

Article

COVID-19 vaccination and mortality in young people during the coronavirus pandemic

An analysis of the mortality following COVID-19 vaccination and of excess death during the pandemic in young people.

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Release date:
22 March 2022

Next release:
To be announced

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1 . Main points

- There is currently no evidence of a change in the number of cardiac-related deaths or death occurring from any cause after a coronavirus (COVID-19) vaccination in young people aged 12 to 29 years in England.
- More deaths were registered in young people aged 15 to 29 years in England in 2021 than the average number registered in 2015 to 2019; however, there was no excess in 2021 for deaths from circulatory diseases.
- We do not yet have a complete picture of how the coronavirus pandemic has affected deaths in young people, because it takes a long time to investigate deaths from external causes; we will continue to monitor the safety of vaccines and the changes in excess deaths.
- Early indications show deaths in 2020 increased for some causes, particularly suicides in young females and accidental poisonings (mostly drug poisonings) in young males.

2 . Safety of the COVID-19 vaccination

On 8 December 2020, the UK began administering vaccines against SARS-CoV-2 according to [the priority groups determined by the Joint Committee on Vaccination and Immunisation \(JCVI\)](#). The vaccines have had high effectiveness against [death](#) and [hospitalisation](#) and have saved thousands of lives worldwide.

However, the safety of these vaccines is still of concern. An extensive international programme of surveillance and research monitors potential adverse effects. The overall picture is reassuring, but there are some [reports of potential side effects](#), including an alleged association between vaccination and mild myocarditis and myopericarditis in young people.

Deaths in people aged 15 to 29 years are relatively rare. Our [Deaths registered in England and Wales dataset](#) shows there were around 3,600 such deaths in England each year in the years preceding the coronavirus (COVID-19) pandemic. More deaths were registered in England in 2021 in people aged 15 to 29 years compared with the average for the five years preceding the coronavirus pandemic. It is important to investigate potential causes of this excess of death registrations, and consider any possible connection with the vaccination programme.

3 . COVID-19 vaccination and risk of death in young people

To assess whether the deaths of young people in 2021 were temporally linked with receiving a COVID-19 vaccination, we compared the number of deaths in two time periods; these were weeks one to six following vaccination (risk period) and weeks 7 to 12 following vaccination (baseline period). Myocarditis tends to appear very soon after vaccination, with [evidence suggesting the median time from vaccination to symptom onset is two days](#). However, we used the first six weeks after vaccination as the risk period to ensure that all deaths resulting from myocarditis would be captured. The number of follow up weeks was restricted to 12 to minimise the impact of registration delay, where deaths that occurred in later calendar weeks were less likely to have been registered. See the [Data sources and quality section](#) for more detail.

We analysed deaths of vaccinated people aged 12 to 29 years that occurred up to 2 February 2022 and were registered by 16 February 2022, and vaccinations that were recorded up to 2 February 2022.

In this self-controlled case series study (see [Glossary](#)), we estimated the incidence rate ratio of cardiac-related death (ICD-10 code I30-I52 mentioned on the death certificate) and all cause deaths, comparing deaths in the risk period with deaths in the baseline period. We examined these ratios for each of the six individual weeks in the risk period as well the six weeks as a whole.

585 young people aged 12 to 29 years died within 12 weeks of receiving a dose of a COVID-19 vaccine.

Figure 1: There was no change in the risk of cardiac death in the risk period after vaccination among those aged 12 to 29 years

Relative incidence of cardiac and all cause deaths in each of the six weeks in the risk period and in the risk period as a whole compared with the baseline period, England, up to 16 February 2020

Notes:

1. Error bars give 95% confidence intervals (see [Glossary](#)).

Download this chart

[.xlsx](#)

There was no evidence of a change in the risk of cardiac-related death in any of the first six weeks in the risk period after vaccination or in the risk period as a whole. The risk of death in the first six weeks after vaccination was 0.99 times (95% confidence interval 0.67 to 1.46) that of the risk in the baseline period. Therefore, there is no statistically significant difference.

There was also no evidence of an elevated risk of all cause death in any of the first six weeks in the risk period after vaccination, and no change in the risk of all cause death in the risk period as a whole (relative incidence 0.94, 95% confidence interval 0.79 to 1.10). A decrease in the risk of death for all causes was observed in the first week after vaccination (0.50, 0.33 to 0.74).

This may reflect the "healthy vaccine effect", where people who are unwell are more likely to delay vaccination until recovered. Therefore, the health of people who have recently received a vaccination is generally better than those who have been vaccinated for a longer time.

There was also no evidence of a change in the risk of cardiac-related death or death from any cause for any of the subgroups analysed (those aged 12 to 17 years, those aged 18 to 24 years, and those aged 25 to 29 years, males, and females) or by dose or vaccine type they received (see [dataset](#)).

This analysis therefore does not indicate any increased risk of cardiac-related deaths or deaths owing to any cause following vaccination. To explore this further, we compared excess deaths in young people in 2021 with earlier years.

4 . Death registrations during the coronavirus (COVID-19) pandemic

In young people aged 15 to 29 years in England, there were more deaths registered in 2021 compared with the average in the five years preceding the coronavirus (COVID-19) pandemic, 2015 to 2019 (Table 1). The number of excess deaths in this age group in 2021 was higher for males than females (113 and 66 deaths, respectively). In females aged 15 to 19 years, there were no excess deaths.

Table 1: 2021 saw a higher number of excess deaths in males compared with females
Number of deaths in England for ages 15 to 29, by sex and year of registration, from 2015-19 (annual average) to 2021

Sex	Age group	Annual average 2015-19	Deaths 2020	Deaths 2021	Excess deaths in 2020 Compared with 2015-19	Excess deaths in 2021 Compared with 2015-19
Males	15-19	473	408	545	-65	72
Males	20-24	889	789	893	-100	4
Males	25-29	1120	1098	1157	-22	37
Males	15-29	2482	2295	2595	-187	113
Females	15-19	248	219	237	-29	-11
Females	20-24	349	311	391	-38	42
Females	25-29	518	497	554	-21	36
Females	15-29	1116	1027	1182	-89	66

Source: Office for National Statistics

Notes

1. Figures for England exclude deaths of non-residents.
2. Figures are for deaths registered rather than deaths occurring in each period.
3. Figures for 2021 are based on provisional mortality data.
4. For 2021, the five year average has been provided for 2015 to 2019 (rather than 2016 to 2020) because of the impact of the coronavirus (COVID-19) pandemic on deaths registered in 2020. The average for 2015 to 2019 provides a comparison of the number of deaths expected per month in a usual (non-coronavirus pandemic) year.

Although the number of death registrations was higher in 2021 than the pre-coronavirus pandemic average, the number registered in 2020 was lower than the pre-coronavirus pandemic average for both sexes and across all groups aged 15 to 29 years (Table 1).

The fall in death registrations in 2020 and subsequent increase in 2021 could be explained by the known disruption to the operation of coroners' courts during the coronavirus pandemic, particularly the first lockdown in spring 2020. Deaths are generally not registered until after the coronial process is complete. Therefore, delays will particularly affect deaths from those causes that are most likely to be referred to the coroner, such as deaths from external causes.

To examine this hypothesis further, numbers of death registrations are presented for each sex in Tables 2A and 2B by selected underlying causes of death, for deaths in those aged 15 to 29 years.

The excess death registrations in 2021 in those aged 15 to 29 years were largely owing to external causes and deaths from COVID-19 (Table 2A and 2B). However, there was also a fall in death registrations from external causes in 2020. Therefore, it is likely that these trends are heavily influenced by delays to the coronial process.

Deaths with an underlying cause of myocarditis or pericarditis would be counted in the "diseases of the circulatory system" category. However, there was not an excess of death registrations in 2021 in that category for either sex compared with the annual average for 2015 to 2019.

Table 2a: For some causes, (particularly external), registrations were higher in 2021 than the pre-coronavirus pandemic average, but these numbers will be heavily influenced by delays to death registrations
Deaths in England of males aged 15 to 29 years, by selected underlying cause of death and year of registration from 2015 to 2019 (annual average) to 2021

