Diabetes and Immunizations

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Abstract
Vaccines are important for patients with chronic health conditions, including those living with diabetes, to prevent a variety of infectious diseases. The use of vaccines has reduced hospitalizations and deaths due to influenza and pneumococcal disease in patients with diabetes. Such patients also are at increased risk of hepatitis B infection. Therefore, in addition to the vaccines recommended for all persons, the Centers for Disease Control and Prevention (CDC) specifically recommends that patients with diabetes receive annual influenza vaccines, pneumococcal vaccine, and the hepatitis vaccine series.

Introduction
Immunization practices were followed in China more than 1000 years ago, but vaccines became accepted more widely among medical practitioners after 1798, when Edward Jenner developed a vaccination to eradicate small pox. Since then, a substantial number of other infectious diseases have been prevented or, in the most successful situations, nearly eradicated through the use of vaccinations (1).

Guidelines and Literature Review
The ACIP periodically publishes recommendations for all patients regarding appropriate vaccinations. The most current versions of these recommendations identify diabetes as a specific indication in adults for hepatitis B virus (HBV), influenza, and pneumococcal vaccines.

Hepatitis B
The ACIP recommendations published in 2011 recommended the HBV vaccine series for all adults age 59 and younger who have diabetes (5). Additionally, patients age 60 years and older with diabetes may receive the HBV vaccine at the discretion of the clinician. This recommendation was prompted by outbreaks of HBV infection in practice settings that provide assisted blood glucose monitoring (5). One explanation for the outbreak in this patient population is that current basic infection control practices are not adequate to prevent the spread of HBV, making vaccination critical to prevent an increased incidence of this infection (6).

Patients with diabetes may be at increased risk of HBV infection. In one population-based study, persons 23 to 59 years of age with diabetes were approximately twice as likely to be infected with HBV compared to patients without diabetes (7). This trend was also observed in patients 60 years of age and older. In a study that examined HBV serology data from the National Health and Nutrition Examination Survey, the overall prevalence of previous or current infection was statistically higher in patients with diabetes compared with persons without diabetes (8.3% and 5.2%, respectively) (7). In a national evaluation, hospitalizations associated with HBV occurred three times more frequently in persons with diabetes than without diabetes (8).

The HBV vaccine series should be initiated and completed as soon as feasible after the patient is diagnosed with diabetes. The recommendation does not extend to women with gestational diabetes.

Influenza
Influenza is the most frequent cause of vaccine-preventable death in the
United States (9,10). Additionally, seasonal influenza results in greater than 200,000 hospitalizations each year. The risks of complications, hospitalizations, and mortality are greatest in persons 65 years of age and older, children younger than 5 years, and patients who have medical conditions that place them at increased risk for complications, which includes diabetes. Thus, although the CDC recommends annual seasonal influenza vaccination for all patients 6 months of age and older, those with an increased risk of complications should be targeted (6). Annual influenza vaccine administration has been documented to decrease diabetes-related hospitalizations for influenza during “flu epidemics” by up to 79% (11). In a population-based cohort study in Spain, influenza vaccination reduced all-cause mortality by 33% among patients with diabetes during the study period (12). Per the ACIP, patients with diabetes who currently control the disease strictly with diet still should receive the influenza vaccine yearly (9).

**Pneumococcal Disease**

Pneumococcal disease is caused by *Streptococcus pneumoniae*. This bacterium has greater than 90 serotypes, but only a few of these cause most invasive pneumococcal disease (9,10). Pneumococcal disease may include bacteremia, meningitis, and pneumococcal pneumonia presenting in combination or as individual syndromes. The risk for mortality is highest among patients older than 65 years and those who have underlying medical conditions, including diabetes (9,10).

The first pneumococcal vaccine available in the United States was a polysaccharide vaccine that contained antigen from 14 serotypes of pneumococcal bacteria (9). In 1983, a 23-valent polysaccharide vaccine was licensed (PPSV23) (9). In 2000, the first polyconjugate pneumococcal vaccine that contained seven serotypes was licensed (9). The new 13-valent product (PCV13) was licensed in 2010.

