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Considerations for vaccine administration in the emergency department

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Routine vaccination has helped prevent many diseases, decreased the number of severe outbreaks, and lowered death rates from vaccine-preventable diseases. Over 200,000 hospitalizations and about 23,000 deaths in the United States annually are related to influenza.7,8 The impact of influenza varies from season to season, depending on the characteristics of the circulating strain. According to the Centers for Disease Control and Prevention (CDC), the 2009–10 influenza A H1N1 virus pandemic affected 43–89 million people and resulted in 18,300 deaths in the United States.9 Often, uncomplicated influenza will resolve after three to seven days; however, it can lead to significant complications such as pneumonia, Reye syndrome, myocarditis, and death.9 The risk of complications, hospitalization, and mortality is higher in people age 65 years or older, young children, pregnant women, and people of any age with certain chronic underlying conditions (asthma, diabetes, heart disease).7 The Advisory Committee on Immunization Practices (ACIP) recommends routine annual influenza vaccination for individuals age six months or older.10 Pneumococcal disease is a leading cause of serious illness, including meningitis, bacteremia, and pneumonia, among children and adults worldwide.1,11 In the United States, pneumococcal pneumonia is responsible for about 175,000 hospitalizations annually, including about 36% of adult community-acquired bacterial pneumonia cases and 50% of hospital-acquired pneumonia cases.7 In 2009, about 43,500 cases of invasive pneumococcal disease with 5,000 deaths were reported in the United States.12 People with chronic organ disease (i.e., lung, heart, or liver), cerebrospinal fluid leak, immunosuppression, functional or anatomical asplenia, or asthma and people who smoke tobacco have been found to have an increased risk for invasive pneumococcal disease. Therefore, ACIP recommends vaccinating individuals in these high-risk groups.1,7,9,11-13

Another major opportunity to vaccinate in the ED is related to exposure to a vaccine-preventable disease such as rabies, tetanus, or hepatitis B. Worldwide, there are more than 50,000 human deaths caused by the rabies virus each year.14 Without proper vaccination and immunotherapy (i.e., active and passive immunization), rabies is nearly 100% fatal; therefore, identification and appropriate immunization of at-risk individuals is critical.

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patients are imperative.\textsuperscript{15} Since rabies vaccination requires multiple doses, it is important for pharmacists to help plan appropriate follow-up.

Generalized tetanus occurs most commonly after tetanus spores gain entry into the body via nonintact skin; the spores germinate and ultimately produce a potent neurotoxin called tetanospasmin.\textsuperscript{16} The classic progression of clinical tetanus is descending muscle spasms that affect the jaw, neck, upper airway, other muscles involved with respiration, and skeletal muscles.\textsuperscript{7,16} The majority of tetanus infections are preceded by an acute wound, but chronic wounds and i.v. drug abuse are also recognized risk factors.\textsuperscript{17} Appropriate postexposure vaccination, immunotherapy, and wound treatment can prevent this potentially fatal disease.\textsuperscript{7} A prospective observational study in five university-affiliated EDs found that 57.6\% of patients who were underimmunized did not receive appropriate tetanus prophylaxis according to ACIP recommendations.\textsuperscript{18}

An estimated 2 billion people worldwide have been infected with hepatitis B virus (HBV) at some point in their lifetime, with about 1.4 million people chronically infected with hepatitis B in the United States.\textsuperscript{7,19} The virus can multiply in the liver, leading to complications such as acute hepatitis, chronic hepatitis, liver cancer, and death.\textsuperscript{5,19} Like other vaccine-preventable diseases, HBV has occupational and behavioral risk factors. Patients arriving at the ED who have been exposed to potentially infected bodily fluids may require vaccination and immunotherapy, as there is no available treatment for acute HBV infection.\textsuperscript{20}

This article reviews the opportunities to vaccinate patients in the ED, the requirements for administering vaccines, and the role of the ED pharmacist in vaccinations.