Underlying cause of death	Annual average 2015-19	Deaths 2020	Deaths 2021	Excess deaths in 2020 Compared with 2015-19	Excess deaths in 2021 Compared with 2015-19
Neoplasms	246	190	244	-56	-2
Diseases of the nervous system	155	154	167	-1	12
Diseases of the circulatory system	163	153	152	-10	-11
Diseases of the respiratory system	69	60	43	-9	-26
Diseases of the digestive system	50	48	66	-2	16
External causes	1,581	1,423	1,621	-158	40
External causes - Land transport accidents	295	168	243	-127	-52
External causes - Accidental poisoning	316	307	323	-9	7
External causes - Accidental poisoning - Drug poisoning	282	293	294	11	12
External causes - Accidental poisoning - Alcohol poisoning	15	7	15	-8	0
External causes - Suicide and injury /poisoning of undetermined intent	662	629	720	-33	58
External causes - Homicide and probable homicide	163	179	178	16	15
External causes - Other external causes of mortality	145	140	157	-5	12
COVID-19	0	62	102	62	102
All causes	2,482	2,295	2,595	-187	113

Source: Office for National Statistics

Notes

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5. Deaths records are extracted based on the underlying cause of death, defined using the International Classification of Diseases, tenth revision (ICD-10).
6. Figure breakdowns by underlying cause exclude neonatal deaths (persons aged under 28 days) that are not assigned an underlying cause.
7. Further information on the definition of drug-related deaths is available in the Deaths related to drug poisoning in England and Wales Quality and Methodology Information.
8. Further information on the definition of suicide deaths is available in the Suicide rates in the UK Quality and Methodology Information.
9. Further information on the definition of alcohol-specific deaths is available in the Alcohol-specific deaths in the UK Quality and Methodology Information.

Table 2b: For some causes, (particularly external), registrations were higher in 2021 than the pre-coronavirus pandemic average, but these numbers will be heavily influenced by delays to death registrations
Deaths in England of females aged 15 to 29 years, by selected underlying cause of death and year of registration from 2015 to 2019 (annual average) to 2021

Underlying cause of death	Annual average 2015-19	Deaths 2020	Deaths 2021	Excess deaths in 2020 Compared with 2015-19	Excess deaths in 2021 Compared with 2015-19
Neoplasms	214	186	193	-28	-21
Diseases of the nervous system	81	80	82	-1	1
Diseases of the circulatory system	91	96	89	5	-2
Diseases of the respiratory system	53	34	20	-19	-33
Diseases of the digestive system	37	47	47	10	10
Pregnancy, childbirth and the puerperium	10	6	17	-4	7
External causes	459	399	517	-60	58
External causes - Land transport accidents	59	31	47	-28	-12
External causes - Accidental poisoning	95	83	95	-12	0
External causes - Accidental poisoning - Drug poisoning	94	80	90	-14	-4
External causes - Accidental poisoning - Alcohol poisoning	4	1	2	-3	-2
External causes - Suicide and injury /poisoning of undetermined intent	212	218	277	6	65
External causes - Homicide and probable homicide	44	31	48	-13	4
External causes - Other external causes of mortality	48	36	50	-12	2
COVID-19	0	40	64	40	64
All causes	1,116	1,027	1,182	-89	66

Source: Office for National Statistics

Notes

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5 . Impact of death registration delays during the coronavirus (COVID-19) pandemic

To illustrate the impact of registration delays on specific causes, Figure 2 shows deaths that were registered in 2021 by the year in which they occurred. For deaths of people aged 15 to 29 years from all causes registered in 2021, only 56% occurred in that year; 32% occurred in 2020 and 11% occurred in earlier years.

Deaths from external causes take longer to be registered than other deaths. For land transport accidents, for example, only 22% of deaths that were registered in 2021 actually occurred in that year. For deaths from homicide or probable homicide, 30% of deaths registered in 2021 occurred in 2019 or earlier years. For deaths from suicide, that figure was 14%.

