Get the facts about COVID-19 vaccines

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A vaccine to prevent COVID-19 is perhaps the best hope for ending the pandemic. Currently, there is no vaccine to prevent infection with the COVID-19 virus, but researchers are racing to create one.

Coronavirus vaccine research

Coronaviruses are a family of viruses that cause illnesses such as the common cold, severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). COVID-19 is caused by a virus that's closely related to the one that causes SARS. For this reason, scientists named the new virus SARS-CoV-2.

While vaccine development can take years, researchers aren't starting from scratch to develop a COVID-19 vaccine. Past research on SARS and MERS vaccines has identified potential approaches.

Coronaviruses have a spike-like structure on their surface called an S protein. (The spikes create the corona-like, or crown-like, appearance that gives the viruses their name.) The S protein attaches to the surface of human cells. A vaccine that targets this protein would prevent it from binding to human cells and stop the virus from reproducing.

Coronavirus vaccine challenges

Past research on vaccines for coronaviruses has also identified some challenges to developing a COVID-19 vaccine, including:

Ensuring vaccine safety. Several vaccines for SARS have been tested in animals. Most of the vaccines improved the animals' survival but didn't prevent infection. Some vaccines also caused complications, such as lung damage. A COVID-19 vaccine will need to be thoroughly tested to make sure it's safe for humans.

Providing long-term protection. After infection with coronaviruses, re-infection with the same virus—though usually mild and only happening in a fraction of people—is possible after a period of months or years. An effective COVID-19 vaccine will need to provide people with long-term infection protection.

Protecting older people. People older than age 50 are at higher risk of severe COVID-19. But older people usually don't respond to vaccines as well as younger people. An ideal COVID-19 vaccine would work well for this age group.

Pathways to develop and produce a COVID-19 vaccine

Global health authorities and vaccine developers are currently partnering to support the technology needed to produce vaccines. Some approaches have been used before to create vaccines, but some are still quite new.

Live vaccines

Live vaccines use a weakened (attenuated) form of the germ that causes a disease. This kind of vaccine prompts an immune response without causing disease. The term attenuated means that the vaccine's ability to cause disease has been reduced.

Live vaccines are used to protect against measles, mumps, rubella, smallpox and chickenpox. As a result, the infrastructure is in place to develop these kinds of vaccines.

However, live virus vaccines often need extensive safety testing. Some live viruses can be transmitted to a person who isn't immunized. This is a concern for people who have weakened immune systems.

Inactivated vaccines

Inactivated vaccines use a killed (inactive) version of the germ that causes a disease. This kind of vaccine causes an immune response but not infection. Inactivated vaccines are used to prevent the flu, hepatitis

A and rabies.

However, inactivated vaccines may not provide protection that's as strong as that produced by live vaccines. This type of vaccine often requires multiple doses, followed by booster doses, to provide long-term immunity. Producing these types of vaccines might require the handling of large amounts of the infectious virus.

Genetically engineered vaccines

This type of vaccine uses genetically engineered RNA or DNA that has instructions for making copies of the S protein. These copies prompt an immune response to the virus. With this approach, no infectious virus needs to be handled. While genetically engineered vaccines are in the works, none has been licensed for human use.

The vaccine development timeline

The development of vaccines can take years. This is especially true when the vaccines involve new technologies that haven't been tested for safety or adapted to allow for mass production.

Why does it take so long? First, a vaccine is tested in animals to see if it works and if it's safe. This testing must follow strict lab guidelines and generally takes three to six months. The manufacturing of vaccines also must follow quality and safety practices.

Next comes testing in humans. Small phase I clinical trials evaluate the safety of the vaccine in humans. During phase II, the formulation and doses of the vaccine are established to prove the vaccine's effectiveness. Finally, during phase III, the safety and efficacy of a vaccine need to be demonstrated in a larger group of people.

Because of the seriousness of the COVID-19 pandemic, vaccine regulators might fast-track some of these steps. But it's unlikely that a COVID-19 vaccine will become available sooner than six months after clinical trials start. Realistically, a vaccine will take 12 to 18 months or longer to develop and test in human clinical trials. And we don't know yet whether an effective vaccine is possible for this virus.

If a vaccine is approved, it will take time to produce, distribute and administer to the global population. Because people have no immunity to the COVID-19 virus, it's likely that two vaccinations will be needed, three to four weeks apart. People would likely start to achieve immunity to the COVID-19 virus one to two weeks after the second vaccination.

A lot of work remains. Still, the number of pharmaceutical companies, governments and other agencies working on a COVID-19 vaccine is cause for hope.

How to protect yourself and prevent COVID-19 infection

Until a COVID-19 vaccine is available, infection prevention is crucial. The Centers for Disease Control and Prevention (CDC) recommend following these precautions for avoiding infection with the COVID-19 virus:

Avoid close contact. This means avoiding close contact (within about 6 feet, or 2 meters) with anyone who is sick or has symptoms. Also, avoid large events and mass gatherings.

Wear cloth face coverings in public places. Cloth face coverings offer extra protection in places such as the grocery store, where it's difficult to avoid close contact with others. They are especially suggested in areas

with ongoing community spread. This updated advice is based on data showing that people with COVID-19 can transmit the virus before they realize they have it. Using masks in public may help reduce the spread from people who don't have symptoms. Non-medical cloth masks are recommended for the public. Surgical masks and N-95 respirators are in short supply and should be reserved for health care providers.

Practice good hygiene. Wash your hands often with soap and water for at least 20 seconds, or use an alcohol-based hand sanitizer that contains at least 60% alcohol. Cover your mouth and nose with your elbow or a tissue when you cough or sneeze. Throw away the used tissue. Avoid touching your eyes, nose and mouth. Avoid sharing dishes, glasses, bedding and other household items if you're sick. Clean and disinfect high-touch surfaces daily.

Stay home if you're sick. If you aren't feeling well, stay home unless you're going to get medical care. Avoid going to work, school and public areas and don't take public transportation.

If you have a chronic medical condition and may have a higher risk of serious illness, check with your doctor about other ways to protect yourself.