Variety of Processes Transmit Respiratory Infections

Respiratory Infections: Routes of Transmission.
Nancy Andrews, RDH, BS

Keywords: Infection Control, Respiratory Infections, Transmission

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In 2009, the H1N1 influenza pandemic focused our attention in dentistry on respiratory diseases. As a result, several recommendations have been updated for respiratory protection in dentistry. During the pandemic, many workers realized that they were unclear about exactly how much protection they get from their masks, how to handle situations when sick patients arrive in the clinic, and how respiratory diseases were transmitted. In addition, they did not understand the scope of respiratory diseases for which patients should be monitored, other than the flu, and how to recognize and deal with these infections. During the H1N1 influenza pandemic, health care workers became afraid because perhaps they realized their education was lacking or their preparation for respiratory diseases was not complete. In dentistry, we should be comfortable with our personal protection precautions and our patient management systems for reducing the transmission of these highly infectious diseases. Transmission Routes: Each disease is different, but basically, respiratory diseases are transmitted via contact, droplets, and aerosol. In other words, respiratory secretions are spread in a variety of ways, which gives rise to all kinds of questions. If respiratory secretions get sprayed on a counter, how long does the influenza virus remain alive on that surface? If tuberculosis is on the counter, how long does it stay alive and how does it get transmitted from one person to another? Do I have to touch the counter and then touch my nose to transmit the infection? Contact Transmission: Respiratory diseases are basically contact diseases, and this “contact transmission” can be either direct or indirect: you can directly contact the person or you can contact a contaminated surface and then indirectly transmit it to yourself. Usually safe practices and environmental asepsis will prevent this type of transmission. In the dental office, our standard precautions can handle this kind of transmission. Droplet Transmission: Our standard precautions also work for most droplet-transmitted diseases. The droplets are large enough particles that our personal protective equipment (masks, gloves, eye protection, gowns) will catch them and prevent transmission if we are conscious of safe practices such as hand hygiene and not cross-contaminating and self-inoculating ourselves with a contaminated glove. Aerosol Transmission: The question came with the H1N1 pandemic about how to control and protect against aerosol-transmitted diseases. What about these things flying in the air that you cannot see? As a result, new recommendations were developed to manage patients with aerosol-transmitted diseases. For example, California passed an Occupational Safety and Health Administration law instructing dental personnel to avoid exposure to aerosol-transmitted diseases. (Reviewer-).
One of the ways in which respiratory diseases can be transmitted to dental health care workers is via aerosol transmission. Aerosols are unique because they stay suspended in the air much longer than regular droplets. In medicine, these aerosols originally led to development of transmission-based precautions. **Transmission-Based Precautions:** Standard precautions are designed for the care of all patients, while transmission-based precautions are performed in addition to standard precautions and are applied to patients who are known to be or suspected of being infected or colonized with a serious pathogen that might be transmissible via contact, droplets, or aerosol. For example, if the patient has a contact disease, transmission-based precautions would recommend normal contact precaution procedures, but you would perform them a little differently. Perhaps you would use different products or use them in a different order than you would use with your standard precautions. There are 3 different types of transmission-based precautions: contact precautions, droplet precautions, and airborne (aerosol) precautions. **Contact Precautions:** For a contact disease, these precautions are designed to help prevent contact with the pathogen. You would not see the patient, put the bib on them, do an oral exam, or do anything without first protecting your skin surfaces from contact. This would include protecting your face and eyes. For example, you would not enter a room without wearing your gloves. **Droplet Precautions:** For droplet precautions, you are trying to protect yourself from droplets that would be expelled when the patient coughs, sneezes, or talks. Droplet precautions basically help you protect yourself from inhalation and contact with the pathogen when within a 3-foot range of the patient. In this case, you would not enter the room without your gloves, gown, and mask. These precautions are not just for a worker approaching a patient, but they also apply to how you separate patients. For example, you would not want a patient within 3 feet of another patient. **Airborne Precautions:** Aerosols require a whole set of special precautions beyond the normal things that we typically do in dentistry. These precautions require specialized air exchanges in the facility and the wearing of N95 respirators. Therefore, an increasing level of effort must be made when particles become smaller and more infectious. (Reviewer-).
Most dental facilities are not set up for dealing with aerosol-transmissible diseases. California made a rule advising all dental clinics to prescreen patients and to not see patients with aerosol-transmissible infections.

In the United States, we are currently faced with an influenza pandemic, which typically has many more cases and a higher mortality rate. This experience has reawakened an interest in the general population and in health care workers with regard to the need for managing respiratory disease transmission risks. In some regards, the H1N1 pandemic flu prepared dental health care workers for managing these risks. Because we have been through the drill with preventing H1N1 transmission, dental offices should now be ready to take more conservative approaches in dealing with aerosol-transmissible diseases and should be ready to follow guidelines from the Centers for Disease Control and Prevention (CDC) and other health departments. For example, we do not know how the 2009-2010 H1N1 virus will evolve, but airborne or inhalation transmission is one of the potential routes of transmission. When entering the room of a patient in isolation with a confirmed or suspected aerosol-transmissible disease, such as the H1N1 flu, all health care personnel should wear personal protective equipment, including specialized respiratory protection. This equipment should include a fit-tested disposable N95 respirator approved by the National Institute for Occupational Safety and Health, gloves, gowns, and eye protection. Other transmission-prevention strategies could include innovative triage processes, special hand washing, disinfection, vaccinations, antiviral drug use, a screening program for identifying respiratory illness, staff training, and special building construction and operation to contain or control airflow. All these precautions must be in place when dealing with an infectious patient. The truth is that dental facilities are not set up for this, and it is not realistic to expect them to be able to deal with aerosol transmission. California made a rule relative to this and basically advised all dental clinics to prescreen their patients and to not see patients who are potentially infectious. However, for patients who are infectious or likely to be infectious who absolutely need dentistry, they must be seen in an alternative setting (probably a hospital setting) where a negative-pressure room is available and the staff have completed a training program to wear all the right personal protective equipment. It is a very complex system. It is reasonable that the approach taken in California has set the model for other states because it is putting into practice only current CDC guidelines. These CDC guidelines recommend using all those processes when dealing with a patient who is sick. If these processes cannot be used, then the patient should be avoided. (Reviewer-).

