



A PHARMACY CONTINUING EDUCATION PROGRAM

W-F Professional Associates, Inc. 400 Lake Cook Rd., Suite 207 Deerfield, IL 60015 847-945-8050

June 2009 "Review of Immunizations & Common Vaccines" #707-000-09-006-H01-P



THIS MONTH
"Immunizations &
Vaccines"

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Common vaccinations and immunization schedules (combined) are topics that provide us as pharmacists with the perfect kinds of information that we can share with patients. It's requested, and it's important to provide counseling in this area. That's why we review it on a fairly regular basis. This lesson provides 1.25 hours (0.125 CEUs) of credit, and is intended for pharmacists in all practice settings. **The program ID # for this lesson is 707-000-09-006-H01-P. Pharmacists completing this lesson by June 30, 2012 may receive full credit.**

To obtain continuing education credit for this lesson, you must answer the questions on the quiz (70% correct required), and return the quiz. Should you score less than 70%, you will be asked to repeat the quiz. Computerized records are maintained for each participant.

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The objectives of this lesson are such that upon completion the participant will be able to:

1. Define "immunization."
2. Describe the functions of the immune system.
3. Differentiate between passive & active immunities.
4. Discuss the safety of common vaccines.
5. List & describe common diseases that can be prevented by immunization.

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BACKGROUND

Immunizations are intended to fortify the body's defense system against foreign pathogens. Immunization is the process by which this function is achieved. Over two hundred years ago, Edward Jenner observed that milkmaids who acquired cow pox rarely developed the dreaded and deadly smallpox. That led him to inoculate a person with cowpox, and he coined the term, "vaccination", (vacca, Latin for cow) for this procedure. Often the terms immunization and vaccination are used interchangeably. Protection of the body against an infectious disease is referred to as "immunity".

The immune system is actually a group of biological elements or processes that protects against diseases by recognizing and destroying many types of pathogens that range from viruses to cancer cells. While the immune system acts against the invasion of such agents, it should not have a detrimental effect on the organism's healthy cells or tissue. Pathogens can evolve and adapt themselves to the presence of the immune system by modifying themselves and creating favorable conditions to infect the host. However, human immune systems possess many defense mechanisms that consist of proteins, cells, organs or tissues. When the immune system becomes impaired, it results in life-threatening immunodeficiency disorders such as AIDS. On the other hand, if the immune system becomes hyperactive, it may invade the normal healthy body tissue in the same manner as the invasion of pathogens, causing autoimmune diseases such as rheumatoid arthritis, diabetes mellitus type I, and lupus erythematosus. The immune system can trigger a response with an immunological memory in which a pathogen is remembered by a specific antigen. Adaptive immune response is antigen-specific. Such specificity is preserved in the body by memory cells. The hematopoietic stem cells of the bone marrow produce lymphocytes called B cells and T cells, both of which possess molecules that recognize specific targets. Memory B cells and memory T cells are responsible for the quick response that is exhibited when a foreign molecule enters the body. When B cells and T cells become active, they replicate and produce an offspring that will become long-lived memory cells. These will remember, throughout the lifetime of a person, each specific pathogen that enters the body. Immunological memory can be **passive short-lived memory** or **active long-term memory**. Immunization can be either passive or active.

Passive short memory immunization is usually temporary and lasts for a few weeks or months. It is acquired when the B cells, and the antibodies that they manufacture, are transferred directly into the body of susceptible individuals. The short duration is due to the eventual breakdown of the antibodies after which immunity ceases to exist. Newborn infants have no exposure to the environment, and, thus, their bodies have not developed any immunity on their own. Therefore, they are vulnerable to infection. However, the mother provides passive protection to the fetus by supplying the IgE antibody directly via the placenta, especially during the last five weeks of pregnancy. Consequently, at birth the newborn has enough immune system elements until the body can produce its own antibodies and for defense against infections. This protection may last up to one year. In addition, breast milk is a good source of antibodies. The antibodies that provide temporary immunity to the newborn are passive in nature. Protective passive immunity can be transferred to children and adults by injecting serum that is enriched with antibodies. An antitoxin is a product produced in animals and contains antibodies against a specific disease. The antibodies are produced by the animal in response to injection of a specific biological toxin. Such antibodies are extracted from the animal's blood. For example, to boost the immune system against tetanus, a tetanus antitoxin is injected, resulting in neutralization of the toxin produced by the tetanus bacteria. Thus the patient will have a short-lived, artificially provided protective passive immunity.

Active immunity takes place when the immune system produces its own antibodies by activation of the B cells and T cells in order to protect against infection. This type of immunity can be achieved artificially by vaccination and immunization. The purpose of a vaccine is to introduce an antigen from the pathogen to stimulate the immune system to develop a specific immunity against the specific pathogen or microorganism without causing the disease associated with the pathogen. Active immunity is usually permanent. Thus, the difference between active and passive immunities is that passive immunity occurs when elements of the immune system (antibodies) are injected into the body, while active immunity takes place when the body itself produces these elements and guards itself against

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infection. For example, if a patient is infected with measles, the body's immune system will provide specific antibodies that destroy the measles organisms. These antibodies will remain in the body. Once the patient recovers from the infection, the next exposure to measles will trigger the already present antibodies and primed immune system to attack and destroy the microorganisms before causing the disease. A second bout with measles will not occur. The prolonged protection produced after immunization is termed immunologic memory. Once an immune system encounters an antigen or pathogen, memory B cells will remain in circulation for many years or for a lifetime. Following contact with an antigen, these cells respond rapidly by providing the antibodies for the needed protection.

IMMUNIZATION

Immunizations are administered to the young and old. Adults require all childhood vaccinations, and continue receiving these recommended for adults later on in life. Presently in the U.S., university or college students are required to be immunized against certain diseases prior to admission.

A vaccine is a biological preparation of an infectious microorganism, or some part thereof, administered to induce immunity, and thus protection from the disease. They are of two major classes: **live attenuated (weakened) vaccine** and **inactivated (killed) vaccine**.

Live Attenuated Vaccine: Live attenuated vaccine contains living, but weakened, virus or bacteria. These microorganisms are weakened in the laboratory usually by repeated culturing that results in disabling their virulence. When administered to a recipient, live attenuated vaccine must multiply within the body in order to stimulate an immune response and produce antibodies. The dose of a given virus or bacteria usually is large enough to cause immune response, but not to result in the disease. Destruction of the live microorganism as well as interference with their growth in the body can result in rendering the vaccine ineffective (vaccination failure). Normally, the live attenuated vaccine does not cause the disease, but occasionally, it may result in a mild case. When live attenuated vaccine is given, it produces an immune response similar to that caused by the actual virus or bacteria. Individuals who suffer from diseases such as leukemia, HIV, or are taking anticancer drugs or immunosuppressive agents or are undergoing radiotherapy, may experience severe adverse effects. Such adverse effects may occur because the immune system may be unable to control the growth of the live attenuated microorganisms. Viral, live, attenuated vaccines are available for measles, mumps, rubella, polio, yellow fever, and varicella. Bacterial, live attenuated vaccine is available for tuberculosis (BCG) made of the non-contagious strain.

Inactivated (killed) Vaccine: Inactivated vaccines contain previously virulent microorganisms that have been killed by heat or chemicals.

The microorganisms are allowed to grow in a culture medium, after which they are destroyed either by heat or chemical agents, such as formalin. Fractional inactivated vaccine is achieved by further treating it to extract the components to be included in the vaccine. Unlike the live attenuated vaccine, inactivated vaccines neither multiply in the body nor cause infection, even in immunodeficient individuals. Additionally, these vaccines are not neutralized by circulating antibodies. While live attenuated vaccine can stimulate the immune system following one dose, inactivated vaccine may require two or three more doses. Some inactivated vaccines may require periodic injections in order to boost the antibody titer, which decreases after a certain length of time. Polio, rabies, hepatitis A, pertussis, cholera, plague, flu, and the Lyme disease vaccines are examples.

Toxoids, such as those for diphtheria, tetanus, and botulism, are inactivated toxic compounds of the microorganisms.

Conjugate polysaccharide vaccine is more potent than polysaccharide vaccine due to a chemical linkage with a protein.

Polysaccharide vaccine consists of the pure cell wall of certain bacteria. Polysaccharide vaccines are available for pneumococcal disease, meningococcal disease and *Haemophilus influenzae* type b. Conjugate polysaccharide is available in pneumococcal disease and *H. influenzae* type b. Recombinant vaccines such as for Hepatitis B vaccine is prepared by introducing a portion of the hepatitis B virus gene into the gene of a yeast cell which will produce pure hepatitis B surface antigen.

VACCINE SAFETY

Like any medication, adverse reactions may occur following the administering of vaccines. For the most part they are safe and effective. The reactions may be **local, systemic or allergic** in nature.

Local reactions such as pain, swelling, and erythema at the site of injection are commonly encountered. These usually occur following the use of inactivated vaccines, especially those that contain adjuvants.

Systemic adverse reactions consist of fever, muscle pain, headache, weakness, rash and anorexia. These

are more common following vaccination with live attenuated vaccines that contain living microorganisms. The systemic symptoms are usually mild and occur after a certain incubation period characteristic of the natural disease.

Allergic reactions may be caused by the antigen itself, or some component of the vaccine such as preservatives, cell culture materials, or chemicals used to inhibit bacterial and viral multiplication. Vaccines propagated in embryonic eggs may cause hypersensitivity reactions including anaphylaxis, especially if large quantities of egg protein remain in the final product (e.g., yellow fever and influenza vaccines). Such vaccines are contraindicated in individuals who show allergic symptoms following the ingestion of eggs or egg products.

During pregnancy, vaccination with live attenuated vaccines should be avoided in order not to expose the fetus to infection. Inactivated vaccines may only be given, with caution, to expecting mothers, since the vaccines contain microorganisms. Individuals who are immunodeficient should not be given live attenuated vaccine, since there is no adequate defense mechanism that prevents the microorganisms especially viruses, from serious growth. Individuals with cancer, HIV, or who are receiving immunosuppressive agents or radiotherapy should not receive live attenuated vaccine. Inactivated vaccines may be given to immunosuppressed persons.

VACCINE EFFECTIVENESS

Vaccines may fail to provide complete protection in cases where:

- The patient's immune system does not have an adequate level of B cells to produce antibodies to the vaccine, or
- If the immunity has been diminished due to the intake of anti-inflammatory agents, or
- The presence of diseases such as HIV.

To enhance the immune response, adjuvants are included in the vaccine formulation. Aluminum adjuvants are commonly used, but squalene and phosphate adjuvants may be employed. Efficacy of a vaccine depends on:

- The disease,
- The strain of the vaccine,
- Compliance of the timetable to vaccination,
- Ability of the immune system to produce antibodies, and
- Genetic predispositions.

Even if the vaccine did not provide complete protection and the person becomes ill, usually the result is much milder than without vaccination.

VACCINATION SCHEDULE

To achieve the intended protection from infections, children should receive immunizations once their immune system is able to react to a vaccine. A booster injection may be required to achieve full immunity. For best results, vaccination schedules recommended by the Advisory Committee on Immunization Practices should be followed.

