

Immunity and Vaccinations

Course

Medical
Microbiology

Unit IV

The Immune
Response

Essential Question

How can we, as
a society,
prevent the
spread of
disease?

TEKS

130.207 (c)
3DF,4A, 5DFH

Prior Student Learning

Intro to
Microorganisms

Estimated time

3-4 hours
lecture
2-3 hours for
reinforcement
and enrichment
exercises

Rationale

The ability to develop immunity to diseases is a key factor in maintaining health and wellness.

Objectives

Upon completion of this lesson, the student will be able to

- Compare and contrast the difference between naturally acquired and artificially acquired immunity
- Communicate the importance of vaccinations for individual and community health

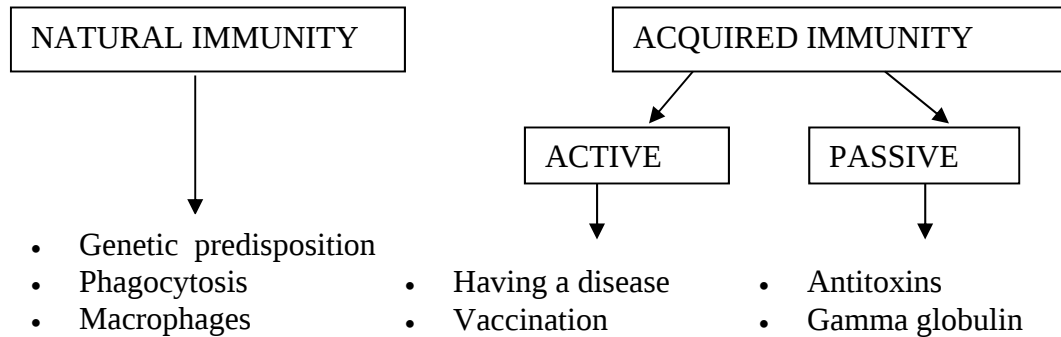
Engage

Show pictures of smallpox. Tell the students that the smallpox disease has virtually been eradicated because of the availability of vaccines. Explain that for today's youth the smallpox vaccine is not required because there has not been a case of smallpox documented in the US since 1946. This was accomplished by having people take the smallpox vaccine. (Smallpox article and pictures attached to lesson plan)

Key Points

- I. Immune System – the body's special defense response against foreign organisms.
 - A. The system includes
 1. Lymphoid organs
 - a. lymph nodes
 - b. spleen
 - c. thymus gland
 2. Their products
 - a. lymphocytes
 - b. antibodies
 3. Macrophages – phagocytes that are found in the blood, brain, liver, lymph nodes, and spleen
 - B. Immunity – the capacity to resist certain types of organisms and toxins (poisons) that will damage tissues and organs
 1. Natural (innate) immunity – one's own ability to fight off disease
 2. Acquired immunity – the body develops specific immunity (antibodies and cells) against invading agents such as lethal bacteria, viruses, toxins, and even foreign tissues from other organisms.
 - a. Acquired active immunity occurs in two ways:
 - i. By having a disease
 - ii. By receiving a vaccination containing a modified pathogen or

- toxin which stimulates production of antibodies
- b. Acquired passive immunity – the patient receives immune serum containing antibodies produced in another animal
 - i. Antitoxins
 - ii. Gamma globulin



- II. White Blood Cells (WBCs, leukocytes) – part of the immune system that help fight infection. They circulate in the blood and are transported to the area where an infection has developed.
- III. Granulocytes are white blood cells that have granules in their cytoplasm.
 - A. Neutrophil
 - 1. One of the body's main defenses against bacteria
 - 2. Kill bacteria by actually ingesting them (this is called phagocytosis)
 - B. Eosinophil – kill parasites and have a role in allergic reactions
 - C. Basophil
 - 1. Function in allergic reactions. They release:
 - a. Histamine – causes blood vessels to leak and attract WBCs
 - b. Heparin – prevents clotting in the infected area so that the WBCs can reach the bacteria
- IV. Agranulocytes are white blood cells that do not have granules in their cytoplasm and have a one lobed nucleus
 - A. Lymphocytes – complex cells that direct the body's immune system
 - 1. T-lymphocytes (T-cells) – they mature in the thymus and are responsible for cell-mediated immunity.
 - a. Helper T-cells – direct the rest of the immune system by releasing cytokines
 - b. Cytotoxic T-cells – release chemicals that break open and kill invading organisms
 - c. Memory T-cells – remain afterwards to help the immune system respond more quickly if the same organism is encountered again
 - d. Suppressor T-cells – suppress the immune response so that it

- does not get out of control and destroy normal cells once the immune response is no longer needed
- 2. B-lymphocytes – responsible for humoral immunity (antibody production)
- B. Monocytes – called “wandering cells” until they enter a tissue where they become “fixed” and turn into macrophages
 - 1. Destroy old, damaged, and dead cells in the body
 - 2. Macrophages are found in the liver, spleen, lungs, lymph nodes, skin, and intestine.
- V. Naturally Acquired Immunity
 - A. Active Immunity – Immunity may be acquired by exposure to a disease.
 - B. Antigen – a substance that triggers an antibody response
 - 1. Can be anything from bacteria to pollen; dust to drug; food to animal (usually a foreign substance, but does not have to be.)
 - 2. People are born with certain antigens. For example: depending on blood type, there are certain antigen sites (ag) on the Red Blood Cells (RBCs).
 - 3. An antigen does not produce an allergic reaction in all people, but in hypersensitive people the presence of an ag combined with an antibody (ab) provokes the release of histamine which forms the basis for all allergic symptoms.
 - C. Passive Immunity - Immunity may be acquired naturally by a fetus through the passage of antibodies from the mother through the placenta or through breast milk to a nursing infant.
 - 1. Antibodies come from an outside source.
 - 2. Antibodies are temporary (antibodies will protect for up to 6 months, or longer if the mother continues nursing).
- IV. Artificially Acquired Immunity
 - A. Vaccination or immunization – an agent is introduced into the body to stimulate antibody production.
 - 1. A vaccine is given by injection or orally, in liquid form. The use of inhalation by aerosol or powder is a needle-free alternative. Most vaccines contain a weakened or killed organism, or part of the pathogen. Other vaccines use inactivated toxins.
 - a. The body makes antibodies against the weakened or killed pathogens in the vaccine
 - b. These antibodies can fight the pathogens when they invade the body. The antibodies destroy them and the individual will not become ill. Vaccines do not cause full symptoms of the disease; they are designed to prevent diseases.
 - c. Protective antibodies stay on guard in the individual's body to safeguard it from the real disease.
 - d. After exposure to a live, weakened, or dead germ, the

antibodies or memory cells fight infectious diseases and usually stay in an individual's immune system for a lifetime. This protects a person from getting sick again. This protection is called immunity.

