Office for National Statistics

Article

Comparisons of all-cause mortality between European countries and regions: 2020

Mortality patterns of selected European countries and regions, week ending 3 January 2020 (Week 1) to week ending 1 January 2021 (Week 53) and up to week ending 12 February 2021 (Week 6) for the UK.

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Notice

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Due to a typographical error the title of Figure 4c has been updated to correctly identify Madrid as the city with the highest relative cumulative age-standardised mortality rate across all ages for major cities where data were available.

In addition, the links to download the data for charts 1a, 1b, 1c, 4a, 4b and 4c have been updated to provide the full time series of data.

We apologise for any inconvenience caused.

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1 . Main points

Overview of UK excess mortality

- The UK experienced unprecedented levels of excess mortality during the spring of 2020 and again in the autumn and winter of 2020 and 2021, reflecting the two waves of the COVID-19 pandemic in the UK so far.
- When looking at 2020, the UK ended the year neither the highest nor lowest in Europe for cumulative excess mortality, but this masks different patterns for the two waves.

Comparison between spring and autumn in Europe

- By 26 June 2020, the UK had the highest cumulative excess mortality rate in Europe; the cumulative excess mortality rate for the UK was 7.2% above the five-year average by 18 December 2020.
- During the autumn and early winter months central and eastern European countries had the highest levels of excess mortality in Europe; western European countries still experienced some excess mortality but at lower levels than those experienced in the spring.
- Of all countries analysed, Poland had the greatest cumulative excess mortality (relative cumulative age-standardised mortality rates, (rcASMRs)) by 18 December 2020, at 11.6% above the five-year average.
- The highest peak in weekly excess mortality (relative age-standardised mortality rates (rASMRs)) in the autumn was in Bulgaria, at 112.3% (week ending 27 November), but this was the second-highest peak in the year overall, behind Spain at 142.9% in week ending 3 April; the UK's highest peak was 101.5% (week ending 17 April).

Mortality rates for people aged under 65 years

- The UK had among the highest excess mortality rates for people aged under 65 years; by 18 December it had the second highest cumulative excess mortality rate for this age group, behind Bulgaria.
- For those aged under 65 years, the UK had the second highest peak in weekly excess mortality rates across the year, at 62.7% above the five-year average during week ending 24 April, second to Bulgaria at 108.5% during week ending 27 November.

Regional European differences

- Cities of central and eastern Europe have suffered high excess mortality in the autumn and winter period; Sofia (112.5%) and Warsaw (103.8%) had the highest weekly excess mortality rates, however, their rates were much lower than those cities and regions affected during the spring, for example, Madrid (452.0%), Barcelona (266.0%) and London (228.4%).
- Excess mortality in the autumn and winter period at regional level has seen one or more areas in Poland, Belgium, Bulgaria and Switzerland record rates of 160.0% or more; these rates are much lower than those of the spring, where Bergamo in northern Italy recorded excess mortality of 841.7% and Sergovia in Spain of 593.8%.
- In the autumn and winter period the UK's highest rate was in Hackney and Newham Greater London at 233.2%.

This article looks at all-cause mortality as a comparable international indicator of the impact of the coronavirus (COVID-19) pandemic and does not specifically analyse deaths due to COVID-19.

Statistician's comment

"While the UK may no longer have one of the highest levels of cumulative excess mortality in Europe, it does persist to have some of the highest cumulative excess mortality rates for those aged under 65 years. Only Bulgaria had a higher cumulative excess mortality rate for this age group by the end of 2020, with the UK and its constituent countries having excess mortality levels well above most other European countries.

This has been a pattern observed throughout 2020 since the COVID-19 pandemic began in March showing that the impact of the pandemic in the UK has not exclusively affected those at the oldest ages. We are working to better understand the reasons behind this trend."

Dr Annie Campbell, Health Analysis and Life Events, Office for National Statistics

2 . Comparability of the data

The best way of comparing the mortality impact internationally is by looking at all-cause mortality rates by local area, region and country compared with the five-year average. All-cause mortality avoids the problem of different countries recording COVID-19 deaths in different ways, and also takes into account the indirect impact of the pandemic, such as deaths from other causes that might be related to delayed access to healthcare.

This article has been designed to reflect deaths in the whole of the calendar year 2020 as far as possible and data up to 12 February 2021 for the UK. No division is made into "waves" of the pandemic as these patterns over time have varied between different countries.

We have sourced our European mortality and population data from databases published by Eurostat. There are strict criteria data must meet to be included in this database so analysing data from the source provides us with the best opportunity to be as comparable as possible. This does mean we are reliant on the availability of data that has been submitted to Eurostat by participating countries. Unfortunately, data from Germany are only available as total death counts for the whole country and are not broken down by age group, we therefore cannot include Germany in most of our analyses. More information about the data used in this article can be found in the Data sources and quality section.

Despite the UK having similar numbers of COVID-19 related deaths in the spring and at the end of 2020 and early 2021, all-cause excess mortality was greater in the spring than in the winter of 2020 to 2021. As more people generally die in the winter, some of those who died from COVID-19 during the winter months may have otherwise died during this period from other causes such as seasonal influenza. However, there was still a peak of 42.0% by 8 January 2021 indicating a substantial excess mortality rate at the start of January 2021.

3 . Relative age-standardised mortality rates in European countries

Age-standardised mortality rates (ASMRs) are the number of deaths observed per 100,000 people, standardised to control for differences in population size and age-structure between places and time points.

Relative age-standardised mortality rates (rASMRs) are measures of excess mortality. They are expressed as the percentage change per week in 2020 from the average expected age-standardised mortality rate in 2015 to 2019. rASMRs are calculated by:

- subtracting the weekly 2015 to 2019 mean ASMR from the weekly 2020 ASMR
- dividing by mean annual cumulative ASMR for 2015 to 2019
- which in turn is divided by 52, the number of weeks in an average year

The resulting figure is a percentage change in the 2020 mortality rate, from what would have been expected in each week based upon the five-year average mortality rate in 2015 to 2019.

A negative value indicates a weekly 2020 ASMR below what is expected given the five-year average. In contrast, a positive value indicates a weekly ASMR above the five-year average.

Figure 1a shows rASMRs for all countries with data available, with the UK and central and eastern countries highlighted. Figure 1b shows rASMRs for 15 selected European countries with the highest cumulative excess mortality (relative cumulative age-standardised mortality rates, rcASMRs) by the end of 2020. These are presented for all ages and those aged under 65 years.

When looking at the excess mortality at nation state level for total persons all ages, during the spring of 2020, Spain had the highest peak rASMR at 142.9%, followed by the UK at 101.5% and Belgium at 96.5%.

