

## COVID-19 VACCINATION – FACTS TO KEEP US ALL SAFE



Did you know that more and more Americans are choosing to get the COVID-19 vaccine as we learn more about its effectiveness and safety? Making decisions about the COVID-19 vaccine can be hard. This fact sheet includes the most up-to-date, expert information about COVID-19 vaccines, created by an infectious disease epidemiologist with no agenda other than providing scientific information in a clear way, to keep people healthy and help them make informed decisions.

### EFFECTIVENESS

#### Q: How well do COVID-19 vaccines work?

**A:** The COVID-19 vaccines available now are as effective as the best vaccines we've ever had. No vaccine is perfect. For comparison, the chickenpox vaccine children routinely receive in the U.S. has ~90% effectiveness after two doses.<sup>1</sup> The Pfizer vaccine has 95% efficacy against symptomatic COVID-19 in original clinical trials.<sup>2</sup> This means that under the conditions of the clinical trial, people who are vaccinated are 95% less likely to develop COVID-19 symptoms from one of the original strains of the virus, compared to those who are unvaccinated. However, the real world isn't like a clinical trial—people have underlying conditions they may or may not know about, they may not get the second shot at the time that's expected, or there may be something else unique about the situation. We need real-world studies to learn about the effectiveness of the vaccine in everyday life. A recent real-world study in England found that the Pfizer vaccine protected 95% of fully vaccinated people with breakthrough infections of COVID-19 from hospitalization, even with the Delta variant circulating.<sup>3</sup> Similarly, the Moderna vaccine has been found to be 98.7% effective against death after both doses (again, before Delta).<sup>4</sup> Johnson & Johnson real-world effectiveness against symptomatic COVID-19 appears to be around 76.7%, at least two weeks after the single dose.<sup>5</sup>

It may be confusing to hear varying statistics about vaccine effectiveness, but it doesn't mean people are wrong, or changing their minds—ask for clarification about what's being measured to make informed decisions. It's important to pay attention to what is being measured when you hear a statistic about efficacy or effectiveness. Protection from “severe disease” (hospitalization or death)? Symptomatic infection? Asymptomatic infection? Or protection from being able to infect others? The scientist who runs the “Your Local Epidemiologist” website maintains a chart of the latest vaccine effectiveness statistics, with vetted citations. The latest update from June 28 is available [here](#).<sup>6</sup>

#### Q: What about protection against variants?

**A:** As of August 1, 2021 we have four “variants of concern” per the World Health Organization: Alpha (UK), Beta (South Africa), Gamma (Brazil), Delta (India).<sup>7</sup> Variants are normal and expected because viruses mutate to try to survive. The longer it takes us to get most people vaccinated, the higher the chance the virus will mutate into a variant that may more easily evade existing vaccines.

The currently available vaccines were developed before variants were known, so we can only learn how well they work against variants with real-world studies. So far our vaccines have held up pretty well—against the South Africa variant (Beta) the Pfizer vaccine still had 72-75% effectiveness against symptomatic infection.<sup>8</sup> **With the Delta variant the vaccine has still been more than 88% effective against severe disease from COVID-19.**<sup>9</sup>

However, Delta is a gamechanger because it's the first time that fully vaccinated people appear to be able to spread infection to others (including children or immunocompromised people who can't be vaccinated), and this might be true even if they don't realize they have COVID-19.<sup>10</sup> This is why we see changing guidelines asking people who are fully vaccinated to wear masks again, especially indoors. We have to get the spread of Delta under control in the US, and everyone has to play their part to make that happen.

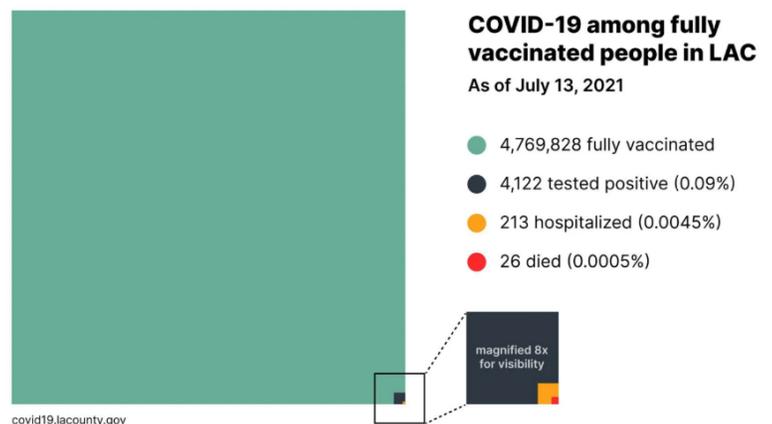
### Q: What about “breakthrough” cases?

