Office for National Statistics

Statistical bulletin

Deaths involving COVID-19 by vaccination status, England: deaths occurring between 1 April 2021 and 31 May 2023

Age-standardised mortality rates for deaths involving coronavirus (COVID-19) by vaccination status, broken down by age group. Deaths occurring between 1 April 2021 and 31 May 2023 in England.

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Next release:
To be announced

Correction

29 August 2023 15:15

We have corrected an issue with some of the data in this release which affected the way person years were summed when incorporating fourth vaccination doses.

The ONS apologises for any inconvenience.

Notice

25 August 2023

We will no longer be updating the Deaths by vaccination status analysis, England series. The last edition was for April 2021 to May 2023, published on 25 August 2023.

This publication was created during the coronavirus (COVID-19) pandemic to answer important questions around mortality by vaccine status in a timely manner.

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1 . Main points

- Monthly age-standardised mortality rates (ASMRs) for deaths involving coronavirus (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 and those with just a first or second dose.
- The ASMRs for deaths involving COVID-19 have been consistently lower for all months since fourth dose or extra booster in spring 2022 for people who had received at least a fourth dose or extra booster at least 21 days ago, compared with unvaccinated people and those with just a first, second or third dose.
- The ASMRs for first and second vaccine doses have been similar to those for unvaccinated people from March 2022 onwards; however, the confidence limits are wide for these groups because of lower populations in these vaccination statuses.
- The ASMRs 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) that affect mortality rates.
- Non-COVID-19 mortality rates are similar, though slightly lower, in people who have had a third dose or booster compared with unvaccinated people in the latter half of 2022 and in 2023.
- Non-COVID-19 mortality rates for first and second doses are more likely to be affected by confounding factors in the latter half of 2022 and in 2023 as these are people who did not receive a booster when eligible and therefore may differ from the general population.

Mortality rates among people who received a fourth vaccination dose are likely to be affected by the fact that this dose was targeted at a specific population, including people of all ages who were clinically vulnerable, those in a household with someone who is clinically vulnerable and older adults in care homes. Therefore, mortality rates in this group are not directly comparable to those for other vaccine doses and the results should be interpreted with caution.

2 . Deaths by vaccination status, England data

Deaths by vaccination status, England
Dataset | Released on 25 August 2023
Age-standardised mortality rates for deaths involving coronavirus (COVID-19), non-COVID-19 deaths and all deaths by vaccination status, broken down by age group.

3 . 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. In this bulletin, the ASMRs are calculated for each month. For more information, see Section 4: Measuring the data.

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.

Confounding factors

Factors that are related both to an outcome (for example, death) and an exposure (for example, vaccination) and therefore must be controlled for to find the impact of the exposure on the outcome. For example, age is a confounding factor for analyses of mortality by vaccination status because older people have higher mortality rates in general and were also more likely to be vaccinated earlier because of age-based prioritisation and differences in uptake. Therefore, if age is not controlled for, mortality rates of the vaccinated population can be inflated because of age rather than the impact of vaccination.

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 on COVID-19 is available from the World Health Organization (WHO).

Deaths involving COVID-19

For this analysis, we define a death as involving coronavirus (COVID-19) if either of the International Classification of Diseases 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.

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.

4 . Measuring the data

To compare mortality across coronavirus (COVID-19) vaccination statuses, age-standardised mortality rates (ASMRs) are calculated. 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.

Our accompanying dataset includes monthly ASMRs by vaccination status for deaths involving COVID-19, non-COVID-19 deaths, and all deaths. These are broken down by age group and sex for the population in the linked dataset using data on death occurrences between 1 April and 31 May 2023 for deaths registered by 10 July 2023. The dataset also includes counts of deaths by vaccination status for all registered deaths.

Other strengths and limitations, and further information can be found in our previous Deaths involving COVID-19 by vaccination status bulletins.

This release contains changes compared with the previous release from February 2023. The methodology used to calculate the rates has not changed. The changes are:

- the fourth dose or extra booster vaccination categories cover people who have had at least a fourth dose or extra booster but may have had more booster doses, which are not recorded in our data
- information about first to third doses and booster dose is taken from the old vaccination data feed (the same as used in all publications up to February 2023); information for fourth and extra booster doses is taken from a new vaccination feed provided by the UK Health Security Agency (UKHSA) in order to derive fourth doses

The 2021 Census linked dataset

The 2021 Census linked dataset is based on the population in Census 2021. This allows for analyses to be carried out that require a known living population with known characteristics. We linked deidentified Census 2021 records to NHS numbers using the personal demographics service to obtain NHS numbers for census identifiers. People with no NHS number or multiple entries are not included, and imputed individuals are not included.

