Characteristics of SARS-CoV-2 patients dying in Italy
Report based on available data on October 28th, 2020

1. Sample

The present report describes characteristics of 37,468 SARS-CoV-2 patients dying in Italy.* Geographic distribution across the 19 regions and 2 autonomous provinces of Trento and Bozen is presented in the table below. Data are update to October 28th, 2020.
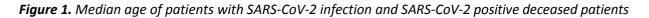
Table 1. Geographic distribution of deceased patients SARS-CoV-2 positive

REGION	N	%
Lombardia	17,279	46.1
Emilia Romagna	4,579	12.2
Piemonte	4,121	11.0
Veneto	2,337	6.2
Liguria	1,727	4.6
Toscana	1,244	3.3
Lazio	1,197	3.2
Marche	994	2.7
Puglia	698	1.9
Campania	561	1.5
Abruzzo	534	1.4
Sicilia	463	1.2
Trento	427	1.1
Friuli Venezia Giulia	387	1.0
Bolzano	303	0.8
Sardegna	186	0.5
Valle d'Aosta	146	0.4
Umbria	111	0.3
Calabria	106	0.3
Basilicata	37	0.1
Molise	31	0.1
Total	**37,468**	**100.0**

* SARS-CoV-2 related deaths presented in this report are those occurring in patients who test positive for SARS-CoV-2RT by PCR, independently from pre-existing diseases.

2. Demographics

Mean age of patients dying for SARS-CoV-2 infection was 80 years (median 82, range 0-109, IQR 74-88). Women were 16,002 (42.7%). *Figure 1* shows that median age of patients dying for SARS-CoV-2 infection was about 30 years higher as compared with the national sample diagnosed with SARS-CoV-2 infection (median age 51 years). *Figure 2* shows the absolute number of deaths by age group. Women dying for SARS-CoV-2 infection had an older age than men (median age women 85 - median age men 79).
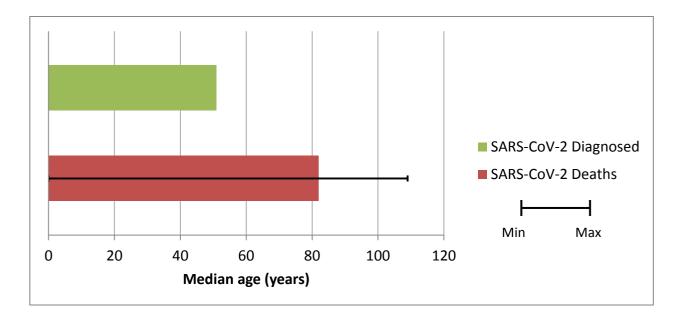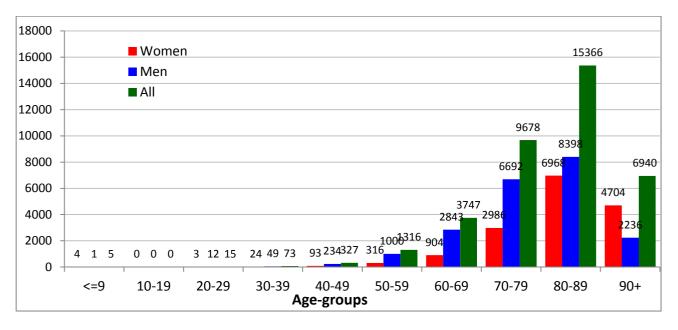
Figure 1. *Median age of patients with SARS-CoV-2 infection and SARS-CoV-2 positive deceased patients*

