Brief Report

COVID-19 and the excess of mortality in Italy from January to April 2020: What are the risks for oldest old?

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Abstract

In February 2020, Italy has been the first country in Europe fighting against COVID-19. In March 2020, Italian government declared national lockdown. Until May 4th, people stayed in home confinement and only the so-called *essential works and activities* were continued. Like in other countries, both for the disease severity and for the risk of death, the higher the age of people the higher the risk. In the first months of 2020, Italy saw a very high number of deaths related to COVID-19, with a huge age effect. There is an agreement on the view that there had been also an excess of mortality and on the role of mortality as a correct way to reflect the dynamics of the virus's spread. In this paper we briefly discuss the trends of mortality during the first 4 months of 2020 according to the data by the Italian National Institute of Statistics.

Introduction

Since the last days of 2019, China has fight with a new coronavirus called SARS-CoV-2 and the related disease called COVID-19. Starting from China, in first months of 2020 the outbreak took Europe and then USA and other countries of the world and now it is spreading all over the world. As of March 11, 2020, World Health Organization declared pandemic status. Today, after more than 13 months, the pandemic is still going on, with more than 150 millions of infected people and 3 millions of deaths all over the World.

Italy is one the oldest country in Europe and in the World and it has been the first country in Europe that start fighting against COVID-19.[1,2] Like in other countries, the higher the age of people the higher the risk of contagion, the risk of severity of the disease and the risk of death.[3-11] The month of March represented the first step of the Italian's experience with the outbreak, with a progressive diffusion of the contagion and with government progressive introduction of the mitigation measures. As of March 2020, Italian government declared national lockdown. Until May 4th, 2020, people stayed in home confinement, schools were closed, face to face lesson were stopped and only the so-called *essential works and activities* were continued. Despite the introduction of measures to mitigate the infection and spread of the virus, Italy was particularly affected in this first phase, both for the number of people who contracted the virus and for the number of deaths.

In this paper we aim to describe some effects of the pandemic and the spread of contagion, with a focus on COVID-19-related deaths. There is an agreement on the role of mortality as a correct way to reflect the dynamics of the virus's spread.[2] Moreover, according to Bartoszek and colleagues,[2] there is a need to put attention not only on a country level, but also on a region-level because the country-level *does not say much about the dynamic of the disease* and of the contagion that could have taken place at regional level. We choose to focus our attention on the first four months of 2020 that represent the so-called *first wave of pandemic* in Italy. In these months, Italy saw a very high number of deaths related to the COVID-19 infection and there is an agreement on the view that there has been an excess of mortality, mainly in the north regions of Italy and some papers described a clear difference between regions, with a clear picture of two or three areas with different mortality and morbidity. Aiming to offer a contribute on this field, the present study examined the trends of mortality during the first 4 months of 2020 in Italy according to the official data released by Italian National Institute of Statistics (ISTAT www.istat.it), and it compared them with findings from a previous interval of 5 years. Moreover, the study examined the effect of age in the trend of mortality, with a focus on oldest old.

Design and methods

We analyzed daily data on total mortality in the first four months of 2020 in Italy published by ISTAT (Italian National Institute of Statistics). We compare data of the first four months of 2020 with data on the same months in 2015, 2016, 2017, 2018, 2019. We considered data in each region of Italy: we summed daily data and calculated total mortality in the period 1st January – 30th April 2020. We calculated total mortality in the same period in the years 2015-2019. Then we calculated daily average death for each region, for each month and for each year.

Significance for public health

Data on mortality and on excess of mortality during pandemic are critical to be investigated as there is an agreement on their role in the understanding of the dynamic of pandemic. The paper shows differences in Italy: while some regions showed an excess of mortality, other regions did not show differences. The paper discusses possible reasons for the excess of mortality (high pressure on Italian public health system during the acute phase of pandemic could have had the indirect effect of increase other causes of death, like the ones related to other disorders or diseases for which individuals had difficulty to access to care during the more critical phases of pandemic. From an intervention perspective, it proposes some practical suggestions for planning and implementing specific interventions during current and future steps of the COVID-19 Pandemic, aiming to prevent excess of deaths.

Results

Tables 1-4 and Figures 1-4 show total mortality in Italy in each region in each month in 2020 with a comparison to the total mortality in Italy in each month of the previous 5 years. Each table and in each figure describe data on a group of 5 Italian regions.

