At 2 am, in early winter, an 18-month-old girl is brought to the emergency department by her parents, who report a runny nose and fever lasting 1 day. The patient was born by vaginal delivery at 38 weeks’ gestation, has no known history of medical problems, was growing well and gaining weight until this illness, has met appropriate developmental milestones, and is up-to-date on her vaccinations. Upon further inquiry, you learn that she has been eating very little during the current illness, with slightly-reduced urine output. When questioned further, the parents report frequent coughing episodes, some resulting in vomiting. On examination, the patient shows no apparent distress but seems unhappy about being in your emergency department at 2 am and cries on your approach. A check of her vital signs reveals a temperature of 39.2°C (102.6°F), a pulse rate of 130 beats per minute, a respiratory rate of 36 breaths per minute, and an oxygen saturation level of 100% on room air. Her capillary refill time is 2 seconds. The patient’s anterior fontanel is soft and not bulging. She is following you with her teary eyes, and her tympanic membranes are clear and not bulging. The oropharynx is clear, with moist mucosal membranes. On auscultation of the lungs, you hear some coarse (low-pitched, louder, less brief) crackles, which appear more pronounced in the right base, although examination is limited due to crying, and there is no respiratory distress when the patient is calm. Her heart sounds are clear with no murmurs, and her abdomen is soft and neither tender nor distended. You suspect this child has a viral infection of the upper respiratory tract. Is influenza testing appropriate, and what sort of test should be done? How reliable is rapid influenza testing? You recall neither tender nor distended. You suspect this child has a viral infection of the lungs, you hear some coarse (low-pitched, louder, less brief) crackles, which appear more pronounced in the right base, although examination is limited due to crying, and there is no respiratory distress when the patient is calm. Her heart sounds are clear with no murmurs, and her abdomen is soft and neither tender nor distended. You suspect this child has a viral infection of the upper respiratory tract. Is influenza testing appropriate, and what sort of test should be done? How reliable is rapid influenza testing? You recall that some patients with an influenza infection are at increased risk for a more severe disease course, including bacterial pneumonia. Is this patient in such a defined high-risk group? Given pulmonary findings, could this patient have bacterial or viral pneumonia? Should a chest radiograph be ordered?
Influenza is one of the most common pediatric infectious diseases, occurring annually in up to 20% of children worldwide. The rate in preschool children can exceed 40% during an epidemic.

Respiratory illnesses, including influenza, are common causes of healthcare utilization, especially in younger children. In parts of California and Washington, the rates of hospitalization for acute respiratory disease among children 5 to 17 years old without high-risk conditions in 1992-1997 ranged from 16 to 19 per 100,000 person-months. For patients younger than 2 years, the rate was 12 times higher. In one population-based study of outpatient visits by children younger than 5 years in 3 states (Tennessee, New York, and Ohio), approximately 6 emergency department (ED) visits and 50 clinic visits per 1000 children were associated with influenza during the 2002-2003 season. Those numbers increased to 27 ED visits and 95 clinic visits per 1000 children in the 2003-2004 season. The average annual rate of admissions associated with influenza was almost 1 per 1000 children during 2002-2004.

Emergency departments around the country face significant surges in intake during outbreaks of influenza and may be challenged to treat all patients in a timely manner. A study of the burden of illness attributable to respiratory viruses in children 7 years or younger over a decade at one hospital revealed that almost 400 of every 1000 ED visits were associated with influenza. In this study, the diagnosis of influenza was second only to that of respiratory syncytial virus (RSV). The seasonal incidence of influenza is particularly high in young children who present to the ED with a fever. Among febrile children younger than 36 months who were consecutively recruited in an ED in France over a 4-week period of peak influenza activity, the prevalence of positive test results for influenza was 57% in children older than 1 year and 39% in children younger than 1 year.

Influenza in children is also associated with significant healthcare costs. The New Vaccine Surveillance Network, which covers numerous medical centers around the country, used population-based surveillance to identify the direct healthcare cost of cases of laboratory-confirmed influenza in children younger than 5 years over 3 influenza seasons. The mean medical cost per ED visit was $512, with the annual ED cost burden estimated at $62 million to $279 million. The mean direct cost per hospitalized child was $5402, with the annual cost burden estimated at $44 million to $163 million. The indirect costs of pediatric influenza, including those associated with caregivers missed days of work, remain difficult to measure.
Classification Of Influenza

Influenza is classified into types, subtypes, and strains. The 3 types of influenza viruses are A, B, and C. Influenza A is the most common form of the virus affecting children and the one that leads to epidemics. Influenza B occurs less frequently but has the potential to cause epidemics. Influenza C is uncommon in humans. It typically produces a milder form of illness; hence, this influenza type does not generally need diagnosis and treatment.

Influenza A viruses are further divided into subtypes based on 2 surface proteins: hemagglutinin (H) and neuraminidase (N). There are 16 different hemagglutinin subtypes and 9 neuraminidase subtypes.

Every year, different strains of influenza A and B viruses affect adults and children. Change from natural mutations that occur in influenza virus strains is termed antigenic drift, a process which occurs continuously. With influenza A infection, a new subtype may be formed from the reassortment of two or more influenza virus strains (often combining animal and human strains), a process which is termed antigenic shift. This latter phenomenon can cause a pandemic, as occurred in 2009 with the novel influenza A (H1N1) virus.

Emergency Department Evaluation

Clinical Presentations

Influenza is spread primarily through large-particle respiratory droplets during close contact. Young children might shed the virus several days before the onset of symptoms and can be infectious up to 10 days after onset. The incubation period for influenza is 1 to 4 days.

Classic symptoms of the illness include fever, myalgia, headache, malaise, nonproductive cough, sore throat, and rhinitis. Acute gastrointestinal symptoms may be evident in children and include nausea and vomiting. These symptoms, including the height of fever, are variable in their presentation and duration. In a Finnish study involving almost 400 children under 13 years of age with influenza, symptoms included fever in 95% and cough and rhinitis in nearly 80%. Half of the children had a fever of 39°C (102.2°F) or higher, and in children younger than 3 years, one-fifth had a fever greater than 40°C (104°F). Among children 7 to 13 years of age, 39% had headache and 13% had myalgia.

The presentation of influenza among children follows a clear seasonal pattern. In the northern hemisphere, influenza is most active from November to March. The illness is likely more common during the winter months because of transmission between children in crowded places such as schools and in poorly ventilated spaces. Lack of infection control measures such as hand washing is one of the key reasons for rapid transmission in the pediatric population.

When influenza is suspected, the clinical presentation and assessed severity of illness together with the age of the child, the presence of high-risk medical conditions, and the prevalence of the disease within a community should be considered by the emergency clinician when determining treatment and disposition in the ED.

Complications

Influenza can present in children as a classic influenza-like-illness (ILI) or with symptoms associated with common complications such as otitis media, pneumonia, or bronchiolitis. Invasive pneumococcal disease after a respiratory viral infection is also well documented, especially in the 2-week period after influenza infection.

