

Comparison of deaths rates for COVID-19 across Europe

Leonardo Villani

Department of Life Science and Public Health, Section of Hygiene and Public Health, Università Cattolica del Sacro Cuore, Rome, Italy

Martin McKee

London School of Hygiene and Tropical Medicine, London, UK

Luca Giraldi

Department of Woman and Child Health and Public Health - Public Health Area, Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy

Walter Ricciardi

Department of Life Science and Public Health, Section of Hygiene and Public Health, Università Cattolica del Sacro Cuore, Rome, Italy

Stefania Boccia (✉ Stefania.Boccia@unicatt.it)

Department of Life Science and Public Health, Section of Hygiene and Public Health, Università Cattolica del Sacro Cuore, Rome, Italy

Short Report

Keywords: COVID-19, death rates, standardized mortality rate, epidemics, pandemics

DOI: <https://doi.org/10.21203/rs.3.rs-57226/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Europe suffered greatly in the early stages of the COVID-19 pandemic. Italy was in the forefront, with its Lombardy region especially badly affected. However, European countries have been impacted to quite different degrees. We report Crude Mortality Rates (CMRs) and, in five countries supplying comparable age-specific data, Standardized Mortality Rates (SMRs) from deaths reported as due to COVID-19 in the European Union and United Kingdom. As of 21st July 2020, Belgium was the country with the highest cumulative CMR (85.6/100,000), but Lombardy region was at almost double this value (167.0/100,000), while corresponding figure for the rest of Italy was 36.3/100,000. SMRs could be calculated for five countries (Italy, Portugal, Sweden, Germany and Netherlands). Among them, Sweden had the highest SMR (60.7/100,000). The corresponding figures for Italy, Netherlands, Portugal and Germany were 48.2/100,000, 41.0/100,000, 15.1/100,000 and 10.0/100,000 respectively. It is clear that countries within Europe have performed very differently in their responses to the COVID-19 pandemic, but the many limitations in the available data must be addressed before a definitive detailed assessment of the reasons can be made.

Background

At least in the initial phase of the SARS-CoV-2 pandemic, Europe was the continent worst affected. Italy reported the earliest cases and soon deaths were rising rapidly in several northern regions, especially Lombardy ¹. Faced with graphic scenes from Italian hospitals struggling to cope European governments adopted a series of unprecedented measures to contain the spread of the virus, although with differing speed and intensity. These included restrictions on movement outside the home, or “lockdown”, rules on physical distancing, mandatory face covering in closed public settings, and introduction of elements of find, test, trace, isolate, and support systems. Even where restrictions were minimal, as in Sweden, or delayed, as in the United Kingdom, many in the population changed their behaviour in ways that reduced risks ². Unlike the situation in Africa and the Americas, the initial peak of infection in Europe is now subsiding, and while some countries are seeing a resurgence associated with loosening of restrictions, it is timely to take stock of how Europe has fared.

The impact of the pandemic can be measured several ways, with the two main outcomes reported being incident infection and mortality, both of which can be expressed in different ways, including trends over time and cumulatively. Both are sensitive to case definitions, which in turn are influenced by the extent of testing. Mortality rates are also affected by how the data are collected, with several countries operating separate systems collecting information from hospitals and/or long term care facilities alongside their existing vital registration system, and definitions can vary, even within countries, in how a death from COVID is defined, such as whether it is a death in someone who ever had a positive test, had one within a defined period before death, or did not have a test but had symptoms consistent with COVID ³. As a consequence, excess all cause mortality is widely viewed as the gold standard, although it also includes deaths only indirectly related to SARS-CoV-2, such as those resulting from overstretch in health facilities.

It can also underestimate SARS-CoV-2 related deaths as there may be reductions in deaths from, for example, road traffic injuries. There are also operational problems, such as delays in processing of mortality data in some places.

In practice, however, most media and political attention has focused on reports of deaths attributed to COVID-19 in official reports. Their presentation often demonstrates a lack of even basic epidemiological understanding, for example as they are presented as numbers and not rates, and even less often as age-standardised rates. Given their widespread use, but recognizing their limitations, we have brought together the available data for EU countries plus the United Kingdom (UK), calculating where possible age standardized mortality rates, and examining the situation now and cumulatively.

Methods

We obtained the absolute number of COVID-19 deaths in each EU country plus the UK as of July, 21st from the European Centre for Disease Prevention and Control (ECDC) ⁴. We calculated crude mortality rates (CMRs) for COVID-19 using the daily number of deaths/ 100,000 resident population. We were only able to calculate standardized mortality rates (SMRs) for countries reporting identical age ranges of COVID-19 deaths (Italy, Germany, Netherlands, Sweden and Portugal), which we obtained from national data sources. To capture the overall burden of mortality officially attributed to COVID-19 we calculated CMRs based on cumulative deaths from 22nd February until 21st July, as reported to the ECDC and, for the five countries with age-specific data in national data sources, the age standardized cumulative figures. In the latter case, we were only able to include data from March 11th when the first data on COVID-19 deaths by age group were published in Italy, again up to July, 21st. When computing the crude mortality rates, we undertook two analyses, one including and one excluding the Lombardy region (10 million inhabitants), which was the epicentre of the Italian COVID-19 epidemics ⁶. As we were unable to use indirect standardization to compare all countries due to data limitations, we calculated the Comparative Mortality Figure (CMF) by using the direct standardization procedure ⁵. We were unable to calculate the standardized death rates in Lombardy alone, as data on age at death from COVID-19 were not publicly available.

Results

As of 21st July, the CMR for COVID-19 varied greatly across EU countries, with Belgium reporting the highest value (85.6/100,000), followed by the UK (67.8/100,000) and Spain (60.6/100,000), while Slovakia had the lowest (0.5/100,000) (Fig. 1, A). When considering Lombardy region on its own, the CMR was almost twice that of Belgium, with 167.0/100,000 in Lombardy versus 36.3/100,000 for the rest of the country (Fig. 1A). Among the five countries where we could estimate age-standardised rates, Sweden reported the highest, with a SMR of 60.7/100,000, followed by Italy (48.2/100,000), Netherlands (41.0/100,000), Portugal (15.1/100,000) and Germany (10.0/100,000) (Fig. 1B).

Turning to mortality trends, Lombardy region experienced the earliest steep increase in Europe, with death rates increasing from 0.2/100,000 on 1st March to 75.5/100,000 on 1st April. The worst affected of the remaining EU countries and the UK only increased steep increases in CMRs from the beginning of April until the beginning of May, with Belgium experiencing the highest increase among the 28 countries (from 11.4/100,000 to 69.8/100,000) in this period, followed by UK (from 3.6/100,000 to 40.1/100,000) and Spain (from 17.5/100,000 to 52.9/100,000). The CMR in Sweden showed a consistent increase from the beginning of April and, as of 21st July it had not yet plateaued (from 1.8/100,000 to 55.1/100,000).

When looking at cumulative SMRs, the trends were similar for Italy and the Netherlands (0.9/100,000 and 0.0/100,000 on 11th March, 40.9/100,000 and 36.4/100,000 on 11th May, and 48.2/100,000 and 41.0/100,000 on 21st July respectively) where the plateau was reached at the beginning of June (Fig. 2 B). Similar trends, although with lower values, were also observed for Germany and Portugal (both 0.0/100,000 on 11th March, 8.1/100,000 and 11.7/100,000 on 11th May, 10.0/100,000 and 15.1/100,000 on 21st July, respectively) with the plateau reached in the second half of May in Germany, and in the first half of June in Portugal. Reflecting the trends mentioned above, Sweden has not yet reached a plateau, experiencing a constant increase (0.0/100,000 on 11th March, 32.4/100,000 on 11th May, and 60.7/100,000 on 21st July).

Discussion

Before discussing our findings, it is necessary to note some limitations, not least because they have implications for policy. It seems remarkable that, in the face of a common threat that has had an enormous impact on the burden of disease in Europe, but also on the economy, governments have been unable to develop a shared understanding of what is being measured or to ensure that there are systems in place to measure it accurately and report it in a timely way. The ECDC has performed remarkably in collating and presenting the available data but it is constrained by what is collected by national and regional governments. Given that this will not be the last pandemic, this is something that should be addressed as a priority. However, the problems in obtaining comparable data are only the start. It cannot be acceptable that the data reported lack information on age at death. Published studies demonstrate that the lethality of this disease increases with increasing age. Yet we have very little information about whether the increase is the same everywhere. Are some countries protecting older people better than others? This is important information that could offer insights to inform policy but the data are lacking. More contentious, but as important, is the almost complete lack of data on mortality by ethnicity (the UK is a rare exception), so once again it is impossible to know if some countries are protecting vulnerable groups more than others.⁶