Figure 2. *Absolute number of deaths by age group*

Note: For 1 deceased person, age was not possible to be evaluated

Figure 3 shows the trend in the average age of SARS-CoV-2 positive deceased patients per calendar week, starting from the 3rd week of February 2020 (the date of the first death dates back to 21st February 2020). The average age of weekly deceased persons has substantially increased up to 85 years (1st week of July) and then dropped slightly.
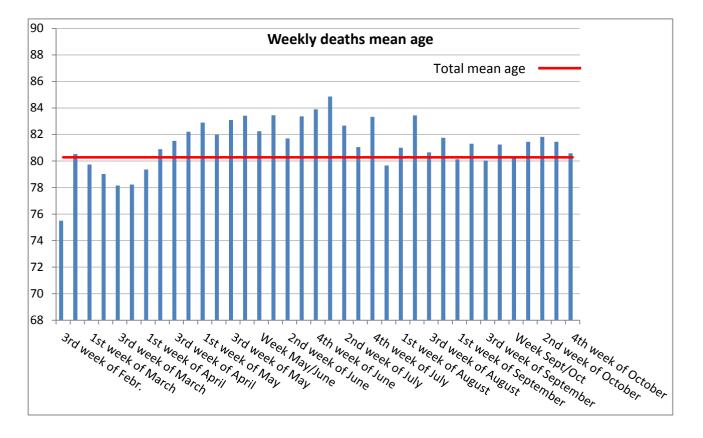
Figure 3. *Mean age of SARS-CoV-2 positive deceased patients by week of death*

3. Pre-existing conditions

Table 2 presents most common comorbidities diagnosed before SARS-CoV-2 infection. Data on diseases were based on chart review and was available on 4,888 patients dying in-hospital for whom it was possible to analyse clinic charts. Mean number of diseases was 3.5 (median 3, SD 2.0). Overall, 3.5% of the sample presented with a no comorbidities, 13.2% with a single comorbidity, 19.3% with 2, and 64.0% with 3 or more.

Before hospitalization, 21% of SARS-CoV-2 positive deceased patients followed ACE-inhibitor therapy and 14% angiotensin receptor blockers-ARBs therapy. This information can be underestimated because data on drug treatment before admission were not always described in the chart.

Table 2. *Most common comorbidities observed in SARS-CoV-2 positive deceased patients*

Diseases	N	%
Ischemic heart disease	1363	27.9
Atrial Fibrillation	1163	23.8
Heart failure	785	16.1
Stroke	544	11.1
Hypertension	3206	65.6
Type 2-Diabetes	1431	29.3
Dementia	1040	21.3
COPD (Chronic Obstructive Pulmonary Disease)	826	16.9
Active cancer in the past 5 years	835	17.1
Chronic liver disease	227	4.6
Chronic renal failure	1018	20.8
Dialysis	103	2.1
Respiratory failure	309	6.3
HIV Infection	10	0.2
Autoimmune diseases	208	4.3
Obesity	504	10.3
Number of comorbidities		
0 comorbidities	170	3.5
1 comorbidity	647	13.2
2 comorbidities	945	19.3
3 comorbidities and over	3126	64.0

Table 3 presents the most common pre-existing chronic pathologies in patients who died, separately in men (n = 3,016) and women (n = 1,872). The average number of pathologies observed in women is 3.6 (median 3, Standard Deviation 2.0). In men the average number of pathologies observed is 3.4 (median 3, Standard Deviation 2.0).

Table 3. *Most common comorbidities observed in SARS-CoV-2 positive deceased patients by gender*

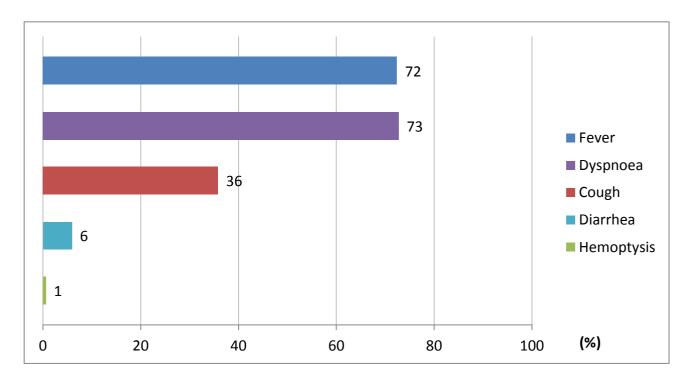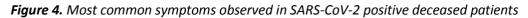| