What Immunizations Should I Offer to My Patients? A Primer on Adult Immunizations

Heidi Roeber Rice*, Prathibha Varkey**

Abstract

Despite the cost-effectiveness and widespread availability of vaccines, vaccine-preventable diseases remain an important cause of morbidity and mortality worldwide. We present the indications, contraindications and administration of adult vaccinations, as well as the strategies for improving the rate of outpatient adult vaccination as an effective means of disease prevention. Although immunizations have altered the course of many infectious diseases worldwide, there is a significant chasm in what we know is best for our patients versus what reaches our patients. A greater emphasis is needed for vaccination of adults, especially in primary care and public health settings as well as in special populations such as the pregnant, elderly or immunosuppressed.

Introduction

As one of the most effective Public Health interventions, vaccine use entered common practice in the 1940s with the introduction of a vaccine for diphtheria and tetanus. Despite the cost-effectiveness and widespread availability of vaccines, vaccine-preventable diseases remain an important cause of morbidity and mortality worldwide. For example, in the United States, 50,000 to 70,000 deaths occur each year due to vaccine preventable diseases (VPD)—99% of these in adults. By means of this article, we review the principles behind adult vaccination, recommended schedules, contraindications and precautions based on the Advisory Committee on Immunization Practices (ACIP).

Toxoid Vaccines

Tetanus and Diphtheria

A primary vaccination series for tetanus and diphtheria consists of 3 doses: the first two doses at least four weeks apart and the third dose 6 to 12 months after the second. One of the three doses in the series should be Tdap (tetanus-diphtheria-acellular pertussis), withTd (tetanus-diphtheria) used for the other two doses. An adult with uncertain history of complete primary vaccination series should begin or complete the series as necessary. A booster dose of Tdap or Td is administered to adults who have completed the primary series and the last vaccination was greater than 10 years previously. Table 1 summarizes the recommendations for tetanus boosters in the setting of wound management. Of note, the diphtheria-tetanus-pertussis (DTP) preparation which is often used for children should not be used for adult immunization. Also important to note is that the Tdap vaccine is not licensed for use among adults aged 65 and older.

Vaccination is nearly 100% and 95% effective in preventing tetanus and diphtheria respectively. A history of neurologic reactions or immediate hypersensitivity reactions to the vaccine or its components are contraindications to receive the vaccine. Adverse effects associated with the vaccines tend to increase with the number of doses administered. Headache, pain, tenderness, swelling and erythema at the injection site are commonly reported. Although pregnancy is not a contraindication to receiving Tdap, limited data does not address the safety of Tdap during pregnancy. ACIP recommends that routine booster vaccination be deferred until the immediate postpartum period when Tdap is recommended. When indicated, Td may be administered during pregnancy for protection against tetanus and diphtheria.

Bacterial Vaccines

Pertussis

Pertussis (whooping cough) is an infectious disease caused by Bordetella pertussis which results in substantial morbidity among adults. Pertussis cases have increased dramatically in the United States, increasing from approximately 1000 cases in 1976 to nearly 26,000 cases in 2004. Most of these cases have been in adults and inadequate immunization and waning immunity have been proposed as causative factors.

The indications, contraindications, and schedules are as discussed in the prior section of tetanus and diphtheria vaccinations.

Meningococcus

Meningococcal meningitis due to Neisseria meningitidis has a case fatality rate of 10 -14% with survivors at risk for the development of long term sequelae including deafness, limb loss and neurological deficit. The vaccine is administered as a single dose polysaccharide vaccine (MPSV4 or Menomune) or quadrivalent conjugate (MCV4 or Menactra).
Routine vaccination is recommended for college freshmen living in dormitories, microbiologists who may be occupationally exposed, military personnel, those with asplenia, terminal complement component deficiency and travelers to a country with an outbreak of meningococcal disease. The vaccine is administered subcutaneously as a single dose.

Adverse reactions are mild and infrequent and consist principally of localized erythema. The MCV4 vaccination has been linked to Guillain-Barre Syndrome (GBS); therefore this vaccine carries a precaution for those patients with a prior history of neurologic issues. Alternatively, MPSV4 may be administered.

In an individual at ongoing risk for meningococcal disease who previously received the MPSV4, revaccination is recommended in 3 years with MCV4. It is uncertain if additional booster doses are needed, however they are not recommended at this time.

Pneumococcus

Streptococcus pneumoniae is responsible for 500,000 cases of pneumonia and 3,000 cases of meningitis, which result in nearly 40,000 deaths annually in the United States. Rates of complication and mortality are highest among the elderly and younger adults with chronic illness. The current vaccine contains a purified capsular polysaccharide of 23 serotypes responsible for 90% of the bacteremic pneumococcal infections in the United States and has demonstrated 60-70% efficacy against invasive disease.

