Adult Immunization-A Guide to Safe Immunization Practices

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Objectives: Upon completion of this CNE article, the reader will be able to

1. List the recommendations for administration of the vaccines discussed in this article.
2. Describe the difference between live attenuated vaccines and those that are not live vaccines.
3. Discuss the complications that can occur after vaccine administration including local reactions, systemic reactions, anaphylaxis, and Guillain-Barre Syndrome.
4. Explain how to manage vaccine complications and what should be documented in the record and reported to the Vaccine Adverse Event Report System.

Adult Immunization

A Guide to Safe Immunization Practices

Appropriate vaccine administration is critical for vaccine effectiveness and safety. The information in this article is intended to supplement standards of practice for medication administration and manufacturers' product guidelines and is based on the Centers for Disease Control and Prevention's (CDC) Advisory Committee on Immunization Practices (ACIP). Many of the vaccines that will be discussed are administered to children or teenagers, some on a routine basis. However, this article will only discuss vaccination issues for adults. In addition, this article will not discuss the vaccines that are available exclusively for travel outside of the United States.

Available Adult Immunizations and Recommendations

Immunization recommendations for healthy adults in the United States are based on policies developed by the ACIP. ACIP statements and immunization information can be obtained from the CDC’s Immunization Hotline (at 1-800-232-2522) or downloaded from the CDC’s web site. The immunization recommendations for adults are categorized for ages 19 to 49, 50 to 64, and those 65 and older. The available adult vaccines discussed in this article are:

- Hepatitis A (HAV) – (Inactivated)
- Hepatitis B (HBV) – (Recombinant Developed Antigen – Not Live)
- Herpes Zoster – (Live Attenuated)
- Human Papillomavirus (HPV) – (Virus-like Particles – Not Live)
- Influenza – (Intramuscular is Inactivated / Nasal Spray is Live Attenuated)
- Meningococcal (Quadrivalent Polysaccharide – Not Live)
- Measles, Mumps, Rubella (MMR) (Live Attenuated)
- Pneumococcal (Polyvalent Polysaccharide – Not Live)
- Tetanus, Diphtheria, and Pertussis / Tdap (Not Live – See Below)
Varicella (Live Attenuated)

Hepatitis A Vaccine Recommendations:
- Persons with chronic liver disease and persons who receive clotting factor concentrates
- Men who have sex with men and persons who use illegal drugs
- Persons working with hepatitis A virus infected primates or with HAV in a research laboratory setting
- Persons traveling to or working in countries that have high or intermediate incidence of hepatitis A

Hepatitis B Vaccine Recommendations:
- Persons with end-stage renal disease, including those receiving hemodialysis
- Persons seeking evaluation or treatment for a sexually transmitted disease
- Persons with HIV infection
- Persons with chronic liver disease
- Persons who receive clotting factor concentrates
- Health-care workers and public-safety workers who are exposed to blood or other potentially infectious body fluids
- Sexually active persons who are not in a long-term, mutually monogamous relationship
- Users of illegal drugs
- Men who have sex with men
- Household contacts or sex partners of persons with chronic hepatitis B infection
- Clients and staff of institutions for persons with developmental disabilities

Herpes Zoster Vaccine Recommendations:
- People 60 years of age and older, including those that have had a previous episode of shingles.

Human Papillomavirus Vaccine Recommendations:
- Women aged < 26 years who have not completed the vaccine series
- Sexually active women who have not been infected with genotypes 6, 11, 16, or 18

Influenza Vaccine Recommendations:
- People 65 years of age and older
- Residents of long-term care facilities
- Persons with chronic medical conditions
- People who have long-term health problems with heart disease, kidney disease, lung disease, or metabolic disease
- People with certain conditions such as neuromuscular disorders that can cause breathing difficulties
- People with a weakened immune system due to HIV/AIDS or other diseases affecting the immune system
- Health-care workers and employees of long-term care and assisted living facilities
- Persons likely to transmit influenza to persons at high risk
- Women who will be pregnant during the influenza season

Meningococcal Vaccine Recommendations
- Adults with anatomic or functional asplenia, or terminal complement component deficiencies
- First-year college students living in dormitories
- Persons who travel to or live in countries in which meningococcal disease is epidemic
- It is important to note that the new vaccine is to be administered intramuscular; whereas prior formulations were administered subcutaneously

Measles, Mumps, Rubella (MMR) Vaccine Recommendations:
- Adults born during or after 1957 should receive 1 to 2 doses of the MMR vaccine unless they have a medical contraindication, have documentation of receiving the vaccine in the past, a history of measles, mumps, and rubella based on health-care provider diagnosis, or laboratory evidence of immunity.

