza viruses and commonly is referred to as "seasonal" influenza because it typically occurs in winter. It can cause mild to severe illness, but sometimes it can lead to death. Influenza is spread from person to person primarily when an infected person coughs and sneezes, so it is a good example of a condition requiring Droplet Precautions. As I previously mentioned, sometimes people become infected by touching something with influenza viruses on it and then touching their mouths or noses. Therefore, frequent hand hygiene is critical in preventing further spread of influenza. Patients with acute respiratory illnesses often visit their dentists, and, as with any patient, the goal of infection control is to prevent transmission of the disease. Other examples of diseases spread through droplets include pertussis, mumps and rubella. Implementing respiratory hygiene and cough etiquette measures at the first point of contact with a potentially infected person is vital with diseases

spread by droplets.

PPE. HCP should wear a mask that preferably is donned when entering a room before engaging in close contact with infective patients. CDC's 2007 isolation guideline does not make a recommendation for routinely wearing eye protection in addition to a mask for close contact with patients who require Droplet Precautions.⁸ Nevertheless, protective eyewear is indicated for DHCP because rotary dental and surgical instruments (for example, handpieces and ultrasonic scalers) and air-water syringes primarily generate a large-particle spatter of water, saliva, blood, microorganisms and other debris that may contact unprotected mucous membranes of the eyes, leading to microorganisms entering the body.^{1,4}

Patient placement. As with Contact Precautions, placing each patient in a single-patient room is preferable so that opportunities for transmission are limited. In some cases, cohorting may be acceptable after assessing the risks associated with this type of patient placement. Instruct patients receiving treatment in dental ambulatory care settings to follow respiratory hygiene and cough etiquette and place them in an examination room promptly after arriving at the dental office to limit exposure to other people in the waiting area.⁸

Patient transport. Transporting of patients who require Droplet Precautions should be limited. If a patient requires transport to another area of the facility, the patient should wear a mask and follow respiratory hygiene and cough etiquette to reduce opportunities for transmission.⁸

Airborne Precautions. Airborne transmission involves particles that are smaller ($< 5 \mu\text{m}$) and are called "droplet nuclei" or "aerosols." Transmission occurs when these particles, which can remain suspended in the air for long periods, are inhaled by DHCP or patients. Exposure to aerosols containing microorganisms from a patient's blood or saliva may occur during a use of rotary dental and surgical instruments, including dental handpieces and ultrasonic scalers.^{8,13} Airborne Precautions are used to prevent transmission of infectious agents that remain infectious across long distances when suspended in the air. Examples of diseases transmitted via the airborne route may include, but are not limited to, rubeola

virus (measles) and *Mycobacterium tuberculosis*.

PPE. Because surgical masks protect the mouth and nose only from splashes, spray and spatter from large-particle droplets and not the smaller aerosol particles, they cannot be used when Airborne Precautions are indicated. When breathing with a surgical mask in place, much of the inhaled air comes in around the sides of the mask, along with airborne organisms. According to CDC's 2007 isolation guideline, HCP should don fit-tested N95 respirators approved by CDC's National Institute for Occupational Safety and Health (NIOSH) when entering the room of a patient who has confirmed or suspected infectious pulmonary or laryngeal tuberculosis (TB) or who is suspected of having TB when infectious skin lesions are present and for aerosol-generating procedures.⁸ This recommendation also applies when treating patients with smallpox.

When HCP use respirators while treating patients with diseases requiring Airborne Precautions, they should use the respirators in the context of a complete respiratory protection program. This program should include training and fit testing to ensure an adequate seal between the edges of the respirator and the wearer's face.^{1,8,15,16} Because

it is not likely that patients with confirmed TB or who are suspected of having TB will be treated in nonhospital-based dental clinics, a respiratory protection program is not always necessary for ambulatory care settings. Health care settings in which HCP do not treat patients with TB need only written protocols for recognizing the signs and symptoms of TB and for referring patients to a setting in which they can be treated.¹⁷

Patient placement. A patient requiring Airborne Precautions should be in an airborne infection isolation room (AIIR), which is a single-patient room with special air-handling and ventilation capacity. If the facility has an AIIR, a respiratory protection program is required. Elements of a respiratory protection program include education about use of respirators, fit testing and user seal checks with each use of an N95 respirator.⁸

In dental offices or other medical settings in which Airborne Precautions cannot be implemented because of limited engineering resources, having the patient wear a mask, placing the

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patient in a private room (for example, an examination room) with the door closed and providing N95 or better respirators (or masks, if respirators are not available) to HCP will reduce the likelihood of airborne transmission until the patient is either transferred to a facility with an AIIR or returned to the home environment, as deemed medically appropriate.^{1,8,16,17} If a patient has TB or is suspected of having TB, CDC recommends postponing any nonurgent dental treatment until the patient does not have TB or is not infectious. If treatment cannot be postponed, it should be performed in an AIIR, and DHCP should wear at least a fit-tested N95 disposable respirator.^{1,16,17}