**A:** Vaccines are not 100% perfect. Even if scientists say a vaccine has 100% efficacy against severe disease, that's in a clinical trial. People *can* still get sick, and *can* spread the disease to others (especially with the Delta variant). Out of 163 million people fully vaccinated in the US as of July 26, 2021, the CDC has received reports of 6,587 patients with COVID-19 vaccine breakthrough infections who were hospitalized or died. (That's about 0.00004% of vaccinated people.) 1,598 (26%) of those hospitalized and 309 (24%) of those who died were believed to have had severe illness not actually related to the COVID-19 infection (i.e., it was coincidence that they had a breakthrough COVID-19 infection at the time of hospitalization or death). This information is regularly updated on the CDC website [here](#).<sup>11</sup>

In Los Angeles County from January 19 through July 13, 2021, of 4,769,828 fully vaccinated people, 4,122 (0.09%) tested positive for COVID-19, 213 (0.0045%) were hospitalized because of their infection, and 26 (0.0005%) died.<sup>12</sup> That's compared to estimates of 166,563 cases (3.0%) and 7,070 deaths (0.1%) among the remaining 5,487,729 unvaccinated people in the county during the same timeframe.<sup>13</sup>

**Those statistics mean that COVID-19 has been more than 200 times more fatal for unvaccinated people in LA County, compared to those who are vaccinated.**

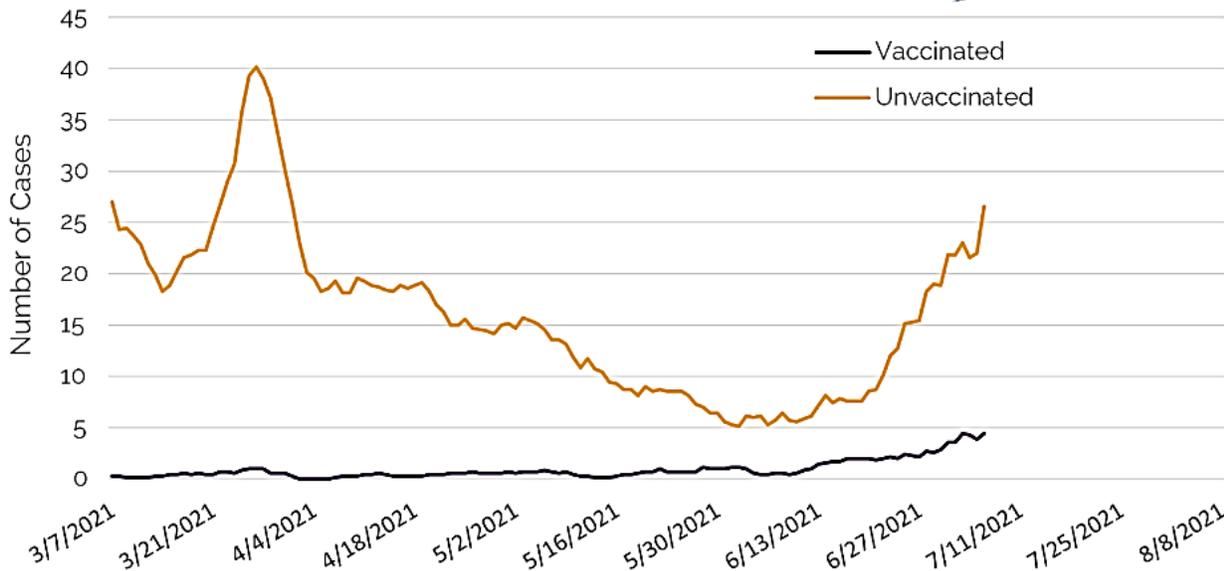
Breakthrough cases happen, but you are MUCH safer if you've been vaccinated!



### Q: I heard that 20% of COVID-19 cases in L.A. County in June were among vaccinated people. Isn't that evidence that the vaccine isn't working?

**A:** No! It's true that due to the Delta variant, there is a considerable increase in breakthrough infections among people who are vaccinated. Because of this, in June around 20% of the confirmed cases occurred in residents who were fully vaccinated. **However, this still means that less than 3 out of 10,000 vaccinated people in LA County came down with COVID-19 in June 2021 (0.03%).**<sup>14</sup> It's common to hear a statistic like “20% of cases were among vaccinated people” and equate that with “20% of vaccinated people still get COVID-19,” or to think that means the vaccine is performing poorly. That's what known as a *base rate fallacy*,<sup>15</sup> and it's a common misunderstanding. The figure on the next page, from Long Beach Health and Human Services, illustrates clearly that there's a huge difference between the impact of the current COVID-19 surge among vaccinated and unvaccinated people.