The mechanism for the development of secondary pneumonia in children with influenza is not fully understood; however, several explanations are offered in the literature. Viral-induced, respiratory epithelial damage is most likely responsible for depletion of normal bronchopulmonary defenses, leading to secondary pneumococcal infection. In one study, the use of a neuraminidase inhibitor (oseltamivir) in mice significantly reduced the rate of pneumococcal infection, as documented by pathologic examination of the lungs and live imaging of pneumonic lesions. The proposed mechanism of action was the inhibition of the stripping of sialic acid from the lung caused by neuraminidase. While a chest radiograph may be obtained when pneumonia is suspected, the test is unlikely to be positive in infants without tachypnea, increased work of breathing, or adventitious sounds on auscultation.

Influenza causes significant mortality each year. In many cases, death is reported in children with underlying chronic conditions; however, death is also reported frequently in healthy children. Pediatric influenza-associated deaths became a nationally modifiable condition in the United States in 2004.

In a study of 166 influenza-associated pediatric deaths (median age, 5 years) by Finelli et al, a rapid disease progression was noted; 45% of the children died within 72 hours of illness onset. Only 6% of the children had been fully vaccinated for influenza. The role of *Staphylococcus aureus* in secondary infections after influenza has been elucidated in recent years. Staphylococci were isolated from a sterile site or endotracheal tube culture in only 1 child who died from a secondary infection after influenza in 2004-2005, in 3 children in 2005-2006, and in 22 children who died in 2006-2007. Interestingly, more than half of these children had a methicillin-resistant *S. aureus* (MRSA) infection. Emergency clinicians should also be aware of the increased risk of community-acquired MRSA as a complicating factor in pediatric influenza. For more information on MRSA, see the October 2010 issue of *Emergency Medicine Practice*.

Patients at risk for a more severe course of influenza are described in Table 1. The age of the child at
the time of illness is of great significance, with children younger than 2 years at an especially high risk for a more severe course. Recently, the CDC announced new groups at increased risk for complications: those with morbid obesity (ie, body mass index > 40) as well as American Indians and Alaskan Natives.

**Influenza And Serious Bacterial Infections**

The differentiation of viral illnesses such as influenza from an SBI in young children presenting to the ED is essential but challenging. Although fever and associated symptoms such as rhinorrhea, cough, and sneezing often have a viral etiology, the emergency clinician must continue to consider an SBI such as urinary tract infection (UTI), bacteremia, or meningitis, especially in patients in the first 3 months of life.

Among febrile young children with laboratory-confirmed influenza infection in the ED, the rates of SBI appear low, although not negligible, particularly in the case of UTI. The RSV-SBI Study Group of the AAP’s Pediatric Emergency Medicine Collaborative Research Committee conducted a 3-year multicenter study. The study involved 809 febrile infants 60 days or younger who were tested for influenza in 5 EDs. Almost 12% (95 patients) had an SBI. In this study, SBI was defined as a single-pathogen urine culture with positive urinalysis or growth of a known bacterial pathogen from a blood, cerebrospinal fluid (CSF), or stool sample. Infants with an influenza infection determined by rapid antigen detection had a significantly lower prevalence of SBI (2.5%, all cases were UTIs) than infants with negative test results for the influenza virus. Though there were no cases of bacteremia, meningitis, or enteritis in the influenza-positive group, the differences between the 2 groups were not statistically significant, suggesting that a larger sample size was needed.

In another study in Salt Lake City, almost 500 febrile infants 90 days of age and younger had 1 or more viruses identified. Serious bacterial infections were significantly less common in infants with a viral infection compared to infants without an infection (4.2% vs 12.3%, respectively). In that study, SBI was defined as bacteremia, bacterial meningitis, UTI, soft tissue or bone infection, bacterial pneumonia, or bacterial enteritis.

In an earlier retrospective study, 163 of 705 children (23%) between 3 and 36 months of age with a clinically recognizable viral syndrome had a documented influenza A virus infection, and lower proportions of SBIs were seen in this group. Bacteremia was documented in only 1 of the 163 patients (0.6%) with influenza, compared with 23 documented cases in the 542 patients (4.2%) without influenza. In the group with documented influenza, 2 of 110 patients (1.8%) had a UTI compared with 38 of 382 patients (9.9%) in the non-influenza group; 13 of 51 patients with influenza (25.4%) had radiographically documented pneumonia compared with 99 of 236 patients (41.9%) in the non-influenza group. Meningitis was not documented in any of the 41 samples from children with influenza, but it was seen in 4 samples from 179 children without influenza. With the lower prevalence of bacteremia in children with influenza A infection, the authors suggested reconsidering the routine use of blood cultures in well-appearing, vaccinated febrile children over 3 months of age with influenza.

Ultimately, the emergency clinician should be committed to considering SBI in febrile infants, even in the face of a positive test for influenza. The decision to forego blood, CSF, and especially urine testing should not be made simply because an influenza infection is documented. Moreover, because testing for influenza in the ED may result in false-positive or false-negative results, emergency clin-

Table 1. People at High Risk of Developing Flu–Related Complications

Most people who get the flu will have mild illness, will not need medical care or antiviral drugs, and will recover in less than 2 weeks. However, some people are more likely to get flu complications that result in being hospitalized and eventually result in death.

- Children younger than 5, but especially children younger than 2 years old
- Adults 65 years of age and older
- Pregnant women
- Also, last flu season, American Indians and Alaskan Natives seemed to be at higher risk of flu complications

### People who have medical conditions including:

- Asthma
- Neurological and neurodevelopmental conditions (including disorders of the brain, spinal cord, peripheral nerve, and muscle such as cerebral palsy, epilepsy [seizure disorders], stroke, intellectual disability [mental retardation], moderate to severe developmental delay, muscular dystrophy, or spinal cord injury).
- Chronic lung disease (such as COPD and cystic fibrosis)
- Heart disease (such as congenital heart disease, congestive heart failure, and coronary artery disease)
- Blood disorders (such as sickle cell disease)
- Endocrine disorders (such as diabetes mellitus)
- Kidney disorders
- Liver disorders
- Metabolic disorders (such as inherited metabolic disorders and mitochondrial disorders)
- Weakened immune system due to disease or medication (such as people with HIV or AIDS, with cancer, or on chronic steroids)
- People younger than 19 years of age who are receiving long-term aspirin therapy
- People who are morbidly obese (BMI of 40 or greater)

From: [http://www.cdc.gov/flu/about/disease/high_risk.htm](http://www.cdc.gov/flu/about/disease/high_risk.htm)

Abbreviations: COPD, chronic obstructive pulmonary disease; HIV, human immunodeficiency virus; AIDS, acquired immune deficiency syndrome; BMI, body mass index
Diagnosis Of Influenza

Available Tests
Currently available diagnostic tests for identifying influenza infection include viral culture, reverse transcriptase-polymerase chain reaction (RT-PCR) assay, and rapid antigen testing. Tests for influenza may be available for influenza A only or for both A and B. Further tests may be needed for subtypes of influenza detected, and these are performed in numerous centers around the country. A complete list of current tests for influenza is provided in Table 2 on page 6.

