

Statistical bulletin

# Deaths involving COVID-19 by vaccination status, England: deaths occurring between 1 January and 31 December 2021

Age-standardised mortality rates for deaths involving coronavirus (COVID-19) by vaccination status, broken down by age group; deaths occurring between 1 January and 31 December 2021 in England.

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# 1 . Main points

- In the period July to December 2021, the age-adjusted risk of death involving coronavirus (COVID-19) was 93.4% lower for people who had received a third dose, or booster, at least 21 days ago compared with unvaccinated people.
- In the period July to December 2021, the age-adjusted risk of death involving COVID-19 was 81.2% lower for people who had received a second dose at least 21 days ago compared with unvaccinated people; for January to June 2021, this was 99.5% lower.
- The monthly age-standardised mortality rates (ASMRs) for death involving COVID-19 have been consistently lower for all months since booster introduction in September 2021 for people who had received a third dose, or booster, at least 21 days ago, compared with unvaccinated people; this is the case for all age groups.
- The monthly ASMRs for death involving COVID-19 have been consistently lower for people who had received a second dose at least 21 days ago compared with unvaccinated people, until October 2021 but increased in November and December 2021, particularly in older age groups; this may be driven by a change in the composition of the group with most people in older age groups having received a third dose, or booster, or waning protection from prior vaccination.
- The age-adjusted rates are not equivalent to measures of vaccine effectiveness; they account for differences in age structure and population size but there may be other differences between the groups, particularly underlying health, which affect the mortality rates.
- Changes in non-COVID-19 mortality by vaccination status are largely driven by the changing composition of the vaccination status groups because of the prioritisation of clinically extremely vulnerable and people with underlying health conditions, and differences in timing of vaccination among people who were eligible.

## 2 . Background to the data

Comparing mortality across coronavirus (COVID-19) vaccination status is challenging because the size and age structure of vaccinated and unvaccinated populations changes over time, because of vaccinations being offered according to priority groups set out by the Joint Committee on Vaccination and Immunisation (JCVI).

To account for these differences, we calculated age-standardised mortality rates (ASMRs). However, there are other factors such as the health status of individuals, changing infection levels, changing dominant variants and differing levels of immunity from prior infection that can influence the mortality rates.

ASMRs are therefore not equivalent to measures of vaccine effectiveness. More information on this can be found in our [previous release](#).

The vaccination status is split by dose and time since vaccination, to allow for the increase in protection in the first few weeks after vaccination. We have updated our vaccination status definitions to include booster doses, defined as a third or booster dose received after 16 September 2021, the date from which booster doses were first administered. Therefore, vaccination status can be one of:

- unvaccinated
- received only the first dose, less than 21 days ago
- received only the first dose, at least 21 days ago
- received only the first and second dose, less than 21 days ago
- received only the first and second dose, at least 21 days ago
- received a third dose, or booster, less than 21 days ago
- received a third dose, or booster, at least 21 days ago

This bulletin includes six-month and monthly ASMRs by vaccination status for deaths involving COVID-19, broken down by age group for the population in the Public Health Data Asset. More information on the dataset can be found in the [Measuring the data](#) section and our [previous release](#). Annual data and ASMRs broken down by sex and age for deaths involving COVID-19, non-COVID-19 deaths and all deaths are provided in the [datasets](#) for all vaccination statuses, as well as counts of deaths by vaccination status for all registered deaths.

### 3 . Six-month age-standardised mortality rates by vaccination status, deaths involving COVID-19

**Figure 1: For the period July to December 2021, the age-standardised mortality rates for people with a second or third dose, or booster, are lower than those for the unvaccinated in all age groups**

Six-month age-standardised mortality rates, by age group and vaccination status, England, 2021

#### Notes:

1. Age-standardised mortality rates per 100,000 person-years, standardised to the 2013 European Standard Population using five-year age groups from those aged 10 years and over. Age-standardised mortality rates are also presented for specific age groups. "Person-years" take into account both the number of people and the amount of time spent in each vaccination status.
2. These figures represent death occurrences for deaths registered by 12 January 2022; there can be a delay between the date a death occurred and the date a death was registered. See [Impact of registration delays](#) on mortality statistics in England and Wales.
3. 95% confidence intervals are given in the data download. Where the total number of deaths is less than 100, Dobson's method is used, otherwise the normal approximation is used. Non-overlapping confidence intervals denote a statistically significant difference in ASMR.
4. Age is defined at the beginning of each month.
5. Third dose, or booster vaccinations are defined as a third or booster dose received after 16 September 2021, the date from which booster doses were first administered. Therefore, there are no data for third doses, or boosters for the period January to June.
6. Different scales are used to allow trends of the mortality rates for the different vaccination status groups and age groups to be compared within each six-month period.

