

Brief Report

Causes of Death during the First COVID-19 Pandemic Wave in Italy: A Comparison with Some European Countries

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Abstract: Studies comparing cause-of-death patterns across countries during the COVID-19 outbreak are still lacking although such studies would contribute to the understanding of the direct and indirect effect of the virus on mortality. In this report, we compare the mortality pattern observed in Italy during the first pandemic wave (March–April 2020) with that of some European countries. We calculated cause-specific, age-standardized mortality ratios (SMR) for Spain, England, and Sweden for the two mentioned months from 2016 to 2020, using already published data. Although Italy presented the highest crude overall mortality rate (267 per 100,000 population), age-adjusted ratios showed that all-cause and COVID-19 mortality in Italy were higher than in Sweden but lower than in the other two countries. Some causes had a similar increase in 2020 compared to previous years in all countries, i.e., endocrine diseases (especially diabetes), dementia and Alzheimer’s (in general mental disorders), and hypertensive heart diseases. Conversely, respiratory diseases, in particular pneumonia and influenza, increased to a greater extent in Italy. This latter result could be, in part, related to the underreporting of COVID-19 on death certificates during the first period of the pandemic, when Italy was the first European country severely hit by the virus.

Keywords: COVID-19 mortality; causes of death; age-standardized mortality



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1. Introduction

The overall excess mortality and the number of COVID-19 reported deaths in most European countries during the first wave of the pandemic have been widely documented and compared [1–3]. In some countries, the early months of the pandemic were characterized by a change in the pattern of causes of death with respect to the previous years, also due to the notable increase in the number of deaths for causes other than COVID-19 [4–6]. However, to our knowledge, there is a lack of studies that compare cause-specific mortality figures across countries during the pandemic. Despite the limits represented by the different coding and reporting practices, international comparisons could enable the evaluation of similarities and differences in both direct and indirect effects of the pandemic on cause-specific mortality.

The objective of the study was to compare the cause-specific mortality observed in Italy during the early pandemic phase with that of other European countries using the available statistics published.

2. Materials and Methods

The study compares cause-specific mortality rates from 2016 to 2020 in selected countries in Europe. Since data available for Italy referred to provisional figures for the period March–April 2020 [4], we focused the analysis on these months. Countries, study

periods, and causes of death were selected taking into account the availability of official data. At the time the analysis was carried out, it was possible to compare data for Italy with those from Spain [7], Sweden [8], and England (complete data for Scotland and Wales were not available) [5,9]. In each country, the International Classification of Diseases of WHO (ICD10) was used for cause-of-death coding.

For each country we calculated crude rates and standardized mortality ratios (SMRs) for specific causes of death, using age- and sex-specific mortality rates observed in Italy in March–April 2020 as standard. The expected number of deaths by cause was obtained by multiplying standard rates to the age-, sex-, and year-specific population available at Eurostat database by 5-year age groups except for 0 years, 1–4 years, and 85 years and more. The populations were taken at 1st January except for England, for which mid-year population was used [10]. Expected numbers were compared with the observed deaths by calculating ratios observed/expected.

Comparisons were not possible for the same detail of causes for all countries. Sweden published the data at ICD10 chapter level, while for the other countries, a finer detail was available. On the other hand, for England, it was sometimes not possible to aggregate the published data at ICD10 chapter level since only leading causes were available. In summary, we limited the analysis to a list of causes common to all countries, where each cause is defined by the same set of ICD10 codes reported next to the description of the cause in Table 1.

Table 1. Mortality by cause of death in March–April 2016–2020 in selected European Countries: number of deaths, crude rates per 100 thousand, and standardized mortality ratios (SMR). Standard rates are those registered in Italy in 2020.

