Vaccinations are most commonly associated with children, and physicians often think primarily of pediatric patients when asked about immunization schedules. There is good reason for this perception, because the majority of available vaccinations are recommended for use in the pediatric population. However, it is important to remember that not all preventable diseases occur exclusively in children. Many illnesses, disabilities, and deaths that occur in adults could be prevented by immunizations, and there are vaccines recommended for young adults, middle-aged people, and elderly individuals. The adult immunization schedule currently recommended by the Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC) lists 10 vaccines for 14 infectious diseases in adults aged 19 years or older (Figure).\(^1\) Of these vaccines, the focus of the present article is on the measles, mumps, and rubella (MMR) vaccine, the varicella vaccine, and the herpes zoster vaccine.

Many adults assume that they received all of their necessary immunizations during childhood. This assumption does not take into account newer vaccines that were not available decades ago—or the possibility that some people were only partially immunized, such as by receiving only 1 vaccine in a 3-vaccine series. Also often overlooked are the facts that immunity to certain diseases can wane over time and that elderly individuals face increased susceptibility to disease as a result of immunosenescence. Measles, mumps, rubella, varicella (ie, chickenpox), and herpes zoster (ie, shingles) are all preventable illnesses with dangerous complications that can affect adults and impact public health.\(^2\) Thus, it is crucial that healthcare providers be aware of the indications and importance of the available vaccinations against these diseases.

Measles, Mumps, and Rubella Vaccine

Measles is a highly contagious viral illness that, until recently, was virtually eradicated in the United States.\(^3\) The disease can be severe, with complications ranging from diarrhea and bronchopneumonia to subacute sclerosing panencephalitis and spontaneous abortion.\(^2\) Complications from measles are estimated to be fatal in 1 or 2 of every 1000 reported cases in the United States.\(^2\) Pneumonia and acute encephalitis are the complications that are the most common causes of measles-related deaths.\(^2\)

Before the measles vaccine became licensed for use in the United States in 1963, there was an average of 500,000 new cases of the illness reported every year in the nation.\(^2\) However, it is estimated that virtually all children in the United States acquired measles prior to the introduction of the vaccine.\(^2\) Since the vaccine became available, the reported incidence of measles in the United States has been reduced by 98%.\(^2\)

During the past 2 decades, however, outbreaks of measles have occurred in the United States. In the first 19 weeks of 2011, 118 cases of measles were reported in the United States—the highest number reported for that period since 1996.\(^3\) Of those 118 patients, 105 (89%) were unvaccinated and 53 (45%) were aged 20 years or older.\(^3\) The majority of the cases (89%)...
were associated with importations (ie, US residents traveling abroad and foreign visitors).3 Even if all transmission of measles is eliminated within the United States, cases of measles resulting from importations would continue to occur.3 It is for this reason that adults need to remain current with their MMR vaccinations, and physicians need to increase awareness of the risk of measles among their patients who travel abroad.

The CDC recommends MMR vaccination for all adults born after 1957 who do not have documentation of previously receiving 1 or more doses of the MMR vaccine.1 (People born before 1957 are generally considered to be immune against measles and mumps.) Exceptions to this recommendation include individuals who have medical contraindications to the vaccine, laboratory evidence of immunity to all 3 diseases, or documentation of provider-diagnosed measles or mumps.1

The CDC recommends that adults receive a second dose of the MMR vaccine at least 28 days after the first dose if any of the following conditions apply to them: they have recently been exposed to the measles or mumps virus or live in a setting at risk for outbreaks; they are students in a postsecondary educational institution; they plan to travel internationally; or they work in a healthcare facility.1 In addition, anyone who has been vaccinated with an inactivated (ie, killed virus) vaccine, or an unknown type of vaccine, for measles or mumps should be revaccinated with 2 doses of the MMR vaccine.1

Immunity to rubella should be determined for all women of child-bearing age.1 If women who are not pregnant show no evidence of immunity to rubella, they should be immunized with the MMR vaccine.1 Pregnant women who show no evidence of immunity to rubella should receive the MMR vaccine upon completion or termination of the pregnancy and before discharge from the healthcare facility.1

Varicella-Zoster Virus

The varicella-zoster virus (VZV) causes a preventable infection that affects both children and adults, and it can lead to substantial morbidity and mortality. Varicella is the result of a primary infection with VZV. Like other members of the herpesvirus group, VZV can persist in the sensory nerve ganglia as a latent infection after the primary infection.4 Herpes zoster is the result of reactivation of the virus.