As of September 2014, the ACIP recommends that all adults 65 years and older receive both pneumococcal vaccines (PCV13 and PPSV 23) (9,10). The series of four PCV13 vaccinations are recommended for all children younger than 2 years (Fig. 1). In addition, those with diabetes ages 2 to 64 years should receive PPSV23. Ideally, PPSV23 is administered at least 8 weeks after PCV13 if both are indicated. If the patient received PPSV23 before age 65, PCV13 should be administered after age 65 and at least 1 year after PPSV23 was given (Fig. 2). Another dose of PPSV23 is required after the age of 65 years and after a period of 5 years since the previous PPSV23 vaccination.

In addition to HBV, influenza, and pneumococcal vaccines, patients with diabetes should follow general vaccine recommendations provided by the CDC. The Table lists all vaccines recommended for adults with diabetes.

**Clinical Application**

Patients with diabetes are six times more likely to be hospitalized and three times more likely to die from influenza and pneumococcal complications compared to patients in the general population (6). Patients with diabetes also are at an increased risk of developing HBV infection. Accordingly, it is imperative for clinicians to understand and communicate the benefits of immunizing this patient population.

Further, clinicians should review and understand the CDC recommendations for other vaccinations because they also can help prevent serious health
illnesses for those living with diabetes (Table). In general, practitioners should be aware of precautions, contraindications, and adverse effects of the various vaccines. For example, patients with diabetes should not receive the live attenuated flu vaccine. The CDC considers diabetes and other underlying medical conditions that place a patient at increased risk for serious complications resulting from flu to be a precaution for the live attenuated flu vaccine (10). The safety of this vaccine has not been established in this patient population.

Summary
Evidence indicates the importance of appropriate vaccination of patients with diabetes. The most effective method of disease prevention is immunization. Because patients with diabetes are at increased risk of morbidity or mortality from influenza, pneumococcal disease, and HBV infection, their clinicians must identify if specific vaccinations are needed in individual patients, provide needed vaccines, or refer patients to other clinicians for vaccination. Finally, clinicians must work with patients to overcome barriers to care and make certain that systems are in place to identify and provide needed vaccinations (3).

References

### Table. Recommended Vaccines for Adults Living With Diabetes (13,14)

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Ages 19 to 64 Years</th>
<th>Ages 65 Years and Older</th>
<th>Pregnant Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza</td>
<td>Annually</td>
<td>Annually</td>
<td>Annually</td>
</tr>
<tr>
<td>Tdap (Tetanus, Diphtheria, Pertussis)</td>
<td>One dose, if not given at younger age</td>
<td>One dose, if not given at younger age</td>
<td>One dose during each pregnancy</td>
</tr>
<tr>
<td>Td (Tetanus, diphtheria)</td>
<td>Give every 10 years following Tdap</td>
<td>Give every 10 years following Tdap</td>
<td>Not given during pregnancy</td>
</tr>
<tr>
<td>PCV 13 (pneumococcal)</td>
<td>One dose as adult, only if other high risk conditions</td>
<td>One dose if have diabetes and have not received as an adult</td>
<td>Not given during pregnancy</td>
</tr>
<tr>
<td>PPSV23 (Pneumococcal)</td>
<td>One to three doses</td>
<td>One dose at least (5 years after last dose before age 65)</td>
<td>One dose, if never given</td>
</tr>
<tr>
<td>Zoster (Shingles)</td>
<td>One dose after age 60 years</td>
<td>One dose if not given before age 65 years</td>
<td>Contraindicated</td>
</tr>
<tr>
<td>MMR (Measles, Mumps Rubella)</td>
<td>May need one to two doses if born after 1957</td>
<td>Not needed</td>
<td>Contraindicated</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>Give, if not previously vaccinated</td>
<td>Assess need for</td>
<td>Assess need for</td>
</tr>
<tr>
<td>Human papillomavirus</td>
<td>Before age 26 years if female and age 21 years if male</td>
<td>Not indicated</td>
<td>Not indicated</td>
</tr>
</tbody>
</table>

Hepatitis A and meningococcal vaccines are recommended for children but are not needed for unvaccinated adults with diabetes unless other risk factors are present. The varicella vaccine is recommended for all children and is only needed by nonpregnant adults who have not been vaccinated or infected with chickenpox.


