Office for National Statistics

Statistical bulletin

COVID-19 vaccine effectiveness estimated using Census 2021 variables, England: 31 March 2021 to 20 March 2022

Estimates of the risk of hospital admission for coronavirus (COVID-19) and death involving COVID-19 by vaccination status, overall and by age group, using anonymised linked data from Census 2021. Experimental Statistics.

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1 . Main points

- Vaccine effectiveness (VE) is the reduction in risk as a result of receiving a vaccine; it is estimated by comparing the risk in vaccinated and unvaccinated individuals, taking into account differences in the vaccinated and unvaccinated populations (confounding factors).
- We used linked, population-level datasets based on anonymised individuals in Census 2021, adjusting for a wide variety of confounding factors, to estimate vaccine effectiveness against coronavirus (COVID-19) hospitalisation and death involving COVID-19.
- Between 21 March 2021 and 20 March 2022, vaccine effectiveness against hospitalisation for COVID-19 was 52.2% (95% confidence interval: 51.4% to 52.9%) for a first dose, 55.7% (confidence interval: 55.2% to 56.1%) for a second dose, and 77.6% (confidence interval: 77.3% to 80.0%) for a third dose.
- Vaccine effectiveness against COVID-19 mortality was 58.7% (confidence interval: 52.7% to 65.9%) for a first dose, 88.6% (confidence interval: 87.5% to 89.5%) for a second dose, and 93.2% (confidence interval: 92.9% to 93.5%) for a third dose.
- Protection increases with subsequent doses and is high for the third dose or booster as has been shown in previous research, however results are slightly lower in general than previously published estimates.
- Although these estimates take into account many sociodemographic and health-related differences between people in different vaccination statuses using up-to-date data sources, some residual confounding remains; this includes confounding because of prioritisation of the clinically vulnerable in young people, and delayed vaccination of more frail older people.

Census estimates provided here may be very slightly different to the estimates provided in other census products. This is because of the application of statistical disclosure control (SDC) processes to the census data to prevent the identification of individuals in published statistics.

2 . Understanding the data

The coronavirus (COVID-19) vaccine has been shown in both clinical trials and real-world effectiveness studies to be effective at preventing infection, hospitalisation, and death from COVID-19. Estimating vaccine effectiveness in the real world as the roll-out of booster vaccinations continues is vital to assess the impact of the vaccination campaign.

Vaccine effectiveness provides a measure of the percentage reduction in an outcome (for example, infection, hospitalisation, or death) among people who are vaccinated compared with those who are not. To provide an accurate measure of vaccine effectiveness, factors that affect both the likelihood to be vaccinated and the likelihood of the outcome, known as confounding factors, must be controlled for.

The age-standardised mortality rates that we publish by month provide an indication of the impact of the vaccine, but they only take into account differences in age. These are subject to confounding, where characteristics of the populations differ by vaccination status. These differences in characteristics may lead to differences in mortality that are not caused by the vaccine. By contrast, in this publication we provide a more in-depth assessment of the impact of vaccination, by estimating vaccine effectiveness against COVID-19 hospitalisation and death involving COVID-19 while controlling for a range of confounding factors. The quality of the data used to adjust for confounding is important to sufficiently adjust the estimates. Here, we used anonymised data from Census 2021 to adjust for socio-demographic and self-reported health confounding factors. We also use data from Hospital Episode Statistics and General Practice Extraction Service (GPES) data for Pandemic Planning and Research version 3 (GDPPR) to further adjust for health-related factors. More information on the data used in this publication is in Section 9: Measuring the data.

The confounding factors that we adjusted for are:

- age on Census Day (21 March 2021)
- sex
- self-reported ethnic group
- religious affiliation
- region of residence
- index of multiple deprivation
- level of highest qualification
- English language proficiency
- National Statistics Socio-economic classification (NS-SEC)
- key worker status, derived from Standard Occupational Classification (SOC) 2020 classification
- care home residency
- long-term health problem or disability
- self-reported general health
- body mass index (BMI)
- number of comorbidities as defined in the QCOVID model
- frailty
- hospitalisation within the last 21 days

