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President Joe Biden talks about the next steps in the effort to get more Americans vaccinated and combat the spread of the delta variant of COVID-19 in the East Room of the White House on Thursday, July 29, 2021.

## Digging deep on the delta variant

How it became the dominant strain

By **DEBORAH NETBURN**

Los Angeles Times

The Delta variant continues to tear across the United States, causing hospital rates to soar and leading the Centers for Disease Control and Prevention to recommend that even people who are fully vaccinated resume wearing masks in indoor public spaces in most parts of the country.

The Delta variant was first detected in India in December of 2020 and likely arrived in the United States around March. It wasted little time outcompeting all other variants here to become the country's dominant coronavirus strain. The CDC estimates that Delta is responsible for about 82% of recent SARS-CoV-2 infections here.

"The virus has been very successful in humans from Day One, but this Delta variant just puts the earlier variants to shame," said Michael Worobey, a virologist at the University of Arizona.

Luckily for us, the Delta variant is far less likely to cause serious disease or death in people who are fully vaccinated against COVID-19. However, the variant does have a formidable super power: It replicates far more rapidly and efficiently in the human body than any previous known variant.

Nasal swabs reveal that people infected with Delta have 1,000 times more virus particles in their upper respiratory systems than those who were infected with the coronavirus that sparked the pandemic in the first place.

"That means every cough, every sneeze is packed with that much more virus," said Dr. Jaimie Meyer, an infectious disease physician at Yale Medicine in New Haven, Conn.

Worobey put it this way: "If you think of the individual particles as machine gun fire, the Delta variant is shooting at us at 1,000 rounds per second, while previous variants were only shooting at one round per second."

This helps explain why Delta is roughly twice as transmissible as the original strain of the virus.

Delta's rapid, efficient replication also helps explain another troubling aspect of this super-

charged foe: A person infected with this variant can pass it along sooner than a person who harbors another strain.

With previous variants, it took about six days after an initial infection for an individual to produce enough virus to infect others, said Chunhui Chi, director of the Center for Global Health at Oregon State University.

The Delta variant reduced that timeline to just four days, allowing it to spread through communities with unprecedented speed.

"Delta is different," said Dr. Joseph Kanter, state health officer of the Louisiana Department of Health. "The transmission dynamics are different. The level of viral load we see in people is different."

Scientists are still analyzing exactly what mutations in the Delta variant's genome helped it outcompete earlier versions of SARS-CoV-2.

"It's a very good question," Worobey said. "It could be a variety of things."

One candidate is a mutation in the virus' spike protein that improves its odds of entering a target cell.

Viruses cannot replicate on their own. Instead, they must hijack the machinery of a host cell to make copies of themselves. Those copies are then released into the body and infect other cells, repeating the cycle.

Like other versions of SARS-CoV-2, the Delta variant has to first bind to a protein on the surface of the cell it plans to infect. Then it has to cleave itself at the exact right time and place to force itself inside.

Researchers have found evidence that one of the Delta variant's mutations — called P681R — makes this essential cleaving step easier and more efficient than it is in previous variants.

This may sound like a subtle change, but the cumulative effect of a mutation that improves the odds of the virus entering a cell is significant, said Benhur Lee, a microbiologist at the Icahn School of Medicine at Mount Sinai in New York.

"Multiply this by a gazillion times and average it out, and what you might see is increased transmissibility," he said.

There may be additional forces at work too, he said, since Delta's genome has other mutations that don't affect the spike protein.

"We do not know that the spike is the answer to everything," Lee said.

Other possibilities include genetic changes that allow individual virus particles to bind more easily — and hold on longer — to the surface of cells in our nasal passages and upper airways, and those that may make it more difficult for the immune system to fend off viral invaders.

One thing Lee can say for sure is that the Delta variant's increased transmissibility has nothing to do with how far individual virus particles can travel, or how long they can remain in the air.

"It is not the case that something magic happened such that the virus is more airborne," he said.

With all this in mind, what is the best way to protect yourself from Delta?

The answer from scientists will sound familiar: Get vaccinated, wear a mask, and avoid crowded, poorly ventilated areas.

And, yes, even vaccinated people should wear masks in public indoor spaces because with the Delta variant boosting viral loads, breakthrough cases are more likely.

"As a general rule, what would have been an unsuccessful encounter with the virus is now much more likely to be successful," Worobey said. "That's why we need to be thinking not just vaccines as protection against this, but back to the mask-wearing we had hoped to put behind us."

Still, it's worth keeping in mind that vaccines continue to provide an amazingly effective line of defense. In Los Angeles County, for example, unvaccinated residents still accounted for almost three times as many infections, even though they've been a minority of the population since the start of the month, according to data released by the County's Public Health Department. In addition, 92% of all hospitalizations occurred in people who weren't vaccinated.