In the autumn and early winter of 2020 (week ending 18 September onwards) western European countries overall had lower levels of excess mortality while countries in central and eastern Europe had higher peaks in rASMRs. For example, in autumn, Bulgaria had the highest rASMR at 112.3% in week ending 27 November, followed by Poland (104.6%) and Czechia (96.7%) in week ending 6 November.

Looking at deaths of people aged under 65 years, the UK had the highest peak rASMR during the spring out of all European countries where data were available (62.7%, week ending 24 April). Spain had the second highest spring peak at 49.1% in week ending 26 March.

During the autumn Bulgaria suffered the highest weekly rASMR for those aged under 65 years (108.5%) for the whole of Europe, during the week ending 27 November. Poland's peak rASMR for those aged under 65 years (59.6%) occurred during the week ending 6 November.

Figure 1a: Central and eastern European countries had peaks in autumn months, whereas western and northern European countries had higher peaks in spring 2020

Relative age-standardised mortality rates for all countries where data are available, colour-coded by whether the highest peak was in spring 2020 or autumn to winter 2020

Download the data

Notes:

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2. Age-standardised mortality rates are standardised to the 2013 European standard population.
3. Relative age-standardised mortality rates (rASMRs) are expressed as the percentage change per week in 2020 from the average expected age-standardised mortality rate in 2015 to 2019.
4. For UK countries, non-residents are excluded for figures from England, Scotland and Wales but are included for Northern Ireland. However, the numbers of non-residents included are very small.
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Figure 1b: Spain had the highest peak of relative excess mortality across all ages in the whole of 2020 while Bulgaria had the highest peak in the autumn months

Relative age-standardised mortality rates for 15 selected European countries for all ages and those aged under 65 years, Weeks 1 to 53 2020

Download the data

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Figure 1c shows rASMRs for 15 selected major European cities with the highest cumulative excess mortality rate (rcASMRs) by the end of 2020 for which data are available.

Of the selected major European cities, the highest relative excess mortality was observed in Madrid where it reached a peak of 452.0% in the week ending 27 March 2020. Barcelona peaked at 266.0% in the week ending 3 April 2020.

In the UK, Birmingham was the British city with the highest peak excess mortality (250.9%, week ending 17 April), followed by London (228.4% week ending 17 April) and Manchester (198.6%, week ending 17 April). Meanwhile Brussels peaked at 210.7% in week ending 10 April.

During the autumn and early winter of 2020, the highest peaks were observed in Sofia (112.5%, week ending 20 November) and Warsaw (103.8% week ending 13 November). Overall, the peak rASMRs observed in central and eastern European countries in the autumn months were not as high as those observed in western European countries during the spring months of 2020.

Figure 1c: Madrid had the highest peak excess mortality of large cities during spring 2020 while Sofia had the highest peak excess mortality in the autumn

Relative age-standardised mortality rates for all persons and for those aged under 65 years, by week of 2020 for selected European cities and cities of the UK, Weeks 1 to 53

Download the data

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From the beginning of 2020 to week ending 21 February 2021, rASMRs fell within normal historical ranges for each European country. From week ending 28 February, mortality rates began to increase significantly in the province of Lodi, in the Lombardy region of Northern Italy as a result of an outbreak of COVID-19. In turn, the rASMR in Lodi province deviated away from zero (the average) to a maximum value of 447.2% in week ending 13 March. This was the beginning of the coronavirus (COVID-19) pandemic in Europe.

Figure 2 shows a map of rASMRs at local authority level (NUTS3 level, which is a regional level of geography usually constituting one or two local government areas or municipalities). The map depicts the spread of the impacts of the pandemic across Europe in the spring months, starting in Lodi in northern Italy, through the relative low excess mortality for most countries during the summer months and then in the autumn the high levels of excess mortality in eastern Europe.

Figure 2: Relative age-standardised mortality rates by week for local authorities (NUTS3 regions) of Europe

Download the data

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At the regional level, rASMRs throughout the first half of 2020 varied both between and within countries. rASMRs at the NUTS3 region level have much larger variation than those at the national level because of smaller numbers of deaths involved, as well as specific areas within each country being more affected than others.

The highest recorded rASMR was 841.7% in the Northern Italian city of Bergamo in week ending 20 March 2020. Table 1 lists the twenty NUTS3 regions with the highest recorded rASMR values in the spring months of 2020. The 10 highest regional rASMRs were all in Central Spain and Northern Italy. At the peak of their respective epidemics, the following had the second, third and fourth highest rASMRs respectively: Cremona (Italy, 608.4%, week ending 20 March), Segovia (Spain, 593.8%, week ending 27 March), Brescia (Spain, 472.1%, week ending 27 March).

Table 1. The twenty NUTS3 regions with the highest recorded values of rASMRs at the peak of their respective epidemic weeks in spring 2020

NUTS3 Region	Max rASMR (%)	Week Ending	Country
Bergamo	841.7	20/03/2020	Italy
Cremona	608.4	20/03/2020	Italy
Segovia	593.8	27/03/2020	Spain
Brescia	472.1	27/03/2020	Italy
Piacenza	463.8	20/03/2020	Italy
Ciudad Real	459.0	27/03/2020	Spain
Madrid	452.0	27/03/2020	Spain
Lodi	447.3	13/03/2020	Italy
Albacete	416.2	03/04/2020	Spain
Guadalajara	409.9	27/03/2020	Spain
Soria	382.0	27/03/2020	Spain
Cuenca	364.7	03/04/2020	Spain
Brent (GL)	361.6	17/04/2020	United Kingdom
Enfield (GL)	361.4	24/04/2020	United Kingdom
Ealing (GL)	322.3	24/04/2020	United Kingdom
Parma	312.8	20/03/2020	Italy
Lecco	302.2	27/03/2020	Italy
Thurrock (Essex)	296.5	17/04/2020	United Kingdom
Salamanca	292.3	03/04/2020	Spain
Seine-Saint-Denis	285.0	03/04/2020	France

Source: Eurostat, Office for National Statistics

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Among the 20 regions with the highest peaks were four areas of the UK, of which three are in London and one in Essex, South East England.

During the autumn and early winter 2020 (week ending 18 September onwards) the 20 NUTS3 regions with the highest rASMRs were located within Poland, Greece, Bulgaria, Belgium, the Netherlands, Switzerland and France. Tarnowski in Poland recorded the highest rASMR of 206.1% in the week ending 6 November. The nations with NUTS3 regions that experienced the highest rASMR values during the spring as shown in Table 1 were not represented in the 20 NUTS3 regions with the highest rASMRS values in the autumn to early winter period (see Table 2). Bulgaria's peak was during the week ending 4 December, later than Poland's peak week nearly a month earlier, ending 8 November.