The Committee recommends routine vaccination of children against the following diseases:

Hepatitis A	Hepatitis B	Polio
Mumps	Measles	Rubella
Diphtheria	Pertussis	Tetanus
Chickenpox	Rotavirus	Influenza
Meningococcal	Infections	Pneumonia

However, due to the large number of administered vaccines and subsequent boosters for children up to age two, parents' compliance with childhood vaccination is not always adequate. To improve this, notification systems have been initiated along with the production of a number of combination injections such as pneumococcal conjugate vaccine and the MMR (measles, mumps, and rubella) vaccine. The decrease in number of cases of these diseases has led some parents erroneously to believe that they have been eradicated or they are not serious. This misconception often leads to noncompliance. It has been shown that when immunization rate declines, the diseases re-emerge, and the number of cases increase. Measles kills over 250,000 children annually. Outbreaks of measles, mumps, and rubella are encountered in areas where vaccination is not enforced. Combination vaccines are as safe and effective as scheduling one vaccine at a time.

In addition to the inoculations that children receive, there are certain vaccines or repeated injections that need to be administered to patients who missed vaccinations during childhood. These may include:

- Measles,
- Tetanus,
- Influenza and
- Pneumonia.

The human papillomavirus (HPV) vaccine is recommended for females from 11 to 25 years of age.

PREVENTABLE DISEASES

Even though a number of infections may occur during childhood, vaccination against such diseases will play a role in prevention of these from occurring later on in life. Once recovery is achieved, the child will usually develop immunity. These include:

Measles	German measles	Chickenpox
Mumps	Polio	Hepatitis
Smallpox	Influenza	Pertussis
Diphtheria	Meningococci	Pneumococci

All of these are contagious, and are transmitted either through tiny droplets that the infected individual releases following coughing and sneezing, or by direct contact.

Measles (Rubeola): Measles is a highly communicable, systemic infectious disease caused by paramyxovirus; the genus is *Morbillivirus*. Currently, measles is less common than it once was, mainly because of immunization. It is encountered primarily in school-age children, with outbreaks in winter and spring. Due to the acquired passive immunity that infants receive from their mothers, measles rarely affects infants who are six months of age and younger. Prior to 1963, measles affected 3 – 4 million children annually.

Onset of symptoms appears gradually after an incubation of 7 – 14 days. On the first and second day, the patient experiences fever, rhinitis, watering eyes, loss of appetite and dry cough. Koplik's spots appear two to four days later, usually on the buccal mucosa. The spots are usually white in color, raised in the center and surrounded by an inflammatory areola. In severe cases, the spots appear as a mottled erythema.

One or two days later, a characteristic rash appears, first on the forehead and below the ears, but spreads rapidly within 24 – 48 hours to the trunk and extremities. By day 5 or 6, the rash begins to subside, and the temperature declines, leaving a brown discoloration of the skin, followed by a desquamation.

Barring any complications, mortality rate of measles is low. About 30% of reported cases develop complications that may include encephalitis, pneumonia, otitis media, and diarrhea. Deaths caused by measles occur in approximately 1-2 per 1000 reported cases. About one in eight children who develop encephalitis die, and 50% will develop permanent CNS defects. The remainder will recover completely.

All children who have not been vaccinated previously should be inoculated at 12 months of age. Exposed susceptible children may be protected, if vaccination is administered within two days of the exposure. Measles immune serum globulin is effective in preventing measles, if injected after no more than five days following exposure. Administration of live attenuated vaccine will provide permanent immunity to the child. It produces an antibody response near that of the natural disease. A second dose of measles vaccine should be given at age 4 – 6 years of age.

German measles (Rubella): The name rubella is derived from the Latin word *rubellus*, meaning reddish. In 1814, it was recognized as a disease in the German medical literature. It is a contagious, acute, infectious disease that resembles both scarlet fever and measles. It is caused by an RNA virus.

Rubella is less contagious than measles, and the symptoms are much milder. The majority of infected patients experience symptoms no more troublesome than the common cold. About 30 to 50% of cases may be subclinical. Early symptoms may be slight or not apparent. The patient may experience slight fever, upper respiratory infection, and swollen glands behind the ears or around the neck. A rash, that is usually the first manifestation, appears on the second or third day. The rash is similar to that caused by measles, except it is less extensive.

