

SARS-CoV-2 Vaccine Breakthrough Surveillance Resource

Washington State Department of Health

December 13, 2023



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Executive Summary

Evidence from research studies indicates that COVID-19 vaccines reduce the risk of severe symptoms, hospitalization, and death, which may result from infection with SARS-CoV-2 (the virus causing COVID-19 disease). Since most vaccines are not 100% effective, we expect to see SARS-CoV-2 vaccine breakthrough cases. The criteria for a vaccine breakthrough case requires a positive lab test (either a PCR test or antigen test) occurring at least 14 days after a person received their last recommended dose of an authorized, age-appropriate COVID-19 vaccine.

On February 1, 2023, this report was updated to remove case data to focus on the most severe outcomes of hospitalizations and deaths among SARS-CoV-2 vaccine breakthrough cases. Several factors affect the ability to interpret vaccine breakthrough case data:

- At-home tests are used more frequently, and most results are not routinely reported to the Washington State Department of Health
- The potential for people who are vaccinated and boosted to be more likely to be tested
- Previous SARS CoV-2 infection may provide some immunity from a reinfection for those who are unvaccinated
- Individuals with underlying health conditions are potentially more likely to get vaccinated, boosted, tested, and also experience severe outcomes

COVID-19 deaths that do not have a positive PCR or antigen test are not included in this report. These deaths represent approximately 20% of all COVID-19 deaths that have occurred since January 1, 2023.

Findings in this report show that between January 17, 2021 and December 02, 2023:

- Individuals who completed a COVID-19 primary vaccine series but did not receive a booster dose represented a higher proportion of hospitalized breakthroughs among all age groups, with the exception of individuals 65+ years of age, compared to those who completed the primary vaccine series and also received a booster dose
- Individuals aged 65+ years represented the majority of SARS-CoV-2 breakthroughs for both hospitalizations and deaths
- 66% of the 4,774 SARS-CoV-2 breakthrough deaths were hospitalized
- 55% of the 4,774 SARS-CoV-2 breakthrough deaths had only completed their primary series and had not yet received an additional dose
- Of the 862,699 SARS-CoV-2 vaccine breakthrough cases that have been identified in Washington State:
 - 4% were hospitalized
 - 0.6% died of COVID-related illness

Introduction

COVID-19 vaccines are effective and critical tools to aid in the control of this pandemic. Large-scale clinical studies found that COVID-19 vaccines prevented most people from getting COVID-19 illness, but like most other vaccines, they are not 100% effective. This means some people who completed the primary series of the vaccines will still get infected with SARS-CoV-2. These individuals may or may not develop COVID-19 symptoms or experience severe outcomes.

Vaccine breakthrough occurs when someone gets infected with an organism they are fully vaccinated against. For the COVID-19 vaccine, this means someone tests positive for SARS-CoV-2 two weeks or more after receiving the primary series of an authorized COVID-19 vaccine. Since millions of people in the United States have been getting vaccinated, we expect to see some breakthrough disease. Fortunately, there is evidence from research studies that the COVID-19 vaccine reduces the risk of people developing severe symptoms and needing to go to the hospital or dying from COVID-19.

The Washington State Department of Health (WA DOH) is closely monitoring and investigating hospitalizations and deaths among vaccine breakthrough cases in Washington to identify possible patterns of severe COVID-19 outcomes in our population. The data in this report may change as we get additional information.

Criteria for SARS-CoV-2 vaccine breakthrough cases

The criteria for identifying vaccine breakthrough cases include a positive lab test (either a PCR or antigen test) at least 14 days after a person received their last recommended dose of an authorized, age-appropriate COVID-19 vaccine.

At least 14 days are required to have passed after vaccination to be considered a breakthrough case as some people could get COVID-19 soon after vaccination when their body hasn't had enough time yet to build full protection. Infections that occur less than 14 days after vaccination are not considered vaccine breakthrough cases because a person could have been exposed to the virus before they were vaccinated. It typically takes about two weeks after the final dose of vaccine for the body to build a high level of protection against the disease.