To calculate our estimates of vaccine effectiveness, we used a Cox Proportional Hazard model. This is a regression model that compares the time to an outcome such as death in vaccinated people to that in unvaccinated people, taking into account confounding factors. Hazard ratios are estimated using the Cox Proportional Hazard model, where a hazard ratio of 1 means there is no difference in risk, a hazard ratio above 1 means the risk is greater for the vaccinated group, and a hazard ratio of less than 1 means the risk is lower for the vaccinated group. Vaccine effectiveness is then calculated from the hazard ratio as 1 minus the hazard ratio. A vaccine effectiveness of 90% means the vaccine reduces the incidence of the outcome by 90% in vaccinated people compared with unvaccinated. A vaccine effectiveness of 0% means the vaccine has no effect on the risk of the outcome occurring. See Section 9: Measuring the data for more information.

We calculated vaccine effectiveness for different doses (first, second and third dose or booster) and time since dose, to observe how the effectiveness changes over time. The vaccination statuses used were:

- unvaccinated (those with no vaccination or who were vaccinated with a first dose less than 21 days ago)
- first dose (those who were vaccinated with a first dose at least 21 days ago to earliest of less than 91 days after first dose or less than 21 days after second dose)
- over three months after first dose (those vaccinated with a first dose at least 91 days ago to less than 21 days after the second dose)
- second dose (those who were vaccinated with a second dose at least 21 days ago to earliest of less than 91 days after second dose or less than 21 days after third dose)
- three to six months after second dose (those vaccinated with a second dose at least 91 days ago to earliest of less than 182 days after second dose or less than 21 days after third dose)
- over six months after second dose (those vaccinated with a second dose at least 182 days ago to less than 21 days after third dose)
- third dose (those vaccinated with a third dose at least 21 days ago to less than 91 days after third dose)
- over three months after third dose (those vaccinated with a third dose at least 91 days ago)

3 . Vaccine effectiveness against COVID-19 hospitalisation and mortality

Overall

Vaccine effectiveness (VE) against hospitalisation for coronavirus (COVID-19) was 52.2% (95% confidence interval: 51.4% to 52.9%) for a first dose, 55.6% (confidence interval: 55.2% to 56.1%) for a second dose, and 77.6% (confidence interval: 77.3% to 78.0%) for a third dose or booster. The estimate of VE was negative over three months after the first dose, however this group of people are those who did not receive a second dose when eligible. Therefore, it is possible that not all confounding because of differences in health is taken into account. There is no consistent evidence of waning protection against COVID-19 hospitalisation after vaccinations; there is a decrease in VE over three months after the third dose, but not after the second dose.

Vaccine effectiveness against COVID-19 mortality was 58.7% (confidence interval: 52.7% to 63.9%) for a first dose, 88.6% (confidence interval: 87.5% to 89.5%) for a second dose, and 93.2% (confidence interval: 92.9% to 93.5%) for a third dose of the vaccine. Vaccine effectiveness decreases with time after the second and third doses.

Figure 1: Vaccine effectiveness for the third dose against COVID-19 mortality was over 90%

Vaccine effectiveness against coronavirus (COVID-19) hospitalisation and death involving COVID-19, England, 21 March 2021 to 20 March 2022

Notes:

1. 95% confidence intervals are indicated by the horizontal bars.

2. The model was adjusted for age (as a natural spline), plus socio-demographic characteristics (sex, region, ethnicity, religion, Index of Multiple Deprivation (IMD) decile, National Statistics Socio-economic classification (NS-SEC) category, highest qualification, English language proficiency, and key worker status), plus health-related characteristics (disability, self-reported health, care home residency, number of QCOVID comorbidities (grouped), body mass index (BMI) category, frailty flag and hospitalisation within the last 21 days).

3. Estimates are calculated for residents of England, who were enumerated in Census 2021 and could be linked to an NHS number, who were alive and aged 16 years and over on Census Day (21 March) 2021, and who did not have ambiguous or erroneous vaccination data.

4. The time at risk was the earliest of time until the outcome occurred or 20 March 2022.

5. COVID-19 hospitalisation is based on the date of the start of a hospital episode and is defined as an inpatient episode in Hospital Episode Statistics where the primary diagnosis was COVID-19, identified by the International Classification of Diseases 10th Revision (ICD-10) codes U07.1 (COVID-19, virus identified) or U07.2 (COVID-19, virus not identified).