As the month of March had the higher level of mortality in Italy in the first four months of the year 2020, we chose to focus our attention on this month. We calculated the daily mean of mortality in each region in March 2020, and the daily mean of mortality in each region in an interval of five years (2015-2019). Then we compared the number of deaths in March 2020 with the mean of the mortality in March in the previous five years.

Tables 5 and 6 compared the daily number of deaths in March 2020 with the mean of the daily number or deaths in March in the previous five years (2015-2019). We show data for each region, and we propose statistical comparison. In Table 5 we also ordered Italian regions by the number of inhabitants and population density. Table 6 shows that for some regions there is a clear difference in the number of deaths in the month of March of the previous 5 years and in the month of March 2020. Specifically, Lombardy, Piedmont, Emilia Romagna had the higher increase of deaths in March 2020, compared to the average trend in the previous five years in the same month; also, Veneto, Liguria, Trentino Alto Adige, Valle d'Aosta, Marche showed a increase of deaths in March 2020, compared to the average trend in the previous five years in the same month, but

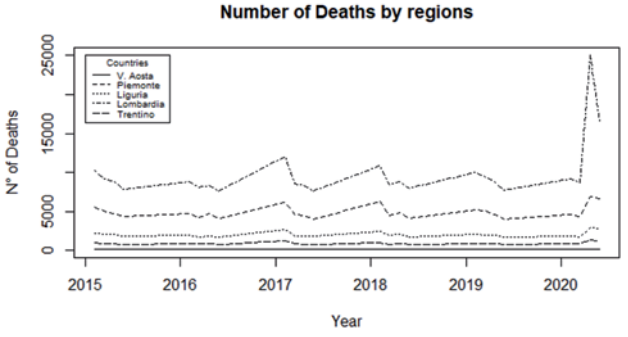

Figure 1. Total mortality for month in the first 5 regions (Valle d'Aosta, Piedmont, Liguria, Lombardy and Trentino Alto Adige).

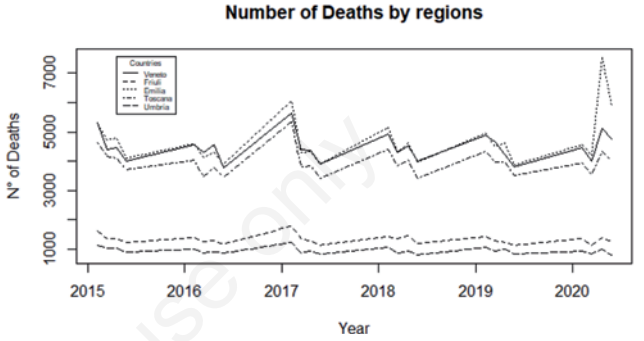

Figure 2. Total mortality for month in 5 regions Veneto, Friuli-Venezia Giulia, Emilia Romagna, Tuscany, Umbria.

Table 1. Total mortality for month in the first 5 regions - Valle d'Aosta, Piedmont, Liguria, Lombardy and Trentino Alto Adige.

Years	Valle D'Aosta	Piedmont	Liguria	Lombardy	Trentino Alto Adige
January 2015	144	5523	2246	10275	989
February 2015	141	5135	2098	9186	899
March 2015	133	4759	2052	8873	918
April 2015	143	4328	1769	7865	779
January 2016	120	4744	1917	8851	824
February 2016	114	4230	1761	8030	833
March 2016	124	4748	1876	8308	837
April 2016	117	4065	1674	7609	739
January 2017	175	6188	2627	12019	1175
February 2017	124	4645	1850	8522	820
March 2017	115	4486	1842	8368	777
April 2017	108	4045	1785	7647	726
January 2018	161	6310	2422	10796	974
February 2018	133	4495	1913	8421	787
March 2018	133	4825	2035	8837	877
April 2018	110	4137	1703	7907	769
January 2019	144	5212	2078	9976	912
February 2019	123	5100	1930	9366	847
March 2019	140	4582	1891	8867	876
April 2019	107	4021	1718	7747	782
January 2020	116	4565	1844	9206	844
February 2020	120	4339	1696	8659	845
March 2020	194	6841	2954	24997	1364
April 2020	190	6696	2733	16383	1238

of minor entity. Lazio and Sicily showed a reduction of deaths in March 2020, compared to the average trend in the previous five years in the same month.

