Vaccine Education Module: Vaccines

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What Is a Vaccine?

A **vaccine** is the deliberate stimulation of adaptive immunity. Vaccines:

- Work by mimicking what happens during natural infection without causing illness.
- Use altered versions of viruses or bacteria to trigger an immune response.
- Are the most effective means of controlling infectious diseases.
- Not only protect those who get them, but they also help keep diseases at bay in the community; this is called herd immunity.
How Do Vaccines Work?

During natural infection:

• The immune system recognizes a pathogen as foreign and makes an immune response to it. When a pathogen causes an immune response, it is known as an antigen.
• Unfortunately, while the immune response is gaining strength, the person is likely to be ill as the struggle between the pathogen and the immune response is decided.
• One part of the immune response creates antibodies; this is known as the antibody-mediated or humoral immune response.
• Antibodies are specific to antigens and have the ability to remember them, so that if the same (or a very similar) antigen tries to infect the person again, the immune response will be stronger and faster thereby protecting the person from infection—and illness.
How Do Vaccines Work?

With a vaccine:

- The immune system recognizes the vaccine as foreign and makes an immune response to it. The vaccine serves as an antigen in that it causes the immune system to respond to it.
- One part of the immune response creates antibodies; this is known as the antibody-mediated or humoral immune response.
- Antibodies are specific to the vaccine and have the ability to remember it, so that if the vaccine or a very similar antigen is seen again, the immune response will be stronger and faster thereby protecting the person from infection.
- The main difference between a vaccine and natural infection is that the person does not become ill while the immune system is responding to the vaccine.
How Are Vaccines Made?

Vaccines are made by:

• Weakening the virus
• Inactivating the virus
• Using part of the virus or bacteria
• Inactivating a toxin (poison) made by the bacteria
How Are Vaccines Determined to Be Safe and Effective?

• Phase I studies
  • Use fewer than 100 volunteers
  • Answer the questions
    • Is the vaccine safe?
    • Does it trigger an immune response?

• Phase II studies
  • Use a few hundred volunteers
  • Use the type of people likely to get the vaccine
How Are Vaccines Determined to Be Safe and Effective?

- Phase III studies
  - Use more than 5,000 volunteers across a large geographical area
  - Use the type of people who will get the vaccine
  - All data is submitted to U.S. Food and Drug Administration (FDA)
  - FDA reviews all data and determines whether the vaccine can be licensed and sold
How Are Vaccines Determined to Be Safe and Effective?

• Phase IV studies
  • Vaccines continue to be monitored for safety even after they are being used.

• Sometimes rare side effects are found after the vaccine is given to a large number of people
  • Vaccine Adverse Event Reporting System (VAERS) is monitored by the CDC and FDA

• Can include data from selected health departments or health maintenance groups
Recommendation

- Vaccine recommendations are a group decision between:
  - Centers for Disease Control and Prevention
  - American Academy of Pediatrics
  - American Academy of Family Physicians
Requirements

- The government of each state decides whether people in that state will be required to get a vaccine.
  - Influenced by economics and politics
Infants and Children 0 Through 6 Years of Age – Vaccines

- Hepatitis B
- Rotavirus
- Diphtheria, Tetanus and Pertussis
- *Haemophilus influenzae* type b
- Pneumococcus
- Polio
- Influenza
- Measles, Mumps and Rubella
- Varicella
- Hepatitis A
Children and Teens 7 Through 18 Years of Age – Vaccines

- Tetanus, diphtheria and pertussis
- Human papillomavirus (HPV)
- Meningococcus
- Influenza
Adolescents and Teens May Need to “Catch-up” on Certain Vaccines

- Hepatitis A
- Hepatitis B
- Poliovirus
- Measles, Mumps and Rubella
- Varicella
Adults

Photo Credit: James Gathany, CDC
Adults

- Most adults don’t realize when they, too, need vaccines:
  - At certain ages
  - During pregnancy
  - Before travel
  - For occupational risks
  - When they have certain medical conditions
Vaccines for Adults

- Td/Tdap
- Human Papillomavirus (HPV)
- Varicella
- Herpes Zoster
- Measles, Mumps and Rubella
- Influenza
- Pneumococcal
- Hepatitis A
- Hepatitis B
- Meningococcus