Lesson Plan: Vaccination Investigation

Overview and Purpose:
Through a cooperative learning activity called an Expert Jigsaw, students will develop an understanding and awareness of six types of vaccines. Students will gain knowledge about each vaccine and the disease each vaccine prevents. This knowledge will teach students why vaccines are an important tool for maintaining a healthy lifestyle for themselves, their families, and the community.

Grade Level: Grades 9-12

Estimated Time Allotment: Four class periods
(based on 50-minute class periods, with 45 minutes of instructional time per class for this lesson; specific durations of activities are provided within the Lesson Procedures section)

Curriculum Focus: Health and Science

Learning Objectives

The student will be able to…

- utilize prior knowledge to answer questions about vaccines
- read, comprehend and identify important facts about vaccines
- describe which diseases various vaccines prevent
- describe relevant information about the following vaccines: polio, MMR, DTaP, hepatitis B, varicella, HPV, and meningicoccal
- collaborate with other students

Standards Addressed

Health

American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) – American Association for Health Education (AAHE), National Health Education Standards

Health Education Standard 1: Students will comprehend concepts related to health promotion and disease prevention

1.12.5. (9-12) Propose ways to reduce or prevent injuries and health problems
1.12.8. (9-12) Analyze personal susceptibility to injury, illness or death if engaging in unhealthy behaviors

Health Education Standard 3: Students will demonstrate the ability to access valid information and products and services to

3.12.2. (9-12) Use resources from home, school and community that provide valid health information

Lesson Plan: Vaccination Investigation

Health Education Standard 2: Students will analyze the influence of family, peers, culture, media, technology and other factors on health behavior

2.12.10. (9-12) Analyze how public health policies and government regulations can influence health promotion and disease prevention

Health Education Standard 8: Students will demonstrate the ability to advocate for personal, family and community health.

8.12.3. (9-12) Work cooperatively as an advocate for improving personal, family and community health

Mid-Continent Research for Education and Learning (McREL) Standards

Curriculum Standards for Health

Content Standard 2: Knows environmental and external factors that affect individual and community health

Level IV (Grade 9-12) Benchmark 4. Understands how the prevention and control of health problems are influenced by research and medical advances.

Knowledge/skill statements

1.Understands how the prevention of health problems are influenced by research

2.Understands how the prevention of health problems are influenced by medical advances

3.Understands how the control of health problems are influenced by research

4.Understands how the control of health problems are influenced by medical advances

Content Standard 8: Knows essential concepts about the prevention and control of disease

Level IV (9-12) Benchmark 1. Understands how the immune system functions to prevent or combat disease

Knowledge/skill statements

1.Understands how the immune system functions to prevent disease

2.Understands how the immune system functions to combat disease

Curriculum Standards for Career Education/Health Education

Content Standard 9: Knows techniques to prevent the spread of illness and disease

Level IV (Grade 9-12) Benchmark 1. Knows the body's natural defense systems against infection such as barriers, the inflammatory response, and the immune response

Knowledge/skill statements

1.Knows the body's natural defense systems against infection

2.Understands the role of barriers as a natural defense against infection

3.Understands the inflammatory response as a natural defense against infection

4.Understands the immune response as a natural defense against infection

Lesson Plan: Vaccination Investigation

Content Standard 9: Knows techniques to prevent the spread of illness and disease

Level IV (Grade 9-12) Benchmark 2. Knows common infectious diseases present at school or home and details of the diseases (e.g., signs and symptoms, means of transmission, causative microorganism, and recommendations to prevent the spread of the diseases)

Knowledge/skill statements

1.Knows common infectious diseases present at school or home
2.Knows details of common infectious diseases present at school or home
3.Knows the signs and symptoms of common infectious diseases
4.Knows how common infectious diseases are transmitted
5.Knows the microorganisms that cause common infectious diseases
6.Knows recommendations to prevent the spread of common infectious diseases

Science

National Science Education Standards, Science Content Standards

Content Standard C (Life Science): As a result of their activities in grades 9-12, all students should develop understanding of the behavior of organisms

Content Standard F (Science in Personal and Social Perspectives): As a result of activities in grades 9-12, all students should develop understanding of personal and community health

Curriculum Integrations

Reading and Language Arts, International Reading Association and National Council of Teachers of English Standards, Standards for the English Language Arts

3: Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, and graphics)

4: Students adjust their use of spoken, written, and visual language (e.g., conventions, style, and vocabulary) to communicate effectively with a variety of audiences and for different purposes

5: Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes

11: Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities

12: Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information)

Social Studies, Center for Civic Education, National Standards for Civics and Government

Content Standard K-12, V: What are the Roles of the Citizen in American Democracy? What are important responsibilities of Americans?

Social Studies, National Center for History in Schools

Historical Thinking Content Standard 3: Historical Analysis and Interpretation

Lesson Plan: Vaccination Investigation

C. Analyze cause-and-effect relationships and multiple causation, including the importance of the individual, the influence of ideas

Lesson Procedures for Teacher

***Before* teaching the Lesson**

Teacher Background: Content Background and Resources, Lesson Vocabulary, and Instructional Strategy Overview (Teacher Resources 1, 2 and 3)

Teacher Preparation:

Materials and Planning Notes

Prepare a Vaccination Articles Packet for each student (Student Resource 1). Attach a copy of the CDC Vaccination Schedules to each packet. (To obtain the most recent copy of the vaccination schedule go to http://www.cdc.gov/vaccines/recs/schedules/default.htm.)
Prepare Assignment Cards (Student Resource 2)
Prepare to have the students work in "Home" Groups made up of seven students
Prepare locations for "Home" and "Expert" Group meetings
Prepare to have a variety of materials available to the "Expert" Groups as they meet

Additional Materials: chart paper, markers, tape

***During* teaching of the Lesson**

Opening Activity – Think-Pair-Share **45 minutes**

1. Introduce the topic of vaccinations to the group by leading a small group Think-Pair-Share discussion. (What is a vaccine? Why are vaccines important?) *(Preparation note: Use Teacher Resource 1 – Content Background Knowledge and Resources to become familiar and well versed with the answers to these questions. As the discussion continues, the teacher will supplement the students' discussion with the necessary background information to begin the Jigsaw.)*
2. Continue Think-Pair-Share discussion. (What are some common vaccines you know of or have received?) Can students list any vaccinations? (Generate answers and list them on the board.)
3. Supplement the list and highlight the following vaccines by specifying/circling them:
   - Polio
   - MMR (measles, mumps, rubella)

Lesson Plan: Vaccination Investigation

- DTaP (DTaP=Pediatric - Diphtheria-Tetanus-acellular Pertussis vaccine)
- Hepatitis B
- Varicella
- HPV
- Meningicoccal

4. Continue Think-Pair-Share discussion. (What is an immune system? How do vaccines work? What does a vaccine do? What does it mean if something is infectious? What does it mean if someone is contagious? What is immunity? What is Herd Immunity?) Supplement discussion with background information.
5. Continue Think-Pair-Share discussion. (What are the potential side effects of vaccinations? Should vaccinations be required?) Supplement discussion with background information.
6. Introduce the lesson objective: Students will learn about these vaccinations by participating in the Expert Jigsaw Activity.

Learning Activity – Expert Jigsaw **90 minutes**

1. Have the students sit in their "Home" Groups.
2. Explain the Expert Jigsaw activity procedures to the students:
   -Students are all placed in "Home" Groups, and within those groups each student is assigned as an "Expert" to be responsible for a particular topic.
   -"Experts" learn their own topic either individually or cooperatively with other experts in an "Expert" Group.
   -"Experts" return to the home group, and each person teaches the rest of the home group about expert material that was covered.
3. Pass out Assignment Cards (Student Resource 2) to each group (one set per group). Ask the students to keep the cards face down until directed.
4. Direct the students to turn the card over and explain that the number they have is the number of the article they will be reading and the number for their "Expert" Group.
5. Have the whole class brainstorm questions they want the "Experts" to answer about each vaccine. Post these questions and review them with the class. Supplement the list as necessary. The "Expert" Group's teaching plan should address these items:
   - What infection and/or disease(s) does this vaccine prevent?
   - Describe the infection and/or disease(s) this vaccine prevents. What are the symptoms? What can it lead to?
   - Who should receive the vaccine? When is the best time to receive the vaccine? Is there a "window" for vaccination?
   - What are some possible side effects of the vaccine?

Lesson Plan: Vaccination Investigation

- Should this vaccine be required?
- What is the history of this vaccine?
- Do kids our age need this vaccine?

6. Have students move to sit in the "Expert" Groups. Pass out Article Packets (Student Resource 1). Every student gets the same packet and will read about the section of the packet for the vaccine they are assigned. The packets also contain the vaccination schedules for pre-teen and adolescent vaccines (everyone will read this part). Allow time for reading and discussion. The "Experts" must have enough time and the necessary materials to develop a teaching plan in order to return to their home group and share the information about the vaccination they are studying.
7. Have students return to their home groups to share their "Expert" information.

Closing Activity – Top Ten **45 minutes**

1. In "Home" Groups, ask students to discuss what they feel are the most important points from the "Expert" presentations.
2. Ask students to appoint a recorder in their "Home" Group.
3. Provide each group with tape, chart paper, and markers.
4. Ask groups to create a Top Ten Most Important or Interesting Things about Vaccines List and record the list on chart paper.
5. Post lists around the room and allow students time to view each other's lists.
6. Summary Discussion Questions: Why is it important to vaccinate against rare diseases? Considering what you learned about vaccinations, why do you think most are given during the first year of life? Do you think there will be new vaccinations required during your lifetime? Explain your answer.
7. Optional: Use one of the ideas provided in the Assessment or Extension section of this lesson plan.

Supplemental Materials

Resources to accompany this lesson plan have been created and are provided after this section. This lesson plan contains the following supplemental materials (as referenced throughout this section).

Student Resources

Student Resource 1: Vaccination Article Packet
Student Resource 2: Jigsaw Assignment Cards
Student Resource 3: Vaccination Quick Write

Lesson Plan: Vaccination Investigation

Teacher Resources
Teacher Resource 1: Content Background and Resources for Vaccine Education
Teacher Resource 2: Lesson Vocabulary
Teacher Resource 3: Instructional Strategy Overview
Teacher Resource 4: Group Work Evaluation Rubric
Teacher Resource 5: Reference List

Modifications

- Give students the opportunity to select the "Expert" Group they want to join rather than being assigned
- To find out what to do if you have an uneven number of students, read the Instructional Strategy Overview (Teacher Resource 3)
- Have "Home" Groups present the Top Ten lists during the closing
- Hold a class debate about whether certain vaccinations should be mandatory
- Find out when National Immunization Week is honored and plan a unit for that time
- Instead of the Jigsaw Article Packet, order or download/print a variety of publications regarding vaccinations from various organizations listed on Content Background and Resources for Vaccine Education (Teacher Resource 1). Provide these materials to the expert groups for their research.

Assessment

- Assessment of Learning Process: Anecdotally observe students during class and small group discussion.
- Assessment of Group Skills: Informally observe students working together. If appropriate, use the Group Work Evaluation Rubric (Teacher Resource 4) or create your own.
- Assessment of Content Knowledge: If appropriate, use the Vaccination Quick Write Activity (Student Resource 3) at the end of the lesson, collect and evaluate. The Quick Write can also be utilized as a Pre and Post Assessment.

***After* teaching the Lesson**

Extension and Additional Activities (Take Home Component)

- Have students take home the Vaccine Inventory Article packet and/or Top Ten Lists to share with their families. Together families can create a "Vaccination Plan" by listing each family member and creating columns for the seven vaccines in the article packet.

Lesson Plan: Vaccination Investigation

- They can indicate if each family member has already been vaccinated or still needs to/still can be vaccinated for the disease. Have students bring the Family Vaccination Plan back to class for discussion.
- Complete the Expert Jigsaw activity, again choosing alternative vaccinations not included in this lesson such as Influenza, Rotavirus, Pneumococcal, Hib, and Hepatitis A.
- Teach another subject using the Expert Jigsaw activity.

Lesson At – A– Glance

Opening: Group Discussion and Think-Pair-Share	**45 minutes**
Learning Activity: Expert Jigsaw	**90 minutes**
Closing: Top Ten Lists	**30 minutes**

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

Poliomyelitis or polio is an infectious disease caused by a virus. It is spread by person-to-person contact. It enters the body through the mouth. It does not always cause serious illness, but in the most severe cases it can be fatal. The polio vaccine is the most effective way to prevent this disease.

According to information from the U.S. Centers for Disease Control and Prevention (CDC), a 1916 polio epidemic in the United States killed 6,000 people and paralyzed 27,000 more. In the early 1950's there were more than 20,000 cases of polio each year until the vaccination was introduced in 1955. From that point the number of cases each year began to drop. The first symptoms of polio are fever, sore throat, headache and a stiff neck. Polio has become very rare since the vaccine became available. The current version of the vaccine, which has been in place since 1987, protects 99% of children who receive a minimum of three doses. The U.S. was a leader in the success of the polio vaccine. Most other countries have eliminated polio as well. There are some areas of the world where the disease is still common. Until the disease has been completely eliminated we need to be vaccinated.

There are two types of vaccines for polio: a live oral vaccine that is swallowed (OPV – Oral Polio Vaccine) or a shot given in the arm or leg (IPV – Inactivated Polio Vaccine). Both vaccines give immunity to polio. Now that polio has been eradicated in the U.S., it is no longer necessary to use OPV. The polio shot is now the common method for vaccination. The most common age to receive the polio vaccine is as a young child. There are four doses provided throughout early childhood (2 months, 4 months, 6-18 months, and 4-6 years). The polio vaccine may be given at the same time as other vaccines. If the vaccine is not given in childhood, it is still effective when given to adults. In this case, three staggered doses would be given. There are three groups of adults considered high risk: people traveling to areas of the world where polio is common, laboratory workers who might handle the disease, and health care workers treating patients who might have polio. An adult fitting any of theses three categories who was not vaccinated as a child should be vaccinated as an adult.

There are few side effects to the polio vaccine. Some people who get the shot get a sore spot where the shot is given. The vaccine used today has never been known to cause any serious problems, and most people don't have any problems at all with it. The risk of a polio shot causing serious harm, or death, is extremely small. One possible and rare side effect is a serious allergic reaction.

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

According to the CDC, if we stopped vaccinating for polio:

"Stopping vaccination against polio will leave people susceptible to infection with the polio virus. Polio virus causes acute paralysis that can lead to permanent physical disability and even death. Before polio vaccine was available, 13,000 to 20,000 cases of paralytic polio were reported each year in the United States. These annual epidemics of polio often left thousands of victims--mostly children--in braces, crutches, wheelchairs, and iron lungs. The effects were life-long. In 1988 the World Health Assembly unanimously agreed to eradicate polio worldwide. As a result of global polio eradication efforts, the number of cases reported globally has decreased from more than 350,000 cases in 125 countries in 1988 to 2,000 cases of polio in 17 countries in 2006, and only four countries remain endemic (Afghanistan, India, Nigeria, Pakistan). To date polio has been eliminated from the Western hemisphere, and the European and Western Pacific regions. Stopping vaccination before eradication is achieved would result in a resurgence of the disease in the United States and worldwide."

