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IMPACT OF COVID-19 EPIDEMIC ON TOTAL MORTALITY OF THE RESIDENT POPULATION FIRST QUARTER 2020

This Report is produced jointly by the National Institute of Statistics and the Higher Institute of Health (Iss). The aim is to provide an integrated reading of epidemiological data on the spread of the Covid-19 epidemic and total mortality data acquired and validated by Istat. The main results are presented at provincial level and by aggregations of provinces, both for criteria of administrative nature (regions, breakdowns) and on the basis of the degree of spread of the Covid-19 epidemic in the provinces themselves, compared to three classes identified.

The total mortality figures commented on refer to the first consolidated quarter 2020 and concern 6,866 municipalities (87 % of the total 7,904). This is the first time that ISTAT has disseminated this information to such a large number of municipalities. This has been made possible thanks to the integration of the registry source (ANPR and municipalities) with the tax registry data1. The extensive database, relating to 86% of the population resident in Italy, makes it possible to assess the impact of the spread of Covid-19 on total mortality by gender and age in the initial period and the most rapid spread of the contagion: March 2020.

The Istituto Superiore di Sanità has the task of coordinating the Integrated National Surveillance Covid- 19, through Ordinance 640 of the Presidency of the Council of Ministers - Department of Civil Protection of 27/2/2020 (Further urgent civil protection interventions in relation to the emergency related to the health risk associated with the onset of pathologies deriving from transmissible viral agents).

The Surveillance Unit collects individual data of Covid-19 positive subjects, in particular personal data, data on domicile and residence, some laboratory information and others on hospitalization and clinical status (synthetic indicator of symptomatology severity), the presence of some risk factors (basic chronic diseases) and the final outcome (healed or deceased). The data, related to all the Covid-19 cases microbiologically diagnosed (nose-pharyngeal swab positive for SARS-Cov-2) by the regional reference laboratories, are collected by the Autonomous Regions/Autonomous Provinces through a dedicated web platform and updated daily2. The data commented in the report are being continuously refined. Therefore, it was decided to limit the reference period to the first quarter of 2020 so that the analysis of the impact of the Covid-19 outbreak on the total mortality of the resident population is carried out on data as consolidated as possible3.

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[1] For information on the quality and coverage of mortality data see the Methodological Note attached to the Report.

[2] It should be noted that the data of the Integrated National Surveillance Covid-19 of the ISS are not perfectly aligned with the flow of the Civil Protection and the Ministry of Health which report aggregated data sent daily by the regions
http://opendatadpc.maps.arcgis.com/apps/opsdashboard/index.html#/b0c68bce2cce478eaac82fe38d4138b1

[3] Integrated Surveillance database extraction date 26 April 2020, ANPR extraction date 28 April 2020.

SUMMARY OF THE MAIN RESULTS

👥 The first Italian case of Covid-19 is reported in Lombardy on February 20, 2020. The entire epidemic was characterised by local transmission, apart from the first 3 cases imported from China at the end of January 2020. To contain the epidemic, preventive public health measures were taken to "social distancing" initially located in some restricted areas and gradually extended to the whole of Italy from 11 March 2020 (lockdown).

👥 The geographical spread of the Covid-19 epidemic is heterogeneous: it was very limited in the Southern Regions and Islands, on average higher in the Centre than in the South and very high in the Northern regions.

👥 Despite the decline in contagions due to "social distancing" measures taken since the beginning of March, the national curves of diagnosed cases and deaths only started to decrease in the last days of March.

👥 52.7% of cases (104,861) are female. The median age is 62 years (range 0-100). In the age range 0-9 years, 60-69 and 70-79 years there is a higher number of male cases. In the age group >90 years, the number of female subjects is more than three times higher than that of male subjects probably due to the clear prevalence of women in this age group.

👥 Lethality is highest in male subjects in all age groups, except for the 0-19 age group. In 34.7% of reported cases, at least one co-morbidity is reported (one among: cardiovascular diseases, respiratory diseases, diabetes, immune deficits, metabolic diseases, oncological diseases, obesity, kidney diseases or other chronic diseases).

👥 Of the 14,324 deaths recorded at 31 March in persons diagnosed with Covid-19, 13,710 (96% of the total) were considered in this analysis, selected on the basis of the availability of the Municipality of residence in the Covid-19 Integrated Surveillance data and the presence of the Municipality among the 6,866 selected by Istat.

👥 Considering the month of March, a 49.4% increase in deaths was observed at national average level for all causes. If we take as a reference the period from the first Covid-19 death reported to the Integrated Surveillance System (20 February) until 31 March, deaths increase from 65,592 (average period 2015-2019) to 90,946 in 2020. The excess of deaths is 25,354, of which 54% are Covid-19 diagnosed deaths (13,710). Due to the high concentration of the phenomenon in some areas of the country, the data reported at national average level "flatten" the size of the impact of the Covid-19 epidemic on total mortality.

👥 91% of the excess mortality found at the national average level in March 2020 is concentrated in the areas of high prevalence of the epidemic: 3,271 municipalities, 37 northern provinces plus Pesaro and Urbino. In all of these provinces, deaths from all causes more than doubled compared to the 2015-2019 average for the month of March. If we consider the period from 20 February to 31 March, deaths rose from 26,218 to 49,351 (+ 23,133); just over half of this increase (52%) is made up of deaths reported to the Covid-19 Integrated Surveillance System (12,156). Within this grouping the provinces most affected by the epidemic paid a very high price in human lives, with percentage increases in deaths in March 2020, compared to March 2015-2019, in three figures: Bergamo (568%), Cremona (391%), Lodi (371%), Brescia (291%), Piacenza (264%), Parma (208%), Lecco (174%), Pavia (133%), Mantova (122%), Pesaro and Urbino (120%).

In the areas with a medium spread of the epidemic (1,778 municipalities, 35 provinces mainly in the Center-North) the increase in deaths for all the causes in the period from 20 February to 31 March is much more contained, from 17,317 to 19,743 (2,426 more than the average for 2015-2019); 47% can be attributed to deaths with positive results at Covid-19 (1,151). Finally, in areas with a low prevalence (1,817 municipalities, 34 provinces mostly in the Centre and the South), deaths in March 2020 were on average 1.8% lower than the average for the previous five years.

The highest excess mortality rate is found for men aged 70-79 years: deaths increase about 2.3 times between 20 February and 31 March; the 80-89 age group follows (almost 2.2 times increase). The increase in mortality in women, on the other hand, is more limited for all age groups. It reaches 20% more than the average of the years 2015-2019 at the end of March, both for the age group 70-79 and 90 and more.

The combined analysis of ISTAT daily mortality data with data from the Iss Integrated Surveillance showed that the "direct" mortality attributable to Covid-19 in individuals with a confirmed diagnosis was approximately 13,700 deaths in the first quarter of 2020.

There is an additional share of about 11 others.600 deaths for which we can, with the data available today, only speculate on three possible causes: a further mortality associated with Covid-19 (deaths in which the swab was not performed), an indirect mortality related to Covid-19 (deaths from dysfunction of organs such as heart or kidneys, probable consequences of the disease triggered by the virus in untested people, as happens by analogy with the increase in mortality from cardiorespiratory causes during influenza) and, finally, a share of indirect mortality not related to the virus but caused by the crisis of the hospital system and the fear of going to hospital in the most affected areas.

Comparing total and Covid-19 deaths in 2020 with deaths in March 2017[4] shows that, since the beginning of March, the number of Covid-19 deaths with confirmed diagnosis in the areas of the epidemic is higher than in 2017 for other diseases such as diabetes, dementia and Alzheimer's disease. In the middle of the same month the number of Covid-19 deaths exceeds the deaths caused by all respiratory diseases and cancers; in just over twenty days the daily deaths reported to the Covid-19 Integrated Surveillance exceed the daily number of deaths for all causes in March 2017. The analysis of all causes of death in 2020 will make it possible to assess how much of the excess mortality observed in 2020 is also attributable to the deaths of people not tested but certified by doctors on the basis of a clinical diagnosis of Covid-19 (which are not currently counted in the surveillance) and how much of the indirect effects are related or not to the epidemic.

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[4] The year 2017 is the latest available for official data on mortality by cause issued by Istat.

The "Three Italies" of the Covid-19 epidemic highlighted by the Covid-19 Integrated Surveillance System

In Italy from February 20, the date the epidemic began, until April 28, 2020, 199,740 positive cases of Covid-19 diagnosed by the regional reference laboratories were reported to the Integrated National Surveillance System, of which 113,312 until March 31, 2020 (reference period of this Report).

The geographical spread of the Covid-19 epidemic is heterogeneous. In the southern regions and islands, the spread of infections was very low, in the Centre, on average, it was higher than in the South, while in the North, the virus circulation was very high.

In order to assess the spread within the Provinces and eliminate the heterogeneity due to the different age structures of the corresponding populations, the standardized cumulative incidence rates [5] at March 31 of confirmed positive cases of infection were calculated; the standard used is the Italian Population at the 2011 Census.

The distribution of these rates has been divided into three classes: the first class, defined as "low" diffusion, includes provinces with rate values below 40 cases per 100 thousand residents; the second class, defined as "medium" diffusion, includes provinces with rate values between 40 and 100 cases per 100 thousand residents; the third class, defined as "high" diffusion, includes provinces with values above 100 cases per 100 thousand residents6.

Figure 1 shows the trend in the number of Covid-19 cases reported by sampling/diagnosis date (available for 110,277 of 113,312 cases) in low, medium and high incidence areas. The epidemic curve shows an early start of the epidemic in high incidence areas that reach their peak on March 20, 2020 and then decrease steadily thereafter.

Figure 1. Daily trend of cases reported to the Covid-19 National Surveillance System. First quarter 2020
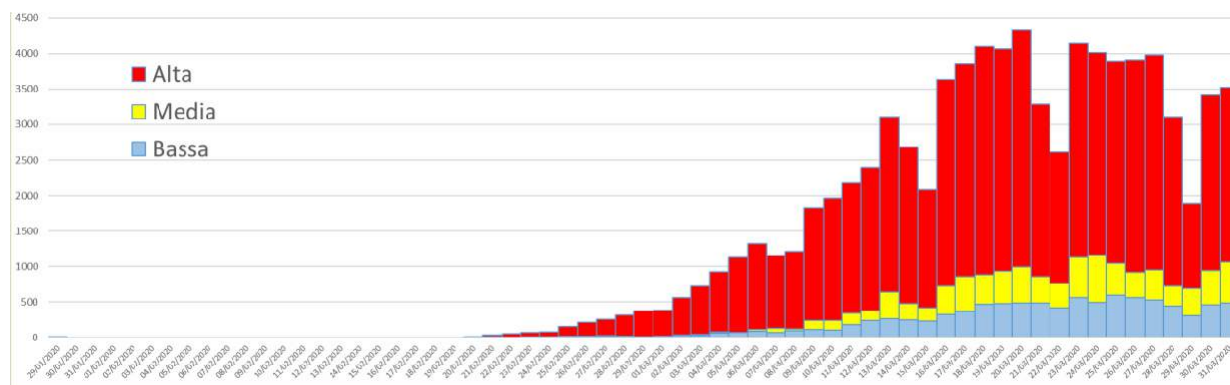
Source: Iss surveillance register Covid-19

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[5] See glossary

[6] Riccardo et al. Epidemiological characteristics of Covid-19 cases in Italy and estimates of the reproductive numbers one month into the epidemic. https://www.medrxiv.org/content/10.1101/2020.04.08.20056861v1.full.pdf; Bollettino Sorveglianza Integrata Covid-19, 30 Aprile 2020, Iss. https://www.epicentro.iss.it/coronavirus/bollettino/Bollettino-sorveglianza-integrata-Covid-19_28-aprile-2020.pdf

In medium and low incidence areas, the number of cases starts to increase from mid-March, reaching a peak between 24 and 25 March 2020, respectively. For these areas, after reaching the peak, there has not been a constant decrease, a clear sign that the epidemic, even if in a slower manner, is still ongoing. It should be noted, however, that the curve of cases diagnosed has slowed down, especially because of the "lockdown" measures taken first in some areas of the North and then throughout the country since March 11.