Viral culture and RT-PCR are considered the criterion standards for influenza testing. Although they take longer to process than the newer rapid diagnostic tests and require more expertise by laboratory personnel, they provide confirmation of the diagnosis and can differentiate between influenza subtypes.

Accuracy of Rapid Antigen Tests
Rapid diagnostic tests are purchased as a kit and can easily be used by personnel in the ED or the hospital’s microbiology laboratory. Some kits do not differentiate between influenza types A and B, and results may be inaccurate if the nasopharyngeal wash or nasal swab is not performed appropriately.

The diagnostic accuracy of rapid influenza tests have been investigated extensively in the literature, including their use in the pediatric emergency setting. Their sensitivity has been quite variable, although their specificity has been very good. The multitude of point-of-care tests/kits available, the different populations investigated, the collection methods, and the time between sample collection and test performance are barriers to simple comparison.

One commonly used kit was found to have sensitivity ranging from 37% to 96% (mean ± SD, 75 ± 18%) and specificity ranging from 81% to 98% (mean ± SD, 88 ± 10%). Interestingly, younger children showed higher viral titers than older children, resulting in greater sensitivity of the rapid diagnostic test.

Cruz et al determined the properties of rapid influenza testing during the 2009 influenza A (H1N1) pandemic. For more than 3000 specimens that were compared with RT-PCR results, the overall test sensitivity was 45% (95% confidence interval [CI], 43.3%-46.3%) and the specificity was 98.6% (95% CI, 98.1%-99%). Positive and negative likelihood ratios were 32.9 (95% CI, 22.9-45.4) and 0.56 (95% CI, 0.54-0.58), respectively. As expected, the sensitivity of the rapid diagnostic test was significantly higher in children 2 years and younger. The authors suggested that for children at high risk for influenza during high-prevalence periods of influenza, initiation of empiric antiviral therapy should be considered even if rapid testing results are negative.

Although use of rapid testing has increased significantly in the ED setting in recent years and has helped to identify epidemics early in their course, emergency clinicians must be aware of the rate of false-positive and, even more so, false-negative test results. Since viral culture and RT-PCR are the criterion standards for influenza testing, local protocols in many centers recommend using these techniques when sending samples from very young or very sick children for further analysis. Given the varying ranges of sensitivity and specificity with the rapid antigen test, emergency clinicians should also consider antiviral therapy in appropriate cases of clinically suspected influenza.

At many institutions, influenza testing is not performed routinely in children in the ED or outpatient clinic setting. In areas where local epidemiologic patterns have been identified, available surveillance data on circulating influenza subtypes may be extrapolated to children presenting with influenza-like symptoms. This can help guide ED providers in management decisions such as determining appropriate antiviral therapy.

Impact Of Rapid Tests On ED Resource Utilization
The use of timely, specific-antigen testing for suspected influenza in children with fever may decrease the need for additional laboratory testing, antibiotic prescriptions, ED length of stay, and associated healthcare costs. However, these benefits have not been consistently demonstrated in the literature.

In a prospective study of 700 children, Iyer et al found that the number of additional tests ordered and the rate of antibiotic treatment given in one pediatric ED were not significantly different between patients who received standard testing and those who received point-of-care testing. The number of samples sent for urinalysis and urine cultures was smaller among those receiving point-of-care influenza testing.

In another study, Poehling et al randomly assigned children from a pediatric ED and an outpatient clinic to either point-of-care rapid influenza tests or traditional nasal and throat swabs. Children in the ED who had a positive influenza rapid test result had fewer diagnostic tests than the group tested with swabs; however, this difference was not documented in the clinic population. There was also no difference in the rate of antibiotic prescriptions between the point-of-care and traditional influenza testing groups in either setting.

Other studies have shown a reduction in antibiotic use when rapid influenza testing is performed. One retrospective study found that rapid testing for influenza A in the ED significantly reduced the
use of antibiotics among children with positive test results when compared with children who did not undergo rapid testing (20% vs 53%, respectively; \( P = .04 \)). Antiviral therapy was started more frequently in children with a positive immunoassay result versus those with a negative result.\(^{23}\)

In Spain, children between 0 and 36 months of age who presented to the ED with fever were recruited for a study. A rapid test was performed for influenza A and B. Among patients with posi-

Table 2. Influenza Diagnostic Table\(^{\dagger}\)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Influenza Virus Types Detected</th>
<th>Acceptable Specimens</th>
<th>Test Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viral culture</td>
<td>A and B</td>
<td>NP(^{\dagger}) swab/aspirate; nasal swab/aspirate/wash; throat swab; bronchioalveolar lavage</td>
<td>3-10 days(^{\dagger})</td>
</tr>
<tr>
<td>Immunofluorescence</td>
<td>A and B</td>
<td>NP(^{\dagger}) swab/aspirate; nasal swab/aspirate/wash; throat swab</td>
<td>2-4 hours</td>
</tr>
<tr>
<td>RT-PCR(^{\dagger})</td>
<td>A and B</td>
<td>NP(^{\dagger}) swab/aspirate; nasal swab/aspirate/wash; throat swab; bronchioalveolar lavage sputum</td>
<td>2-4 hours</td>
</tr>
<tr>
<td>Serology*</td>
<td>A and B</td>
<td>paired acute and convalescent serum samples(^{a})</td>
<td>2 weeks or more</td>
</tr>
<tr>
<td>Enzyme Immuno Assay (EIA)</td>
<td>A and B</td>
<td>NP(^{\dagger}) swab/aspirate; nasal swab/aspirate/wash; throat swab</td>
<td>2 hours</td>
</tr>
<tr>
<td>Rapid Influenza Diagnostic Tests</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3M™ Rapid Detection Flu A+B Test(^{<strong>,</strong>,\dagger}) (3M)</td>
<td>A and B</td>
<td>NP(^{\dagger}) swab/aspirate; nasal wash/aspirate/wash</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Directigen™ Flu A+B(^{<strong>,</strong>,\dagger}) (Becton-Dickinson)</td>
<td>A and B</td>
<td>NP(^{\dagger}) wash/aspirate/swab; lower nasal swab; throat swab; bronchioalveolar lavage</td>
<td>Less than 15 minutes</td>
</tr>
<tr>
<td>Directigen™ EZ Flu A+B(^{<strong>,</strong>,\dagger}) (Becton-Dickinson)</td>
<td>A and B</td>
<td>NP(^{\dagger}) wash/aspirate/swab; throat swab</td>
<td>15 minutes</td>
</tr>
<tr>
<td>BinaxNOW® Influenza A&amp;B(^{<strong>,</strong>,\dagger}) (Alere)</td>
<td>A and B</td>
<td>NP(^{\dagger}) swab; nasal wash/aspirate/swab</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Clearview Exact® IL Influenza A &amp;B(^{<strong>,</strong>,\dagger}) (Alere)</td>
<td>A and B</td>
<td>Nasal swab</td>
<td>15 minutes</td>
</tr>
<tr>
<td>OSOM® Influenza A&amp;B(^{<strong>,</strong>,\dagger}) (Genzyme)</td>
<td>A and B</td>
<td>Nasal swab</td>
<td>10 minutes</td>
</tr>
<tr>
<td>QuickVue® Influenza Test(^{<strong>,</strong>,\dagger}) (Quidel)</td>
<td>A or B</td>
<td>Nasal wash/aspirate/swab</td>
<td>10 minutes</td>
</tr>
<tr>
<td>QuickVue® Influenza A+B Test(^{<strong>,</strong>,\dagger}) (Quidel)</td>
<td>A and B</td>
<td>NP(^{\dagger}) swab; nasal wash/aspirate/swab</td>
<td>10 minutes</td>
</tr>
<tr>
<td>SAS™ FluAlert A&amp;B(^{<strong>,</strong>,\dagger}) (SA Scientific)</td>
<td>A and B</td>
<td>Nasal wash/aspirate</td>
<td>15 minutes</td>
</tr>
<tr>
<td>SAS™ FluAlert A(^{<strong>,</strong>,\dagger}) (SA Scientific)</td>
<td>A only</td>
<td>Nasal wash/aspirate</td>
<td>15 minutes</td>
</tr>
<tr>
<td>SAS™ FluAlert B(^{<strong>,</strong>,\dagger}) (SA Scientific)</td>
<td>B only</td>
<td>Nasal wash/aspirate</td>
<td>15 minutes</td>
</tr>
<tr>
<td>TRU FLU®(^{<strong>,</strong>,\dagger}) (Remel/Thermofisher)</td>
<td>A and B</td>
<td>NP(^{\dagger}) aspirate/swab; nasal wash</td>
<td>15 minutes</td>
</tr>
<tr>
<td>XPECT™ Flu A&amp;B(^{<strong>,</strong>,\dagger}) (Remel/Thermofisher)</td>
<td>A and B</td>
<td>Nasal wash/swab; throat swab</td>
<td>15 minutes</td>
</tr>
</tbody>
</table>