Vaccination is indicated in adults of age 65 and older, immunocompromised adults and those with chronic illnesses such as chronic cardiovascular or pulmonary disease (excluding asthma), chronic renal disease, diabetes, alcoholism or cerebrospinal fluid leak. Individuals with functional or anatomic asplenia are also included, and in the event of elective splenectomy, vaccination is recommended two weeks prior to surgery.

It is not known how long immunity persists, therefore revaccination is recommended in 5 years for persons at highest risk of pneumococcal infections (eg. Asplenia, chronic renal failure, nephrotic syndrome or other immunosuppressed conditions) with booster if primary vaccination was received before the age of 65. At this time, the need for further booster doses remains unclear and is not recommended.

Contraindications to the pneumococcal vaccine include previous anaphylactic reaction to the vaccine or its components. Injections of the pneumococcal vaccine are usually well tolerated, with the most common side effects reported being redness and tenderness at the vaccination site, occurring at rates up to 50%. These generally resolve over a 48 hour period.

Inactivated Virus Vaccines

Hepatitis A

Hepatitis A virus (HAV) is the most common cause of acute viral hepatitis. The vaccine is highly effective, with a single dose inducing protective antibody level in approximately 4 weeks. To achieve long-lasting immunity, a second dose is recommended at 6-12 months and seroconversion will occur in nearly 100% of recipients upon receiving the second dose.

Medical indications for Hepatitis A vaccination include men who have sex with men, recipients of clotting factor concentrates, users of illegal drugs, persons with chronic liver disease, persons working with HAV in a research or animal laboratory setting, individuals traveling to or working in countries where HAV is endemic or any person seeking protection from HAV infection.

Previously, acute exposure to HAV necessitated administration of immune globulin. However, a single dose of hepatitis A vaccine is now the preferred postexposure prophylaxis (PEP) for adults aged 40 years or younger. Over the age of 40, immune globulin remains the preferred PEP, but the vaccine is also acceptable. For healthy individuals traveling to endemic areas with inadequate time to complete the series, a single dose of vaccine is considered sufficient, with a second dose at the recommended interval to complete the series and no immune-globulin is required.

Contraindications to vaccination include a severe allergic reaction such as anaphylaxis after a previous vaccine dose or to a vaccine component. Mild illness is not a contraindication, but precaution is recommended in the case of moderate or severe illness and pregnant patients as safety during pregnancy has not yet been determined.

Few adverse effects are reported with HAV vaccination; pain and tenderness at the injection site, as well as headache and diarrhea are adverse effects that have been reported.

Hepatitis B

The Hepatitis B virus (HBV) is a blood-borne pathogen with a lifetime risk of infection in the United States of 5%. More than 90% of those affected are 20 years of age or older. Of the 150,000 cases which occur annually in the United States, 5% to 10% will become carriers with the risk of developing chronic active hepatitis. Most of the deaths associated with HBV infection are due to hepatocellular carcinoma, placing HBV infection as the second leading cause of cancer worldwide.

The HBV vaccine presently used is a yeast recombinant vaccine, with a normal primary series of 3 doses at 0,1 and 6 months. More than 90% of healthy adults will develop immunity upon completion of the vaccine series. Actual sero-conversion rates, however, decrease substantially with age. For immunocompetent adults, revaccination is generally not recommended. Periodic serologic testing may, however, be valuable in those at very high risk of infection such as health care workers performing invasive procedures and dialysis patients. When antibody levels decline to less than 10 mIU/mL, a booster dose is recommended.

Indications for HBV vaccination include persons with end-stage renal disease, including those receiving dialysis, persons seeking evaluation or treatment for a sexually transmitted infection (STI) persons with HIV or chronic liver disease, healthcare personnel and public safety workers exposed to blood or body fluids, sexually active individuals who are not in a long-term, mutually monogamous relationship, IV drug users, men who have sex with men, clients and staff members of institutions for persons with developmental disabilities, international travelers, household contacts of infected individuals and any adult who seeks protection from HBV infection.

Contraindications to vaccination include a severe allergic reaction such as anaphylaxis after a previous vaccine dose or hypersensitivity to yeast. Mild illness is not a contraindication, but precaution is recommended in the case of moderate or severe illness. Precaution should also be taken when giving consideration to the vaccination of the pregnant patient as safety during pregnancy has not yet been determined. The side effect most commonly reported with HBV vaccination is mild, self-limited soreness at injection site.

There is a combined HAV and hepatitis B vaccine (Twinrix) which is administered in three doses at 0, 1, and 6 months. For travelers who need to depart in a shorter period, an alternate 4
dose schedule has been approved for administration on days 0, 7, and 21 with a final dose at 12 months.