Both varicella and herpes zoster can occur in adults and cause potentially dangerous sequelae. Severe complications of VZV infection may include bacterial pneumonia, necrotizing fasciitis, osteomyelitis, septic arthritis, septicemia, and toxic shock syndrome.4,5 Other complications caused by VZV include bleeding problems, cerebellar ataxia, encephalitis, and viral pneumonia.5 Compared with children, adolescents and adults are at increased risk of severe complications from varicella and the development of herpes zoster.4 All adults should stay up-to-date with immunizations against VZV. Two vaccines against VZV are available—varicella virus vaccine live (Varivax; Merck & Co Inc, Whitehouse Station, New Jersey), to prevent varicella; and zoster vaccine live (Zostavax; Merck & Co Inc), to protect against herpes zoster.4,6 The concentration of attenuated varicella virus in the herpes zoster vaccine is 14 times that in the varicella vaccine.4 The herpes zoster vaccine cannot be used in children and cannot be used in place of varicella vaccine.6 Similarly, the varicella vaccine cannot be used in place of the herpes zoster vaccine.6

Varicella Vaccine

The indications for the varicella vaccine include all adults who do not show evidence of immunity to varicella, unless they have a medical contraindication (eg, allergic reaction to a vaccine component, severe immunodeficiency, current pregnancy).1 Evidence of immunity to VZV in adults can be demonstrated in a number of ways, including documen-

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### Table: 2011 Adult Immunization Schedule

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Age Group, y</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza</td>
<td></td>
<td>1 dose annually</td>
</tr>
<tr>
<td>Tetanus, diphtheria, pertussis</td>
<td></td>
<td>Substitute 1-time dose of Tdap for Td booster; then boost with Td every 10 years</td>
</tr>
<tr>
<td>Varicella</td>
<td>2 doses</td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus</td>
<td>3 doses (women)</td>
<td></td>
</tr>
<tr>
<td>Zoster</td>
<td>1 dose*</td>
<td></td>
</tr>
<tr>
<td>Measles, mumps, rubella (MMR)</td>
<td>1 or 2 doses</td>
<td>1 dose*</td>
</tr>
<tr>
<td>Pneumococcal (polysaccharide)</td>
<td>1 or 2 doses*</td>
<td>1 dose*</td>
</tr>
<tr>
<td>Meningococcal</td>
<td>1 or more doses*</td>
<td></td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>2 doses*</td>
<td></td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>3 doses*</td>
<td></td>
</tr>
</tbody>
</table>

*Recommended if some other risk factor is present.

**Figure.** The 2011 adult immunization schedule, by vaccine and age group, as recommended by the Committee on Immunization Practices of the Centers for Disease Control and Prevention.1
tion of 2 doses of varicella vaccine at least 4 weeks apart; evidence of a history of varicella or herpes zoster based on diagnosis or verification by a healthcare provider; and laboratory confirmation of the diseases or protective titers. Anyone born in the United States before 1980 is assumed to have immunity to varicella-zoster infection.

Groups for whom varicella vaccination is especially important because of high risk for exposure, transmission, or severe disease include the following: healthcare personnel; family contacts of people with immunocompromising conditions; teachers at and employees of childcare institutions; residents and staff of correctional institutions; college students; military personnel; nonpregnant women of childbearing age; adults and adolescents living with children; and international travelers. As with the MMR vaccine, pregnant women who have no evidence of immunity to VZV should receive the varicella vaccine on completion or termination of pregnancy and before discharge from the healthcare facility.

**Herpes Zoster Vaccine**

The indications for the herpes zoster vaccine are different than those for the varicella vaccine. A single dose of the herpes zoster vaccine is recommended for all adults aged 60 years or older, regardless of whether they report previous episodes of herpes zoster. Herpes zoster occurs most commonly in people aged 50 years or older and in individuals who are immunosuppressed (whether from illness or medications). Clinical trials have shown that the herpes zoster vaccine reduces the risk of herpes zoster by about 51% and the risk of postherpetic neuralgia by about 67%. It is important to note that this vaccine cannot be used as treatment for patients with active cases of herpes zoster, and it will not alter the course of concurrent postherpetic neuralgia. Although the vaccine has been found to be most effective in people aged 60 to 69 years, it also provides some protection in older individuals. Research suggests that the protective effects of the herpes zoster vaccine persist for at least 6 years, although the effects may last longer. Ongoing studies are being conducted to determine more accurately the length of time that the vaccine protects against herpes zoster.

Similar to the MMR and varicella vaccines, the herpes zoster vaccine is contraindicated in individuals who have had an adverse reaction to components of the vaccine; in pregnant women; and in patients who have blood cancers or human immunodeficiency virus or who are taking medications that weaken the immune system (eg, chemotherapy agents, steroids).

**Conclusion**

Healthcare professionals should be familiar with the MMR, varicella, and herpes zoster vaccines, including their indications and contraindications and their benefits in regard to disease burden and public health. Healthcare professionals should also educate their patients about the benefits of vaccination. With appropriate use, these vaccines will help protect the public against transmission of dangerous and costly diseases.

**References**