COVID-19 deaths that do not have a positive PCR or antigen test are not included in this report. These deaths represent approximately 20% of all COVID-19 deaths that have occurred since January 1, 2023.

Additionally, the updated 2023-2024 dose is not yet included in this report's analyses. These doses will be included once a sufficient percentage of the WA population has received them.

The first COVID-19 vaccines were administered in Washington in mid-December 2020. DOH started surveillance for people who meet these case criteria on January 17, 2021.

For information on updates to this report's methodology, please see the "A review of the methodologies used for this report" section below.

SARS-CoV-2 VACCINE BREAKTHROUGH HOSPITALIZATIONS

This section of the report provides a description of the SARS-CoV-2 breakthrough cases that were hospitalized for COVID-19. Please refer to the [Respiratory Illness Data Dashboard](#) for details regarding COVID-19 hospitalization definitions.

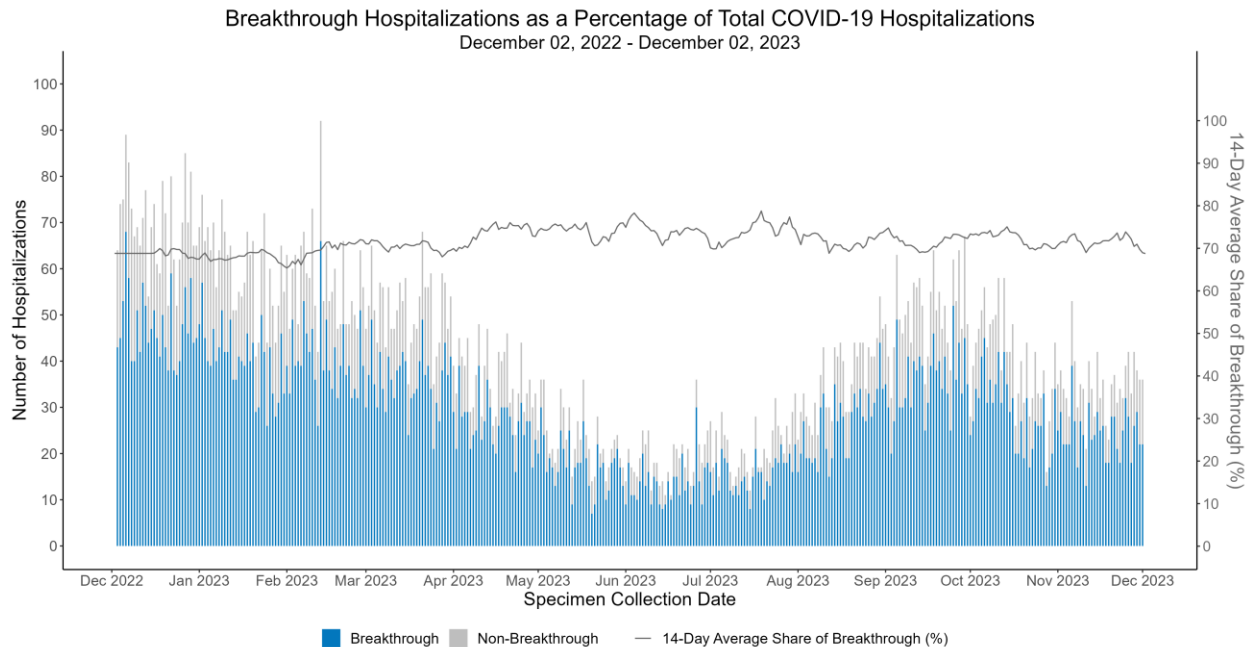
Washington State SARS-CoV-2 breakthrough and non-breakthrough hospitalizations by month

The epidemiologic curve below shows non-breakthrough COVID-19 hospitalizations (among confirmed and probable COVID-19 cases) in grey and the number of breakthrough hospitalizations in blue by specimen collection date. The graph also shows the 14-day average of breakthrough as a percentage of overall COVID-19 hospitalizations.

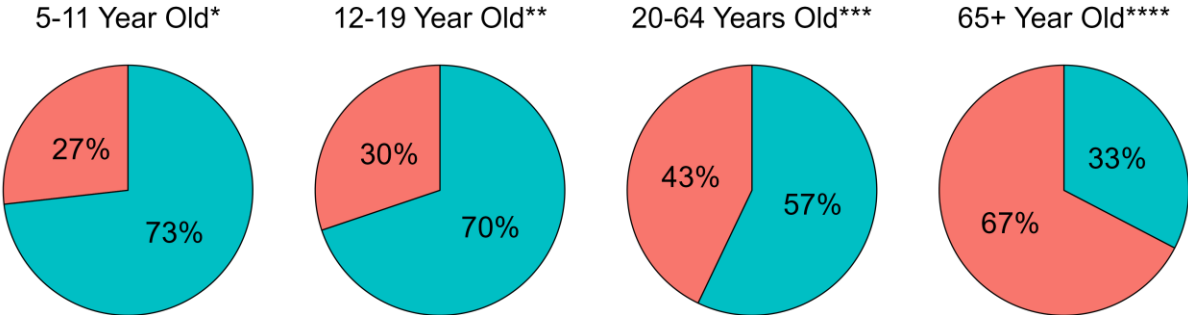
Several factors affect the number and percent of breakthrough hospitalizations:

- increased numbers of vaccinated persons,
- different SARS-CoV-2 variants circulating at a given time,
- possible waning immunity, and
- changes in mitigation recommendations for the community.

Additional analyses are needed to fully understand breakthrough as a percentage of overall COVID-19 hospitalizations.



Washington State SARS-CoV-2 breakthrough hospitalizations by vaccination status



* 05/31/2022 – 12/02/2023

** 01/17/2022 – 12/02/2023

*** 12/03/2021 – 12/02/2023

**** 11/03/2021 - 12/02/2023

■ Completed primary series with an additional dose ■ Completed primary series without an additional dose

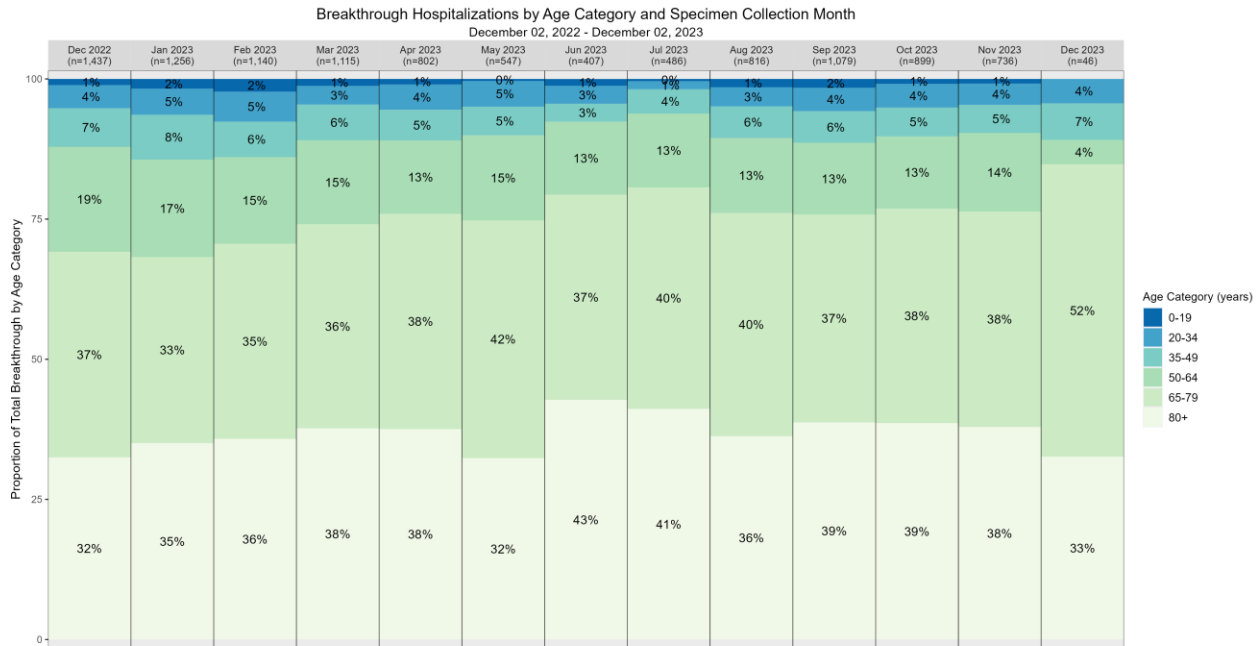
- After the completion of a primary series, additional doses were made available to different age groups on different dates. The figures above only include breakthrough hospitalizations that tested positive for SARS-CoV-2 14 or more days after their age group was eligible to receive an additional dose. Please refer to the [COVID-19 Vaccine Timeline](#) for details regarding vaccine eligibility and requirements in WA State.