B. Vaccines

1. Live organisms – must be non-virulent for humans, or treated in the lab to weaken them so they are not as pathogenic to humans.
2. Attenuated – an organism that has been weakened
3. Killed vaccination with a toxoid occurs when the toxin produced by an organism is altered with heat or chemicals to render it harmless, but still allow the body to make antibodies against it.

VI. Examples of Vaccines

A. **Anthrax** – a serious disease that can affect both animals and humans

1. Caused by the bacteria, *Bacillus anthracis*
2. Contracted from infected animals, wool, meat, or hides
3. Most commonly causing skin disease, ulcers, fever, and fatigue
4. 20 % of the cases are fatal
5. Inhaled anthrax is more serious.
 - a. initial symptoms include sore throat, fever, and muscle aches
 - b. within a few days severe breathing problems develop, leading to shock and possibly meningitis
 - c. frequently fatal, despite antibiotic therapy
6. Anthrax vaccine
 - a. Protects against cutaneous and inhalation anthrax
 - b. individuals who should be vaccinated
 - i. people 18 – 65 year olds, potentially exposed to large amounts of the virus, such as laboratory workers
 - ii. military personnel at risk
 - c. consists of three doses
 - i. the 1st three doses are given at two week intervals
 - ii. three additional doses are given, one every six months after the previous dose
 - iii. annual booster doses are needed for ongoing protection
 - iv. may be given at the same time as other vaccines
 - d. Individuals who should not receive the vaccine
 - i. anyone who has a serious allergic reaction to a previous dose of the vaccine
 - ii. anyone who has recovered from cutaneous anthrax
 - iii. pregnant women
 - e. Possible side effects of vaccination
 - i. soreness, redness, or itching where the shot was given
 - ii. a lump where the shot was given
 - iii. muscle or joint aches
 - iv. headaches, fatigue, chills, fever, nausea

v. an allergic reaction

B. DPT – Diphtheria, Tetanus, and Pertussis – DtaP

1. Diphtheria – causes a thick covering on the back of the throat; can lead to breathing problems, paralysis, heart failure, and death
2. Tetanus (Lockjaw) – causes painful tightening of the muscles, usually all over the body, leading to “locking” of the jaw, so the victim cannot open his or her mouth or swallow. Tetanus leads to death in about 1 out of 10 cases.
3. Pertussis (Whooping Cough) – causes coughing spells so bad that it is hard for infants to eat, drink, or breathe; it can lead to pneumonia, seizures, brain damage, and death.
4. Children should receive 5 doses of the DTaP vaccine
5. Children who should not receive the DTaP
 - a. children who are moderately or severely ill should wait until they are well.
 - b. any child who has had a life threatening allergic reaction to a previous dose
 - c. any child who has suffered a brain or nervous system disease within 7 days of a previous dose
 - d. caution should be taken if the child has had a seizure or collapsed, cried nonstop for 3 hours or more after a dose, or had a fever of 105 degrees F after a dose.
 - e. should not be given to anyone 7 years old or older
 - f. booster shot (Td or Tap) –recommended at 11 – 12 years of age, and then every 10 years
6. Possible side effects of vaccination
 - a. fever, redness, or swelling at the injection site; fussiness, tiredness, poor appetite, or vomiting
 - b. more serious – seizures, nonstop crying, or high fever over 105 degrees F.
 - c. serious problems – serious allergic reaction, long-term seizures, coma, lowered consciousness, or permanent brain damage

- C. Haemophilus Influenza, Type b (Hib) Vaccine** – serious disease caused by bacteria. Hib is spread from person to person. If the bacteria remain in the nose and throat, the individual will not get sick. If it spreads to the lungs or blood stream, the Hib can be serious. Before the Hib vaccine, Hib disease was the leading cause of bacterial meningitis among children under 5 years old in the United States. Meningitis is an infection of the brain and spinal cord coverings which can lead to lasting brain damage and deafness. Hib disease can also cause
1. pneumonia
 2. severe swelling in the throat, making it hard to breathe
 3. infections of the blood, joints, bones, and covering of the heart

4. death
5. Who should get vaccinated?
 - a. Children should receive the dose at
 - i. 2 months of age
 - ii. 4 months of age
 - iii. 6 months of age, and
 - iv. 12 – 15 months of age
 - b. Older children or adults with special health conditions, including but not limited to
 - i. Sickle cell disease
 - ii. HIV/AIDS
 - iii. removal of the spleen, bone marrow transplant, or cancer treatment with drugs
 - c. Who should not get the vaccine or should wait?
 - i. individuals who have had a life-threatening allergic reaction to a previous dose of Hib vaccine
 - ii. children less than 6 weeks of age
 - iii. people who are moderately or severely ill at the time the shot is scheduled
 - d. Possible side effects of vaccination
 - i. redness, warmth, and swelling where the shot was given
 - ii. fever over 101 degrees F
 - iii. serious allergic reactions, including breathing difficulty, hoarseness or wheezing, hives, paleness, weakness, a fast heartbeat, or dizziness within a few minutes to a few hours after the shot

D. Hepatitis A vaccine – Hepatitis A is a serious disease caused by the hepatitis A virus (HAV). HAV is found in the stool of persons with hepatitis A. It is usually spread by close personal contact, and sometimes by eating food or drinking water contaminated with HAV. Hepatitis A can cause a mild flu-like illness, jaundice (yellow tint to the skin and/or eyes), and severe stomach pains and diarrhea.