6. Deaths involving COVID-19 are based on date of occurrence and are defined as a death where either of the (International Classification of Diseases 10th Revision (ICD-10) codes U07.1 (COVID-19, virus identified) or U07.2 (COVID-19, virus not identified) is mentioned on the death certificate.

Download the data

.csv

Age-group breakdown

VE against COVID-19 hospitalisation by age group follows broadly similar trends to the non-age stratified VE among the older age groups (aged 30 to 64 years, aged 65 to 79 years, and aged 80 years and over). In those aged 16 to 29 years, negative vaccine effectiveness was observed for individuals over three months after the third dose. This could be because of the prioritisation of clinically young people, meaning people in this category were more likely to have poorer health and these differences may not be fully accounted for using model adjustments.

The decrease in VE over three months after the third dose that is observed for the overall population is not seen in those aged 65 to 79 years and those aged 80 years and over, and therefore may be because of the effects of confounding rather than vaccine waning. Other sources of a decrease in VE after vaccination could include the healthy vaccine effect where people who are unwell delay vaccination, increasing VE shortly after vaccination, and confounding by indication, where people vaccinated earlier were more likely to be clinically vulnerable.

VE against COVID-19 mortality follows broadly similar trends to the non-age stratified VE among the older age groups (those aged 30 to 64 years, those aged 65 to 79 years, and those aged 80 years and over), with protection also seen in those aged 16 to 29 years for all except the "over three months after the first dose" category but with higher uncertainty because of lower counts.

For those aged 80 years and over, VE after the first dose is not significantly different from zero. However, the uncertainty is large, probably because most of those aged 80 years and over received the first dose towards the beginning of the vaccination campaign before our study period begins, therefore resulting in low numbers for this group.

Figure 2: Vaccine effectiveness for older age groups is consistent with that for all ages

Vaccine effectiveness against coronavirus (COVID-19) hospitalisation and death involving COVID-19, by age group, England, 21 March 2021 to 20 March 2022

Notes:

1. 95% confidence intervals are indicated by the horizontal bars.

2. The model was adjusted for age (as a natural spline), plus socio-demographic characteristics (sex, region, ethnicity, religion, Index of Multiple Deprivation (IMD) decile, National Statistics Socio-economic classification (NS-SEC) category, highest qualification, English language proficiency, and key worker status), plus health-related characteristics (disability, self-reported health, care home residency, number of QCOVID comorbidities (grouped), body mass index (BMI) category, frailty flag and hospitalisation within the last 21 days).

3. Estimates are calculated for residents of England, who were enumerated in Census 2021 and could be linked to an NHS number, who were alive and aged 16 years and over on Census Day (21 March) 2021, and who did not have ambiguous or erroneous vaccination data.

4. The time at risk was the earliest of time until the outcome occurred or 20 March 2022.

5. COVID-19 hospitalisation is based on the date of the end of a hospital episode and is defined as an inpatient episode in Hospital Episode Statistics where the primary diagnosis was COVID-19, identified by the International Classification of Diseases 10th Revision (ICD-10) codes U07.1 (COVID-19, virus identified) or U07.2 (COVID-19, virus not identified).

6. Deaths involving COVID-19 are based on date of occurrence and are defined as a death where either of the International Classification of Diseases 10th Revision (ICD-10) codes U07.1 (COVID-19, virus identified) or U07.2 (COVID-19, virus not identified) is mentioned on the death certificate.

Download the data

.csv

4 . Non-COVID-19 mortality

As coronavirus (COVID-19) vaccination should not provide protection against non-COVID-19 mortality, we can use non-COVID-19 mortality as a control outcome to assess the amount of confounding left in our model. The risk of death would not be expected to differ between vaccination status groups if all confounding factors were accounted for, the vaccine has no effect on non-COVID-19 mortality, and all deaths caused by COVID-19 were accurately classified as deaths involving COVID-19. Given instances of adverse events are rare, we can assume that the non-COVID-19 risk of death should be similar to, or close to, zero if there is no residual confounding. We use the same model as for the COVID-19 hospitalisation and mortality vaccine effectiveness estimates, but applied to non-COVID-19 deaths. Since we do not expect the estimates to be primarily related to the effect of the vaccine, we refer to this as "reduction in risk of death" (compared with the unvaccinated population) rather than vaccine effectiveness.

