Excess mortality during the Coronavirus pandemic (COVID-19)

On this page we provide an overview of excess mortality along with charts to explore the data. You can learn in more depth about different measures of excess mortality, their strengths and limitations, and their comparability across countries in our work with John Muellbauer and Janine Aron.

What is 'excess mortality'?

Excess mortality is a term used in epidemiology and public health that refers to the number of deaths *from all causes* during a crisis above and beyond what we would have expected to see under 'normal' conditions.[1] In this case, we're interested in how the number of deaths during the COVID-19 pandemic compares to the deaths we would have expected had the pandemic not occurred — a crucial quantity that cannot be known but can be estimated in several ways.

Excess mortality is a more comprehensive measure of the *total* impact of the pandemic on deaths than the confirmed COVID-19 death count alone. It captures not only the confirmed deaths, but also COVID-19 deaths that were not correctly diagnosed and reported[2] as well as deaths from other causes that are attributable to the overall crisis conditions.[3]

We further discuss the relationship between confirmed COVID-19 deaths and excess mortality in the section 'Excess mortality during COVID-19: background.'

How is excess mortality measured?

Excess mortality can be measured in several ways, each of which depends on an estimate of the expected deaths in 2020–2021 had the COVID-19

pandemic not occurred.

The simplest approach is to take the raw number of deaths observed in a given period during the COVID-19 pandemic — say Week 10 of 2020, which ended on Sunday 8 March[4] — and subtract, as an estimate of expected deaths, the average deaths in that week over the previous years, for example the last five.

While the raw number of deaths helps give us a rough sense of scale, this measure has its limitations, including being less comparable across countries due to large differences in populations.

A measure that is more comparable across countries is the P-score, which calculates excess mortality as the *percentage difference* between the number of deaths in 2020–2021 and the average number of deaths in the same period — week or month — over the years 2015–2019.[5]

For example, if a country had a P-score of 100% in a given week in 2020, that would mean the death count for that week was 100% higher than — that is, double — the average death count in the same week over the previous five years.

While the P-score is a useful measure, it too has limitations. For example, the five-year average death count might be a relatively crude measure of expected deaths because it does not account for trends in population size or mortality.[6] To learn about other measures of excess mortality and their strengths and limitations, see our article with John Muellbauer and Janine Aron.

Excess mortality P-scores

The chart here shows excess mortality during the pandemic for all ages using the P-score.[7] To see the P-scores for other countries click **Add country** on the chart.

Important points about excess mortality figures to keep in mind

The reported number of deaths might not count all deaths that occurred. This is the case for two reasons:

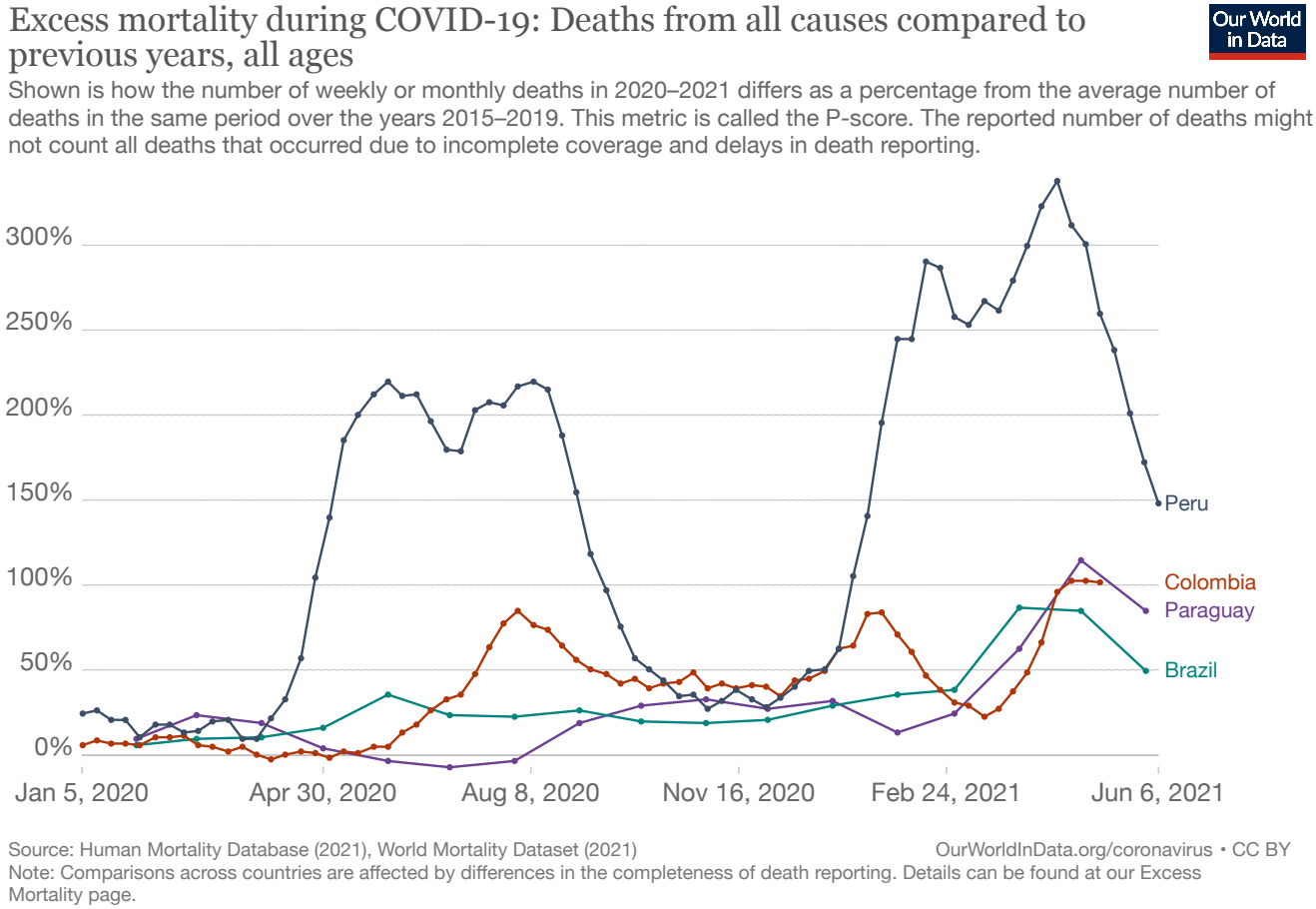
- First, not all countries have the infrastructure and capacity to register and report all deaths. In richer countries with high-quality mortality reporting systems, nearly 100% of deaths are registered; but in many low- and middle-income countries, undercounting of mortality is a serious issue. The UN estimates that only two-thirds of countries register at least 90% of all deaths that occur, and some countries register less than 50% — or even under 10% — of deaths.[8]
- Second, there are delays in death reporting that make mortality data provisional and incomplete in the weeks, months, and even years after a death occurs — even in richer countries with high-quality mortality reporting systems.[9] The extent of the delay varies by country. For some, the most recent data points are clearly very incomplete and therefore inaccurate — we *do not show* these clearly incomplete data points.[10]

The date associated with a death might refer to when the death *occurred* or to when it was *registered*. This varies by country. Death counts by date of registration can vary significantly irrespectively of any actual variation in deaths, such as from registration delays or the closure of registration offices on weekends and holidays. It can also happen that deaths are registered, but the date of death is unknown — those deaths are not included in the weekly or monthly data shown here.[11]

The dates of any particular reporting week might differ slightly between countries. This is because countries that report weekly data define the start and end days of the week differently. Most follow international standard ISO 8601, which defines the week as from Monday to Sunday, but not all countries follow this standard.[12] In the charts on this page we use the ISO 8601 week end dates from 2020–2021.[13]

Deaths reported weekly might not be directly comparable to deaths reported monthly. For instance, because excess mortality calculated from monthly data tends to be lower than the excess calculated from weekly data.[14]

For more discussion and detail on these points, see our article with John Muellbauer and Janine Aron as well as the metadata from our data sources: the Human Mortality Database and World Mortality Dataset.



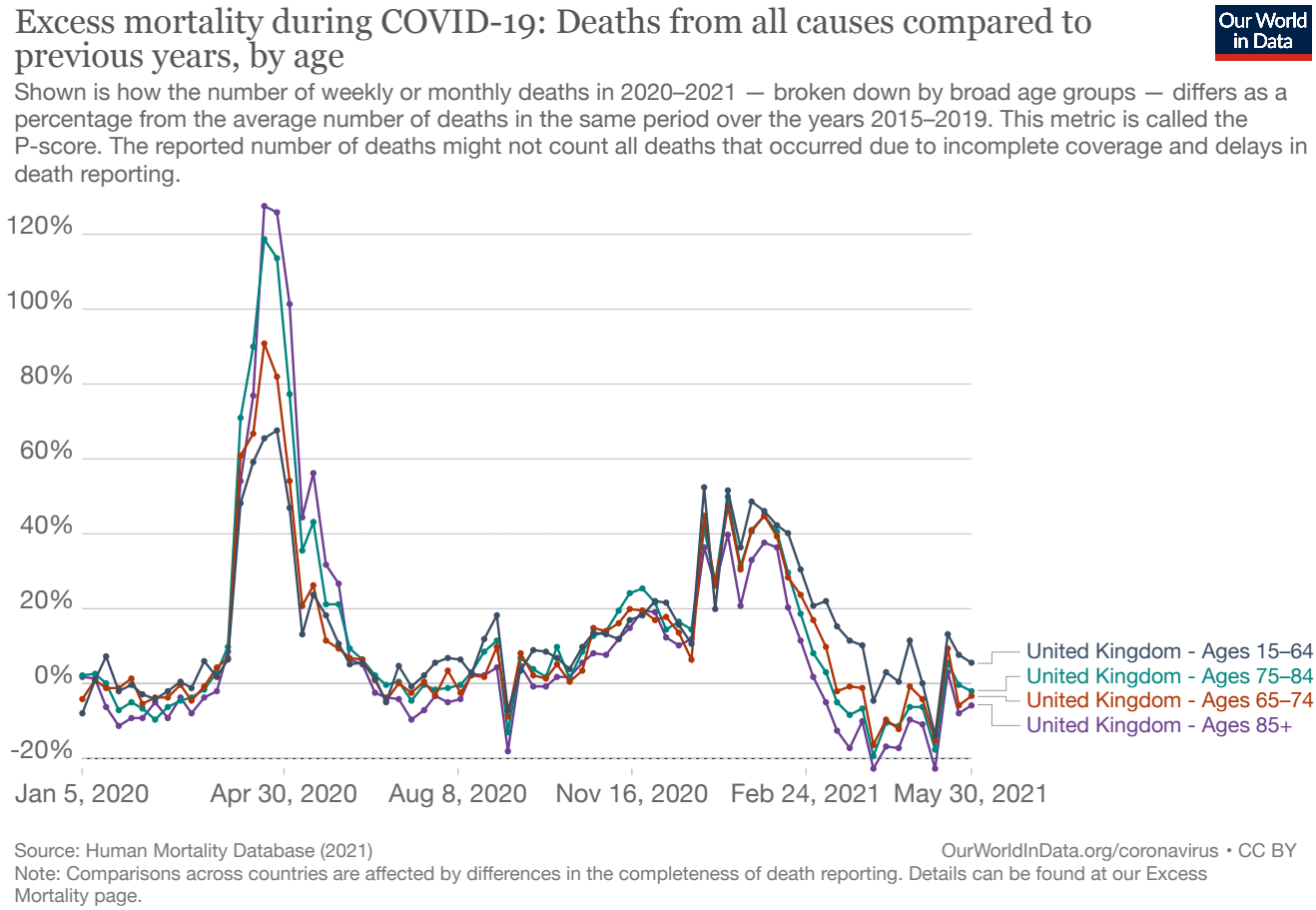
Excess mortality P-scores by age group

The chart here shows P-scores broken down by four broad age groups: ages 15–64, which contains most of the working age population, and ages 65–74, 75–84, and 85+, which have an increasing mortality risk from COVID-19.[15] Countries for which the data is sourced from the World Mortality Dataset are not included in this chart because the data is not

broken down by age.

Why is it informative to look at P-scores for different age groups?

The chart in the previous section showed P-scores for *all ages* — these are impacted by differences in both mortality risk by age and countries' age distributions. For example, countries with older populations — which have a higher mortality risk, including from COVID-19 — will tend to have higher all-age P-scores by default. Looking at the P-scores for *different age groups* is therefore informative when comparing countries.