Country	Number of Observed Deaths		Crude Mortality Rate per 100 Thousand		Standardized Mortality Ratio (SMR)	
	2020	Average 2016–2019	2020	Average 2016–2019	2020	Average 2016–2019
COVID-19 (ICD10 codes U07.1–U07.2)						
Italy	29,184		49		1.00	
England	30,604		54		1.45	
Spain	41,730		88		2.11	
Sweden	3090		30		0.76	
All causes of death						
Italy	159,310	109,083	267	181	1.00	0.71
England	129,784	84,198	230	151	1.15	0.78
Spain	117,835	71,720	249	154	1.08	0.69
Sweden	19,116	16,026	185	159	0.89	0.78
All causes excluding COVID-19						
Italy	130,126		218		1.00	
England	99,180		175		1.08	
Spain	76,105		161		0.85	
Sweden	16,026		155		0.91	
Neoplasms (ICD10 codes C00–C96)						
Italy	29,973	30,034	50	50	1.00	1.04
Spain	18,710	18,701	40	40	0.91	0.95
Sweden	4003	3975	39	40	0.93	0.97
Endocrine, nutritional, and metabolic diseases (ICD10 codes E00–E90)						
Italy	6835	4942	11	8	1.00	0.75
Spain	3149	2261	7	5	0.67	0.51
Sweden	560	486	5	5	0.61	0.55
Diabetes (ICD10 codes E10–E14)						
Italy	5376	3779	9	6	1.00	0.73
England	1425	958	3	2	0.38	0.27
Spain	2401	1645	5	4	0.66	0.47

Table 1. Cont.

Country	Number of Observed Deaths		Crude Mortality Rate per 100 Thousand		Standardized Mortality Ratio (SMR)	
	2020	Average 2016–2019	2020	Average 2016–2019	2020	Average 2016–2019
Mental and behavioral disorders (ICD10 codes F00–F99)						
Italy	5855	3972	10	7	1.00	0.71
Spain	4121	3639	9	8	1.02	0.96
Sweden	1305	1167	13	12	1.78	1.65
Dementia and Alzheimer's disease (ICD10 codes F03, G30)						
Italy	8319	5643	14	9	1.00	0.71
England	15,825	10,786	28	19	2.91	2.06
Spain	7241	5970	15	13	1.28	1.11
Diseases of the circulatory system (ICD10 codes I00–I99)						
Italy	44,802	39,399	75	65	1.00	0.92
Spain	22,060	21,042	47	45	0.72	0.72
Sweden	4967	5389	48	54	0.85	0.96
Hypertensive heart diseases (ICD10 codes I10–I15)						
Italy	8776	6285	15	10	1.00	0.75
England	1308	1129	2	2	0.22	0.20
Spain	3012	2160	6	5	0.50	0.38
Diseases of the respiratory system (ICD10 codes J00–J99)						
Italy	16,353	9420	27	16	1.00	0.60
Spain	9637	9088	20	19	0.86	0.86
Sweden	1208	1362	12	14	0.55	0.65
Influenza and pneumonia (ICD10 codes J09–J18)						
Italy	5094	2466	9	4	1.00	0.50
England	4084	4795	7	9	1.15	1.41
Spain	2240	2087	5	4	0.64	0.63
Symptoms, signs, and other ill-defined conditions (ICD10 codes R00–R99)						
Italy	4745	2363	8	4	1.00	0.52
England	3375	2125	6	4	1.04	0.68
Spain	1789	1519	4	3	0.54	0.48
Sweden	553	484	5	5	0.90	0.81
External causes of death (ICD10 codes V01–Y98)						
Italy	3867	4014	6	7	1.00	1.07
Spain	2133	2535	5	5	0.78	0.97
Sweden	822	830	8	8	1.53	1.60

3. Results

Figure 1 reports SMR by country for March–April 2020, and in the period 2016–2019 (average), absolute numbers and crude death rates are reported in Table 1 together with SMR values. In March–April 2020, there were, in Italy, 159,310 deaths, about 50 thousand more than the average number registered in 2016–2020. The crude mortality rate was 267 deaths per 100 thousand population, the highest value among the considered countries for which crude rates ranged from 185 per 100 thousand in Sweden to 249 in Spain. Nevertheless, taking into account the differences in the age structure of the population, SMRs show that, in 2020, overall mortality in Italy (SMR = 1.00, reference value) was higher than in Sweden (SMR = 0.89) but lower than in England (SMR = 1.15) and Spain (SMR = 1.08).