Keywords: Infection Control, Respiratory Diseases, Infectious Patients

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Patients should be reminded not to come into the dental clinic if they are ill with a febrile or upper respiratory illness. Staff members, including dentists, should not come to work if they are infectious.

California has made a rule advising all dental clinics to prescreen their patients for possible respiratory infections and to not see patients who are potentially infectious. This will likely serve as a model for dental practices in other states to manage infectious patients. Influenza is probably one of the most infectious respiratory diseases, and, when someone is asymptomatic, a virus could be spread to a number of individuals in a relatively short time. Symptomatic patients are easier to restrict in outpatient dental facilities because these patients are aware that they are sick and have the potential to infect staff members. To successfully restrict infectious patients from your practice will require both education and strategizing. How can dental professionals routinely avoid some of these aerosol-transmitted infections in their clinic? **Prescreening Patients:** Because we are supposed to avoid treating infectious patients, we must first educate our patients not to come into the clinic when ill. When patients are called for an appointment confirmation and when they enter the office, they should be screened for obvious things such as a febrile respiratory illness. We must plan for the fact that some patients may be sick when they arrive at the clinic. Provisions should be made to allow for prompt isolation and assessment of symptomatic patients. The patient’s privacy must always be protected during screening. I suggest a written screening form as the most appropriate way to initiate the whole screening process. As the patient’s appointment is being confirmed, even if by leaving a message on the recorder, remind them not to come into the clinic if they are ill with a febrile or upper respiratory illness. Goals of this prescreening process are for early detection before the patient arrives or for prompt isolation of the symptomatic patient who arrives at check-in. **Respiratory Hygiene:** Make sure all offices implement respiratory hygiene and cough etiquette, which is a complete program to deal with respiratory secretions by covering coughs, providing tissues, and providing receptacles for proper tissue disposal. Educate the whole staff so they set a good example. Provide materials and posters in the office reminding everyone to behave in a way that does not spread disease. Send out this information to educate patients ahead of their visit so that they know what to expect and are not shocked by your requests. Then, if a patient or staff member is ill, implement appropriate precautions. Follow the clear guidelines from the Centers for Disease Control and Prevention for health care workers who are infectious. Remind staff members, including dentists, that they should not come to work if they are violating these rules. (Reviewer-).

**Keywords:** Infection Control, Respiratory Diseases

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The screening program implemented by your practice should be customized to incorporate respiratory infection risks seen in your geographic area or patient demographic.

When considering respiratory infections as they relate to our dental practices, we tend to focus on influenza. However, there are several other aerosol-transmitted infections for which dental professionals should be looking, be they frequent or infrequent. **Screening:** The screening program implemented by your practice should be customized to incorporate respiratory infection risks seen in your geographic area. For example, a practice in California might consider monitoring patients for signs and symptoms of tuberculosis (TB). Therefore, every year, staff members should be trained to screen patients for TB symptoms. As an aside, dental health care workers should be aware that skin tests (the tuberculin skin test) are required when they are hired, and they should be retested periodically as appropriate to the risk in their geographic area or patient demographic. **Screening for TB:** To screen patients for TB, ask them if they have a history or symptoms of TB. The main symptom of TB is a productive cough of >3 weeks' duration, which is typically accompanied by bloody sputum, night sweats, fatigue, malaise, fever, and unexpected weight loss. If patients answer yes to any of these symptoms, they need a medical referral because this is a reportable condition. **Other Respiratory Infections:** Other important respiratory infections for which to screen include measles, mumps, rubella, and chickenpox. People do not always think of chickenpox as a respiratory disease, but it is. It is transmitted via contact and droplets. **Screening Form:** General questions to include on a screening form would be as follows: Do you have a fever? Do you have respiratory symptoms and severe coughing spasms, painful swollen glands, a skin rash with blisters, or a stiff neck with mental changes? Answers to these questions could indicate illnesses such as meningitis. Ask about symptoms of the regular flu: coughing, sneezing, fever, body aches, runny nose, sore throat, headache, nausea, vomiting, and diarrhea. Again, customize questions to infection risks encountered in your patient demographic. These screening forms can help your staff identify patients who are potentially infectious. (Reviewer-).
Masks are classified as low, moderate, or high barrier masks based on sizes and percentages of particles filtered by the mask and the fluid resistance of the mask.

Masks are an important safety measure to help prevent transmission of respiratory infections to dental healthcare workers. There are standards from the American Society of Testing and Materials that classify respiratory protection qualities of a mask as low, moderate, or high barrier masks. Key features for classifying masks are (1) the sizes of particles filtered by the mask, (2) the percentage of those particles filtered out, and (3) the fluid resistance of the mask. A mask’s fluid resistance translates into how long the mask protects the worker in a moist environment. In addition, masks come in all gradations, and healthcare workers should have a choice in their office based on the anticipated risk of the procedure they are to perform. I think healthcare workers are becoming more aware that they have choices in the masks they use. However, I do not know how many people are actually purchasing more than 1 type of mask for their office setting. If they purchase only 1 type, I think it should be a high barrier mask because that is what is required for use with an aerosol-producing device, such as a handpiece or an ultrasonic scaler. **N95 Respirators:** N95 respirators are higher-volume masks that are not required to comply with standard precautions. These masks have come down in cost, and they come in different varieties. They are made to provide that extra protection needed when a worker literally comes face-to-face with an infectious individual. Every office should have at least 1 box of N95 respirators available, even though these are not required to comply with standards from the Occupational Safety and Health Administration. However, in my opinion, it is wise to have these masks available because, even if you implement a very effective patient screening program, you cannot always stop infectious people from coming to the office. You cannot always anticipate a situation. **Correct Use:** An important issue in the dental office is that health care workers should know how to correctly wear and use their masks. Masks should not be worn too long, based on humidity in the area, the type of task being performed, aerosols being produced, and activities of the person wearing the mask, such as a runny nose. All these factors can compromise the protective abilities of the mask. Generally, compliance with changing masks is not good because the person wearing the mask perceives that the mask is still protective, when in fact it is not. Remember, masks are single-use items. (Reviewer-).
Because respiratory diseases are transmitted in a variety of ways, masks must be used properly, and that use must comply with aseptic techniques to make the mask effective.