1. Who should get vaccinated?
 - a. individuals 2 years of age and older traveling or working in countries with high rates of hepatitis A, such as those located in Central or South America, the Caribbean, Mexico, Asia (except Japan), Africa, and southern or eastern Europe. The vaccine series should be started at least one month before traveling.
 - b. individuals who live in communities that have prolonged outbreaks of hepatitis A
 - c. individuals who live in communities with high rates of hepatitis A: for example, American Indian, Alaska Native, and Pacific Islander communities, and some religious communities
 - d. men who have consensual, same gender sex
 - e. individuals who use street drugs

- f. individuals with chronic liver disease
- g. individuals receiving clotting factor concentrates
- 2. The vaccine should be given in two doses, at least 2 months apart.
 - a. it may be given at the same time as other vaccines
 - b. the doses may be given between the ages of 12 and 23 months
- 3. Who should not get the vaccine?
 - a. individuals who have had a serious allergic reaction to a previous dose of the vaccine
 - b. individuals who are moderately or severely ill at the time the vaccine is scheduled should wait
- 4. Risks and possible side effects of vaccination
 - a. soreness at the sight of injection, headache, loss of appetite, or tiredness
 - b. serious allergic reaction

E. Hepatitis B vaccine – Hepatitis B is a serious disease. The hepatitis B virus (HBV) can cause a short-term (acute) illness that leads to

- 1. Loss of appetite
- 2. Tiredness
- 3. Pain in the muscles, joints, and stomach
- 4. Diarrhea and vomiting
- 5. Jaundice (yellow tint to the skin and/or eyes)
- 6. It can also cause a long-term (chronic) illness that leads to
 - a. liver damage (cirrhosis)
 - b. liver cancer
 - c. death
- 7. About 1.25 million people in the U. S. have chronic HBV infection. Each year it is estimated that:
 - a. 80,000 people, mostly young adults, get infected with HBV
 - b. more than 11,000 people have to stay in the hospital because of Hepatitis B
 - c. 4,000 – 5,000 people die from hepatitis B
- 8. Hepatitis B vaccine can prevent hepatitis B. It is the first anti-cancer vaccine because it can prevent a form of liver cancer. Hepatitis B is spread through contact with the blood and bodily fluids of an infected person. A person can get infected in several ways, such as:
 - a. by having unprotected sex with an infected person
 - b. by sharing needles when injecting illegal drugs
 - c. by being stuck with a needle used on the job
 - d. during birth when the virus passes from an infected mother to her baby.
- 9. About 1/3 of people who are infected with hepatitis B in the United States don't know how they got it.
- 10. Who should get the vaccine?
 - a. everyone 18 years of age and younger

- b. adults over 18 who are at risk
 - i. people who have had more than one sex partner in 6 months
 - ii. men who have consensual, same gender sex
 - iii. sexual contact with infected people
 - iv. people who inject illegal drugs
 - v. healthcare and public safety workers who might be exposed to infected blood or bodily fluids
 - a) almost all healthcare facilities strongly encourage their employees to receive the Hepatitis B vaccine.
 - b) it is the law that all healthcare facilities offer this vaccine to their employees free of charge
 - vi. household contacts of persons with chronic HBV infection
 - vii. hemodialysis patients
- c. individuals should get 3 doses of hepatitis B vaccine
 - i. the second dose should be given at least 1 month after the first dose.
 - ii. the third dose should be given at least 2 months after the second dose, and at least 4 months after the first.
 - iii. the third dose should not be given to infants under 6 months of age.
 - iv. the vaccine may be given at the same time as other vaccines.

11. Who should not get the vaccine?

- a. individuals who have had a life-threatening allergic reaction to baker's yeast or a previous dose of the vaccine
- b. individuals who are moderately or severely ill at the time the shot is scheduled should wait.

12. Risks and possible side effects

- a. soreness where the shot was given, lasting a day or two
- b. mild to moderate fever
- c. serious allergic reaction

F. Influenza vaccine – Influenza is caused by a virus that spreads from infected persons to the nose or throat of others. The “influenza season” in the U.S. is from November through April each year. Influenza can cause fever, cough, chills, sore throat, headache, and muscle aches. People of any age can get influenza. Most people are ill with influenza for only a few days, but some get much sicker and need to be hospitalized. Influenza causes thousands of deaths each year, mostly among the elderly. Influenza viruses change often. Therefore, the influenza vaccine is updated each year to make sure it is as effective as possible. Protection develops about 2 weeks after getting the shot and may last up to a year.

1. Who should get the influenza vaccine?

- a. individuals 50 years of age or older.

- b. school-aged children
- c. residents of long-term care facilities housing persons with chronic medical conditions
- d. anyone who has a serious long-term health problem with
 - i. heart disease
 - ii. lung disease
 - iii. asthma
 - iv. kidney disease
 - v. metabolic disease such as diabetes
 - vi. anemia and other blood disorders
- e. anyone whose immune system is weakened because of
 - i. HIV/AIDS, or other diseases that affect the immune system
 - ii. long-term treatment with drugs such as steroids
 - iii. cancer treatment with x-rays or drugs
- f. anyone 6 months to 18 years of age on long-term aspirin treatment
- g. women who will be past the 3rd month of pregnancy during the influenza season
- h. physicians, nurses, family members, or anyone else coming into close contact with people at risk of serious influenza
- i. people who provide essential community services
- j. people traveling to the Southern Hemisphere between April and September, or to the Tropics at any time
- k. people living in dormitories or other crowded conditions
- l. anyone who wants to reduce their chance of catching influenza
- m. when should an individual get vaccinated?
October or November, yearly
- n. individuals who should not get the vaccine or who should wait
 - i. anyone who has ever had a serious allergic reaction to eggs or a previous dose of the vaccine
 - ii. a history of Guillain-Barre Syndrome
 - iii. anyone with a fever, or who is seriously ill at the time, should wait until recovered
- o. risks and possible side effects
 - i. soreness, redness, or swelling at the injection site
 - ii. fever
 - iii. aches
 - iv. allergic reaction
 - v. Guillain-Barre Syndrome (risk is 1 or 2 cases per million persons vaccinated)

G. Lyme Disease Vaccine – Lyme Disease is caused by an infection from being bitten by an infected tick. A common sign of Lyme disease is a round, red, expanding rash 2 inches or more in diameter, which

appears between 3 days and a month after the tick bite. Fever, chills, headaches, muscle and joint pain, and fatigue are also signs. If not treated promptly, arthritis, numbness or paralysis, problems with heart rhythm, and problems with memory or concentration may occur.

1. Who should get vaccinated?
 - a. people between 15 and 70 years old who live in areas where Lyme disease is a problem
 - b. people who work or spend leisure time in wooded, brushy, or overgrown areas where ticks live
 - c. people who travel to areas where Lyme disease is common
2. Three doses are recommended
 - a. the first dose may be given at any time, but ideally between January and March
 - b. the second dose should be given one month after the first
 - c. the third dose should be given twelve months after the first
3. who should not get vaccinated?
 - a. children younger than 15 years of age
 - b. pregnant women
 - c. anyone with arthritis caused by a previous case of Lyme disease that has not responded to antibiotic treatment
 - d. anyone with an allergic reaction to a previous dose
 - e. anyone with an immune system problem
4. Risks and possible side effects
 - a. soreness, redness, and swelling at the injection site
 - b. muscle aches, joint pain, fever, and chills
 - c. severe allergic reaction

H. Measles, Mumps, Rubella (MMR) – Measles virus causes rash, cough, runny nose, eye irritation, and fever. It can lead to ear infection, pneumonia, seizures, brain damage, and death. Mumps virus causes fever, headache, and swollen glands. It can lead to deafness, meningitis, painful swelling of the testicles or ovaries, and rarely, death. Rubella (German Measles) virus causes rash, mild fever, and arthritis. If a woman gets rubella while she is pregnant, she could have a miscarriage or her baby could be born with serious birth defects.

1. Who should get vaccinated?
 - a. children should receive 2 doses of MMR:
 - i. the first at 12 – 15 months of age
 - ii. the second at 4 – 6 years of age
 - b. anyone 18 years or older that was born after 1956
 - c. healthcare workers
2. Who should not get vaccinated?
 - a. anyone who has had a life threatening allergic reaction to gelatin, neomycin, or a previous dose of MMR
 - b. people who are moderately or severely ill should wait.
 - c. pregnant women should wait until after birth; women should wait

- 3 months after getting the vaccine before getting pregnant
 - d. some people should check with their doctor first
 - i. anyone with HIV/AIDS
 - ii. anyone being treated with drugs that affect the immune system
 - iii. anyone with any kind of cancer
 - iv. anyone taking cancer treatment with x-rays or drugs
 - v. anyone who has ever had a low platelet count
 - vi. anyone who recently had a transfusion or was given other blood products
 - 3. Risks and possible side effects
 - a. fever, mild rash, and swelling of the glands in the cheeks or neck
 - b. seizure
 - c. temporary pain and stiffness in the joints
 - d. temporarily low platelet count
 - e. serious allergic reaction
 - f. deafness
 - g. long-term seizures, coma, or lowered consciousness
 - h. permanent brain damage
- I. **Meningococcal vaccine** – Meningococcal disease is a serious illness caused by bacteria. It is the leading cause of bacterial meningitis in children 2 – 18 years old in the United States. Meningitis is an infection of the brain and spinal cord coverings.
- 1. Who should get the meningococcal vaccine and when?
 - a. U.S. Military recruits
 - b. anyone traveling to, or living in, a part of the world where the disease is common
 - c. anyone who has a damaged spleen, or whose spleen has been removed
 - d. anyone who has terminal complement component deficiency (an immune system disorder)
 - e. some laboratory workers who are routinely exposed to the bacteria
 - f. college students living in the dorm
 - g. one dose for people 7 – 18 years of age
 - 2. Who should not receive the vaccine?
 - a. anyone who has had a serious allergic reaction to a previous dose of the vaccine
 - b. anyone who is moderately or severely ill needs to wait.
 - 3. Risks and possible side effects
 - a. redness or pain at the injection site
 - b. fever
 - c. severe allergic reaction

J. **Pneumococcal conjugate vaccine** – Infection with *Streptococcus pneumoniae* bacteria can cause serious illness and death. Invasive pneumococcal disease is responsible for about 200 deaths each year among children under 5 years old. It is the leading cause of death by bacterial meningitis in the United States. Each year pneumococcal infection causes severe disease in children under 5 years old: over 700 cases of meningitis, 13,000 blood infections, and about 5 million ear infections. It can also lead to pneumonia, deafness, and brain damage. It is spread from person to person through close contact. The bacteria are resistant to some drugs.

1. Who should get it and when?
 - a. children under 2 years of age
 - b. children between 2 – 5 years old who have not already gotten the vaccine, and are at high risk of serious pneumococcal disease, including children who
 - i. have sickle cell disease
 - ii. have a damaged spleen or no spleen
 - iii. have HIV/AIDS
 - iv. have other diseases that affect the immune system
 - v. take medications that affect the immune system
 - vi. have chronic heart or lung disease
2. Who should not get the vaccine?
 - a. children who have had a previous serious allergic reaction to the vaccine
 - b. children who are moderately or severely ill should wait.
3. Risks and possible side effects
 - a. redness, tenderness, and swelling at the injection site
 - b. fever over 100.4 degrees F
 - c. fussiness, drowsiness, and loss of appetite
 - d. serious allergic reaction

K. **Pneumococcal Polysaccharide vaccine** – Pneumococcal disease kills more people in the United States each year than all other vaccine-preventable diseases combined. Pneumococcal disease can lead to pneumonia, bacteremia, meningitis, and death. The disease is becoming more resistant to drugs. The vaccine protects against 23 types of pneumococcal bacteria.

1. Who should get the vaccine?
 - a. all adults 65 years of age or older
 - b. anyone over 2 years of age who has a long-term health problem such as heart disease, sickle cell anemia, alcoholism, leaks of cerebrospinal fluid, lung disease, diabetes, and cirrhosis
 - c. anyone over 2 years of age who has a disease or condition that lowers the body's resistance to infection, such as Hodgkin's disease, kidney failure, nephritic syndrome, damaged spleen or no spleen, organ transplant, lymphoma, leukemia, multiple

myeloma, HIV infection, and AIDS

- d. anyone over 2 years of age who is taking any drug or treatment that lowers the body's resistance to infection, such as long-term steroids, radiation therapy, and certain cancer drugs
 - e. Alaskan Natives and certain Native American populations
2. Risks and possible side effects
- a. redness and pain at the injection site
 - b. fever and muscle aches
 - c. severe allergic reaction

L. **Polio Vaccine** – Polio is a disease caused by a virus. It enters the body through the mouth. It can cause paralysis and death. No “wild” polio has been reported in the United States for over 20 years. The disease is still common in some parts of the world.

1. Who should get the vaccine and when?
- a. most people should get the vaccine when they are children. Children should get four doses:
 - i. One at 2 months, 4 months, and 6-18 months
 - ii. A booster dose at 4 – 6 years
 - b. adults at higher risk should consider vaccination
 - c. people traveling to areas of the world where polio is common, laboratory workers who might handle polio virus, and health care workers treating patients that could have polio
2. Who should not get the vaccine?
- a. anyone who has ever had a life-threatening allergic reaction to neomycin, streptomycin, or polymyxin B
 - b. anyone who has had a severe allergic reaction to a polio shot
 - c. anyone who is moderately or severely ill at the time the shot is scheduled should wait until they recover.
3. Risks and possible side effects
- a. soreness at the injection site
 - b. severe allergic reaction

M. **Rotavirus vaccine** – Rotavirus is a virus that causes severe diarrhea and sometimes vomiting. It usually affects babies and young children. It is the most common cause of severe diarrhea.