52.7% of cases (104,861) are female. The median age is 62 years (range 0-100). In the age range 0-9 years, 60-69 and 70-79 years there are more cases among men than women. In the >90 age group, women are more than three times as many as men probably due to the clear predominance of women in this age group.

Trends in Covid-19 integrated surveillance deaths

The Integrated Surveillance Unit, which began collecting data on deaths as of February 20, recorded 14,324 deaths up to March 31 in persons notified as positive to Covid-19; of these, 13,710 (96% of the total) were considered in this analysis, based both on the availability of the Municipality of residence and the presence of the Municipality among the 6,866 selected by Istat (Figure 2). It should be noted that the death curve substantially reflects that of the cases in Figure 1 but is substantially delayed by one to two weeks.

The vast majority of deaths occur in the provinces defined as high diffusion (89%), where it is 8% in medium diffusion areas and 3% in low diffusion areas. 32% of total deaths involved the female gender, this proportion remains unchanged within the class defined as high prevalence while it is slightly higher in the other two classes (34% for medium prevalence, 35% for low prevalence).

Figure 2. Daily occurrence of deaths reported to the National Surveillance System Covid-19. First quarter 2020.
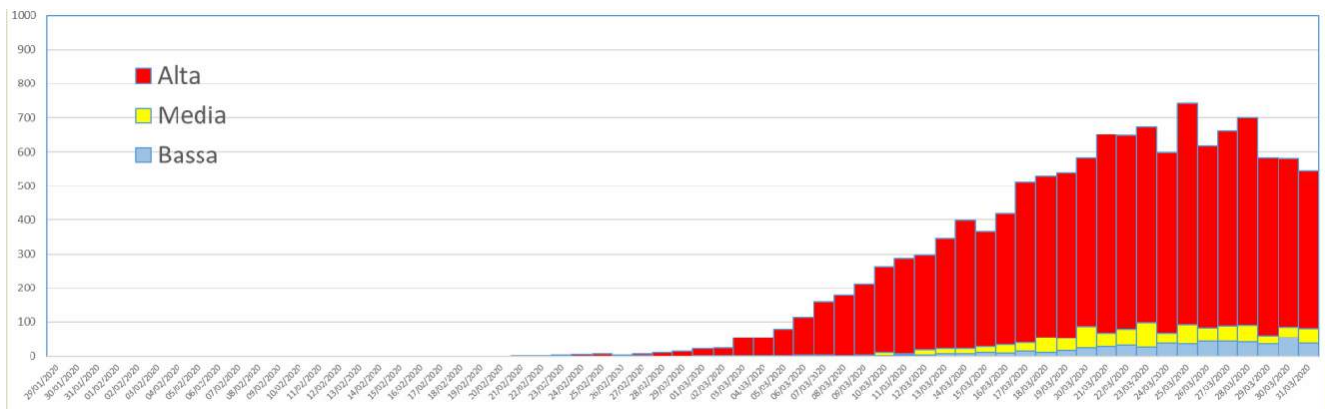
Source: Iss, Covid-19 Integrated Surveillance Deaths

The age distribution of Covid-19 deaths has been shown several times in *ISS7 Reports.*
As at 31 March, only 1% were under 50 years of age, which is why the assessments

on the contribution that the deaths reported to the Covid-19 Integrated Surveillance had on the excess mortality are subsequently made by limiting the analyses to the deaths of subjects at least 50 years old. Considering the distribution by five-year age group, the median age group at death is 80-84 (75-79 for men and 80-84 for women).

The Covid-19 deaths reported to the integrated surveillance are equal to 15% of the total recorded in the period from 20 February to 31 March; if we consider the three classes of diffusion they are about 25% of the total deaths in the provinces with high diffusion, 6% of those in the provinces with medium diffusion and 2% in those with low diffusion (Table 1).

ISTAT data on deaths: sharp increase as of end February 2020

One of the most dramatic consequences of the effects of the epidemic is the overall increase in deaths. On the other hand, the death figures reported to Integrated Surveillance Covid-19 provide only a partial measure of these effects, as they relate only to deaths after a microbiological diagnosis of virus positivity. It is therefore an indicator influenced not only by the way in which causes of death are classified, but also by the presence of a virus positive test.

A more universal measure of the impact of the epidemic on population mortality is the excess number of deaths, for all causes, resulting from the comparison, for the same period, of the figure for 2020 with the average number of deaths in the previous five years (2015-2019). In this way, it is implicitly assumed that the spread of the epidemic will produce an increase in deaths even if not directly related to Covid-19 surveillance, i.e. the number of positive deaths.

Considering the period from 20 February to 31 March, a 38.7% increase in deaths for all causes is observed at a national average level: from 65,592 to 90,946, compared to the same period of the five-year average of 2015-2019 (Table 2). The excess number of deaths is 25,354, of which 54% is made up of deaths diagnosed reported to Covid-19 surveillance (13,710).

There is an additional share of about 11 others.600 deaths for which we can, with the data available today, only speculate on three possible causes: a further mortality associated with Covid-19 (in cases where the swab was not performed), indirect mortality related to Covid-19 (deaths from dysfunction of organs such as heart or kidneys possible consequence of the disease triggered by the virus in untested people as happens by analogy with the increase in mortality from cardiorespiratory causes during influenza), and finally an indirect mortality not related to the virus but caused by the crisis of the hospital system in the most affected areas.

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[7] *https://www.epicentro.iss.it/coronavirus/bollettino/Bollettino-sorveglianza-integrata-Covid-19_28-aprile-2020.pdf) .*

It should be borne in mind that, due to the high concentration of the phenomenon in some areas of the country, the data reported at national average level flatten the size of the impact of Covid-19 on total mortality.

The study of total mortality trends associated with the -Covid-19 epidemic cannot ignore the distribution of cases by SARS-CoV-2 infection, and its differential distribution over the territory. The classification of the provinces into three classes of spread of the epidemic makes it possible to assume with respect to a phenomenon that is strongly localized the most appropriate observation point to grasp its full extent in terms of excess mortality directly or indirectly associated with the epidemic.

91% of the excess mortality found at the national average level is concentrated in the areas of high prevalence of the epidemic: 3,271 municipalities, 37 northern provinces plus Pesaro and Urbino (Table 2). In all these provinces, deaths from all causes more than doubled in March 2020 compared to the average recorded in March in the five-year period 2015-2019. Considering the period from 20 February to 31 March 2020, deaths rose from 26,218 to 49,351 (+ 23,133); just over half of this increase (52%) is made up of positive deaths at Covid-19 (12,156).

In areas with a medium spread of the epidemic (1,778 municipalities, 35 provinces mainly in the centre-north) the increase in deaths due to all the causes is much more limited: from
17,317 to 19,743 (2,426 more than the 2015-2019 average); 47% is attributable to positive deaths at Covid-19 (1,151). Finally, in areas with a low prevalence (1,817 municipalities, 34 provinces mostly in the Centre and the South), deaths in March 2020 were on average 1.8% lower than the average of the previous five years.

Table 1. Deaths for all causes and for Covid-19(a) in the first quarter of 2020, comparison with the average for the same period of 2015-2019, spread class of the epidemic, region, distribution and Italy.

REGION	% communes Population January-February	% March 31	change % average change 2020/ average 2015-2019	change % change March 2020/ 2019	Total deaths 20 February 31 March 2020	Total deaths 20 February 31 March 2015-2019	Covid deaths March 2020	/ deaths total February 20-31 March 2020
Piedmont	92,7	93,3	-10,9	47,0	7.859	5.747	1.018	13,0
Aosta Valley	91,9	91,2	-9,4	60,1	231	160	70	30,3
Lombardy	95,8	97,1	-7,5	186,5	27.279	11.195	8.362	30,7
Trentino-South Tyrol	90,8	92,4	-1,8	65,2	1.613	1.053	281	17,4
Veneto	87,0	87,2	-3,6	24,3	6.097	5.098	511	8,4
Friuli-Venezia Giulia	88,4	73,4	-4,3	9,8	1.350	1.244	57	4,2
Liguria	87,6	92,3	-14,1	50,3	3.234	2.364	368	11,4
Emilia-Romagna	89,9	94,6	-6,8	70,1	8.739	5.631	1.890	21,6
Tuscany	83,9	89,1	-7,9	13,8	5.089	4.606	226	4,4
Umbria	88,0	93,8	-9,2	7,0	1.220	1.173	37	3,0
Brands	84,2	83,4	-5,1	53,3	2.465	1.736	328	13,3
Lazio	73,3	80,9	-8,5	-8,1	5.211	5.605	158	3,0
Abruzzo	85,6	85,2	-2,9	8,8	1.706	1.539	64	3,8
Molise	81,6	73,5	-10,1	4,2	354	338	4	1,1
Campania	78,0	79,3	-4,7	-1,9	5.117	5.168	79	1,5
Puglia	81,3	85,0	-4,8	8,7	4.327	4.003	118	2,7
Basilicata	83,2	75,0	-1,6	-7,2	583	588	5	0,9
Calabria	80,0	77,0	-4,2	-1,0	1.918	1.902	18	0,9
Sicily	71,0	73,4	-5,4	-2,7	4.847	4.948	77	1,6
Sardinia	86,7	75,6	1,1	13,7	1.707	1.495	39	2,3
North	**92,2**	**92,8**	**-7,6**	**94,9**	**56.402**	**32.491**	**12.557**	**22,3**
Center	**80,2**	**84,7**	**-7,9**	**9,1**	**13.985**	**13.120**	**749**	**5,4**
Noon	**80,2**	**78,7**	**-4,3**	**2,0**	**20.559**	**19.981**	**404**	**2,0**
ITALY	**86,9**	**86,4**	**-6,6**	**49,4**	**90.946**	**65.592**	**13.710**	**15,1**
Diffusion class								
High	92,8	93,8	-7,3	113,2	49.351	26.218	12.156	24,6
Media	86,3	87,2	-6,9	18,0	19.743	17.317	1.151	5,8
Low	78,3	78,5	-5,6	-1,8	21.852	22.057	403	1,8

Source: Istat. Integrated municipal daily mortality database, Iss surveillance register Covid-19
Notes: (a) Covid-19 integrated surveillance deaths.

Considering the trend of deaths for all the causes in the first two months of 2020, compared to 2015-2019, and that in March 2020, it can be seen that in the latter month there is an important "break" in the downward trend of mortality in early 2020. Even when there is no clear reversal of the trend, in fact, the decrease in deaths in March 2020 is much smaller than in the previous two months.

At the regional level it is in Lombardy that the most marked inversion can be seen: there is a 7.5% decrease in deaths in the two-year period January-February 2020 - compared to the average in the same period 2015-2019 - to an increase of 185% in March, followed by Emilia-Romagna, with an increase of 70%, Trentino Alto-Adige (65%), and Marche, Liguria and Piedmont, with increases in the order of 50% (Table 1).

Due to the high concentration of the phenomenon, even the synthesis at regional level does not account for the dramatically high intensity that this has assumed in some areas. To this end, a more effective level of territorial detail is undoubtedly the provincial one (Table 2). Within the class of provinces with a high prevalence of the epidemic, the most affected have paid a very high price in human lives with percentage increases in deaths in the month of March 2020, compared to 2015- 2019, in three figures: Bergamo (568%), Cremona (391%), Lodi (370%), Brescia (290%), Piacenza

(264%), Parma (208%), Lecco (174%), Pavia (133%), Mantova (122%), Pesaro and Urbino (120%).

With regard to the excess of deaths for all causes recorded between 20 February 2020 and 31 March, compared to the same period of 2015-2019, deaths in the Covid-19 integrated surveillance are a variable proportion. This proportion is, for example, about 46% in some of the most affected provinces of Lombardy (Bergamo, Cremona, Lecco). Values of this share higher than 60% are recorded in Lodi, Mantua and Pavia, while in Piacenza the share is among the highest in the class of provinces with a high prevalence of the epidemic (68.6%).

