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# Immunization update: Recommendations for adults with chronic disease

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Adults with diabetes, heart disease, and chronic lung diseases are susceptible to increased morbidity and mortality from infectious diseases. Utilization of vaccinations for disease prevention in this population is low. The Centers for Disease Control and Prevention provide vaccine guidance for patients with these conditions and the schedules are published annually. Patients with chronic conditions are advised to receive annual inactivated influenza vaccinations and the pneumococcal polysaccharide vaccine. An additional dose of pneumococcal polysaccharide vaccine is recommended if the first dose was administered before the age of 65 and 5 years have elapsed since the first dose. The hepatitis B vaccine series was recently added to the vaccine schedule for patients with diabetes because of the increased incidence of infection and poor disease outcomes. All adults are recommended to receive the tetanus, diphtheria, and acellular pertussis vaccine in place of a routine tetanus diphtheria booster. In addition, all adults older than 60 years should be vaccinated against herpes zoster. Strategies to increase immunization rates utilize multiple approaches; however, direct recommendations from healthcare providers are more successful at increasing patient engagement and compliance. Immunization counseling should be a priority and standard of care in the office.

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## Introduction

Despite broad public education efforts, the adult vaccination rates in the United States are consistently lower than those targeted by “Healthy People 2020” and other health promotion initiatives.<sup>1,2</sup> Adults with common chronic conditions such as diabetes, heart disease, and lung disease are particularly vulnerable to the morbidity associated with vaccine-preventable infections. The adult vaccine schedule published annually by the Centers for Disease Control and

Prevention (CDC) specifically outlines recommendations for these high-risk patients.<sup>3</sup> Recent findings from the 2010 National Health Interview Survey, which assesses vaccine behaviors through participants’ self-report, indicate a pneumococcal vaccination rate of only 18.5% among adults aged 19 to 64 years who are considered high risk.<sup>2</sup> This falls far below the rate of 60% targeted by Healthy People 2020 for this population and demonstrates limited improvement in the vaccination rate of 17% documented in 2008.<sup>1</sup> Surveillance of the 2011–2012 influenza season demonstrated a vaccination rate of 45.2% in high-risk adults aged 18 to 64 years with asthma, diabetes, or heart disease.<sup>4</sup> Again, this falls below the Healthy People 2020 target of 90% and shows limited improvement over the 39%

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**Table 1** Immunization recommendations for adults with chronic heart disease, pulmonary disease, and diabetes<sup>a</sup>

Immunization	Recommendations	Dose and frequency
Influenza	All adults with heart disease, pulmonary disease, and diabetes	Inactivated only; LAIV not recommended  ACIP expresses no preference for any given inactivated formulation (IM, ID, high dose) within the approved age indications. 1 Dose of 0.5 mL IM or 0.1 mL ID annually
Pneumococcal	All adults $\geq 65$ years of age Adults $< 65$ years of age with heart disease, pulmonary disease, or diabetes	PPSV23 vaccine only 1 Dose $\geq 65$ years of age  1 Dose at $< 65$ years of age with 1 additional dose at $\geq 65$ and $\geq 5$ years from first dose. Dose is 0.5 mL IM or SubQ
Hepatitis B	All adults $\leq 60$ years of age with diabetes Consider $> 60$ years of age with diabetes	3 Doses of 1 mL IM at 0, 1, and 6 months
Td/Tdap	All adults	Td every 10 years with 1 dose of Tdap regardless of interval since last Td. Dose is 0.5 mL IM
Zoster	All adults $\geq 60$ years of age	1 Lifetime dose of 0.65 mL subcutaneous

ID = intradermal; IM = intramuscular; LAIV = live, attenuated influenza vaccine; SubQ = subcutaneous; Td = tetanus and diphtheria; Tdap = tetanus, diphtheria, and acellular pertussis; PPSV23 = 23 valent pneumococcal polysaccharide

<sup>a</sup>Refer to the CDC and ACIP recommended adult immunization schedule <http://www.cdc.gov/vaccines/schedules/hcp/adult.html> for the complete and up-to-date immunization recommendations, schedule, contraindications, and precautions.

vaccination rate documented for this population in 2008.<sup>1</sup> These disparities offer a challenge to all providers caring for patients with chronic conditions. This review presents 3 case scenarios targeted at updated vaccine recommendations for these chronic conditions and outlines strategies for improving vaccination rates.