1. Who should get vaccinated and when?
- a. the vaccine is an oral preparation.
 - b. children should receive 3 doses of the vaccine:
 - i. one at 2 months of age
 - ii. one at 4 months of age
 - iii. one at 6 months of age
2. Who should not get the vaccine?
- a. babies who have passed their first birthday
 - b. babies who are 7 months or older, who have not gotten at least one dose of the vaccine

- c. babies who have had a serious allergic reaction to a previous dose of the vaccine
 - d. babies with certain diseases of the stomach or intestines
 - e. babies with ongoing diarrhea
 - f. babies who are unable to fight serious infections because of HIV/AIDS or any other disease that affects the immune system
 - g. anyone under treatment with drugs such as long-term steroids
 - h. anyone with any kind of cancer
 - i. anyone undergoing cancer treatment with x-rays or drugs
 - j. babies that are moderately or severely ill at the time the vaccine is scheduled should wait until they recover.
3. Risks and possible side effects
- a. mild to moderate fever
 - b. poor appetite, tiredness, and fussiness
 - c. severe allergic reaction

N. **Smallpox** – The last natural case of smallpox occurred in 1977, and in 1980, the World Health Organization declared the global eradication of smallpox and recommended that all countries cease vaccination. Because there are concerns that the smallpox virus could be used as a bioterrorism weapon, the CDC has developed a plan. The plan will coordinate CDC, state, and local public health activities should a smallpox outbreak occur, and it will help health officials define and control the outbreak. This plan includes indications for vaccination, contraindications for vaccination, risks, sites, personnel, facilities, etc.

1. Who should be vaccinated during a smallpox emergency?
- a. persons who were exposed to the initial release of the virus
 - b. persons who have had face-to-face, household, or close proximity, or contact, with a confirmed or suspected smallpox patient, after the patient developed fever and all the scabs had separated
 - c. personnel selected for the direct medical or public health evaluation, care, or transportation of confirmed, probable, or suspected smallpox cases
 - d. laboratory personnel selected for the collection or processing of clinical specimens from confirmed, probable, or suspected smallpox cases
 - e. other persons with increased likelihood of contact with infectious materials from a smallpox patient, such as laundry or medical waste handlers for a facility where smallpox patients are admitted
 - f. other groups whose unhindered function is deemed essential to the support of response activities, and who are not otherwise involved in patient care activities, but who have a reasonable probability of contact with smallpox patients or infectious material (selected law enforcement, emergency response, or

- military personnel)
- g. consideration of vaccination for all individuals present in a hospital during the time a case was presented, not isolated in an appropriate manner in a room with ventilation, and separate from other areas of the hospital
- 2. Contraindications for vaccination of non-contacts during a smallpox emergency – Persons with certain medical conditions are known to have a higher risk of developing severe complications following vaccinations. These include:
 - a. persons with diseases or conditions which cause immunodeficiency, such as HIV, AIDS, leukemia, lymphoma, malignancy, radiation, and chemotherapy
 - b. persons with serious or life threatening allergies to the antibiotics polymyxin B, streptomycin, tetracycline, or neomycin
 - c. persons who have ever been diagnosed with eczema
 - d. women who are pregnant
 - e. persons with other acute or chronic skin conditions such as atopic dermatitis, burns, impetigo, and shingles should not be vaccinated until the condition resolves.
- 3. Risks and possible side effects
 - a. tenderness, redness, swelling and a lesion at the injection site (evidence of successful vaccination)
 - b. fever, or enlarged and tender lymph nodes in the axilla of the vaccinated arm
 - c. primary (major) reaction – the injection site becomes red and pruritic; a vesicle is formed; it becomes umbilicated and pustular. The red areola has enlarged, the pustule begins to dry, the redness subsides, and the lesion becomes crusted. By the end of the 3rd week after vaccination, the scab falls off, leaving a permanent scar that at first is pink, but eventually becomes flesh-colored.
 - d. a delayed type of skin sensitivity, consisting of erythema only, within 24 – 48 hours may occur; this type of reaction indicates the person should be revaccinated.
 - e. inadvertent inoculation of another site by the individual; this is done usually by hand from the site of the inoculation to another site like the face, nose, mouth, or genitalia.
 - f. generalized vaccinia – blood-borne dissemination of the vaccinia virus, usually characterized by a rash
 - g. eczema vaccinatum – skin lesions on a person with a history of eczema
 - h. progressive vaccinia – underlying immune deficiencies; can be fatal

O. Tetanus and Diphtheria vaccine (Td) – Tetanus (lockjaw) is caused by a germ that enters the body through a cut or a wound. Diphtheria

spreads when germs pass from an infected person to the nose or throat of others.

1. Who should be vaccinated?
 - a. people 7 years of age and older
 - b. people who have not gotten at least 3 doses of any DTP, DtaP, or DT during their lifetime
 - c. every 10 years throughout a person's life
2. Who should not get vaccinated?
 - a. anyone who has had an allergic reaction to a previous dose
3. Risks and possible side effects
 - a. soreness, redness, or swelling at the injection site
 - b. serious allergic reaction
 - c. deep, aching pain, and muscle atrophy in upper arms

P. Varicella (chickenpox) vaccine – The chickenpox virus can spread from person to person through the air, or by contact with fluid from the chickenpox blisters. It causes a rash, itching, fever, and tiredness. It can lead to severe skin infections, scars, pneumonia, brain damage, or death. A person who has had chickenpox can get a painful rash: herpes zoster (shingles) years later.

1. Who should get the vaccination?
 - a. children should get one dose between the ages of 12 and 15 months.
 - b. people who did not get the vaccine until 13 years of age or older should get 2 doses, 4- 8 weeks apart.
2. Who should not get the vaccine or should wait?
 - a. people who have had a life-threatening allergic reaction to gelatin, neomycin, or a previous dose of the vaccine
 - b. people who are moderately or severely ill should wait.
 - c. pregnant women should wait until after delivery; women should not get pregnant for 1 month after getting the vaccine.
 - d. people with HIV/AIDS or immune system problems; who are taking any drugs that affect the immune system; have cancer, or are taking chemotherapy or x-ray therapy for cancer, should check with their doctor before receiving the vaccine.
 - e. people who recently had a blood transfusion should check with their doctor.
3. Risks and possible side effects
 - a. soreness and swelling at the injection site
 - b. fever
 - c. rash
 - d. seizure
 - e. pneumonia
 - f. severe allergic reaction
 - g. severe brain reaction, low blood count

- Q. Immunity may or may not be life-long with vaccines. To help keep the antibody levels high enough to keep you protected, you sometimes need to have “booster shots.”