Our analysis does, however, have some important strengths. First, it does adjust for the age distribution of populations in some countries, rendering them more comparable, although even where we had age-specific data, the early reports from each country had around 10% of missing values for age. Second, by waiting until the initial peaks had subsided, it is possible to compare the overall impact. This is a function

of both the height of the peak and the time that the rate remained elevated. The importance of this can be illustrated by the situation in Lombardy. Initially there was some debate about how it had fared. Thus, despite the scenes of struggling hospitals, the death rate 30 days after the onset of the epidemic there was well below the corresponding figures in the Community of Madrid and in Brussels (41.4/100,000 in Lombardy versus 77.1 and 48.6/100,000, respectively)⁷. Yet it can now be seen that Lombardy has experienced overall the highest COVID-19 mortality rates in Europe. There are several possible reasons: it was the first region to be affected in Europe, at a time when there was little understanding how to manage this new illness. Lombardy adopted a hospital-centred approach, in contrast to neighbouring regions (45% of COVID-19 patients hospitalized versus 22% of other Italian regions)⁸, its intensive care units were overwhelmed⁹, and its nursing homes accommodated many elderly frail patients¹⁰. The first COVID-19 clusters in the Netherlands, Germany, and Portugal started between one and two-weeks later than in Italy, by which time they had seen what was happening in Lombardy. Germany stands out from other countries. A plausible explanation relates to its much greater ICU capacity, with 29.2 beds/100,000 population in Germany versus 8.4/100,000 in Italy, 4.2/100,000 in Portugal and 6.4/100,000 in the Netherlands at the onset of the epidemics^{9,11}. Sweden also stands out. Although it had made some recommendations about interpersonal distancing, it rejected many of the restrictions imposed elsewhere.

The COVID-19 pandemic is far from over. Already, it is clear that some countries have responded better than others. It is beyond the scope of this paper to determine why and as several countries are already experiencing a resurgence of cases, any definitive assessment would be premature. However, answers are likely to lie in three areas, political decision making, scientific advice, and health system and public health capacity¹². For now, there is an urgent need to put in place systems that can provide timely, complete, and internationally comparable data.

Declarations

Funding

No funding was received for this study.

Conflicts of interest/Competing interests

All authors confirm that they have no conflicts of interest or competing interests.

Availability of data and material

All data were collected from National and International databases.

Ethics approval

Not applicable.

Consent to participate

Not applicable.

Consent for publication

Not applicable.

Author contributions

All authors contributed to the study conception and design. Material preparation and data collection were performed by Leonardo Villani and Stefania Boccia. Leonardo Villani and Luca Giraldi performed the statistical analysis. The first draft of the manuscript was written by Stefania Boccia and Leonardo Villani and Martin McKee commented on the latest version of the manuscript. Walter Ricciardi, Martin McKee and Stefania Boccia supervised the study. All authors read and approved the final manuscript.

Data were extracted from official national data sources.

Italy, Istituto Superiore di Sanità (ISS), <https://www.epicentro.iss.it/coronavirus/sars-cov-2-sorveglianza-dati-archivio>

Portugal, Direção Geral de Saúde Portuguese, <https://covid19.min-saude.pt/relatorio-de-situacao/>

Germany, Robert Koch Institute,

https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Situationsberichte/Gesamt.html

Netherlands, Rijksinstituut voor Volksgezondheid en Milieu, <https://www.rivm.nl/coronavirus-covid-19/grafieken>

Sweden, Folkhälsomyndigheten, <https://www.folkhalsomyndigheten.se/folkhalsorapportering-statistik/statistik-a-o/sjukdomsstatistik/covid-19-veckorapporter/>

References

1. Boccia S, Cascini F, McKee M, Ricciardi W. How the Italian NHS Is Fighting Against the COVID-19 Emergency. *Frontiers in public health* 2020; **8**: 167.
2. Vanoni M, McKee M, Bonell C, Semenza J, Stuckler D. Using volunteered geographic information to assess mobility in the COVID-19 pandemic context: cross-city time series analysis of 41 cities in 22 countries from March 2nd to 26th 2020. *Globalization Health* 2020; **(n press)**.
3. Karanikolos M, McKee M. How comparable is covid-19 mortality across countries? 2020. <https://analysis.covid19healthsystem.org/index.php/2020/06/04/how-comparable-is-covid-19-mortality-across-countries/> (accessed 31st July 2020).
4. ECDC. COVID-19 situation update for the EU/EEA and the UK, as of 21st July. 2020. <https://www.ecdc.europa.eu/en/cases-2019-ncov-eueea> (accessed 21st July 2020).