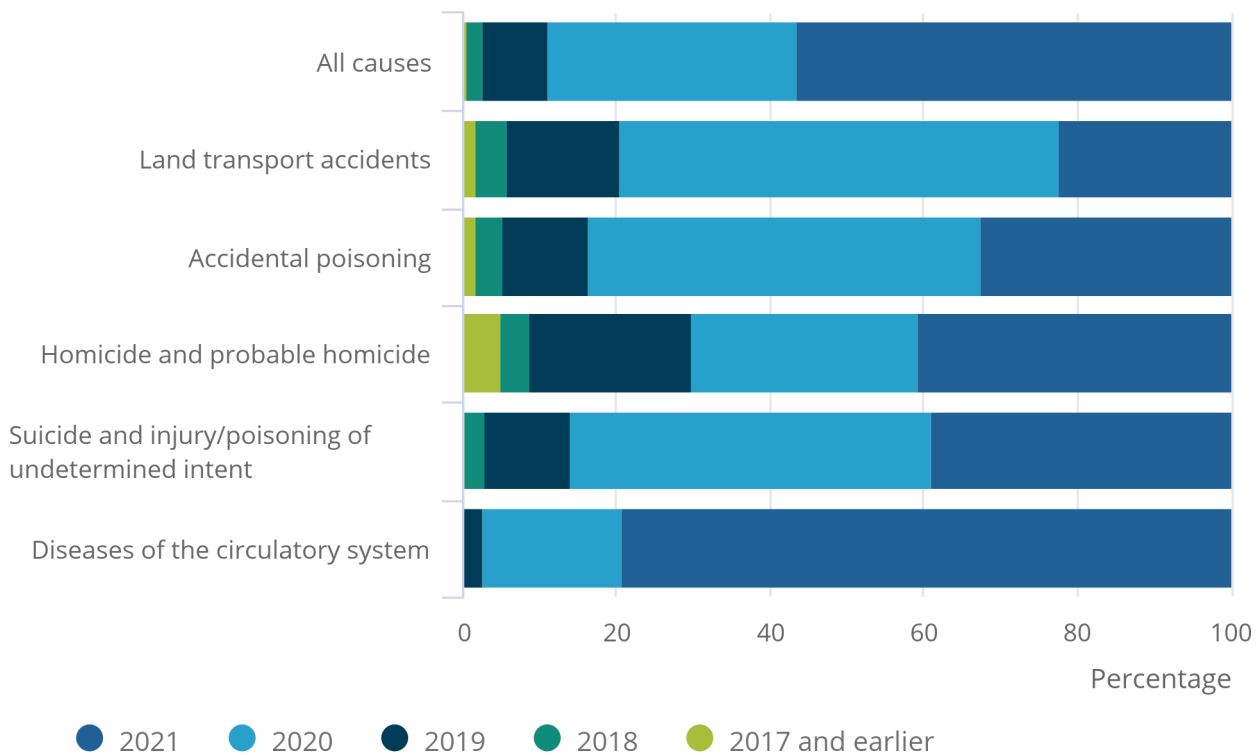
Deaths from circulatory disease are less likely to be referred to the coroner. 98% of deaths that were registered in 2021 for ages 15 to 29 years occurred either in that year or 2020 (Figure 2).

Figure 2: External causes had a higher proportion of deaths registered in 2021 occurring in 2020 and prior years compared with diseases of the circulatory system

Deaths registered in England in 2021 for selected underlying causes in those aged 15 to 29 years, by year of occurrence of death

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6 . Death occurrences during the coronavirus (COVID-19) pandemic

Because of the impact of registration delays, analysis for external causes was repeated using year of occurrence, rather than year of registration. Figure 2 shows that for leading external causes, fewer than half of deaths registered in 2021 actually occurred in that year. It is therefore too early to look at numbers of cause specific deaths that occurred in 2021, because for some causes, the majority are likely yet to be registered. Numbers for 2020 will be more complete, but not all deaths that occurred in 2020 will yet have been registered.

To account for unregistered deaths, an adjustment was made to numbers of deaths in 2020. For deaths occurring in 2017 (the most recent pre-coronavirus (COVID-19) pandemic year for which most deaths will have been registered), the numbers registered by the end of January 2019 were extracted. This was done for specific age and sex groups, and done separately for selected underlying causes (because Figure 2 shows that registration delays vary between causes). These numbers were then compared with the numbers of deaths that occurred in 2017 and were registered by the end of January 2022. This allows us to calculate the percentage of deaths that were unregistered by the end of January 2019.

These percentages were used to adjust the number of deaths that occurred in 2020 and were registered by the end of January 2022. As the adjusted numbers are based on registration delays in the pre-coronavirus pandemic period, they should be regarded as the estimated minimum number of occurrences that could be expected once registrations are complete.

For males aged 25 to 29 years, the adjusted counts for 2020 show a total excess for all cause deaths to be 27 more than the average for 2015 to 2019. For males aged 15 to 19 years and aged 20 to 24 years, the adjusted 2020 counts for all causes remained below the pre-coronavirus pandemic average (Table 3A).

By cause, the adjusted numbers for 2020 show an excess for accidental poisoning deaths for males aged 15 to 24 years. As Table 2 indicates, the majority of these will have been caused by accidental drug poisoning.