**Immunization opportunities in the ED setting.** The goal of the Healthy People Initiative 2020 is to reduce, eliminate, or maintain elimination of cases of vaccine-preventable disease by increasing immunization rates.\textsuperscript{2} More than 135 million ED visits occur in the United States annually, and this number will likely increase.\textsuperscript{21} However, vaccination coverage remains low for most vaccine-preventable diseases. According to CDC, pneumococcal disease vaccination coverage was 18.5\% among high-risk adults age 19–64 years and 59.7\% among adults age 65 years or older in 2010,\textsuperscript{22} much lower than the goals of 60\% and 90\%, respectively, established in the Healthy People Initiative 2020.\textsuperscript{2} Many initiatives and interventions are being or have been implemented to improve vaccination coverage. The Task Force on Community Preventive Services, a panel of public health and prevention experts appointed by the director of CDC, makes recommendations based on evidence of effectiveness from different multicomponent studies.\textsuperscript{23} The task force recommended combining interventions that enhance access to vaccination services (e.g., lower out-of-pocket costs) with provider- or system-based interventions (standing orders, provider reminder and assessment).\textsuperscript{24} Interventions that increase client demand for vaccination services (client reminder and education) were also deemed beneficial if added to the recommendations above. Some guidelines and recommendations have been revised for this purpose. For example, ACIP now recommends routine influenza vaccination for individuals age six months or older, while the new hepatitis B vaccination recommendation has been revised to capture more at-risk groups and anyone previously unvaccinated who would like to be vaccinated.

One of the main reasons that patients visit the ED is access to care. The ED is the closest medical contact for many people because they have no primary medical provider. A survey of reasons for ED visits among adults age 18–64 years in 2011 revealed that 79.9\% visited the ED due to a lack of access to other providers.\textsuperscript{25} This means that the ED may be the only setting where these individuals can be educated about the importance of and the need for vaccinations. Missed opportunities for vaccination in the ED have been documented.\textsuperscript{26} However, some studies have demonstrated that vaccination programs are feasible and can be successful in the ED. Rodriguez and Baraff\textsuperscript{27} concluded that the majority of elderly ED patients are not adequately immunized (especially with the pneumococcal and influenza vaccines) but that these vaccines can be delivered effectively through an ED-based immunization protocol. Rimple et al.\textsuperscript{28} found that after the initiation of an ED vaccination program, vaccination rates increased from 16\% to 83\% in patients at high risk for influenza and from 18\% to 84\% in patients at high risk for pneumococcal disease. Every ED visit should be seen as an opportunity for vaccination. The majority of patients who seek care at the ED do not have illnesses of sufficient severity to warrant admission to the hospital and are discharged back into the community setting.\textsuperscript{21} This is significant, because one of the precautions when using many vaccines is the presence of a moderate-to-severe illness, which minimizes one of the reasons patients may not be immunized.\textsuperscript{29}

Vaccines for rabies and HBV require multiple doses. Some institutions may have patients return to the ED for each vaccine dose; others may work with local health departments or community pharmacies. Whatever the follow-up plan, patients must understand the importance of subsequent vaccinations and where they should receive each additional dose. An extensive interdisciplinary team approach that includes emergency physicians, residents, physician assistants, nurses, and the ED pharmacist would address immunization needs in the ED.
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The role of the ED pharmacist. The use of pharmacists to increase vaccination rates has been supported by the American College of Physicians and the American Society of Internal Medicine. The American Pharmacists Association (APhA) has also published guidelines detailing pharmacist involvement in immunization. Many pharmacists have completed extensive immunization training and have added this distinct skill set to a multidisciplinary vaccine delivery team. As of 2011, over 150,000 pharmacists and pharmacy students have been trained to provide vaccinations through an APhA certificate program. Currently, all 50 states in addition to the District of Columbia and Puerto Rico allow pharmacists to administer at least one type of vaccine. However, the scope and limitation of authorization are defined by each state and differ among states. Some states allow pharmacists to administer vaccines to individuals of any age group, where others define age ranges (e.g., 12 years of age or older) for those whom pharmacists can vaccinated. In addition, some states restrict the vaccines that can be administered by pharmacists. It is imperative for all pharmacists who provide vaccination services to be familiar with their state’s laws and regulations regarding pharmacist-provided vaccination.