Washington State SARS-CoV-2 breakthrough hospitalizations by age group

January 17, 2021 - December 02, 2023

	Primary Series only	Primary Series with Additional Dose	Total breakthrough
Age group (years)	Number of cases (%)	Number of cases (%)	Number of cases
0-19	366 (77%)	111 (23%)	477
20-34	1,472 (73%)	536 (27%)	2,008
35-49	1,786 (65%)	950 (35%)	2,736
50-64	3,441 (57%)	2,589 (43%)	6,030
65-79	4,925 (43%)	6,575 (57%)	11,500
80+	3,689 (36%)	6,483 (64%)	10,172
Total	15,679 (48%)	17,244 (52%)	32,923

- Age distribution of breakthrough hospitalizations has changed over time as more age groups became eligible for vaccine as shown below. Please refer to the [COVID-19 Vaccine Timeline](#) for details regarding vaccine eligibility and requirements in WA State.



Washington State SARS-CoV-2 breakthrough hospitalizations by sex

January 17, 2021 - December 02, 2023

	Primary Series only	Primary Series with Additional Dose	Total breakthrough
Sex	Number of cases (%)	Number of cases (%)	Number of cases
Female	8,022 (48%)	8,636 (52%)	16,658
Male	7,493 (47%)	8,480 (53%)	15,973
Unknown	164 (56%)	128 (44%)	292
Total	15,679 (48%)	17,244 (52%)	32,923

- In Washington, recorded vaccinations indicate a slightly higher percentage of uptake among women compared to men. Please refer to the [COVID-19 Vaccination Data Dashboard](#) for more information on vaccination trends in Washington State.
- Among 32,923 total COVID-19 breakthrough hospitalizations, 51% identified as female, 49% identified as male, and 1% are unknown.

Washington State SARS-CoV-2 breakthrough hospitalizations by race and ethnicity

For all race and ethnicity reporting, all those who indicated Hispanic ethnicity are grouped in the Hispanic ethnicity, regardless of race. Racial groups are identified only for those who indicated non-Hispanic ethnicity. Based on this classification, our report includes the following groups:

- Hispanic; and
- Non-Hispanic race categorizations for white, Black, Native Hawaiian and Pacific Islander, Asian, and American Indian/Alaska Native.

The multiracial group includes people who chose more than one category. This can include a selection of unknown and one other race category. This method of categorization allows us to assess the data by race and ethnicity. However, the reporting categories are incomplete and do not reflect the diversity of people and experiences across Washington state.

January 17, 2021 - December 02, 2023

	Primary Series only	Primary Series with Additional Dose	Total breakthrough
Race and Ethnicity	Number of cases (%)	Number of cases (%)	Number of cases
American Indian or Alaska Native*	344 (57%)	259 (43%)	603
Asian*	591 (41%)	849 (59%)	1,440
Black*	655 (56%)	512 (44%)	1,167
Hispanic	998 (62%)	611 (38%)	1,609
Multiracial*	117 (53%)	104 (47%)	221
Native Hawaiian or Other Pacific Islander*	211 (69%)	94 (31%)	305
Other Race*	83 (55%)	68 (45%)	151
White*	10,165 (46%)	11,839 (54%)	22,004
Unknown	2,515 (46%)	2,908 (54%)	5,423
Total	15,679 (48%)	17,244 (52%)	32,923

* Non-Hispanic

- Among 32,923 COVID-19 breakthrough hospitalizations, no race and/or ethnicity information was available for 5,423 (16%) people.