Despite weekly peak rASMR values reaching 206.1%, the rASMR values during autumn and early winter were significantly lower than the extremes recorded in Northern Italy, Spain and the UK during the spring. Table 1 highlights that Bergamo had an rASMR of 841.7% during the week ending 20 March.

Table 2: The twenty NUTS3 regions with the highest recorded values of rASMRs at the peak of their respective epidemic weeks in autumn to early winter 2020

NUTS3 Region	Highest % rASMR	Week Ending	Nation State /Country
Tarnobrzeski	178.7	06/11/2020	Poland
Pieria	178.3	27/11/2020	Greece
Pazardzhik Province	178.1	04/12/2020	Bulgaria
Silistra Province	173.7	04/12/2020	Bulgaria
Arrondissement of Thuin	171.6	13/11/2020	Belgium
Kyustendil Province	170.4	27/11/2020	Bulgaria
Arrondissement of Huy	168.5	06/11/2020	Belgium
Arrondissement of Philippeville	167.4	13/11/2020	Belgium
Freiburg	164.9	06/11/2020	Switzerland
Arrondissement of Bastogne	163.2	30/10/2020	Belgium
Ruse Province	162.7	04/12/2020	Bulgaria
Vidin Province	160.9	05/12/2020	Bulgaria
Pernik Province	159.2	04/12/2020	Bulgaria
Savoie	158.1	06/11/2020	France
Delft en Westland	157.1	20/11/2020	Netherlands
Krosnienski	156.4	30/10/2020	Poland
Imathia	153.5	27/11/2020	Greece
Pulawski	153.4	06/11/2020	Poland
Przemyski	152.3	30/10/2020	Poland
Rzeszowski	152.1	06/11/2020	Poland

Source: Eurostat, Office for National Statistics

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From the week ending 29 May, most of the western European nations that had experienced extremely high weekly excess mortality earlier in the spring returned to normal levels of weekly mortality. Throughout June, July and August most of Europe experienced weekly mortality that fluctuated around the five-year average; often below average mortality was recorded.

There were exceptions to this within four countries with short-lived weekly peaks experienced during the summer.

Portugal experienced its highest weekly peak rASMR (31.8%) in the week ending 17 July. Belgium experienced a peak in rASMRs (42.1%) in the week ending 14 August; Belgium's weekly all-cause mortality then returned to the five-year average until rising sharply again in late October.

From the week ending 2 October, Czechia and Poland's excess mortality increased sharply. This rapid rise in excess mortality was followed a week later by steep increases across much of Eastern and Central Europe, Lithuania, Bulgaria, Romania, Switzerland and Austria. Belgium, a geographical outlier during this Autumn period, also experienced a third significant peak with an rASMR of 72.1% in week ending 6 November. Italy's weekly rASMR values were also increasing up to the week ending 30 October. Unfortunately this was the most recent week for which Italian death counts were available when our downloads from the Eurostat website were undertaken in early February 2021.

Poland's rASMR (104.6%) peaked in the week ending 8 November, as did Czechia's rASMR (96.7%). Bulgaria experienced the highest peak rASMR (112.3%) of the autumn period during the week ending 27 November.

Spain (28.0%), France (27.8%), the UK (26.6%) and the Netherlands (24.2%), also experienced a period of higher-than-average excess mortality in November and December 2020. In Greece the highest peak in weekly rASMRs during 2020 (32.2%) was recorded in the week ending 27 November. However, none of these countries experienced excess mortality on the scale of the central and eastern European nations, which had largely been unscathed by the spring-time wave that affected large parts of western and northern Europe to such an extreme extent.

4 . Comparisons of relative age-standardised mortality rate within the UK

During the spring of 2020, comparing each of the four nations of the UK separately shows us that England had the highest peak relative age-standardised mortality rate (rASMR) of the four nations of 108.4% during Week 16 (ending 17 April). This is followed by Scotland with a peak rASMR of 73.0% during Week 15 (ending 10 April), then Wales with a peak rASMR of 68.1% during Week 16. Comparatively, Northern Ireland experienced the lowest peak rASMR of the four nations of 53.4% during week 17 (ending 24 April) (Figure 3).

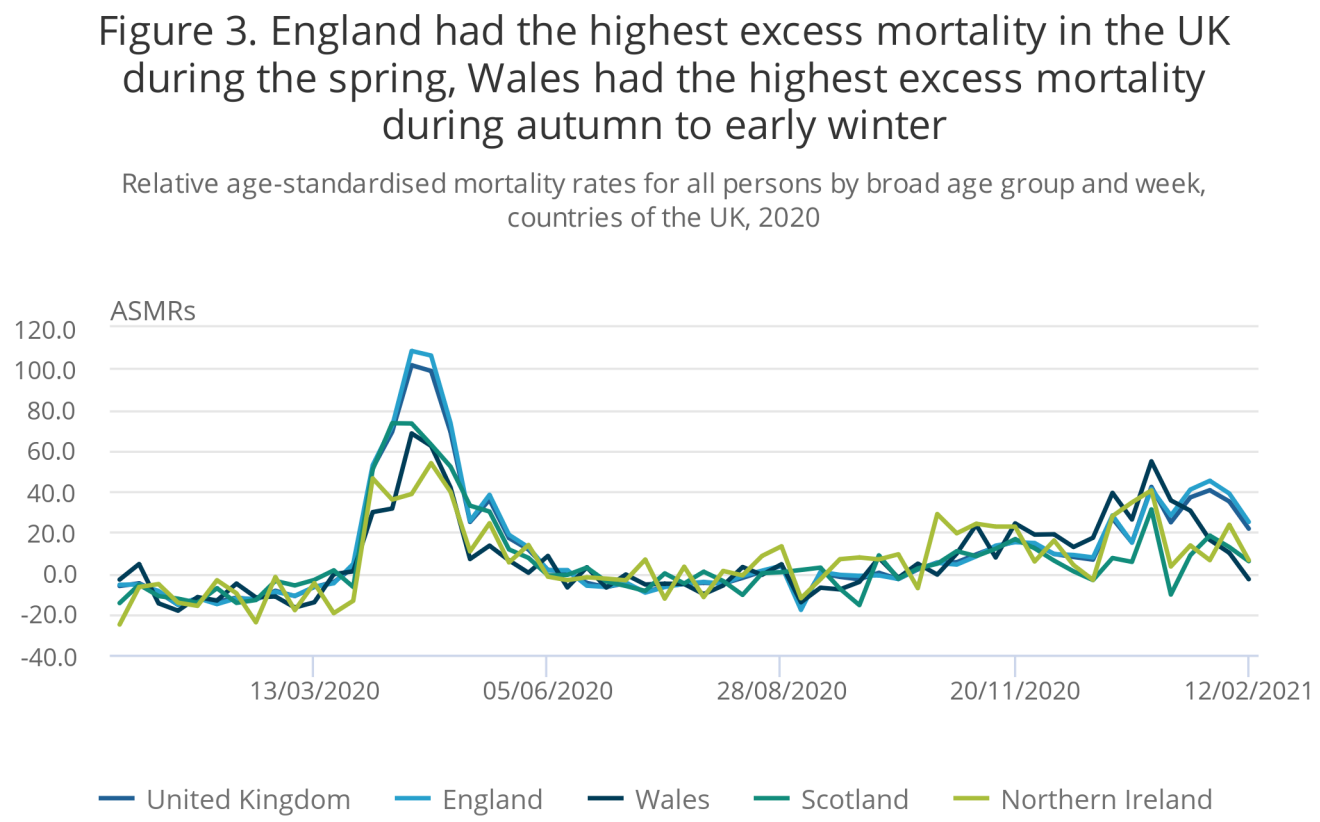
During the summer and early autumn weeks, the weekly rASMRs for the UK's constituent countries returned to the five-year average values with the usual week-to-week fluctuations.

