COVID-19 Vaccination
Product Info by US Vaccine
Clinical Care
Provider Requirements and Support
Training and Education
Recipient Education
mRNA COVID-19 Vaccines
Viral Vector COVID-19 Vaccines
Making a Strong Recommendation for COVID-19 Vaccination
Answering Patients' Questions
Planning & Partnerships
Vaccine Effectiveness Research
Vaccination Toolkits
COVID-19 Vaccination Reporting Data Systems
Content Syndication
Vaccinate with Confidence

Understanding and Explaining Viral Vector COVID-19 Vaccines

Several COVID-19 vaccine candidates entering late-stage clinical trials are what is known as viral vector vaccines. These vaccines are likely to be among the COVID-19 vaccines authorized for use in the United States. This page provides background and safety information about these vaccines for healthcare professionals and other vaccine providers, as well as tips for explaining viral vector vaccines to patients.

Key Points to Share with Your Patients

In addition to sharing the following key messages, you can refer your patients with questions to CDC's COVID-19 viral vector vaccine webpage

- Like all vaccines, viral vector vaccines for COVID-19 will be rigorously tested for safety before being authorized or approved for use in the United States.
- Vaccines of this type have been well-studied in clinical trials, and viral vector vaccines have been used to respond to recent Ebola outbreaks.
- Viral vector vaccines use a modified version of a different virus as a vector to deliver instructions, in the form of genetic material (a gene), to a cell. The vaccine does not cause infection with either COVID-19 or the virus that is used as the vector.
- The genetic material delivered by the viral vector does not integrate into a person's DNA.

A Vehicle for Vaccine Delivery

Many vaccines use a weakened or inactivated form of the target pathogen to trigger an immune response. Viral vector vaccines use a different virus as a vector instead, which delivers important instructions (in the form of a gene) to our cells. For COVID-19 vaccines, a modified virus delivers a gene that instructs our cells to make a SARS-CoV-2 antigen called the spike protein. This antigen triggers production of antibodies and a resulting immune response. The virus used in a viral vector vaccine poses no threat of causing illness in humans because it has been modified or, in some cases, because the type of virus used as the vector cannot cause disease in humans.

A Closer Look at How COVID-19 Viral Vector Vaccines Work

In the development of viral vector vaccines, several different viruses have been used as vectors, including influenza, vesicular stomatitis virus (VSV), measles virus, and adenovirus, which causes the common cold. Adenovirus is one of the viral vectors used in some late-stage COVID-19 vaccine trials.

In viral vector vaccines, a gene unique to the virus being targeted is added to the viral vector. For COVID-19 vaccines, this gene codes for the spike protein, which is only found on the surface of SARS-CoV-2. The viral vector is used to shuttle this gene into a human cell. Once inside a cell, the viral vector uses this gene and the cell's machinery to produce the spike protein and display it on the cell's surface.

Once displayed on the cell's surface, the protein (or antigen) causes the immune system to begin producing antibodies and activating T-cells to fight off what it thinks is an infection. These antibodies are specific to the SARS-CoV-2 virus, which means the immune system is primed to protect against future infection.

COVID-19 Viral Vector Vaccines Will Be Rigorously Evaluated for Safety

COVID-19 viral vector vaccines are being held to the same rigorous safety and effectiveness standards as all other types of vaccines in the United States. The only COVID-19 vaccines the U.S. Food and Drug Administration (FDA) will make available for use in the United States (by approval or emergency use authorization) are those that meet these standards. This rigorous review includes large clinical trials and data review by a safety monitoring board.

Viral Vector Vaccines Have Been Used for Recent Disease Outbreaks

Since the 1970s when scientists began creating viral vectors, hundreds of scientific studies have been done and published around the world concerning the creation of viral vector vaccines. A number of human clinical trials have been conducted for viral vector vaccines against different infectious diseases, including Zika virus, influenza viruses, respiratory syncytial virus (RSV), HIV, and malaria. Two Ebola vaccines using viral vector technology have been used in recent Ebola outbreaks in West Africa and the Democratic Republic of the Congo.

Challenges and Benefits of Viral Vector Vaccines

Because humans develop immune responses when exposed to viruses, our bodies can potentially have pre-existing immunity to vector viruses. Since adenoviral vectors are based on natural viruses that some of us might already have been exposed to, the vaccines might not work for everyone. To overcome this challenge, scientists have used uncommon viruses or viruses only found in other species (such as chimpanzees) as viral vectors.

Adenoviruses are often used for viral vector vaccines because they can induce a robust immune response. The adenovirus genome has been well studied by scientists. Adenovirus vector vaccines are easy to design and produce on a mass scale, making them well suited for pandemic response. VSV has been used effectively as a vector for Ebola vaccines, and numerous other viral vectors have shown promise in early clinical trials.

Related Links

- Talking to Patients about COVID-19 Vaccines
- FDA Vaccine Development 101
- FDA Emergency Use Authorization for Vaccines Explained
- FDA Infographic: The Path for a COVID-19 Vaccine from Research to Emergency Use Authorization

Additional Resources

- Humphreys IR, Sebastian S. Novel viral vectors in infectious diseases. *Immunology*. 2018;153(1):1-9. doi:1111/imm.12829
- Zhang, Chao, and Dongming Zhou. "Adenoviral Vector-Based Strategies against Infectious Disease and Cancer." *Human Vaccines & Immunotherapeutics* 12, no. 8 (April 22, 2016): 2064–74. https://doi.org/10.1080/21645515.2016.1165908 .
- Afrough, Sara, Sophie Rhodes, Thomas Evans, Richard White, and John Benest. "Immunologic Dose-Response to Adenovirus-Vectored Vaccines in Animals and Humans: A Systematic Review of Dose-Response Studies of Replication Incompetent Adenoviral Vaccine Vectors When Given via an Intramuscular or Subcutaneous Route." *Vaccines* 8, no. 1 (March 17, 2020). https://doi.org/10.3390/vaccines8010131 .

Top of Page

Page last reviewed: February 17, 2021
Content source: National Center for Immunization and Respiratory Diseases