COVID-19 deaths among SARS-CoV-2 breakthrough hospitalizations in Washington State

January 17, 2021 - December 02, 2023

Among hospitalized breakthrough cases from this surveillance period, **3,153** have died of COVID-related illness. Please refer to the [Respiratory Illness Data Dashboard](#) for details regarding death definitions.

The age range of deceased cases was 15 - 104 years (median 79 years).

Among the **3,153** deceased:

Underlying Conditions	
Yes	No/Unknown
1,273 (40%)	1,880 (60%)
Long-term Care Facility Association	
Yes	No/Unknown
750 (24%)	2,403 (76%)
Received Additional Dose After Primary Series	
Yes	No/Unknown
1,406 (45%)	1,747 (55%)

SARS-CoV-2 VACCINE BREAKTHROUGH DEATHS

This section of the report provides a description of the SARS-CoV-2 breakthrough cases that died of COVID-related illness. Please refer to the [Respiratory Illness Data Dashboard](#) for details regarding death definitions.

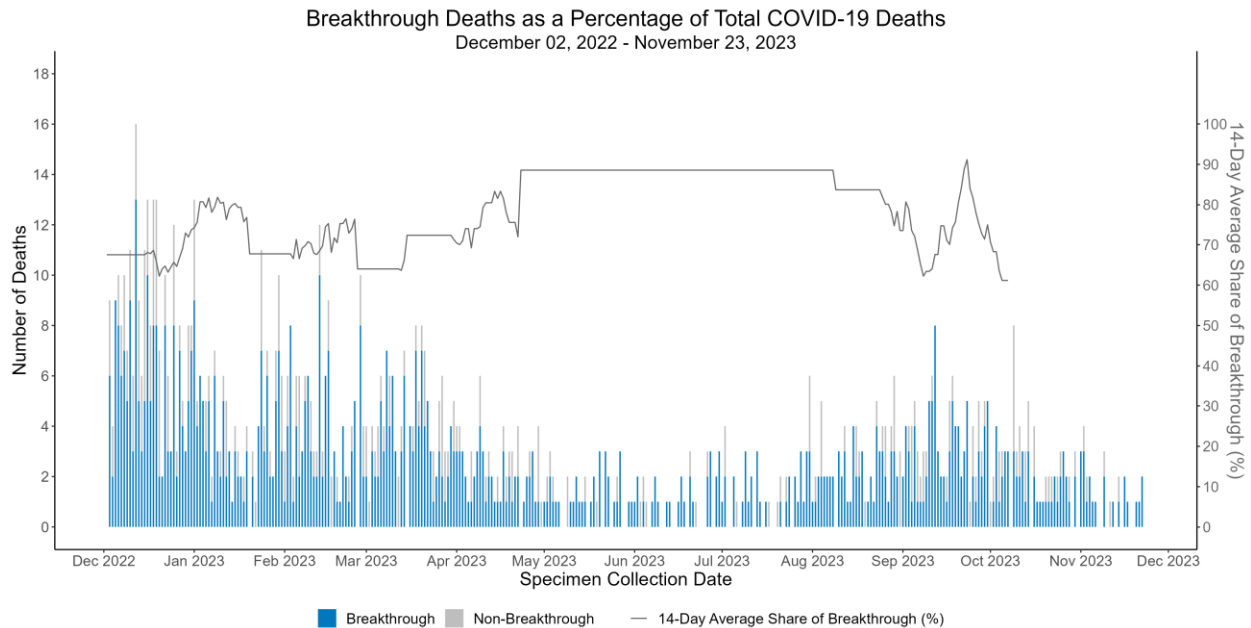
Washington State SARS-CoV-2 breakthrough and non-breakthrough deaths by month

The epidemiologic curve below shows non-breakthrough COVID-19 deaths (among confirmed and probable COVID-19 cases) in grey and the number of breakthrough deaths in blue by specimen collection date. The graph also shows the 14-day average of breakthrough as a percentage of overall COVID-19 deaths.

