

## In this issue: The leading vaccine candidates

Vaccine trials of multiple vaccines are proceeding well, with the first results from a Phase 3 trial yielding excellent efficacy in a large and epidemiologically balanced patient population. Such results are on par with the remarkable efficacy of the MMR vaccine and significantly better than flu vaccine.

Questions remain about side effects (although reports to date are encouraging), effectiveness in specific

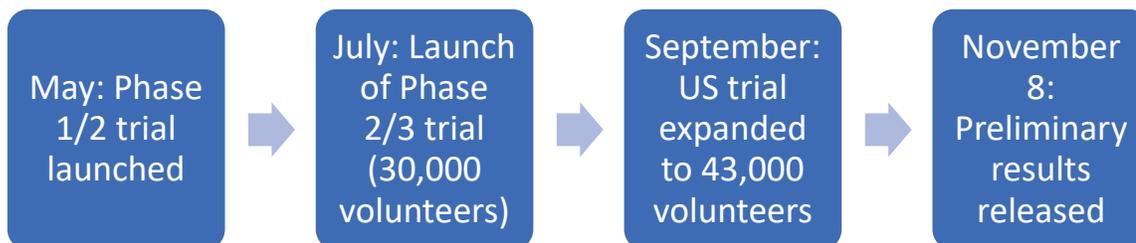
populations such as children, and the durability of protection. Answering such questions will take additional study and time.

There are currently four vaccine candidates in Phase 3 trials in the United States, and a fifth vaccine candidate will expand Phase 3 trials to this country by the end of November. A summary of each can be found below:

### Pfizer/BioNTech/Fosun Pharma

Type of vaccine: messenger RNA (mRNA)

Progression of the vaccine:



#### Things to note:

- mRNA falls apart if it's not stored at very cold temperatures, so this vaccine must be stored at -70°C, which is a different storage requirement than any other vaccine commonly found at medical offices or hospitals, and presents unique challenges.
- The vaccine can be stored in the refrigerator for five days.
- Beginning in October, Pfizer gained approval to test the vaccine on children as young as 12.
- It requires two doses, 21 days apart.
- Pfizer has not taken any federal money for the trial, but they do have a contract with the federal government to manufacture large quantities of vaccine if it is approved.
- More details can be found [here](#) and the entire study protocol can be found [here](#).

#### Data so far:

- This trial released preliminary data on Nov. 18, 2020, which showed that the vaccine is 95% effective at preventing COVID-19. They will continue surveillance for a full two months after all participants receive their second dose of vaccine, and application to FDA for EUA is expected very soon. This vaccine is quite likely to be the first to apply for Emergency Use Authorization. More information can be found [here](#).

## Moderna

Type of vaccine: mRNA

Progression of the vaccine:



### Things to note:

- Like the Pfizer vaccine, this is an mRNA vaccine; however it can be stored at -20°C (as opposed to the Pfizer vaccine which must be stored at -70°C).
- It can be stored in the refrigerator for 30 days, and at room temperature for 12 hours.
- This trial has enrolled older adults, as well as adults with chronic conditions which put them at high risk for COVID-19.
- The study includes more than 11,000 participants from communities of color.
- Requires two doses, 28 days apart.
- The entire study protocol can be found [here](#).

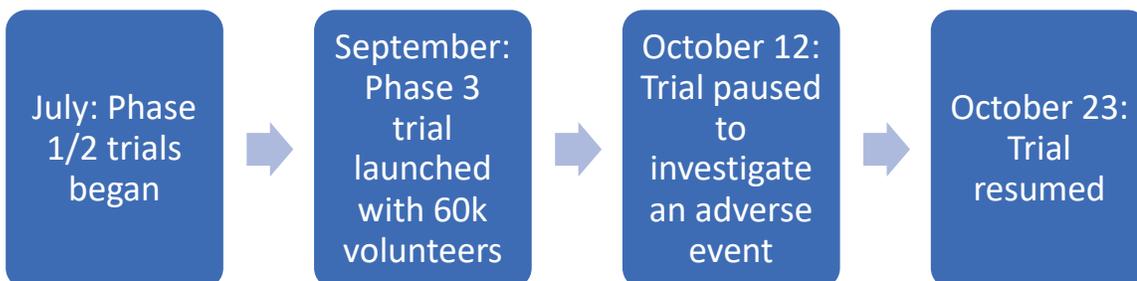
### Data so far:

- A preliminary report on Phase 1 data was [published](#) in the NEJM in July 2020, and another Phase 1 report describing the vaccine's use in older adults was [published](#) in September, also in the NEJM. In both articles, Moderna reported that the vaccine generated a robust immune response and was well tolerated. As of Oct. 22, 2020, nearly all (25,650 out of 30,000) participants had received both doses of the vaccine.
- On Nov. 16, 2020, Moderna released preliminary results showing that its vaccine is 94.5% effective. To learn more, [click here](#).

## Johnson & Johnson

Type of vaccine: made from Adenovirus 26, or Ad26 for short

Progression of the vaccine:



### Things to note:

- This vaccine is single-dose.
- It requires refrigeration, not ultra-cold storage.
- Johnson & Johnson previously developed a vaccine for Ebola from Adenovirus 26.
- You can read the entire study protocol [here](#).

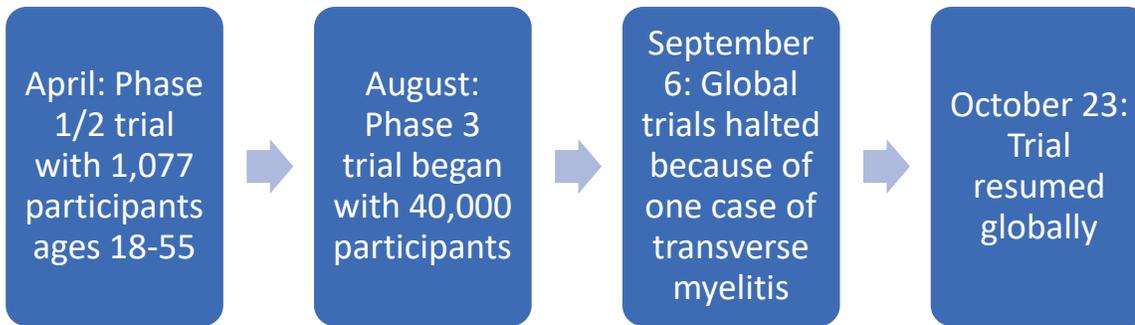
### Data so far:

- The company released Phase 1/2a [data](#) in September, which showed that the vaccine generated an immune response and was well tolerated.
- They have not yet published Phase 3 data.

## AstraZeneca

Type of vaccine: based on a chimpanzee adenovirus called ChAdOx1

Progression of the vaccine:



### Things to note:

- The Phase 1/2 trial was single-blind and compared the COVID-19 vaccine with a meningococcal vaccine, rather than with a placebo; the Phase 3 trial is double-blind placebo-controlled.
- The vaccine requires two doses, 28 days apart.
- It requires refrigeration, not ultra-cold storage.
- Two reports of neurological symptoms were reported by participants in this trial, both in the UK. In July, one participant developed neurological symptoms, which were then found to be due to an underlying diagnosis of multiple sclerosis, unrelated to the vaccine. The second case involved a previously healthy 37-year-old woman who developed transverse myelitis in September; an independent regulatory body ultimately determined that there was not sufficient evidence to link the vaccine to her symptoms.
- One participant in this trial in Brazil died; however, that person had received the placebo and there was no connection between the trial and the death.

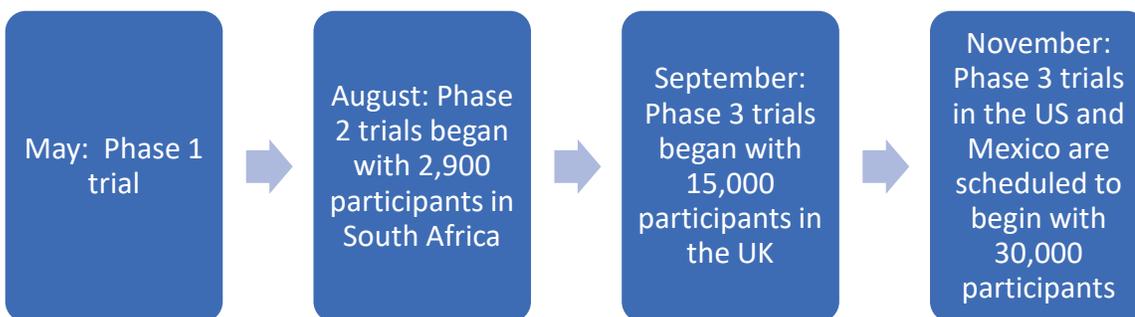
### Data so far:

- Phase 1/2 trials showed a good immune response as well as good safety data.
- CEO of AstraZeneca has said they expect results by the end of December.

## Novavax

Type of vaccine: coronavirus proteins (no genetic material) are attached to microscopic particles

Progression of the vaccine:



### Things to note:

- If trials are successful, they expect to deliver 100 million doses by the first quarter of 2021 for use in the United States.
- It requires two doses, 21 days apart.
- Technology is similar to what's used in Shingles and HPV vaccines.

### Data so far:

- Early data showed a strong immune response in both humans and monkeys.

# Vaccine candidates at a glance

	Pfizer	Moderna	Johnson & Johnson	AstraZeneca	Novavax
Type of vaccine	mRNA	mRNA	Adenovirus 26	ChAdOx1 (Chimpanzee adenovirus)	Protein
In phase 3?	Y	Y	Y	Y	Y
# of doses	2	2	1	2	2
Time between doses	21 days	28 days	n/a	28 days	21 days
Storage	-70°C	-20°C	2-8°C	-20°C	2-7°C

For additional detail, please see COVID-19 vaccine trackers:



Vizient is a healthcare performance improvement company [Vizient vaccine tracker](#)

The Regulatory Affairs Professionals Society (RAPS) <https://www.raps.org/news-and-articles/news-articles/2020/3/covid-19-vaccine-tracker>

The New York Times tracker has won wide endorsement, including from the Hopkins Coronavirus Resource Center [COVID-19 Vaccine Tracker](#)

## Members of the COVID-19 Vaccine Workgroup

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