Discussion and Conclusions

This study has three aims. First, it aimed to describe data on mortality in Italian regions in the first 4 months of 2020 and to compare them with the trend in the previous 5 years (2015-2019). The number of total deaths for month and the daily average in each region showed an excess of mortality in some regions in the first 4 months of 2020. The excess of mortality is region dependent.[2,12] As expected, we found that in the first months of 2020 there has been a significative increase of mortality in some North regions but with a different gradient (Lombardy, Piedmont, Liguria, Valle d'Aosta, Veneto, Emilia Romagna). In these regions, the month of March 2020 had the higher level of mortality, both on a daily base and on a monthly base. Moreover, there has been a different trend in other regions, with no increase of mortality or even with a slight reduction (see for example Lazio, Sicily). Second, with reference to the causes of excess of mortality, the number of total deaths in regions with the higher frequency of death is higher than the total official number of COVID-19 related deaths (as declared by official data of the Italian Minister of Health) (for example, about 28.000 total COVID-19-related deaths in Italy in the months of

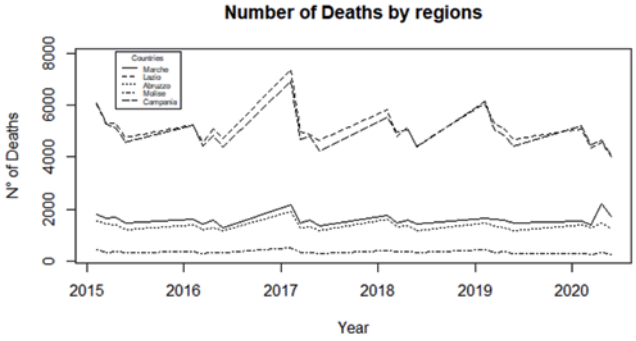

Figure 3. Total mortality for month in 5 regions (5 regions-Marche, Lazio, Abruzzo, Molise, Campania).

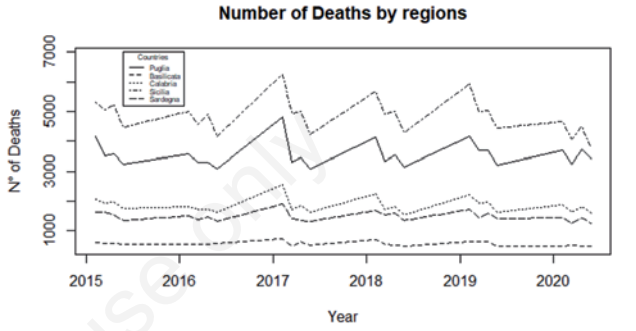

Figure 4. Total mortality for month in 5 regions (5 regions-Apulia, Basilicata, Calabria, Sicily, Sardinia).

Table 2. Total Mortality for month in the 5 regions - Veneto, Friuli-Venezia Giulia, Emilia Romagna, Tuscany, Umbria.

Years	Veneto	Friuli-Venezia Giulia	Emilia Romagna	Tuscany	Umbria
January 2015	5317	1606	5274	4644	1129
February 2015	4400	1371	4716	4156	1019
March 2015	4471	1365	4792	4107	1017
April 2015	4022	1228	4099	3726	908
January 2016	4553	1379	4595	4031	992
February 2016	4285	1274	4137	3485	851
March 2016	4549	1281	4289	3782	896
April 2016	3776	1149	3924	3449	860
January 2017	5629	1780	6065	5345	1234
February 2017	4413	1370	4302	3813	854
March 2017	4374	1295	4346	3838	941
April 2017	3923	1130	3907	3426	830
January 2018	4919	1407	5165	4388	1074
February 2018	4297	1344	4307	3832	854
March 2018	4519	1441	4623	4050	917
April 2018	4000	1193	3961	3408	790
January 2019	4884	1428	4957	4327	1061
February 2019	4645	1303	4512	3961	945
March 2019	4248	1220	4642	3981	995
April 2019	3799	1130	3865	3516	825
January 2020	4474	1353	4549	3942	932
February 2020	4000	1137	4210	3536	826
March 2020	5109	1384	7556	4349	988
April 2020	4749	1256	5885	4002	795

Table 3. Total mortality for month in the first 5 regions - Marche, Lazio, Abruzzo, Molise, Campania.