Patient transport. In hospitals, transport of patients requiring Airborne Precautions should be limited. If a patient must be moved outside of the AIIR, the patient should wear a surgical mask, if possible, and observe respiratory hygiene and cough etiquette.^{8,16} If the patient has skin lesions, such as with varicella zoster (chicken pox) or smallpox, the affected areas should be covered to prevent aerosolization or anyone coming into contact with any infectious agents in the skin lesions. If the patient is wearing a mask and skin lesions are covered, the HCP transporting the patient is not required to wear a mask.⁸

Special considerations. I have presented limited examples of conditions requiring Transmission-Based Precautions. Many conditions (for example, SARS, smallpox, varicella zoster, 2009 H1N1 influenza) can be transmitted via multiple routes and, therefore, require the use of more than one type of Transmission-Based Precaution in addition to Standard Precautions. Also, as with MDROs, additional precautions may be indicated. Additional information can be found in CDC's 2007 isolation guideline⁸ and CDC's MDROs guideline.⁹ In addition, as new diseases emerge, infection control guidance and information about any special considerations for various practice settings can be found at CDC's Web site ("www.cdc.gov"). A relevant example of this is 2009 H1N1 influenza.^{18,19}

Sometimes called "swine flu," the 2009 H1N1 influenza is an influenza virus that was first detected in people in the United States in April 2009. 2009 H1N1 is an example of a disease that requires more than one category of Transmission-Based Precautions be followed because transmission is thought to occur through droplet exposure of mucosal surfaces, indirect contact via contaminated hands or environmental surfaces, and

inhalation of aerosols near an infected person.^{18,19}

CDC has published specific 2009 H1N1 influenza infection control recommendations for dentistry on its Web site.¹⁹ With respect to the Standard and Transmission-Based Precautions infection control guidance I reviewed in this article, the following precautions are recommended.

- Use patient-reminder calls to identify patients reporting influenzalike illness. If the patient reports influenzalike illness, reschedule nonurgent visits for 24 hours after the patient is free of fever without the use of fever-reducing medicine.
 - Identify patients with influenzalike illness at check-in. Offer a face mask or tissues to patients with symptoms, ask them to follow respiratory hygiene and cough etiquette, and reschedule nonurgent care. When evaluating patients for urgent care, separate ill patients from others whenever possible.
 - Urgent dental treatment can be performed without the use of an AIIR because transmission of 2009 H1N1 influenza is thought not to occur across long distances through the air, such as from one patient room to another.
 - Use a treatment room with a closed door, if available. If one is not available, use the one that is the farthest away from other patients and personnel.
 - Wear recommended PPE before entering the treatment room.
 - DHCP should wear a NIOSH fit-tested, disposable N95 respirator when entering the patient's room and when performing dental procedures in patients with confirmed or suspected 2009 H1N1 influenza.
 - If N95 respirators, fit testing services or both are not available despite reasonable attempts to obtain them, the dental office should transition to a prioritized use mode (that is, nonfit-tested disposable N95 respirators or surgical face masks can be considered a lower level of protection for personnel at lower risk of exposure or lower risk of complications resulting from influenza than personnel at the highest risk of experiencing influenza exposure until fit-tested N95 respirators are available). Detailed information is available in CDC's Interim Guidance on Infection Control Measures for 2009 H1N1 Influenza in Healthcare Settings, Including Protection of Healthcare Personnel.¹⁸
- The recommendation for using an N95 respirator when treating patients with 2009 H1N1 influenza differs from current infection control

guidance for seasonal influenza, which recommends that HCP wear surgical masks for patient care.¹⁸ Since the 2009 H1N1 influenza situation is evolving, guidance may change as additional information becomes available. CDC's Web site will have the most current infection control recommendations.

CONCLUSIONS

In this article, I reviewed the importance of using Standard Precautions and introduced two new elements of Standard Precautions—safe injection practices and respiratory hygiene and cough etiquette—which DHCP should add to their infection control programs. Using Standard Precautions is the primary infection control strategy; it was designed to use when treating all patients, regardless of diagnosis or presumed infectious status. However, when the routes of transmission cannot be interrupted completely with Standard Precautions alone, it is necessary to use Transmission-Based Precautions. I reviewed the three categories of Transmission-Based Precautions—Contact, Droplet and Airborne—along with recommendations for managing the treatment of patients with conditions that require the use of these measures as well as Standard Precautions. Traditionally, patients with diseases requiring Transmission-Based Precautions were too ill to seek routine outpatient dental care. However, with the emergence of new pathogens and more patients' seeking care in ambulatory care facilities, it is more likely that dentists may see these patients for treatment. DHCP need to be aware of additional measures they need to take when treating these patients in an outpatient setting so that they fully protect other patients, their staff members and themselves. ■

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1. Kohn WG, Collins AS, Cleveland JL, et al. Guidelines for infection control in dental health-care settings—2003. *MMWR Recomm Rep* 2003;52(RR-17):1-61. "www.cdc.gov/mmwr/preview/mmwrhtml/rr5217a1.htm". Accessed March 16, 2010.