The adjustments for socio-demographics, and particularly for health, act to bring the non-COVID-19 estimates closer to zero, indicating the importance of including these confounding factors. The adjustments had a lower impact on the vaccine effectiveness estimates against COVID-19 mortality. This indicates that confounding is less of an issue here, apart from where the groups are unusual such as the "over three months after the first dose" group, which only includes people who did not get a second dose when eligible. Data on models adjusted for age only, age and socio-demographics, and age, socio-demographics and health are included in the accompanying dataset.

However, even when including all adjustments for confounding factors, we observe a reduction in risk of non-COVID-19 death for vaccinated groups compared with the unvaccinated population. The risk of non-COVID-19 death is lower for all vaccinated groups compared with unvaccinated groups except the "over three months after the first dose" group. This indicates the presence of residual confounding, despite taking into account recent socio-demographic factors and different sources of health data.

Figure 3: Reduction in risk of non-COVID-19 death by vaccination status shows the importance of adjusting for health-related factors

Reduction in risk of non-coronavirus (COVID-19) death by vaccination status compared with unvaccinated, England, 21 March 2021 to 20 March 2022

Notes:

1. 95% confidence intervals are indicated by the horizontal bars.

2. Three sets of model adjustments were used. The first was age-adjusted: adjusted for age only (as a natural spline). The second was age, socio-demographic adjusted: adjusted for age plus socio-demographic characteristics (sex, region, ethnicity, religion, Index of Multiple Deprivation (IMD) decile, National Statistics Socio-economic classification (NS-SEC) category, highest qualification, English language proficiency, and key worker status). The third was fully adjusted: adjusted for age and socio-demographic characteristics plus health-related characteristics (disability, self-reported health, care home residency, number of QCOVID comorbidities (grouped), body mass index (BMI) category, frailty flag and hospitalisation within the last 21 days).

3. Estimates are calculated for residents of England, who were enumerated in Census 2021 and could be linked to an NHS number, who were alive and aged 16 years and over on Census Day (21 March) 2021, and who did not have ambiguous or erroneous vaccination data.

4. The time at risk was the earliest of time until the outcome occurred or 20 March 2022.

5. Non-COVID-19 deaths are based on date of occurrence and are defined as a death where neither of the International Classification of Diseases 10th Revision (ICD-10) codes U07.1 (COVID-19, virus identified) nor U07.2 (COVID-19, virus not identified) is mentioned on the death certificate.

Download the data

.csv

5 . Comparison with other measures of vaccine effectiveness

Age-standardised mortality rates (ASMRs)

We recently published an update to the age-standardised mortality rates (ASMRs) in our Deaths involving COVID-19 by vaccination status, England bulletin, also using Census 2021 as a base population. The ASMRs show differences in mortality rates, taking into account differences in age between people in different vaccination statuses, for each month since April 2021. In comparison, the vaccine effectiveness estimates are an estimate of effectiveness over the whole period from 21 March 2021 to 20 March 2022, but they account for a wide range of socio-demographic and health-related confounding factors.

Since the introduction of booster vaccinations, the ASMRs for coronavirus (COVID-19) mortality have shown consistently lower mortality rates for people who had had the third dose or booster than unvaccinated people. This is consistent with the high vaccine effectiveness against COVID-19 mortality observed for the third dose or booster in this publication. The ASMRs also show protection from the first and second doses against COVID-19 mortality in periods when there are higher numbers of people with these doses; however, in recent months, these rates have been similar to the unvaccinated population. This could be related to the lower vaccine effectiveness against COVID-19 mortality observed over three months after the first, second and third doses compared with the "21 days to three months" groups. It is likely that although the adjustments go some way to accounting for the differences between the longer and shorter time since vaccination groups, they are insufficient to fully account for the differences in these groups who do not receive the next vaccine when eligible. These differences could be related to health differences between the groups, which are difficult to fully account for. The lower vaccine effectiveness for longer times after vaccination could also be because of real differences in effectiveness where the vaccine protection has waned.