Years	Marche	Lazio	Abruzzo	Molise	Campania
January 2015	1788	6054	1526	415	6089
February 2015	1656	5311	1423	329	5271
March 2015	1702	5318	1390	366	5135
April 2015	1467	4754	1213	321	4559
January 2016	1614	5231	1380	339	5222
February 2016	1427	4567	1189	299	4424
March 2016	1588	5096	1291	315	4843
April 2016	1285	4709	1176	312	4376
January 2017	2173	7380	1920	502	6936
February 2017	1478	4978	1289	303	4696
March 2017	1572	4868	1306	334	4787
April 2017	1361	4659	1168	283	4240
January 2018	1768	5814	1618	385	5540
February 2018	1477	4776	1314	355	4969
March 2018	1568	5178	1357	344	5033
April 2018	1415	4422	1170	314	4388
January 2019	1661	6082	1473	420	6164
February 2019	1630	5280	1351	318	5063
March 2019	1593	5103	1298	355	4841
April 2019	1462	4664	1177	277	4437
January 2020	1532	5097	1374	281	5209
February 2020	1404	4364	1265	249	4475
March 2020	2221	4575	1452	300	4645
April 2020	1739	4003	1240	233	4045

Table 4. Total mortality for month in the first 5 regions - Apulia, Basilicata, Calabria, Sicily, Sardinia).

Years	Apulia	Basilicata	Calabria	Sicily	Sardinia
January 2015	4168	611	2063	5293	1617
February 2015	3511	587	1930	5047	1626
March 2015	3584	585	1960	5214	1546
April 2015	3246	539	1754	4485	1353
January 2016	3576	561	1807	4998	1498
February 2016	3291	543	1709	4572	1399
March 2016	3292	540	1730	4892	1489
April 2016	3069	567	1639	4169	1323
January 2017	4805	725	2563	6267	1903
February 2017	3300	495	1734	4927	1422
March 2017	3440	629	1844	4987	1367
April 2017	3085	506	1645	4211	1317
January 2018	4145	711	2235	5674	1705
February 2018	3318	558	1737	4893	1549
March 2018	3544	513	1808	5008	1601
April 2018	3150	490	1553	4275	1349
January 2019	4158	632	2226	5940	1737
February 2019	3689	653	1944	5004	1459
March 2019	3708	649	1968	5038	1593
April 2019	3198	495	1639	4437	1426
January 2020	3710	484	1888	4671	1440
February 2020	3239	525	1616	4062	1249
March 2020	3744	486	1818	4491	1454
April 2020	3421	479	1601	3773	1251

March and April of 2020).[13] Further research is needed to better understand these data.

Third, it aimed to discuss age differences in the trend of mortality during the first month of 2020, with a focus on oldest old. According to Italian National Institute of Statistics, the total increase in mortality is explained at 76.3% by people over the age of 80, 20% by people aged 65 to 79. Furthermore, the excess mortality observed is higher in the higher ages and it is more pronounced in men than in women (Report_ISS_Istat_2020_5_marzo.pdf). Other papers demonstrated again an age-effect, where the excess of mortality affects more the older ages.[14,15] Again, further research is needed on this topic to better understand these data. By now, we can only propose some general hints of analysis: 1. the excess of mortality could be the effect of the high pressure that the outbreak put on Italian Health system 2. a part of the excess mortality would still be linked to the contagion from COVID19 but in people who died in their homes for which the presence of the virus was not detected. Both hypotheses are consistent with what emerged in that period. Again, with reference to the first hypothesis, the high burden due to COVID-19 pandemic on the Italian health system could have had the indirect effect of increase other causes of deaths (like the ones related to other disorders or diseases for which individuals had difficulty to access to care during the more critical phases of pandemic). In summary, in agreement with Wolf and colleagues (2020),[16] we could assume that excess deaths attributed to causes other than COVID-19 could reflect deaths from unrecognized or undocumented infection or deaths among uninfected individuals resulting from other effect produced by the pandemic, like the huge pressure on health system.[17,18]

This phenomenon could have had a higher effect on some countries, and in Italy in the North regions that are the first that have fight against pandemic (even if they had also the stronger health system). The same phenomenon could have had a higher effect on some group of oldest old, that from this perspective seems the more vulnerable group, mainly when they live in rest homes, nursing homes and similar facilities, like long-term care facilities,[19,20] because, unfortunately, in the first phase of the outbreak, these institutions acted as a sort of incubator of infection. Some data demonstrated that for people living in Long-Term Care Facilities the risk of death increased about 4 times during the more critical phases of pandemic when compared to the previous years in some regions of Italy.[20]

Moreover, further research is also needed to better understand different effects on other regions, in the center and in the South of Italy, where there had been a peculiar pattern of deaths.