Daily Average Cases by Vaccination Status (with seven-day lag)



Importantly, **the main reason to be vaccinated is *not* to prevent infection; it's to prevent infection so severe that it results in hospitalization or death.** People who are vaccinated against COVID-19 are still dramatically less likely to experience severe disease in the rare case of a breakthrough infection.

## SAFETY

**Q: How do I know the COVID-19 vaccine is safe if we don't have long-term data?**

**A:** It's true that we can't know for sure whether there could be long-term complications as a result of this vaccine. It's still new. But, we've never waited for years of data before rolling out a vaccine that will save lives. **Many years of experience with vaccines tells us that most serious reactions from a vaccination occur within 2 months of the shot being administered. At this point, many millions of people have already passed the 2-month mark safely.** Adverse reactions can happen, but they are extremely rare. It feels scary because it's new; however, it's important to keep in perspective that most vaccines and medications that are FDA approved and widely distributed in the U.S. had similar length and quantity of safety data as what we have now for the COVID-19 vaccines, when they start being used widely. The fact that these vaccines were developed incredibly quickly does *not* mean they were rushed and can't be trusted. Research into vaccination for coronaviruses like the one causing COVID-19 started back in 2003, due to the original Severe Acute Respiratory Syndrome (SARS) outbreak.<sup>16</sup> Plus, while this is the first mRNA vaccine in commercial use, we have in fact been experimenting with mRNA vaccines for many years, in both animals and people<sup>17,18</sup>—we know a lot, even though this is a novel vaccine. A leading developer of this technology is Dr. Kizzmekia Corbett, a Black American scientist who has worked for the past 6 years to develop coronavirus vaccines because of the potential for a pandemic like this one. Using that research, Dr. Corbett's team was able to move rapidly after the emergence of COVID-19, and within 10 months her team created and tested the Moderna vaccine being administered today.<sup>19</sup> Of course, the speed of vaccine development in this case was helped by two things not usually true: 1) high rates of disease in the community meant it didn't take long to enroll

people in large clinical trials to evaluate the efficacy of the vaccine, and 2) the U.S. government and other major players spent a huge amount of money to fund rapid research, testing, and production of the vaccines determined to be safe and effective.<sup>20</sup>

**Q: Can an mRNA vaccine (like Pfizer or Moderna) change my DNA?**

**A:** No. mRNA (m = messenger) is like an instruction manual to rev up our immune systems to specifically protect us from COVID-19. It can't combine with our DNA to change our genetic code. First, mRNA never enters the nucleus of our cells, which is where DNA lives—it does not have the “nuclear access signal” that is needed to gain entry. Plus, for mRNA to affect DNA it would require two enzymes not present in the vaccine: “reverse transcriptase” to create DNA based on the mRNA, and “integrase” to insert that DNA into the body's DNA.<sup>21</sup>

Ultimately, the mRNA protein in these vaccines is incredibly fragile – it disintegrates within about 72 hours and is then flushed out of the body naturally. It's so fragile it needs to be stored at very cold temperatures or it disintegrates before it has a chance to do its job.<sup>22</sup> In fact, until the COVID-19 pandemic, mRNA was too fragile to be very effective in other vaccines where it was tried.<sup>23</sup> This time around, scientists figured out just how to use lipid nanoparticles (“fat bubbles”) to preserve the mRNA long enough for it to work.<sup>24</sup> Luck and many years of research and hard work by some of the world's best scientists led to this critical discovery that made these vaccines possible.

**Q: I saw a video online that said lots of people have died from COVID vaccines but it's being covered up. Is this true?**

**A:** No. In the United States, we have something called the Vaccine Adverse Events Reporting System (VAERS), run by the CDC. It's designed for healthcare providers but anyone can report anything. VAERS is run on the honor system. Reports are not necessarily validated, and multiple problems have been identified related to bias in reporting in VAERS.<sup>25</sup> Alternatively, *V-safe* is the U.S.'s active surveillance system. (If you've been vaccinated and haven't already signed up for *v-safe*, you should!

<https://vsafe.cdc.gov/en>.) From December 14, 2020 through February 28, 2021, more than 3.6 million people received at least one dose of an mRNA vaccine and enrolled in *V-safe*. More symptoms were reported for the second dose compared to the first, overall reactions were similar among people who received the Pfizer vaccine and the Moderna vaccine. The table below shows the number and percentage of people who received one of the mRNA vaccines and reported any of the following symptoms to *v-Safe* within 7 days of each dose.<sup>26</sup> Remember, mild side effects are normal signs that

your body is building protection to COVID-19, and most side effects go away in a few days. Through *V-safe*, people reported feeling most sick the day after the vaccine and the number of reported symptoms dropped markedly through day 7. People who were 65 and older reported symptoms less frequently than those under 65.