Pharmacists can identify qualified patients for vaccination based on their medication history or knowledge of disease-based risk factors. Pharmacists can also act as a liaison between patients and their providers and can initiate referrals if and when needed. They can participate in vaccinations in three ways: as an advocate, as a facilitator (partner), or as a vaccinator. An advocate educates and motivates patients, a facilitator helps or hosts others who vaccinate, and a vaccinator administers vaccines. While community-based pharmacists are more likely to be vaccinators, the pharmacist practicing in the ED is likely to serve as a facilitator by reviewing patient history and screening patients, counseling patients, documenting patient information, managing the formulary, performing administrative measures such as standing order-set development, and educating patients and providers. An ED pharmacist can also be an advocate by identifying high-risk patients during ED visits based on patient age, vaccination history, or medical conditions. After screening for contraindications and precautions, the pharmacist can initiate appropriate vaccination through recommendations for vaccination or use of standing orders. This can and should be incorporated as part of the daily routine of the ED pharmacist. A standing-order program authorizes nurses, pharmacists, or other medical staff to administer vaccinations according to their institution’s or a physician-approved protocol without a physician’s examination. ED pharmacists should be advocates for the standing-order program if none exists in their institution. They should also be able to assist in developing vaccination protocols (e.g., standing order for pneumococcal disease and influenza) or order sets (e.g., rabies, tetanus). If a vaccination program already exists, the ED pharmacist should ensure that the protocol is used appropriately. The program should document a plan for the program’s infrastructure, key service-delivery components, and quality assurance.

Patients should also receive appropriate counseling regarding their need for vaccination based on their condition (e.g., diabetes, asthma, any chronic lung or cardiac condition) that puts them at high risk for vaccine-preventable diseases. Patients’ concerns about vaccine safety and efficacy should also be addressed, and patients’ acceptance or refusal of vaccination should be documented.

Education on vaccination should not be limited to patients alone: their families and caregivers should also be educated. ED pharmacists can also raise awareness about the importance of vaccination by educating other health care professionals through in-service education programs or other educational activities. Public awareness about vaccination is also important; brochures, fliers, posters, and newsletters can be used to publicize the need for and availability of vaccinations (e.g., during influenza season or pharmacy week).

In addition to the functions listed as a facilitator, the pharmacist will also directly administer vaccines to patients in accordance with state laws. Pharmacists have had a positive impact on influenza immunization rates in the community setting. For example, in the 2010–11 influenza season, nearly 20% of influenza vaccines were administered at a supermarket or drug store, largely driven by state laws allowing this practice and access to care. While the practice of vaccine administration by pharmacists has gained acceptance in the community setting, it may not be common practice or necessary in EDs because of the presence of other health care professionals. However, if permitted by the state and the employer, an opportunity to act as a direct immunizer should be seized if and when presented. For example, the pharmacist can volunteer to advertise free immunization to patients in the common areas of the hospital during special periods like pharmacy week (usually during influenza season). The pharmacist can also offer to volunteer to assist in employee immunizations if needed and allowed by the organization. This will not only promote community outreach but will also add value to the pharmacist’s role. Furthermore, this will help the pharmacist stay up-to-date on skills and techniques gained during immunization training. The ED pharmacist may be able to help with outreach efforts such as temporary influenza vaccination...
at the host institution or assist with employee vaccination if state and institution regulations allow.