During the H1N1 influenza pandemic of 2009, many people tried to purchase specialized N95 masks to reduce infection transmission to dental health care workers. Because of the H1N1 pandemic, N95 masks were in short supply because they were in great demand for critical care areas, including emergency department visits and medical visits. Dentistry was having a difficult time purchasing N95 masks because we were low on the priority list. Frankly, some people really did not know they should have them. Now that we have had a little time to recover from the onset of the pandemic, I believe that everyone should be geared up for protecting against these respiratory infections. **Proper Technique:** I cannot stress enough that, because these diseases are transmitted in a variety of ways, you must use your mask properly and comply with aseptic techniques to make its use effective. If you touch your mask with contaminated hands, the mask may not be effective. If you wear a mask too long and it becomes saturated, then any germs landing on the outside of the mask may get through to the inside. Therefore, when a mask is saturated, you have worn it too long. In addition, air will not go through it very well, so you will be sucking more air in around the edges of the mask, thus losing the protection of filtered air. Under these conditions, a regular mask can be a source of contamination, especially considering the variety of ways that respiratory diseases can be transmitted. Dentistry has come a long way in both the use of masks and the various types of masks that are available. However, the very things we do to protect ourselves as dental professionals can put us at risk if we are not knowledgeable and compliant with aseptic techniques. (Reviewer-).

Keywords: Infection Control, Respiratory Diseases

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Reschedule Clinic Visits for Suspicious H1N1 Cases

Prevention of 2009 H1N1 Influenza Transmission in Dental Health Care Settings.
Centers for Disease Control and Prevention:

H1N1 Flu Clinical and Public Health Guidance 2009; (November 23): online

All patients should be screened for potential respiratory infections and asked to reschedule their clinic visit for when they are well. Any coughing individual who enters the clinic should be asked to wear a mask.

Dental health care workers will likely have contact with patients with H1N1 influenza. Comprehensive information regarding 2009 H1N1 infection control guidelines can be found on the Web site for the Centers for Disease Control and Prevention (CDC), http://www.cdc.gov/oralhealth/infectioncontrol/factsheets/2009_h1n1.htm. H1N1 Transmission: The H1N1 virus is spread through contact, droplet, and aerosol transmissions. The virus can be spread indirectly from infectious respiratory secretions or contaminated surfaces to vulnerable mucosal surfaces on the health care worker, and this spread usually occurs via contaminated hands. In addition, when in the vicinity of the infectious patient, small particle aerosols can be inhaled by the health care worker. Symptoms of H1N1: Symptoms of H1N1 may include fever (not all patients have fever), cough, sore throat, runny or stuffy nose, body aches, headache, chills, fatigue, and sometimes diarrhea and vomiting. Dental Clinic Recommendations: All dental health care personnel should be encouraged to receive vaccines against both seasonal influenza and H1N1. In addition, the clinic should implement a solid respiratory hygiene/cough etiquette policy. When reminding patients of upcoming appointments, screen them for possible respiratory illness and ask them to reschedule non-urgent appointments until free of fever for at least 24 hours. At check-in, screen patients for possible respiratory illness and offer symptomatic patients a mask and/or tissues. If possible, reschedule the symptomatic patient for a later date when he or she is well. If a symptomatic patient needs urgent care, then separate them from other waiting patients and treat them far away from other patients and personnel. In addition, wear the recommended personal protective equipment when entering the treatment area of a potentially infectious individual. This equipment should include a fit-tested disposable N95 respirator. When treating these patients, minimize spray and spatter associated with procedures. Recommendations for Dental Staff Members: On a daily basis, staff members should assess themselves for fever, nasal congestion/runny nose, sore throat, or cough. Those with fever and respiratory symptoms should stay home until at least 24 hours after they are fever-free without use of fever-reducing medications.

Reviewer's Comments: This reference provides important information for dental professionals concerning basic precautions to be used when confronted with patients exhibiting flu-like symptoms. This applies for both seasonal and A/H1N1 pandemic flu instances. (Reviewer-John A. Molinari, PhD).

Keywords: Infection Control, H1N1

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These guidelines published in 2003 by the Centers for Disease Control and Prevention represent a collaborative effort between leading experts in infection control from other federal agencies, public health, and hospital epidemiology and infection control. Each recommendation has a rank assigned to it, categorizing it on the basis of existing scientific data, theoretical rationale, and applicability. In this brief review, a few of the many pertinent points are summarized.

**Personnel & Infection Control:** Education of personnel along with clearly written policies and procedures will increase compliance with infection-control programs and exposure-control plans. Therefore, all dental health care personnel (DHCP) should be trained regarding principles of infection control, work-related infection risks, infection control measures, and exposure management.

**Personal Protective Equipment:** During procedures and patient care activities that are likely to splash or spray blood or body fluids, DHCP should wear surgical masks and protective eyewear with solid side shields. All DHCP should be aware that the mask’s outer surface can become contaminated via spray of oral fluids or contaminated fingers. Resistance to airflow is increased in wet masks, causing increased airflow around the edges of the mask (less filtered air). Therefore, wet masks should be changed between patients or during patient treatment. An N95 respirator should be worn when aerosol transmission precautions are necessary. These respirators should be fit-tested for each DHCP who will be wearing them. All gowns should have sleeves long enough to protect the forearms. All protective clothing should be changed when visibly soiled or if penetrated by blood or other infectious body fluids.

**Managing TB Patients:** Transmission of tuberculosis (TB) occurs when a susceptible person inhales infected droplet nuclei, which then settle into the alveoli of the lungs. The overall risk of being exposed to a patient with active TB is low for DHCP. However, depending on the dental practice’s patient demographic, the risk for exposure can be relatively high. Surgical masks do not prevent TB, so standard precautions are inadequate for preventing transmission. DHCP should be trained to recognize signs and symptoms of TB so that the infectious patient can be identified promptly. A baseline tuberculin skin test is required for all DHCP who may be exposed to patients with TB. This test should be repeated periodically, depending on the risk in the community. All patients identified with active TB should be referred for medical evaluation.