5. Breslow N, Day N. Statistical methods in cancer research. Volume II-The design and analysis of cohort studies. Lyons: International Agency for Research on Cancer; 1987.
6. Pan D, Sze S, Minhas JS, et al. The impact of ethnicity on clinical outcomes in COVID-19: A systematic review. *EClinicalMedicine* 2020; **23**: 100404.
7. Signorelli C, Odone A, Gianfredi V, et al. The spread of COVID-19 in six western metropolitan regions: a false myth on the excess of mortality in Lombardy and the defense of the city of Milan. *Acta bio-medica : Atenei Parmensis* 2020; **91**(2): 23-30.
8. Boccia S, Ricciardi W, Ioannidis JPA. What Other Countries Can Learn From Italy During the COVID-19 Pandemic. *JAMA internal medicine* 2020.
9. ALTEMS. Analisi dei modelli organizzativi di risposta al Covid-19, 31st March 2020. 2020. <https://altems.unicatt.it/altems-report.pdf> (accessed 30th July 2020).
10. Istituto Superiore di Sanità. Survey nazionale sul contagio COVID-19 nelle strutture residenziali e sociosanitarie, 5th May 2020. 2020. https://www.iss.it/documents/20126/0/Report_surveyFinale+RSA.pdf/4b14b829-5a07-24e9-955a-4d4c9a7e4440?t=1592402115720 (accessed 30th July 2020).
11. Rhodes A, Ferdinande P, Flaatten H, Guidet B, Metnitz PG, Moreno RP. The variability of critical care bed numbers in Europe. *Intensive care medicine* 2012; **38**(10): 1647-53.
12. McKee M, Gugushvili A, Koltai J, Stuckler D. Are Populist Leaders Creating the Conditions for the Spread of COVID-19? Comment on "A Scoping Review of Populist Radical Right Parties' Influence on Welfare Policy and its Implications for Population Health in Europe". *International journal of health policy and management* 2020.

Figures

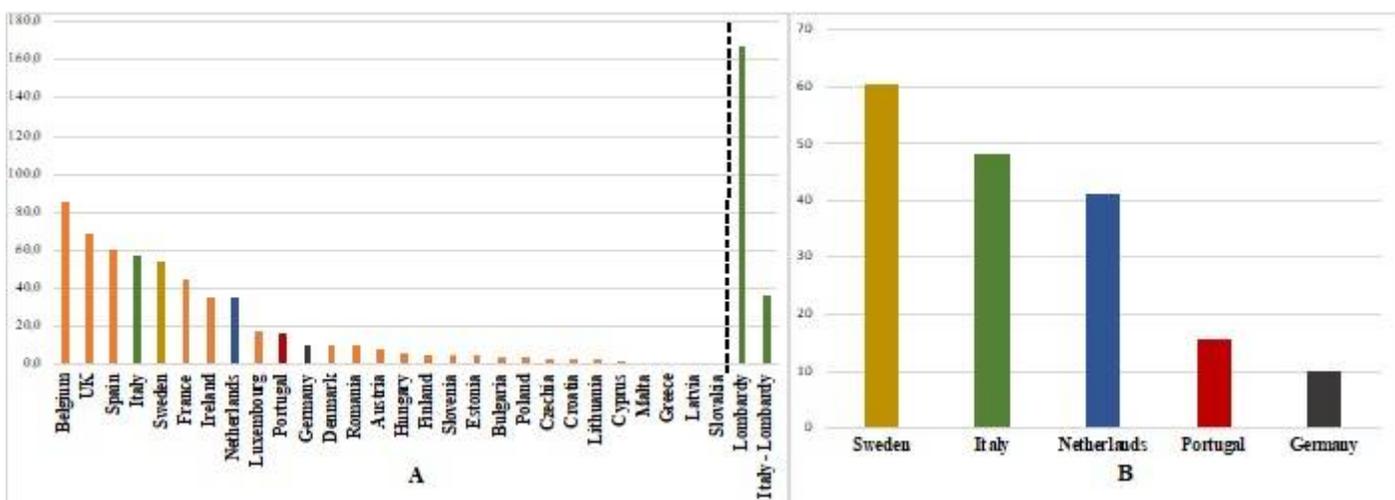


Figure 1

Crude Mortality Rates(A) for COVID-19 in 27 EU Countries plus UK, and Standardized Mortality Rates (B), July,21st, 2020 (x 100,000 inhabitants)