The non-COVID-19 ASMRs show elevated mortality rates for vaccinated people in some months, for example in the first dose group when most people have received the second vaccine, which later settled above the estimates for unvaccinated people in recent months. This is consistent with the higher risk of death observed here, for people in the "over three months after the first dose" group compared with unvaccinated people. The elevated ASMRs in recent months for second doses compared with unvaccinated people are not reflected in the non-COVID-19 risk of death estimates, as these are lower for the vaccinated groups. However, the risk of death estimates include more time where people would have been receiving the second dose when eligible than the first dose estimates, as well as after this time period, where there could be unusual characteristics of this group.

We can see the importance of adjustments for socio-demographic and health-related factors in the adjusted differences in non-COVID-19 mortality, as described in Section 4: Non-COVID-19 mortality. This shows that these factors will be affecting the non-COVID-19 mortality estimates in the ASMRs. However, the COVID-19 ASMRs should be less affected by these confounding factors indicated by the lower impact of the adjustments on vaccine effectiveness against COVID-19, except where the groups are more unusual such as the "over three months after the first dose" group.

Previous vaccine effectiveness studies

For both COVID-19 hospitalisation and mortality, protection increases with subsequent doses as expected from previous research. However, in general, the VE estimates for both COVID-19 hospitalisation and mortality are slightly lower than previously published estimates. Our use of Census 2021 as a population necessitates exclusion of outcomes that occur before the Census Day, which could result in an underestimation of vaccine effectiveness (see Section 10: Strengths and limitations). It is also possible that previous estimates of vaccine effectiveness may be over-inflated because of issues of confounding in observational studies, which have not been fully adjusted for.

6 . Further vaccine effectiveness work

This analysis will be followed by an accompanying release including further breakdowns by vaccine vector and periods in which different coronavirus (COVID-19) variants were dominant.

7 . COVID-19 vaccine effectiveness estimated using Census 2021 variables data

COVID-19 vaccine effectiveness estimated using Census 2021 variables
Dataset | Released 8 March 2023
Estimates of the risk of hospital admission for coronavirus (COVID-19) and death involving COVID-19 by vaccination status, in England, using anonymised linked data from the Public Health Data Asset and Census 2021. Vaccine effectiveness estimates are given for the whole study population, stratified for age groups, for different periods of dominant variant and by vaccine vector. Experimental Statistics.

8 . Glossary

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 International Classification of Diseases 10th Revision (ICD-10) codes U07.1 (COVID-19, virus identified) or U07.2 (COVID-19, virus not identified) is mentioned on the death certificate.

COVID-19 hospitalisation

An inpatient episode in Hospital Episode Statistics where the primary diagnosis was COVID-19, identified by the International Classification of Diseases 10th Revision (ICD-10) codes U07.1 (COVID-19, virus identified) or U07.2 (COVID-19, virus not identified).

Vaccine effectiveness

The percentage reduction in the occurrence of an outcome in the vaccinated population compared with the equivalent unvaccinated population. To be a true estimate of vaccine effectiveness, all confounding factors must be accounted for.

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. This is 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.

Cox Proportional Hazard Model

Cox regression (or proportional hazards regression) is a method for investigating the effect of several variables upon the time a specified event takes to occur. The purpose of the model is to evaluate simultaneously the effect of several factors on survival. In other words, it allows us to examine how specified factors influence the rate of a particular event happening (for example, infection or death) at a particular point in time. This rate is commonly referred to as the hazard rate.

The exponentials of the model estimates give the hazard ratios, which is the effect of a unit increase, or the increase compared with a reference population, in a covariate on the hazard rate, which is the risk of an event occurring. For example, being one year older may be associated with a doubling of the risk of the outcome, in which case the hazard ratio for age would be 2. Being female rather than male may halve the risk of the outcome, in which case the hazard ratio for sex would be 0.5. In this analysis, the hazard ratios are calculated for each vaccination status with unvaccinated people as the reference population. Vaccine effectiveness is then calculated as 1 minus the hazard ratio and converted to a percentage.