**Reviewer’s Comments:** This reference provides the reader with the most current CDC infection control recommendations for dental care providers regarding their exposure to treatment-induced patient aerosols and spatter. These guidelines offer both appropriate precautionary measures and airborne protection procedures. (Reviewer-John A. Molinari, PhD).

**Keywords:** Infection Control, H1N1

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Influenza’s Uniform Appearance -- Fever, Headache, Muscle Ache

Influenza Symptoms and Duration of Infectious Potential.

Louis G. DePaola, DDS, MS

Louis G. DePaola, DDS, MS - Special Presentation

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Adults infected with the influenza virus are contagious for 1 to 2 days before and for 4 to 5 days after the onset of symptoms. Children can be infectious for as many as 7 to 10 days after symptom onset.

Influenza is an infection from 1 or more of the 3 influenza viruses: influenza A, influenza B, and influenza C. These RNA viruses are very common throughout the world. Almost everyone has had influenza. Symptoms vary significantly from very benign illness, to a little bit more severe illness, to a life-threatening illness that, in many instances, may result in death. Influenza usually starts as an acute infection. It develops very rapidly: the patient becomes symptomatic usually within several days of infection. Usually, the patient develops a fever, which is the hallmark of all influenza infections. Most of these infections are self-limiting -- they resolve with little or no medical attention. However, some influenza infections become very serious. Each year in the United States, an average of 5% to 20% of the population will contract the flu, >200,000 people are hospitalized due to flu-related complications, and approximately 36,000 people die from flu-related causes. **Symptoms:** Influenza symptoms include fever, headache, muscle ache, malaise, and fatigue. Symptoms of upper respiratory infections are very common, such as sore throat, runny nose, cough, and cervical lymphadenopathy. **Contagiousness:** The influenza virus may spread from person to person when respiratory droplets of coughs and sneezes are deposited directly into the respiratory tract of another person or when droplets are found deposited by unwashed hands to the mouth or nose of a person who contacted another infected person or object. The infected individual is contagious for 1 to 2 days before symptoms develop and for 4 to 5 days after the onset of symptoms. In children, duration of the contagious state can be much more protracted. Children can be infectious for as many as 7 to 10 days after onset of symptoms. (Reviewer-).

Keywords: Influenza, Symptoms, Contagiousness

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Medical attention should be sought immediately when any serious symptoms of influenza develop, especially in children and other vulnerable populations.

In the United States, the annual impact of influenza is significant, although it varies from year to year. Some flu seasons are marked by a very widespread, virulent, and serious influenza virus, resulting in more cases than in other years. On average, approximately 36,000 to 45,000 people die from seasonal flu in the U.S. Approximately 500,000 people die worldwide as a result of influenza. Therefore, influenza is a highly significant disease and has a dramatic impact on society in the U.S. and throughout the world. **Flu-Related Mortality:** Influenza is a direct infection of the respiratory system. Therefore, some people die directly from the viral infection and associated secondary pulmonary symptoms. Pneumonia develops in many patients. Individuals who seem to be most vulnerable to seasonal influenza infections are those who are more medically fragile, including (1) those aged >60 or 65 years with underlying medical conditions such as emphysema, asthma, or other comorbidities, and (2) those aged <2 years whose immune systems have not developed completely, making them especially vulnerable to viral infections. **Pediatric Influenza:** More and more emerging data show a very alarming rise in the number of secondary infections/bacterial coinfections in pediatric patients with influenza. Many of these are *Staphylococcus aureus* infections, with many of these being methicillin-resistant *S. aureus* infections. Usually, when a child becomes secondarily infected with these organisms, the clinical course is relatively grave and very rapid. For example, from October 2006 to September 2007, the Centers for Disease Control and Prevention reported 73 deaths from influenza in children in 39 states. Of these 73 children who died, 30 had bacterial coinfection, with 22 (73%) having *S. aureus* infections. Therefore, this is becoming a more significant problem.

**Conclusions:** The lesson to be learned from these emerging data is that medical attention should be sought immediately when any serious symptoms of influenza develop, especially in children and other vulnerable populations. (Reviewer-).

Keywords: Influenza, Mortality

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In humans, the 3 known influenza viruses are classified as influenza A, influenza B, and influenza C. **Influenza B:** Influenza B infects only humans, has a tendency to occur in seasonal epidemics, and has not been linked to a worldwide pandemic outbreak of the flu. These viruses are very significant when they infect elderly patients. **Influenza C:** Both humans and pigs can serve as hosts for influenza C viruses. Although the virus is noteworthy, there are not significant outbreaks of influenza C. **Influenza A:** The most worrisome influenza virus is influenza A. The reason this virus is so significant in health care is that it is capable of a great deal of change. The surface of the influenza A virus basically contains 8 genes that are in a constant state of rearrangement. In addition, there are a number of proteins on the surface of this virus, with hemagglutinin (abbreviated as H) and neuraminidase (abbreviated as N) being 2 of the more significant proteins. The positions of these 2 proteins classify the viruses, such as H1N1, H3N2, etc. Another hallmark of influenza A is that it is capable of infecting multiple species: human, pigs, horses, marine animals, and birds. Therefore, this virus has a wide variety of opportunities to infect 1 species and jump to other species, acquiring characteristics of the influenza virus in these other species and developing capabilities of infecting people with these completely novel viruses. This is one of the ways in which pandemic influenza strains are created. Influenza A has been linked to pandemics throughout history. (Reviewer-).
Each season’s circulating influenza strains are slightly different yet somewhat similar to viruses that circulated the previous year. Therefore, the immune system is not generally presented with a dramatic challenge.