Activity

- I. Investigate the history of a particular type of vaccine and the ramifications if the vaccine were not invented. Present this to the class using your choice of media.
- II. Prepare a timeline showing the history of vaccinations (include the scientist responsible for the development of each). *There is a great one done by CHOP already (see link below) students are likely to just copy it so use it as a resource instead.*
- III. Research and debate the ethical issues recently encountered with the mandatory vaccination of military personnel.
- IV. Prepare a timeline showing the schedule of vaccinations across a human lifespan. *There is a great one done by CDC already (see link below) students are likely to just copy it so use it as a resource instead.*

* These activities may be done in groups

Assessment

Presentation Rubric
Multimedia Rubric
Written test
Activity Rubric

Materials

<http://www.dshs.state.tx.us/>
<http://www.nih.gov>
<http://www.cdc.gov>
<http://www.cdc.gov/vaccines/vpd-vac/vaccines-list.htm>
<http://www.cdc.gov/vaccines/pubs/vis/default.htm>
www.vaccineinformation.org
www.cdc.gov/features/smallpoxeradication

Recommended Childhood Immunization Schedule

<http://www.dshs.state.tx.us/immunize/tvfc/default.shtm>

Recommended Vaccination Schedule for birth to 6 years of age:

<http://www.cdc.gov/vaccines/parents/downloads/parent-ver-sch-0-6yrs.pdf>

Recommended Vaccination Schedule for 7-18 year olds:

<http://www.cdc.gov/vaccines/who/teens/downloads/parent-version-schedule-7-18yrs.pdf>

Recommended Vaccination Schedule for Adults: Easy to read:

<http://www.cdc.gov/vaccines/schedules/downloads/adult/adult-schedule-easy-read.pdf>

Black and white schedules and schedules in Spanish available at:

<http://www.cdc.gov/vaccines/schedules/index.html>

Summary of recommended vaccinations for birth-18, the diseases they cause and who should or should not be vaccinated:

<http://www.immunize.org/catg.d/p2010.pdf>

How and who determines the vaccination schedule:

<http://www.cdc.gov/vaccines/hcp/patient-ed/conversations/downloads/vacsafe-child-immun-color-office.pdf>

Historical time line of vaccinations from Children's Hospital of Philadelphia (posted on the CDC's page): <http://www.chop.edu/service/vaccine-education-center/vaccine-schedule/history-of-vaccine-schedule.html>

Vaccine safety and comparison of illness and death rates with and without the vaccinations: <http://www.chop.edu/service/vaccine-education-center/vaccine-safety/>

Web activity for visualizing response to vaccines and pathogens (posted on the CDC's page here: <http://www.cdc.gov/vaccines/vpd-vac/vpd-vac-basics.htm> "How Vaccines Work")

Direct link: <http://www.historyofvaccines.org/content/how-vaccines-work>

Accommodations for Learning Differences

For reinforcement, the student will create a chart of the different types of vaccines available and give examples for each class.

For enrichment, the student will pick a destination for a trip to a third world country and research the required vaccinations. Determine the diseases the vaccinations will prevent and the percentage of occurrence.

National and State Education Standards

National Healthcare Foundation Standards and Accountability Criteria
Foundation Standard 1

1.21 Describe common diseases and disorders of each body system (prevention, pathology, diagnosis, and treatment).

1.23 Investigate biomedical therapies as they relate to the prevention, pathology, and treatment of disease.

Foundation Standard 2

2.11 interpret verbal and nonverbal communication

2.14 Recognize the elements of communication using a sender-receiver model.

2.15 Apply speaking and active listening skills

2.21. Use roots, prefixes, and suffixes to communicate information.

2.22 Use medical abbreviations to communicate information

Foundation Standard 3

3.12 Explain the factors influencing healthcare delivery systems.

Foundation 7

7.12 Describe methods of controlling the spread and growth of microorganisms.

Foundation Standard 8

8.11 Understand roles and responsibilities of team members.

8.12 Recognize characteristics of effective teams.

Foundation 9

9.12 Describe strategies for the prevention of diseases

TEKS

130.207(c)3(D) evaluate the impact of scientific research on society and the environment; (F) research and describe the history of science and contributions of scientists.

130.207(c)4(A) research and describe the historical development of microbiology as it relates to health care of an individual;

130.207(c)5(D) explain the body's immune response and defenses against infection; (F) examine reemergence of diseases such as malaria, tuberculosis, and polio; (H) outline the role of the governing agencies in monitoring and establishing guidelines based on the spread of infectious diseases.

Texas College and Career Readiness Standards

English/Language Arts Standards,

II Reading B: 1. Identify new words and concepts acquired through study of their relationships to other words and concepts. 2. Apply knowledge of roots and affixes to infer the meaning of new words. 3. Use reference guides to confirm the meanings of new words or concepts.

III Speaking B. 2. Participate actively and effectively in group discussions. 3. Plan and deliver focused and coherent presentations that convey clear and distinct perspectives and demonstrate solid reasoning.

VI. Listening B. 1. Listen critically and respond appropriately to presentations. 3. Listen actively and effectively in group discussions.

IV. Research B. 1. Gather relevant sources. 3. Synthesize and organize information effectively. C. 1. Design and present an effective product.

Science Standards,

III Foundation Skills D. 1. Use search engines, data bases and other digital electronic tools effectively to locate information.

IV. Science, Technology and Society A. 1. Recognize how scientific discoveries are connected to technological innovations. B. 2. Recognize the role of people in important contributions to scientific knowledge.

Social Studies Standards,

IV. Analysis, Syntheses and Evaluation of Information A. 1. Identify and analyze the main ideas and points of view in sources. 6. Read research data critically. B. 3. Gather, organize and display the results of data and research. 4. Identify and collect sources. C. 1. Understand/interpret presentations (e.g. speeches, lectures, less formal presentations) critically.