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

M

This vaccine prevents three diseases: measles, mumps, and rubella (German measles). The combined MMR vaccine was introduced to reduce the pain of three separate shots and to increase the likelihood that each vaccine will be given earlier (since they are given all at once).

Measles is a highly contagious disease caused by a virus. Symptoms include fever, cough, red eyes, and a runny nose. A rash begins with white spots in the mouth and develops into a red rash that covers the entire body. The rash typically lasts four to seven days. Severe cases of measles can cause diarrhea, ear infection, pneumonia, encephalitis (swelling of the brain), and death. The measles virus is highly contagious because it is spread through airborne droplets from coughing or sneezing. The virus can live in the air for up to two hours after an infected person leaves the area. After exposure, the virus lives in the body for about two weeks before symptoms appear. More than 20 million people around the world are infected with measles each year. Due to immunizations, fewer than 150 cases in the U.S. have been reported since 1997. Most cases were reported by someone who had traveled abroad. The MMR vaccine is the most effective way to prevent this disease.

Mumps is also a highly contagious disease caused by a virus. Symptoms include painful swollen salivary glands (under the jaw), fever, fatigue, sore muscles and a headache. In severe cases, mumps can lead to meningitis, encephalitis (swelling of the brain), or hearing loss. In rare cases, mumps can lead to sterility in males.
The mumps virus is spread like measles; it too has a long incubation period, with symptoms appearing more than two weeks after contact. Due to the introduction of the mumps vaccine in 1967, reported mumps cases have declined to fewer than 1,000 per year in the U.S. The MMR Vaccine is the most effective way to prevent this disease.

Rubella is also known as German measles. It is a relatively mild disease caused by a virus. Symptoms include fever and rash. The most severe threat of rubella is to women who are pregnant. It can pass through a pregnant woman's bloodstream to infect her unborn child. In such cases, rubella can lead to birth defects causing deafness, cataracts, heart defects, mental retardation, and liver and/or spleen damage. As with mumps and measles, rubella is spread through airborne droplets from coughing or sneezing. People who have rubella are most contagious from one week before to one week after the rash appears. The MMR vaccine is the most effective way to prevent this disease

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

Before a vaccine against rubella became available in 1969, epidemics occurred every six to nine years in the U.S. Children ages five to nine were primarily affected. Due to immunization, there are now far fewer cases of rubella.

The most common way to receive the MMR vaccine is in two doses as a young child. The first dose is given after the first birthday (12 to 15 months of age). The second dose is given before the start of kindergarten (four to five years). Adults or teenagers should get the vaccine if they have not had the measles (a blood test for the antibodies can be given) or have not had MMR vaccine. Adults such as college students or health care workers are considered high-risk and are strongly encouraged to have the vaccine.

There are few side effects to the MMR vaccine. The risk of the MMR vaccine causing serious harm, or death, is extremely small. Getting the MMR vaccine is much safer than getting any of the three diseases. Mild side effects include fever, mild rash, or swelling of glands. In rare cases side effects may include seizure caused by fever, temporary pain or stiffness in the joints, or bleeding disorder. Very rare severe side effects include serious allergic reactions, deafness, long-term seizures, coma, or brain damage. (These side effects are so rare that experts cannot be sure whether they are caused by the vaccine or not.)

According to the CDC, if we stopped vaccinating for measles:

"Before measles immunization was available, nearly everyone in the U.S. got measles. An average of 450 measles-associated deaths were reported each year between 1953 and 1963. In the U.S., up to 20 percent of persons with measles are hospitalized. Seventeen percent of measles cases have had one or more complications, such as ear infections, pneumonia, or diarrhea. Pneumonia is present in about six percent of cases and accounts for most of the measles deaths. Although less common, some persons with measles develop encephalitis (swelling of the lining of the brain), resulting in brain damage. As many as three of every 1,000 persons with measles will die in the U.S. In the developing world, the rate is much higher, with death occurring in about one of every 100 persons with measles. Measles is one of the most infectious diseases in the world and is frequently imported into the U.S. In the period 1997-2000, most cases were associated with international visitors or U.S. residents who were exposed to the measles virus while traveling abroad. More than 90 percent of people who are not immune will get measles if they are exposed to the virus. According to the World Health Organization (WHO), nearly 900,000 measles-related deaths occurred among persons

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

in developing countries in 1999. In populations that are not immune to measles, measles spreads rapidly. If vaccinations were stopped, each year about 2.7 million measles deaths worldwide could be expected. In the U.S., widespread use of measles vaccine has led to a greater than 99 percent reduction in measles compared with the pre-vaccine era. If we stopped immunization, measles would increase to pre-vaccine levels."

According to the CDC, if we stopped vaccinating for mumps:

"Before the mumps vaccine was introduced, mumps was a major cause of deafness in children, occurring in approximately one in 20,000 reported cases. Mumps is usually a mild viral disease. However, rare conditions such as swelling of the brain, nerves and spinal cord can lead to serious side effects such as paralysis, seizures, and fluid in the brain. Serious side effects of mumps are more common among adults than children. Swelling of the testes is the most common side effect in males past the age of puberty, occurring in up to 20 percent to 50 percent of men who contract mumps. An increase in miscarriages has been found among women who develop mumps during the first trimester of pregnancy. An estimated 212,000 cases of mumps occurred in the U.S. in 1964. After vaccine licensure in 1967, reports of mumps decreased rapidly. In 1986 and 1987, there was a resurgence of mumps with 12,848 cases reported in 1987. Since 1989, the incidence of mumps has declined, with 266 reported cases in 2001. This recent decrease is probably due to the fact that children have received a second dose of mumps vaccine (part of the two-dose schedule for measles, mumps, rubella or MMR) and the eventual development of immunity in those who did not gain protection after the first mumps vaccination. We cannot let our guard down against mumps. A 2006 outbreak among college students, most of whom had received two doses of vaccine, led to over 5,500 cases in 15 states. Mumps is highly communicable and it only takes a few unvaccinated to initiate transmission."

According to the CDC, if we stopped vaccinating for rubella:

"While rubella is usually mild in children and adults, up to 90 percent of infants born to mothers infected with rubella during the first trimester of pregnancy will develop congenital rubella syndrome (CRS), resulting in heart defects, cataracts, mental retardation, and deafness. In 1964-1965, before rubella immunization was used routinely in the U.S., there was an epidemic of rubella that resulted in an estimated 20,000 infants born with CRS, with 2,100 neonatal deaths and 11,250 miscarriages. Of the 20,000 infants born with CRS, 11,600

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

were deaf, 3,580 were blind, and 1,800 were mentally retarded. Due to the widespread use of rubella vaccine, only six CRS cases were provisionally reported in the U.S. in 2000. Because many developing countries do not include rubella in the childhood immunization schedule, many of these cases occurred in foreign-born adults. Since 1996, greater than 50 percent of the reported rubella cases have been among adults. Since 1999, there have been 40 pregnant women infected with rubella. If we stopped rubella immunization, immunity to rubella would decline and rubella would once again return, resulting in pregnant women becoming infected with rubella and then giving birth to infants with CRS."

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

Expert Group 3
DTaP Vaccine
Diphtheria, Tetanus, acellular Pertussis

D

This vaccine prevents three diseases, diphtheria, tetanus, and pertussis. The combined DTaP vaccine was introduced to reduce the pain of three separate shots and to increase the likelihood that each vaccine will be given earlier (since they are given all at once). The "a" in DTaP stands for "acellular," meaning that the pertussis component of the vaccine contains only a part of the pertussis organism.