Seasonal flu is a fact of life. In the northern hemisphere, flu season occurs every year in early to late September, October, November, December, January, and February. As spring emerges, cases usually resolve; in spring and summer months, the seasonal flu almost completely disappears in the northern hemisphere. It is very predictable in its annual appearance (late fall or early winter), which is probably because influenza viruses favor cooler temperatures and low humidity, both of which are characteristic of winter months. Each season’s circulating strains of influenza are slightly different yet somewhat similar to seasonal influenza viruses that occurred the previous year. Therefore, there is some immune recognition from previous exposure – each season’s new influenza viruses typically do not present a dramatic change to the immune system. With seasonal flu, the most serious complications generally occur in vulnerable populations: individuals with medical comorbidities, adults aged >65 years, and children aged ≤2 years. Seasonal influenza has an impact on the health care system, but the health care system generally is adaptable. The health care system is capable of absorbing the number of cases, which averages 200,000 cases/year, without causing too many adverse effects on the delivery of health care in other areas. **Vaccines:** A seasonal vaccine is available every year for seasonal influenza. The seasonal vaccine usually contains 3 strains of influenza from among many dozens, if not hundreds, of circulating influenza strains. Some years, the most common circulating strain is a good match to the strains included in the vaccine. In other years, the vaccine’s contents might not be such a good match to circulating influenza strains, resulting in more cases of the flu. Therefore, the influenza vaccine is very effective, but only for those 3 strains included in the vaccine. Other antiviral drugs are also in adequate supply. Nonetheless, seasonal influenza is associated with 36,000 to 45,000 deaths in the United States every year. Seasonal influenza also has an impact on the economy, but this impact is relatively benign. (Reviewer-).
Using data from the previous flu season, an expert panel determines which 3 strains of influenza virus likely will be the most prevalent circulating strains to incorporate into the flu vaccine for the coming flu season.

One of the misconceptions about the vaccine for seasonal influenza is that the vaccine protects against all strains of the flu virus circulating in the general population. However, every year, the Food and Drug Administration and other regulatory bodies convene an expert panel that reviews available data regarding the viruses circulating around the world. Using the best available data, the committee determines the 3 most likely viral strains that will be circulating in the general population in the coming flu season. **Data:** The information reviewed was collected during the previous year regarding which flu viruses were most prevalent and caused the most illness during that flu season. This information is gathered by 130 national influenza centers in 101 countries. The World Health Organization also participates in this process by analyzing disease trends around the world. The expert panel then takes these data and selects what they predict will be the most common circulating strains in the coming flu season. **Final Vaccine:** The final vaccine for any given year will contain protection against only 3 strains of influenza virus. This “trivalent vaccine” most typically is designed to protect against 2 strains of influenza A and 1 strain of influenza B. Sometimes the expert panel predicts correctly, and the vaccine provides a great deal of protection for the general population during the flu season. However, in some years, their prediction of the most common circulating strains for the upcoming flu season is wrong, and the number of influenza cases rises as the amount of protection provided by the vaccine is reduced. Remember, if exposed to a strain of influenza virus that is not in the vaccine, you can become infected. **The 2010/2011 Flu Vaccine:** The process of selecting viral strains for the northern hemisphere’s vaccine actually begins in January of most years. The final meeting regarding the selection of viral strains for the 2010/2011 seasonal influenza vaccine was held in Geneva, Switzerland, in mid-February of 2010. (Reviewer-)
Antigenic Shift, Drift Linked to New Strains of Flu Virus

Pandemic Influenza and the Emergence of New Viral Strains: Part 1.
Louis G. DePaola, DDS, MS

Louis G. DePaola, DDS, MS -Special Presentation

The 2 phenomena responsible for the emergence of new strains of the influenza virus are antigenic drift and antigenic shift.

(Card 1 of 2) A pandemic flu strain is a strain of influenza virus so different from any strain seen before that almost no one has immunity to it. These strains tend to be virulent, therefore pandemics develop. Influenza pandemics arise at nonpredictable intervals, with the first recognized one occurring in 1580. There may have been other pandemics before this, but they were not identified as flu. Since 1580, >30 influenza pandemics have been identified, with the most recent being the influenza A H1N1 (swine flu) pandemic declared by the World Health Organization on June 11, 2009. Influenza pandemics are regularly occurring events in human history. **How New Flu Strains Arise:** The 2 phenomena responsible for the emergence of new strains of the influenza virus are antigenic drift and antigenic shift. The dental profession should be aware of these 2 important terms. **Antigenic Drift:** When trying to conceptualize antigenic drift, think of the drifting you do when fishing in your small fishing boat. You row to your fishing hole, cast your line into the water, and then just drift along very slowly. Like the drift of your boat, antigenic drift is a very slow process, and it basically is caused by mutation. The virus circulating during the previous flu season changes just a little — it “drifts” genetically. This is the process that usually produces seasonal variations in circulating viral strains that we see every year, which necessitates recomposition of the influenza vaccine on an annual basis. **Antigenic Shift:** Unlike the slow process of antigenic drift, antigenic shift is a much more dramatic process of genetic change. This usually occurs when the virus acquires characteristics that it normally would not have, which usually involves mixing with viral strains from other species. (Reviewer-).
Pigs are thought to be one of the most common mixing vessels for influenza viruses because pigs can be infected by pig, human, and avian influenza viruses.

(Card 2 of 2) The 2 processes responsible for emergence of new strains of influenza virus are antigenic drift and antigenic shift. Antigenic drift is a slow process that involves genetic mutation of 1 strain into a new strain. Antigenic shift is a fast-moving process in which 1 strain of virus mixes with another strain, especially a strain from another species, and results in a new virus with characteristics from both strains. These types of changes can result in strains that cause influenza pandemics. **Mixing Vessels:** Pigs are thought to be one of the most common mixing vessels for influenza viruses, since pigs can be infected by pig influenza viruses, by human influenza viruses, and by avian (bird) influenza viruses. Imagine a pig infected with a swine flu virus that normally would not be transmissible to a human. This pig then becomes infected by a bird flu virus also and perhaps even a human influenza virus. In this 1 pig, 3 different viruses are in very close contact, and they can scramble and exchange genetic material, thus developing characteristics that are completely new to each of the viruses. Two very important markers or proteins are found on these viruses that are very specific for each species: neuraminidase (N) and hyaluronidase (H). Normally, a pig flu virus would not be able to infect a human – human receptors would not accept that pig virus because it is a very specific receptor, almost like a specific key in a lock. Consequently, a pig flu virus normally would not be able to infect a human’s receptors, but these viruses, when they begin to shift, can develop new characteristics. **H1N1 Virus:** This aforementioned shift is exactly what happened with the 2009 outbreak of H1N1 influenza. The H1N1 virus was very unique in its engineering because it resulted from a quadruple reassortment. It had characteristics of a human influenza virus, 2 swine flu viruses, and a bird flu virus. However, the H1N1 pandemic of 2009 was not of the proportion of more significant pandemics, such as the 1918-1919 Spanish influenza pandemic. The Spanish influenza pandemic was caused by an influenza A strain believed to be of avian origin. This virus emerged extremely rapidly, and it was very efficiently transmitted from person to person. As a result, this virus caused the most significant pandemic in history. Conservatively, 20 to 50 million people died worldwide and 500,000 people died in the United States during the Spanish influenza pandemic. (Reviewer-).
Many influenza pandemics have originated in Asia, especially in China. These are areas with large numbers of people and large numbers of domestic animals in close contact with the human population.