**A second dose of MMR is recommended for adults who:**

- Have been recently exposed to measles or are in an outbreak setting
- Have been previously vaccinated with the killed measles vaccine
- Were vaccinated with an unknown type of measles vaccine during 1963-1967
- Students in postsecondary educational institutions
- Individuals that work in a health-care facility
- Individuals that plan to travel internationally

Adults born before 1957 are usually considered to be immune to measles and mumps.

**Rubella Vaccine Recommendations:**

- Women of childbearing age whose rubella vaccination history is unreliable or who lack laboratory evidence of immunity
- Women who do not have evidence of immunity upon completion of any pregnancy (term delivery, preterm delivery, miscarriage, termination, etc.) and before discharge from the health-care facility

**Tetanus, Diphtheria, and Acellular Pertussis (Td/Tdap) Vaccine Recommendations:**

- The vaccine contains tetanus toxoid, diphtheria toxoid, and acellular pertussis antigens (inactivated pertussis toxin and formaldehyde-treated filamentous hemagglutinin and pertactin proteins)
- Adults with uncertain histories of a complete primary vaccination series with diphtheria and tetanus toxoid containing vaccines
- A booster dose to adults who have completed a primary series and the last vaccination was received > 10 years previously
- Individuals who receive wound management care

**Varicella Vaccine Recommendations:**

- Adults without evidence of immunity to varicella
- Health-care workers and family contacts of immunocompromised persons
- Persons at high risk for exposure or transmission (e.g., teachers of young children; child care employees; residents and staff members of institutional settings – including correctional institutions; college students; military personnel; adolescents and adults living in households with children; non-pregnant women of childbearing age; and international travelers)

**Pneumococcal Polysaccharide Vaccine Recommendations:**

- People 65 years of age and older
- Anyone over 2 years of age who has a disease or condition that lowers the body's resistance to infection
- Alaska Natives and certain American Indian populations
- Residents of nursing homes or other long-term care facilities.
- Revaccination of persons aged > 65 years – a one-time revaccination is recommended if they were vaccinated > 5 years previously and were aged < 65 years at the time of the primary vaccination

**Types of Vaccines**

Live attenuated vaccines are created in laboratories by modifying the virulence of disease-causing microorganisms, such as viruses and bacteria. Once modified, the microorganism is still alive, but weakened, and is otherwise known as "attenuated". This means the microorganism can replicate in the body, but does not cause an illness. Live attenuated vaccines can include live viruses and live bacteria. Adverse reactions following live attenuated vaccines are similar to a mild form of the natural disease. The MMR and varicella vaccines are examples of attenuated vaccines.
Inactivated vaccines are made by killing disease-causing microorganisms. Whole dead microorganisms or pieces of dead microorganisms may be put into the vaccine. Because the microorganisms are dead, they cannot replicate nor cause an infection. Dead microorganisms have weaker antigens, so multiple doses of the vaccine may be needed to produce a good immune response. Adverse reactions following inactivated vaccines are often local, with or without a fever. The intramuscular influenza vaccine is an inactivated vaccine.

Other vaccine types that are considered inactivated (or not alive) are toxoid or component vaccines. Toxoid vaccines are made by treating toxins that are produced by bacteria with heat or chemicals (such as formaldehyde), in order to destroy their ability to cause illness. Therefore, toxoid material does not cause any disease, but still stimulates an immune response by the body. Tetanus and diphtheria vaccines are examples of toxoid vaccines. Component vaccines are made by using only parts of the virus or bacteria or proteins that are specific to that organism. These vaccines also do not cause disease, but again will stimulate the body's immune system to develop antibodies. Meningococcal and pneumococcal vaccines are component vaccines.