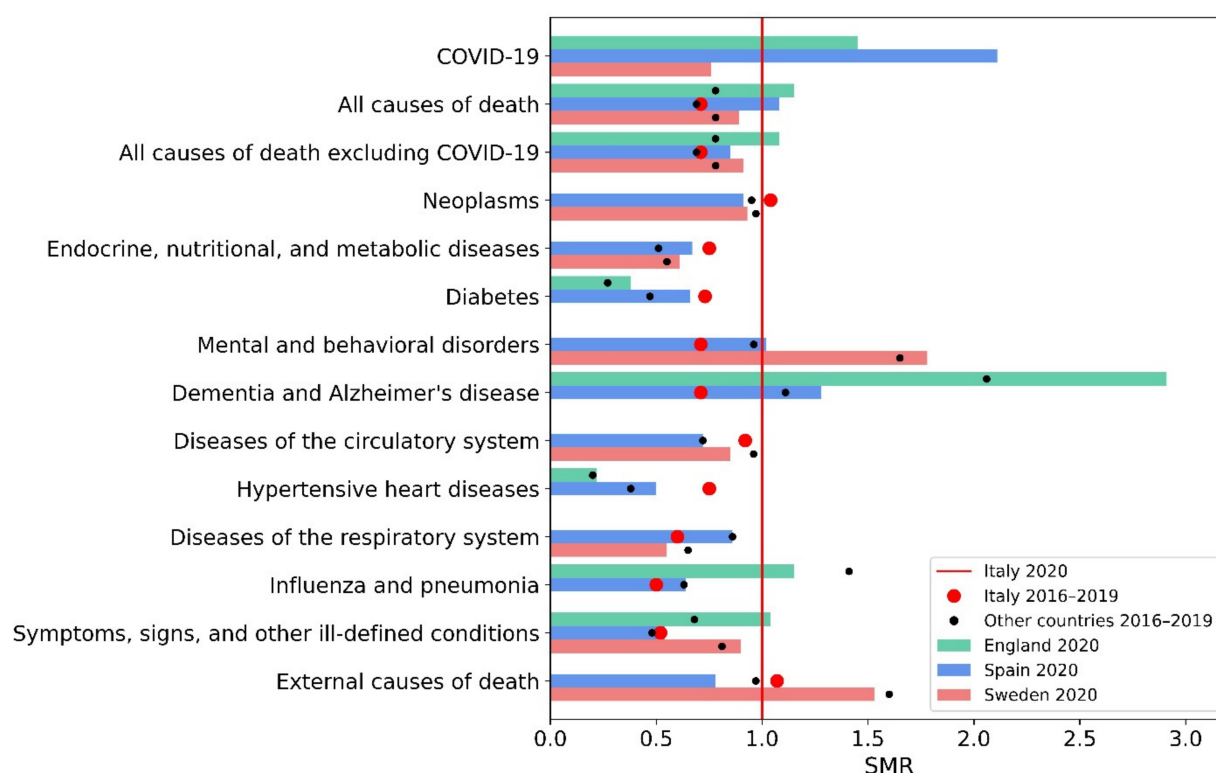


Figure 1. Standardized mortality ratios (SMR) by cause of death in March–April 2020 and 2016–2019 in selected European Countries. Standard rates for the calculation of the SMR are those registered in Italy in 2020.

Compared to Italy, age-standardized COVID-19 mortality resulted double in Spain (SMR = 2.11), 1.45 times in England, and 0.75 in Sweden. For all causes other than COVID-19, Italy showed higher mortality compared to Sweden and Spain, but the highest level of mortality was observed in England (SMR = 1.08)

In Italy, the cause of death showing the highest increase in 2020 rates were influenza and pneumonia and symptoms and signs. Influenza and pneumonia mortality doubled compared to March–April of previous years (SMR = 0.50 in 2016–2019), and the number of deaths increased from the yearly average of 2466 in the period 2016–2019 to 5094 in 2020. Such increase was not observed in Spain, nor England, nor Sweden for the overall respiratory diseases (for Sweden, the rate for influenza and pneumonia is not available). Dementias showed in Italy an increase in mortality of about 30% compared to previous years; nevertheless, a large increase for such cause was observed in England, where mortality levels were generally higher than in Italy also in the period 2016–2019 and Spain. For Sweden, the comparison was feasible only for the larger group of mental and behavioral disorders, for which SMR increased from 1.65 to 1.78, i.e., showing a smaller increase than the one observed in Italy. In 2020, diabetes and hypertensive heart diseases also showed a notable mortality increase in Italy (SMR in 2016–2019 were 0.73 and 0.75 for diabetes and hypertensive heart diseases, respectively). Although less strong than Italy, an increase in mortality for diabetes was observed also in Spain and England.