Diphtheria is a serious bacterial disease that affects the respiratory system or the skin. Respiratory diphtheria causes a sore throat and fever, and sometimes swelling of the neck. In severe cases it can cause an airway obstruction as it causes a membrane (thin layer) to form over the throat, which results in breathing problems. When diphtheria affects the skin, infected lesions form. In severe cases, when untreated, diphtheria can lead to pneumonia, heart failure, paralysis, coma or death. Diphtheria bacteria are spread through airborne droplets from coughing or sneezing. The CDC states, "Before the 1920s, diphtheria was very common in the U.S., with hundreds of thousands of cases occurring every year. Since the introduction of a vaccine in the 1920s, cases of diphtheria in the U.S. have declined greatly, with less than one case reported each year since 2000. But while mandatory vaccines for schoolchildren have gone a long way toward controlling diphtheria in the U.S., the disease is still endemic in many developing countries."

Tetanus is an infection caused by bacteria found in dirt, gravel and rusty metal. It usually enters the body through a cut. Symptoms include muscle spasms. If tetanus attacks the jaw muscles it causes lockjaw (the inability to open and close your mouth). In severe cases it can lead to breathing muscle spasms, which can be deadly.

Pertussis, also known as whooping cough, is a bacterium that clogs the lungs with mucus. Symptoms include a severe cough that sounds like a "whoop." The cough can last for two months. It can lead to pneumonia.

Children should get five doses of DTaP, (two, four, six, and 15-18 months and four to six years). Adults and teenagers also need protection from diphtheria, tetanus, and pertussis. This vaccine should be given to any adult or teenager who was not vaccinated as a child. Td is a tetanus-diphtheria vaccine given to adolescents and adults as a booster shot every 10 years, or after an exposure to tetanus such as an injury. Tdap is similar to Td but it also contains protection against pertussis. A single dose of Tdap is recommended

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

for adolescents 11 or 12 years-of-age, or in place of one Td booster in older adolescents and adults age 19 through 64.

There are few side effects to the DTaP vaccine. Getting diphtheria, tetanus or pertussis disease is much riskier than getting DTaP vaccine. Mild side effects include fever, redness/swelling/soreness/tenderness where the shot was given, fussiness, tiredness, poor appetite, or vomiting. After the fourth or fifth dose the entire arm or leg where the shot was given may swell. Rare side effects include seizure, excessive crying in babies, or very high fever. Very rare side effects include a serious allergic reaction, long-term seizures, coma, or brain damage. (These side effects are so rare, experts cannot be sure whether they are caused by the vaccine or not).

According to the CDC, if we stopped vaccinating for diphtheria:

"Diphtheria is a serious disease caused by a bacterium. This germ produces a poisonous substance or toxin which frequently causes heart and nerve problems. The case fatality rate is five percent to 10 percent, with higher case-fatality rates (up to 20 percent) in the very young and the elderly. In the 1920's, diphtheria was a major cause of illness and death for children in the U.S. In 1921, a total of 206,000 cases and 15,520 deaths were reported. With vaccine development in 1923, new cases of diphtheria began to fall in the U.S., until in 2001 only two cases were reported. Although diphtheria is rare in the U.S., it appears that the bacteria continue to get passed among people. In 1996, 10 isolates of the bacteria were obtained from persons in an American Indian community in South Dakota, none of whom had classic diphtheria disease. There was one death reported in 2003 from clinical diphtheria in a 63-year-old male who had never been vaccinated. There are high rates of susceptibility among adults. Screening tests conducted since 1977 have shown that 41 percent to 84 percent of adults 60 and over lack protective levels of circulating antitoxin against diphtheria. Although diphtheria is rare in the U.S., it is still a threat. Diphtheria is common in other parts of the world and with the increase in international travel, diphtheria and other infectious diseases are only a plane ride away. If we stopped immunization, the U.S. might experience a situation similar to the Newly Independent States of the former Soviet Union. With the breakdown of the public health services in this area, diphtheria epidemics began in 1990, fueled primarily by persons who were not properly vaccinated. From 1990-1999, more than 150,000 cases and 5,000 deaths were reported."

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

According to the CDC, if we stopped vaccinating for tetanus:

"Tetanus is a severe, often fatal disease. The bacteria that cause tetanus are widely distributed in soil and street dust, are found in the waste of many animals, and are very resistant to heat and germ-killing cleaners. From 1922-1926, there were an estimated 1,314 cases of tetanus per year in the U.S. In the late 1940's, the tetanus vaccine was introduced, and tetanus became a disease that was officially counted and tracked by public health officials.

In 2000, only 41 cases of tetanus were reported in the U.S. People who get tetanus suffer from stiffness and spasms of the muscles. The larynx (throat) can close causing breathing and eating difficulties, muscle spasms can cause fractures (breaks) of the spine and long bones, and some people go into a coma and die.

Approximately 20 percent of reported cases end in death. Tetanus in the U.S. is primarily a disease of adults, but unvaccinated children and infants of unvaccinated mothers are also at risk for tetanus and neonatal tetanus, respectively. From 1995-1997, 33 percent of reported cases of tetanus occurred among persons 60 years of age or older and 60 percent occurred in patients greater than 40 years of age. The National Health Interview Survey found that in 1995, only 36 percent of adults 65 or older had received a tetanus vaccination during the preceding 10 years. Worldwide, tetanus in newborn infants continues to be a huge problem. Every year tetanus kills 300,000 newborns and 30,000 birth mothers who were not properly vaccinated. Even though the number of reported cases is low, an increased number of tetanus cases in younger persons have been observed recently in the U.S. among intravenous drug users, particularly heroin users. Tetanus is infectious, but not contagious, so unlike other vaccine-preventable diseases, immunization by members of the community will not protect others from the disease. Because tetanus bacteria are widespread in the environment, tetanus can only be prevented by immunization. If vaccination against tetanus were stopped, persons of all ages in the U.S. would be susceptible to this serious disease."

According to the CDC, if we stopped vaccinating for pertussis:

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

"Since the early 1980s, reported pertussis cases have been increasing, with peaks every three to four years; however, the number of reported cases remains much lower than levels seen in the pre-vaccine era. Compared with pertussis cases in other age groups, infants who are 6 months old or younger with pertussis experience the highest rate of hospitalization, pneumonia, seizures, encephalopathy (a degenerative disease of the brain) and death. From 1990 to 1996, 57 persons died from pertussis; 49 of these were less than six months old. Before pertussis immunizations were available, nearly all children developed whooping cough. In the U.S., prior to pertussis
immunization, between 150,000 and 260,000 cases of pertussis were reported each year, with up to 9,000 pertussis-related deaths. Pertussis can be a severe illness, resulting in prolonged coughing spells that can last for many weeks. These spells can make it difficult for a child to eat, drink, and breathe. Because vomiting often occurs after a coughing spell, infants may lose weight and become dehydrated. In infants, it can also cause pneumonia and lead to brain damage, seizures, and mental retardation. The newer pertussis vaccine (acellular or DTaP) has been available for use in the United States since 1991 and has been recommended for exclusive use since 1998. These vaccines are effective and associated with fewer mild and moderate adverse reactions when compared with the older (whole-cell DTP) vaccines. During the 1970s, widespread concerns about the safety of the older pertussis vaccine led to a rapid fall in immunization levels in the United Kingdom. More than 100,000 cases and 36 deaths due to pertussis were reported during an epidemic in the mid 1970s. In Japan, pertussis vaccination coverage fell from 80 percent in 1974 to 20 percent in 1979. An epidemic occurred in 1979 and resulted in more than 13,000 cases and 41 deaths. Pertussis cases occur throughout the world. If we stopped pertussis immunizations in the U.S., we would experience a massive resurgence of pertussis disease. A recent study found that in eight countries where immunization coverage was reduced, incidence rates of pertussis surged to 10 to 100 times the rates in countries where vaccination rates were sustained."