**Adverse Reactions**

Vaccines are intended to produce an antibody response to specific antigens that are found in certain viruses or bacteria. An adverse reaction is an untoward effect that occurs after a vaccination that is unrelated to the vaccine's primary purpose of producing immunity. All vaccines or vaccine components have the potential to cause an adverse reaction and are classified into three general categories: local, systemic, and anaphylactic.

Local reactions are usually the least severe and most frequent. Symptoms include soreness, pain, swelling, redness, and/or slight bruising at the injection site. Systemic reactions occur less frequently, but often result in the release of allergy mediators, particularly histamine, which causes capillaries to dilate. Symptoms can range from fever, to blood abnormalities (such as thrombocytopenia), to syncope, or to more significant problems, such as anaphylaxis and Guillain-Barre Syndrome.

Nearly every vaccine has been associated with soreness or pain at the injection site. Most have also been associated with fevers (usually low grade), headaches, and/or tiredness. Occasionally, some patients may develop a rash (most common with the MMR or varicella vaccines), generalized itching, or stomach discomfort associated with nausea, vomiting, or diarrhea.

Rarely, syncope or a vasovagal reaction can occur after vaccination, but this seems to be more common in adolescents and younger adults. During an 11-year period from 1991 through 2001, a total of 2,269 reports to the Vaccine Adverse Event Reporting system were coded as syncope.

- 40% of these episodes were reported among persons aged 10--18 years.
- Approximately 12% of the reported syncopal episodes resulted in hospitalization because of injury or medical evaluation.
- A published review of syncope after vaccination reported that 63% of syncopal episodes occurred < 5 minutes after vaccination, and 89% occurred within 15 minutes after vaccination.

Allergic reactions and Guillain-Barre Syndrome are the most severe, but fortunately are the least frequent. Allergic reactions will be discussed below. Guillain-Barre Syndrome is classified as an acute demyelinating polyneuropathy and about 3500 cases occur each year in the United States. The symptoms include muscle weakness that leads to paralysis combined with a mild sensory disturbance. Most patients will require hospitalization and about 25% will actually become intubated. The prognosis is usually good in that about 85% will make a complete or near complete recovery. Guillain-Barre Syndrome most often follows a viral infection (such as cytomegalovirus or Epstein-Barr virus) or a bacterial infection with Campylobacter jejuni.

Vaccine administration has been suggested as a potential cause for Guillain-Barre Syndrome, though most evaluations show no increased risk. In 1976 and 1977, there was a mass immunization performed in the United States for swine flu. In that span, approximately 500 Guillain-Barre Syndrome cases were reported. The reason why this developed for this vaccine was never discovered. Recently, there have been approximately 15 cases reported with the meningococcal vaccine. The CDC has analyzed these reports and has stated that further observation is needed. If the meningococcal vaccine does lead to an increase in Guillain-Barre Syndrome, the risk would only be slightly elevated above the naturally occurring baseline.
Allergic reactions can occur following the administration of a vaccine. Symptoms range from mild to severe anaphylaxis or anaphylactic-like responses (e.g., generalized urticaria or hives, wheezing, swelling of the mouth and throat, difficulty breathing, hypotension, tachycardia, and shock). These reactions can be caused by the vaccine antigens (the agents that produce the antibody response) or be caused by a variety of other ingredients that are related to or found within the vaccine itself, including:

- Stabilizers, such as hydrolyzed gelatin
- Preservatives, such as thimerosal
- Residual by-products from the production process
- Trace amounts of antibiotics such as neomycin sulfate
- Egg proteins

The allergic reactions can be local or systemic and can include mild to severe anaphylaxis or anaphylactic-like responses. Anaphylaxis usually begins within minutes of vaccine administration.