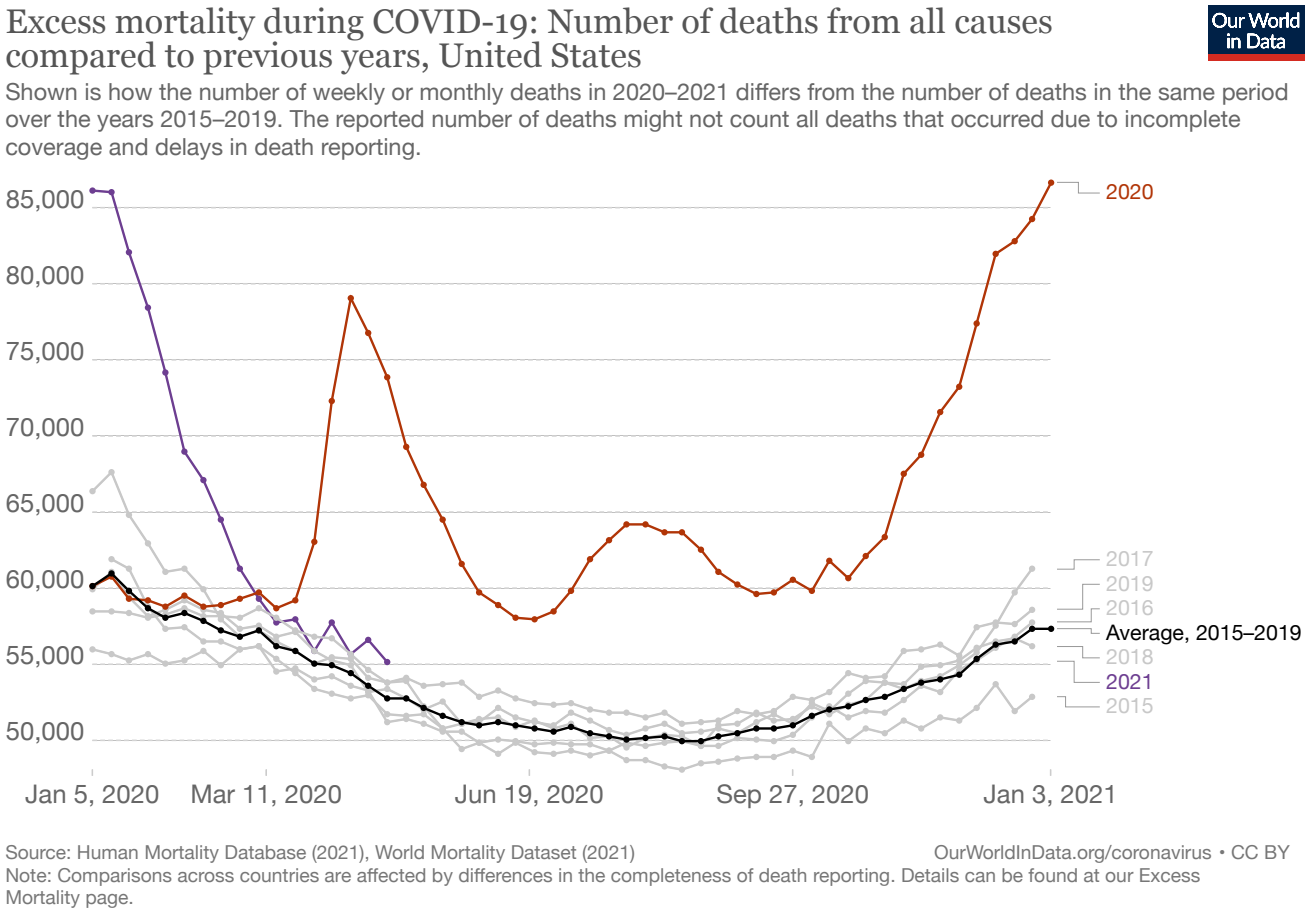


Excess mortality using raw death counts

Besides visualizing excess mortality as a percentage difference, we can also look at the raw death count as shown here in this chart. The raw death count helps give us a sense of scale: for example, the US suffered roughly 360,000 more deaths than the five-year average between 26

January and 3 October 2020, compared to 209,000 confirmed COVID-19 deaths during that period.[16]

However, this measure is less comparable across countries due to large differences in populations. You can still see the death counts for other countries by clicking "Change country" on the chart.



Excess mortality: our data sources

Our World in Data relies on data from the Human Mortality Database and the World Mortality Dataset

In our presentation of excess mortality figures we rely on the all-cause mortality data from the Human Mortality Database and the World Mortality Dataset. We have calculated P-scores from the raw death data provided by these sources. We make the data used in our charts downloadable as a complete and structured .csv file here on our GitHub site.