From November and through December 2020 the UK and its four constituent countries experienced increasing weekly volatility in rASMRs. Peak values occurred in January 2021 with Wales recording the highest peak (54.5%, week ending 8 January 2021) followed by England (45.0%, week ending 29 January 2021) and then UK (42.0%, week ending 8 January 2021). Scotland’s peak rASMR (31.0%) occurred in the week ending 8 January 2021. The peak excess mortality in Northern Ireland (40.3%) was also recorded in the week ending 8 January 2021. Scotland’s rASMR values were predominantly lower than England, Wales and the UK weekly values during this period. By the week ending 12 February 2021, all UK nations were experiencing rapidly declining excess mortality, with Wales entering below average levels of mortality at negative 3.1% (fewer deaths than the five-year average for the same time period

It is important to note that weeks with bank holidays could be affected because of the registration basis of data. For example, dips in registration between Weeks 52 (ending 25 December) and 53 (ending 1 January 2021) are likely because of the presence of bank holidays and fewer days available for deaths to be registered.

Figure 3. England had the highest excess mortality in the UK during the spring, Wales had the highest excess mortality during autumn to early winter

Relative age-standardised mortality rates for all persons by broad age group and week, countries of the UK, 2020



Source: Office for National Statistics - Weekly deaths, National Records Scotland - Weekly deaths, Northern Ireland Statistics and Research Agency - Weekly deaths, Eurostat

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The peak rASMR during winter 2021 for the four UK capital cities and a small selection of other major cities is presented in Table 3. Cardiff (97.0%) experienced the highest peak in the week ending 22 January. Edinburgh's (73.5%) highest weekly rASMR occurred in the week ending 12 February. Glasgow (34.2%) had the lowest peak of the selected cities in the week ending 8 January.

Table 3: Peak rASMRs in 2021 for selected UK cities up to week ending 12 February 2021

City	Peak % Rate	Week Ending
Cardiff	97.0	22/01/2021
Edinburgh	73.5	12/02/2021
London	70.1	22/01/2021
Birmingham	45.1	05/02/2021
Belfast	44.9	22/01/2021
Manchester	36.5	05/02/2021
Glasgow	34.2	08/01/2021

Source: Eurostat, Office for National Statistics

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During winter 2021 up to the week ending 12 February, it has been possible to calculate rASMRs for all UK NUTS3 geographies. The 20 NUTS3 areas with the highest peak rASMRs are listed in Table 4. All areas are located in London, South East, South West and the East of England with the exception of Shropshire and Dudley.

Table 4: Twenty UK NUTS3 areas with the highest weekly peak rASMRs in 2021 up to week ending 12 February 2021

NUTS 3 Area	Peak % Rate	Week Ending
Hackney & Newham	233.2	22/01/2021
Redbridge & Waltham Forest	222.1	15/01/2021
Suffolk	205.2	05/02/2021
Kensington and Chelsea & Hammersmith and Fulham	189.9	29/01/2021
Southend-on-Sea	176.8	08/01/2021
Bexley & Greenwich	174.3	15/01/2021
Berkshire	163.6	22/01/2021
Brent	157.9	29/01/2021
Hertfordshire	151.3	15/01/2021
Camden & City of London	150.5	22/01/2021
Heart of Essex	149.2	08/01/2021
Harrow & Hillingdon	144.1	29/01/2021
Central Hampshire	143.1	29/01/2021
Central Bedfordshire	142.5	29/01/2021
Lewisham & Southwark	141.7	29/01/2021
Barnet	141.0	22/01/2021
Dudley	140.8	29/01/2021
Haringey & Islington	140.0	22/01/2021
Shropshire	138.0	08/01/2021
Westminster	132.6	22/01/2021

Source: Office for National Statistics

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5 . Relative cumulative age-standardised mortality rates

This section uses relative cumulative age-standardised mortality rates (rcASMRs) to measure cumulative excess mortality relative to the 2015 to 2019 average annual mortality rates.

Comparing the cumulative ASMR for a point in 2020 with the average cumulative ASMR to the same point in 2015 to 2019 shows whether age-standardised mortality for 2020 has been above or below average up to that point. The rcASMR expresses this difference as a percentage of the average age-standardised mortality rate for full years 2015 to 2019.

A zero value for rcASMR indicates that age-standardised mortality for the year to date has been equal to the average. A positive value indicates worse than average mortality, and a negative value indicates better than average mortality.

If a country or area has an rcASMR of 10%, then the year-to-date mortality rate in 2020 compared with the five-year average is 10% higher than the equivalent 52 weeks' worth of mortality over the previous five years.

The rcASMR can increase or decrease over time. An increase in rcASMR corresponds to a period when age-standardised mortality has been above the 2015 to 2019 average, and a decrease in rcASMR corresponds to a period when mortality has been below the average.

By using an age-standardised rate-based measure of cumulative excess mortality, we are accounting for differences in both the age structures and seasonal mortality patterns of countries analysed.

Measures of cumulative mortality evaluate the total extent of mortality from one time point to another. In this article week 1 2020 (week ending 3 January 2020) is used as a start point and week 53 2020 (week ending 1 January 2021) is used as the end point.

In our last article we were only able to report up to 8 May 2020 (Week 19) to include Italy and Czechia, and up to 29 May 2020 (week 22) to include most other countries. In this article, we show rcASMRs at the mid-point of the year, Week 26 (ending 26 June 2020), then at Week 51 (ending 18 December 2020), where 26 out of 35 countries have reported data (including the four constituent countries of the UK). This is because of the varying speed at which countries are able to provide all-cause mortality data to Eurostat. Notably, at the time of data extraction (4 February 2021) Italy had only provided data up until 30 October 2020 (Week 44).