One of the most common protein allergens is egg protein, which is found in vaccines prepared by using chicken embryos (such as the influenza vaccine, as well as, the yellow fever vaccine). Ordinarily, persons who are able to eat eggs or egg products can safely receive these vaccines. Persons with a history of an allergy to eggs or egg proteins should not be administered these vaccines. In the past, it was recommended that persons with a serious egg allergy be skin tested prior to receiving the measles, mumps, and rubella vaccine; however, this is no longer needed. The rare allergic reaction seen after an MMR is not believed to be caused by egg antigens but rather to other components of the vaccine, such as gelatin. The varicella vaccine and rubella (as a single agent) vaccine are grown in human diploid cell cultures and can safely be administered to persons with a history of a severe egg allergy.

The measles, mumps, and rubella vaccines (individually or combined as the MMR) and the varicella vaccine contain hydrolyzed gelatin as a stabilizer. Caution should be exercised when administering these vaccines to persons who have a history of an anaphylactic reaction to gelatin or gelatin-containing products. The gelatin used in human vaccines is porcine (or derived from pigs).

Certain vaccines, such as the MMR and varicella vaccines, contain trace amounts of neomycin. Most often, a neomycin allergy is a contact dermatitis, rather than anaphylaxis. A delayed-type hypersensitivity reaction to neomycin is not a contraindication for administering these vaccines. However, persons who have experienced anaphylactic reactions to neomycin should not receive these vaccines.

Some vaccines contain a preservative called thimerosal. Thimerosal has been in use since the 1930’s as a preservative, but it contains 49.5% mercury. Mercury has been associated with neurotoxicity, especially in children. Thus, thimerosal has been removed from many vaccines, but it is still found in trace amounts in multidose vials. Like neomycin, the allergic response to thimerosal usually consists of a localized delayed-type hypersensitivity reaction. This type of reaction is not a contraindication to receipt of a vaccine that contains thimerosal. However, individuals that have had an anaphylactic reaction should avoid these immunizations.

Preventing Adverse Reactions

The key to preventing the majority of serious adverse reactions is screening. Clinicians who administer vaccines must screen recipients for contraindications and precautions to the vaccine before it is administered. At a minimum, the following information should be obtained:

- Vaccines previously received,
- Preexisting health conditions,
- Allergies and adverse events that occurred after previous vaccinations.

A vaccine is obviously contraindicated in cases of prior anaphylaxis to that vaccine or a component of that vaccine. Pregnancy and severe immunosuppression are contraindications to live attenuated vaccines. Any moderate or severe acute illness (with a fever) should result in a temporary delay in administration until the illness has resolved. Anyone for whom a vaccine administration is deferred because of a contraindication should be referred to their primary care
Available to clinicians are "Vaccine Information Statements" (VIS), developed by the Centers for Disease Control and Prevention. VISs provide a standardized format to present objective information about vaccine benefits and adverse events. Federal law actually mandates that a Vaccine Information Statement be provided when an immunization is administered. Healthcare professionals administering immunizations must:

1. Give the recipient time to read the VIS prior to the administration of the vaccine
2. Record in the patient's permanent medical record or in a permanent office log
   - the name and title of the individual who administers the vaccine,
   - the date of administration,
   - the vaccine name and manufacturer, and
   - the lot number of the vaccine used
3. Record on the recipient's record the publication date of the VIS – located on the bottom of the VIS

VISs are available by calling your state or local health department or can be downloaded from the Immunization Action Coalition's website at www.immunize.org/vis or at the CDC's website at www.cdc.gov/nip/publications/vis. Foreign language versions of VISs are not officially available from the CDC. However, several state health departments have arranged for their translations. These versions do not require CDC approval. There are more than 30 languages on the Immunization Action Coalition's website.

Managing Acute Vaccine Reactions:

The Centers for Disease Control and Prevention (CDC) issued a summary of vaccine-related adverse events reported in the United States from 1991 to 2001. The report identified the following:

- In approximately 11 years, more than 1.9 billion doses of human vaccines were given, and nearly 129,000 vaccine-related adverse events were reported. An incidence of about 1 in 15,000 administrations (0.000067%)
- Fever, rash, injection-site hypersensitivity and edema, and vasodilation were the most commonly reported reactions
- 14% of the reported reactions were serious adverse events including hospitalization or prolongation of hospitalization, life-threatening illness, permanent disability, or death.