Table 2. Deaths for all causes and for Covid-19(a) in the first quarter of 2020, comparison with the average for the same period of 2015-2019, by province and class of spread of the epidemic. Provinces of the **high** diffusion class

PROVINCE% %popolazione	%common change %popolazione	%popolazione change widespread	variation January+February 2020/ average 2015-2019	change % change March 2020/ 2015- average 2019	Total deaths 20 February-31 March 2020	Total deaths 20 February 31 March average 2015-2019	Covid deaths 20 February 31 March 2020	Covid deaths / total deaths 20 February-31 March 2020
Alexandria	95,7	98,2	-12,8	91,0	1.199	693	222	18,5
Ancona	76,6	84,3	-10,7	49,4	704	528	86	12,2
Aosta	91,9	91,2	-9,4	60,1	231	160	70	30,3
Asti	93,2	88,8	-13,9	38,5	382	299	38	9,9
Belluno	83,6	63,9	-11,1	9,9	205	201	14	6,8
Bergamo	97,5	98,4	-6,5	567,6	6.238	1.180	2.346	37,6
Connecting rod	97,3	96,5	-9,5	84,0	471	279	74	15,7
Bologna	85,5	92,7	-8,4	20,0	1.525	1.289	183	12,0
Bolzano/Bozen	93,1	93,9	2,1	65,3	767	499	125	16,3
Brescia	98,0	98,9	-8,9	290,6	4.450	1.385	1.574	35,4
Como	94,6	95,6	-5,8	64,2	1.008	668	174	17,3
Cremona	99,1	99,8	-6,3	391,8	1.999	496	687	34,4
Forlì-Cesena	93,3	98,9	-8,5	24,6	609	506	33	5,4
Imperia	87,9	83,7	-15,0	70,6	453	296	61	13,5
Lecco	96,4	97,8	-6,6	174,5	868	364	238	27,4
Lodi	95,0	98,1	-3,3	370,6	1.056	264	509	48,2
Lucca	84,8	92,1	-4,7	10,1	579	525	29	5,0
Mantua	96,9	96,5	-8,4	122,1	1.021	530	317	31,0
Massa-Carrara	82,4	93,0	-18,6	45,6	385	287	36	9,4
Milan	96,2	98,1	-9,1	92,6	5.990	3.488	1.459	24,4
Modena	95,7	97,8	-4,3	51,4	1.201	837	216	18,0
Monza and Brianza	94,5	97,0	-4,1	96,5	1.528	868	359	23,5
Novara	90,8	92,5	-6,6	80,3	724	445	117	16,2
Padua	84,3	86,7	0,9	15,8	1.085	954	84	7,7
Parma	95,5	99,3	-7,8	208,4	1.549	599	468	30,2
Pavia	94,1	97,0	-4,1	132,9	1.614	789	513	31,8
Pesaro and Urbino	86,8	94,9	1,8	120,4	912	454	157	17,2
Piacenza	91,3	95,5	-13,4	264,0	1.250	416	572	45,8
Reggio Emilia	88,1	93,7	-5,9	79,7	955	588	224	23,5
Rimini	84,0	95,7	-1,9	68,2	577	368	134	23,2
Sondrio	100,0	100,0	-3,8	74,3	380	240	87	22,9
Turin	90,1	94,0	-10,1	29,7	3.469	2.803	403	11,6
Trento	89,2	90,9	-5,2	65,1	846	554	156	18,4
Treviso	88,3	90,9	-6,9	32,4	1.149	893	122	10,6
Trieste	33,3	1,3	2,6	15,4	6	4	2	33,3
Verbano-Cusio-Ossola	95,9	94,0	-13,8	44,4	304	228	55	18,1
Vercelli	93,9	91,8	-14,8	90,8	426	259	54	12,7
Verona	91,8	94,5	-0,7	30,6	1.236	981	158	12,8

Source: Istat. Municipal integrated daily mortality database, Iss surveillance register Covid-19
Notes: (a) deaths of integrated surveillance Covid-19

For an overall assessment of the impact of Covid-19 on total mortality, the evolution of the phenomenon should continue to be monitored in the coming weeks/months. Many of the provinces that are in the medium diffusion class (Table 3) have been affected by the epidemic several weeks later than the provinces in the high diffusion class. The analysis of the trend of deaths in March is therefore not sufficient to capture the phenomenon of the increase in these areas. The consolidation of the mortality and surveillance data of the Covid-19 epidemic for the month of April will allow the construction of more accurate measures.

Similar considerations may apply in the case of some of the provinces with low prevalence, which show increases in overall mortality in March 2020 of more than 5%, despite a still low number of deaths diagnosed Covid-19. This is the case in some provinces of Puglia, and in particular that of its capital (13.1%), as well as in some provinces of Sicily and Sardinia (Table 4).

Table 3. Deaths for all causes and for Covid-19(a) in the first quarter of 2020, comparison with the average for the same period of 2015-2019, by province and class of spread of the epidemic. Provinces of the **middle** class spread

PROVINCE	% common widespread	% population	change % change January+February 2020/ average 2015-2019	change % change March 2020/ 2015- average 2019	Total deaths 20 February 31 March 2020	Total deaths 20 February 31 March average 2015-2019	Covid deaths March 2020	Covid deaths / total deaths 20 February-31 March 2020
Arezzo	88,9	89,4	-0,1	2,5	444	432	7	1,6
Ascoli Piceno	81,8	45,0	-7,1	-3,0	131	126	0	0,0
Avellino	84,7	86,2	-1,5	1,8	510	483	13	2,5
Wedge	91,5	88,0	-11,7	26,8	884	740	55	6,2
Enna	60,0	43,1	1,0	12,2	134	117	10	7,5
Stop	90,0	92,8	0,5	22,9	279	228	35	12,5
Ferrara	90,5	95,8	-2,5	2,7	569	564	34	6,0
Florence	87,8	98,1	-11,0	6,0	1.364	1.326	48	3,5
Foggia	80,3	88,6	-5,3	20,6	771	655	43	5,6
Frosinone	73,6	70,3	-2,0	-1,5	479	466	10	2,1
Genoa	83,6	95,3	-14,8	51,9	1.820	1.329	195	10,7
Gorizia	100,0	100,0	-2,0	-0,5	226	224	2	0,9
Grosseto	89,3	94,1	-0,5	17,5	371	314	4	1,1
La Spezia	93,8	99,1	-10,0	51,7	487	343	50	10,3
Livorno	78,9	89,0	-6,1	20,2	505	453	19	3,8
Macerata	85,5	89,1	-7,4	17,8	439	399	50	11,4
Perugia	84,7	92,1	-11,3	6,9	855	812	23	2,7
Pescara	91,3	96,7	-4,5	21,0	467	383	44	9,4
Pisa	86,5	76,5	-10,8	25,8	487	404	24	4,9
Pistoia	85,0	88,0	-6,5	28,8	444	352	42	9,5
Pordenone	94,0	95,2	-6,7	11,4	406	359	17	4,2
Prato	57,1	89,8	-13,8	1,9	253	265	12	4,7
Ravenna	77,8	82,8	-7,8	14,0	504	463	26	5,2
Rieti	80,8	52,7	-2,9	-16,5	108	126	1	0,9
Rovigo	96,0	95,4	-6,3	22,9	404	353	2	0,5
Sassari	92,4	94,4	-0,6	18,7	630	534	27	4,3
Savona	88,4	84,4	-14,6	28,1	474	395	62	13,1
Siena	74,3	63,5	-1,4	1,2	257	249	5	1,9
Teramo	91,5	97,7	2,2	13,8	447	396	6	1,3
Terni	93,9	98,9	-4,4	7,2	365	361	14	3,8
Udine	86,6	85,5	-3,7	12,3	712	657	36	5,1
Varese	87,0	87,9	-11,0	28,3	1.127	923	99	8,8
Venice	86,4	93,4	-4,8	19,9	1.191	1.027	72	6,0
Vicenza	82,5	73,4	-4,1	27,9	827	687	59	7,1
Viterbo	81,7	82,1	-5,1	-3,1	372	369	5	1,3

Source: Istat. Municipal integrated daily mortality database, Iss surveillance register Covid-19 Notes:
(a) deaths of integrated surveillance Covid-19

Table 4. Deaths for all causes and for Covid-19(a) in the first quarter of 2020, comparison with the average for the same period of 2015-2019, by province and class of spread of the epidemic. Provinces of the **low** prevalence class

| PROVINCE% common	widespread	% population	change % change % January+February 2020/ average 2015-2019	change % change March 2020/ 2015- average 2019	Total deaths 20 February 31 March 2020	Total deaths 20 February 31 March average 2015-2019	Covid deaths / total deaths March 2020	Covid deaths 20 February-31 March 2020
Agrigento	67,4	67,9	-10,2	-8,0	404	437	5	1,2
Bari	80,5	86,0	-6,4	13,1	1.286	1.171	37	2,9
Barletta-Andria-Trani	70,0	59,8	-1,6	24,9	301	236	3	1,0
Benevento	82,1	82,1	-1,1	-4,3	295	298	3	1,0
Toast	95,0	98,4	-4,2	7,2	509	483	17	3,3
Cagliari	82,4	45,6	7,8	6,0	186	174	1	0,5
Caltanissetta	59,1	41,9	-11,4	8,3	175	170	3	1,7
Campobasso	81,0	67,7	-10,2	5,4	231	221	3	1,3
Caserta	73,1	68,7	-3,4	2,1	643	626	10	1,6
Catania	53,4	62,7	-6,6	-1,8	839	850	28	3,3
Catanzaro	76,3	81,6	-11,8	-5,0	356	362	2	0,6
Chieti	87,5	76,5	1,8	3,6	487	445	13	2,7
Cosenza	80,7	64,4	-2,5	1,0	586	581	3	0,5
Crotone	81,5	87,5	-10,5	2,4	178	174	4	2,2
Isernia	82,7	88,7	-10,0	2,0	123	117	1	0,8
The Eagle	78,7	71,4	-13,6	-5,4	305	316	1	0,3
Latina	81,8	83,3	-8,5	-4,6	495	522	9	1,8
Lecce	77,1	76,4	-5,4	0,2	794	783	12	1,5
Matera	74,2	80,5	6,3	-11,3	198	204	1	0,5
Messina	80,6	87,7	-6,3	2,6	840	832	18	2,1
Naples	70,7	81,4	-6,5	-0,9	2.615	2.648	45	1,7
Nuoro	83,8	78,9	2,5	5,5	242	227	6	2,5
Oristano	93,1	91,7	1,3	5,7	226	208	1	0,4
Palermo	76,8	87,6	-2,2	-9,2	1.340	1.417	3	0,2
Power	86,0	72,0	-5,3	-5,0	385	384	4	1,0
Ragusa	75,0	54,7	-11,0	-4,7	232	232	2	0,9
Reggio Calabria	80,4	82,6	-2,1	0,3	611	602	8	1,3
Rome	62,0	82,7	-9,7	-9,4	3.757	4.122	133	3,5
Salerno	78,5	79,0	-3,3	-7,7	1.054	1.114	8	0,8
Syracuse	81,0	87,6	-5,9	0,6	452	445	7	1,5
South Sardinia	79,4	76,9	-0,6	20,0	423	351	4	0,9
Taranto	93,1	98,8	-2,4	-5,0	666	674	6	0,9
Drills	66,7	76,5	-2,1	0,9	431	449	1	0,2
Vibo Valentia	82,0	91,5	5,7	-7,2	187	182	1	0,5

Source: Istat. Integrated municipal daily mortality database, Iss Integrated surveillance system Covid-19
(a) deaths of Covid-19 integrated surveillance

Excess mortality by age and gender

The excess mortality recorded in March 2020 is even more pronounced in men. This is a very important fact because, in addition to revealing a fact now known through Surveillance data, it highlights how the scale of the phenomenon of male super-mortality, in relation to the Covid-19 epidemic, is even wider, probably extending to causes that are not directly related to the virus.

The deviation of mortality from the trend prior to the period in which the emergency started is well highlighted for large age and gender classes in the following graphs (Figure 3). The daily evolution of the deviations of cumulative deaths in 2020 from the corresponding 2015-2019 average clearly shows how the increase in deaths started between the end of February and the first days of March. During the month of March, in the areas most affected by the epidemic, the number of deaths began to increase rapidly compared to the 2015-2019 average for the same period.
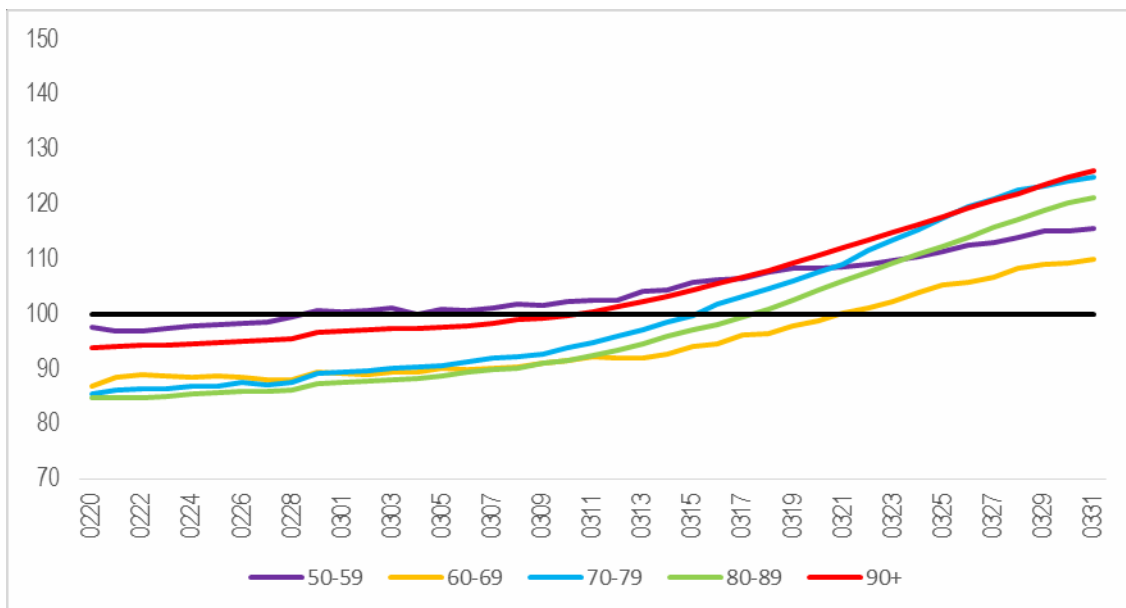
Figure 3. Cumulative male deaths since January 1 by age group. Per 100 deaths in the same age group based on average 2015-2019. Provinces with **high** Covid-19 prevalence. Period: 20/02/2020-31/03/2020
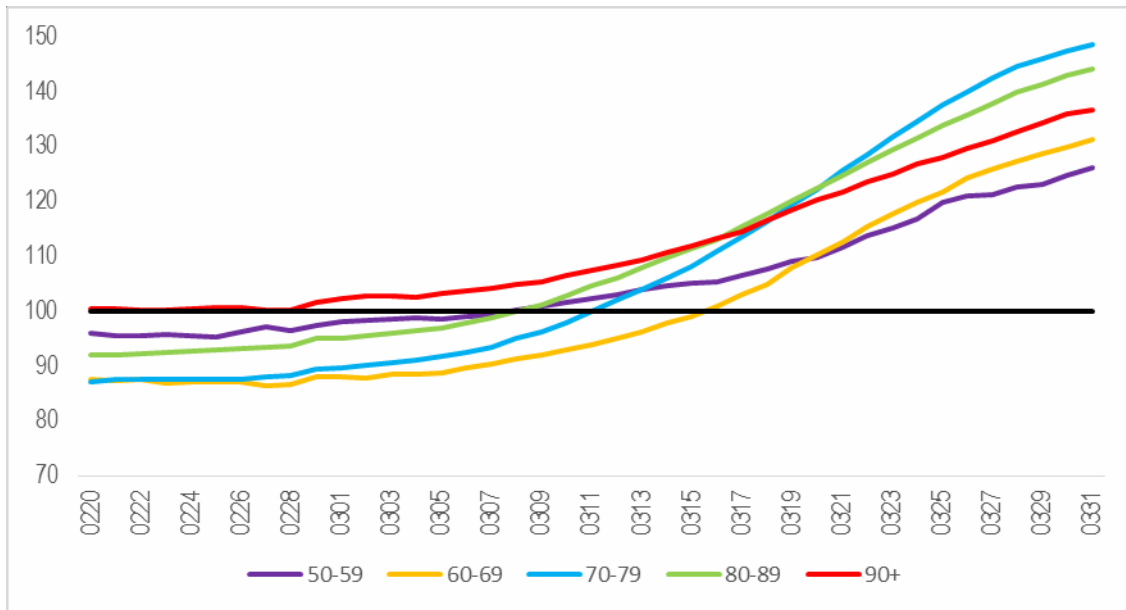
Source: Istat. Integrated municipal daily mortality database

The most consistent excess mortality rate is found for men aged 70-79, with cumulative deaths from 1 January to 31 March 2020 increasing by about 50 percentage points compared to the same period of the 2015-2019 average; the 80-89 age group follows (+ 44%). The increase in mortality in women is, on the other hand, more contained for all age groups; at the end of March it reaches 20% more than the average for the years 2015-2019, both for the age group 70-79 and 90 and over.

Figure 3 (continued). Cumulative female deaths since January 1 by age group. Per 100 deaths in the same age group based on average 2015-2019. Provinces with **high** Covid-19 prevalence. Period: 20/02/2020-31/03/2020
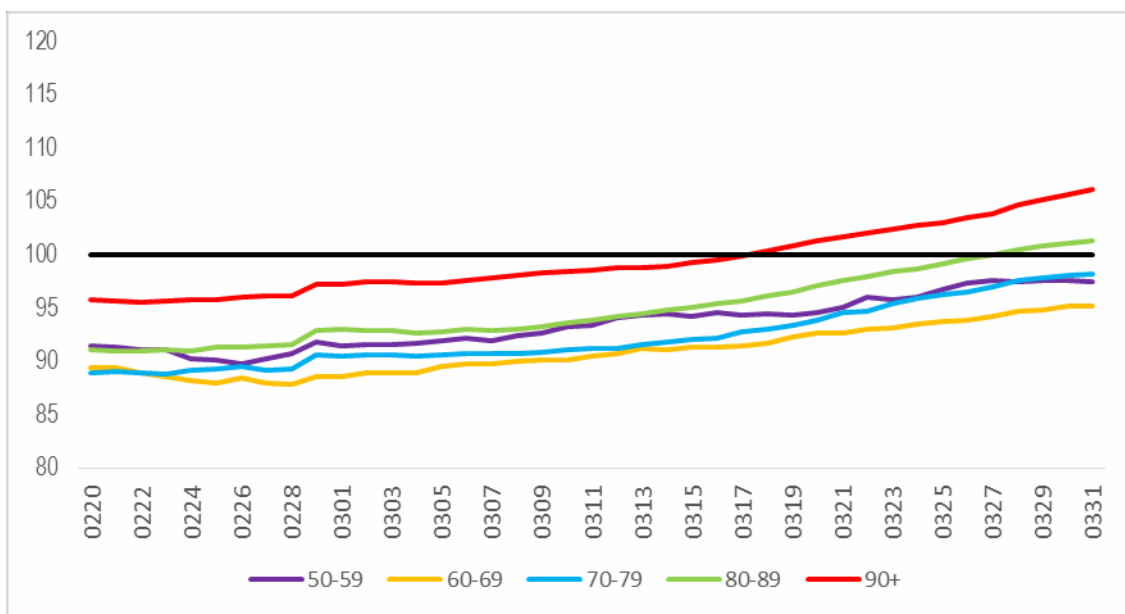

Source: Istat. Integrated municipal daily mortality database

Moving from the areas most affected by Covid-19 to those where the spread was less intense, the excess mortality shifts forward in time and is reduced.

Figures 4 and 5 refer, respectively, to age groups in the provinces with medium and low prevalence of the epidemic. Due to the smaller scale of the phenomenon, cumulative deaths are considered for males and females as a whole.

Figure 4. **Cumulative deaths from January 1 by age group.** Per 100 deaths in the same age group as the 2015-2019 average. Provinces with **medium** Covid-19 prevalence. Period: 20/02/2020-31/03/2020

Source: Istat. Integrated municipal daily mortality database

In the provinces with a medium spread of the epidemic there has been a deviation from the pre-crisis trend, which began after the end of the second week; in particular, there is an increase in deaths accumulated in older age groups: for 90 years and more at 31 March they are about 6% higher (in this age group in the period from 20 February to 31 March there is a 21% increase in deaths compared to the 2015-2019 average). For the provinces with low prevalence there is an excess of deaths, compared to 2015-2019, only referred to ages 90 and over (3% more on 31 March).

Figure 5. Cumulative deaths as of January 1 by age group. Per 100 deaths in the same age group as the 2015-2019 average. Provinces with **low** Covid-19 prevalence. Period: 20/02/2020-31/03/2020
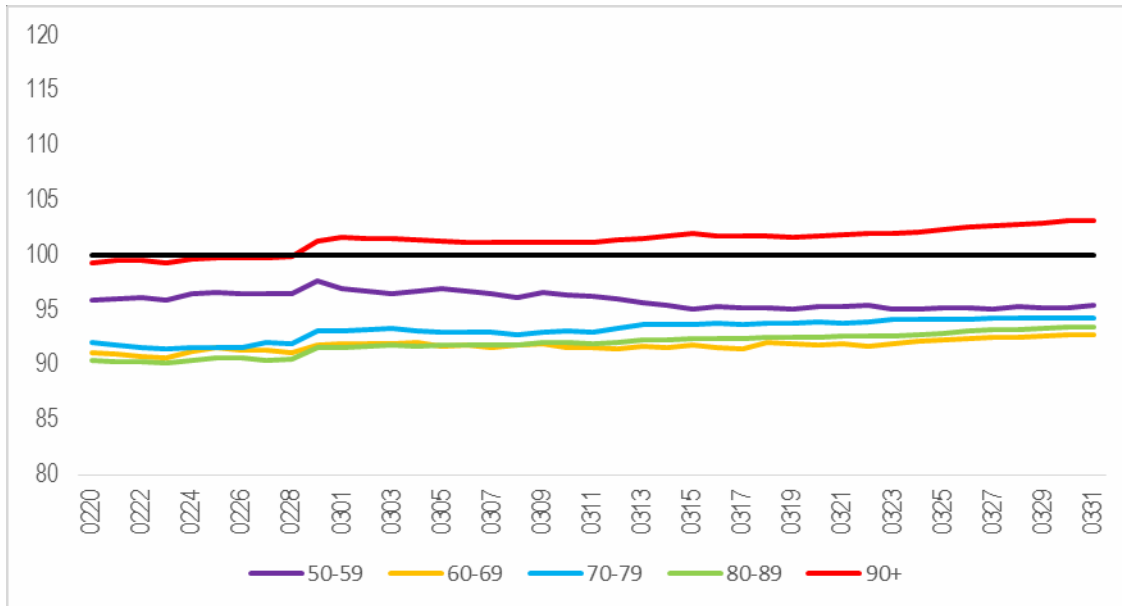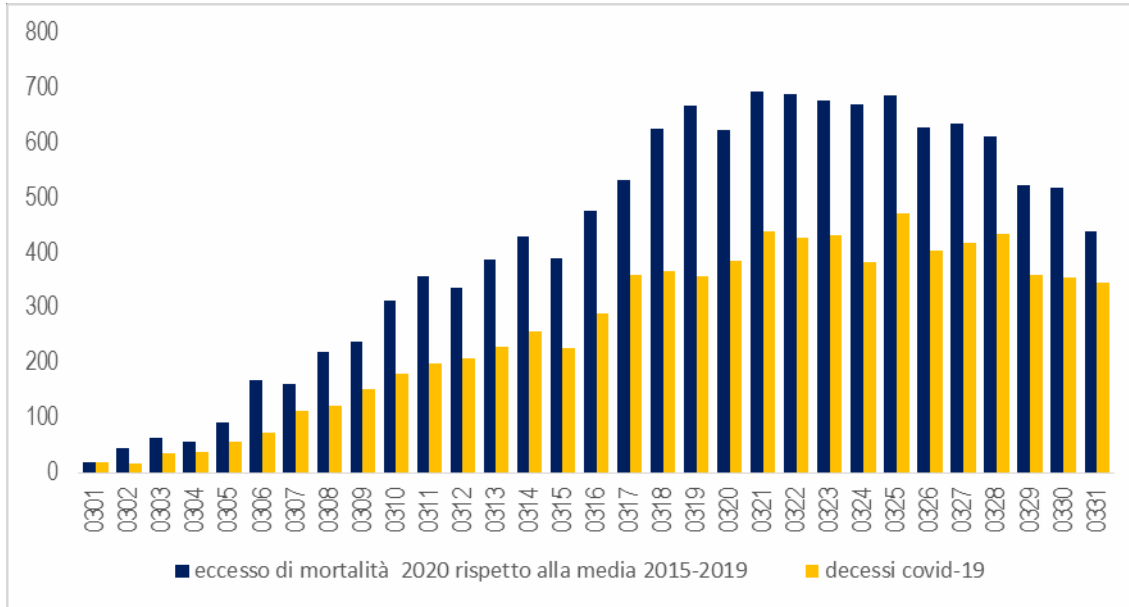

Source: Istat. Integrated municipal daily mortality database

The contribution of Covid-19 deaths to the excess mortality in the provinces of high prevalence

It was only possible to make an assessment of the excess mortality estimated by Istat as a function of the Covid-19 deaths reported by the Integrated Surveillance only considering the month of March. As can be seen from Figure 2, it is from the beginning of March that, in fact, a significant number of deaths begin to be recorded.