"The main advice I would give is to get vaccinated," Lee said.

# Do I need a COVID-19 vaccine booster to protect from delta and other variants?

By **SARAH GANTZ**

The Philadelphia Inquirer

With more contagious variants of the COVID-19 virus spreading just as people are starting to feel comfortable reentering society, talk about the benefit of vaccine boosters is amping up.

Pfizer is seeking approval for a third dose of its vaccine, given as a booster, and some countries, including Britain and Israel, have already said they will boost vulnerable populations.

Yet the U.S. Centers for Disease Control and Prevention and the Food and Drug Administration have said boosters are not currently necessary for fully vaccinated Americans.

### What gives?

We talked to the University of Pennsylvania's Drew Weissman, an immunologist who helped develop the messenger RNA concept behind Pfizer's vaccine, to unpack the international argument about COVID-19 boosters.

### What is a booster shot?

Vaccines cause our bodies to develop antibodies to protect against a virus. A booster shot is an extra dose that "boosts" immunity by spurring the development of more antibodies.

There are two types of booster shots: The first kind is a follow-up dose that is identical to the initial vaccine, such as the tetanus booster recommended every 10 years. Other vaccine boosters are tweaked from their original form to protect against a new variant. A common example is the influenza vaccine, which is slightly different each season to target the most common current strain of the flu virus.

The type of boosters developed for COVID-19 may vary. A follow-up dose of the original vaccine would have a faster path to regulatory approval, since vaccine makers have already received emergency use authorization. Tweaked versions of the COVID-19 vaccines could be useful in targeting variants, especially if a variant emerges against which the current vaccines are not effective. No such variant has come about yet — the vaccines have proven effective against the delta and other new variants.

### Will booster shots be necessary for the COVID-19 vaccine?

Scientists disagree on whether booster shots are

necessary. The CDC and FDA have said there is not currently enough research to suggest that boosters are needed because the vaccines are providing good protection from the original strain and variants, such as delta. Studies have shown the two-dose Pfizer and Moderna vaccines provide greater than 90% protection against infection from the original strain, while the single-shot Johnson & Johnson vaccine provides 66% protection. Nearly all recent COVID-19 hospitalizations and deaths in the United States have been among those who are unvaccinated.

Meanwhile, Pfizer

to control the pandemic. Should doses go toward boosting the immunity of people who are already vaccinated — and have considerable protection against current variants — or toward getting more people their first dose?

Getting as many people vaccinated as possible is the best way to reduce the virus' spread and minimize the likelihood of a new variant against which the current vaccines are not effective, Weissman said.

If a new variant arose that escaped current vaccine protection, vaccination efforts would have to restart with a booster designed to target that variant.



Karl Merton Ferron/Baltimore Sun-TNS

Lesbia Ruiz receives her vaccination from Theresa Williams, a registered nurse during a coronavirus vaccination drive for the Hispanic population at Sacred Heart Church in Highlandtown, a vaccination site partnering with Johns Hopkins Hospital March 24, 2021.

is seeking approval in the United States and Europe for a booster for its COVID-19 vaccine after a study in Israel that found the vaccine's effectiveness in preventing infection fell to 64% after six months, though cases of severe illness remained low. Pfizer said in a statement that the Israeli findings are consistent with its ongoing Phase 3 clinical trial.

### Who is most likely to need a booster?

People who are most vulnerable to severe illness, hospitalization, and death — including the elderly and individuals with autoimmune diseases — would be top of the list for a booster.

Britain plans to administer boosters to people over age 70 beginning in September and Israel has begun offering a third dose of the Pfizer vaccine to at-risk individuals.

There is not enough research to know whether boosters are worthwhile for everyone.

### Are there other factors that could influence decisions about COVID-19 boosters?

Of course. Government agencies must consider the full scope of the public health emergency when prioritizing resources and strategizing how best

### What does the latest Johnson & Johnson risk news mean about vaccine and booster safety?

Through the Vaccine Adverse Event Reporting System, a federal monitoring system, officials have identified 100 cases of Guillain-Barre syndrome among the 12.8 million people who have received the Johnson & Johnson vaccine.

"Every drug we take has adverse events. For the [COVID-19] vaccine, they're in the one-in-a-million range," said Weissman. People are much more likely to die of COVID-19 than they are to develop a complication from the vaccine, he said.

### What does it mean if authorities later decide that everyone should get a booster shot? How can we trust those officials?

It means lawmakers are basing their guidance on science, not politics. Science evolves because scientists are constantly learning through new studies. Scientists make recommendations based on what they know right now. But every new study builds on their knowledge of a disease or virus, and as scientists gain a more complete picture of the problem, their guidance may change.

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