Rubella may cause serious complications during pregnancy, especially in the first trimester. The virus may cause infection in the fetus, resulting in fetal damage, which occurs due to cell destruction and mitotic slowdown. Fetal anomalies such as deafness, cataracts, heart defects, mental retardation and microcephaly have occurred.

The main goal of rubella vaccination is to prevent congenital rubella syndrome. Vaccination of mothers immediately following delivery, and children between the ages of 15 months and puberty, is recommended.

Mumps: Mumps is an acute, contagious, generalized infection caused by paramyxovirus. It is characterized by painful inflammation and swelling of the salivary glands, especially the parotids. The virus can spread to other tissues of the body. Mumps can occur in epidemics, particularly in crowded locations, but the intensity of its communicability is less than measles and chicken pox. The disease may occur at any age, but it is encountered primarily among children 5 to 15 years of age. Normally, it does not affect children younger than two years old.

Following the incubation period, the patient may experience chilliness, malaise, headache, anorexia, pain below the ear, and low to moderate fever. Within one day, enlargement of one or both parotid glands occurs. The patient may complain of pain on swallowing acidic food. Swelling usually lasts from 5 to 7 days. Mumps may affect organs other than the salivary glands, particularly among adults. Orchitis (inflammation of the testes), pancreatitis, oophoritis (inflammation of the ovaries) and mastitis may occur. Live mumps virus vaccine should be used to provide

active immunity. Neither mumps immunoglobulin nor immune globulin is effective for postexposure prophylaxis. Mumps vaccine is very safe and is usually given in combination with measles and rubella vaccine (MMR).

Chickenpox (Varicella): Chickenpox is an acute, highly contagious, viral infection characterized by initial constitutional symptoms followed by an eruption that appears in crops and passes through stages of macules, papules, vesicles, and crusts. The disease is caused by varicella – zoster virus (VZV), which is a member of the herpes virus group that also causes herpes zoster (shingles). This virus is capable of remaining in the sensory nerve ganglia as a latent infection following recovery from the primary infection. The primary infection with VZV is manifested as chickenpox, whereas herpes zoster is the result of reactivation of the latent phase. It may occur at any age, but far less in adults than children. Susceptibility of children to chickenpox takes place following birth. However, some infants may acquire immunity from the mother for up to six months. The disease is believed to be transmitted through infected airborne droplets from the nose and throat that enter the respiratory tract and conjunctiva. The incubation period is 14 to 17 days.

The primary symptom of chickenpox is a macular eruption (rash). The appearance of the rash is preceded by moderate fever, malaise and headache, which occur 10 to 14 days following exposure. The rash is transformed within hours to fluid-filled vesicles that provoke itching. The vesicles appear in successive crops. The vesicles will burst and begin to crust within a few days. Mucous membranes may also be affected. The crusted lesions usually disappear within 20 days after onset. Chickenpox is considered a mild infection, but it can result in several complications. Due to the itching that the skin lesions provoke, and the scratching that follows, secondary streptococcal infection may lead to septicemia, or acute hemorrhagic nephritis. Staphylococci may invade the vesicles causing abscess formation. A post-chickenpox, secondary bacterial infection complication may include scarring or disfigurement, mainly on the face. In order to control itching, wet compresses may be applied to keep the vesicles clean. If the lesions become infected, application of an antiseptic is recommended. Systemic antibiotics may be used in the presence of staphylococcal or streptococcal infections.

Varicella zoster vaccine is a live attenuated viral vaccine. This vaccine was licensed in the United States in 1995. It is estimated that 97% of children 12 months to 12 years of age develop antibodies against chickenpox after receiving one dose of the vaccine. Approximately 90% of children maintain the antibody for six years. Other studies have shown that 97% of recipients of the vaccine have antibodies 7 to 10 years following vaccination. The acquired immunity is believed to be long lasting, and in most cases, permanent. However, it has been reported that about 1% of the vaccine recipients annually have developed mild cases of the disease.