Cross-Disciplinary Standards,

I. Key Cognitive Skills D. Academic Behavior: 1. Self monitor learning needs and seek assistance when needed, 3. Strive for accuracy and precision, 4. Persevere to complete and master task. E. Work habits: 1. Work independently, 2. Work collaboratively

II. Foundation Skills A. 2. Use a variety of strategies to understand the meaning of new words. 4. Identify the key information and supporting details. B. 1. Write clearly and coherently using standard writing conventions. 3. Compose and revise drafts. C. 1. Understand which topics or questions are to be investigated. 2. Explore a research topic 6. Design and present an effective product. 7. Integrate source material. 8. Present final product. B. 3. Present analyzed data and communicate findings in a variety of formats. E. 1. Use technology to gather information. 2. Use technology to organize, manage and analyze information. 4. Use technology appropriately.

Name: _____

Date: _____

Medical Microbiology Immunity/Vaccinations Test

Choose the best answer

1. Macrophages are found in:
 - a. Lymph nodes
 - b. Spleen
 - c. Brain
 - d. All of the above
2. The capacity to resist certain types of organisms and toxins that can damage tissues and organs is known as:
 - a. diphtheria
 - b. immunity
 - c. community wellness
 - d. extreme wellness
3. One's own ability to fight off disease is:
 - a. acquired immunity
 - b. false immunity
 - c. natural immunity
 - d. mother's immunity
4. The body develops specific immunity (antibodies and cells) against invading agents, such as lethal bacteria, viruses and toxins. This is known as:
 - a. acquired immunity
 - b. false immunity
 - c. natural immunity
 - d. mother's immunity
5. These blood cells are part of the immune system and help fight infection.
 - a. Red blood cells
 - b. White blood cells
 - c. All healthy blood cells
 - d. Blue blood cells
6. Immunity that may be acquired by exposure to a disease is known as:
 - a. black immunity
 - b. disease immunity
 - c. passive immunity
 - d. active immunity.
7. Immunity that is acquired naturally by a fetus through the passage of antibodies from the mother is known as:
 - a. black immunity
 - b. disease immunity
 - c. passive immunity
 - d. active immunity.

8. A serious disease that can affect both animals and humans and is caused by the bacteria *Bacillus anthracis* is called:
- Hepatitis B
 - Hepatitis A
 - Anthrax
 - Influenza
9. The disease that causes painful tightening of the muscles all over the body is known as:
- Diphtheria
 - Pertussis
 - Hepatitis B
 - Tetanus.
10. The disease that causes a thick covering on the back of the throat and may lead to breathing problems, paralysis, and heart failure is known as:
- Diphtheria
 - Pertussis
 - Hepatitis B
 - Tetanus
11. Whooping cough causes coughing spells so bad that it is hard for infants to eat, drink, or breathe. Another name for Whooping cough is:
- Diphtheria
 - Pertussis
 - Hepatitis B
 - Tetanus
12. Haemophilus influenza (Hib) is a serious disease caused by bacteria. Hib can lead to:
- Pneumonia
 - Infections of the blood, joints, bones and covering of the heart
 - Death
 - All of the above
13. Both Hepatitis A and Hepatitis B are serious diseases that can be prevented by vaccination. Of these two vaccines, which does the law require healthcare facilities to offer it free to their employees?
- Hepatitis A vaccine
 - Hepatitis B vaccine
14. How often should the influenza vaccine be taken:
- Once at age 10
 - Three doses, 2 months apart
 - Once a year, every year
 - Every 10 years

15. Which disease is caused by an infection from being bitten by an infected tick?
- Rubella
 - Lyme disease
 - Mumps
 - Measles
16. The disease that causes fever, headache, and swollen glands, and can lead to deafness, meningitis, and swelling of testicles or ovaries, is known as:
- Rubella
 - Lyme disease
 - Mumps
 - Measles
17. If a student is planning on going to a university and living in a dormitory, what vaccine is required by most colleges?
- MMR
 - Meningococcal
 - Influenza
 - Both a and b
18. The virus that causes severe diarrhea and vomiting in infants is:
- HIV
 - Pneumococcal
 - Polio
 - Rotavirus
19. The World Health Organization (WHO) declared the global eradication of this disease in 1980.
- Polio
 - Pneumococcal
 - Smallpox
 - Chickenpox
20. How often is a tetanus booster shot required?
- Every 4 years
 - Every 6 years
 - Every 8 years
 - Every 10 years

Medical Microbiology Immunity/Vaccinations Test **KEY**

Choose the best answer

1. Macrophages are found in:
 - a. Lymph nodes
 - b. Spleen
 - c. Brain
 - d. All of the above**
2. The capacity to resist certain types of organisms and toxins that can damage tissues and organs is known as:
 - a. diphtheria
 - b. immunity**
 - c. community wellness
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3. One's own ability to fight off disease is:
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 - b. false immunity
 - c. natural immunity**
 - d. mother's immunity
4. The body develops specific immunity (antibodies and cells) against invading agents, such as lethal bacteria, viruses and toxins. This is known as:
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 - c. passive immunity
 - d. active immunity**
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 - c. Death
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- a. Hepatitis A vaccine
 - b. Hepatitis B vaccine**
14. How often should the influenza vaccine be taken:
- a. Once at age 10
 - b. Three doses, 2 months apart
 - c. Once a year every year**
 - d. Every 10 years

15. Which disease is caused by an infection from being bitten by an infected tick?
- a. Rubella
 - b. Lyme disease**
 - c. Mumps
 - d. Measles
16. The disease that causes fever, headache, and swollen glands, and can lead to deafness, meningitis, and swelling of testicles or ovaries, is known as:
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 - c. Mumps**
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- a. MMR
 - b. Meningococcal
 - c. Influenza
 - d. Both a and b**
18. The virus that causes severe diarrhea and vomiting in infants is:
- a. HIV
 - b. Pneumococcal
 - c. Polio
 - d. Rotavirus**
19. The World Health Organization (WHO) declared the global eradication of this disease in 1980.
- a. Polio
 - b. Pneumococcal
 - c. Smallpox**
 - d. Chickenpox
20. How often is a tetanus booster shot required?
- a. Every 4 years
 - b. Every 6 years
 - c. Every 8 years
 - d. Every 10 years**