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

Hepatitis B is a virus that attacks the liver. Symptoms vary greatly from mild flu-like symptoms, tiredness, and poor appetite to nausea, vomiting, extreme tiredness, and jaundice (all the white parts on your body, like your eyes, teeth and nails, turn yellow). Symptoms may last for months. Hepatitis B can lead to liver damage, scarring, and/or failure. It is the number one cause of liver cancer. It can be fatal. Some people who are infected with hepatitis B become "carriers." They can spread the virus without knowing they have it. Carriers are at higher risk of having liver failure later in life. There are several ways of spreading the virus: at birth - from an infected mother to her baby, coming in contact with the blood or bodily fluids of an infected person, living in the same household for a long time with someone who has hepatitis B virus, or injecting drugs with contaminated (dirty) needles. The hepatitis B vaccine is the most effective way to prevent this disease. Since hepatitis B can lead to liver cancer, this vaccine is significant because it was the first anti-cancer vaccine.

All children should get two doses of the hepatitis B vaccine (birth and 6-18 months). Children and adolescents through 18 years of age who did not get the vaccine when they were younger should also be vaccinated. All unvaccinated adults at risk for hepatitis B should be vaccinated. This includes adults having more than one sex partner; adults living in the same house as a person with hepatitis B virus infection; adults seeking care in a clinic for sexually transmitted diseases, HIV testing or treatment, or drug treatment; people with jobs that involve contact with human blood; or people who travel for more than six months a year in countries where hepatitis B is common.

There are few side effects to the hepatitis B vaccine. The risk of the hepatitis B vaccine causing serious harm or death is extremely small. Getting the hepatitis B vaccine is much safer than getting hepatitis B. Mild side effects include soreness where the shot was given and/or fever. In very rare cases a serious allergic reaction may develop.

According to the CDC, if we stopped vaccinating for hepatitis B:

"More than 2 billion persons worldwide have been infected with the hepatitis B virus at some time in their lives. Of these, 350 million are life-long carriers of the disease and can transmit the virus to others. One million of these people die each year from liver disease and liver cancer. National studies have shown that about 12.5 million Americans have been infected with hepatitis B virus at some point in their lifetime. One and one quarter

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

million Americans are estimated to have chronic (long-lasting) infection, of which 20 percent to 30 percent acquired their infection in childhood. Chronic hepatitis B virus infection increases a person's risk for chronic liver disease, cirrhosis, and liver cancer. About 5,000 persons will die each year from hepatitis B-related liver disease resulting in over $700 million in medical and work loss costs. The number of new infections per year has declined from an average of 450,000 in the 1980s to about 80,000 in 1999. The greatest decline has occurred among children and adolescents due to routine hepatitis B vaccination. Infants and children who become infected with hepatitis B virus are at higher risk of developing lifelong infection, which often leads to death from liver disease (cirrhosis) and liver cancer. Approximately 25 percent of children who become infected with lifelong hepatitis B virus would be expected to die of related liver disease as adults. CDC estimates that one-third of the lifelong hepatitis B virus infections in the United States resulted from infections occurring in infants and young children. About 16,000 - 20,000 hepatitis B antigen infected women give birth each year in the United States. It is estimated that 12,000 children born to hepatitis B virus infected mothers were infected each year before the implementation of infant immunization programs. In addition, approximately 33,000 children (10 years of age and younger) of mothers who are not infected with hepatitis B virus were infected each year before routine recommendation of childhood hepatitis B vaccination."

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

Expert Group 5
Varicella Vaccine

Varicella is a virus also known as chickenpox. It causes an itchy rash and a fever. You can catch it from someone who already has it if you touch an open blister on that person's skin or if that person sneezes or coughs around you. Not everyone gets the vaccine, so a lot of kids still get chickenpox. Chickenpox vaccine is the best way to prevent chickenpox. The chickenpox vaccine is very effective: about eight to nine of every 10 people who are vaccinated are completely protected from chickenpox. If a vaccinated person does get chickenpox, it is usually a very mild case lasting only a few days and involving less of a rash, mild or no fever, and few other symptoms. Children who have never had chickenpox are usually given two doses of the varicella vaccine (12 -15 months and four to six years of age) (it may be given earlier if at least three months after the first dose). People 13 years of age and older (who have never had chickenpox or received varicella vaccine) should get two doses at least 28 days apart. Children or adolescents who are not fully vaccinated should receive one or two doses of varicella vaccine.

There are few side effects from the varicella vaccine. Getting the vaccine is much safer than getting chickenpox. The risk of varicella vaccine causing serious harm, or death, is extremely small. Mild side effects are soreness or swelling where the shot was given, fever, or mild rash. Two rare side effects are seizures caused by fever and pneumonia. There are two extremely rare side effects: severe neurological problems and low blood count. (These side effects are so rare, experts cannot be sure whether they are caused by the vaccine or not.)

According to the CDC, if we stopped vaccinating for chickenpox:

"Prior to the licensing of the chickenpox vaccine in 1995, almost all persons in the United States had suffered from chickenpox by adulthood. Each year, the virus caused an estimated 4 million cases of chickenpox, 11,000 hospitalizations, and 100-150 deaths. A highly contagious disease, chickenpox is usually mild but can be severe in some persons. Infants, adolescents and adults, pregnant women, and immunocompromised persons are at particular risk for serious complications including secondary bacterial infections, loss of fluids (dehydration), pneumonia, and central nervous system involvement. The availability of the chickenpox vaccine and its subsequent widespread use has had a major impact on reducing cases of chickenpox and related morbidity, hospitalizations, and deaths. In some areas, cases have decreased as much as 90% over prevaccination numbers. In 2006, routine two-dose vaccination against chickenpox was recommended for all children,

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

adolescents, and adults who do not have evidence of immunity to the disease. In addition to further reducing cases, this strategy will also decrease the risk for exposure to the virus for persons who are unable to be vaccinated because of illness or other conditions and who may develop severe disease. If vaccination against chickenpox were to stop, the disease would eventually return to prevaccination rates, with virtually all susceptible persons becoming infected with the virus at some point in their lives."

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

HPV (human papillomavirus) is a common virus passed on through genital contact. HPV is the most common sexually transmitted virus in the United States. More than six million people get HPV each year, and most new infections are in 15–24 year olds. There are about 100 types of HPV, 40 of which can impact the genital areas of men and women.

Most types of HPV cause no symptoms and go away on their own. Some types of HPV can cause cervical cancer and other less common cancers as well. These types of HPV are known as high risk because they can last for many years and cause changes in the cells of the cervix. When left untreated, these cell changes can lead to cancer. Other types of HPV can cause warts (called genital warts) on the genital area of men and women. These types of HPV do not lead to cancer. The types of HPV that can cause cervical cancer are not the same as the types that can cause genital warts.

Anyone who has ever had genital contact with another person can get HPV. You do not need to have intercourse to spread HPV. Any skin-to-skin contact with the genital area of another person can allow HPV to spread. A person is more likely to get HPV if they have sex at an early age, have many sex partners, or have a sex partner who has had many partners. Since HPV often causes no symptoms, both men and women can have it and pass it on without knowing it.