9 . Measuring the data

Data sources

We used Census 2021 to provide an anonymised person-level dataset on which health, vaccination, and mortality datasets could be linked. The Census 2021 dataset comprised individuals enumerated in Census 2021, who could be linked to an NHS number in the Personal Demographics Register, with a linkage rate of 91.1%. There were 52 million individuals in this dataset who were usual residents in England, which covered approximately 91.7% of the population of England on Census Day 2021. These individuals were linked to vaccinations data from the National Immunisation Management Service (NIMS) as well as a supplementary extract from NHS-Digital point of care, mortality data from Office for National Statistics (ONS) death registrations, and health data from Hospital Episode Statistics (HES) and the General Practice Extraction Service (GPES) data for Pandemic Planning and Research version 3 (GDPPR). There were 1,069 vaccination records from the NHS-Digital point of care extract, covering records up to 29 January 2023, which provided additional vaccination records when linked to our Census 2021-based dataset.

Study population

The study population included individuals who were enumerated in Census 2021, could be linked to an NHS number, were usual residents of England, were alive and aged 16 years and over on Census Day (41,950,323 individuals), and had non-ambiguous and non-erroneous vaccination data (41,855,563 individuals). For computational reasons, the study population was sampled to run the analyses, including:

- all who died from or were hospitalised for coronavirus (COVID-19)
- all who were aged under 30 years and died of a non-COVID-19 cause
- a weighted 10% sample of those aged 30 years and over who died from a non-COVID-19 cause and were not hospitalised for COVID-19
- a weighted 1% sample of those who did not die and were not hospitalised for COVID-19

Modelling

We used a Cox Proportional Hazard regression model adjusted for confounding factors to estimate hazard ratios for the outcomes of COVID-19 hospitalisation and death. Vaccine effectiveness was calculated as 1 minus the hazard ratio with corresponding 95% confidence intervals.

Analyses were stratified by age group. For the analysis by variant period, vaccination status was interacted with a time-varying variable for variant period, defined as pre-Omicron (start of study 21 March to 19 December 2021) and Omicron (20 December 2021 to end of study 31 March 2022). For the analysis by vaccine vector, a time-varying variable for vaccine status and vector combined was created, for example, first dose mRNA, second dose not mRNA or unknown, and so on, and this was the exposure variable, comparing with unvaccinated.

10 . Strengths and limitations

Population-level data

We used a population-level dataset for England, which enabled estimates of vaccine effectiveness to be calculated using a population representative of the general population of England.

Adjustment for confounding

This is the first study on COVID-19 vaccine effectiveness where adjustments for socio-demographic variables are made using Census 2021 to provide up-to-date variables for factors known to vary by vaccination status and to be associated with differences in mortality rates such as ethnicity and occupation. This is particularly important for factors that may change over time. The use of recent data allows for more accurate estimates of vaccine effectiveness in a real-world setting.

We also adjust for a range of health-related variables from Census 2021, Hospital Episode Statistics, and GP patient records. However, it remains challenging to fully account for differences in health despite the range of data and variables used, and residual confounding likely remains.

Exclusion of first months of vaccination campaign

Census Day was 21 March 2021, over three months after the start of the vaccination campaign on 8 December 2020. The requirement for people in our study population to be alive on Census Day means that outcomes that occurred earlier than this day are excluded. This will mainly affect people who were unvaccinated, and older people who were initially unvaccinated, then received a first and potentially second dose. The unvaccinated older population who are excluded are likely to be healthier as they were vaccinated when eligible rather than delaying vaccination because of poorer health. This may mean our vaccination estimates are underestimates, as outcomes for healthier unvaccinated people will be excluded, therefore reducing vaccine effectiveness estimates, as these are calculated compared with the unvaccinated population.

11 . Related links

Deaths involving COVID-19 by vaccination status, England: deaths occurring between 1 April 2021 and 31 December 2022
Bulletin | Released 21 February 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 December 2022 in England.

Coronavirus (COVID-19) latest insights
Interactive tool | Updated regularly
The latest data and trends about the coronavirus (COVID-19) pandemic from the Office for National Statistics and other sources.

Deaths registered weekly in England and Wales, provisional
Bulletin | Released 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
Dataset | Released 9 December 2022
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 weekly
Percentage of people testing positive for coronavirus (COVID-19) in private residential households in England, Wales, Northern Ireland and Scotland. Thissurveyis being delivered in partnership with University of Oxford, University of Manchester,UK Health Security Agency (UKHSA)and WellcomeTrust, working with the University of Oxfordand partner laboratories tocollect and test samples.

12 . Cite this statistical bulletin

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