\(^{\dagger}\)Serology is not recommended for routine diagnostic testing, only for research purposes or sero-epidemiological investigations, and cannot produce timely results for clinical decision-making.

\(^{\dagger}\)List may not include all test kits approved by the U.S. Food and Drug Administration.

\(^{\dagger}\)NP = nasopharyngeal.

\(^{\dagger}\)Shell vial culture, if available, may reduce time for results to 2 days.

\(^{\dagger}\)Does not distinguish between influenza A and B virus infections when used alone.

\(^{\dagger}\)RT–PCR = reverse transcription polymerase chain reaction.

\(^{\dagger}\)A fourfold or greater rise in antibody titer from the acute– (collected within the 1st week of illness) to the convalescent-phase (collected 2-4 weeks after the acute sample) sample is indicative of recent infection.

\(^{\dagger}\)Moderately complex test – requires specific laboratory certification.

\(^{**}\)Clinical Laboratory Improvement Amendments -waived test. Can be used in any office setting. Requires a certificate of waiver or higher laboratory certification.

\(^{**}\)Distinguishes between influenza A and B virus infections.

Disclaimer: Use of trade names or commercial sources is for identification only and does not imply endorsement by the Centers for Disease Control and Prevention or the Department of Health and Human Services.

From: http://www.cdc.gov/flu/professionals/diagnosis/rapidclin.htm
1. “There is a clear source of infection. This infant’s fever is due to a cold.”
Most children presenting with an ILI will have a viral illness. Yet, the emergency clinician must stay vigilant in order to identify other potential sources of infection such as bacterial pathogens that may cause serious illness. Meningitis, sepsis, UTI, and bacterial pneumonia are the most common SBIs. The emergency clinician must try to rule out these infections in children of all ages, while recognizing that patients under 3 months of age are at highest risk.

2. “This child presented with nausea and vomiting, so she is unlikely to have influenza.”
The presenting signs and symptoms of influenza infection in children are nonspecific and can include gastrointestinal tract symptoms such as nausea and vomiting. Although fever is a symptom in almost all children with seasonal influenza infection, cough and rhinitis may be presenting symptoms in only 80%. The presenting symptoms and the height of fever may also vary by age. In younger children, a cough is a frequent presenting sign, whereas in adolescents, headache and muscle pain are common.

3. “The only way to differentiate those patients with influenza from those with another viral/bacterial illness is with a rapid influenza test.”
No rapid tests can replace the clinical judgment of an experienced clinician. Despite improvements in their availability and their quick turnaround time, these tests can result in false-positive or false-negative results in the ED.

4. “In my ED, rapid influenza testing is done in triage. By the time I see the patients, if the results are negative, I can send them home.”
The quality of the assay used and the skill of the provider performing the test are factors that should be considered in the interpretation of rapid test results. Rapid diagnostic tests can help guide emergency clinicians in their immediate management decisions, especially in sick children who are likely to be admitted to the hospital, but viral culture and RT-PCR are still the criterion standard tests.

5. “There is no point in spending time and money on a radiograph. If there is pneumonia, it will likely be from a viral illness.”
Common influenza-related complications include otitis media, bronchiolitis, and bacterial pneumonia. Early treatment that addresses these complications is important in order to avoid further complications. A diagnosis of influenza as the primary illness does not necessarily rule out the need for imaging of the chest or possible antibacterial treatment for children of all ages.

6. “I learned my lesson from the swine flu; now every child with an ILI receives antiviral medications on my shift.”
Every year, different strains of influenza appear and affect communities at slightly different times during the influenza season. Chemoprophylaxis as well as treatment of influenza in the ED should follow the guidelines for antiviral therapy published annually by the CDC. Treatment recommended during the novel influenza A (H1N1) pandemic may no longer be applicable in the coming year.

7. “I understand that we can now treat young children, even those under 1 year of age, with antiviral medications.”
Use of antiviral medications is currently not indicated for children under 1 year of age because of potential adverse events and the lack of research on safety in this age group. During the influenza A (H1N1) pandemic, emergency use was temporarily authorized for children under 1 year of age, but the approval has since expired.

8. “Influenza vaccines are very safe; everyone should have them.”
Vaccination is the best method for preventing influenza. Vaccines change every year, according to international surveillance and estimations of the types and strains of viruses that are expected to circulate in a given year. Emergency clinicians should advocate for vaccinations but must be aware of the current recommendations and contraindications for their use.
tive influenza test results, only one-third had blood tests, 80% had a urinalysis, 14% had a chest radiograph, and 1% had CSF testing. Among patients without influenza, 100% had blood tests, 32% had a urinalysis, and 21% had a chest radiograph (no lumbar punctures were done). Among children with rapid test results positive for influenza, none received antibiotics, compared with almost 40% of those with fever without focus and no direct test for influenza. Emergency clinicians should note that the number of patients in this study was relatively low, including 84 patients with positive influenza tests. It also included young infants who, under current guidelines, should be further evaluated to rule out SBI.