Within the provinces defined as high prevalence, and taking into account deaths over or equal to 50 years of age, if we compare the daily trends of Covid-19 deaths with the estimated excess, they explain on average 61.5% of the excess mortality in men and 42% in women, with a proportion that increases for the former during the observation period, while it decreases slightly for women (Figure 6 and 7).

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Figure 6. Daily trend in March of the excess male mortality in 2020 compared to the average for 2015-2019 and Covid-19(a) deaths. Absolute values of deaths. Provinces with **high** prevalence Covid-19.

Notes: (a) Covid-19 integrated surveillance deaths

Source: Istat. Integrated municipal daily mortality database, Iss Integrated surveillance system Covid-19

Figure 7. Daily trend in March in the month of March of the excess of female mortality recorded in 2020 compared to the average of the years 2015-2019 and of Covid-19(a) deaths. Absolute values of deaths. Provinces with **high** prevalence Covid-19
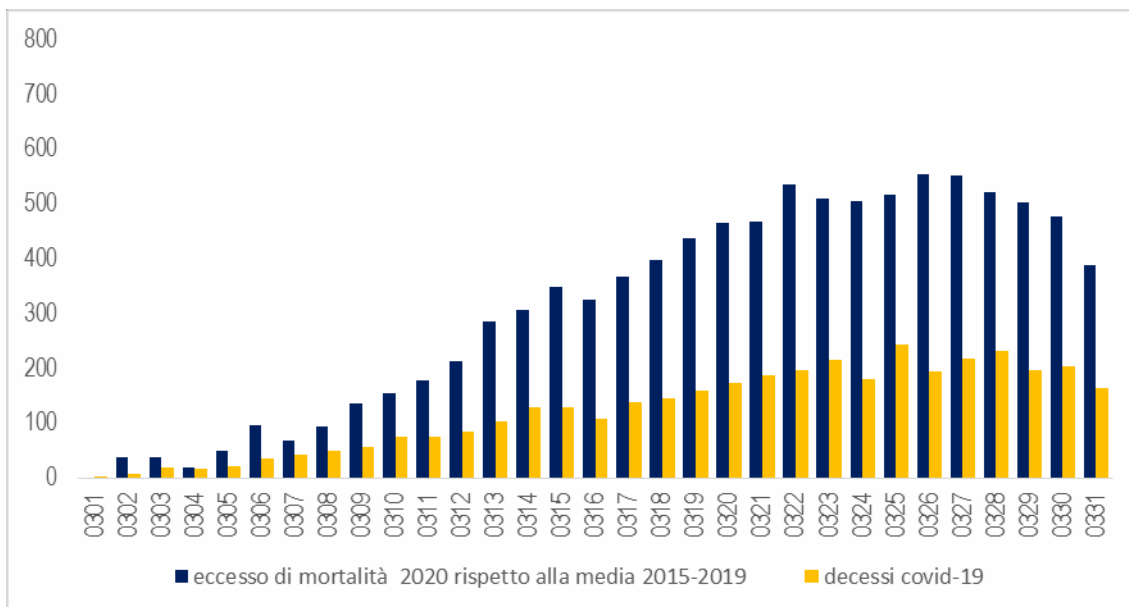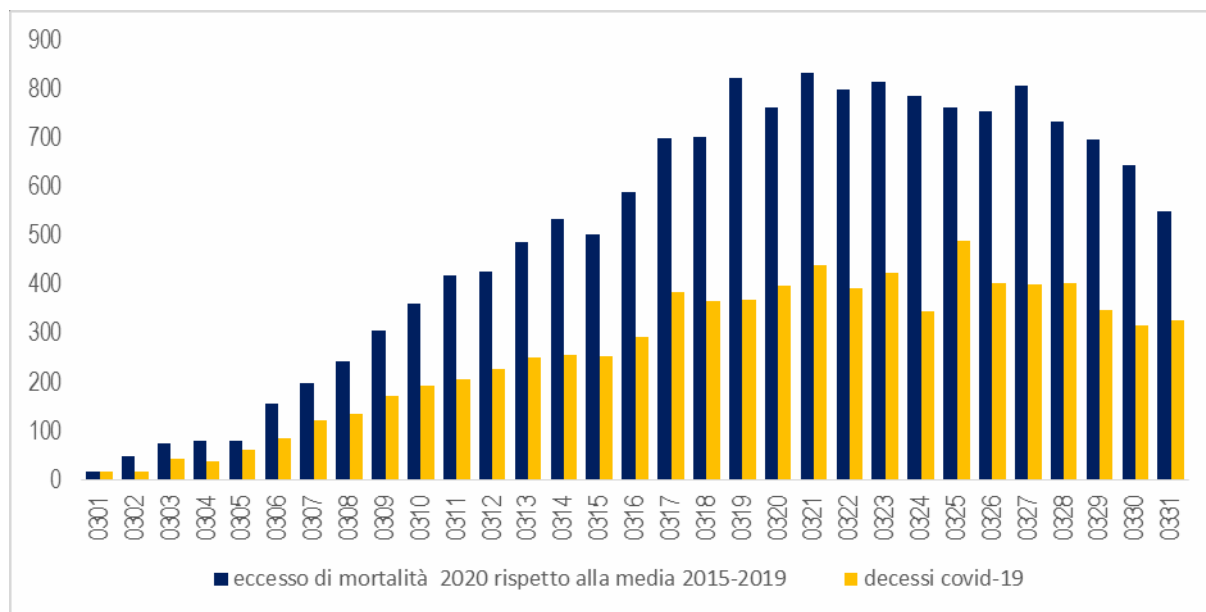

Notes: (a) Covid-19 integrated surveillance deaths

Source: Istat. Integrated municipal daily mortality database, Iss Integrated surveillance system Covid-19

Moving on to a regional detail, Lombardy is the most affected by the epidemic in terms of cases and is also the area where the epidemic started earlier; in the region 61% of Covid-19 deaths recorded in Italy as of 31 March in the Integrated Surveillance system were observed, and the daily percentage ratio of Covid-19/excess deaths was on average 53% (Figure 8).

Figure 8. Daily trend in March of the total excess mortality recorded in 2020 compared to the average of the years 2015-2019 and Covid- 19(a) deaths. Absolute values of deaths of people aged 50 and over. **LOMBARDY Region**
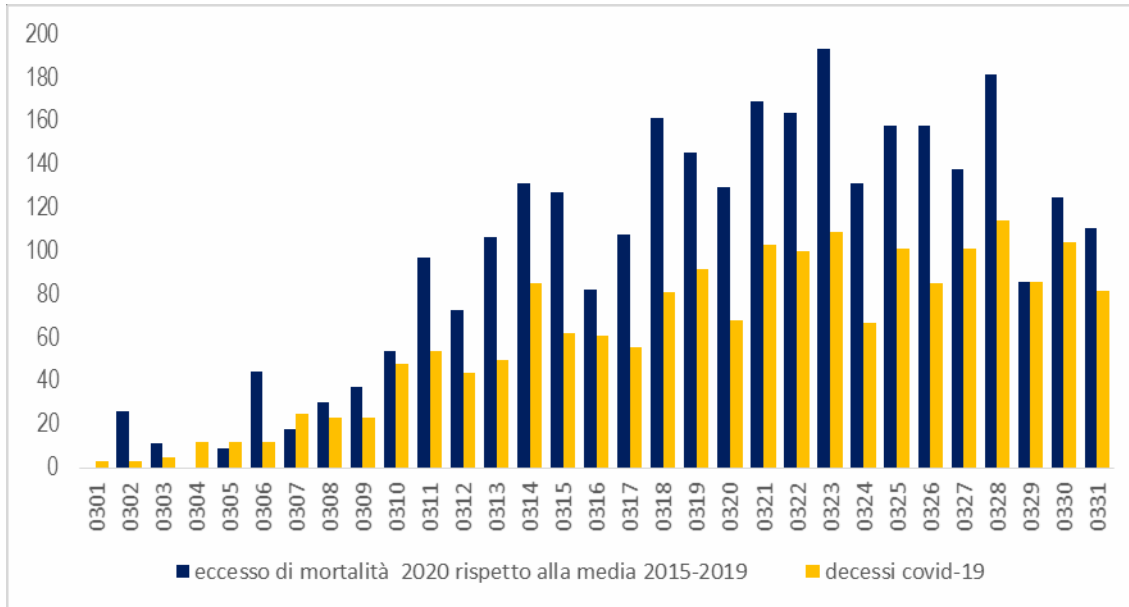

Notes: (a) Covid-19 integrated surveillance deaths

Source: Istat. Integrated municipal daily mortality database, Iss Integrated surveillance system Covid-19

On the other hand, observing the trend of the Emilia-Romagna region, which is also characterized by a high spread of the epidemic, the proportion of Covid-19 deaths on the daily excess mortality is highly variable in the period, but on average on a value of 47% (Figure 9).

Figure 9. **Daily trend in March of total excess mortality in 2020 compared to the average for 2015-2019 and Covid-19(a) deaths and their % ratio.** Absolute values of deaths of people aged 50 and over. **EMILY-ROMAGNA Region**
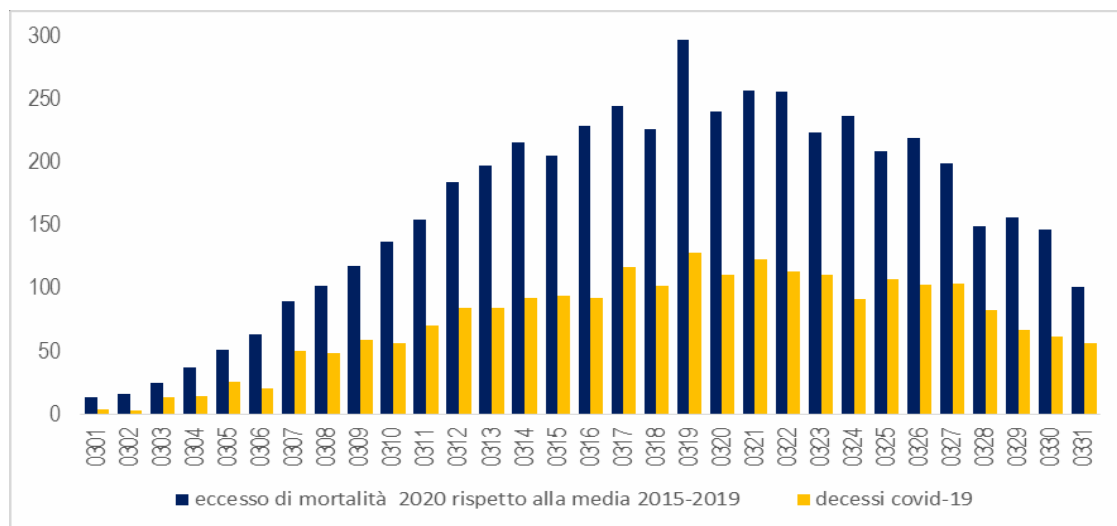

Notes: (a) Covid-19 integrated surveillance deaths

Source: Istat. Integrated municipal daily mortality database, Iss Integrated surveillance system Covid-19

Excess mortality is not uniformly observed in all the provinces with high prevalence: the daily distribution of excesses is in fact dependent on the different time periods of spread of the epidemic within the various regions.