Table 5 shows that by the mid-point of the year -- Week 26 (ending 26 June) 2020 -- England had the highest rcASMR of the countries where data were available. In order of magnitude, this was followed by the UK, Spain, Scotland, and Belgium. At this mid-year point some countries experienced below average levels of mortality suggesting that despite the COVID-19 pandemic they were observing below average levels of mortality, possibly because of low levels of transmission in these countries at this point.

By week ending 18 December (Week 51), the optimal week for data availability and completeness for the year, Poland had the highest rcASMR at 11.6%. By contrast, by 26 June Poland had an rcASMR of negative 2.3%, indicating that this rapid increase in rcASMR was driven entirely by excess mortality in the second half of the year. The impact of the pandemic and subsequent levels of excess mortality was widespread in Poland, leading to high cumulative levels for the country at the end of the year rather than one area experiencing particularly high excess mortality.

Spain remained consistently at the higher end of rcASMRs for Europe with an rcASMR of 10.6% by 18 December (Week 51).

For the UK the rcASMR increased by a relatively small amount from Week 26 to Week 51 (6.7% to 7.2%), so remained fairly constant through the majority of the second half of the year. This is reflecting average to below average levels of mortality in the UK throughout the summer months followed by moderate excess mortality in the autumn and winter months.

Negative rcASMRs indicate an overall improvement in mortality over time, whilst positive values indicate a worsening level of mortality. We recorded seven countries with negative rcASMR values by 18 December 2020 (Week 51) namely Iceland, Norway, Cyprus, Denmark, Latvia, Finland and Estonia. Iceland had the lowest rcASMR at the end of 2020 with an rcASMR of negative 6.2%. These countries saw overall mortality rate improvement throughout 2020 compared with the previous five years despite the pandemic.

Table 5: Relative cumulative age-standardised mortality rates (rcASMRs) for European countries where data are available, to 26 June (Week 26) and 18 December (Week 51).

Week 26 order	Country	rcASMR (%), week 26	Week 51 order	Country	rcASMR (%), week 51
1	England	7.3	1	Poland	11.6
2	United Kingdom	6.7	2	Spain	10.6
3	Spain	5.9	3	Belgium	9.7
4	Scotland	5.3	4	Bulgaria	8.9
5	Belgium	3.5	5	Czechia	8.4
6	Italy	3.4	6	Slovenia	8.2
7	Wales	2.6	7	England	7.8
8	Sweden	2.3	8	United Kingdom	7.2
9	Northern Ireland (UK)	2.2	9	Austria	5.7
10	Netherlands	1.9	10	Scotland	5.7
11	France	0.0	11	Northern Ireland (UK)	5.0
12	Austria	-1.0	12	Netherlands	4.4
13	Portugal	-1.5	13	Wales	4.1
14	Cyprus	-1.9	14	Portugal	3.7
15	Poland	-2.3	15	France	2.6
16	Switzerland	-2.4	16	Malta	2.2
17	Greece	-2.5	17	Lithuania	1.9
18	Finland	-3.0	18	Sweden	1.7
19	Luxembourg	-3.1	19	Hungary	1.6
20	Iceland	-3.2	20	Estonia	-3.0
21	Slovenia	-3.2	21	Finland	-3.6
22	Czechia	-3.2	22	Latvia	-3.9
23	Norway	-3.2	23	Denmark	-4.1
24	Estonia	-3.2	24	Cyprus	-4.5
25	Malta	-3.3	25	Norway	-5.0
26	Denmark	-3.5	26	Iceland	-6.2

Source: Office for National Statistics, National Records Scotland, Northern Ireland Statistics and Research Agency, Eurostat

Notes

1. Data are provisional.
2. Calculated using age-standardised mortality rates standardised to the 2013 European standard population.
3. Relative cumulative age-standardised mortality rates (rcASMRs) are expressed as the percentage change per week in 2020 of the cumulative age-standardised mortality rate from the average annual age-standardised mortality rate in 2015 to 2019.
4. For UK countries, non-residents are excluded for figures from England, Scotland and Wales but are included for Northern Ireland. However, the numbers of non-residents included are very small.
5. Information about whether non-residents are included for countries outside the UK is not provided by Eurostat.
6. UK data are based on date of registration rather than date of death. Most other European countries are based on date of death.

Figures 4a and 4b show the trend in rcASMR over the year for selected countries. From Weeks 1 to 8 2020, most countries saw improving mortality rates compared with the previous five years. For countries with the most prevalent outbreaks of COVID-19 during the spring, cumulative mortality improvement accrued during the first few months of 2020 was offset by rapidly worsening mortality. By the mid-point of the year (Week 26, ending 26 June 2020) Western European countries saw the highest cumulative measures of excess mortality (rcASMRs), the highest being England (7.3%), Spain (5.9%), Scotland (5.3%), Belgium (3.5%). In contrast to many western European countries, most eastern European countries saw an overall decline in mortality rates by this mid-point of the year.

Through the summer months, most countries saw a decline in excess mortality rates, either keeping rcASMRs at a constant level or decreasing if there were below average levels of mortality. However, in the autumn and winter months, eastern European countries in particular, but Belgium, Spain and the Netherlands too, saw increasing levels of excess mortality. For Poland, Bulgaria, and Czechia particularly the excess mortality rates later in the year accounted for large rises in cumulative excess mortality, ending the year with morality rates more than 8% higher than the five-year average.

Figure 4a: Poland had the highest relative cumulative age-standardised mortality rate by the end of 2020 out of countries where data are available

Relative cumulative age-standardised mortality rates for all persons, all ages, by week of 2020 for all countries where data are available.

Download the data

Notes:

1. Data are provisional.

2. UK data for England, Wales and Scotland exclude non-residents, whereas data for Northern Ireland include a small number of deaths from non-residents.

3. UK data are based on date of registration. Most other European countries are based on date of death.

Figure 4b: Bulgaria had the highest relative cumulative age-standardised mortality rate for those aged under 65 years by the end of 2020 out of countries where data are available

Relative cumulative age-standardised mortality rates for all persons, all ages and those aged under 65 years, by week of 2020 for selected European countries and the nations of the UK, weeks 1 to 53 2020

Download the data

Notes:

1. Data are provisional.

2. For the UK Data for England, Wales and Scotland exclude non-residents whereas data for Northern Ireland include a small number of deaths from non-residents.

3. Data for the UK are based on date of registration. Most other European countries are based on date of death.

Table 6 shows rcASMRs by Week 51, split into two age-groups: 0 to 64 years and 65 years and over. For ages 0 to 64, Table 4 shows that Bulgaria had the highest rcASMR by 18 December (Week 51) at 12.3%. This was followed by England (8.7%), Scotland (7.7%), Wales (5.0%) and Northern Ireland (4.1%). This means that the UK and its constituent countries had considerably higher excess mortality in the younger age groups than most other European countries by week ending 18 December 2020 (Week 51).