Several factors affect the number and percent of breakthrough deaths:

- increased numbers of vaccinated persons,
- different SARS-CoV-2 variants circulating at a given time,
- possible waning immunity, and
- changes in mitigation recommendations for the community.

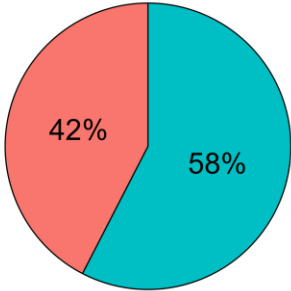
Additional analyses are needed to fully understand breakthrough as a percentage of overall COVID-19 deaths.



In the above figure, the trend line for October, November, and December 2023 was not calculable due to the low number of deaths occurring among reported COVID-19 cases.

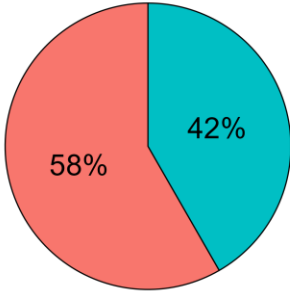
Washington State SARS-CoV-2 breakthrough deaths by vaccination status

20-64 Years Old***



*** 12/03/2021 – 12/02/2023

65+ Year Old****



**** 11/03/2021 - 12/02/2023

■ Completed primary series with an additional dose ■ Completed primary series without an additional dose

- After the completion of a primary series, additional doses were made available to different age groups on different dates. The figures above only include breakthrough deaths that tested positive for SARS-CoV-2 14 or more days after their age group was eligible to receive an additional dose. Please refer to the [COVID-19 Vaccine Timeline](#) for details regarding vaccine eligibility and requirements in WA State.
- In adherence to WA DOH agency reporting standards for small numbers, breakthrough deaths in younger age groups are suppressed in this report.

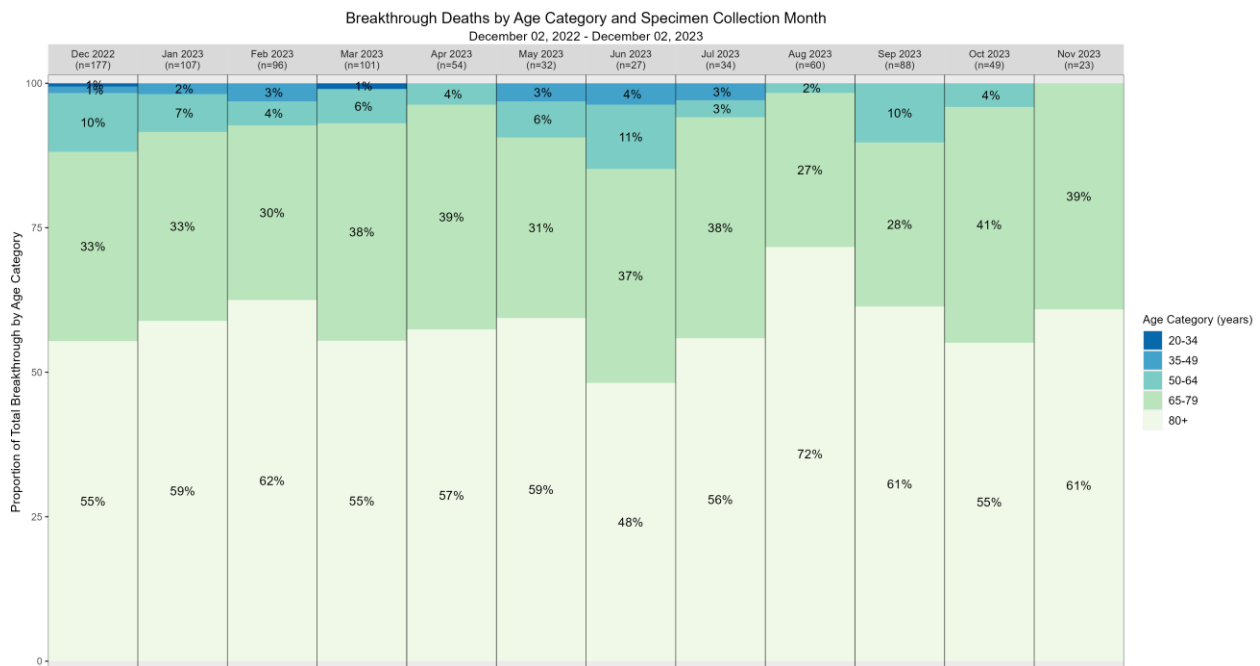
Washington State SARS-CoV-2 breakthrough deaths by age group

