Vaccination

Even though most T cells and B cells die after they eliminate the pathogen, some become **memory cells** and live on. If the same microbe or germ enters the body again, the memory cells rapidly remember it and fight it more quickly.

Medical researchers discovered that we can take advantage of this special memory feature. We can use vaccines to "teach" our immune system how to fight dangerous pathogens without having to endure the actual infection.

How Vaccines Work

- Vaccines are agents that teach the immune system to recognize specific pathogens and defend the body against them
- The vaccine can enter the body via a needle (through the skin), a spray (into the nose), or a liquid or capsule (taken by mouth).
- After the vaccine enters the body, the immune system will recognize the vaccine contents as foreign and make a response.
- Most of the B cells and T cells that responded to the vaccine will die, but some will stay alive for years as memory cells. If the actual pathogen enters the body, the memory cells will remember it and fight it quickly.
- After vaccination, if the real pathogen infects the body, the immune system will recognize it. The memory cells can replicate quickly and get rid of the pathogen, and the person will be less likely to become severely sick.

Importance of Vaccination

- Vaccination has been a medical practice since the 1500s.
- As of 2024, vaccines help protect against over 20 diseases worldwide. Examples include: COVID-19, cervical cancer, measles, Ebola, and tetanus.

Designed by Freepik

- Thanks in large parts to vaccines, deaths in childhood have decreased by 50%. Check out A brief history of vaccines on the website of the World Health Organization.
- However, some diseases are re-emerging in recent years because an increasing number of people are not vaccinated. It is **highly recommended that everyone be vaccinated to avoid suffering and deaths from preventable diseases.**

Vaccination means receiving a vaccine. **Immunization** means receiving a vaccine to teach the body's immune system to recognize invading viruses or bacteria and make antibodies against them. The two terms are often used interchangeably.

Types of Vaccine

Pathogens in vaccines are weakened, inactivated, or incomplete. They are incapable of causing the disease that the vaccines are aiming to prevent.

- **Live attenuated vaccines** – The pathogen is weakened but can still replicate. **Individuals with immune deficiencies should be assessed by an immunologist to see if they can receive these vaccines**. E.g.: Chickenpox (varicella); Measles, mumps, rubella (MMR); Rotavirus; Smallpox; Yellow fever
- **Inactivated vaccines** – The pathogen is inactive and cannot replicate. E.g.: Hepatitis A; Influenza (flu); Polio; Rabies
- **Subunit vaccines** – The vaccine contains only certain parts of the pathogen. E.g.: Hepatitis B; HPV (Human papillomavirus); Influenza (flu); Meningococcal disease; Pertussis (whooping cough); Pneumococcal disease; Shingles
- **Toxoid vaccines** – The vaccine contains weakened toxins of pathogens. E.g.: Diphtheria; Tetanus
- **mRNA vaccines** – The mRNA in the vaccines codes for instructions for human cells to produce a protein that the pathogen usually makes. E.g.: COVID-19 (see our info sheet)
- **Adenoviral vector vaccines** – The viral vector is a harmless, unrelated virus that is used to transport the DNA instructions. The DNA in the vector codes for instruction for human cells to produce a protein that the pathogen makes. E.g.: Smallpox, COVID-19 (see our info sheet)

Immune System Series for Individuals with 22q11.2 Differences

Vaccination (continued)

Vaccination Schedule

- Standard vaccination (0 to 18 years): CDC | WHO
- Vaccination recommended for travelers: CDC | WHO
- Vaccination against the flu (yearly) and COVID-19

All individuals, including those with 22q11.2 deletion and duplication syndrome and their family members, benefit from inactivated vaccinations, even though some may have reduced responses. Live viral vaccines are restricted in some very immunodeficient patients.

Caution for People with Immune Deficiencies

- About 80% of babies with 22q11.2DS have low T cells. (This is not a common problem in babies with 22q11.2DupS.)
- Children whose T cell deficiency is not severe can safely receive these live attenuated vaccines:
  - MMR (measles, mumps, rubella)
  - Chicken pox (varicella)
- **Babies with very low T cells (CD4 <400 or naive CD4 <100 cells/mm^3) should not receive live attenuated vaccines**:
  - MMR (measles, mumps, rubella)
  - Chickenpox (varicella)
  - Smallpox
  - Yellow fever
  - Bacille Calmette-Guérin (BCG) vaccine (tuberculosis)
  - The live attenuated, nasal mist type of flu vaccine (use the inactivated type instead)

Resources

It is very important to **obtain accurate, evidence-based information** about vaccines from health authorities.

If you have any concerns, please discuss them with your immunologist.

Vaccine Responses and 22q Differences

Individuals with 22q11.2 deletion or duplication syndromes largely get protection from vaccines. However, in some cases, the protection may not be as strong as what is seen in the general population.

Here are some research reports on the topic:

- A US study on the vaccination of both children and adults with 22q11.2DS with the inactivated type of flu vaccine
- An Italian study on the vaccination of adults with 22q11.2DS with a COVID-19 mRNA vaccine
- A US study on children with 22q11.2**Dup**S who received the PPSV23 vaccine (a subunit vaccine against pneumococcal diseases such as meningitis and other bacteria infections)

- Vaccination and Immunization – World Health Organization (WHO)
- Vaccines and Immunizations – Centers for Disease Control and Prevention (CDC), USA
- Tell Me More: Vaccines – Public Health Ontario, Canada
- About Vaccines – European Vaccination Information Portal
- Updated clinical practice recommendations for managing [**children** | **adults**] with 22q11.2 deletion syndrome – 2023
- The immune deficiency of chromosome 22q11.2 deletion syndrome – 2017

22q International 22q11.2 Foundation

The mission of the International 22q11.2 Foundation is to improve the quality of life for individuals affected by chromosome 22q11.2 differences through family and professional partnerships.
This information is brought to you by the Foundation for educational purposes only. It is not intended to be taken as medical advice. If you have concerns, please talk to your healthcare provider.

Joanne C. Y. Loo, PhD and Kathleen Sullivan, MD, PhD; 12/2024