We strongly believe that further research is needed in the field, even with a higher attention to the other phases of pandemic, like the current one. In this paper we choose to address the first months of 2020 because we consider these months as a clear model of the acute effect of pandemic and of the outbreak emergency, while the analysis of the other phases and of the current one, could give us some information about the effects of the pandemic on a longer time. Some lessons are learned about the acute phase of the pandemic: from an intervention perspective, these data could be useful to Government, scientific societies, stakeholders and health policy makers for planning and implementing specific interventions during the current and future steps of the COVID-19 Pandemic, taking into account a region-level approach (and even a province-level approach).[12,21] Moreover, the same data are useful with the aims to define specific measures to prevent infection (like pharmacological ones, non-pharmacological ones and vaccines) and to prevent other general negative effect on Health system and on individual lives.[1,12,16-18,22-24]

Table 5. Comparison between March 2020 and the mean of March 2015-2019.

	Inhabitants (31.12.2019)	Inh/km^2	March 2015-2019 (daily deaths)		March 2020 (daily deaths)	Difference (+/-)
			Mean	d.s.		
Lombardy	10.027.602	420	279,05	8,27	806,35	527,3
Lazio	5.755.700	334	164,92	4,71	147,58	-17,34
Campania	5.712.143	418	158,96	4,29	149,84	-9,12
Veneto	4.879.133	266	142,97	3,53	164,81	21,84
Sicily	4.875.290	189	162,19	3,39	144,87	-17,32
Emilia-Romagna	4.464.119	199	146,4	6,14	243,74	97,34
Piedmont	4.311.217	170	150,97	4,66	220,68	69,71
Apulia	3.953.305	202	113,34	4,52	120,77	7,43
Tuscany	3.692.555	161	127,47	3,99	140,29	12,82
Calabria	1.894.110	124	60,06	2,94	58,65	-1,41
Sardinia	1.611.621	67	49,00	2,77	46,90	-2,1
Liguria	1.524.826	282	62,55	2,80	95,29	32,74
Marche	1.512.672	160	51,76	1,60	71,64	19,88
Abruzzo	1.293.941	119	42,85	1,24	46,84	3,99
Friuli Venezia Giulia	1.206.216	152	42,59	2,45	44,64	2,05
Trentino-Alto Adige	1.078.069	79	27,64	1,53	44,00	16,36
Umbria	870.165	103	30,75	1,48	31,87	1,12
Basilicata	553.254	55	18,81	1,66	15,68	-3,13
Molise	300.516	67	11,05	0,56	9,68	-1,37
Valle d'Aosta	125.034	38	4,16	0,28	6,26	2,1

Table 6. *t*-test on the comparison between March 2020 and the mean of March 2015-2019.

	T test	P
Lombardy	127,52	s.
Lazio	-7,36	s.
Campania	-4,25	n.s.
Veneto	12,37	s.
Sicily	-10,21	s.
Emilia-Romagna	31,71	s.
Piedmont	29,92	s.
Apulia	3,288	n.s.
Tuscany	6,43	n.s.
Calabria	-0,956	n.s.
Sardinia	-1,52	n.s.
Liguria	23,39	s.
Marche	24,85	s.
Abruzzo	6,46	n.s.
Friuli Venezia Giulia	1,67	n.s.
Trentino-Alto Adige	21,39	s.
Umbria	1,51	n.s.
Basilicata	-3,77	n.s.
Molise	-4,89	n.s.
Valle d'Aosta	15,00	s.

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Key words: COVID-19 outbreak; ISTAT; Deaths; Italy; Mortality

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Conflict of interest: The authors declare no potential conflict of interest.

Ethical approval: not applicable

Availability of data and material: We analyzed daily data on total mortality in the first four months of 2020 in Italy published by ISTAT (Italian National Institute of Statistics). Data are available on https://www.istat.it/it/archivio/254507

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