January 17, 2021 - December 02, 2023

	Primary Series only	Primary Series with Additional Dose	Total breakthrough
Age group (years)	Number of cases (%)	Number of cases (%)	Number of cases
0-19	*	*	*
20-34	*	*	30
35-49	82 (74%)	29 (26%)	111
50-64	320 (64%)	179 (36%)	499
65-79	971 (58%)	697 (42%)	1,668
80+	1,209 (49%)	1,254 (51%)	2,463
Total	2,607 (55%)	2,167 (45%)	4,774

* In adherence to WA DOH agency reporting standards for small numbers, breakthrough deaths in younger age groups are suppressed in this report.

- Age distribution of breakthrough deaths has changed over time as more age groups became eligible for vaccine as shown below. Please refer to the [COVID-19 Vaccine Timeline](#) for details regarding vaccine eligibility and requirements in WA State.



Washington State SARS-CoV-2 breakthrough deaths by sex

January 17, 2021 - December 02, 2023

	Primary Series only	Primary Series with Additional Dose	Total breakthrough
Sex	Number of cases (%)	Number of cases (%)	Number of cases
Female	1,185 (54%)	1,004 (46%)	2,189
Male	1,387 (55%)	1,142 (45%)	2,529
Unknown	35 (62%)	21 (38%)	56
Total	2,607 (55%)	2,167 (45%)	4,774

- In Washington, recorded vaccinations indicate a higher percentage of uptake among women compared to men. Please refer to the [COVID-19 Vaccination Data Dashboard](#) for more information on vaccination trends in Washington State.
- Among 4,774 total COVID-19 breakthrough deaths, 46% identified as female, 53% identified as male, 1% are unknown.

Washington State SARS-CoV-2 breakthrough deaths by race and ethnicity

For all race and ethnicity reporting, all those who indicated Hispanic ethnicity are grouped in the Hispanic ethnicity, regardless of race. Racial groups are identified only for those who indicated non-Hispanic ethnicity. Based on this classification, our report includes the following groups:

- Hispanic; and
- Non-Hispanic race categorizations for white, Black, Native Hawaiian and Pacific Islander, Asian, and American Indian/Alaska Native.

The multiracial group includes people who chose more than one category. This can include a selection of unknown and one other race category. This method of categorization allows us to assess the data by race and ethnicity. However, the reporting categories are incomplete and do not reflect the diversity of people and experiences across Washington state.

January 17, 2021 - December 02, 2023

	Primary Series only	Primary Series with Additional Dose	Total breakthrough
Race and Ethnicity	Number of cases (%)	Number of cases (%)	Number of cases
American Indian or Alaska Native*	49 (56%)	38 (44%)	87
Asian*	94 (48%)	102 (52%)	196
Black*	81 (63%)	47 (37%)	128
Hispanic	99 (67%)	48 (33%)	147
Multiracial*	25 (61%)	16 (39%)	41
Native Hawaiian or Other Pacific Islander*	24 (71%)	10 (29%)	34
Other Race*	14 (70%)	6 (30%)	20
White*	1,801 (54%)	1,524 (46%)	3,325
Unknown	420 (53%)	376 (47%)	796
Total	2,607 (55%)	2,167 (45%)	4,774

* Non-Hispanic

** In adherence to WA DOH agency reporting standards for small numbers, breakthrough deaths in some race/ethnicity groups are suppressed in this report.