In the Province of Bergamo, the proportion of deaths reported to Covid-19 surveillance is 37.6% of total deaths. The average ratio in March between total excess mortality and that reported by Covid-19 surveillance is 45%.

Figure 10. Daily trend in March of the excess mortality recorded in 2020 compared to the average of the years 2015-2019 and Covid- 19(a) deaths. Absolute values of deaths of people aged 50 and over. **Province of Bergamo**

Notes: (a) Covid-19 integrated surveillance deaths

Source: Istat. Integrated municipal daily mortality database, Iss Integrated surveillance system Covid-19

In the Province of Piacenza, the ratio between the daily distribution of excesses and that of Covid-19 deaths is very variable, and tends to increase as the number of days of observation increases. (Figure 11)

Figure 11. Daily trend in March of the excess mortality recorded in 2020 compared to the average of the years 2015-2019 and Covid- 19(a) deaths. Absolute values of deaths of people aged 50 and over. **Province of Piacenza**
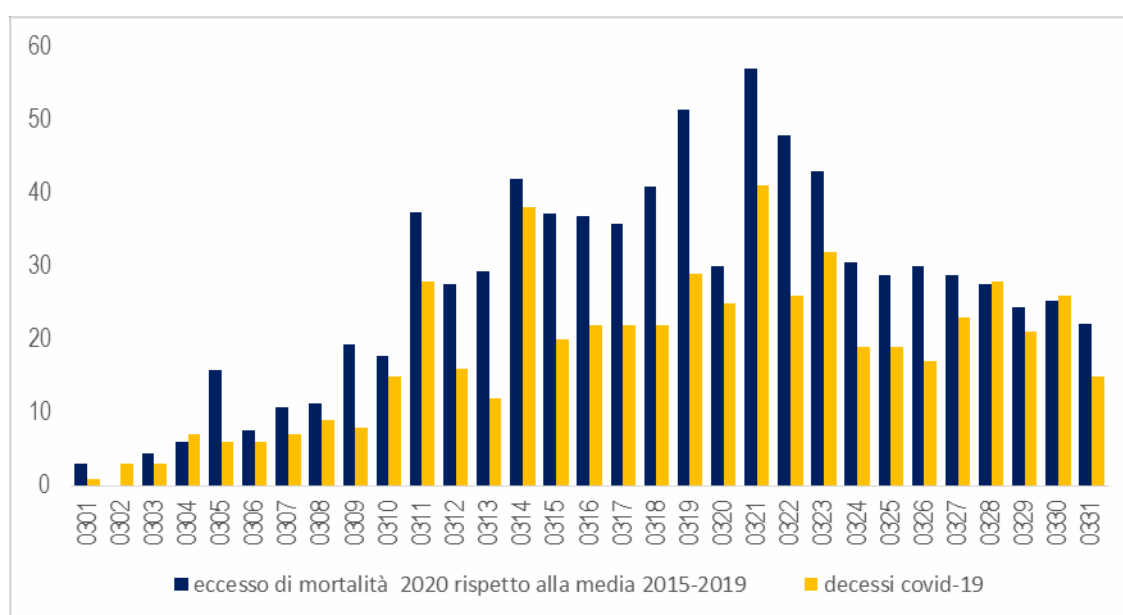

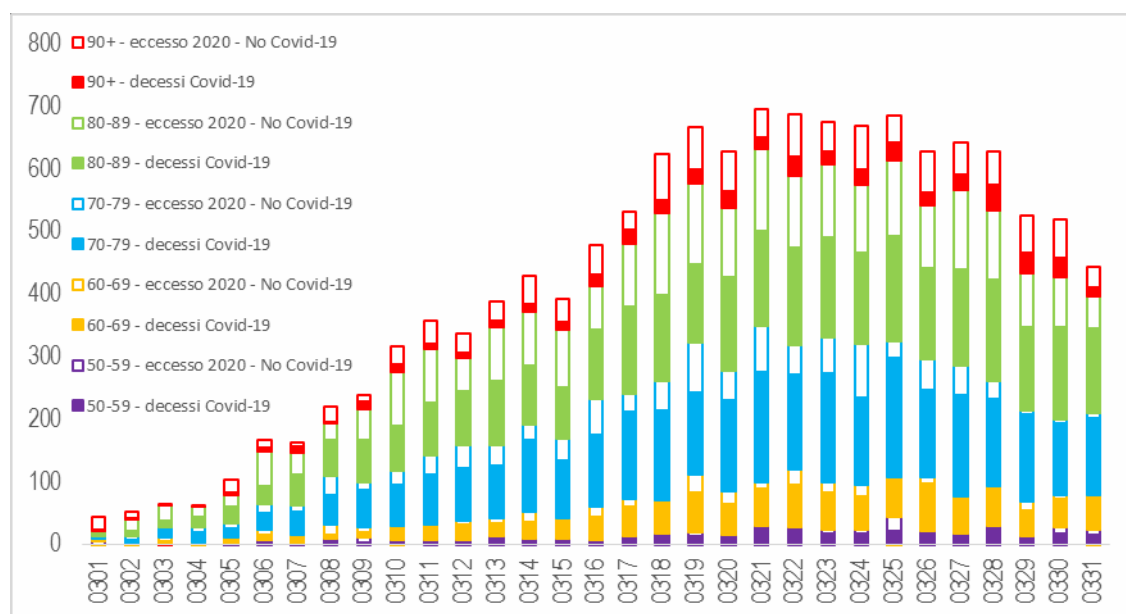Notes: (a) Covid-19 integrated surveillance deaths

Source: Istat. Integrated municipal daily mortality database, Iss Integrated surveillance system Covid-19

Covid-19/excess mortality ratio in high prevalence provinces: the contribution of age

If we break down the excess mortality by age group, we observe how, as the latter increases, the contribution of Covid-19 to the explanation of the excess mortality decreases from 78.5% of the excess in the 50-59 class to 24% in the 90 class and more.

However, this distribution is not homogeneous if the two genders are considered separately. Considering male deaths, it goes from 82.5% of the excess in class 50-59 to 30.4% in class 90 and more. As far as the female gender is concerned, the class in which the contribution of Covid-19 deaths is higher, equal to 89%, is the 60-69 year old class while it drops to 42% in the 80-89 class and 20% in the 90 and over class.

**Figure 12.** **Daily trend in the month of March of the male mortality rate 2020, in excess of the 2015-2019 average, covered by Covid- 19**(a) **deaths.** Absolute values by age group from age 50 and above. **Provinces with high prevalence Covid-19.**

Notes: (a) Covid-19 integrated surveillance deaths

Source: Istat. Integrated municipal daily mortality database, Iss Integrated surveillance system Covid-19

Figure 13. Daily trend in March of the 2020 female mortality rate in excess of the 2015-2019 average covered by Covid- 19(a) **deaths.** Absolute values by age group from 50 years of age. **Provinces with high prevalence Covid-19.**
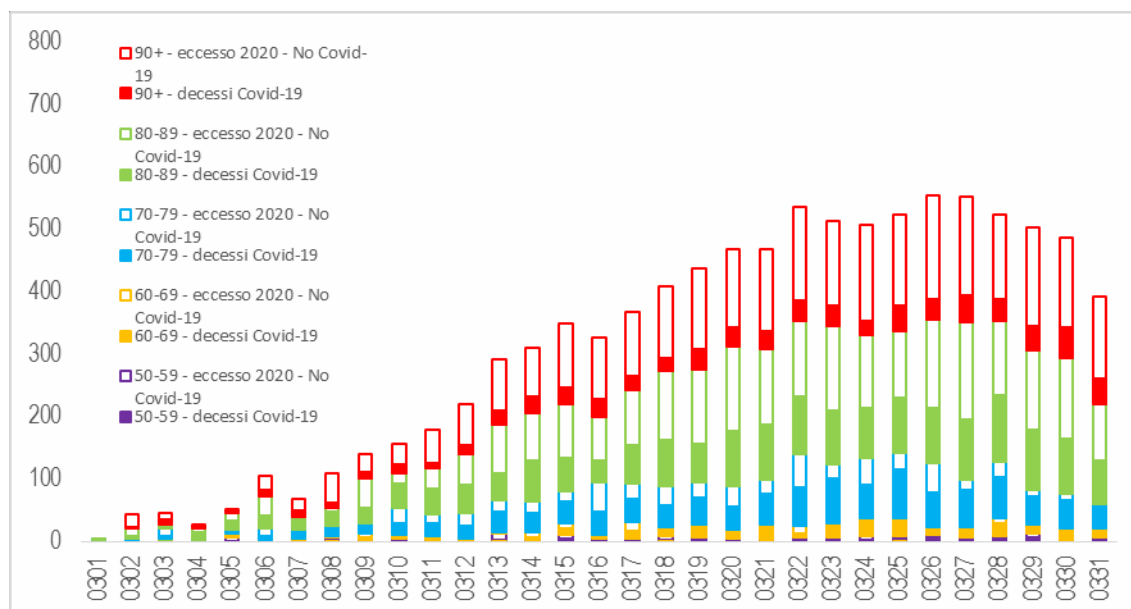
Notes: (a) Covid-19 integrated surveillance deaths

Source: Istat. Integrated municipal daily mortality database, Iss Integrated surveillance system Covid-19

Covid-19 and non-epidemic mortality due to cause

The total amount of deaths in 2020 is the result of the interaction of different components: mortality directly attributable to Covid-19 and mortality for other causes not directly related to it. The latter component, in turn, has been partly modified by the indirect effects of the epidemic. In fact, while it is expected that some causes may have continued to act similarly to what has been observed in recent years, for others some important variations will be noted.

The graphs show the comparison between all deaths with Covid-19, notified daily in March 2020 by the Surveillance Authority, and the daily mortality rate for the main causes of death in March 2017 and can be considered representative of mortality by cause in situations not disturbed by epidemic peaks. The distinction for the 3 territorial classes of spread of the Covid-19 epidemic allows to appreciate the different weight of Covid-19 compared to the most common causes of death.

In March 2017, the main causes of death were circulatory system diseases with 36% of total deaths, followed by cancer with 27%, respiratory system diseases (9%), dementia and Alzheimer's disease (5%), digestive system diseases (4%) and diabetes (3%). This distribution is slightly different only for the macro area with low prevalence, mainly made up of southern provinces, where the percentage of cardiovascular causes is slightly higher (39%).

In other words, an average of 1,523 people died every day in March 2017, of whom 555 died of circulatory disease, 413 of cancer, 132 of respiratory disease, 79 of dementia or Alzheimer's disease.

and 53 for diabetes. It should be noted that the peak of daily deaths in the three macro areas of was reached on 25 March 2020, with 837 cases, the total deaths on the same day were 2.902.

Figures 14-16 show that the frequency of total deaths in 2020, regardless of the class of spread in early March, is very similar to the frequency of deaths in 2017. In some cases it was even slightly lower, especially in the low diffusion area.

As time goes on and the epidemic spreads, the deaths of Covid-19 increase and total mortality increases. Already on March 4, 2020 in the areas of the epidemic's high prevalence, the Covid-19's mortality rate has touched the frequencies of deaths observed in 2017 for the diseases of the respiratory system. On March 10 the Covid-19 deaths reached the total number of all respiratory diseases and tumors. Only six days later, the increase in deaths Covid-19 was able to overcome all the deaths in the two previous cases along with those of the circulatory system. In a little more than twenty days the daily deaths reported by the surveillance integrated Covid-19 have exceeded the amount of daily mortality for all causes registered in 2017.