In another ED, when patients between 2 months and 21 years of age with fever and respiratory symptoms were randomly assigned to either have their physician receive results of a rapid test for influenza or not, the number of blood tests, urine tests, radiographs, as well as frequency of antibiotic use was significantly lower in the “aware” group. Length of stay in the ED was also shorter in this group.

**Infection Control Measures**

Infection control is challenging in the ED setting, particularly when the volume of patients with viral respiratory illness surges. Crowded waiting rooms and lack of private and isolated treatment rooms allow rapid spread of contagious infections such as influenza.

Education of emergency clinicians is essential in containing the spread of influenza. Droplet transmission of influenza can occur with coughing or sneezing, when infectious particles ranging from approximately 0.1 to 100 µm in size may be inhaled. However, the exact nature of influenza transmission that occurs in nonexperimental settings is not well understood. As a consequence, considerable uncertainty exists about the effectiveness of personal respiratory devices for healthcare workers.

Many centers recommend that N95 respirators be used by healthcare providers who examine patients with influenza, although implementation of this recommendation may be hindered by supply and cost considerations. In a randomized controlled trial involving nurses in tertiary hospitals, the efficacy of commonly available and less expensive surgical masks was equivalent to that of N95 respirators in preventing transmission of laboratory-confirmed influenza. Direct and indirect contact transmission of influenza also occurs, emphasizing the importance of contact precautions and vigilant hand washing in preventing unintended spread in the ED.

Vaccinations, particularly for frontline healthcare workers such as those in the ED, may reduce morbidity among staff and the transmission of influenza. In many countries, preparedness plans list healthcare workers as a priority group for mass vaccination during an influenza pandemic. In most studies, fewer than 60% of healthcare workers were vaccinated against seasonal influenza in various clinical settings. Barriers to an improved vaccination rate include concerns about adverse effects and uncertainty about the vaccine’s efficacy, along with misconceptions about the vaccination and the infection.

### Treatment

#### Chemoprophylaxis For Influenza

Chemoprophylaxis of influenza transmission is occasionally indicated in the ED. Guidelines for chemoprophylaxis, which are based on influenza types and antiviral therapy recommendations, are updated annually by the CDC. At the time of publishing, the CDC had not released specific chemoprophylaxis guidelines for 2010-2011.

#### Treatment With Antiviral Medications

Classes of antiviral medications currently approved for the treatment of influenza in children include the neuraminidase inhibitors (oseltamivir and zanamivir) and the adamantanes (amantadine and rimantadine). Although both classes are potentially effective against influenza A, only the neuraminidase inhibitors have action against influenza B. Oseltamivir is formulated as both a capsule and a suspension, whereas zanamivir must be inhaled. Of note, zanamivir is licensed for treatment of influenza in children aged 7 years and older and is contraindicated in patients with chronic respiratory disease (eg, asthma and cystic fibrosis) because of the risk of severe bronchospasm. Oseltamivir is not approved for use in children younger than 1 year because of concerns about neurological side effects, although this age restriction was temporarily removed during the 2009 influenza A (H1N1) pandemic by an emergency use authorization, which has since expired.

The AAP publishes policy statements on prevention and treatment of influenza. For the period of 2009 influenza A (H1N1), the AAP recommendations called for treatment with both oseltamivir and an adamantane (amantadine or rimantadine) if testing was unavailable or if rapid testing documented influenza A. For children older than 7 years, zanamivir was also an option as a single-drug therapy. For influenza B, either oseltamivir or zanamivir was recommended.

Antiviral recommendations change frequently based on currently circulating strains. Updated guidelines are available on the CDC website (www.cdc.gov) and in AAP publications.

Local EDs may decide on a specific drug therapy on the basis of known local strains of influenza. Treatment should be considered for high-risk children and for those who will benefit from a shorter illness, especially
if therapy can start early in the disease course (ie, within the first 48 hours). In practice, this recommendation drives significant variability among providers in the ED, as well as between centers and physicians.

For children with influenza-related illness, such as those in the hospital, antiviral treatment is almost always indicated; although, overall evidence of its benefit in the pediatric population is lacking. Further research is needed to determine if such treatment is effective, particularly for young children, and if it reduces the rate of complications, hospitalizations, or deaths.\(^{32}\)

### Controversies

#### Overuse Of Antibiotics

Antibiotics are often prescribed inappropriately for children with uncomplicated influenza. For example, although antibiotic treatment has been found to be ineffective in preventing otitis media in children with viral upper respiratory tract infections, the drugs are commonly prescribed for children with this condition, even with a positive test for a viral agent such as influenza and without a concomitant clinical bacterial presentation.\(^{33}\) Among 263 febrile children with proven influenza in an ED in France, 110 patients (42%) received antibiotics (up to 3 courses). The authors considered at least 89 of the 263 prescriptions (34%) to be inappropriate.\(^{3}\)

In a large, retrospective cohort study of otherwise healthy children in Tennesse, influenza accounted for 10% to 30% of the excess use of antibiotics during the winter of 2001-2002.\(^{35}\) J udicious use of antibiotics is important for all children, especially in the ED, where follow-up is uncertain. Overprescription of antibiotics can lead to the induction of microbial resistance, increased costs, and increased risk of adverse events that can complicate the clinical picture.

#### Decision To Admit Children With Influenza

The burden of illness of influenza, especially during epidemics, is known to cause a substantial increase in the rate of hospitalizations. Inappropriate hospital admission not only has a negative impact on the child and family, but it also represents significant costs for the healthcare system.

Clinical practice guidelines may help to guide appropriate ED disposition of children with influenza. In an Italian study, the admission rate of children with ILI prior to the implementation of a clinical practice guideline was 26%, with one-third considered inappropriate by reviewers. When pediatricians were trained to use the guidelines, the rate of admission was reduced to 16%\(^{34}\). Clinical practice guidelines can be challenging to disseminate, and adoption rates are often variable.

Clinical prediction rules may also help emergency clinicians make appropriate disposition decisions for children with influenza. Bender et al. developed and validated a risk score for predicting hospitalization in children with influenza.\(^{35}\) Using a retrospective cohort methodology with more than 1200 children 18 years or younger with laboratory-confirmed influenza, they found that patients at high risk for severe influenza (ie, with a total risk score of 3 to 8) had an 86% probability of hospitalization. The score included a history of a high-risk medical condition (odds ratio [OR], 4.06; 95% CI, 2.91-5.68) (2 points); respiratory distress on physical examination (OR, 2.33; 95% CI, 1.61-3.38) (1 point); focal pneumonia on a radiograph (OR, 7.82; 95% CI, 3.62-16.92) (3 points); and influenza B infection (OR, 3.99; 95% CI, 2.57-6.21) (2 points). The authors noted that influenza B infection was an unexpected predictor of admission and may not be reliable, given variations in the severity of individual influenza strains from year to year.