2. Centers for Disease Control (CDC). Recommendations for preventing transmission of infection with human T-lymphotropic virus

type III/lymphadenopathy-associated virus in the workplace. *MMWR Morb Mortal Wkly Rep* 1985;34(45):681-686, 691-695.

3. Centers for Disease Control (CDC). Recommendations for prevention of HIV transmission in health-care settings. *MMWR Morb Mortal Wkly Rep* 1987;36(suppl 2):1S-18S.

4. Centers for Disease Control (CDC). Update: universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis B virus, and other bloodborne pathogens in health-care settings. *MMWR Morb Mortal Wkly Rep* 1988;37(24):377-382, 387-388.

5. U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR Part 1910.1030: Occupational exposure to bloodborne pathogens—OSHA, final rule. *Fed Regist* 1991;56:64004-64182. "www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051". Accessed March 23, 2010.

6. Lynch P, Jackson MM, Cummings MJ, Stamm WE. Rethinking the role of isolation practices in the prevention of nosocomial infections. *Ann Intern Med* 1987;107(2):243-246.

7. Garner JS; The Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals (published correction appears in *Infect Control Hosp Epidemiol* 1996;17[4]:214). *Infect Control Hosp Epidemiol* 1996;17(1):53-80.

8. Siegel JD, Rhinehart E, Jackson M, Chiarello L; Health Care Infection Control Practices Advisory Committee. 2007 Guideline for isolation precautions: preventing transmission of infectious agents in health care settings. *Am J Infect Control* 2007;35(10 suppl 2):S65-S164. "www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf". Accessed March 16, 2009.

9. Siegel JD, Rhinehart E, Jackson M, Chiarello L; Healthcare Infection Control Practices Advisory Committee. Management of multidrug-resistant organisms in healthcare settings, 2006. *Am J Infect Control* 2007;35(10 suppl 2):S165-S193. "www.cdc.gov/ncidod/dhqp/pdf/ar/mdroGuideline2006.pdf". Accessed March 16, 2010.

10. Thompson ND, Perz JF, Moorman AC, Holmberg SD. Nonhospital health care-associated hepatitis B and C virus transmission: United States, 1998-2008. *Ann Intern Med* 2009;150(1):33-39.

11. Boyce JM, Pittet D; Healthcare Infection Control Practices Advisory Committee; HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Guideline for hand hygiene in health-care settings: recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *MMWR Recomm Rep* 2002;51(RR-16):1-45. "www.cdc.gov/mmwr/PDF/rr/rr5116.pdf". Accessed March 16, 2010.

12. Miller CH, Palenik CJ. Development of infectious diseases. In: *Infection Control and Management of Hazardous Materials for the Dental Team*. 4th ed. St. Louis: Mosby; 2010:25-35.

13. Molinari JA, Harte JA. Dental services. In: Carrico R, Adam L, Aureden K, et al., eds. *APIC Text of Infection Control and Epidemiology*. Washington: Association for Professionals in Infection Control and Epidemiology; 2009:50-1-50-21.

14. Klevens RM, Gorwitz RJ, Collins AS. Methicillin-resistant *Staphylococcus aureus*: a primer for dentists. *JADA* 2008;139(10):1328-1337.

15. U.S. Department of Labor, Occupational Safety and Health Administration. OSHA 29 CFR 1910.139. Respiratory protection for *M. tuberculosis*. *Fed Regist* 1998;63:1152-1300.

16. Jensen PA, Lambert LA, Iademarco MF, Ridzon R; Centers for Disease Control and Prevention. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR Recomm Rep* 2005;54(RR-17):1-141. "www.cdc.gov/mmwr/PDF/rr/rr5417.pdf". Accessed March 16, 2010.

17. Cleveland JL, Robison VA, Panlilio AL. Tuberculosis epidemiology, diagnosis and infection control recommendations for dental settings: an update on the Centers for Disease Control and Prevention guidelines. *JADA* 2009;140(9):1092-1099.

18. Centers for Disease Control and Prevention. Interim guidance on infection control measures for 2009 H1N1 influenza in healthcare settings, including protection of healthcare personnel. *Miss RN* 2009; 71(4):13-18. "www.cdc.gov/h1n1flu/guidelines_infection_control.htm". Accessed March 16, 2010.

19. Centers for Disease Control and Prevention. Prevention of 2009 H1N1 influenza transmission in dental health care settings. "www.cdc.gov/oralhealth/infectioncontrol/factsheets/2009_h1n1.htm". Accessed March 16, 2009.