## Immunization recommendations for diabetes

*Case:* a 52-year-old male patient with type 2 diabetes presents to his family physician's office for a quarterly checkup during the fall. In addition to reviewing his laboratory results, medications, and other diabetes risk factors, he is also asked about recent vaccines. He reports receiving all of the recommended childhood vaccines; however, he has not received any vaccines over the past several years. He discusses no adverse reactions to the childhood vaccines or drug allergies, but he is worried about previous reports of Guillain-Barré syndrome (GBS) associated with the swine flu vaccine.

Which vaccines should be recommended today? What vaccine education should be provided regarding his diabetes?

Medical care for patients with diabetes focuses on preventing complications of the disease. Immunizations are critical tools in this process. Patients with diabetes are 6 times more likely to be hospitalized and 3 times more likely to die from complications surrounding influenza or pneumonia than those without diabetes.<sup>5,6</sup> Vaccination

against influenza has resulted in lower rates of hospitalizations and mortality in patients with diabetes.<sup>7</sup> The CDC and Advisory Committee on Immunization Practices (ACIP) immunization recommendations for patients with diabetes are shown in Table 1. The American Diabetes Association Standards of Medical Care in Diabetes and an American Association of Diabetes Educators position statement also endorse these recommendations.<sup>5,8</sup>

The most recent vaccine recommendation for patients with both type 1 and type 2 diabetes is the hepatitis B vaccination series. This was added in response to the low rate of hepatitis B immunization in patients with diabetes, increased incidence of hepatitis B in this population, and risk of poorer disease outcomes in these patients. In patients with diabetes who are younger than 60 years, the hepatitis B immunization series should be administered as soon as possible upon detection of insufficient immunity.<sup>3,9</sup>

Data from the recent 2010 National Health Interview Survey indicate that hepatitis B vaccination rates in patients with diabetes were 22.8% for those aged 19 to 59 years and 10.9% for those aged 60 years and older.<sup>2</sup> These low rates are influenced by the fact that vaccination against hepatitis B was not recommended as a routine childhood vaccine for most adults currently living with diabetes.<sup>10</sup>

It is also recommended to consider the hepatitis B immunization series if the patient is older than 60 years and is in need of assisted blood glucose monitoring, such as residents in long-term care facilities.<sup>3</sup> Twenty-nine outbreaks

of hepatitis B in long-term care facilities and hospitals have been reported to the CDC, and of those, 25 outbreaks were in patients with diabetes receiving assisted blood glucose monitoring.<sup>11</sup> Causes included the use of multiple-use lancet devices, not changing lancets, and sharing insulin pens between multiple patients.<sup>11,12</sup>

Hepatitis B causes acute infection, with 1 in 20 infections progressing to cirrhosis or liver cancer.<sup>11</sup> Hepatitis is the 12th leading cause of death in the United States and many patients with diabetes have underlying liver disease related to nonalcoholic steatohepatitis.<sup>13</sup> Furthermore, outcomes from liver disease in patients with diabetes have been associated with premature death.<sup>6</sup>

For this case, recommendations include 1 dose of the inactivated influenza vaccine, 1 dose of the 23-valent pneumococcal polysaccharide vaccine (PPSV), the first dose of the hepatitis B vaccine series, and 1 dose of tetanus, diphtheria, and acellular pertussis (Tdap). It is appropriate and safe to administer all 4 vaccines during this office visit. Patient education should include information about the increased risk of infections due to diabetes and the important role vaccines play in reducing that risk. To address his concerns regarding GBS, it should be described as a rare disease where the body's own immune system attacks peripheral nerves causing acute weakness of the limbs, and in some cases, it progresses to paralysis. The evidence for the association between GBS and influenza vaccines is conflicting. Recent data indicate that such a risk, if evident, is small and remains difficult to evaluate.<sup>14</sup> In fact, GBS occurs in 3000-6000 people each year regardless of whether a vaccine was administered.<sup>15</sup> The only reason to avoid the influenza vaccine is if he had a personal history of GBS within 6 weeks of a previous influenza vaccination.<sup>16</sup> The beneficial effect of the vaccines otherwise outweighs this risk.