Influenza pandemics usually require the mixing of several strains of viruses, especially strains for different species, to develop a totally new strain not previously encountered by the population. Pigs are considered to be one of the most common mixing vessels for this process because they can be infected by flu viruses for pigs, humans, and birds. Therefore, influenza pandemics typically start in rural areas where people generally are in very close contact with animals. Many influenza pandemics have originated in Asia, especially in China. These are areas with large numbers of people and large numbers of domestic animals in close proximity to the human population. Three influenza epidemics occurred in the 1900s: the 1918-1919 Spanish influenza pandemic, the 1957 Asian influenza pandemic, and the 1968 Hong Kong influenza pandemic.

1957 Asian Flu:
The 1957 Asian flu pandemic was caused by a new antigenic strain (an H2N2 virus). First reported in China in February 1957, the virus had spread to the United States by that following June. This was a novel pandemic because this was the first time we had laboratory technology that allowed the virus to be isolated from the lungs of fatal cases with no evidence of bacterial infection, permitting us to document the primary influenza virus responsible for these deaths. The 1957 Asian flu pandemic killed about 2 million people worldwide (70,000 deaths in the U.S.). This virus selectively killed people with chronic diseases and women in the second and third trimesters of pregnancy (also seen in the 2009 H1N1 pandemic).

1968 Hong Kong Flu:
The Hong Kong flu was first seen in Hong Kong in 1968, spread to the U.S. later that year, and killed about 1 million people worldwide (34,000 deaths in U.S.). This pandemic might have been associated with a much larger death toll, but the previous seasonal vaccination included some strains of H2N2, which may have afforded partial protection for individuals. Therefore, while a seasonal influenza vaccine may not have any benefit in 1 year, it may have a benefit in subsequent years when different influenza viruses emerge.

Fort Dix Outbreak:
In February 1976, a pandemic was predicted in the U.S. that did not develop. A type of swine flu outbreak was identified in Fort Dix, New Jersey. This triggered an almost-hysterical reaction nationwide. President Ford ordered a mass vaccination program that eventually reached >40 million people. The vaccination program turned into a fiasco because the virus never emerged from the Fort Dix area and the vaccine had many unsubstantiated side effects and complications. The program was discontinued shortly after it was initiated. The significance of this outbreak was that the influenza virus was documented to jump from pigs to humans. This knowledge had great implications for the future. (Reviewer-).

Keywords: Influenza

Print Tag: Refer to original journal article
All dental office personnel should avoid close contact with patients who have influenza. Routine procedures should be rescheduled for patients with influenza symptoms, especially if they have a fever of >100°F.

The best prevention against influenza is vaccination. The Centers for Disease Control and Prevention (CDC) and the Advisory Committee on Immunization Practices (ACIP) are now recommending universal vaccination for seasonal influenza (annual influenza vaccination to include all people aged ≥6 months) to take effect in the 2010-2011 influenza season. Universal vaccination is a gigantic step. The next best preventive strategies are to avoid people who are sick and to practice good respiratory hygiene and cough etiquette. **Cough Etiquette:** Cover your mouth and nose when you sneeze and cough. Make sure you use tissues that are disposed of properly. **Hand Hygiene:** As much as possible, practice good hand hygiene. The alcohol-based hand rubs offer a tremendous amount of flexibility in that you can carry some of the material in a very small container and practice hand hygiene anywhere you go. You should perform hand hygiene before you touch your mouth and nose, before you eat, before you apply makeup, or before you touch any areas of your face or nose. **Dental Office Preventive Measures:** In the dental office, prevention is good infection control. The CDC announced in November 2009 that, “The best way to manage the threat of H1N1 is to take every step possible to prevent the infection.” The number 1 recommendation for prevention of both seasonal and H1N1 influenza was that all staff and doctors get vaccinated for both seasonal and H1N1 influenza. All office personnel should practice respiratory hygiene and cough etiquette, use standard precautions for every patient contact, and avoid close contact with people who are sick. In dentistry, this would mean rescheduling routine procedures for patients with symptoms of influenza, especially if they have a fever of >100°F. For the patient with symptoms who requires urgent care, use the least invasive procedure possible, such as palliative treatment, perhaps analgesics and antibiotics, until the patient’s fever has resolved without any medication for approximately 1 day. The CDC has all recommendations available on their comprehensive Web site (www.flu.gov). This also includes considerations for the patient you might be treating and for the rest of the staff. Remember, if you are sick, the recommendation is to stay at home and, if possible, avoid clinical contact. (Reviewer-).

