

COVID-19 Breakthrough Case Investigations and Reporting



This page provides information and resources to help **public health departments** and **laboratories** investigate and report COVID-19 vaccine breakthrough cases.

- **Vaccine breakthrough cases are expected.** COVID-19 vaccines are effective and are a critical tool to bring the pandemic under control. However no vaccines are 100% effective at preventing illness. There will be a small percentage of people who are fully vaccinated who still get sick, are hospitalized, or die from COVID-19.
- **More than 75 million** people in the United States had been fully vaccinated as of April 14, 2021. Like with other vaccines, symptomatic vaccine breakthrough cases will occur, even though the vaccines are working as expected. Asymptomatic infections among vaccinated people also will occur.
- There is some evidence that vaccination may make illness less severe.
- Current data suggest that COVID-19 vaccines authorized for use in the United States offer protection against most SARS-CoV-2 **variants** circulating in the United States. However, variants will cause some of these vaccine breakthrough cases.

What CDC is doing

CDC is leading multiple **vaccine effectiveness studies** to ensure COVID-19 vaccines are working as expected. In addition, CDC is coordinating with **state and local health departments to investigate SARS-CoV-2 infections** among people who received COVID-19 vaccine and identify patterns or trends in:

- Patient characteristics, such as age or underlying medical conditions
- The specific vaccine that was administered
- Specific SARS-CoV-2 variants that causes the infection

Establishing a vaccine breakthrough case definition

A person who has SARS-CoV-2 RNA or antigen detected on a respiratory specimen collected ≥ 14 days after completing the primary series of a U.S. Food and Drug Administration (FDA)-authorized COVID-19 vaccine.

Identifying and investigating COVID-19 vaccine breakthrough cases

State health departments report vaccine breakthrough cases to CDC. CDC monitors reported cases for clustering by patient demographics, geographic location, time since vaccination, vaccine type or lot number, and SARS-CoV-2 lineage.

To the fullest extent possible, respiratory specimens that test positive for SARS-CoV-2 RNA are collected for genomic sequencing to identify the virus lineage that caused the infection.

In the coming weeks, CDC will transition from monitoring all reported vaccine breakthrough cases to focus on identifying and investigating only vaccine breakthrough infections that result in hospitalization or death. This shift will help maximize the quality of the data collected on cases of greatest clinical and public health importance.

Developing a data access and management system for COVID-19 vaccine breakthrough cases

- CDC has developed a national COVID-19 vaccine breakthrough REDCap database where designated state health department investigators can enter, store, and manage data for cases in their jurisdiction. State health departments have full access to data for cases reported from their jurisdiction.
- Ultimately, CDC will use the [National Notifiable Diseases Surveillance System \(NNDSS\)](#) to identify vaccine breakthrough cases. Once CDC has confirmed that a state can report vaccination history data to NNDSS, CDC will identify vaccine breakthrough cases through that system. At that time, the state health department will stop reporting cases directly into the national COVID-19 vaccine breakthrough REDCap database. CDC will upload the available data reported to NNDSS into the COVID-19 vaccine breakthrough REDCap database for further review and confirmation by the state health department.

COVID-19 vaccine breakthrough infections reported to CDC

- As of April 13, 2021, [more than 75 million people](#) in the United States had been fully vaccinated against COVID-19 since December 14, 2020.
- During the same time, CDC received 5,814 reports of vaccine breakthrough infections from 43 U.S. states and territories.
- Vaccine breakthrough infections were reported among people of all ages eligible for vaccination.
 - 2,622 (45%) of the reported infections were among people ≥ 60 years of age.
- 3,752 (65%) of the people experiencing a breakthrough infection were female.
- 1,695 (29%) of the vaccine breakthrough infections were reported as asymptomatic.
- 396 (7%) people with breakthrough infections were known to be hospitalized and 74 (1%) died.
 - Of the 396 hospitalized patients, 133 (34%) were reported as asymptomatic or hospitalized for a reason not related to COVID-19.

- Of the 74 fatal cases, 9 (12%) were reported as asymptomatic or the patient died due to a cause not related to COVID-19.
- Hospitalizations and deaths that are not a direct result of COVID-19 are still considered vaccine breakthrough cases if the person was fully vaccinated and subsequently tested positive for COVID-19.

How to interpret these data

It is important to note that reported vaccine breakthrough cases will represent an undercount. This surveillance system is passive and relies on voluntary reporting from state health departments which may not be complete. Also, not all real-world breakthrough cases will be identified because of lack of testing. This is particularly true in instances of asymptomatic or mild illness. These surveillance data are a snapshot and help identify patterns and look for signals among vaccine breakthrough cases.

