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A side-by-side comparison of the Pfizer/BioNTech and Moderna vaccines

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In an ideal world, a pandemic vaccine could be delivered in a single shot, so supplies could be stretched to cover a lot of people. It would trigger no side effect more significant than a sore arm. And it would be easy to ship and store.

Unfortunately, this is not an ideal world — not yet, anyway.

For now, the good news is that the United States has two Covid-19 vaccines that have been shown to be highly effective.

What follows is a head-to-head comparison of the ones developed by Pfizer and its partner, BioNTech, and by Moderna. Note that the chances of most individuals being able to "pick" one or the other are slim to none, especially in the initial rollout. The vaccine available is the one you'll get.

Target population

The Pfizer emergency use authorization is for people aged 16 and older. Moderna's is for people 18 and older, though the company has recently begun testing its vaccine in 12- to 17-year-olds.

Vaccine efficacy

Both vaccines have shown astonishing — and essentially equivalent — degrees of efficacy, at least in the early stages after vaccination. How they stack up over the long term remains to be seen.

The Pfizer vaccine showed efficacy of 95% at preventing symptomatic Covid infection, measured starting from seven days after the second dose was administered. The vaccine appeared to be more or less equally protective across age groups and racial and ethnic groups.

The Moderna vaccine was 94.1% effective at preventing symptomatic Covid-19, measured starting from 14 days after the second dose. The vaccine's efficacy appeared to be slightly lower in people 65 and older, but during a presentation to the Food and Drug Administration's advisory committee the company explained that the numbers could have been influenced by the fact there were few cases in that age group in the trial. The vaccine appeared to be equally effective across different ethnic and racial groups.

Both vaccines seemed to reduce the risk of severe Covid disease. It's not yet known if either prevents asymptomatic infection with the SARS-CoV-2 virus. Nor is it known if vaccinated people can transmit the virus if they do become infected but don't show symptoms.

Number of doses/amounts of vaccine per dose

Both the Moderna and the Pfizer/BioNTech vaccines require two shots: a priming dose, followed by a booster shot. The interval between Moderna doses is 28 days; for the Pfizer vaccine, it's 21 days.

Each dose of Pfizer's contains 30 micrograms of vaccine. Moderna went with a much larger dose of vaccine, 100 micrograms. It means it is using a little more than three times as much vaccine per person as Pfizer is. And yet, they aren't getting better results.

Side-effect profile

In the vernacular of vaccinology, vaccines that trigger a range of transient side effects in a lot of recipients are known as reactogenic.

Both these vaccines — in fact, most if not all the Covid-19 vaccines that have reported data so far — fall into the reactogenic category. The Advisory Committee on Immunization Practices, an expert panel that helps

the Centers for Disease Control and Prevention set vaccination policies, has advised hospitals they may want to stagger vaccinations among staff — for instance, don't vaccinate all the emergency room staff at the same time — in case some feel too unwell to work the day after being vaccinated.

The most common side effects are injection site pain, fatigue, headache, muscle pain, and joint pain. Some people in the clinical trials have reported fever. Side effects are more common after the second dose; younger adults, who have more robust immune systems, reported more side effects than older adults.

To be clear: These side effects are a sign of an immune system kicking into gear. They do not signal that the vaccine is unsafe. To date there are no serious, long-term side effects associated with receipt of these vaccines, which will be closely monitored as their use expands.

There have been a handful of reports of people having allergic reactions to the Pfizer vaccine since its rollout began. Those reactions — anaphylaxis or a less severe allergic reaction — were not seen in the clinical trials. It remains to be seen if similar events will be seen with the Moderna vaccine.

Safety for those who are pregnant or lactating

Neither of the vaccines has been tested in these two groups.

Moderna has completed animal studies the FDA demanded of manufacturers; these studies look for evidence that the vaccine might harm the pregnancy or the developing fetus. The company said it saw no such signals.

Pfizer has only interim data from its animal studies, but said it saw no concerning signs either.

The authorizations for both vaccines state there are not enough data to gauge whether they are safe for pregnant or lactating people. FDA's Peter Marks, director of the Center for Biologics Evaluation and Research, said Friday that those who are pregnant should choose whether to be vaccinated after discussing the risks and benefits with their physicians.

Storage requirements

Both of these vaccines require an elaborate cold chain, the term used to describe the conditions under which vaccines must be stored during distribution and when they are in the doctors' offices, pharmacies, or public health clinics where they'll be administered.

But the Moderna vaccine will be far easier to use than Pfizer's. For starters, Moderna's must be shipped at -4 Fahrenheit; Pfizer's must be shipped and stored at -94 Fahrenheit. The former is the temperature of a regular refrigerator freezer; the latter requires special ultra-cold freezers that need to be topped up with dry ice every five days. Doctors' offices do not have ultracold freezers; neighborhood pharmacies don't either.

After thawing, a vial of the Pfizer vaccine must be used within five days; Moderna's is stable at fridge temperature for 30 days and at room temperature for 12 hours.

Minimum purchase order

The ultracold storage requirement is not the only challenging aspect of the Pfizer vaccine. The minimum amount of vaccine a location can order is 975 doses. A large teaching hospital might need several of those. But there are plenty of places across the country that don't need 975 doses to vaccinate the people currently eligible for vaccination — health workers and nursing home residents. This is the vaccine that needs to be kept at -94

F. The minimum order size will limit the locations in which this vaccine can be used.

The Moderna vaccine's minimum order is 100 doses, a much more manageable number.

The Pfizer vaccine is shipped in five-dose vials; Moderna's vaccine is shipped in 10-dose vials.

Durability of protection

Figuring out how long the protection provided by either of these vaccines will last will take time. It's going to involve periodic blood draws from some volunteers to see what their antibody levels look like, though a decline in antibody levels doesn't necessarily equate to loss of protection.

But a large part of this work will involve watching for reports that people who were immunized are starting to contract Covid in larger numbers, a development that would probably lead to recommendations to give people booster shots at some yet-to-be-determined interval.

About the Author

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