There is no cure for HPV. There are treatment options for the health problems HPV causes such as genital warts and cervical cancer. Cervical cancer is a cancer that begins in a woman's cervix, the opening to the uterus or womb. Approximately 10,000 women each year in the U.S. will develop cervical cancer, and about 500,000 women will experience serious cervical lesions that may need treatment. Vaccination against HPV makes it much less likely that a woman will develop cervical cancer and other HPV related illnesses. There is currently one HPV vaccine on the market. Others are in development. The HPV vaccine is given in three doses to pre-teenage girls (11-12 years). The vaccine also is given to girls and women who have not been vaccinated (13-26 years). The HPV vaccine does not appear to cause any serious side effects. The mild side effects are pain, itching or swelling at the injection site, and fever. One very rare side effect of the HPV vaccine is an allergic reaction. Research shows that women who are already sexually active can still get some benefit from vaccination, but the vaccine protects best in females who have never been exposed to any type of HPV. Therefore, the vaccine is most effective in girls and young women who receive it before becoming sexually active.

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

With early diagnosis, cervical cancer can be treated and cured. Because treatment is more successful with early detection, it is important for women to get regular Pap tests to detect any changes in the cervix caused by HPV. Doctors recommend that young women begin getting annual Pap tests three years after first sexual contact or at age 21 – whichever comes first.

Although men can get and transmit HPV to their sexual partners, there is currently no U.S. Food and Drug Administration (FDA) approved test to detect HPV in men. The agency states that "there is no clear health benefit to knowing if men have this virus, since HPV is unlikely to affect their health and cannot be treated. For most men, there would be no need to treat HPV, even if treatment were available, since it usually goes away on its own." However, research is ongoing to see how well vaccinating men against HPV may work in preventing HPV infection and diseases in men, and whether it can be an effective strategy for decreasing cervical cancer in women.

According to the CDC, we should vaccinate for HPV because:

"Approximately 20 million Americans are currently infected with HPV, and another 6.2 million people become newly infected each year. At least 50% of sexually active men and women acquire genital HPV infection at some point in their lives. About 1% of sexually active adults in the U.S. have genital warts at any one time. The American Cancer Society estimates that in 2008, 11,070 women will be diagnosed with cervical cancer in the U.S. Other HPV-related cancers are much less common than cervical cancer."

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

Expert Group 7
Meningococcal Vaccine

Meningococcal vaccination protects against most types of meningococcal disease. Meningococcal disease is a severe bacterial illness that can cause meningitis and blood infections (Meningococcal Bacteremia). Meningitis is an infection of the fluid of a person's spinal cord and the fluid that surrounds the brain. It is sometimes called spinal meningitis. Symptoms of meningitis are fever, headache, stiff neck, nausea, vomiting, and mental status changes. Meningitis is contagious. The bacteria are spread person to person through things like coughing, sneezing, or kissing. There is also a form of meningitis caused by a virus. The viral form is much less severe and usually resolves without treatment. There is no vaccine for viral meningitis.

Meningococcal disease affects 1,000 – 2,600 people each year. It can be a deadly disease, fatal to about every one out of 10 people who get it. Even with treatment, 10-15% die and 11-19% of those who live are severely impacted (loss of arms or legs, deafness, nervous system problems, mental disabilities, seizures, and stroke). Meningococcal disease can be treated with penicillin. The most effective way to prevent meningococcal disease is the meningococcal vaccine.

There are two kinds of vaccines. The vaccine given to adolescents is MCV4 (meningococcal conjugate vaccine). It prevents four types of meningococcal disease including the most common types in the U.S. MCV4 is given to young people at their preadolescent pediatrician visit (11 - 12 years). For anyone who has not yet been vaccinated, it is given before starting high school. Meningococcal vaccine is also given to other groups of people considered high risk due to certain medical conditions. College freshmen who live in dormitories and teenagers 15-19 are also considered high risk.

There are few side effects to the meningococcal vaccine. The risk of the meningococcal vaccine causing serious harm, or death, is extremely small. Getting the meningococcal vaccine is much safer than getting meningococcal disease. Mild side effects include redness or pain where the shot was given and fever. One possible side effect is an allergic reaction. One very rare, severe side effect is a nervous system disorder called GBS (Guillain-Barre Syndrome). This is so rare, experts cannot be sure whether the vaccine causes it or not.

Vaccination Investigation

Student Resource 1: Vaccination Article Packet

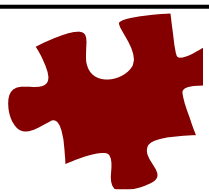
The following story illustrates why the meningococcal vaccination is so important:

The following excerpt is from a story originally published in the December 1, 1999, edition of *The Collegian* as "Ordinary College Student Shares Horror of Meningitis" by Ryan Hockensmith, who was then a senior at Penn State majoring in journalism and a staff writer for *The Collegian*. His story is reprinted with permission from the newspaper.

"The doctor was squeezing my toes hard. I could see his face clench up as he went from toe to toe, tightening two fingers around each of the toes on my left foot. To my horror, in the most excruciating few seconds of my life, I didn't feel anything. It's hard to express in words how I felt at that moment, how it feels to have someone grab a part of your body and not feel anything. It's terrifying. That was the end result of my three-week battle with meningococcal meningitis, a form of meningitis that claims [many] of its victims. I'm alive and well now, two weeks into a long recovery process. I will lose only those four toes I had no feeling in. But I look back now and wonder, why me? Meningitis only attacks a minuscule percentage of people every year, but a high percentage of those are college students. I am now a part of that statistic. If I had spent $75 and gone …for a meningitis vaccine like I should have last year, I wouldn't have to look at my body and nearly cry every day. Please make the most of your opportunity to avoid what happened to me."

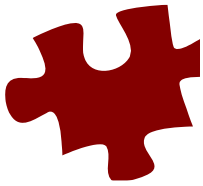
Vaccination Investigation

Student Resource 2: Expert Jigsaw Assignment Cards



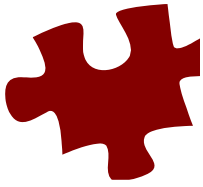
Expert Group 1
Read about …

Polio Vaccine



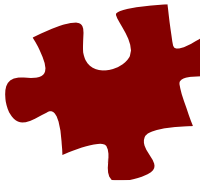
Expert Group 2
Read about …

MMR Vaccine



Expert Group 3
Read about …

DTaP Vaccine

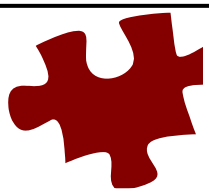


Expert Group 4
Read about …

Hepatitis B Vaccine

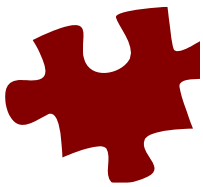
Vaccination Investigation

Student Resource 2: Expert Jigsaw Assignment Cards



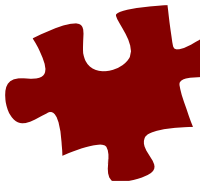
Expert Group 5
Read about …

Varicella Vaccine



Expert Group 6
Read about …

HPV Vaccine



Expert Group 7
Read about …

Meningococcal Vaccine

Vaccination Investigation

Student Resource 3: Vaccination Quick Write

Directions: Reflect on your use of summarizing skills for the Expert Jigsaw activity. Reflect on the knowledge gained for the topic of vaccines.

1. Good readers summarize what they have read. In this lesson you had to summarize what you read for the Jigsaw Activity because you had to become the expert for your part. What did you learn about the skill of summarizing? How might you use what you learned about summarizing in the future?