## Immunization recommendations for chronic lung disease

*Case:* a 72-year-old female patient with chronic obstructive pulmonary disease (COPD) presents to her family physician's office for a follow-up after suffering a recent COPD exacerbation in the outpatient setting. This morning she finished a 10-day course of prednisone and her symptoms have improved. Her other medications include inhaled albuterol, tiotropium, and fluticasone. She received a pneumococcal vaccination at the age of 64 but no other vaccinations in the past 10 years.

What vaccines should be recommended in the office today? Would the recent use of oral or inhaled corticosteroids affect her immune response?

The CDC definition of "chronic lung disease" (CLD) for the purposes of immunization recommendations includes COPD, emphysema, and asthma.<sup>3</sup> Table 1 outlines the CDC immunization schedule for patients with CLD. The National Asthma Education and Prevention Program Guidelines for

the Diagnosis and Management of Asthma supports the influenza vaccination for all patients with asthma and the Global Initiative for Chronic Obstructive Lung Disease recommends influenza and pneumococcal vaccination for all patients with COPD.<sup>17,18</sup>

Research studies regarding the pneumococcal vaccine's efficacy for pneumonia prevention among individuals with COPD and asthma are inconclusive. The global initiative for chronic obstructive lung disease strategy states that pneumococcal vaccination has been shown to decrease community acquired pneumonia in patients younger than 65 years with a forced expiratory volume in the first second (FEV<sub>1</sub>) < 40% of predicted.<sup>18</sup> However, a systematic review documented no statistically significant decrease in pneumonia or COPD exacerbations in patients with COPD who received the pneumococcal vaccine.<sup>19</sup> Furthermore, there was insufficient information to form a conclusion regarding the effect of pneumococcal vaccination in a systematic review of patients with asthma.<sup>20</sup> Further studies have investigated the rates of asthma and COPD exacerbations among vaccinated patients with regard to hospitalizations and mortality rates and also found inconclusive results.<sup>21</sup> Despite these inconsistencies, studies are favorable for vaccine efficacy against invasive pneumococcal disease, including bacteremia, meningitis, or infections of other normally sterile sites.<sup>19,20</sup>

Systematic reviews of the influenza vaccine in patients with asthma and COPD reported that the inactivated influenza vaccine reduced the total number of COPD exacerbations compared with placebo but did not significantly reduce or increase asthma exacerbations.<sup>22,23</sup> Given the risk of infections in patients with CLD and their known safety, the pneumococcal and influenza vaccines should continue to be recommended in this population.<sup>24</sup>

For the patient described in this case, administration of 1 dose of the inactivated influenza vaccine, a second dose of PPSV, 1 dose of Tdap, and 1 dose of zoster vaccine are all indicated. Because she received her PPSV vaccine at the age of 64, she requires 1 additional dose after the age of 65 as long as a 5-year interval has been achieved. At the age of 72, she should receive her second dose of PPSV, with no further doses needed. The zoster vaccine recommendation is based on the patient's age (>60 years) rather than her medical conditions. As the steroid therapy of less than 2 weeks is considered short-term and the inhaled fluticasone has limited systemic absorption, the patient does not have any contraindications or precautions to receive the live zoster virus vaccine and sufficient immune system activation is anticipated.<sup>16</sup>

If the patient was taking long-term prednisone treatment, the patient could receive the inactivated influenza vaccine, PPSV, and Tdap, but the live zoster vaccine should be delayed. The immune system response and vaccine efficacy might be suboptimal because of long-term steroid treatment but there are no safety concerns. For the live zoster vaccine, it is recommended to wait 1 month after discontinuation of steroid therapy to receive the vaccine.<sup>16</sup>

## Immunization recommendations for chronic heart disease

*Case:* a 68-year-old female patient with systolic heart failure presents to her family physician's office for a quarterly checkup. She requests the influenza vaccine and asks for the nasal formulation. She reports an allergy to eggs which she describes as hives. She received a tetanus diphtheria booster 7 years ago and has received the measles, mumps, and rubella series. She also had a shingles outbreak 2 years ago but has not received the vaccine.