#### Vaccination Against Influenza

Vaccination remains the best method of preventing influenza. Although the ED is not typically a primary site for vaccine administration, emergency clinicians should be aware of the issues surrounding influenza vaccination when providing education to families and advocating for children’s health.

The viruses in the vaccine change on the basis of international surveillance and estimations about which subtypes and strains will circulate in a given year.\(^{36}\) Each trivalent seasonal influenza vaccine contains strains from 3 subtypes, currently A(H3N2), A (H1N1), and B.

Vaccines are either an injected inactivated formulation, recommended for all children older than 6 months including those with chronic illnesses, or a live attenuated formulation, administered intranasally and approved for use in healthy children over 2 years of age. Both vaccine formulations are contraindicated in children with severe egg allergy, prior history of severe reaction to an influenza vaccination, or a history of Guillain-Barré syndrome within 6 weeks of influenza vaccine administration. Febrile children with moderate to severe illness should wait to be vaccinated until the illness resolves.\(^{37}\)

Recognizing the burden of influenza in children and its associated morbidity and mortality, the CDC’s Advisory Committee on Immunization Practices in February 2010 recommended universal influenza vaccination “to protect as many people as possible” against the disease.\(^{37}\) The 2010-2011 vaccine will protect against the 2009 influenza A (H1N1) virus, as well as an H3N2 strain and an influenza B strain. Antibodies develop about 2 weeks after vaccination. With the inclusion of 2 new strains in the 2010-2011 vaccine, individuals previously vaccinated for H1N1 still need to receive the new vaccine for the best possible protection.

The efficacy of annual influenza vaccinations among young children has been reported to range between 50% and 90%, depending on how it is measured, the age of patients in the study, and the antigenic match of the vaccine with the circulating strain. One
If child < 2 years old, are all of the following present?
1. Fever or feels feverish (if no thermometer available)*
2. Irritability or cough or vomiting/unable to keep fluids down

If child ≥ 2 years old, are all of the following present?
1. Fever or feverishness*
2. Cough or sore throat
*If antipyretics are taken, this may inhibit a patient’s ability to mount a fever. If antipyretics have been taken, the patient can be reassessed 4 to 6 hours after acetaminophen or 6 to 8 hours after ibuprofen.

Is the child younger than 12 weeks old?

Are any of the following signs or symptoms present?†
Age 12 weeks to < 5 years
• Fast breathing‡ or difficulty breathing or retractions present
• Dehydration (no urine output in 8 hours, decreased tears or no tears when child is crying, or not drinking enough fluids)
• Severe or persistent vomiting/unable to keep fluids down
• Lethargy (excessive sleepiness, significant decrease in activity level, and/or diminished mental status)
• Irritability (cranky, restless, does not want to be held or wants to be held all the time)
• Flu-like symptoms improved but then returned or worsened within one to a few days
• Pain in chest or abdomen (for children who can reliably report)
Age ≥ 5 years
• Fast breathing‡ or difficulty breathing
• Dizziness or lightheadedness
• Severe or persistent vomiting/unable to keep fluids down
• Flu-like symptoms improved but then returned or worsened within one to a few days
• Pain in the chest or abdomen

This child falls into a group that may be at elevated risk for complications from influenza. Recommend that they be evaluated for possible treatment. Recommend that the child’s caregiver contact the child’s medical home/primary care provider that day.

† These symptoms are purposely broad to minimize the possibility of misclassifying people who truly have severe symptoms. The person attempting to triage the patient should take into account the severity and duration of the symptoms when deciding whether or not patients should be advised to seek evaluation immediately.
‡ Suggested respiratory rates indicative of “fast breathing” included in Box

Recommend immediate medical evaluation for child, preferably with child’s medical home/primary care provider.

Recommend immediate medical evaluation for child, preferably with child’s medical home/primary care provider, or refer for emergency medical care or 911 if any signs or symptoms of life threatening illness.

Adapted from http://www.cdc.gov/h1n1flu/clinicians/pdf/childalgorithm.pdf

**2009-2010 Influenza Season Triage Algorithm for Children (≤ 18 years) With Influenza-Like Illness**
Does the ill child have any of the following conditions?

Neurological disorders such as:
1. Epilepsy, cerebral palsy, brain or spinal cord injuries, and neuromuscular disorders (eg, muscular dystrophy)
2. Chronic respiratory diseases such as those associated with impaired pulmonary function and/or difficulty handling secretions; those requiring oxygen, tracheostomy, or a ventilator; and those with asthma.
3. Moderate to profound intellectual disability (mental retardation) or developmental delay
4. Deficiencies in immune function or conditions that require medications or treatments (eg, certain cancer treatments, HIV infection) that result in significant immune deficiencies
5. Cardiovascular disease including congenital heart disease
6. Significant metabolic (eg, mitochondrial) or endocrine disorders
7. Renal, hepatic, hematological (including sickle cell disease) disorders
8. Receiving chronic aspirin therapy
9. Pregnancy

Is the child at least 2 years old but less than 5 years old?

This child appears to be at lower risk for complications from influenza and may not require testing or treatment if their symptoms are mild. In order to help prevent spread of influenza to others, these patients should be advised to:
• Keep away from others to the extent possible, particularly those at higher risk for complications from influenza (see box below). This may include staying in a separate room with the door closed.
• Cover their coughs and sneezes
• Avoid sharing utensils
• Wash their hands frequently with soap and water or alcohol-based hand rubs
• Stay home (eg, no school, child care, group activities) until 24 hours after their fever resolves without the use of antipyretics (ie, acetaminophen, ibuprofen)

More information is available at: http://www.cdc.gov/flu/homecare/index.htm. In addition, remember that vaccination for seasonal influenza and pandemic (H1N1) influenza is recommended for all children 6 months through 18 years old and household contacts and out-of-home caregivers of children less than 6 months old.

For all patients triaged using this algorithm, the following should also be assessed:

Does patient live with a person at higher risk for complications of influenza including someone who is:
• Age < 2 or age ≥ 65, or
• Pregnant
Or someone with any of the following comorbid conditions:
• Chronic pulmonary disease (including asthma), cardiovascular disease (except isolated hypertension), renal disease, hepatic disease, hematological disorders (including sickle cell disease), or metabolic disorders (including diabetes mellitus)
• Disorders that that can compromise respiratory function or the handling of respiratory secretions or that can increase the risk for aspiration (eg, cognitive dysfunction, spinal cord injuries, seizure disorders, or other neuromuscular disorders)
• Immunosuppression, including that caused by medications or by HIV
• Child (< 18) on chronic aspirin therapy

In addition, vaccination for seasonal influenza and pandemic (H1N1) influenza should be recommended for all children 6 months through 18 years old and household contacts and out-of-home caregivers of children less than 6 months old.