The Human Mortality Database (HMD) is maintained by a team of researchers based at the University of California, Berkeley, USA and the Max Planck Institute for Demographic Research in Rostock, Germany. HMD has been publishing updates on all-cause mortality for currently 38 countries as part of its Short-term Mortality Fluctuations project since May 2020.[17]

HMD updates its data weekly, usually on Thursday or Friday. The data is sourced from Eurostat and national statistical agencies — a full list of sources and detailed information for each country's data series can be found in the HMD metadata file. HMD was our sole source of data until 20 February 2021.

The World Mortality Dataset (WMD) is maintained by the researchers Ariel Karlinsky and Dmitry Kobak. WMD has been publishing updates on all-cause mortality for currently 95 countries since January 2021. We do not use the data from some of these countries because they fail to meet the following quality criteria: 1) at least three years of historical data;[18] and 2) data published either weekly or monthly.[19] The data is not broken down by age so we only include it in our all-age charts.

WMD updates its data weekly. The data is sourced from the Human Mortality Database — we use the data directly from HMD and not WMD — Eurostat, and national statistical agencies. A full list of sources and information for each country's data series can be found on WMD's GitHub site.

Source information country by country

Location	Source
Albania	World Mortality Dataset
Andorra	World Mortality Dataset
Armenia	World Mortality Dataset
Aruba	World Mortality Dataset
Australia	Human Mortality Database

Austria	Human Mortality Database
Azerbaijan	World Mortality Dataset
Belarus	World Mortality Dataset
Belgium	Human Mortality Database
Bolivia	World Mortality Dataset
Bosnia and Herzegovina	World Mortality Dataset
Brazil	World Mortality Dataset
Bulgaria	Human Mortality Database
Canada	Human Mortality Database
Chile	Human Mortality Database
Colombia	World Mortality Dataset
Costa Rica	World Mortality Dataset
Croatia	Human Mortality Database
Cuba	World Mortality Dataset
Cyprus	World Mortality Dataset
Czechia	Human Mortality Database
Denmark	Human Mortality Database
Ecuador	World Mortality Dataset
Egypt	World Mortality Dataset
El Salvador	World Mortality Dataset
England & Wales	Human Mortality Database
Estonia	Human Mortality Database
Finland	Human Mortality Database
France	Human Mortality Database
Georgia	World Mortality Dataset
Germany	Human Mortality Database
Gibraltar	World Mortality Dataset
Greece	Human Mortality Database
Greenland	World Mortality Dataset
Guatemala	World Mortality Dataset
Hong Kong	World Mortality Dataset
Hungary	Human Mortality Database
Iceland	Human Mortality Database
Ireland	World Mortality Dataset
Israel	Human Mortality Database
Italy	Human Mortality Database
Jamaica	World Mortality Dataset
Japan	World Mortality Dataset
Kazakhstan	World Mortality Dataset

Kosovo	World Mortality Dataset
Kyrgyzstan	World Mortality Dataset
Latvia	Human Mortality Database
Liechtenstein	World Mortality Dataset
Lithuania	Human Mortality Database
Luxembourg	Human Mortality Database
Macao	World Mortality Dataset
Malaysia	World Mortality Dataset
Malta	World Mortality Dataset
Mauritius	World Mortality Dataset
Mexico	World Mortality Dataset
Moldova	World Mortality Dataset
Monaco	World Mortality Dataset
Mongolia	World Mortality Dataset
Montenegro	World Mortality Dataset
Netherlands	Human Mortality Database
New Zealand	Human Mortality Database
Nicaragua	World Mortality Dataset
North Macedonia	World Mortality Dataset
Northern Ireland	Human Mortality Database
Norway	Human Mortality Database
Oman	World Mortality Dataset
Panama	World Mortality Dataset
Paraguay	World Mortality Dataset
Peru	World Mortality Dataset
Philippines	World Mortality Dataset
Poland	Human Mortality Database
Portugal	Human Mortality Database
Qatar	World Mortality Dataset
Romania	World Mortality Dataset
Russia	World Mortality Dataset
San Marino	World Mortality Dataset
Scotland	Human Mortality Database
Serbia	World Mortality Dataset
Seychelles	World Mortality Dataset
Singapore	World Mortality Dataset
Slovakia	Human Mortality Database
Slovenia	Human Mortality Database
South Korea	Human Mortality Database