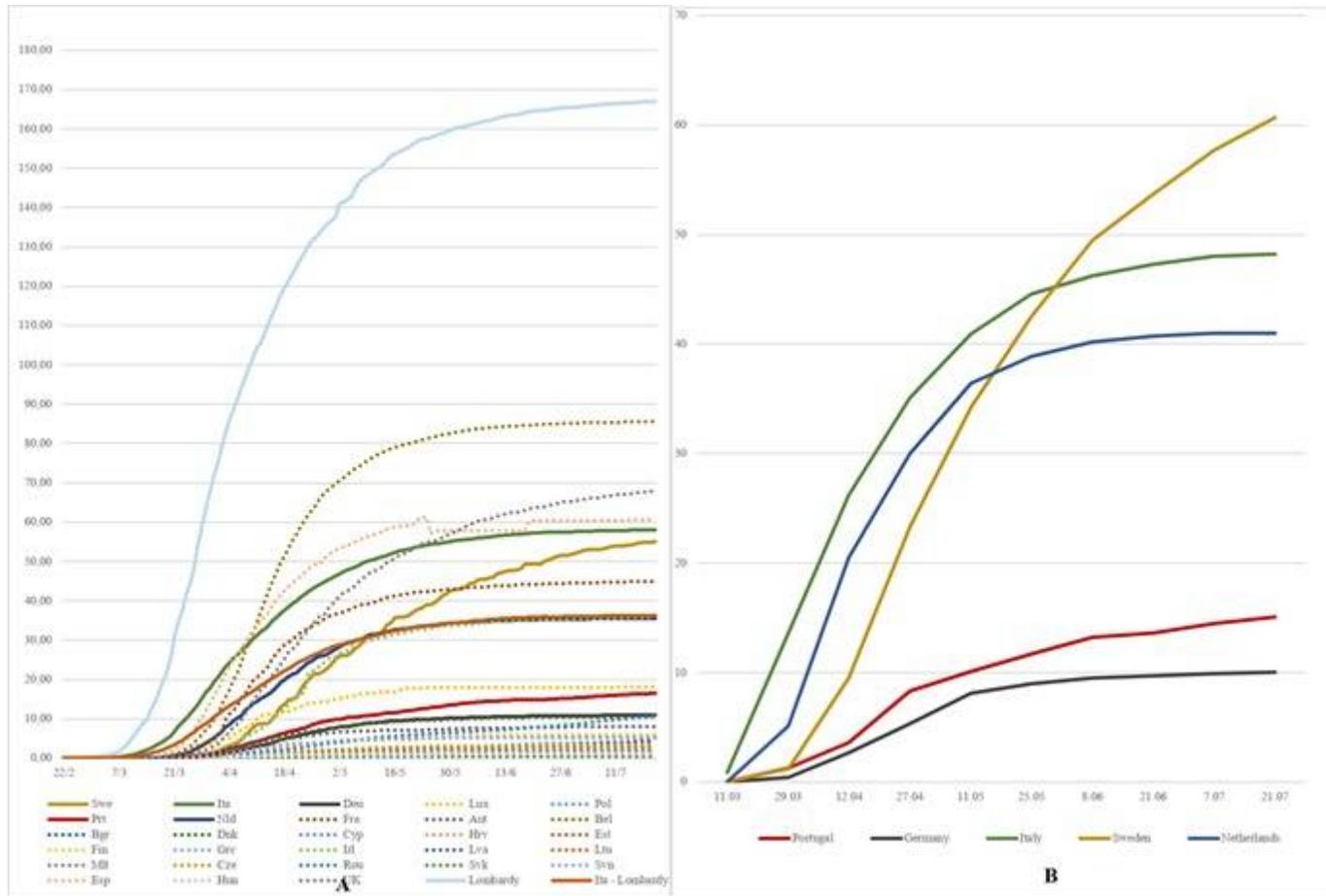


Figure 2

Cumulative Crude Mortality Rates (x 100,000 inhabitants) for COVID-19 in 27 EU Countries plus UK, and Cumulative Standardized Mortality Rates (x 100,000 inhabitants) for selected EU Countries