Poliomyelitis: Poliomyelitis is an acute, highly contagious, viral infection that affects the gray matter of the spinal cord, and may result in paralysis. Poliovirus is an enterovirus that belongs to the family, picornoviridae. Humans are the only natural host for the disease. The infection is transmitted through the mouth (most via fecal-oral route), and replication occurs in the pharynx and the GI tract. The disease has pretty much ceased to exist in the U.S. due to vaccination.

After entering the GI tract, the virus invades the CNS. During the incubation period, which usually ranges from 7 to 12 days, the virus is present in the blood, throat and feces. Onset of symptoms is usually abrupt. Fever, severe headache, stiff neck and back, muscle pain and paresthesias may follow the initial symptoms. Progression of the infection will lead to loss of tendon reflexes and asymptomatic muscular weakness or paralysis. The extent of the paralysis depends on the degree of nerve involvement. A small group of muscles of one or all extremities may be involved. Death may occur, if the respiratory nerves are affected. Muscle atrophy and ultimate deformities, are the main complications.

Active immunization with live oral (Sabin) poliovirus vaccine (OPV) or inactivated (Salk) poliovirus vaccine (IPV) resulted in dramatic reduction in incidences of paralytic poliomyelitis. Until recently, the OPV was recommended. However, about one in 2.4 million OPV recipients actually contract polio. Therefore, IPV seems to be suggested more often—injections at:

- 2 months,
- 6 months,
- 6-18 months, and
- 4-6 years.

Hepatitis: Hepatitis is an inflammation of the liver caused primarily by virus Types A or B. Hepatitis A virus (HAV), formerly known as infectious hepatitis, is an enterovirus-like RNA agent. Humans are the only natural host. Transmission of HAV occurs through the mouth (oral-fecal) from person to person, between household contact or sex partners, or by intake of contaminated food or water. The virus is usually shed in the stool of infected persons. Once the virus enters the body, it replicates in the liver. The incubation period ranges from 15 to 50 days, but is usually about 30 days. Symptoms usually occur abruptly, and include fever, weakness, jaundice, anorexia, nausea, dark

brownish urine, abdominal disturbance and pale stool. The clinical signs gradually disappear within four to six weeks.

Inactivated whole virus hepatitis A vaccine is available for children and adults. About 95% of children and adolescents will show positive seropositivity after one month of the first dose. The vaccine is effective in the prevention of hepatitis A. Passive prophylaxis acquired by injecting immune globulin may provide immunity in clinically apparent HAV or to individuals traveling to endemic areas of the world.

Hepatitis B Virus (HBV) was formerly known as serum hepatitis because jaundice was observed in recipients of blood transfusions. This type of hepatitis is caused by a virus that contains antigenic components. The virus is associated with causing acute and chronic hepatitis, cirrhosis and hepatocellular carcinoma. The incubation period is from 45 to 160 days. The disease is transmitted by parenteral or mucosal exposure to body fluids of an individual that contains hepatitis B surface antigen (HBs Ag). The virus is usually present in highest concentration in the blood and the serous fluids, and in a lesser concentration in fluids such as saliva and semen. Saliva can transmit the disease through bites, but not as a result of kissing. Tears, sweat, urine, and stool do not act as transmission vehicles. Sexual contact, as well as the use of contaminated needles, are the most common routes of transmission.

The clinical course of HBV is similar to that of HAV. The initial symptoms are insidious and consist of weakness, appetite loss, nausea, vomiting, abdominal pain especially at the right upper quadrant, headache, and dark urine. These symptoms occur 3 to 10 days prior to the appearance of jaundice. Within one to three weeks, the person becomes jaundiced, the stool appears light or grey in color, and the patient complains of hepatic tenderness as a result of hepatomegaly.

The following has been approved by the Advisory Committee on Immunization Practices of the American Academy of Pediatrics. "All infants should receive the 1st dose of hepatitis B vaccine soon after birth and before hospital discharge; the first dose may also be given by 2 months if the infant's mother is HbsAG-negative. Only monovalent Hepatitis B vaccine may be used for the birth dose. Monovalent or combination vaccine containing HEP B may be used to complete the series; four doses of vaccine may be administered if combination vaccine is used. The second dose should be given at least 4 weeks after the first dose, except for Hib-containing vaccine which cannot be administered before age 6 weeks. The third dose should be given at least 16 weeks after the first dose and at least 8 weeks after the second dose. The last dose in the vaccination series (3rd or 4th) should not be administered before age 6 months."

Smallpox: Smallpox (variola) is an infectious disease caused by a virus. The virus is located in the skin's blood vessels, mouth and throat. It produces a maculopapular rash that turns into blisters. In the last 100 years, it was responsible for infecting 300 – 500 million people. Its main complications are severe scars on the face, blindness, corneal ulceration and death. At the present time the World Health Organization has certified eradication of smallpox, thanks to vaccination.

Influenza: Influenza is an infectious disease caused by RNA viruses of the family orthomyxoviridae and are capable of affecting birds and mammals. Symptoms include fever, headache, muscular pain, coughing and weakness. It often resembles the common cold but is much more severe. The main complication is pneumonia which can be fatal. It can occur in epidemics or pandemics. The most common vaccine against influenza is the trivalent influenza vaccine. It is safe for persons 6 months of age and older.

Pertussis (Whooping Cough): Pertussis is caused by the bacterium *Bordetella pertussis*. Even today, about half a million deaths occur annually worldwide. The incubation period is approximately ten days after which the infant experiences mild respiratory infection. Symptoms are characterized by coughing, sneezing, and running nose. The cough intensifies with a "whoop" sound. In the absence of complications, the cough gradually subsides over one to three months. The main complications of pertussis are pneumonia, encephalitis, and secondary bacterial infections. Teenagers should receive a booster in one injection that contains diphtheria-tetanus-acellular pertussis (dTap) vaccine. Children can be protected from 5 diseases by injecting a 5-in-1 vaccine: diphtheria, tetanus, pertussis, polio and Itib disease.

Diphtheria: Diphtheria is an upper respiratory infection caused by *Corynebacterium diphtheriae* that results in sore throat, fever, fatigue, nausea, vomiting, neck swelling, and sticky material on the tonsils, pharynx and nasal cavity. It may cause damage to the central and peripheral nervous systems leading to impairment of motor control. These symptoms and signs are due to the toxin released by microorganisms. The disease has been practically eradicated through vaccination. Boosters of the vaccine are recommended for adults.

Meningococci: Meningococcal disease is caused by *Neisseria meningitis* which may develop rapidly leading to illness and death. Children up to 5 years of age, and adults between the ages of 15 to 25 are most vulnerable. These microorganisms may cause infections of the fluid and membranes covering the brain and spinal cord (menin-

gitis), and infection in the blood stream (septicemia), both are life-threatening. Meningococcal vaccines are available for babies and young children of different ages.

Pneumococci: *Streptococcus pneumoniae* is the main cause of pneumonia, an inflammatory condition of the lungs that is characterized by abnormal alveolar filling with fluid, cough, chest pain, fever, and dyspnea. Pneumonia can also be caused by viruses, fungi or parasites. It occurs in all age groups and is a leading cause of death among the elderly and those who are suffering from chronic, terminal, or immunodeficient diseases. Vaccines against certain types of pneumonia are available. Children may be inoculated starting at the age of 2 months.

Human Papillomavirus (HPV): Human Papillomavirus is a common sexually transmitted disease (STD) and is contracted through any type of sexual activity. The virus exists in different types. HPV may cause cervical cancer. (See **CE PRN**[®] May 2009 lesson).