For the aged 65 years and over age group, Poland had the highest rcASMR by 18 December (week 51) at 14.5%. For this age group the UK and its constituent countries have a relatively lower rcASMR compared with other European countries.

Table 6: Relative cumulative age-standardised mortality rates (rcASMRs) for European countries by 18 December (week 51) by age groups 0 to 64 years and 65 years and over

Week 51 order	Country	rcASMR (%)Ages 0-64	Week 51 order	Country	rcASMR (%) Ages 65+
1	Bulgaria	12.3	1	Poland	14.5
2	England	8.7	2	Belgium	12
3	United Kingdom	7.7	3	Spain	11.8
4	Scotland	7.7	4	Slovenia	11.8
5	Wales	5	5	Czechia	9.8
6	Northern Ireland	4.1	6	Bulgaria	8.1
7	Spain	3.7	7	England	7.7
8	Iceland	2.3	8	United Kingdom	7.1
9	Poland	1.3	9	Austria	7
10	Portugal	1	10	Netherlands	5.5
11	Czechia	1	11	Northern Ireland	5.2
12	Estonia	0.2	12	Scotland	5.2
13	Lithuania	-0.7	13	Portugal	4.2
14	Cyprus	-1.1	14	Wales	4
15	Malta	-1.3	15	France	3.7
16	Austria	-1.6	16	Sweden	2.9
17	Belgium	-2	17	Malta	2.8
18	France	-2.3	18	Lithuania	2.7
19	Hungary	-2.3	19	Hungary	2.7
20	Netherlands	-2.7	20	Latvia	-2.2
21	Finland	-2.8	21	Denmark	-3.2
22	Sweden	-6.45	22	Finland	-3.8
23	Norway	-7.6	23	Estonia	-3.9
24	Latvia	-9.1	24	Norway	-4.6
25	Denmark	-9.3	25	Cyprus	-4.9
26	Slovenia	-10.1	26	Iceland	-7.5

Source: Office for National Statistics, National Records Scotland, Northern Ireland Statistics and Research Agency, Eurostat

Notes

1. Data are provisional.

2. Calculated using age-standardised mortality rates standardised to the 2013 European standard population.

3. Relative cumulative age-standardised mortality rates (rcASMRs) are expressed as the percentage change per week in 2020 of the cumulative age-standardised mortality rate from the average annual age-standardised mortality rate in 2015 to 2019.

4. For UK countries, non-residents are excluded for figures from England, Scotland and Wales but are included for Northern Ireland. However, the numbers of non-residents included are very small.

5. Information about whether non-residents are included for countries outside the UK is not provided by Eurostat.

6. UK data are based on date of registration rather than date of death. Most other European countries are based on date of death.

Looking at major cities, by the week ending 26 June (Week 26) Madrid was the major city with the highest level of cumulative excess mortality rates (27.7%), followed by Barcelona (16.0%), Amsterdam (15.7%), Birmingham (14.9%) and London (14.3%). By 18 December 2020 (Week 51), Madrid was the major city with the highest cumulative excess mortality rate at 29.5%, this was followed by Barcelona (21.9%), Brussels (21.0%) and Birmingham (17.9 %).

Figure 4b shows the trend in rcASMRs over the year for selected major cities for all ages, and those age 0 to 64 years, and 65 years and over.

Despite eastern European countries experiencing high levels of excess mortality during the autumn period pushing cumulative measures of excess mortality to high levels by the end of the year, the rcASMRs for major cities in these countries were not higher than those for major cities in western Europe. For example, the rcASMR for Sofia was 8.5% by 18 December (Week 51) and 6.8% for Warsaw.

Figure 4c: Madrid had the highest relative cumulative age-standardised mortality rate across all ages for major cities where data were available

Relative cumulative age-standardised mortality rates for all persons, all ages, and those aged under 65 years, by week of 2020 for selected major European cities and the nations of the UK, weeks 1 to 53 2020

Download the data

Notes:

1. Data are provisional.

2. For the UK Data for England, Wales and Scotland exclude non-residents whereas data for Northern Ireland include a small number of deaths from non-residents.

3. Data for the UK are based on date of registration. Most other European countries are based on date of death.

6 . Glossary

Age-standardised mortality rate

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. See the Data sources and quality section for how these are calculated.

Relative age-standardised mortality rate (rASMR)

Relative age-standardised mortality rates (rASMRs) are expressed as the percentage change per week in 2020 from the average expected age-standardised mortality rate in 2015 to 2019.

A negative value indicates a weekly 2020 ASMR below what is expected given the five-year average. In contrast, a positive value indicates a weekly ASMR above the five-year average.

Relative cumulative age-standardised mortality rate (rcASMR)

Relative cumulative age-standardised mortality rates (rcASMRs) are expressed as the percentage change per week in 2020 of the cumulative age-standardised mortality rate from the average cumulative age-standardised mortality rate in 2015 to 2019

A nil value for rcASMR indicates that age-standardised mortality for the year to date has been equal to the average. A positive value indicates worse than average mortality, and a negative value indicates better than average mortality.

7 . Data sources and quality

This article presents provisional analysis of European all-cause mortality patterns during 2020 and the first 6 weeks of 2021 for the UK. Weekly deaths data are examined for 34 European countries where official data was available by 4 February 2021 and compares measures from week ending 3 January 2020 (Week 1) to week ending 1 January 2021 (Week 53). Comparisons have been made for local areas (NUTS3 areas that are approximately local authority district or equivalent) as well as nationally for most of the countries included.

We use weekly all-cause death registration data published by Eurostat from contributing nations of the European Union and European Free Trade Association. There are clear criteria set out by Eurostat for data to be submitted to their database, based on official recording of deaths occurring in all settings, to maximise comparability.

For the UK we use Office for National Statistics (ONS) data for England and Wales, National Records Scotland (NRS) data for Scotland and Northern Ireland Statistics and Research Agency (NISRA) data for Northern Ireland.

Analysis of all-cause mortality allows us to examine the impact of the pandemic not only from deaths due to COVID-19 but also excess deaths that have occurred as a result of the wider impacts of the virus on healthcare systems and society. Given the widely differing practices in recording and reporting deaths relating to COVID-19 it is not possible at this time to conduct accurate international comparisons of deaths involving COVID-19 specifically.

This article examines 2020 mortality patterns set against patterns observed during the preceding five years (2015 to 2019). The difference between the current period and a past average is often referred to as "excess mortality". This article is not a direct comparison of COVID-19 deaths or epidemic curves.