[.xlsx](#)

In the period July to December 2021, for people aged 10 years and over, the age-adjusted risk of death involving coronavirus (COVID-19) was 93.4% lower for people who had received a third dose, or booster, at least 21 days ago compared with unvaccinated people. For people who had received a second dose at least 21 days ago, the age-adjusted risk of death involving COVID-19 was 81.2% lower than for unvaccinated people.

In the period July to December 2021, the age-standardised mortality rates were significantly lower for people who had received a second or third dose, or booster, at least 21 days ago than unvaccinated people for all age groups. The mortality rates for people who had received the first dose were similar to unvaccinated people, particularly for older age groups. This was possibly because of the longer length of time when people had the first dose leading to waning protection from prior vaccination and also because of the exclusion of people who had received a first and third dose, or booster, but not second dose from the analysis because of incomplete vaccination records (see [Strengths and limitations](#)).

In the period January to June 2021, for people aged 10 years and over, the age-adjusted risk of death involving COVID-19 was 99.5% lower for people who had received a second dose at least 21 days ago compared with unvaccinated people. The unvaccinated mortality rates for the period January to June were higher than the later period (July to December) for age groups over 60 years. This could be because, for example, of changes in the infection rates, particularly the high infection rates in January when most people were unvaccinated, changing dominant variants and changing levels of immunity from prior infection.

#### More about coronavirus

- Find the latest on [coronavirus \(COVID-19\) in the UK](#).
- [Explore the latest coronavirus data](#) from the ONS and other sources.
- All ONS analysis, summarised in our [coronavirus roundup](#).
- View [all coronavirus data](#).
- Find out how we are [working safely in our studies and surveys](#).

## 4 . Monthly age-standardised mortality rates by vaccination status, deaths involving COVID-19

**Figure 2: Monthly age-standardised mortality rates for deaths involving COVID-19 are consistently lower for people who had a third dose, or booster, at least 21 days ago than unvaccinated people**

ASMRs calculated for each month in 2021, by vaccine status, total and by age-group, for deaths involving COVID-19, England, deaths occurring between 1 January and 31 December 2021

#### Notes:

1. Age-standardised mortality rates per 100,000 person-years, standardised to the 2013 European Standard Population using five-year age groups from those aged 10 years and over. Age-standardised mortality rates are also presented for specific age groups. "Person-years" take into account both the number of people and the amount of time spent in each vaccination status.
2. 95% confidence intervals are indicated by the shaded regions. Where the total number of deaths is less than 100, Dobson's method is used, otherwise the normal approximation is used. Non-overlapping confidence intervals denote a statistically significant difference in ASMR.
3. Rates for all ages are not calculated where the total number of deaths is less than 10. Rates for age breakdowns are not calculated where the total number of deaths is less than 3.
4. Age is defined on the first day of each month.
5. The month in which people in each age group first became eligible for the first vaccination is indicated on the plots, both for people with underlying health conditions and the general population (for the 80 to 89 years and 90 years and over age groups, this is December 2020). Within some age groups, there can be differences in the start of vaccination by age. Some people were vaccinated before the indicated months if they are frontline health and social care workers or people who are clinically extremely vulnerable. Booster vaccinations were first administered on 16 September 2021, indicated on the all-ages plot, initially to people aged over 50 years or at higher risk because of occupation or comorbidities.
6. Different scales are used for the age-breakdown plots to allow trends of the mortality rates for the different vaccination status groups within the age groups to be compared.
7. These figures represent death occurrences for deaths registered by 12 January 2022; there can be a delay between the date a death occurred and the date a death was registered. See [Impact of registration delays](#) on mortality statistics in England and Wales.
8. Third dose, or booster vaccinations are defined as a third or booster dose received after 16 September 2021, the date from which booster doses were first administered. Therefore, there are no data for third doses, or boosters before September for "Within 21 days of third dose, or booster" and "21 days or more after third dose, or booster", and within September for "21 days or more after third dose, or booster".

#### Download the data

[.xlsx](#)

Age-standardised mortality rates (ASMRs) for deaths involving coronavirus (COVID-19) for people who have had a third dose, or booster, are significantly lower than those for unvaccinated people and people who had only a first or second dose.

There is a rise in the ASMRs in November and December 2021 for people who had a second dose at least 21 days ago. This is also seen in the non-COVID-19 mortality rates (see [datasets](#)). This could be because of a change in composition of the people who have had a second dose, but not a third dose, or booster, similar to the effect seen in people who had the first dose at least 21 days ago discussed in our [previous update](#).

These trends are broadly reflected in the data broken down by age. The mortality rates 21 days or more after a first dose are similar to those for unvaccinated people in older age groups. This could be because of people having had the first dose a long time ago and therefore now having limited protection, and the exclusion of people who had received a first and third dose, or booster, but not second dose from the analysis because of incomplete vaccination records (see [Strengths and limitations](#)).

ASMRs for non-COVID-19 deaths and all deaths are given in the [datasets](#). These rates can be affected by composition effects such as the prioritisation of younger people with comorbidities for earlier vaccination than other people in their age group, and the poorer health of people who do not go on to receive subsequent vaccinations when eligible. These effects are discussed in our [previous release](#).

## 5 . Deaths by vaccination status, England data

[Deaths by vaccination status, England](#)

Dataset | Released 4 February 2022

Age-standardised mortality rates and age-specific mortality rates for deaths involving COVID-19, non-COVID-19 deaths and all deaths by vaccination status.

## 6 . Glossary

### Age-standardised mortality rates

Age-standardised mortality rates (ASMRs) are used to allow comparisons between populations that may contain different proportions of people of different ages. The [2013 European Standard Population](#) is used to standardise rates. For more information see the [Measuring the data](#) section.

### Coronaviruses

The World Health Organization (WHO) defines coronaviruses as "a large family of viruses that are known to cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS)". Between 2001 and 2018, there were 12 deaths in England and Wales because of a coronavirus infection, with a further 13 deaths mentioning the virus as a contributory factor on the death certificate.

### Coronavirus (COVID-19)

COVID-19 refers to the "coronavirus disease 2019" and is a disease that can affect the lungs and airways. It is caused by a type of coronavirus. Further information is available from the [World Health Organization \(WHO\)](#).

### Statistical significance

The term "significant" refers to statistically significant changes or differences. Significance has been determined using the 95% confidence intervals, where instances of non-overlapping confidence intervals between estimates indicate the difference is unlikely to have arisen from random fluctuation.

### 95% confidence intervals

A confidence interval is a measure of the uncertainty around a specific estimate. If a confidence interval is 95%, it is expected that the interval will contain the true value on 95 occasions if repeated 100 times. As intervals around estimates widen, the level of uncertainty about where the true value lies increases. The size of the interval around the estimate is strongly related to the number of deaths, prevalence of health states and the size of the underlying population. At a national level, the overall level of error will be small compared with the error associated with a local area or a specific age and sex breakdown. More information is available on our [uncertainty pages](#).

## Deaths involving COVID-19

For this analysis we define a death as involving COVID-19 if either of the ICD-10 codes U07.1 (COVID-19, virus identified) or U07.2 (COVID-19, virus not identified) is mentioned on the death certificate.

In contrast to the definition used in the weekly deaths release, deaths where the ICD-10 code U09.9 (post-COVID condition, where the acute COVID-19 had ended before the condition immediately causing death occurred) is mentioned on the death certificate and neither of the other two COVID-19 codes are mentioned are not included. This is because they are likely to be the result of an infection caught a long time previously, and therefore not linked to the vaccination status of the person at date of death.

Deaths involving U10.9 (multisystem inflammatory syndrome associated with COVID-19) where U07.1 or U07.2 are not mentioned are also excluded. This is a rare complication affecting children, and there are no such deaths in our dataset.

## 7 . Measuring the data

Methodological information on the calculation of age-standardised mortality rates can be found in our accompanying [Methodology article](#).