- Among 4,774 COVID-19 breakthrough deaths, no race and/or ethnicity information was available for 860 (18%) people.

Washington State SARS-CoV-2 breakthrough deaths by hospitalization

January 17, 2021 - December 02, 2023

	Primary Series only	Primary Series with Additional Dose	Total breakthrough
Hospitalization	Number of cases (%)	Number of cases (%)	Number of cases
Yes	1,747 (55%)	1,406 (45%)	3,153
No/Unknown	860 (53%)	761 (47%)	1,621
Total	2,607 (55%)	2,167 (45%)	4,774

- Among the 4,774 COVID-19 breakthrough deaths, 3,153 (66%) were hospitalized. Please refer to the [Respiratory Illness Data Dashboard](#) for details regarding hospitalization definitions.

COVID-19 deaths among all SARS-CoV-2 breakthrough cases in Washington State

January 17, 2021 - December 02, 2023

Among breakthrough cases from this surveillance period, **4,774** have died of COVID-related illness. Please refer to the [Respiratory Illness Data Dashboard](#) for details regarding death definitions.

The age range of deceased cases was 7 - 106 years (median 80 years).

Among the **4,774** deceased:

Underlying Conditions	
Yes	No/Unknown
1,778 (37%)	2,996 (63%)
Hospitalizations	
Yes	No/Unknown
3,153 (66%)	1,621 (34%)
Long-term Care Facility Association	
Yes	No/Unknown
1,552 (33%)	3,222 (67%)
Received Additional Dose After Primary Series	
Yes	No/Unknown
2,167 (45%)	2,607 (55%)

Washington State SARS-CoV-2 vaccine breakthrough cases - variants

As of March 29, 2023, sequencing data for breakthrough cases is no longer shared in the SARS-CoV-2 Sequencing and Variants in Washington State report.

For further information on SARS-CoV-2 sequencing in Washington State, please refer to the [SARS-CoV-2 Sequencing and Variants in Washington State](#) report on the WA DOH [Respiratory Illness Data Dashboard](#).

Washington State SARS-CoV-2 vaccine breakthrough hospitalizations and deaths – Vaccination Rates

In order to understand the impact of vaccination on COVID-19, it is important to look at vaccine breakthrough hospitalizations and deaths in the context of overall vaccination rates in Washington State.

Please refer to the [COVID-19 Hospitalizations and Deaths by Vaccination Status in Washington State](#) report for more details.

A review of the methodologies used for this report

Early in the pandemic, breakthrough case information was only available through reports from local public health and other interviewers who had talked to people who had a positive PCR or antigen test and learned whether the interviewee had been vaccinated.

Beginning with the September 1, 2021 issue of this report, DOH included an additional method of identifying breakthrough cases by matching Washington Immunization Information Systems (IIS) data with new positive COVID tests using exact matches between first name, last name, and date of birth. The matching method automatically verified the vaccine doses and assured that at least 14 days had passed between the final vaccine administration date and the specimen collection date for an individual's positive test.

Because the initial matching methodology allowed us to report as breakthrough cases people that had only received the recommended primary COVID-19 vaccination series (2 doses of mRNA vaccines or 1 dose of J&J vaccine), on January 29, 2022 the report's methodology was updated to retrospectively include people who received doses of the COVID-19 vaccine in addition to their primary series doses.

On June 28, 2022 the methodology was updated to include standardized definitions and only breakthrough cases that can be identified by matching IIS data with new positive COVID tests.

On September 14, 2022, this report was updated to include analyses on breakthrough cases that received an additional dose after the primary series. After FDA-authorization of the bivalent booster doses, we updated the definition of an additional dose to also include bivalent booster doses, starting with the October edition of this report.

DOH continues to review and incorporate methodologies to enhance its COVID-19 related data including that for breakthrough surveillance. The goal is to ensure a more accurate account of the number of breakthrough cases in our state.

Vaccines remain a critical tool for providing protection against COVID-19, especially against severe illness and hospitalization.