This child falls into a group that may be at elevated risk for complications from influenza. Recommend that they be evaluated for possible treatment. Recommend that the child’s caregiver contact the child’s medical home/primary care provider that day.

This child falls into a group that may be at elevated risk for complications from influenza. Recommend that the child’s caregiver contact the child’s medical home/primary care provider that day to discuss the need for further evaluation and treatment.

Should symptoms worsen (eg, shortness of breath, unresolving fever) or should the child’s caregiver have further questions or concerns about the child’s health, recommend the caregiver contact the child’s health-care provider.

The higher risk contacts of these patients should be advised to contact their medical home/primary care provider that day for advice on steps they might need to take to prevent infection.
meta-analysis reported that in children aged 2 years and older, vaccine efficacy was 65% (95% CI, 45%-77%) for the inactivated formulation and 80% (95% CI, 53%-91%) for the live attenuated formulation.

Considering that many children visiting EDs have a chronic illness, Pappano et al suggested the ED visit as a unique opportunity for increased use of influenza vaccination in children. This ED-based influenza vaccination program appeared to be successful. Families who were “offered” a vaccine were immunized more frequently than families who received education only. This was true for children (57% vs 36%, respectively) as well as for accompanying adults and family members (75% vs 34%, respectively). Given that influenza vaccination recommendations have recently been expanded to include all children over 6 months of age, the potential population served by ED-based influenza vaccinations programs has grown significantly.

**Novel Influenza A (H1N1)**

In March and early April 2009, small outbreaks of ILI were first reported in several areas in Mexico, and in late April, confirmation of a strain of swine-origin influenza A (H1N1) was reported. Very rapidly, this virus spread globally, and in June 2009, the WHO declared a pandemic.

Clinical symptoms of illness reported with novel influenza A (H1N1) were similar to those seen with seasonal influenza: fever, cough, sore throat, malaise, headache, myalgia, arthralgia, and fatigue. Interestingly, children also presented with gastrointestinal-associated symptoms, more frequently than seen with previous influenza strains. The most commonly reported complication of H1N1 infection was pneumonia, which at times was accompanied by a necrotizing disease or empyema. Other described complications were dehydration, encephalopathy, and exacerbation of underlying chronic disease, as also seen with seasonal influenza.

While pandemic H1N1 influenza appeared to disproportionately affect older children and those with chronic medical conditions, particularly neurodevelopmental disorders and asthma, the relative severity of illness seen in hospitalized children appeared unchanged from previous influenza seasons. A study by the CDC revealed that of the 477 deaths initially reported in the United States from novel influenza A (H1N1), 36 (7.5%) were children younger than 18 years. Of these 36 pediatric deaths, 24 (67%) were children with an underlying chronic medical illness, and one-fifth were children younger than 5 years. Further, a higher proportion of the deaths from H1N1 influenza occurred in older children and those with chronic medical conditions as compared to previous influenza seasons.

A Canadian study found that hospitalized children with pandemic H1N1 influenza were significantly older than those hospitalized in prior years with seasonal influenza A (median age, 6.4 years vs 3.3 years, respectively) and were more likely to have asthma (22% vs 6%, respectively). The rate of admission to intensive care units was not significantly higher among children with H1N1 influenza than those with seasonal influenza (21% vs 14%, respectively).

**Overcrowded Emergency Departments**

Surges in ED capacity that occur during influenza outbreaks can be challenging to manage. Such was the case during the 2009 H1N1 pandemic. Initially, many families, some with ill children and others considered the “worried well,” arrived at EDs after hearing media reports of morbidity and mortality in Mexico and other countries. A subsequent problem was that a large percentage of emergency clinicians also became infected or were thought to be infected with H1N1 and had to be quarantined from work.

Strategic planning and contingency plans are needed for such pandemic scenarios. These pandemic plans should address moderate surges, for which ED personnel and space are sufficient, as well as more elaborate scenarios in which the entire hospital needs to scale down its regular ambulatory services. These plans should allow space for secondary EDs and the utilization of ad hoc healthcare providers to manage increased numbers of patients arriving at the ED. During the 2009 pandemic, for example, a mobile pediatric emergency response team implemented in the parking lot of Texas Children’s Hospital in Houston, together with screening and triage algorithms, allowed management of low-acuity patients, resulting in reduced ED volume and potentially preventing transmission of influenza A (H1N1).

Influenza epidemics also highlight ethical and legal issues in the ED. Clear understanding of the team’s commitment and guidance for emergency clinicians are needed so appropriate care can be provided for prospective patients, employers, and fellow healthcare workers.

**Summary**

Children and infants with influenza infections can present with a wide range of nonspecific clinical signs and symptoms as well as with the potential for complications. The emergency clinician must be aware of this diagnosis. Although influenza is a potential source of fever in the young infant, emergency clinicians must not forget the risks associated with other SBIs. Clinicians need to conduct appropriate investigations to determine the source of fever, especially in patients in the first 3 months of life.

Communicating with local agencies and keeping up-to-date with the most recent recommendations from the CDC will help the emergency clinician to identify specific strains of influenza circulating within a particular region. This informa-
tion may also help to determine appropriate diagnostic and treatment decisions for children.

Balancing the level of reassurance, investigation, and pharmacologic therapy is a complex task. Emergency clinicians are in a unique position not only to help the child brought in for care, but also to recognize local outbreaks and act to ensure safe and effective management of the communities affected by them.

Case Conclusion

You call the microbiology laboratory, and the technician confirms your suspicion that a new influenza outbreak has surfaced in your area. You also learn that the CDC has published guidelines for the evaluation and treatment of patients who present with ILI. The agency’s website also outlines the specific groups of patients at known higher risk for a severe disease course. After looking at the patient’s chest radiograph, which shows no specific infiltrates, you decide to initiate supportive care and treatment with an appropriate antiviral agent. The patient is discharged from the ED with close telephone follow-up planned with her primary care provider.

References

Evidence-based medicine requires a critical appraisal of the literature based upon study methodology and number of subjects. Not all references are equally robust. The findings of a large, prospective, randomized, and blinded trial should carry more weight than a case report.

To help the reader judge the strength of each reference, pertinent information about the study, such as the type of study and the number of patients in the study, will be included in bold type following the reference, where available.