Keywords: Influenza, Prevention Strategies, Vaccination

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Most people infected with the influenza virus do not require treatment with antiviral drugs because they will recover without complications. However, some individuals are at risk of flu complications and may require antiviral treatment should they become infected. Antiviral medications prevent the flu from reproducing in the body, and they are intended to help shorten the length of illness and prevent complications. Four drugs have been approved by the Food and Drug Administration for either prevention or treatment of influenza. **Ineffective Drugs:** Both amantadine (Symmetrel®) and rimantadine (Flumadine®) have been shown to have a high degree of viral resistance. These 2 drugs have been shown to be ineffective for treating avian influenza (H5N1) and swine flu (H1N1). As such, neither amantadine nor rimantadine is recommended. **Effective Drugs:** The remaining 2 antiviral agents are zanamivir (Relenza®) and oseltamivir (Tamiflu®), which can reduce the severity and duration of illness caused by influenza. Both zanamivir and oseltamivir have been found to be effective for treating H1N1 cases, although some have reported viral resistance to these drugs. When using zanamivir and oseltamivir, the best clinical result is achieved when they are prescribed very early in the infection (treatment initiated within 48 hours of symptom onset). The sooner treatment is initiated with one of these drugs, the more likely a treatment success will be achieved. **Prophylaxis:** In addition to treating active influenza infection, oseltamivir also may be used for prophylaxis. Remember, while these antiviral medications may help prevent the disease or break the chain of infection, the best preventive strategy is to make the host noninfectious through vaccination. (Reviewer-).

Keywords: Influenza, Antiviral Treatment

Print Tag: Refer to original journal article
The injectable influenza vaccine uses a killed virus and, therefore, cannot possibly give a person the flu. The intranasal form of the influenza vaccine contains a live attenuated virus.

(Card 1 of 2) Many people question the safety of both the seasonal and H1N1 influenza vaccines. These vaccines have been put through a very vigorous review, and they have been proven to be safe. **Injectable Vaccine:** The influenza vaccines are manufactured in 2 different forms: the injectable form and the intranasal (spray) form. The injectable vaccine uses a killed virus (contains no live virus). Therefore, this vaccine cannot possibly give a person the flu. The virus is dead, and you cannot get the flu from a dead virus. **Intranasal Vaccine:** The intranasal form of the vaccine is known as LAIV (live attenuated influenza vaccine; FluMist®), which contains a live virus that is attenuated (made less virulent). This vaccine is sprayed up the nose. The intranasal form of the vaccine is most often used in children because it eliminates the need for the needle, which may cause a great deal of fear in children and some adults. Fear or dislike of the needle may be one of the biggest reasons why people are not vaccinated. Although very safe, the intranasal vaccine contains a live virus vaccine and therefore is contraindicated for anyone aged <2 years or aged >50 years. **Vaccine Contraindications:** Currently, the process by which most influenza vaccines are developed requires growth of the virus in chick embryos. Therefore, individuals who are allergic to eggs generally should not get the influenza vaccine. **H1N1 Vaccine:** The newest vaccine is the H1N1 vaccine, which was produced very quickly. One misconception is that this vaccine may not be safe or may be associated with a large number of adverse effects. People fear that the vaccine, which was manufactured with great haste, did not undergo the same testing and scrutiny that other vaccines must undergo. The reality is that the H1N1 vaccine was approved by the Food and Drug Administration (FDA) with exactly the same degree of scrutiny that other seasonal influenza vaccines must follow. Therefore, the H1N1 vaccine is very safe. **H1N1 Vaccine Adverse Events:** In the United States, the FDA operates a vaccine adverse event reporting system that is accessible on the Internet. As of March 2010, approximately 100 million doses of H1N1 vaccine have been produced. The exact number of people who have been vaccinated is not known. For argument’s sake, let us say that half of the vaccine has been used (approximately 50 million doses). Of that, only 6472 adverse events have been reported, of which 94.1% were determined to be nonserious events. Therefore, of approximately 50 million doses administered, only 380 patients had a serious reaction, including 26 reports of death. After a significant follow-up, no direct association has been found between these deaths and the vaccine to date. (Reviewer-).
Any vaccination has the potential to cause an adverse effect: nothing is 100% safe. However, for the number of doses of influenza vaccine administered, the number of adverse events is remarkably low.

(Card 2 of 2) Although many people question the safety of the seasonal and H1N1 influenza vaccines, these vaccines have undergone very vigorous reviews and have been proven safe. Nonetheless, some vaccine-related adverse events have been reported. **Guillain-Barré Syndrome**: Especially with the 1976 influenza vaccine, cases of Guillain-Barré syndrome (GBS) related to influenza vaccination have been reported. In 1976, someone identified what was thought to be GBS associated with the swine flu vaccine, and the word went out that everyone should be aware of GBS. As a result, everyone was looking for GBS in 1976. Anything that resembled a similar presentation was reported as GBS. GBS is a rare disorder of the patient’s immune system: it damages nerve cells, causing weakness and sometimes paralysis that can last for weeks or even several months. This unpleasant disease can lead to death if the respiratory muscles are involved in the paralysis. In the United States, 3000 to 6000 cases of GBS are reported every year, and about 80 to 160 cases occur each week independent of vaccination. This translates to approximately 1 to 2 cases per 100,000. The exact cause of GBS is unknown, but it is believed that stimulation of the body’s immune system plays a role. In about two thirds of these cases, symptoms develop days or weeks after patients have been sick with respiratory illnesses and diarrhea. For example, *Campylobacter* infection is very commonly linked with GBS. In addition, cytomegalovirus and the Epstein-Barr virus (both herpes viruses) are linked to GBS. On rare occasions, there have actually been some reports of GBS following vaccination (perhaps 1 case per 100,000). Any drug, medication, or vaccination has the potential to have an adverse effect: nothing is 100% safe. However, for the number of people who have been vaccinated, the number of adverse events is remarkably low. **Reporting Adverse Reactions**: Anyone who believes they have had an adverse reaction related to the influenza vaccine should report it on the Food and Drug Administration’s (FDA) Web site, which contains forms that can be downloaded. These reports will be investigated by the FDA. **Decision to Vaccinate**: The most important thing to remember with vaccination is that the decision to receive a vaccination should be determined by (1) current recommendations and guidelines from the Centers for Disease Control and Prevention and other organizations, in conjunction with (2) an evaluation or consultation with your personal physician to determine if you have a condition that may contraindicate vaccination. (Reviewer-).
In an analysis of air travel passengers departing from Mexico in March and April of 2009, the highest degree of risk for H1N1 importations was seen in countries receiving >1400 passengers from Mexico.

Background: In this letter to the editor in *The New England Journal of Medicine*, the authors describe how cities and countries around the world might perform an analysis of air travel patterns to determine the potential spread of infectious diseases.