It is important for ED pharmacists to achieve competency in all aspects of vaccine administration before any attempt to administer vaccines. They must be properly trained and evaluated in disease epidemiology, patient screening, vaccine characteristics, vaccine administration, monitoring for and management of vaccine-related emergencies, and documentation.\(^3\) ED pharmacists who are not trained to administer vaccines or wish to learn more about optimal pharmacological care related to vaccines can complete training programs such as APhA’s pharmacy-based vaccination program.\(^4\) In addition, general courses on vaccination such as those offered by CDC are available to help the pharmacist appreciate and become educated on many aspects of vaccination delivery.\(^5\)

Regulatory and practical considerations. Issues related to the general principles of vaccine administration are beyond the scope of this article, but an excellent reference that details the timing and spacing of vaccines, the storage of immunobiologics, vaccination in special circumstances, and the management of vaccine-related adverse events is available.\(^6\)

Individual states may have registries and requirements related to vaccine administration and documentation; pharmacists should be aware of the requirements in their state. Links to each state’s immunization information system is available through CDC.\(^7\)

ED pharmacists should be familiar with the contraindications and precautions of each vaccine that patients are likely to receive in the ED (appendix). They may also encounter adverse events related to vaccines as primary complaints of patients seeking treatment after receiving a vaccine or directly related to vaccine administration in the ED. Anaphylactic reactions are the most severe adverse effects and require prompt treatment with intramuscular epinephrine; some may require the placement of an airway and supplemental oxygen.\(^8\) The ED pharmacist can help ensure prompt and proper treatment for life-threatening reactions and symptomatic treatment for less-severe reactions.

The Vaccine Adverse Event Reporting System is a national reporting system that collects adverse events related to vaccine administration. Reports can be completed electronically or in paper form after an adverse reaction related to a vaccine is suspected. It is important for ED pharmacists to be aware of the reporting requirements because they are optimally positioned to recognize and report these adverse events. Certain adverse reactions are required to be reported and are generally severe reactions (e.g., anaphylaxis), listed in the package insert as contraindications to additional doses of the vaccine or are an expression of the disease the vaccine was supposed to prevent.\(^9\)

Vaccine information statements (VISs) must be provided to patients whenever there is a vaccine containing diphtheria, tetanus, pertussis, polio, measles, mumps, rubella, hepatitis B, Haemophilus influenzae type b, and varicella.\(^10\) Printable VISs are available from CDC’s website.\(^11\) Two-dimensional barcodes containing the name of the VIS and the edition date are now available for some VISs and can be scanned into the electronic medication administration record to document that a patient received the VIS.\(^12\)

Conclusion. Vaccines are an important part of overall health care. The increasing number of ED visits coupled with the fact that majority of ED visits are due to lack of access to a primary care provider makes the ED an important health care setting for vaccination. ED pharmacists are well positioned and should embrace the opportunity to improve vaccination rates and potentially improve morbidity and mortality related to vaccine-preventable diseases.

References
12. American Society of Health-System Pharmacists. Improving adults immuni-
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33. American Pharmacists Association. Pharmacist administered vaccines: types of vaccines authorized to adminis-
### Vaccine Frequency, Contraindications, Precautions, and Adverse Effects

