World Health Organization

WHO COVID-19 Excess Mortality Estimation Methodology

Executive Summary

5 October 2021

The World Health Organisation (WHO) is tracking the impact of the COVID-19 pandemic as it evolves over time.

Aggregate case and death numbers are reported to the WHO and the data is publicly available. The data do not always provide a complete picture of the health burden attributable to COVID-19 or number of lives lost due to the pandemic. This is due to variations in testing, differences in the application of rules for attribution of death and certification, delays in reporting, data gaps and weak health information systems in many countries.

In addition to the deaths directly attributable to COVID-19, deaths that have occurred or have been averted indirectly due to COVID-19 include those linked to conditions that existed before the pandemic and have resulted in deaths due to health systems being overwhelmed or some patients avoiding healthcare, or linked to mitigation measures that have prevented deaths from non-COVID causes. Indirect deaths due to COVID-19 are not captured in the COVID-19 death numbers reported to WHO.

Considering the challenges posed by using reported COVID-19 data, excess mortality is considered a more objective and comparable measure that accounts for both the direct and indirect impacts of the pandemic.

In February 2021, WHO and the United Nations Department of Economics and Social Affairs (UN DESA) jointly convened a Technical Advisory Group (TAG) on COVID-19 Mortality Assessment to advise and provide guidance on the best methods to estimate excess mortality for each country, for the period January 2020 – June 2021.

The WHO defines excess mortality as, "The mortality above what would be expected based on the non-crisis mortality rate in the population of interest."

Estimates of the excess mortality attributable to COVID-19 are derived from the total location-specific all-cause death numbers for a period during the years 2020 and 2021 e.g., aggregated by week or month based on the assumption that these are a result of the direct effects of COVID-19 (deaths attributable to it) and the indirect knock-on effects on health systems and society. In addition, the corresponding expected death numbers for the same place and period are based on a hypothetical or "counterfactual" no-COVID-19 scenario. The expected numbers are derived by applying a forecast to the historical location and time-specific deaths (prior to the pandemic). Therefore, excess deaths, are defined as the difference between the total deaths that have occurred in years 2020/2021 and those that were expected to occur in the absence of COVID-19.

Currently, excess mortality cannot be derived for all countries when using standard methods because of gaps in the underlying data. Routine mortality data is usually received by the WHO a year or more after the year of death or following an even longer lag. In addition, differential reporting capacity and variable data quality across countries has resulted in many nations lacking the systems to provide good quality routine data even in the past. Correspondingly, these countries lack the capacity and data required to monitor all-cause mortality during this unprecedented pandemic. Consequently, several countries are unable to contribute to a centralized systematic mortality surveillance that would be needed to measure global, regional and country level excess mortality. Apart from being able to generate the overall death numbers, many countries also do not have historical data that are disaggregated by periods shorter than a year.

Therefore, statistical methods are required to derive the expected and total deaths based on the levels of data availability for countries. A Poisson regression model that accounts for wide variations between countries is used to predict the total number of deaths from all causes for the year 2020 and first half of 2021, conditional on the monthly expected deaths over the period and a predicted relative rate parameter which is modelled using country-specific variables such as the reported COVID-19 death rate and the reported proportions of positive COVID-19 tests. The model generates estimates for countries and WHO regions for which adequate input data were available for reliable inference and to then predict estimates for countries with no data available.

Statistical methods are applied for disaggregating the estimated number of excess deaths by age and sex for countries based on the levels of data availability. In most countries, the sex and age attributes are not identified in the mortality data that are available for years 2020 and 2021. These are necessary inputs when one begins to look at sex and age differential impact relative to other causes as well as life tables, and the impact on life expectancy.

The methods and estimates will undergo Member State consultation. The consultation process aims to provide opportunity for countries to review the preliminary estimates and provide feedback. It offers an opportunity for countries to provide more / additional data to WHO, where available. WHO is working with partners to strengthen country data and health information system capacity using the SCORE for Health Data Technical Package which includes supporting Civil Registration and Vital Statistics (CRVS) and cause of death certification and Rapid Mortality Surveillance.

Considering the evolving situation surrounding the COVID-19 pandemic, these estimates and methods are work in progress and will be updated accordingly. Initial estimates up until the middle of 2021 are scheduled for release later this year.

Please submit any questions to: ddi@who.int

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