### Data sources

The data for the age-standardised mortality rates (ASMRs) are created using the Public Health Data Asset (PHDA), a linked dataset combining the 2011 Census, the General Practice Extraction Service (GPES) data for coronavirus (COVID-19) pandemic planning and research, and the Hospital Episode Statistics (HES). We linked vaccination data from the National Immunisation Management Service (NIMS) to the PHDA based on NHS number.

The PHDA dataset contains a subset of the population and allows for analyses to be carried out that require a known living population with known characteristics (such as for ASMRs by vaccination status) and the use of variables such as health conditions and census characteristics.

## 8 . Strengths and limitations

### Provisional data are used

Provisional death registrations and death occurrences data are used in this bulletin. This enables timely analysis to be completed to monitor mortality trends. However, as the data for 2021 are provisional, they are subject to change.

### Use of death occurrences rather than registrations

This publication uses death occurrences registered up to 12 January 2022, rather than death registrations. Because of [registration delays](#), more deaths may be registered at later dates, leading to an increase in the death occurrences. This is especially true for more recent deaths.



## Data coverage

The data are for England only, as vaccinations data for Wales are not yet available and the Public Health Data Asset (PHDA) covers England only.

The PHDA dataset was used in order to calculate the age-standardised mortality rates (ASMRs) by vaccination status. One of the main strengths of the linked PHDA is that it combines a rich set of demographic and socio-economic factors from the 2011 Census and 2019 Patient Register with pre-existing conditions based on clinical records. This unique dataset was linked to the data from the National Immunisation Management Service (NIMS) to allow us to analyse how ASMRs differ by vaccination status. People with erroneous or inconsistent vaccination data were removed from the analysis. This includes 76,068 people who have a recorded first and third dose, or booster, but not a second dose. This means that deaths are not incorrectly assigned to the wrong vaccination status, however, it also has the effect of reducing the population therefore increasing the mortality rates for people who received a first dose.

The PHDA contains data on approximately 79% of the population of England aged 10 years and over and includes 85% of all deaths of residents in England that occurred between 1 January 2021 and 31 December 2021 as published in the [Monthly mortality analysis dataset](#), which includes all ages and deaths registered by 12 January 2022.

The PHDA data contains lower proportions of deaths for the younger age groups because of migration since the 2011 Census. The proportion of deaths of unvaccinated people included in the PHDA is slightly lower than for vaccinated people, because younger people are more likely to be unvaccinated and unlinked people (who would be classed as unvaccinated) are not included in the PHDA. The NIMS data in our dataset cover the period up to 18 January 2022; however, there may be some additional lag in reporting the data.

## 9 . Related links

### [Weekly COVID-19 age-standardised mortality rates by vaccination status, England: methodology](#)

Methodology | Released 13 September 2021

Detailed quality and methodology information for coronavirus (COVID-19) age-standardised mortality rates by vaccination status, initially published for Weeks 1 to 25 2021 in "Deaths involving COVID-19 by vaccination status and vaccine manufacturer, England: deaths occurring between 2 January and 2 July 2021".

### [Coronavirus \(COVID-19\) latest insights](#)

Interactive tool | Updated regularly

A live roundup of the latest data and trends about the coronavirus (COVID-19) pandemic from the ONS and other sources.

### [Deaths registered weekly in England and Wales](#)

Bulletin | Weekly

Provisional counts of the number of deaths registered in England and Wales, including deaths involving the coronavirus (COVID-19) pandemic, by age, sex and region, in the latest weeks for which data are available.

### [Coronavirus and vaccination rates in people aged 50 years and over by socio-demographic characteristic, England: 8 December 2020 to 12 December 2021](#)

Bulletin | Released 24 December 2021

First and second dose COVID-19 vaccination rates among people aged 70 years and older who live in England, both in private households and communal establishments. Includes estimates by socio-demographic factor such as ethnic group, religious group, and those identified as disabled.

### [Coronavirus \(COVID-19\) Infection Survey. UK](#)

Bulletin | Weekly

Estimates for England, Wales, Northern Ireland and Scotland. This survey is being delivered in partnership with University of Oxford, University of Manchester, Public Health England and Wellcome Trust. This study is jointly led by the ONS and the Department for Health and Social Care (DHSC) working with the University of Oxford and Lighthouse laboratory to collect and test samples.