2. Beside each vaccine, list the disease(s) it prevents.
   Polio _____
   MMR _____
   DTaP _____
   Hepatitis B _____
   Varicella _____
   HPV _____
   Meningococcal _____

3. List one (or more) important fact(s) about each of the vaccines you learned about today.

Polio

MMR

DTaP

Hepatitis B

Varicella

HPV

Meningococcal

Vaccination Investigation

Teacher Resource 1: Content Background and Resources

"Disease prevention is the key to public health. It is always better to prevent a disease than to treat it. Vaccines prevent disease in the people who receive them and protect those who come into contact with unvaccinated individuals. Vaccines help prevent infectious diseases and save lives. Vaccines are responsible for the control of many infectious diseases that were once common in this country, including polio, measles, diphtheria, pertussis (whooping cough), rubella (German measles), mumps, tetanus, and Haemophilus influenzae type b (Hib).

"Parents are constantly concerned about the health and safety of their children and take many steps to protect them. These steps range from child-proof door latches to child safety seats. In the same way, vaccines work to protect infants, children, and adults from illnesses and death caused by infectious diseases. While the US currently has record, or near record, low cases of vaccine-preventable diseases, the viruses and bacteria that cause them still exist. Even diseases that have been eliminated in this country, such as polio, are only a plane ride away. Polio, and other infectious diseases, can be passed on to people who are not protected by vaccines.

"Vaccine-preventable diseases have a costly impact, resulting in doctor's visits, hospitalizations, and premature deaths. Sick children can also cause parents to lose time from work."

Statement from the US Department of Health and Human Services
Centers for Disease Control and Prevention (CDC)

What is a vaccine?
A vaccine is made from the antigen—either a bacteria or a virus—that causes the disease. Some vaccines use live or active but weakened versions of the antigen. Some are made from killed or inactive antigens, and others are made from parts of the antigen or one that closely resembles the targeted bacteria or virus. In any form, a vaccine does not contain enough antigens to cause the disease. It has just enough to trigger the body's immune system to produce antibodies against that disease. In most cases, these antibodies remain active and protective against the disease for a person's lifetime. This protection is called immunity. In some cases, a vaccine requires booster shots, doses given at regular intervals.

What are some common vaccines? When do children typically get them?
Explain that usually, children receive several vaccinations during the first 10 years of their lives, most of them before the age of one: polio, MMR (measles, mumps, rubella), DTaP (diphtheria, tetanus, pertussis), hepatitis B, varicella (chickenpox). CDC and the American Academy of Pediatrics (AAP) recommend that pre-teens get

Vaccination Investigation

Teacher Resource 1: Content Background and Resources

several vaccines at their 11 or 12-year-old check-up: tetanus-diphtheria-acellular pertussis vaccine (Tdap), meningococcal conjugate vaccine (MCV4), and human papillomavirus (HPV) vaccine for girls.

How do vaccines work? What does a vaccine do? How do vaccines prevent disease?
A weakened form of the disease germ is injected into the body. The body makes antibodies to fight these invaders. If and when the actual disease germs attack the body, the antibodies will still be there to destroy them.

What is an immune system? What is immunity?
Explain that the immune system is the body's method of protecting itself from foreign substances that invade the body. Vaccines work with our immune system to protect against diseases. A vaccine helps your body create antibodies, or cells that fight off antigens, and foreign substances like bacteria or viruses. Sometimes your body creates antibodies by itself, but not enough to fight a serious disease like polio. Immunity to a disease is achieved through the presence of antibodies to that disease in a person's system. Antibodies are proteins produced by the body to neutralize or destroy toxins or disease-carrying organisms. Antibodies are disease-specific. For example, measles antibody will protect a person who is exposed to measles disease, but will have no effect if he or she is exposed to mumps.

There are two types of immunity: active and passive. Active immunity results when exposure to a disease organism triggers the immune system to produce antibodies to that disease. Exposure to the disease organism can occur through infection with the actual disease (resulting in natural immunity), or introduction of a killed or weakened form of the disease organism through vaccination (vaccine-induced immunity). Either way, if an immune person comes into contact with that disease in the future, their immune system will recognize it and immediately produce the antibodies needed to fight it. Active immunity is long-lasting, and sometimes lifelong. Passive immunity is provided when a person is given antibodies to a disease rather than producing them through his or her own immune system. A newborn baby acquires passive immunity from its mother through the placenta. A person can also get passive immunity through antibody-containing blood products such as immune globulin, which may be given when immediate protection from a specific disease is needed. This is the major advantage to passive immunity; protection is immediate, whereas active immunity takes time (usually several weeks) to develop. However, passive immunity lasts only for a few weeks or months. Only active immunity is long-lasting.

What are the potential side effects of vaccinations?
While vaccines are very safe, like any medicine they do sometimes cause reactions. Mostly, these are mild "local" reactions (soreness or redness where the shot is given) or a low-grade fever. They may last a day or two and then go away. Sometimes more serious reactions are associated with vaccines. These are much less common. Some of them are clearly caused by the vaccine. Some have been reported after vaccination but are

Vaccination Investigation

Teacher Resource 1: Content Background and Resources

so rare that it is impossible to tell if they were caused by the vaccine or would have happened anyway. There is a very small risk that any vaccine could trigger a severe allergic reaction.

Why should vaccinations be required?

Immunizing individual children also helps to protect the health of our community, especially those people who are not immunized. People who are not immunized include those who are too young to be vaccinated (e.g., children less than a year old cannot receive the measles vaccine but can be infected by the measles virus), those who cannot be vaccinated for medical reasons (e.g., children with leukemia), and those who cannot make an adequate response to vaccination. Also protected, therefore, are people who received a vaccine, but who have not developed immunity. In addition, people who are sick will be less likely to be exposed to disease germs that can be passed around by unvaccinated children. Immunization also slows down or stops disease outbreaks.

To explore the concept of community disease prevention, Garrett Hardin's classic essay The Tragedy of the Commons describes the challenges presented when societal interest conflicts with the individual's interest. Hardin notes*: "…a community free of an infectious disease because of a high vaccination rate can be viewed as a common. The very existence of this common leads to tension between the best interests of the individual and those of the community. Increased immunization rates result in significantly decreased risk for disease. Although no remaining unimmunized individual can be said to be free of risk from the infectious disease, the herd effect generated from high immunization rates significantly reduces the risk for disease for those individuals. Additional benefit is conferred on the unimmunized person because avoidance of the vaccine avoids the risk for any adverse reactions associated with the vaccine. As disease rates drop, the risks associated with the vaccine come even more to the fore, providing further incentive to avoid immunization. Thus, when an individual in this common chooses to go unimmunized, it only minimally increases the risk of illness for that individual, while conferring on that person the benefit of avoiding the risk of vaccine induced side effects. At the same time, however, this action weakens the herd effect protection for the entire community. As more and more individuals choose to do what is in their 'best' individual interest, the common eventually fails as herd immunity disappears and disease outbreaks occur. To avoid this 'tragedy of the commons', legal requirements have been imposed by communities (in recent times, by states) to mandate particular vaccinations."*

Vaccination Investigation

Teacher Resource 1: Content Background and Resources

WEB RESOURCES

Content Background
http://www.cdc.gov/vaccines
http://www.cdc.gov/vaccines/vpd-vac/default.htm
http://kidshealth.org/parent/general/body/vaccine.html
http://www.vaccineinformation.org
http://www.cancer.org
http://www.neahin.org

Vaccine Information Statements
http://www.cdc.gov/vaccines/pubs/vis/default.htm

Instructional Strategies
http://www.jigsaw.org/

Group Work Rubric
http://www.uen.org/Rubric/rubric.cgi?rubric_id=12916

Create your own rubric
http://rubistar.4teachers.org/index.php

Internet Safety
http://www.bnetsavvy.org

Vaccination Investigation

Teacher Resource 2: Lesson Vocabulary

antibody
Definition: A substance that fights a disease by protecting the body from a virus or bacteria.
Context: Vaccines cause the body to develop antibodies to fight a disease.