What vaccines should be recommended in the office today? Is the nasal formulation of the influenza vaccine appropriate and safe for her to receive?

The CDC definition of "heart disease" for the purpose of vaccine recommendations includes congestive heart failure and cardiomyopathies and excludes hypertension.<sup>3</sup> The immunization recommendations for those with cardiovascular conditions are the same as for those with CLD and are supported by the American Heart Association (AHA)<sup>25</sup> (Table 1). Influenza-related deaths and hospitalizations are common in cardiovascular disease because of exacerbations of heart disease as well as pneumonia.<sup>25-28</sup> From 1990-1999, 36,000 deaths in the United States were attributed to influenza-related pulmonary and circulatory complications.<sup>26</sup> In a study of 3 health maintenance databases for patients between 50 and 64 years of age with high-risk chronic conditions, the rate of influenza-associated hospitalizations was 12.3 hospitalizations per 10,000 person-periods vs 1.8 in low-risk patients (without chronic conditions) of the same age group. For patients aged 65 years and older, those with high-risk chronic conditions had 55.6 influenza-associated hospitalizations per 10,000 person-periods vs 18.7 in those without chronic conditions.<sup>27</sup> Immunization against influenza and pneumococcal disease may reduce the risk of respiratory infection and subsequent hospitalizations in patients with heart failure.<sup>29</sup>

Influenza and respiratory infections are associated with increased cardiovascular events. The pathophysiology of influenza infection causing cardiovascular events is poorly understood.<sup>25</sup> One hypothesis links the progression of atherosclerosis and vascular injury with the systemic inflammatory response during a viral infection. The AHA and the American College of Cardiology recommend inactivated influenza vaccine as a component of secondary prevention for persons with coronary disease and other atherosclerotic vascular conditions.<sup>25</sup> Data from 2 large randomized controlled trials of patients with a history of diabetes or vascular disease demonstrated a reduced risk of cardiovascular events in the patients who were immunized against influenza.<sup>30</sup> Additionally, a meta-analysis of 5 studies found that compared with the unvaccinated patients, those who were vaccinated against influenza had decreased rates of myocardial infarctions and mortality.<sup>28</sup>

For this patient case, 1 dose of the inactivated influenza vaccine, 1 dose of PPSV, 1 dose of Tdap, and 1 dose of zoster (because of her age) are recommended during this visit. There are 2 issues with the intranasal influenza vaccine.

First, the intranasal vaccine is only approved for use in individuals who are not pregnant, without chronic or immunosuppressive medical conditions, and between the ages of 2 and 49. Second, patients with a history of hives due to eggs should only receive the inactivated influenza vaccine and should be observed for at least 30 minutes following their dose. Patients who have experienced other severe reactions to eggs, such as hypotension, respiratory changes, and repeated emesis, or have required the use of epinephrine to manage the allergic reaction to eggs should be referred to an allergy specialist to evaluate the appropriateness of influenza vaccination. These recommendations have been updated by the ACIP for the 2012-2013 season.<sup>31</sup>

Although the patient has recently experienced an outbreak of herpes zoster, it is recommended that she receive the zoster vaccine to decrease further incidents as well as postherpetic neuralgia.<sup>32</sup> The zoster vaccine reduced the number of postherpetic neuralgia (PHN) cases by 66.5% and the duration of PHN by 57% in a landmark efficacy trial.<sup>33</sup> A small study of 101 patients tested the safety of the zoster vaccine in patients with a history of shingles and found that adverse events were similar to those seen with placebo.<sup>34</sup> A Tdap booster is recommended by ACIP for all adult patients who have not yet received a dose. It should be given regardless of the time interval since the last tetanus diphtheria vaccine. Adverse effects associated with Tdap in elderly patients have been compared with those in patients younger than 65 years and no significant differences were found.<sup>35</sup>