No important variations were found in 2020 for the overall group of circulatory system diseases and neoplasms in each country.

Lastly, a decline in mortality for external causes was observed especially in Spain but also in Italy and Sweden.

4. Discussion

In March–April 2020, an excess of overall and non-COVID-19 mortality was observed in all the compared countries. Age-adjusted COVID-19 mortality rate in Italy was lower than in England and Spain and higher than in Sweden. Compared to previous years,

mortality for diabetes, hypertensive heart diseases, and respiratory system diseases (especially influenza and pneumonia) increased more in Italy than in the other countries. A marked increase in mortality for mental and behavioral diseases (including dementia) was observed in all the countries.

The lower COVID-19 mortality observed in Italy compared to the other countries might reflect differences in the direct impact of the pandemic but also the possible underreporting of COVID-19 deaths, as Italy was the first European country severely hit by the first pandemic wave. In particular, the limited availability of SARS-CoV2 tests countrywide during the early pandemic phase might have led to attribute a certain number of deaths to causes other than COVID-19. This could explain the highest increase in mortality for respiratory diseases observed in Italy, especially influenza and pneumonia, which, without a diagnostic confirmation of SARS-CoV2 infection, might have been identified as the cause of death. Underreporting of COVID-19 can also partly explain the mortality increase for chronic diseases, such as diabetes, hypertensive heart diseases, and dementia, observed in all the countries. However, the increase in mortality for diabetes and hypertensive heart diseases could also be related to the indirect effects of the early pandemic phase, such as the difficulties in accessing healthcare services or in the clinical management of the patients affected by the diseases [11]. An additional explanation is the fragility of individuals, for example, exposing people affected by diabetes and hypertension to an increased risk of death [12]. Various explanations have been provided for the increased mortality of people with dementia and Alzheimer's disease, such as the tendency of COVID-19 to present in this group of individuals with atypical and misleading manifestations, the reduced access to intensive care and supportive therapies, and the spread of the virus in long-term care facilities [13].

Among the main strengths of the study, there is the use of cause-of-death data. These statistics have national coverage and make use of standardized tools for the classification of causes of death, such as the ICD10. Due to the high level of international harmonization, this source is less affected by the differences that can occur among the national SARS-CoV-2 epidemic surveillance systems. In addition, it allows analyses of all the causes of death instead of focusing only on COVID-19 mortality. Moreover, the comparisons described in this report are made taking into account the differences in the age structure across the countries that avoid biases in the interpretation of results based on absolute numbers or crude rates only. Lastly, the study also considers a non-pandemic period (2016–2019), allowing analysis of the variations in causes-of-death patterns in 2020 taking into account the pre-existing differences among countries.

The study also has some limitations. In particular, it focused only on March and April, whereas the first wave of the COVID-19 pandemic partially extended also in May, and the compared countries experienced the first pandemic wave in slightly different periods. For instance, the impact of the virus in Sweden manifested later than in the other countries [14]. The uneven detail of available data constrained the analysis to some countries and few causes of death. Indeed, published data are not homogeneous concerning the available cross-tabulation variables. The differences in the cause-of-death grouping, therefore, did not allow us to compare all the causes for all countries.

Despite these limitations, the followed approach allowed to highlight similarities and differences in the impact of the COVID-19 pandemic on cause-specific mortality in different countries. We believe that cause-of-death monitoring is a core tool for understanding the epidemiological scenario during the COVID-19 pandemic. As a future step, we would repeat the analysis when additional data become available and when long-term effects of the burden of COVID-19 on the healthcare system have impacted the cause-of-death mortality.

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Data Availability Statement: All data used in this study are publicly available and downloadable from the following web sites: Italy: <https://www.istat.it/it/archivio/240401>; England: <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/deathsinvolvingcovid19englandandwales>; Spain: <https://www.ine.es/dynt3/inebase/es/index.htm?padre=7615&capsel=7613>; Sweden: <https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/statistik/2021-6-7454-tables.xlsx>; Population: Eurostat Database: <http://ec.europa.eu/eurostat/data/database>. On request, authors are available to share the data used for calculation (contact: frgripo@istat.it).

Conflicts of Interest: The authors declare no conflict of interest.

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