Adjusted numbers for male suicides in 2020 were similar to the pre-coronavirus pandemic average for those aged 20 to 29 years, and lower for those aged 15 to 19 years. For land transport accidents, adjusted numbers for 2020 remained lower than the pre-coronavirus pandemic average for males in all three age groups. Numbers for these causes may increase, however, as more registrations are completed for deaths that occurred in 2020.

Table 3a: Accidental poisoning deaths were higher in 2020 for males aged 15 to 24 years, following adjustments for delayed registrations

Deaths of males in England by selected underlying cause of death and year of occurrence for 2015 to 2019 (annual average) and 2020

Age group	Underlying cause of death	Annual average 2015-19	Deaths 2020	Excess deaths in 2020 Compared with 2015-19	Adjusted deaths 2020	Excess adjusted deaths in 2020 Compared with 2015-19
15-19	All causes	476	407	-69	429	-47
15-19	Suicide and injury/poisoning of undetermined intent	117	100	-17	107	-10
15-19	Homicide and probable homicide	49	46	-3	52	3
15-19	Accidental poisoning	30	34	4	35	5
15-19	Land transport accidents	56	39	-17	41	-15
20-24	All causes	896	771	-125	813	-83
20-24	Suicide and injury/poisoning of undetermined intent	260	248	-12	260	-1
20-24	Homicide and probable homicide	70	42	-28	50	-20
20-24	Accidental poisoning	108	109	1	119	12
20-24	Land transport accidents	124	68	-56	72	-52
25-29	All causes	1,132	1,086	-46	1,159	27
25-29	Suicide and injury/poisoning of undetermined intent	300	290	-10	302	3
25-29	Homicide and probable homicide	57	40	-17	46	-11
25-29	Accidental poisoning	188	166	-22	175	-13
25-29	Land transport accidents	101	80	-21	92	-9

Source: Office for National Statistics

Notes

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For females, adjusting the numbers of deaths occurring in 2020 to account for unregistered deaths resulted in a small overall excess for those aged 20 to 24 years, and a slightly larger one for those aged 25 to 29 years (Table 3B).

In all three age groups, the number of female suicides occurring in 2020 that are already registered was higher than the pre-coronavirus pandemic average, and adjusting the numbers increased the size of this excess further. The biggest excess was for females aged 25 to 29 years, where the adjusted number showed 31 more suicides in 2020 when compared with the average for 2015 to 2019.

For other external causes for females, adjusted numbers in 2020 were similar to, or lower than, the pre-coronavirus pandemic average.

Table 3b: Suicides were higher in 2020 for females aged 15 to 29 years, both before and after adjusting for delayed registrations

Deaths of females in England by selected underlying cause of death and year of occurrence for 2015 to 2019 (annual average) and 2020

Age group	Underlying cause of death	Annual average 2015-19	Deaths 2020	Excess deaths in 2020 Compared with 2015-19	Adjusted deaths 2020	Excess adjusted deaths in 2020 Compared with 2015-19
15-19	All causes	249	215	-34	231	-18
15-19	Suicide and injury /poisoning of undetermined intent	52	55	3	62	10
15-19	Homicide and probable homicide	13	4	-9	5	-8
15-19	Accidental poisoning	15	14	-1	16	1
15-19	Land transport accidents	18	10	-8	11	-7
20-24	All causes	354	337	-17	358	4
20-24	Suicide and injury /poisoning of undetermined intent	77	84	7	90	13
20-24	Homicide and probable homicide	16	12	-4	15	-1
20-24	Accidental poisoning	30	22	-8	25	-4
20-24	Land transport accidents	16	16	0	17	1
25-29	All causes	521	517	-4	544	23
25-29	Suicide and injury /poisoning of undetermined intent	91	114	23	122	31
25-29	Homicide and probable homicide	17	8	-9	9	-8
25-29	Accidental poisoning	53	47	-6	50	-3
25-29	Land transport accidents	20	11	-9	14	-6

Source: Office for National Statistics

Notes

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4. For 2021, the five year average has been provided for 2015 to 2019 (rather than 2016 to 2020) because of the impact of the coronavirus (COVID-19) pandemic on deaths registered in 2020. The average for 2015 to 2019 provides a comparison of the number of deaths expected per month in a usual (non-coronavirus pandemic) year.
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7 . COVID-19 vaccination and mortality in young people during the coronavirus pandemic data

[Excess deaths in young people during the coronavirus \(COVID-19\) pandemic. England](#)

Dataset | Released 22 March 2022

Data on excess death during the coronavirus pandemic in young people.