Clinicians must encourage recipients to report any post-vaccination adverse event that occurs after they leave their primary care provider. Clinicians that administer vaccines must be aware of the signs and symptoms of a significant reaction and should know the appropriate procedures in managing a reaction when one occurs, especially an anaphylactic episode. Although syncopal episodes are uncommon and serious allergic reactions are even more rare, vaccination specialists recommend that recipients be observed for 15 to 20 minutes after being vaccinated.

For Localized Reactions, such as soreness, redness, bruising, or swelling at the injection site:

- Record specific observations (a photo can be obtained if desired)
- To minimize pain and swelling, a cold compress can be applied. Analgesic agents or anti-pruritic medication can be considered

For Systemic Reactions, such as extreme paleness, sweating, coldness of the hands and feet, nausea, light-headedness, dizziness, weakness, visual disturbances, or falling without loss of consciousness:

- Have the recipient sit or lie down or place their head between their knees for several minutes
- Loosen tight clothing and maintain an open airway
- Apply cool, damp cloths to the face and neck
- Observe the recipient until symptoms resolve and call for help if they do not recover immediately – call 911 if not in a hospital setting

For Anaphylactic Reactions, such as flushing, facial edema, urticaria, itching, swelling of the mouth or throat, wheezing, difficulty breathing, tachycardia or other signs of anaphylaxis:
• Place the recipient in a recumbent position with the legs elevated
• Maintain an airway
• Immediately call for help or call 911 if not in a hospital setting
• Administer aqueous epinephrine (1:1000), which can be repeated within 10 to 20 minutes. (A dose of diphenhydramine hydrochloride might shorten the reaction, but it will have little immediate effect.)

**Vaccine Adverse Event Reporting System**

Any post-vaccination adverse event(s) must be reported to the Vaccine Adverse Event Reporting System (VAERS) regardless of whether or not you believe the events are caused by the vaccine. This system was established in 1990 by the Department of Health & Human Services to provide a single entity for the collection and analysis of reports regarding adverse vaccine events in the United States. VAERS is operated by the CDC and the Food and Drug Administration (FDA). The primary objectives of VAERS are to:

1. detect new, unusual, or rare vaccine adverse events
2. monitor increases in known adverse events
3. determine patient risk factors for particular types of adverse events
4. identify vaccine lots with increased numbers or types of reported adverse events
5. assess the safety of newly licensed vaccines

**Adverse events following immunization occur even in the safest of programs. Causes of adverse events are classified under four categories:**

1. Program error: An error in vaccine preparation, handling, or administration, such as:
   - Giving too much vaccine in one dose caused by faults in vaccine administration, storage, or handling
   - Injecting the vaccine in the wrong place as per the recommendations, such as subcutaneous versus intramuscular
   - Not using sterilized syringes and needles for each injection
   - Using the wrong diluent or the wrong amount of diluent
   - Giving the wrong vaccine or other biological substance

2. Vaccine related errors: Events associated with the inherent properties of vaccines, such as:
   - rash or fever
   - serious allergic reactions, anaphylactic shock, etc.

3. Coincidental: Events occurring just after the vaccination that may have occurred whether or not the individual had been vaccinated or an event that happens after immunization but is not caused by the vaccine itself, such as anxiety.

4. Unknown: cause cannot be determined.

**Conclusion**

The World Health Organization estimates that about 12 billion injections are administered worldwide every year. Of these injections, about 20% are given for immunization, mostly by nurses, who are also responsible for the training and supervision of others. Nurses need to be at the forefront of immunization safety and be prepared to prevent and address adverse events that may occur.

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About the Author(s)

Colleen Symanski-Sanders, RN, Forensic Nurse Specialist, has been a Registered Nurse for over 18 years. She has extended her education into forensic nursing, criminal profiling, and psychopathy receiving a Certificate as a Forensic Nurse Specialist. She has over 16 years experience in public health and home care nursing.

Colleen has been an author of educational material for St. Petersburg College, St. Petersburg, Florida. She has also lectured on a variety of topics at numerous nursing symposiums and conferences across the country. She is on the Editorial Board for &quot;Home Health Aide Digest&quot; and &quot;Private Duty Homecare&quot; publications.