Reaction	Dose 1 n (%)	Dose 2 n (%)
Pain, redness, swelling, itching at the injection site	2,550,710 (70.0%)	1,443,899 (75.2%)
Fatigue	1,127,638 (30.9%)	1,034,462 (53.9%)
Headache	943,607 (25.9%)	897,005 (40.4%)
Myalgia (muscle soreness)	705,100 (19.4%)	845,314 (44.0%)
Chills	321,009 (8.8%)	600,354 (31.3%)
Fever	314,676 (8.6%)	566,112 (29.5%)
Joint pain	317,034 (8.7%)	492,031 (25.6%)
Nausea	275,423 (7.6%)	319,248 (16.6%)

Importantly, serious reactions (like anaphylaxis, Bell's palsy, Stroke, Guillain-Barré syndrome, etc.) have not occurred in rates above what would normally occur in the population being vaccinated,<sup>27</sup> with two exceptions: mild heart inflammation (myocarditis), linked to mRNA vaccines especially in males aged 12-29 years,<sup>28</sup> and blood clots, linked to the Johnson & Johnson vaccine in women ages 18-49.<sup>29</sup> However, these reactions are *much rarer* than severe health complications from COVID-19 infection: 0.000007% of women have developed blood clots from the Johnson & Johnson vaccine,<sup>29</sup> compared to 0.3%-0.09% of women who've developed blood clots from taking birth control pills.<sup>30</sup> A total of 0.0004% of people have developed myocarditis<sup>28</sup> compared to 1.7% of people who've *died* from COVID-19.<sup>31</sup> **Fear of adverse reactions to the vaccine should not outweigh the fear of symptoms from COVID-19 itself, because the data are very clear that COVID-19 poses a greater danger, even to young, healthy people!**

## OTHER COMMON QUESTIONS ABOUT THE COVID-19 VACCINE

### Q: What are the downsides to getting vaccinated against COVID-19?

**A:** As described above, if you take a COVID-19 vaccine, you might not feel well for a few days. There's an extremely small risk of more serious complications, like with any medical procedure, vaccine, or medication. You also have to make and attend a vaccination appointment—probably two of them—and you can optionally sign up for V-safe and respond to text messages asking about your health every day in the beginning (this takes about 1 minute per day). Plus, especially with the Delta variant circulating in the U.S., you should still take precautions (like masking and social distancing) to prevent transmission to yourself and others. But, if you *do* get infected, you are much more likely to have a mild case of COVID-19 if you are vaccinated—and you are *extremely* unlikely to be hospitalized or die.

### Q: How long does immunity last from the vaccines?

**A:** We'll only know as time passes and we can collect more data. It's true that researchers at the Israel Ministry of Health recently found that people vaccinated back in January 2021 more commonly had breakthrough infections than people vaccinated in April 2021, which might mean that vaccine immunity is waning after 6 or 7 months.<sup>9</sup> But, there isn't yet reason to really believe that's true. In some studies of vaccinated people with mild COVID-19, there is a waning of antibodies that target the virus sooner than originally expected.<sup>32</sup> However, the immune system is complicated. Antibodies are only one sign of immunity; memory from immune system cells (T-cells, B-cells) also confer immunity, and some studies have shown that those cells persist long after the antibodies themselves.<sup>33</sup> This appears to especially be true for people who receive a vaccine and don't rely on natural immunity (i.e., immunity following COVID-19 infection) for protection.<sup>34</sup> This is one reason that vaccination is still recommended for people who've had COVID-19.<sup>35</sup>

### Q: Wouldn't it just be better to reach COVID-19 herd immunity naturally?

**A:** No. First of all, given how many people who become infected die, end up with severe medical complications, and/or end up with "long COVID" (persistent symptoms 4 or more weeks after infection<sup>36</sup>), waiting to reach herd immunity naturally would cause a lot of unnecessary death and suffering. Plus, herd immunity isn't a magic threshold (i.e., once 80% of people have been infected, we don't magically watch the pandemic disappear, never to return). Even countries or regions who originally thought natural herd immunity was the way out of this pandemic have generally reversed course.<sup>37</sup> **Vaccination is the way we find ourselves on the other side of COVID-19 for good, just like with polio and smallpox – two diseases we don't worry about anymore, thanks to vaccines!**

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