**Human Papilloma Virus (HPV)**

It has been estimated that more than 50% of sexually active individuals in the United States are infected with HPV. A quadrivalent vaccine (Gardasil) was approved in 2006 and has demonstrated 100% effectiveness against infection with HPV strains 16 and 18, which are responsible for 70% of all cervical cancer cases. In addition, it was shown to be 99% effective against HPV strains 6 and 11 which are responsible for 90% of genital warts. Immune response and vaccine efficacy might be less in individuals who are immunocompromised. The HPV vaccination is recommended for all women ages 9 through 26 years of age, and ideally prior to sexual activity.

The HPV vaccine is given in a three dose series, at 0, 2 and 6 months. The primary contraindication to vaccination is anaphylaxis to yeast. Given the paucity of data in pregnancy, delay until completion of pregnancy is recommended at this time. Common side effects include fever, pain, erythema and pruritus at the injection site.

**Influenza**

Influenza illness may result in serious complications, and deaths due to influenza are responsible for the greatest number of deaths due to vaccine preventable disease (VPD) with approximately 90% of these occurring among adults age 65 and older. Among the elderly in nursing homes, vaccination against influenza may result in 30-40% reduction in the incidence of illness and be 80% effective in the prevention of influenza death.

The influenza vaccines contain one Type B and two Type A influenza strains considered likely to circulate in the influenza season. A single dose of the vaccine, ideally administered between October and November typically confers protection among 70 to 90% of healthy adults under the age of 65 years. Target populations for influenza vaccine are noted in Table 2. While concern has been raised regarding influenza vaccination and exacerbation of asthma symptoms, several studies present evidence to the contrary.

An intranasal preparation of live, attenuated vaccine (FluMist, MedImmune Vaccines) may be used for vaccination of healthy, non-pregnant adults less than 50 years of age who have no high-risk medical conditions and are not contacts of persons who are severely immunocompromised.

Side effects to the vaccine are generally mild such as localized tenderness and erythema. The injectable vaccine contains only noninfectious virus and is incapable of producing influenza infection. Contraindications include severe allergic reaction to eggs or sensitivity to thimerosal. Precaution is recommended when vaccinating individuals with moderate to severe acute illness, or persons with a history of Guillain-Barre syndrome (GBS) within 6 weeks of previous influenza immunization.

**Polio**

Successful vaccination since the mid-1950s has resulted in the eradication of polio from the Western Hemisphere. Occasional vaccine-associated cases of infection were reported after administration of live oral polio vaccine (OPV), hence only injectable polio vaccines (inactivated virus) are recommended for use in the United States. The current vaccine is more than 95% effective when properly administered. The vaccination of adults over the age of 18 years is not recommended unless the primary series has not been completed and the patient intends to travel to one of the few remaining areas where polio is considered to be endemic. For these individuals, a three dose primary series of injectable polio vaccine at 0, 1 and 6 to 12 months is recommended. For incomplete primary series, completion of the series should commence without restarting, regardless of the interval.

**Live Virus Vaccines**

**Measles, Mumps, Rubella (MMR)**

An estimated one million people die annually due to complications of measles. Mumps, which is rarely fatal, causes a bilateral parotitis or occasionally orchitis. A recent outbreak in 2006 caused nearly 6000 cases in the United States. Rubella, commonly known as German measles, generally results in mild disease including fever and rash. However, if infected during pregnancy, congenital rubella syndrome may result in fetal deafness, cataracts, cardiac anomalies and profound neurologic difficulty.

Adults born prior to 1957 are generally considered to be immune to measles and mumps, however individuals who may be at risk of exposure including travelers to endemic areas, healthcare and educational workers should consider revaccination or serologic testing to verify immunity. In an adult with no vaccination history, two doses of MMR are recommended, to be administered at least one month apart. Approximately 95% of recipients of the vaccine will develop immunity after a single dose of the vaccine.

The primary target of vaccination against rubella includes all women of childbearing age, healthcare workers and travelers to endemic areas. Contraindications to MMR vaccine include receipt of blood products or immune globulin within the preceding 3 to 12 months, pregnancy and allergy to neomycin or gelatin.

Common side effects include fever in up to 15% of vaccine recipients. Burning or stinging at the injection site is the most commonly noted side effect, although arthritis or joint swelling have occasionally been reported.

**Varicella**

Varicella zoster virus (VZV) susceptibility results in 3 million
infection. Complications of shingles include the development and elderly populations. shingles is caused by the varicella—
with the highest risk of severe disease in immunocompromised care workers.

The vaccine has been demonstrated to be 95% effective in the prevention of severe disease in adults, although breakthrough infections have been reported. These tend to result in mild illness, and generally noted only after intense exposure to wild virus. Adults with a reliable history of infection with chickenpox during childhood are considered immune. Additionally, adults with laboratory evidence and those who were born in the United States before 1980 (with the exception of healthcare workers and pregnant women) are also considered immune to varicella. For all adults without evidence of immunity to varicella, the vaccine (Varivax) is recommended.1 It is a live, attenuated vaccine which is administered in two doses, 4 to 8 weeks apart. In the event the second dose is delayed, the first dose should not be repeated and the second dose should be administered.