## Strategies for increasing adult immunization rates

Immunizations are an essential and vital component of preventive medical care; however, nationwide immunization rates in adults are substandard.<sup>2,36</sup> Many adult patients do not pursue healthcare from a provider on a regular basis. Adult immunizations during regular office visits should be optimized and prioritized, especially for patients with chronic conditions. Simultaneous vaccines administered during a single visit are effective and safe.<sup>16</sup> The National Foundation on Infectious Diseases' telephone survey of public opinion in 2007 found that 40% of adults thought they did not need vaccines because they were vaccinated as children, 34% were not concerned about catching the disease, 32% were not concerned about spreading it to coworkers, 25% thought that vaccine-preventable diseases were not serious, 18% thought vaccines were not necessary for adults, 35% heard vaccines were not safe, and 25% reported that a vaccine had made them sick. There are also patient concerns about cost and lack of insurance reimbursement.<sup>37</sup> Multiple studies have reported the most common reason that adults do not receive vaccines is because of a lack of recommendations from their healthcare provider.<sup>38,39</sup>

Strategies for increasing immunization rates typically utilize a multifaceted approach.<sup>40</sup> Options for direct patient

**Table 2** Immunization Web sites and mobile apps for current information and patient education

Organization	Web site	Description or comments	Media type
CDC immunization schedules	<a href="http://www.cdc.gov/vaccines/schedules/hcp/index.html">http://www.cdc.gov/vaccines/schedules/hcp/index.html</a>	Immunization schedules for each age group and specific health conditions and catch-up immunizations Updated annually; usually in January or February	Web site
CDC Pink book	<a href="http://www.cdc.gov/vaccines/pubs/pinkbook/index.html">http://www.cdc.gov/vaccines/pubs/pinkbook/index.html</a>	Comprehensive information on vaccine-preventable diseases Disease information, vaccine details including contraindications, adverse reactions, storage, etc.	Web site
CDC vaccines for adult patients	<a href="http://www.cdc.gov/vaccines/hcp/patient-ed/adults/index.html">http://www.cdc.gov/vaccines/hcp/patient-ed/adults/index.html</a>	Resources for educating adult patients about vaccines Patient handouts, flyers, posters, cards, and video	Web site
CDC MMWR for immunizations	<a href="http://www.cdc.gov/vaccines/news/news-pubs.htm">http://www.cdc.gov/vaccines/news/news-pubs.htm</a>	Compilation of weekly morbidity and mortality reports on immunizations Includes disease trends and new recommendations by ACIP	Web site
CDC Mobile Activities	<a href="http://www.cdc.gov/mobile/mobileapp.html">http://www.cdc.gov/mobile/mobileapp.html</a>	Influenza activity and information apps MMWR app	Mobile app for iPhone products
Immunization Action Coalition (IAC)	For healthcare providers: <a href="http://www.immunize.org/">http://www.immunize.org/</a> For patients: <a href="http://www.vaccineinformation.org">http://www.vaccineinformation.org</a>	Patient handouts and vaccine information statements Clinic billing information Weekly e-mails with immunization updates	Web site and e-mail news service
American College of Physicians	<a href="http://immunization.acponline.org/app/">http://immunization.acponline.org/app/</a>	Free immunization advisor iPhone app Up-to-date adult immunization recommendations	Mobile app for the iPhone
Society of Teachers of Family Medicine	<a href="http://www.immunizationed.org/">http://www.immunizationed.org/</a>	Free app of Shots On-Line Up-to-date immunization schedules	Mobile app for iPhone and Android phones

reminders include the use of mail, telephone, or text messaging. Computerized reminders in the medical record and providing information and consent forms in waiting rooms and patient examination rooms facilitate the discussion of vaccine needs at each patient visit.<sup>16,41</sup> The ACIP and CDC endorse the use of standing orders in the healthcare provider's office. Finally, direct recommendations from the healthcare provider increase vaccination rates and are considered to be the strongest predictors of adult immunization utilization and success.<sup>41</sup>

## Conclusion

Immunizations are effective and safe and should be administered to adults with common chronic conditions including heart disease, lung disease, and diabetes. Many patients who present to their healthcare provider have one or a combination of these conditions. These patients represent populations that are the most vulnerable to preventable infections, and efforts should be increased toward improving vaccine rates and compliance.

Development and research efforts surrounding vaccines are dynamic and updates occur frequently. Both the patient and healthcare provider should be aware of these changes with respect to disease prevention. Annually, the ACIP and CDC update their immunization recommendations and provide continuing medical education for healthcare providers on their web site. Table 2 provides information about up-to-date online and mobile application resources.

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