[Deaths following COVID-19 vaccination in young people during the coronavirus \(COVID-19\) pandemic. England](#)

Dataset | Release 22 March 2022

Data on deaths in young people following COVID-19 vaccination registered by 16 February 2022.

8 . Glossary

Coronavirus (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).

Self-controlled case series

The [self-controlled case series](#) (SCCS) is a method developed to study adverse reactions to vaccines. This method compares the incidence of the outcome in a risk period (weeks one to six after vaccination) with a baseline period (weeks 7 to 12 after vaccination) to assess whether there is a change in the risk of death soon after vaccination compared with later after vaccination.

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 and how we measure it for our surveys page](#).

Relative incidence

In this study, the relative incidence is a measure of the relative differences in the number of deaths in different groups. A relative incidence greater than one indicates the incidence of death is higher in a given period, compared with a baseline period. Likewise, a relative incidence less than one indicates the incidence of death is lower in a given period.

9 . Data sources and quality

The analysis of death following vaccination in young people is based on linked death registration data from the Office for National Statistics (ONS) to data on COVID-19 vaccination from the National Immunisation Management Service (NIMS) and an extract from NHS point of care data provided by NHS-Digital.

The NIMS data includes most COVID-19 vaccinations administered in England since 8 December 2020. However, in some rare cases, the vaccination records of people who died shortly after vaccination may not be recorded in NIMS. This would happen if the death was recorded on the Personal Demographics Service (PDS) before the vaccination records were sent to NIMS. Therefore, we supplemented the vaccination records from NIMS using a special extract of 2,044 people who died after vaccination but whose records for the last vaccination received were not sent to NIMS.

Two of these were aged 12 to 29 years and had a linked death record. The linkage was conducted using NHS number, which was available for 99.96% of NIMS records, 99.6% of deaths and 100% of the extract from NHS Digital.

The data covers people residing in England and included deaths that occurred between 8 December 2020 and 2 February 2022 and were registered by 16 February 2022, and vaccinations that were recorded up to 16 February 2022.

We used a self-controlled case study design, which compares the incidence rate of the outcome in a risk period to a baseline period. This helps us assess whether there is a change in the risk of death soon after vaccination compared with later after vaccination.

Follow up started on the day of last vaccination received. Participants were not censored if a death occurred, but were followed for 12 weeks after vaccination or a whole number of weeks until the end of study if sooner. The number of follow up weeks was restricted to 12 to minimise the impact of registration delay, where deaths that occurred in later calendar weeks were less likely to have been registered. We analysed cardiac-related death (ICD-10 code I30-I52 mentioned on the death certificate) and deaths owing to all causes.

The self-controlled case series models were fitted using a conditional logistic regression model on a person-week level, with an individual effect. Incidence rate ratios, the relative rate of cardiac-related or all cause deaths in risk periods relative to baseline periods, and their 95% confidence intervals were estimated using each model. Clustered standard errors accounted for multiple measurements per participant.

10 . Collaboration

These analyses were conducted in collaboration with analysts from the Office for Health Improvement and Disparities (OHID), in particular Allan Baker, Leigh Fowler-Dowd and Ed Klodawski.

11 . Related links

[Monthly mortality analysis, England and Wales: January 2022](#)

Bulletin | Released 23 February 2022

Provisional death registration data for England and Wales, broken down by sex, age and country. Includes deaths due to coronavirus (COVID-19) and leading causes of death.

[Deaths involving COVID-19 by vaccination status, England: deaths occurring between 1 January 2021 and 31 January 2022](#)

Bulletin | Released 16 March 2022

Age-standardised mortality rates for deaths involving coronavirus (COVID-19) by vaccination status, broken down by age group; deaths occurring between 1 January 2021 and 31 January 2022 in England.

[Coronavirus \(COVID-19\) vaccination uptake in school pupils, England: up to 9 January 2022](#)

Article | Released 1 February 2022

Coronavirus (COVID-19) vaccination uptake in school pupils aged 12 to 17 years attending state-funded schools. Including detailed analysis by demographic and geographic characteristics for those aged 12 to 15 years. Experimental statistics.