The individuals were then linked via NHS number to vaccination data from the National Immunisation Management Service (NIMS) and ONS death registrations. The population was restricted to people in England, alive on 1 April 2021 (51,786,812 people). This is 91.6% of the England population on Census Day 2021.

The NIMS data in our dataset cover the period up to 28 June 2023; however, there may be some additional lag in reporting the data.

Mortality data

This publication uses death occurrences registered up to 10 July 2023, 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. More information can be found in our Impact of registration delays on mortality statistics in England and Wales: 2020 article. Finalised death data for 2021 are used so no additional death registrations for 2021 will be added but some 2021 death occurrences may yet be registered in 2022. However, provisional death registrations for 2022 are used to enable timely analysis to be completed to monitor mortality change but may be subject to change.

The data for the more recent months, particularly for December 2022, are subject to change as more deaths are registered, and therefore should be interpreted more cautiously.

Of the 1,149,784 deaths that occurred in England between 1 April 2021 and 31 May 2023 and were registered by 10 July 2023, 90.6% (1,041,524) could be linked to individuals in the 2021 Census.

Vaccination data

Vaccination status is based on the number of doses received (1, 2, 3 or 4 and more) and the time since that dose. From the day of vaccination, the individual will be classed as vaccinated.

The Joint Committee on Vaccination and Immunisation (JCVI) advised in September 2022 an autumn booster for over 50s and those more at risk because of their occupation or health. In February 2023, the JCVI advised a spring booster for over 75s and for the most vulnerable. People who are in the “at least fourth dose or extra booster” category may have received further booster doses, which are not recorded in our dataset.

People with erroneous or inconsistent vaccination data were removed from the analysis. This includes 103,142 people who have multiple entries for the same dose or who have a recorded first and third dose or booster but not a second dose, or who have a recorded first, second and fourth dose or extra booster, but not a third dose or booster. This ensures 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.

In rare cases, a vaccination may not be recorded if the person has died soon after vaccination and before the record is entered into the system. We therefore include in our dataset an extract of people who died soon after vaccination and do not have a record in NIMS up to 28 June 2023. There were 1,484 new vaccination entries for people who linked to our 2021 Census-linked dataset who were vaccinated but not included in the NIMS data as their vaccine record was entered after they had died.

Age-standardised mortality rates (ASMRs)

ASMR confidence is influenced by death occurrences and person-years in each vaccination status category. In May 2023, 49% of person-years were attributed to those who had a third dose at least 21 days ago, and 26% were attributed to those who had a fourth dose or extra booster at least 21 days ago. The remaining categories have much less confidence, which can be seen as wider, and often overlapping, confidence intervals. This is also especially true for the age breakdowns because there are even fewer deaths per status.

Non-COVID-19 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. This also includes the poorer health of people who do not go on to receive subsequent vaccinations when eligible. These effects are discussed in our Deaths involving COVID-19 by vaccination status bulletin from December 2021. Seasonal mortality and the healthy vaccinee effect may also be influencing the rates.

5 . Related links

Deaths registered weekly in England and Wales
Bulletin | Weekly
Provisional number of deaths registered in England and Wales, including deaths involving coronavirus (COVID-19), in the latest weeks.

Coronavirus and vaccination rates in people aged 18 years and over by socio-demographic characteristic, region and local authority, England
Bulletin | Released 10 March 2023
Coronavirus (COVID-19) vaccination rates for people aged 18 years and over in England. Estimates by socio-demographic characteristic, region and local authority.

Coronavirus (COVID-19) Infection Survey, UK
Bulletin | Released 24 March 2023
Percentage of people testing positive for coronavirus (COVID-19) in private residential households in England, Wales, Northern Ireland and Scotland, including regional and age breakdowns. Thissurveyis delivered in partnership with University of Oxford, University of Manchester,UK Health Security Agency (UKHSA)and Wellcome Trust, working with the University of Oxfordand partner laboratories tocollect and test samples.

6 . Cite this statistical bulletin

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