



Addressing Concerns About COVID-19 Breakthrough Infections

Note: While this section was written with COVID-19 vaccines in mind, many of the general principles apply to other vaccines as well. Individual vaccines may vary in their antigenic components or dosage forms, but the principles of human behavior and good communication skills transcend most differences between vaccines.

The Issue

Vaccines—including COVID-19 vaccines—are not 100% effective at preventing infection. People who are fully vaccinated or even up to date on their vaccines can still get COVID-19—infections referred to as “breakthrough infections.” The possibility of breakthrough infection may cause confusion or anxiety among some vaccinated people. Other people may view reports of breakthrough infections as evidence that the COVID-19 vaccines are ineffective.

Sound Bites

- > No vaccines—including COVID-19 vaccines—are 100% effective at preventing infection. Breakthrough COVID-19 infections are expected; they are not a sign that the vaccines don’t work.
- > Even when people who are fully vaccinated and people who are up to date on COVID-19 vaccines develop COVID-19 symptoms, those symptoms tend to be less severe than in unvaccinated people. Fully vaccinated people and people who are up to date on vaccines are much less likely than unvaccinated people to be hospitalized or die.
- > **All eligible persons should get vaccinated** and stay up to date on their COVID-19 vaccines to protect themselves from serious COVID-19 illness and death.
- > Although the number of breakthrough infections is increasing as the number of people who are fully vaccinated increases, the risk of COVID-19 infection still is much lower among vaccinated people.

What We Know

Breakthrough COVID-19 infections are expected.¹ As the number of people who are fully vaccinated increases, the number of breakthrough infections will increase. There also will be more breakthrough infections at times when there are more COVID-19 infections overall.

Breakthrough infections are attributable at least in part to mutations in SARS-CoV-2 (the virus that causes COVID-19). The spike protein on the surface of SARS-CoV-2 is the primary target of vaccine-induced immunity.² The Delta variant had mutations in 2 of the 201 amino acids in the spike protein receptor-binding domain.³ The Omicron variant had mutations in 15 of the 201 amino acids, which helped it circumvent immunity in vaccinated people. A study conducted in Denmark during the Omicron surge found the Omicron variant to be 2.7 to 3.7 times more infectious than the Delta variant among vaccinated Danes.⁴

Addressing Concerns About COVID-19 Breakthrough Infections

The good news is that the risk of infection, hospitalization, and death all remain much lower in vaccinated people than in unvaccinated people.¹ This has been consistently true for the original COVID-19 vaccines, the bivalent vaccines, and the current vaccines. People who were up to date with COVID-19 vaccines had the best protection: the risk of testing positive for COVID-19 was 3.2 times higher for unvaccinated people 12 years of age and older compared with people vaccinated with a primary series and a booster dose. The risk of dying for unvaccinated people from COVID-19 was 21 times higher.⁵

The CDC recommends that all eligible persons get their primary COVID-19 vaccine and stay up to date with the current vaccine.⁶ The current recommendations are summarized in the [CDC At-a-Glance COVID-19 Vaccination Schedules](#).

People who are fully vaccinated and up to date on COVID-19 vaccines should understand that it is possible to transmit SARS-CoV-2 during a breakthrough infection. People with a confirmed or suspected infection should [follow all recommended steps](#) to prevent the spread of COVID-19.⁷

References

1. Infectious Diseases Society of America. What is breakthrough infection? Updated February 7, 2024. Accessed February 23, 2024. <https://www.idsociety.org/covid-19-real-time-learning-network/vaccines/what-is-a-breakthrough-infection/>
2. Greaney AJ, Loes AN, Crawford KHD, et al. Comprehensive mapping of mutations in the SARS-CoV-2 receptor-binding domain that affect recognition by polyclonal human plasma antibodies. *Cell Host Microbe*. 2021;29(3):463–476.e6. doi: 10.1016/j.chom.2021.02.003
3. Cobey S, Bloom J, Starr T, et al. We study virus evolution. Here's where we think the coronavirus is going. *The New York Times*. March 28, 2022. Accessed February 23, 2024. <https://www.nytimes.com/interactive/2022/03/28/opinion/coronavirus-mutation-future.html>
4. Hansen CH, Schelde AB, Moustsen-Helm IR, et al. Vaccine effectiveness against SARS-CoV-2 infection with the Omicron or Delta variants following a two-dose or booster BNT162b2 or mRNA-1273 vaccination series: a Danish cohort study. *medRxiv*. Preprint posted December 22, 2021. doi: 10.1101/2021.12.20.21267966
5. Centers for Disease Control and Prevention. COVID Data Tracker. Accessed February 23, 2024. <https://covid.cdc.gov/covid-data-tracker/>
6. Centers for Disease Control and Prevention. Stay up to date with COVID-19 vaccines. March 7, 2024. Accessed April 11, 2024. <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/stay-up-to-date.html>
7. Centers for Disease Control and Prevention. How to protect yourself and others. Updated April 4, 2024. Accessed April 25, 2024. <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html>