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Frequency</th>
<th>Contraindications</th>
<th>Precautionsa</th>
<th>Precautions²</th>
<th>Adverse Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumococcal</td>
<td>Primary series is 4 doses in children; adults require 1 or 2 boosters depending on age</td>
<td>Severe allergic reaction to a component in the vaccine or to a previous dose ¹</td>
<td>Moderate or severe acute illness ³</td>
<td>History of Guillain-Barré syndrome within 6 wk of prior dose of influenza vaccine</td>
<td>Pneumococcal polysaccharide: pain, swelling, or erythema at the site of injection; rare moderate systemic reactions (e.g., fever, myalgia) may occur</td>
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<tr>
<td>Trivalent inactivated influenza vaccine</td>
<td>Annual (age 2–49 yr)</td>
<td>Severe allergic reaction (e.g., anaphylaxis) to a vaccine component or after previous dose ²</td>
<td>Moderate or severe acute illness</td>
<td>History of Guillain-Barré syndrome within 6 wk of prior dose of influenza vaccine</td>
<td>Pneumococcal conjugated: local reactions (e.g., pain, swelling, erythema), fever, and nonspecific gastrointestinal symptoms (e.g., decreased appetite, irritability)</td>
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<tr>
<td>Live attenuated influenza vaccine</td>
<td>Annual (age 2–49 yr)</td>
<td>Severe allergic reaction (e.g., anaphylaxis) to a vaccine component or after previous dose³</td>
<td>History of Guillain-Barré syndrome within 6 wk of prior dose of influenza vaccine</td>
<td>Moderate or severe acute illness</td>
<td>In children: significantly increased risk of asthma or reactive airways disease in children age 12–59 mo</td>
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<tr>
<td>Tetanus (DTaP, Tdap, Td) ⁴</td>
<td>Primary series is 5 doses (DTaP); one time Tdap booster; Td every 10 yr</td>
<td>Severe allergic reaction to a vaccine component or following previous dose</td>
<td>History of Guillain-Barré syndrome within 6 wk of prior dose</td>
<td>Progressive neurologic disorder</td>
<td>Local reactions (pain, redness, swelling)</td>
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<tr>
<td></td>
<td></td>
<td>Encephalopathy not caused by another identifiable cause arising within 7 days after vaccination</td>
<td>History of severe local reaction (Arthus reaction)</td>
<td>History of severe local reaction (Arthus reaction)</td>
<td>High temperature (101 °F or higher)</td>
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<td>Moderate or severe acute illness</td>
<td>High temperature (105°F)</td>
<td>Moderate or severe systemic reactions (e.g., fever, febrile seizures, hypotonic hyporeactive episodes)</td>
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<td>Collapse or shocklike state (e.g., hypotonic hyporesponsive episode) within 48 hr</td>
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<td>Persistent and inconsolable crying lasting ≥3 hr</td>
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<td>Convulsion with or without fever occurring within 3 days of administration</td>
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<tr>
<td>Hepatitis B</td>
<td>Primary series is 3–4 doses, depending on product; postexposure prophylaxis requires hepatitis B immune globulin and vaccine administration</td>
<td>Severe allergic reaction to a vaccine component (yeast) or following a prior dose</td>
<td>Moderate or severe acute illness</td>
<td>Guillain-Barré syndrome, systemic lupus erythematosus, rheumatoid arthritis</td>
<td>Pain at injection site</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>Mild systemic complaints (fatigue, headache)</td>
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<tr>
<td>Rabies</td>
<td>Postexposure prophylaxis requires human rabies immune globulin plus 4–5 vaccine doses</td>
<td>No absolute contraindications</td>
<td>History of hypersensitivity to vaccine or components—evaluate need for pretreatment with antihistamines and availability of epinephrine to treat anaphylactic reactions</td>
<td>Immunosuppression—avoid immunosuppressive agents if possible; perform serology testing to ensure adequate titers of rabies antibodies</td>
<td>Local reactions common including pain, swelling, and redness</td>
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<td></td>
<td>Fever, headache, dizziness, gastrointestinal complaints</td>
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¹Vaccination is deferred when a precaution is present.

²Wait until condition improves before administering vaccine. Minor illnesses (e.g., upper respiratory tract infection) are not contraindications to vaccination.

³The Advisory Committee on Immunization Practices recommends that a person with egg allergy who reports only hives after egg exposure should/can receive trivalent inactivated influenza vaccine with several additional safety measures.

⁴DTaP = diphtheria, tetanus, and acellular pertussis; Tdap = tetanus, diphtheria, and acellular pertussis; Td = tetanus and diphtheria.