As CDC and state health departments shift to focus only on investigating vaccine breakthrough cases that result in hospitalization or death, those data will be regularly updated and posted every Friday.




COVID-19 Vaccines are Effective

- Vaccine breakthrough cases occur in only a small percentage of vaccinated persons. To date, no unexpected patterns have been identified in the case demographics or vaccine characteristics among people with reported vaccine breakthrough infections.
- COVID-19 vaccines are effective. CDC recommends that all eligible people get a COVID-19 vaccine as soon as one is available to them.
- CDC recommends that fully vaccinated people continue take steps to protect themselves and others in many situations, like wearing a mask, maintaining an appropriate social distance from others, avoiding crowds and poorly ventilated spaces, and washing their hands often.

For local health departments, healthcare providers, and clinical laboratories



- CDC encourages local health departments, healthcare providers, and clinical laboratories that identify a COVID-19 vaccine breakthrough case to:
 - Request the respiratory specimen be held for further testing.
 - Report the case to the state health department where the individual resides for further investigation and reporting to the national system.
- COVID-19 vaccine breakthrough cases that result in hospitalization or death should be reported to the [Vaccine Adverse Event Reporting System \(VAERS\)](#) [↗](#).

For state health departments

- If a possible vaccine breakthrough case is identified:
 - Request that the clinical or public health laboratory hold any residual respiratory specimens from the positive SARS-CoV-2 test.
 - Report the available case data to NNDSS, per normal procedures.
 - [Review CDC's screening questions to assess whether the case meets the COVID-19 vaccine breakthrough investigation criteria](#)  .
- If the reported case meets those criteria, CDC encourages state health departments to:
 - [Follow the steps for initiating a COVID-19 vaccine breakthrough case investigation](#)  .
 - Record the case in the COVID-19 vaccine breakthrough REDCap database.
- Because CDC would like to characterize the SARS-CoV-2 lineages responsible for COVID-19 vaccine breakthrough cases, including variants:
 - Report sequence results from a state public health laboratory, commercial reference laboratory, or academic laboratory by entering the PANGO lineage and GenBank or GISAID accession number into the COVID-19 vaccine breakthrough REDCap database.
 - If SARS-CoV-2 sequencing will not be performed locally and an acceptable clinical respiratory specimen is available, [provide instructions for the testing laboratory to send the residual respiratory specimen to CDC](#)  .
 - For cases with a known RT-PCR cycle threshold (Ct) value, submit only specimens with Ct value ≤ 28 to CDC for sequencing. (Sequencing is not feasible with higher Ct values.)
 - If the Ct value is not known (e.g., positive by antigen test only or by a molecular test that does not provide a Ct value), the positive specimen may still be submitted to CDC for RT-PCR and possible sequencing.

CDC will be transitioning to focus on identifying and investigating only vaccine breakthrough infections that result in hospitalization or death and will provide additional details on reporting.

How to send CDC sequence data or respiratory specimens from suspected vaccine breakthrough cases

- CDC would like to receive sequence data and respiratory specimens from COVID-19 vaccine breakthrough cases to assess the SARS-CoV-2 lineage, including variants. When a vaccine breakthrough case is identified, the health department will contact the laboratory to request that any residual respiratory specimen from the positive test be held for sequencing at CDC.
- The health department also will request the specimen ID numbers and the Ct value for positive RT-PCR results.
- If SARS-CoV-2 sequencing will not be performed locally and a specimen is available, [the state public health laboratory should request the residual clinical respiratory specimen for subsequent shipping to CDC](#)  .
 - For cases with a known RT-PCR cycle threshold (Ct) value, submit only specimens with Ct value ≤ 28 to CDC for sequencing.
 - If the Ct value is not known (e.g., positive by antigen test only or by a molecular test that does not provide a Ct value), the positive specimen may still be submitted to CDC for RT-PCR and potential sequencing.
- If your laboratory identifies a COVID-19 vaccine breakthrough case, please report it to your state health department so it can initiate the investigation with CDC.
- These instructions can also be found here: [NS3 Submission Guidance Documents](#)  .

Resources to support submitting breakthrough case data to CDC

[COVID-19 vaccine breakthrough case investigation form](#)  [2 pages]

[Information for laboratories COVID-19 vaccine breakthrough case investigation](#)  [2 pages]

[Information for state and local health departments COVID-19 vaccine breakthrough case investigation](#)  [2 pages]

[Public health investigations of COVID-19 vaccine breakthrough cases protocol](#)  [10 pages]

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