Health Science

Immunization Presentation

Team Members

1. _____ 2. _____ 3. _____
 4. _____ 5. _____ 6. _____

Topic: _____

	Best 😊	Good 😊	Average 😐	Bad 🙄	Points Awarded
Presentation/Demonstration - Presented information clearly - All members participated in presentation with speaking parts	25	20	15	10	
Display - Pleasing to look at - Easy to follow - Legible	20	16	12	8	
Stage Presence - Voice quality (pitch & tempo) - Posture - Eye contact	25	20	15	10	
Answer Questions - Able to easily answer audience questions - Gave well thought out responses	25	20	15	10	
Effectively communicated the main idea	5	4	3	2	
Total Points – Possible/Awarded	100	80	60	40	

Comments:



Smallpox 1 (cdc.gov)

Smallpox 2 (cdc.gov)





Small pox 3 (cdc.gov)

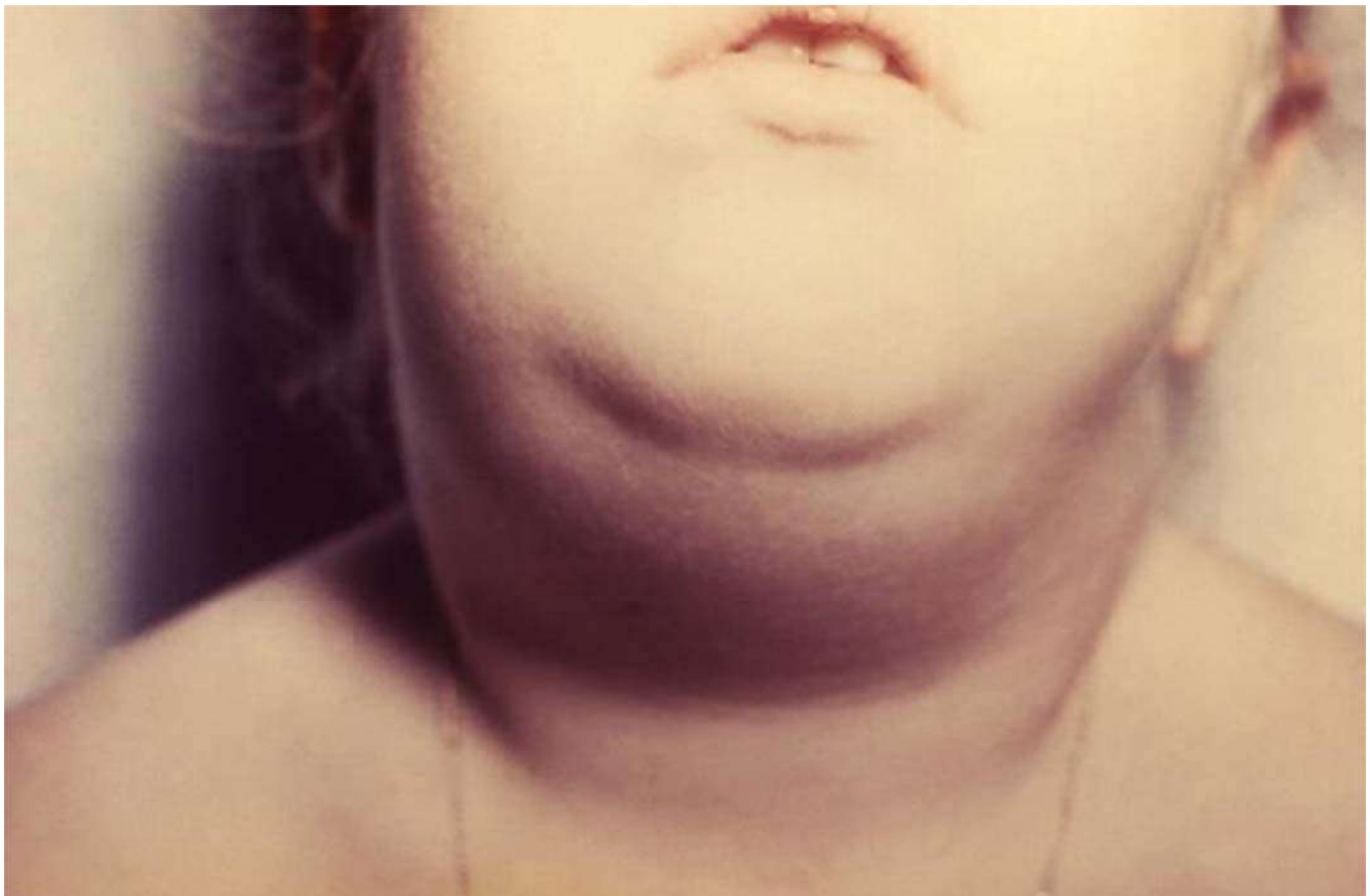


Chickenpox (cdc.gov)



Measles (phil.cdc.gov)

Mumps (phil.cdc.gov)





Rubella (cdc.gov)

Immunity and Vaccinations Notes Sheets

Cell

Action

1.

2.

3.

4.

5.

Natural Immunity

Acquired Immunity

Natural

Active

Passive

Artificial

Vaccines page_____

Name of shot and causative agent	
Disease being prevented	
Who should be vaccinated?	
Who should not be vaccinated or wait?	
Possible side effects	
Series and Booster	
Other	
Name of shot and causative agent	
Disease being prevented	
Who should be vaccinated?	
Who should not be vaccinated or wait?	
Possible side effects	
Series and Booster	
Other	

Multimedia Rubric

Student: _____

Class: _____

Title: _____

Other Group Members: _____

Date: _____

Scoring criteria	5 Excellent	4 Good	3 Needs Some Improvement	2 Needs Much Improvement	1 N/A
Clearly and effectively communicates an introduction of the theme/objective of the project.					
Clearly and effectively communicates the content throughout the presentation.					
Integrated a variety of multimedia resources to create a professional presentation (transition, graphics).					
Presentation holds audience attention and relates a clear message.					
Timing between slides is beneficial for the viewer to read or observe content.					
Each image and font size is legible to entire audience.					

Scale:

26-30 A Excellent

21-25 B Good

16-20 C Needs Some Improvement

11-15 D Needs Much Improvement

6-10 F Not Appropriate

TOTAL=

Comments

Oral Presentation Rubric

Student: _____

Date: _____

Scoring criteria	4. Excellent	3. Good	2. Needs Some Improvement	1. Needs Much Improvement	N/A
Clearly and effectively communicates the main idea or theme.					
Presenter is self-confident and clearly expresses ideas.					
Presenter answers questions with well thought out responses.					
Holds audience attention and maintains eye contact.					
Visual aids are clear and add to the presentation.					

NOTE: N/A represents a response to the performance which is "not appropriate."