This evolution has been translated over time and much more attenuated in areas with medium diffusion. In this context, the daily frequencies of Covid-19 deaths were the same as those of those of respiratory mortality as of March 17. Overall deaths Covid-19 in March in this area (1,150 deaths) exceeded the total number of deaths in this area for diabetes, dementia and Alzheimer's disease (1,008) in 2017.

In areas of low prevalence, Covid-19 had no significant effect on the structure of mortality by cause. It was only towards the end of March that a number of deaths with Covid-19 was observed very close to the diabetes deaths in March 2017, which however accounted for 5% of total mortality in the period.

Covid-19 has probably acted both by anticipating death in individuals suffering from serious diseases and by increasing mortality with its direct and indirect effects, particularly evident in areas with medium and high prevalence.

Compared to March 2017, an excess mortality rate was observed in the same month of 2020. higher than the number of deaths attributable to Covid-19 in individuals with confirmed diagnosis. The analysis of all causes of death in 2020 will make it possible to assess the extent to which excess mortality observed is also attributable to the deaths of people who were not tested but certified by doctors based on a clinical diagnosis (which are not currently counted in the Surveillance), and as to the indirect effects on specific causes of death, especially those that can be attributed to the difficulties of the hospital system in working under conditions of high stress but also the least recourse to it to the provision of health services by citizens for fear of contagion.

Figure 14. Comparison between daily deaths for the main initial causes of death in March 2017 and deaths with Covid-19 and for all causes in March 2020. Covid-19 High
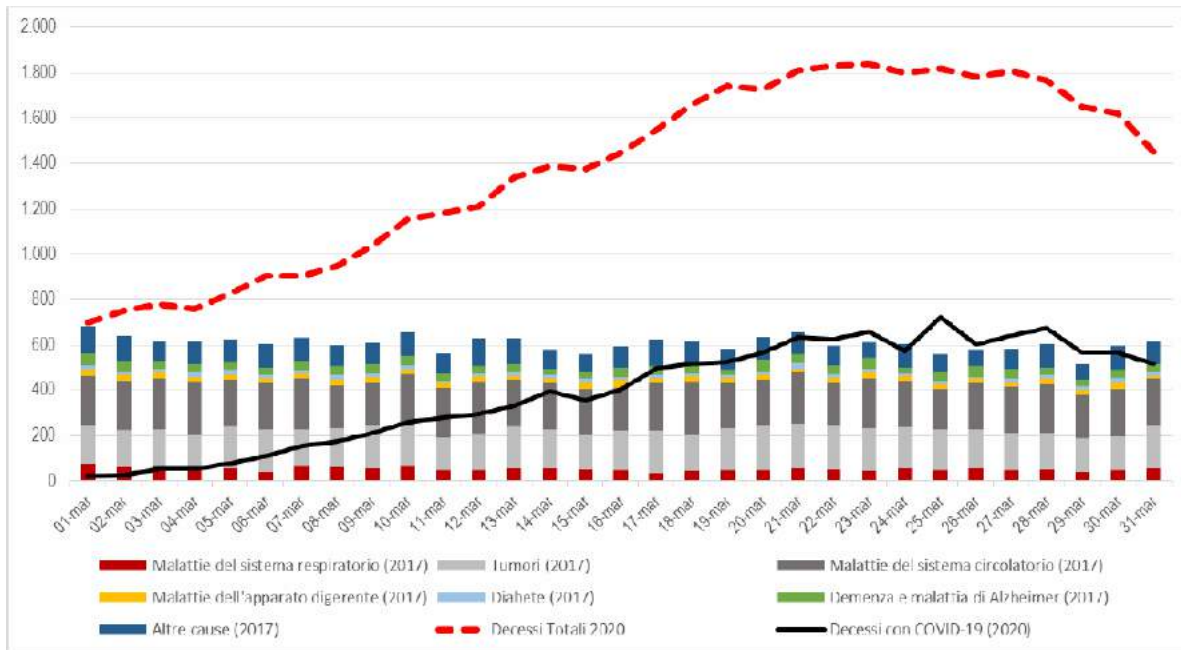
Source: Istat. Investigation of deaths and causes of death, Istat Integrated municipal daily mortality database, Iss surveillance register Covid-19

Figure 15. Comparison between daily deaths for the main initial causes of death in March 2017 and deaths with Covid-19 and for all causes in March 2020. Covid-19 **Medium**
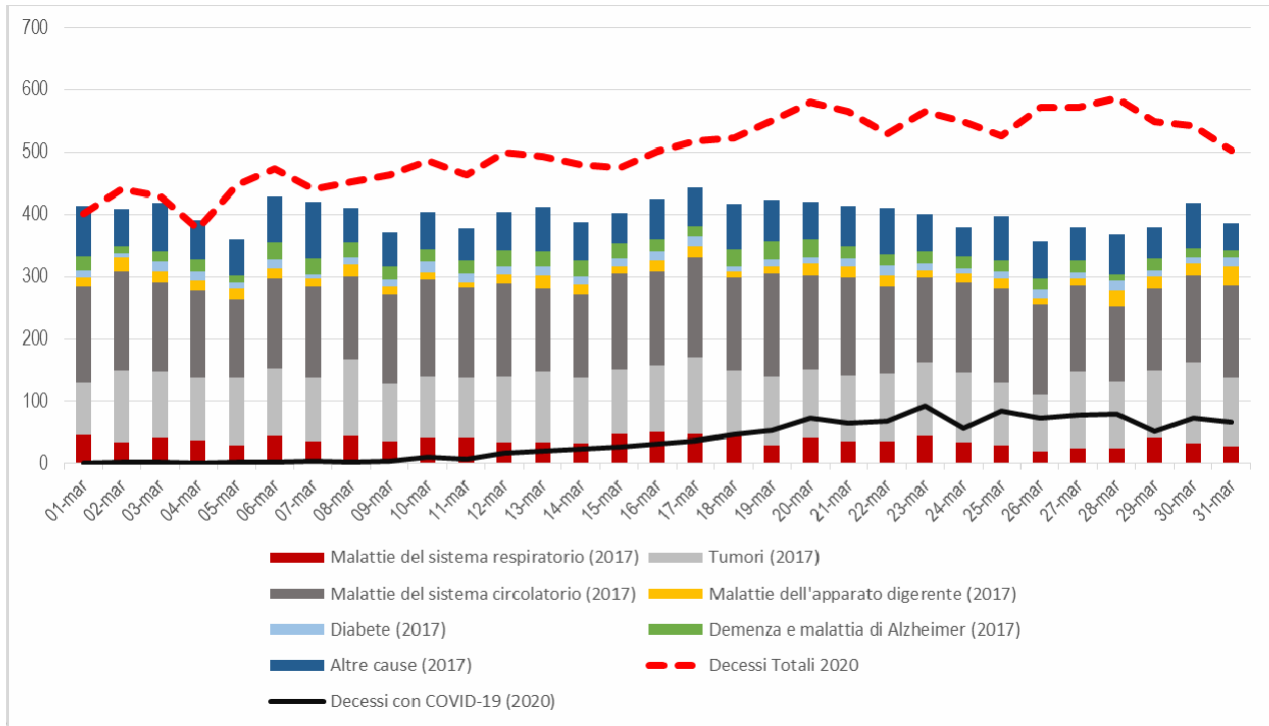
Source: Istat. Investigation of deaths and causes of death, Istat Integrated municipal daily mortality database, Iss surveillance register Covid-19

Figure 16. Comparison between daily deaths for the main initial causes of death in March 2017 and deaths with Covid-19 and for all causes in March 2020. Covid-19 **Low prevalence** area
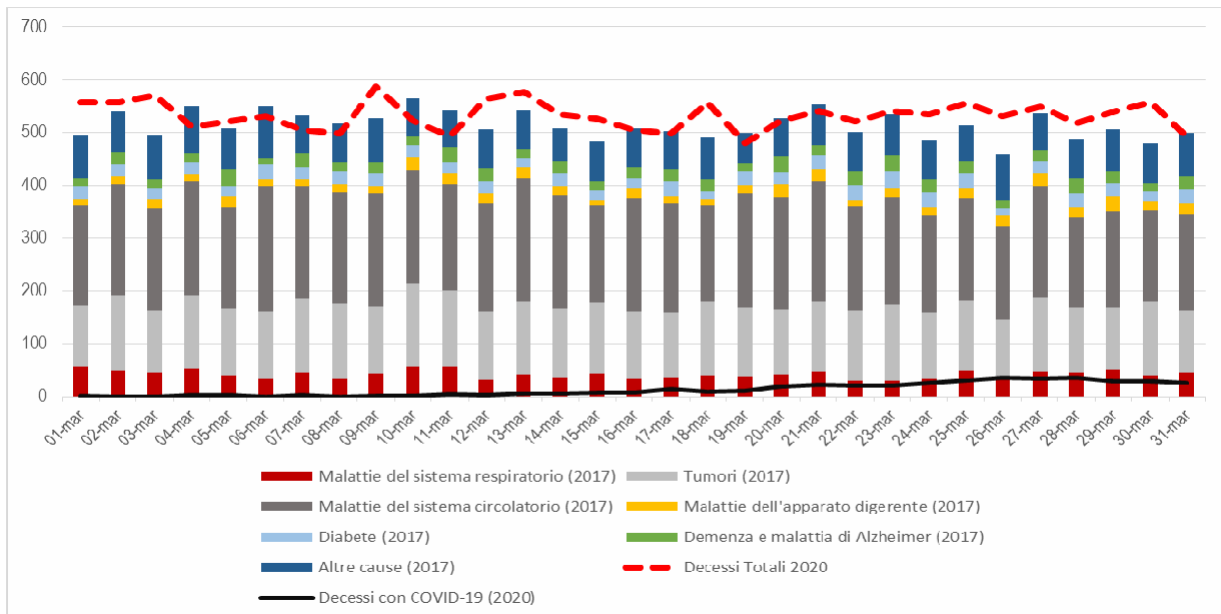

Source: Istat. Investigation of deaths and causes of death, Istat Integrated municipal daily mortality database, Iss surveillance register Covid-19

Methodological note

1. The new daily mortality database for the resident population

Istat, thanks to the synergies activated with the Ministry of the Interior for the timely acquisition of ANPR (National Register of Resident Population) data and the Ministry of Economy and Finance for the acquisition of the flow of the deceased through the Tax Registry, is able to contribute to the dissemination of information useful for the understanding of the situation related to the health emergency by COVID-19. The use for statistical purposes, and the related treatment of information allows the National Institute of Statistics to disseminate data on the general mortality of 6,866 Italian municipalities, which to date amount to 7,904, 87% of the total. The percentage of population that these municipalities represent is 86%.

In a normal situation, the details of information that the Institute releases (daily series of deaths by gender and age class) require the completion of a process of acquisition and validation of the micro-data of deletions from the registry office for death that involves a delay of about 10 months compared to 31/12 of each year of reference (in October of year t the validated data of year t-1 are released). In view of the emergency situation, ISTAT has undertaken to guarantee the dissemination of this information with a very tight timeframe, with the understanding, however, that the data should be considered provisional and subject to change with the next updates. Unlike the statistics relating to the balance sheet of the resident population, which ISTAT updates periodically, the date of death refers to the date of the event and not the date of the personal data cancellation.

The validation of the death data of the 7,904 Italian municipalities is based on the amount of the first three months of the year 2020, compared with the data of the same average period 2015/2019. Absolute and percentage changes in the period, individual months and information on the presence of deaths Covid-19 (source ISS) were used. In the light of these analyses, ISTAT assessed that it did not disseminate data for 1,038 municipalities for which the decrease recorded in 2020 is probably due to an incomplete or untimely flow of data notifications from the municipality to the ANPR system or ISTAT (for those municipalities that did not take over from ANPR).

