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The impact of COVID-19 on total mortality in Italy up to November 2020.

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Since the beginning of the COVID-19 pandemic the scientific community and the policy makers struggled to find reliable indicators to measure the overall effect of the COVID-19 pandemic. It soon became evident that total mortality was a key candidate, since it reflects not only the deaths directly due to the COVID-19 but also those missing from official COVID-19 registration and resulting from the disruption of the healthcare system.

To face with the pandemic, countries adopted a series of measures to contain the spread of the infection, such as the closing of high epidemic areas, tracing, isolation of suspected or confirmed cases, reduction movements outside and within the countries, use of face masks and physical distancing. However, a reorganization of the healthcare system was also necessary to manage the uniquely large burden of the disease. This included the conversion of many wards in COVID-19 centers and the consequent allocation of health personnel to the care of COVID-19 patients as well as the postponing of deferrable interventions. The overall effect of this reorganization is still to be quantified.

The Italian National Institute of Statistics reported from January to November 2020 an excess of more than 75,000 total deaths in Italy accounting for about 13% excess mortality as compared to the previous quinquennium (2015-19). Excluding January and February, i.e. the months before the widespread diffusion of the COVID-19 pandemic in Italy, the excess total mortality over the period March-November was 85,625 deaths. Most of this excess was observed in the months of March, April and November with more than 20,000 more deaths than expected in a single month. The excess mortality was not observed in June and July, where a “harvesting” effect resulting from the death of the weakest individuals in the previous months may have yielded less deaths than expected. From August the excess mortality started to rise again and reached its maximum in November 2020 (**Table 1**).

In the past, virulent flu seasons with low vaccine coverage or heat peaks in the summer months led to some years (e.g. 2015 and 2017) of excess mortality: which, however, did not exceed 50,000 more deaths as compared to previous quinquennia. An excess of this magnitude was never observed in the post war period.

During the first wave of the pandemic (March-April 2020), the excess mortality from any cause (48,761 deaths) was far higher than the number of deaths due to COVID-19 (about 28,000 registered deaths, 57.3% of the overall excess). At that time only a limited number of individuals had been tested, leaving, therefore

many likely died untested and untreated (**Figure 1**). During the second wave, the number of tests substantially increased from less than 500,000 in the month of March 2020 to more than 6 million in November 2020. However, an important difference between the excess total mortality and COVID-19 deaths still remains (31,715 total deaths registered in October-November 2020 and only 19,682 deaths reported as COVID-19 in the same months, accounting for 62% of the excess deaths). Thus, it becomes clear that this discrepancy is not fully attributable to the low testing rate, and rather reflects the effect of the pandemic on the care of diseases other than COVID-19, mainly cardiovascular diseases.

The gap between the excess in total deaths and the deaths attributed to COVID-19 was also observed in the UK and the USA. In the UK, there were about 47,000 excess deaths in March-May 2020 and of them almost 10,000 were not attributed to COVID-19 ¹. In the USA, of the 225,530 excess deaths observed in March-July 2020, only 67% of them were attributed to COVID-19, and an analysis of causes of deaths showed that the five states with the highest numbers of COVID-19 deaths also experienced important increases in mortality from heart diseases, diabetes and Alzheimer disease ².

In Italy during the first wave of the pandemic the activity of oncology centers had a contraction of 10-30%, while the reduction in cardiology units account for almost 50% ³. Since the early and more tough days of the pandemic, the time from symptoms onset to coronary angiography increased, while hospitalizations due to acute coronary syndrome (ACS) decreased in many cardiovascular centers, likely because of reduced seek of medical attention due to the fear of getting infected in hospital ⁴. The reduction of hospitalizations for ACS comes with a higher complication and fatality rates ⁵.

Causes of death data for all the Italian population, including those who did not get infected, are not available yet. However, the gap between the deaths registered as COVID-19 and the total number of deaths indicates that it is not negligible.

In December 2020 over 18,500 deaths were registered as COVID-19. Assuming that the differential between COVID-19 and total deaths was not appreciably different for November, it is likely that the excess total deaths in December was over 25,000. This would lead to an excess total deaths over 100,000 (+16%) in the year 2020 and 110,000 (+20%) in the period March-December 2020.

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Figure's legend

Figure 1. Number of swab tests (bars) performed in Italy between March and November 2020, difference in total mortality compared to the same month of the previous quinquennium and number of COVID deaths registered in the same period (lines).

Table 1. Number of total deaths and COVID-19 deaths registered in Italy, comparison with the number of deaths registered in the previous quinquennium and number of tests for the detection of SARS-CoV-2 performed in the period January-November 2020.

Month	2020 ^a	Average 2015-19 ^a	Absolute difference (2020 - average 2015-19)	Percent difference (2020 - average 2015-19)	Number of deaths registered as COVID-19 ^b	Number of swab tests performed (thousands)
January	61,476	68,324	-6,848	-10.0%	0	0
February ^c	53,906	57,062	-3,156	-5.5%	29	18.7
March	86,261	58,267	27,994	48.0%	12,399	488.3
April	72,568	51,801	20,767	40.1%	15,539	1472.2
May	52,218	50,724	1,494	2.9%	5,448	1899.5
June	48,382	48,501	-119	-0.2%	1,352	1511.4
July	51,133	51,810	-677	-1.3%	374	1423.0
August	53,306	51,041	2,265	4.4%	342	1831.7
September	48,734	46,548	2,186	4.7%	411	2689.1
October	58,476	51,590	6,886	13.3%	2,724	4450.5
November	76,291 ^d	51,462	24,829	48.2%	16,958	6160.6
January-November	662,751	587,130	75,621	12.9%	55,576	26,598.6
February-November	601,275	518,806	82,469	15.9%	55,576	26,598.6
March-November	547,369	461,744	85,625	18.5%	55,547	26,579.9

^a The total number of deaths registered in Italy were downloaded from the daily mortality data published by the Italian National Institute of Statistics. Decessi anni 2015-2020 [Internet]. 2020 [cited 2020 Dec 30]. Available from: <https://www.istat.it/it/archivio/240401>

^b The number of deaths registered as COVID-19 were obtained from the surveillance system of the Ministry of Health and the Civil Protection Department (Presidenza del Consiglio dei Ministri - Dipartimento di Protezione Civile. Andamento Nazionale COVID-19 [Internet]. 2020 [cited 2020 Dec 30]. Available from: <https://dati-covid.italia.it>)

^c To compare the same number of days in each month of the year, the number of deaths registered on 29th February 2016 and 2020 (leap years) were dropped.

^d Preliminary estimate