The vaccine is contraindicated in any individual with a previous anaphylactic reaction to this vaccine, pregnancy or possibility of pregnancy within 4 weeks, and any individuals who are immunosuppressed due to malignancy or HIV. Precaution is warranted if the patient has been a recipient of blood, plasma or immune globulin within the past 11 months, or if there is moderate or severe acute illness. In addition, if two or more live virus vaccines are to be administered (eg. FluMist, MMR or varicella) they should be given on the same day in different locations. If not administered on the same day, they must be spaced by at least 28 days.

Of the adverse effects noted among adults receiving their first and second doses, approximately 10% were reported to have increased oral temperature, with transient localized soreness, induration and erythema being more common. There is a risk of transmission from a recently immunized individual to a susceptible contact which is increased in the presence of a vaccine-associated rash. However, this low risk is thought to be outweighed by the benefit of vaccinating susceptible health care workers.

Zoster

Approximately one million cases of shingles occur annually, with the highest risk of severe disease in immunocompromised and elderly populations. Shingles is caused by the varicella-zoster virus (VZV) which occurs upon reactivation of latent virus infection. Complications of shingles include the development of postherpetic neuralgia (PHN) which is more commonly seen with increasing age and is estimated to occur in approximately 10% to 33% of cases.

A live attenuated zoster vaccine has been demonstrated to reduce the risk of zoster as well as PHN. The zoster vaccine is recommended in a single dose for adults age 60 and older, and at this time booster doses are not recommended. While the vaccine is safe for persons who have had a previous episode of zoster, the efficacy remains uncertain. Common adverse reactions noted at the injection site included erythema, pain and swelling.

Table 3: Vaccination of Elderly, Pregnant and immunocompromised Populations

<table>
<thead>
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<th>Population</th>
<th>Indications</th>
<th>Contraindications</th>
<th>Other Considerations</th>
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<tbody>
<tr>
<td>Elderly</td>
<td>Influenza</td>
<td>Influenza (LAIV) Tdap (&gt;65)</td>
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<tr>
<td></td>
<td>Pneumococcal</td>
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<tr>
<td></td>
<td>Zoster</td>
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<td>Pregnant</td>
<td>Td</td>
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<td>Influenza</td>
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<td>Immune Compromised (HIV+, severe immunosuppression, leukemia, lymphoma, generalized malignancy)</td>
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Immunization of Pregnant Women, Elderly and the Immunocompromised

Women of childbearing age represent a frequent missed opportunity to maximize the benefit of immunization and an important subset of the adult population to target. While several vaccines are contraindicated due to theoretical risk of fetal infection or lack of evidence, routine termination of pregnancy is not indicated for inadvertent administration of any vaccine during pregnancy.9 A summary of recommendations for vaccination in pregnant women, elderly and the immunocompromised is presented in Table 3.

Strategies for Increasing Immunization Rates in the Outpatient Practice Setting

Despite broad support of vaccination across professional medical organizations, vaccination of susceptible adults throughout the world remains suboptimal. The cost associated with vaccine preventable disease approaches $10 billion yearly.3 Strategies which have been proven to enhance the rate of adult immunization include practice-based systematic models, chart-based flow sheets, electronic medical record reminders, community partnerships and the creation of a culture of excellence.10 Additional recommendations which have been proposed target awareness campaigns to educate providers and the public about the importance of immunization. Funding and infrastructure development to increase the capacity of the health system must be required at local, regional and national levels to address the adults who do not receive the recommended vaccinations. Legislative efforts to expand and standardize adult immunization coverage by public and private insurance programs as well as adequate support for research of vaccines and VPDs to include surveillance have also been endorsed.11 As indicators of health care quality become more prominent in health care organizations, the promotion of patient immunization as a potential quality metric may serve to increase provider and organizational awareness of the importance of vaccination in VPDs.

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While vaccination programs to date have produced substantial achievements in the control of infectious disease, the continuing burden of VPD—particularly among adults—remains a public health issue of significance. A combined focus on the access to and reimbursement for vaccination services, enhanced systematic tracking as a means of quality assurance and awareness of public and providers alike present opportunities to reduce the morbidity and mortality associated with VPD worldwide.

References


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**8TH INTERNATIONAL CONFERENCE ON GERIATRIC CARE (GSICON - 2011)**

**NOVEMBER 5-6, 2011**

(Under the Aegis of Geriatric society of India)

**Venue:** Govt. Medical College and Guru Nanak Dev Hospital, Amritsar (Punjab), INDIA

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