antigen
Definition: A substance such as bacteria or a virus that invades the body and stimulates the production of an antibody.
Context: Recognized as a threat by the immune system, an antigen, such as the streptococcus bacteria, triggers the production of an antibody.

bacteria
Definition: Simple one-celled organisms classified as prokaryotes.
Context: Although many bacteria live in the human body without causing harm, some cause tuberculosis, typhoid fever, whooping cough, and other diseases.

contagious
Definition: Capable of being transmitted by bodily contact with an infected person or object
Context: Measles is highly contagious, and infected people are usually contagious from about four days before their rash starts to four days afterwards.

endemic
Definition: The continual, low-level presence of disease in a community
Context: Cutaneous diphtheria is endemic in tropical countries but unusual in the United Kingdom.

herd immunity
Definition: Having a large percentage of the population vaccinated in order to prevent the spread of certain infectious diseases. Also known as community immunity.
Context: Herd immunity benefits individuals not vaccinated (such as newborns and those with chronic illnesses) because the disease has little opportunity to spread within the community.

immunity
Definition: Protection against a disease. There are two types of immunity, passive and active. Immunity is indicated by the presence of antibodies in the blood and can usually be determined with a laboratory test.
Context: Without evidence of immunity, it is beneficial to give the vaccine within three to five days of exposure.

Vaccination Investigation

Teacher Resource 2: Lesson Vocabulary

immunization
Definition: The process of protecting the body against disease using vaccines or serums.
Context: Most children begin their immunization schedule as babies and continue before they begin elementary and middle school.

incubation period
Definition: The time from contact with infectious agents (bacteria or viruses) to onset of disease.
Context: The typical incubation period for measles from exposure to rash onset is approximately 10 days.

infectious
Definition: Likely to spread to others. Capable of spreading disease. Also known as communicable.
Context: Measles is an infectious disease

vaccine
Definition: A substance that protects a body against a disease by causing the body's immune system to produce antibodies.
Context: Some vaccines provide lifelong protection against infection, while others require several doses given at regular intervals.

virus
Definition: An infectious agent that lives in a cell of another living thing.
Context: Viruses are a major cause of disease and can infect human beings with measles, influenza, and the common cold.

Vaccination Investigation

Teacher Resource 3: Instructional Strategy Overview

Expert Jigsaw Strategy

Jigsaw is a cooperative learning strategy. Teachers arrange students in groups called Home Groups. Each Home Group member is assigned a different piece of expert information related to the main topic. Home Group members join with members of other groups assigned the same piece of expert information. Students become experts on the topic by reading and/or researching. After reading/researching the given topic, the expert group members share ideas about the information and develop a teaching plan for the topic. Expert Group members return to their original Home Groups to teach each other about their topics. This strategy enables students to be responsible for learning and creates a deep understanding of the content. It also develops teamwork and cooperative learning skills. The Jigsaw Strategy can be modified to accommodate a wide variety of instructional needs for any content area.

Jigsaw secret: The number of students in each Home Group is equal to the number of reading sections for the topic. For example, if you are studying the five Great Lakes, you would create Home Groups of five students. Do not be concerned with the size of the Expert Groups. If you have a large class size, and the Expert Group size is too large, you can subdivide the Expert Group. Also, if you have "remainder" students, for example the class size is 32, you have six Home Groups (five in each group) and two students left over. Assign each of those remainder students to any of the Home Groups. The two Home Groups with the extra person can send two members to the same Expert Group.

Think-Pair-Share Strategy

Think-Pair-Share is a simple and powerful thinking structure. A problem or question is posed and students think alone about the question for a designated period of time. Next, students pair off to discuss the question or problem. Finally, students are called upon to share the ideas with the whole class. This strategy dramatically increases participation in class discussions. Research shows that the quality of student responses goes up significantly when you allow adequate think time. This strategy helps a teacher to make transitions during direct instruction. It is versatile because it can be used at any grade level, for any subject matter, and at any point during a lesson.

Think–Pair–Share secrets: Use an easy method to create partners to use at various times during instruction. Have students complete a partner hunt such as "Compass Partners". Students go around the room and identify and record four partners on a recording sheet. They keep the sheet in their class notebook. When the teacher needs the students to find a partner, she or he can say, "Take out your Compass Partner card and sit beside your 'North' partner." If a teacher would like to use assigned partners, he or she can pre-fill the "East" partner on each student's card before beginning the partner hunt. Another time-saving hint is to have an attention-getting-signal in place in order to move the discussion along during the Think-Pair-Share.

Vaccination Investigation

Teacher Resource 4: Group Work Evaluation Rubric

Directions: Explain the rubric to the class before the activity begins. First, have students complete a self evaluation using the first Group Work Rubric on the sheet. Second, give the rubric to an "Expert" Group member to complete the second rubric. Finally, based on anecdotal observations, the teacher completes the third rubric on the page.

STUDENT NAME _____

SELF EVALUATION

Vaccine Jigsaw Activity	**Point Total _____/20**				
	1	2	3	4	Total
Prepared for the Expert Group meeting	never	rarely	often	always	
Prepared for the Home Group meeting	never	rarely	often	always	
Interacted, discussed, and posed questions	never	rarely	often	always	
Offered ideas and reported information	never	rarely	often	always	
Encouraged and supported teammates	never	rarely	often	always	

PEER EVALUATION

Vaccine Jigsaw Activity	**Point Total _____/20**				
	1	2	3	4	Total
Prepared for the Expert Group meeting	never	rarely	often	always	
Prepared for the Home Group meeting	never	rarely	often	always	
Interacted, discussed, and posed questions	never	rarely	often	always	
Offered ideas and reported information	never	rarely	often	always	
Encouraged and supported teammates	never	rarely	often	always	

TEACHER EVALUATION

Vaccine Jigsaw Activity	**Point Total _____/20**				
	1	2	3	4	Total
Prepared for the Expert Group meeting	never	rarely	often	always	
Prepared for the Home Group meeting	never	rarely	often	always	
Interacted, discussed, and posed questions	never	rarely	often	always	
Offered ideas and reported information	never	rarely	often	always	
Encouraged and supported teammates	never	rarely	often	always	

Evaluation Point Total _____/60

Vaccination Investigation

Teacher Resource 5: Reference List

American Cancer Society <http://www.cancer.org/docroot/home/index.asp>

Hockensmith, Ryan. "Ordinary College Student Shares Horror of Meningitis." The Collegian 1 Dec. 1999 .

Immunization Action Coalition <http://www.vaccineinformation.org/>

Kagan, Spencer. (1992). *Cooperative Learning.* Resources for Teachers.

Kids Health Organization <http://kidshealth.org>

Murray, Bonnie P. (2002). *The New Teacher's Complete Sourcebook: Grades K–4*. Scholastic Books.

National Education Association Health Information Network <http://www.neahin.org>

Sexuality Information and Education Council of the United States <http://www.siecus.org/index.cfm>

Stanford University <http://www.stanford.edu/group/arts/nicaragua/student/mural/glossary.html>

U.S. Centers for Disease Control and Prevention <http://www.cdc.gov/>

U.S. Department of Health and Human Services <http://www.hhs.gov/diseases/>

Wong, Harry K. (1998). *The First Days of School*: *How to Be an Effective Teacher.* Harry K. Wong Publications Inc.

World Health Organization <www.who.org/>