Spain	Human Mortality Database
Sweden	Human Mortality Database
Switzerland	Human Mortality Database
Taiwan	Human Mortality Database
Thailand	World Mortality Dataset
Transnistria	World Mortality Dataset
Tunisia	World Mortality Dataset
Ukraine	World Mortality Dataset
United Kingdom	Human Mortality Database
United States	Human Mortality Database
Uruguay	World Mortality Dataset
Uzbekistan	World Mortality Dataset

Other publicly available data on excess mortality

International organizations are not publishing an international database on excess mortality

Unlike statistics on confirmed COVID-19 deaths — for which several organizations such as the WHO, ECDC, and Johns Hopkins University are collating data for all countries — there is no single source of data on excess mortality. And no data source will have data for all countries, because excess mortality statistics will only be available for a minority of countries.

This is a major problem for policymakers, researchers, and the general public that have a need to understand the ongoing pandemic.

Several media publications and regional data sources are publishing public databases

In addition to the Human Mortality Database and the World Mortality Dataset, several media publications and regional data sources have been publishing excess death data for some countries.

- *The Economist* published the first database on excess mortality on GitHub. Its reporting on the topic can be found here.

- *The New York Times* publishes its dataset on excess mortality on GitHub. Its reporting on the topic can be found here.
- *The Financial Times* publishes its dataset on excess mortality on GitHub. Its reporting on the topic can be found here.
- *The Washington Post* publishes its dataset on excess mortality in the US on GitHub. The GitHub page also contains links to the Post's reporting on the topic.
- *Eurostat* publishes downloadable data for European countries on its website.

Excess mortality during COVID-19: background

What is the relationship between confirmed COVID-19 deaths and excess mortality?

In our work on the Coronavirus pandemic we visualize the data on the confirmed number of deaths from COVID-19 for all countries. We update this data daily based on figures published by Johns Hopkins University (JHU).

But these confirmed deaths figures may differ from the excess mortality figures, which better capture the *total* impact of the pandemic on deaths, for several reasons:

- Some (but not all) countries only report COVID-19 deaths that occur in hospitals — people that die from the disease at home may not be recorded;
- Some countries only report deaths for which a COVID-19 test has confirmed that a patient was infected with the virus — untested individuals may not be included;
- Death reporting systems may be insufficient to accurately measure mortality — this is particularly true in poorer countries;
- The pandemic may result in increased deaths from other causes for a number of reasons including weakened healthcare systems; fewer

people seeking treatment for other health risks; or less available funding and treatment for other diseases (e.g. HIV/AIDS, malaria, tuberculosis);
- The pandemic may also result in *fewer* deaths from other causes. For example, the mobility restrictions during the pandemic might lead to fewer deaths from road accidents. Or there might be fewer deaths from the flu because of interventions to stop the spread of COVID-19, or because COVID-19 now causes deaths that would have otherwise been caused by the flu.

Because COVID-19 "competes" with other causes of death like the flu, this means that COVID-19 deaths are not by default excess deaths. It is possible for there to be more confirmed COVID-19 deaths than excess deaths, and in fact for there to be confirmed COVID-19 deaths without *any* excess deaths.

This all makes clear that the two statistics — confirmed deaths due to COVID-19 and excess mortality — can be related in ways that are not straightforward.

This is because they are giving a perspective on different questions: The confirmed deaths often undercount the total impact of the pandemic on deaths, but in contrast to excess mortality they contain information about the *cause of death*. The excess mortality includes not only those who have died from COVID-19, but also those from all other causes — and these numbers may also be changing due to the overall pandemic conditions. This means both metrics are needed to understand the total impact of the pandemic on deaths.

Excess mortality statistics will only be available for a minority of countries

Excess mortality data is unfortunately not available for many countries, and because the required data from previous years is lacking this will

continue to be the case. When the goal is to monitor a global pandemic, this is a major limitation of this metric.

Excess mortality can only be calculated on the basis of accurate, high-frequency data on mortality from previous years. But few countries have statistical agencies with the capacity and infrastructure to report the number of people that died in a given month, week or even day-to-day. For most low- and middle-income countries, such data is not available for previous years.

As we saw from the available excess mortality estimates discussed previously, this data is most often only available for richer countries that can afford high-quality data reporting systems.

Researchers can draw on some other sources to estimate excess mortality — such as funeral or burial records — or on data from subnational regions of poorer countries (often the capital). But in many cases no information at all can be obtained.

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Citation

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    note = {https://ourworldindata.org/coronavirus}
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