Objective: To describe the authors' analysis of how the novel influenza A (H1N1) virus might have spread from Mexico to the rest of the world in the spring of 2009 via air travel.

Methods: In this study, flight itineraries were analyzed for all commercial flights leaving Mexico in March and April of 2008. Although the H1N1 outbreak occurred in 2009, the analysis used 2008 data for air travel because the 2009 data were not yet available. In addition, it is known that itineraries for flights leaving Mexico in March and April vary little from year to year.

Results: In March 2009, the H1N1 epidemic was not yet well recognized in Mexico. Therefore, flight restrictions were not yet in place for passengers leaving Mexico. Seasonal travel patterns predicted that 2.35 million passengers would depart from Mexico and travel to 1018 cities in 164 countries. Overall, 80.7% of these passengers were destined for the United States or Canada. As of May 25, 2009, of 20 countries with the highest number of passengers arriving from Mexico, 16 had confirmed cases of “imported” H1N1 influenza. The highest degree of risk for H1N1 importations was seen in countries receiving >1400 passengers from Mexico.

Conclusions: The authors recommend that quantitative analysis of worldwide air travel be performed to help cities and countries better prepare for possible outbreaks of H1N1 influenza and other infectious diseases. Seasonal air travel patterns typically vary little on an annual basis, so data from previous years may be used in the analysis.

Reviewer's Comments: This letter provides insight as to how a pandemic can be readily spread throughout a population. We know so much more about “swine flu” now, but the information here is very useful for preparation to address future pandemics. (Reviewer-John A. Molinari, PhD).

Keywords: Influenza, H1N1 Transmission

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In this landmark article regarding the history of influenza pandemics during the 20th century, the author describes the 3 main pandemics and the abortive influenza pandemic in Fort Dix, New Jersey. **1918 Influenza Pandemic:** In the spring of 1918, the rapid worldwide spread of human influenza was seen. Although this viral strain was highly virulent, most infected individuals had typical influenza symptoms and recovered. However, during this era, bacterial superinfections were seen in association with other viral diseases, such as measles, and could be fatal. Postmortem examinations of individuals who died during the 1918 pandemic showed bacterial pathogens in the lungs. **1957 Asian Flu (H2N2):** In the 1930s, we gained the ability to isolate viruses, and the 1957 pandemic allowed for isolation and identification of the influenza virus as the causative agent. Only people aged >70 years had some previous experience with the virus. Thus, most of the population was at risk for infection and illness. Even without bacterial coinfections, this strain of influenza A virus was lethal. The virus was eventually identified as H2N2, which had not previously been seen by humans. Unlike the 1918 pandemic, fatal cases did not necessarily have bacterial coinfections in the lung. **1968 Hong Kong Flu (H3N2):** This pandemic started in southeast Asia. In the United States, high mortality rates were associated with initial outbreaks, but in western Europe, mortality rates remained low until the second year of the pandemic. Because the 1957 pandemic strain contained N2 (H2N2) and the strain for this pandemic also contained N2 (H3N2), a larger segment of the population had previous experience with at least part of the viral strain. Therefore, the pandemic of 1968 was not as devastating as the pandemic of 1957. **1947 Pseudopandemic (H1N1):** U.S. military troops stationed in Japan and Korea experienced an outbreak of H1N1 influenza in 1946. The infection quickly spread to military bases in the U.S. Although this outbreak spread globally, it caused few deaths. **1976 Abortive Pandemic, Fort Dix Swine Flu (H1N1):** A pandemic was predicted after an outbreak of H1N1 influenza at Fort Dix, New Jersey, in 1976. Mass vaccination programs were established quickly in the U.S., and 43 million people were vaccinated. The program was later abandoned because the outbreak did not spread beyond Fort Dix and because suspected cases of Guillain-Barré syndrome were reported as a complication of vaccination.

**Reviewer’s Comments:** The article serves as an excellent, comprehensive review of influenza pandemics. The reader can get an appreciation of the variability these outbreaks can manifest concerning global spread, severity, and mortality of disease. (Reviewer-John A. Molinari, PhD).

Keywords: Influenza, Pandemics, History

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Coughing patients should be asked to sit ≥3 feet away from other patients in the waiting area. Those with signs or symptoms of respiratory infections should be offered masks to help isolate their respiratory secretions.

Two of the major strategies for preventing the spread of infection are to practice good respiratory hygiene and cough etiquette. Both of these strategies are good infection control measures in the health care setting. Keeping patients and staff members safe from infection is of primary importance in our health care offices. As such, notices/signs should be posted at the entries to our clinics and offices, asking patients and those who accompany them to report any symptoms of a respiratory infection to staff members at the registration desk. These notices should be written in the language or languages most commonly spoken by patients in your practice. **Respiratory Hygiene:** Anyone with signs or symptoms of respiratory infection should try to prevent their respiratory secretions from spreading. Tissues should be available in convenient locations so that they can be used to cover coughs or sneezes when needed. Convenient no-touch waste receptacles should be available for proper disposal of used tissues. These items should be available in waiting areas as well as in other public areas in the clinic/office. Hands that have contacted respiratory secretions or contaminated objects should immediately be washed with soap and water, and alcohol-based hand rubs can be used to sanitize hands. **Managing Patients With Respiratory Symptoms:** Especially during the cold and flu season, patients with signs or symptoms of respiratory infections should be offered either procedure masks or surgical masks to help isolate their respiratory secretions. If a patient is coughing in the waiting area, ask them to sit ≥3 feet away from other patients. As sound infection control measures, these strategies can be implemented throughout the year rather than just during the cold and flu season. **Protecting Health Care Workers:** Health care workers should be trained in and encouraged to observe Droplet Precautions, which include wearing masks for close contact. They should also understand and observe Standard Precautions when working with patients who appear to have a respiratory infection.

**Reviewer's Comments:** The information contained in this Centers for Disease Control and Prevention update outlines and reinforces basic public health and health professional measures aimed at minimizing exposure to respiratory pathogens. This publication offers excellent preventive information for all. (Reviewer-John A. Molinari, PhD).

Keywords: Influenza

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