In this article we focus on two main measures of excess mortality: relative age-standardised mortality rates (rASMRs) and relative cumulative age-standardised mortality rates (rcASMRs). Each measure has strengths and limitations when comparing populations between geographical areas. Broadly, these measures aim to control for non-modifiable population characteristics such as the age and size of differing populations so that like-for-like comparisons can be made between countries and regions. See the Glossary for definitions of each of these terms.

For assessing weekly measures of excess mortality, rASMRs are the best measure to show you periods where mortality rates were higher than average, the same as the five-year average or below average, they allow for identification of peaks in excess mortality.

rcASMRs are the best measure for for assessing the cumulation of excess mortality over the course of the year. They are calculated weekly and the value at the end of the shows how much above or below the mortality rate is compared with the five-year average.

Country comparability of the data

Because of the established system of reporting weekly mortality events in the UK, we submit weekly death counts to Eurostat based on date of death registration rather than actual date of death (date of occurrence). Death registration counts in any given week represent between 50% and 60% of deaths that occurred in that seven-day period. Extensive analysis by ONS on predicting total weekly death occurrences has shown that by three weeks after date of occurrence, approximately 95% of occurrences will be registered. The remaining 5% may be delayed by one year or more due to the length of time before a Coroner's hearing and subsequent report is finalised and the cause of death is registered.

Therefore, for us to submit weekly deaths by date of occurrence on behalf of the UK there would need to be at least a three-week delay in the reporting of total deaths. This is because of the delay between death occurrence and death registration. Please see our recent blog Counting deaths involving the coronavirus (COVID-19) and article Impact of registration delays on mortality statistics in England and Wales: 2018 about registration delays.

Eurostat report that the following countries report by date of occurrence: Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Greece, Spain, France, Italy, Latvia, Lithuania, Luxembourg, Hungary, Montenegro, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, Iceland, Switzerland, Serbia, Albania and Georgia. Data referring to recent weeks may be under-reporting the actual number of deaths and they are likely to be revised.

The following countries report by date of registration: UK and Armenia.

We refer to weeks starting on a Saturday and ending on a Friday, as is standard for the ONS weekly reporting of deaths. The rest of Europe report weeks starting on Monday and ending on Sunday; therefore, these dates are a guide rather than exact for all countries. This is also the case for weekly deaths for Scotland.

Eurostat assign some deaths for some nations, for example Sweden, Hungary and Latvia, to a "Week 99" when the nation supplying the death numbers cannot confirm the date of occurrence. These deaths are omitted from our analyses, which may reflect missing data from unknown weeks throughout the year.

This means that any comparison of weekly deaths between the UK and its hierarchy of Nomenclature of Territorial Units for Statistics (NUTS), with other European countries should, therefore, be subject to caveats in relation to the temporal comparability for any given week. Patterns of total deaths by date of registration broadly follow those of deaths by date of occurrence but are affected by public holidays when registry offices are closed.

The most recent statistical week in 2020 for which death counts were available on the Eurostat website as of 4 February 2021 are listed in Table 7.

Notably the Republic of Ireland has not submitted any data to the Eurostat mortality database, so we are unable to report any measure of excess mortality for this country.

Table 7: Countries included in the Eurostat Weekly Mortality Online Database and the latest week of delivery of data at time of data collection

NUTS Level	Nation State / Country	Latest week Deaths Delivered for 2020 as at 4th February 2021	Week Ending Date
NUTS0	Austria	53	01/01/2021
NUTS0	Belgium	53	01/01/2021
NUTS0	Bulgaria	53	01/01/2021
NUTS0	Croatia	48	27/11/2020
NUTS0	Cyprus	51	18/12/2020
NUTS0	Czechia	51	18/12/2020
NUTS0	Denmark	53	01/01/2021
NUTS0	Estonia	53	01/01/2021
NUTS0	Finland	53	01/01/2021
NUTS0	France	53	01/01/2021
NUTS0	Germany (total persons only)	52	25/12/2020
NUTS0	Greece	49	04/12/2020
NUTS0	Hungary	52	25/12/2020
NUTS0	Iceland	53	01/01/2021
NUTS0	Italy	44	30/10/2020
NUTS0	Latvia	53	01/01/2021
NUTS0	Lithuania	53	01/01/2021
NUTS0	Luxembourg	49	04/12/2020
NUTS0	Malta	53	01/01/2021
NUTS0	Montenegro	39	25/09/2020
NUTS0	Netherlands	53	01/01/2021
NUTS0	Norway	53	01/01/2021
NUTS0	Poland	53	01/01/2021
NUTS0	Portugal	53	01/01/2021
NUTS0	Romania	48	27/11/2020
NUTS0	Slovakia	48	27/11/2020
NUTS0	Slovenia	51	18/12/2020
NUTS0	Spain	53	01/01/2021
NUTS0	Sweden	53	01/01/2021
NUTS0	Switzerland	50	11/12/2020
NUTS0	United Kingdom	53	01/01/2021
UKENG	England	53	01/01/2021
NUTS1	Wales	53	01/01/2021
NUTS1	Scotland	53	01/01/2021
NUTS1	Northern Ireland	53	01/01/2021

Source: Eurostat, Office for National Statistics, National Records Scotland, Northern Ireland Statistics and Research Agency

Interpreting the data

As statistical measures, age-standardised mortality rates (ASMRs), relative ASMRs (rASMRs), and relative cumulative ASMRs (rcASMRs) all aim to reduce bias, allowing for comparisons between populations in differing geographical areas to be made. Each measure has revealed something different about the patterns of all-cause mortality during 2020 and 2021 so far. Presentation of age-standardised mortality rates shows us how these vary by seasons within countries and how they vary in size between countries.

It is important to keep in mind that countries and regions with smaller populations are subject to great fluctuations and variations in relative measures of excess mortality. Small changes in the total number of deaths may be represented by large changes in relative excess mortality.

The measures we have reported on do not, however, offer conclusive explanations for the reasons behind the patterns observed. Nonetheless, our measures do offer insight into relative change in mortality levels.

There are other potential statistical measures that could be used to measure excess mortality, including p-scores. We have chosen to report on age-standardised mortality rate-based measures in this report to account for differing age structures of the populations of the countries included in our analyses. We include data for Germany in these tables but not in those for ASMRs, rASMRs and rcASMRs. Data broken down by sex or age is not available on the Eurostat database for Germany, so it is not possible to calculate age-standardised mortality rates.

Data sources

All data analysed in this article is publicly available on the Eurostat website (European Union Statistics Office). We contribute weekly counts of death registrations from all causes of death on behalf of the UK. This is combining death registration data for England and Wales held by us as well as death registration data for Scotland from National Records Scotland and Northern Ireland from Northern Ireland Statistics and Research Agency.