SUMMARY

Immunization is the process through which an individual becomes immune from pathogen invasion usually by means of administering a vaccine. Once the inoculation is complete, the vaccine will stimulate the immune system to produce antibodies that protect the body against infections. Ever since its inception, immunization has controlled or eliminated life threatening diseases that otherwise would have caused millions of deaths. Furthermore, these outcomes are achieved at a low cost and with a great deal of accessibility to the vulnerable populations.

REFERENCES

1. Pancer Z, and Cooper M, "The Evolution of Adaptive Immunity". *Annu. Rev. Immunol.*, 24: 497 (2006)
2. Abbas A, Murphy K, and Sher A, "Functional Diversity of Helper T Lymphocytes". *Nature*, 383:787 (2006)
3. Van der Perre P "Transfer of Antibody via Mother's Milk". *Vaccine*, 21: (2003)
4. Singh M., and O'Hagan D, "Advances in Vaccine Adjuvants". *Nat. Biotechnol.*, 17:4075 (1999)
5. Orenstein WA, Papania MJ, and Wharton ME, "Measles Elimination in the United States". *J. Infect. Dis.*, 189 suppl 1: S1-3 (2004)
6. Plotkin SA, "Vaccines: Past, Present and Future". *Nat Med* 11 (4 suppl): S5-11 (2005)

REMAINING TOPICS FOR 2009

Herbals	Hormone Replacement Therapy
Parkinson's Therapy	MRSA
Chronic Fatigue Syndrome & Fibromyalgia	

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LESSON EVALUATION

Please fill out this section as a means of evaluating this lesson. The information will aid us in improving future efforts. Either circle the appropriate evaluation answer, or rate the item from 1 to 7 (1 is the lowest rating; 7 is the highest).

1. Does the program meet the learning objectives?

Define "immunization"	Yes	No
Describe the functions of the immune system	Yes	No
Differentiate between passive & active immunities	Yes	No
Discuss the safety of common vaccines	Yes	No
List & describe common diseases that can be prevented by immunization	Yes	No

2. Was the program independent & non-commercial Yes No

Poor Average Excellent

3. Relevance of topic 1 2 3 4 5 6 7

4. What did you like most about this lesson? _____

5. What did you like least about this lesson? _____

Please Select the Most Correct Answer

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| <p>1. Which of these is incorrect?</p> <p>A. The immune system acts only against pathogens</p> <p>B. The immune system acts to protect the body only when it's hyperactive</p> <p>C. Pathogens can evolve & adapt themselves to presence of immune system</p> <p>D. Hematopoietic bone marrow stem cells produce B & T cells</p> <p>2. Passive immunity:</p> <p>A. Usually temporary</p> <p>B. Usually for life</p> <p>C. Provided upon birth by the body of the newborn</p> <p>D. Stimulated in presence of HIV</p> <p>3. Active immunity can be achieved by vaccination.</p> <p>A. True B. False</p> <p>4. Live attenuated vaccine must be administered in large doses.</p> <p>A. True</p> <p>B. False</p> <p>5. The inclusion of adjuvants in a vaccine will diminish its activity.</p> <p>A. True B. False</p> | <p>6. Pregnant women should be vaccinated only with attenuated vaccines.</p> <p>A. True B. False</p> <p>7. Conjugated polysaccharide vaccine:</p> <p>A. Is an inactivated toxic compound to the microorganism</p> <p>B. Is a recombinant vaccine</p> <p>C. Is ineffective</p> <p>D. Is more potent than regular polysaccharide vaccine</p> <p>8. Rubella is synonymous with:</p> <p>A. Measles</p> <p>B. Smallpox</p> <p>C. Mumps</p> <p>D. German measles</p> <p>9. Mumps is caused by:</p> <p>A. RNA virus</p> <p>B. Varicella-zoster virus</p> <p>C. Paramyxovirus</p> <p>D. Streptococci</p> <p>10. Human papillomavirus:</p> <p>A. Is sexually transmitted</p> <p>B. Often causes septicemia</p> <p>C. May cause convulsions due to high fever</p> <p>D. Is acquired via blood transfusions</p> |
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