18. Smitherman HF, Caviness AC, Macias CG. Retrospective review of serious bacterial infections in infants who are 0 to 36 months of age and have influenza A infection. Pediatrics. 2005;115(3):710-718. (Retrospective medical record review)


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1. Which of the following symptoms is most common in children with seasonal influenza?
   a. Cough
   b. Fever
   c. Rhinorrhea
   d. Vomiting

2. A 27-day-old otherwise healthy baby is presented to the ED with a temperature of 38.5°C (101.3°F) over the last 3 hours. Both parents were diagnosed with influenza 2 days earlier, and the patient’s rapid diagnostic test in the ED is positive for influenza. What is your next step?
   a. Admit the baby and start antibiotics and antiviral treatment
   b. Admit the baby and start antiviral treatment
   c. Conduct a workup that includes blood, urine, and CSF testing
   d. Observe the baby in the ED for 24 hours and discharge her if the symptoms improve
   e. Report the start of a pandemic in your area to the local public health agency

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3. Which of the following children with a confirmed influenza infection is NOT at risk for a more severe influenza illness?
   a. A 1-year-old with shunt-corrected tetralogy of Fallot
   b. A 5-year-old with sickle cell disease
   c. A 7-year-old with 3 siblings who have pharmacology-controlled asthma
   d. An 8-year-old with cystic fibrosis and pulmonary function tests showing 70% of expected function for her age
   e. A 13-year-old with spastic cerebral palsy

4. Which of the following patients should receive the influenza vaccine in the 2010-2011 season?
   a. Children aged 6 months to 10 years
   b. People 65 years of age and older
   c. Children older than 2 years living with people older than 65 years
   d. All of the above

5. The 2010-2011 influenza vaccine will protect against all of the following viruses EXCEPT:
   a. Influenza A (H1N1) virus
   b. Influenza A (H3N2) virus
   c. Influenza A (H5N1) virus
   d. Influenza B virus

6. Which of the following tests is considered the criterion standard for diagnosing influenza?
   a. Viral culture
   b. RT-PCR
   c. Rapid influenza test from a nasopharyngeal wash sample
   d. a + b

7. Healthcare providers examining patients with influenza should do all the following EXCEPT:
   a. Use a surgical mask or N95 respirator
   b. Get an immunization early in the influenza season
   c. Test themselves for influenza once a week
   d. Wash their hands before and after examining each patient

8. The antiviral medication recommended for use in children under 1 year of age who have been diagnosed with influenza is:
   a. Amantadine
   b. Oseltamivir
   c. Zanamivir
   d. Currently not approved
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Needs Assessment: The need for this educational activity was determined by a survey of medical staff, including the editorial board of this publication; review of morbidity and mortality data from the CDC, AHA, NCHS, and ACEP; and evaluation of prior activities for emergency physicians.

Target Audience: This enduring material is designed for emergency medicine physicians, physician assistants, nurse practitioners, and residents.

Goals & Objectives: Upon reading Pediatric Emergency Medicine Practice, you should be able to: (1) demonstrate medical decision-making based on the strongest clinical evidence; (2) cost-effectively diagnose and treat the most critical ED presentations; and (3) describe the most common medicolegal pitfalls for each topic covered.

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**EVIDENCE-BASED PRACTICE RECOMMENDATIONS**

**Pediatric Influenza In The Emergency Department Setting**

Goldman R. November 2010; Volume 7, Number 11

This issue of Pediatric Emergency Medicine Practice presents a critical appraisal of the most current literature on influenza in children. Recent studies on clinical presentation, diagnosis, and treatment are reviewed, and recommendations for the evaluation and management of suspected influenza and its complications are provided. Special attention is given to the management of influenza in the febrile young child and the risk of concomitant serious bacterial infection (SBI). This review also discusses the novel influenza A (H1N1) pandemic of 2009 and the most recent recommendations for the 2010-2011 season. For a more detailed and systematic look at the critically ill neonate, see the full text article at www.ebmedicine.net.

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<th>Key Points</th>
<th>Comments</th>
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<td>Influenza can present in children as a classic influenza-like-illness (ILI) or with symptoms associated with common complications. Invasive pneumococcal disease after a respiratory viral infection is also well documented, especially in the 2-week period after influenza infection.</td>
<td>Common influenza-related complications include otitis media, bronchiolitis, and bacterial pneumonia. Early treatment that addresses these complications is important in order to avoid further complications. A diagnosis of influenza as the primary illness does not necessarily rule out the need for imaging of the chest or possible antibacterial treatment for children of all ages.</td>
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<td>Although fever and associated symptoms such as rhinorrhea, cough, and sneezing often have a viral etiology, consider an SBI such as urinary tract infection (UTI), bacteremia, or meningitis, especially in patients in the first 3 months of life.</td>
<td>The RSV-SBI Study Group of the AAP’s Pediatric Emergency Medicine Collaborative Research Committee conducted a 3-year multicenter study involving 809 febrile infants 60 days or younger who were tested for influenza in 5 EDs. Almost 12% (95 patients) had an SBI. The decision to forego blood, CSF, and especially urine testing should not be made simply because an influenza infection is documented. Moreover, because testing for influenza in the ED may result in false-positive or false-negative results, emergency clinicians should use their clinical skills with laboratory findings to guide their investigation and treatment of young children with fever.</td>
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<td>Currently available diagnostic tests for identifying influenza infection include viral culture, reverse transcriptase-polymerase chain reaction (RT-PCR) assay, and rapid antigen testing. Viral culture and RT-PCR are considered the criterion standards for influenza testing. Although they take longer to process than the newer rapid diagnostic tests and require more expertise by laboratory personnel, they provide confirmation of the diagnosis and can differentiate between influenza subtypes.</td>
<td>Although use of rapid testing has increased significantly in the ED setting in recent years and has helped to identify epidemics early in their course, emergency clinicians must be aware of the rate of false-positive—and, even more so, false-negative test results. Since viral culture and RT-PCR are the criterion standards for influenza testing, local protocols in many centers recommend using these techniques when sending samples from very young or very sick children for further analysis.</td>
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<td>Communicating with local agencies and keeping up-to-date with the most recent recommendations from the CDC will help the emergency clinician to identify specific strains of influenza circulating within a particular region. This information may also help to determine appropriate diagnostic and treatment decisions for children.</td>
<td>Every year, different strains of influenza appear and affect communities at slightly different times during the influenza season. Chemoprophylaxis as well as treatment of influenza in the ED should follow the guidelines for antiviral therapy published annually by the CDC. Treatment recommended during the novel influenza A (H1N1) pandemic is no longer applicable.</td>
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<td>Antibiotics are often prescribed inappropriately for children with uncomplicated influenza. Although antibiotic treatment has been found to be ineffective in preventing otitis media in children with viral upper respiratory tract infections, the drugs are commonly prescribed for children with this condition, even with a positive test for a viral agent such as influenza and without a concomitant clinical bacterial presentation.</td>
<td>In a large, retrospective cohort study of otherwise healthy children in Tennessee, influenza accounted for 10% to 30% of the excess use of antibiotics during the winter of 2001-2002. Judicious use of antibiotics is important for all children, especially in the ED, where follow-up is uncertain. Over-prescription of antibiotics can lead to the induction of microbial resistance, increased costs, and increased risk of adverse events that can complicate the clinical picture.</td>
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See reverse side for reference citations.
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Use The Evidence-Based Clinical Recommendations On The Reverse Side For:

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