The metadata for the weekly mortality data can be found on the Eurostat website. Each national statistical institute in the European Union has been requested to provide mortality counts by week, sex, five-year age group and a geographical breakdown to NUTS3 level. Where these are not possible broader age groups or geographical areas are accepted.

Readily available international comparisons of COVID-19 mortality are of limited quality because of different reporting systems and definitions. National differences in testing and diagnosis make comparisons especially difficult, along with hospital versus non-hospital coverage. The distinction between numbers based on death certification and those depending on test results is reflected in the international differences in data availability and quality. As has been noted elsewhere in this article and by health statisticians across the globe "excess mortality" is the most robust international comparator for the COVID-19 pandemic.

The Eurostat Weekly Mortality Online Database has emerged since March 2020, containing the greatest granularity of total weekly mortality, both in demographic terms, quinary deaths by gender, and geographically with published deaths by nation state and sub-nationally at NUTS 1, 2 and 3 levels. Furthermore, participating European countries have supplied a back series of five years of weekly deaths (2015 to 2019 inclusive) at the national and sub-national levels, enabling the calculating of average deaths per week, an essential part of the calculation of excess mortality and cumulative excess mortality during the pandemic.

Methodology

In this article, three measures for evaluating levels of mortality have been calculated. We have also calculated p-scores, a further measure of evaluating deviations from expected levels of mortality that users may wish to use.

Age-Standardised Mortality Rates

Age-standardised mortality rates (ASMRs) are used to allow comparisons between populations that may contain different overall population sizes and proportions of people of different ages. The 2013 European Standard Population is used to standardise age-specific rates to a consistent population. The formula used is:

$$ASMR\left(G,i\right)=\sum_{(x,s)\in G}\left(\frac{D\left(x,s,i\right)}{E\left(x,s,i\right)}\right)\cdot 100,000\cdot ESP\left(x,s\right)$$

Where:

- G is the group (defined by some combination of age and sex) for which we calculate the ASMR
- i is the time interval for which we calculate the ASMR
- x is age
- s is sex
- ESP(x,s) is the standard population for age x and sex s
- D(x,s,i) is the number of deaths for age x and sex s in time interval i
- E(x,s,i) is a measure of the exposure for age x and sex s in time interval i

Weekly estimates of person-years exposed has been calculated using known population estimates on January 1 2015, 2016, 2017, 2018 and 2019. Between these dates, weekly population estimates have been calculated by means of linear interpolation. For example:

Writing P(x,s,w,y) for the population in week w of year y, we set P(x,s,1,y) equal to the population estimates at January 1 and calculate exposure by:

$$E\left(x,s,w,y\right)=P\left(x,s,1,y\right)+\frac{\left(w-1\right)}{52}\left(P\left(x,s,1,y+1\right)-P\left(x,s,1,y\right)\right)$$

We define cASMR, the cumulative ASMR, which is used in calculating relative ASMRs and relative cASMRs, as the sum of weekly ASMRs up to that point in the year; i.e.

$$cASMR\left(G,w,y\right)=\sum_{i=1}^{i=w}ASMR\left(G,w,y\right)$$

Relative age-standardised mortality rates

Relative age-standardised mortality rates (rASMRs) are weekly measures of excess mortality using age-standardised mortality rates that are standardised to the 2013 European standard population.

Excess mortality for a particular week is defined as the difference between the ASMR for that week and average ASMR for that week in the five years from 2015 to 2019 inclusive. For Week 53 2020 we compared against Week 52 in the five-year average. This excess mortality is then expressed as a proportion of the five-year average ASMR for full years. The following formula is used:

$$rASMR(G,w,y) = \frac{ASMR(G,w,y) - \overline{ASMR}(G,w,2015-19)}{\frac{\overline{cASMR}(G,52,2015-19)}{52}}$$

Where:

- rASMR(G,w,y) is relative age-standardised mortality rate in week w and year y
- ASMR(G,w,y) is age-standardised mortality rate in week w and year y, as defined in 'Age-standardised mortality rates' section
- $\overline{ASMR}(G,w,2015-19)$ is mean age-standardised mortality in week w, averaged over years 2015-19
- $\overline{cASMR}(G,52,2015-19)$ is mean age-standardised mortality for the end of the year, averaged over the full years 2015-19

Relative cumulative age-standardised mortality rates

. Rather than absolute values of death counts, rcASMRs sum all age-standardised mortality rates between two time points. In this article, rcASMRs are calculated cumulatively from Week 1, 2020 until Week 52, 2020 and are relative to the 2015 to 2019 average cumulative age-standardised mortality rate for that time period. The following formula is used:

$$rcASMR(G,w,y) = \frac{cASMR(G,w,y) - \overline{cASMR}(G,w,2015-19)}{\overline{cASMR}(G,52,2015-19)}$$

Where:

- cASMR(G,w,y) is cumulative standardised mortality rate in week w and year y, as defined in 9.2.1
- $\overline{cASMR}(G,w,2015-19)$ is mean cumulative age-standardised mortality rate to week w, averaged over 2015-19
- $\overline{cASMR}(G,52,2015-19)$ is mean age-standardised mortality, averaged over the full years 2015-19

We omit Week 53 2020 from this calculation given the infrequency in the five-year average of a year with 53 weeks. This makes it difficult to draw meaningful comparisons for relative cumulative mortality at week 53 against the five-year average. Therefore, all statistics for rcASMRs in this article are reported up until Week 52.

P-scores

P-scores are weekly measures of excess mortality. An article was published in June 2020 recommending the use of p-scores in evaluating excess mortality in the COVID-19 pandemic.

Excess deaths are defined as the number of deaths registered in excess of the five-year average (2015 to 2019). To determine a p-score, the following formula is used:

$$\rho_t = \frac{D(G,i,2020) - \overline{D}(G,i,2015-19)}{\overline{D}(G,i,2015-19)}$$

Where:

- is the p-score at time point t
- (G i,2020) is the number of deaths for group G in time interval i in 2020.
- $\overline{D(G,i,2015-19)}$ is the mean number of deaths for group G in time interval i in years 2015 to 2019 inclusive.

The formula for a p-score is similar to that for rASMR except that the p-score:

- uses deaths rather than age-standardised mortality rates, so does not control for changes in the population; and
- the denominator for p-scores is for the period rather than the full year.

8 . Related links

Eurostat data explorer
Webpage | Updated regularly
Deaths by week, five-year age group and NUTS 3 region.

NISRA Weekly deaths
Webpage | Updated weekly
Weekly death registrations in Northern Ireland.

Weekly and Monthly Data on Births and Deaths Registered in Scotland
Webpage |Updated regularly
Summary weekly and monthly data on births and deaths. All the figures for 2020 and 2021 are provisional and may be revised.

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