The municipalities for which the anticipatory data are released do not constitute a statistical sample of the universe of Italian municipalities, but a more or less representative subset of them, whose population coverage at provincial level varies from a maximum of 100% for the provinces of Gorizia and Sondrio, to a minimum of 1.3% for the province of Trieste; at regional level the population coverage varies from 97.1% for Lombardy to 73.4% for Friuli-Venezia Giulia and Sicily. At national average level the coverage is 86.4% in terms of population (see table A1).

Table A1. Provincial coverage by municipality and resident population of the 6,866 municipalities disseminated by Istat.

Province	percentage municipalities	percentage population resident	Province	percentage municipalities	percentage population resident
Agrigento	67.4	67.9	Messina	80.6	87.7
Alexandria	95.7	98.2	Milan	96.2	98.1
Ancona	76.6	84.3	Modena	95.7	97.8
Aosta	91.9	91.2	Monza and Brianza	94.5	97.0
Arezzo	88.9	89.4	Naples	70.7	81.4
Ascoli Piceno	81.8	45.0	Novara	90.8	92.5
Asti	93.2	88.8	Nuoro	83.8	78.9
Avellino	84.7	86.2	Oristano	93.1	91.7
Bari	80.5	86.0	Padua	84.3	86.7
Barletta-Andria-Trani	70.0	59.8	Palermo	76.8	87.6
Belluno	83.6	63.9	Parma	95.5	99.3
Benevento	82.1	82.1	Pavia	94.1	97.0
Bergamo	97.5	98.4	Perugia	84.7	92.1
Connecting rod	97.3	96.5	Pesaro and Urbino	86.8	94.9
Bologna	85.5	92.7	Pescara	91.3	96.7
Bolzano/Bozen	93.1	93.9	Piacenza	91.3	95.5
Brescia	98.0	98.9	Pisa	86.5	76.5
Toast	95.0	98.4	Pistoia	85.0	88.0
Cagliari	82.4	45.6	Pordenone	94.0	95.2
Caltanissetta	59.1	41.9	Power	86.0	72.0
Campobasso	81.0	67.7	Prato	57.1	89.8
Caserta	73.1	68.7	Ragusa	75.0	54.7
Catania	53.4	62.7	Ravenna	77.8	82.8
Catanzaro	76.3	81.6	Reggio Calabria	80.4	82.6
Chieti	87.5	76.5	Reggio Emilia	88.1	93.7
Como	94.6	95.6	Rieti	80.8	52.7
Cosenza	80.7	64.4	Rimini	84.0	95.7
Cremona	99.1	99.8	Rome	62.0	82.7
Crotone	81.5	87.5	Rovigo	96.0	95.4
Wedge	91.5	88.0	Salerno	78.5	79.0
Enna	60.0	43.1	Sassari	92.4	94.4
Stop	90.0	92.8	Savona	88.4	84.4
Ferrara	90.5	95.8	Siena	74.3	63.5
Florence	87.8	98.1	Syracuse	81.0	87.6
Foggia	80.3	88.6	Sondrio	100.0	100.0
Forlì-Cesena	93.3	98.9	South Sardinia	79.4	76.9
Frosinone	73.6	70.3	Taranto	93.1	98.8
Genoa	83.6	95.3	Teramo	91.5	97.7
Gorizia	100.0	100.0	Terni	93.9	98.9
Grosseto	89.3	94.1	Turin	90.1	94.0
Imperia	87.9	83.7	Drills	66.7	76.5
Isernia	82.7	88.7	Trento	89.2	90.9
La Spezia	93.8	99.1	Treviso	88.3	90.9
The Eagle	78.7	71.4	Trieste	33.3	1.3
Latina	81.8	83.3	Udine	86.6	85.5
Lecce	77.1	76.4	Varese	87.0	87.9
Lecco	96.4	97.8	Venice	86.4	93.4
Livorno	78.9	89.0	Verbano-Cusio-Ossola	95.9	94.0
Lodi	95.0	98.1	Vercelli	93.9	91.8
Lucca	84.8	92.1	Verona	91.8	94.5
Macerata	85.5	89.1	Vibo Valentia	82.0	91.5
Mantua	96.9	96.5	Vicenza	82.5	73.4
Massa-Carrara	82.4	93.0	Viterbo	81.7	82.1
Matera	74.2	80.5	**ITALY**	**86.9**	**86.4**

Table A2. Regional and distribution coverage by municipality and resident population of the 6,866 municipalities disseminated by Istat.

Region/RepartitionPopulation	percentuale		Region/RepartitionPopulation	percentage	
	comuni	resident		municipalities	resident
Piedmont	92.7	93.3	Abruzzo	85.6	85.2
Aosta Valley	91.9	91.2	Molise	81.6	73.5
Lombardy	95.8	97.1	Campania	78.0	79.3
Trentino-South Tyrol	90.8	92.4	Puglia	81.3	85.0
Veneto	87.0	87.2	Basilicata	83.2	75.0
Friuli-Venezia Giulia	88.4	73.4	Calabria	80.0	77.0
Liguria	87.6	92.3	Sicily	71.0	73.4
Emilia-Romagna	89.9	94.6	Sardinia	86.7	75.6
Tuscany	83.9	89.1	**North**	**92.2**	**92.8**
Umbria	88.0	93.8	**Center**	**80.2**	**84.7**
Brands	84.2	83.4	**Noon**	**80.2**	**78.7**
Lazio	73.3	80.9	**ITALY**	**86.9**	**86.4**

2. Data on cases and deaths in the surveillance system

With the Ordinance no. 640 of 27 February 2020, the Istituto Superiore di Sanità (ISS), since 28 February, coordinates a surveillance system that integrates at individual level the microbiological and epidemiological data provided by the Regions and Autonomous Provinces (PA) and the National Reference Laboratory for SARS-CoV-2 of the ISS. The data are collected through a dedicated web platform and cover all cases of COVID-19 diagnosed by the regional reference laboratories. The data are updated daily by each Region even if some information may take a few days to be entered. For this reason, there may not be a complete agreement with what is reported through the information flow of the Civil Protection and the Ministry of Health that report aggregated data. The surveillance collects individual data of Covid-19 positive subjects and in particular personal data, data on home and residence, some laboratory information, information on hospitalization and clinical status (a synthetic indicator of the severity of the symptomatology), the presence of some risk factors (basic chronic diseases), and the final outcome (healed or deceased).

A dedicated infographics report - with graphs, maps and tables - a description of the spread in time and space of the COVID-19 epidemic in Italy and a description of the characteristics of the affected people. Once a week, a bulletin is also published which, in a more extensive way, deepens the information collected. These documents can be downloaded from the Epicentro website of the ISS. The latest available are the weekly report of 30 April 2020:
https://www.epicentro.iss.it/coronavirus/bollettino/Bollettino-sorveglianza-integrata-COVID-19_28-april-2020.pdf

and the infographic of 1 May 2020:
https://www.epicentro.iss.it/coronavirus/bollettino/Infografica_1maggio%20ITA.pdf

An English language version is also available for the latter:
https://www.epicentro.iss.it/en/coronavirus/bollettino/Infografica_1maggio%20ENG.pdf

3. Data on causes of death

The 2017 cause of death data comes from the annual cause of death survey, which is the main comprehensive source of epidemiological information in the country. The survey has a total coverage and its field of observation consists of all deaths occurring on the national territory (population present) in a calendar year. The medical information contained in individual death certificates is coded according to the ICD- 10 (International Statistical Classification of Diseases, Injuries and Causes of Death, X Revision) of the World Health Organization (WHO). In line with EU legislation, data are validated and disseminated within 24 months of the reference year (https://www.istat.it/it/archivio/4216). In December 2019, the last final data for the year 2017 were released. In the report, the deaths in March 2017 of residents in the 6,866 municipalities for which data for 2020 are available were selected.

GLOSSARY

Population registry: the continuous system of registration of the resident population. It is continuously updated through registrations by birth from parents resident in the municipality, cancellations by death of residents and registrations/cancellations by transfer of residence from/to another municipality or from/to abroad.

ANPR: National Register of Resident Population (ANPR). It is the national database into which all the municipal registries gradually converge.
It was established at the Ministry of the Interior pursuant to Article 62 of Legislative Decree no. 82/2005 (Digital Administration Code).

Covid-19 positive case: For Covid-19 (synthesis of the terms CO-rona VI-rus D-isease and year of identification, 2019) the World Health Organization (WHO) understands respiratory disease caused by the new coronavirus SARS-Cov-2. The Covid-19 confirmed positive case definition according to the Covid-19 Integrated Surveillance is based on a case definition defined by ministerial circulars taking into account scientific evidence and indications from international bodies such as WHO and ECDC. The current definition is microbiological: positive result with confirmatory test carried out by the Regional Reference Laboratory(s) on a nose-pharyngeal swab.
(https://www.fnopi.it/wp-content/uploads/2020/03/Circolare_9_marzo_2020.pdf)

Cause of death: the "initial" cause of death, i.e. the morbid condition directly responsible for death. It is defined and identified among all the diseases certified by the doctor on the death card, according to strict rules dictated by the World Health Organization (listed in the International Classification of Diseases Icd-10) and is the most used and consolidated indicator for official statistics and comparisons at national and international level.

International Classification of Diseases (ICD): International Classification of Diseases and Related Health Problems, is the system of classification of diseases, drawn up by the World Health Organization. This international standard classifies Istat's health information on deaths and causes of death. (https://icd.who.int/browse10/2019/en#/)

ICD-10 codes of the main causes of death analyzed: Respiratory system diseases J00- J99; Tumors C00-D48; Circulatory system diseases I00-I99; Digestive system diseases K00-K93; Diabetes E10-E14; Dementia and Alzheimer's disease F01-F03,G30.

Co-morbidity: means the pre-existence of chronic conditions at the time of diagnosis; these include: cardiovascular diseases, respiratory diseases, diabetes, immune deficits, metabolic diseases, oncological diseases, obesity, kidney diseases or other chronic diseases.

Coverage (Rate of) of municipalities: ratio between the number of municipalities considered and the number of all Italian municipalities.

Population coverage (Rate of): ratio of the sum of the resident population in the municipalities concerned to the total resident population.

Death: the cessation of all signs of life at any time after vital birth. Total mortality (total deaths) or total death means the counting of deaths that occurred for any cause of death without distinction of a specific cause.

Covid-19 death: The World Health Organization defines a COVID-19 death as follows: A COVID-19 death is defined for surveillance purposes as a death resulting from a clinical disease picture with a probable or (microbiologically) confirmed case of Covid-19, unless there is a clear alternative cause of death not attributable to the disease associated with COVID disease (e.g. trauma).
https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200411-sitrep-82-covid-19.pdf?sfvrsn=74a5d15_2

Deletion from the registry office due to death: the survey on deletions from the registry office due to death collects the main individual characteristics of the deceased with which to derive the main measures of survival of the resident population. The information regarding deceased persons is that in the possession of the registry office of the municipality.

Excess mortality: difference between total deaths in the period 20/2/2020-31/3/2020 and the average of total deaths in the five-year period 2015-2019 in the same period.

Median age: age that divides a population into two numerically equal groups; one having the population younger than the identified age, the other higher.

Incidence: the ratio of the number of cases of a disease to the population at risk over a certain period of time. If the period of time is the same for the whole population the incidence is defined as cumulative

Lethality: the ratio between the number of deaths and the number of patients with a given disease, in relation to a given population and a given interval.

Mortality (rate of): ratio between the number of deaths in the year and the average amount of the resident population, multiplied by 1,000.

Resident population: it is made up of persons, of Italian and foreign citizenship, having their usual residence in the national territory even if temporarily absent. Every person with habitual residence in Italy must register, by law, in the registry office of the municipality in which he has established his habitual residence. Following each population census, the legal population is determined. This population is then added to the population of the following periods, calculated with reference to the end of each calendar year, and the population residing in each municipality at 31 December of each year is thus calculated.

Positive buffer: this term refers to a positive result in a reference diagnostic test on a real-time RT-PCR assay which basically consists of an amplification of the genome. In the case of SARS-Cov-2, the collection of biological material (sample) is performed by means of a rhinopharyngeal aspirate or a nasopharyngeal or gold-pharyngeal swab. The swab analysis is carried out in all regional reference laboratories and in the main hospitals identified by the Regions.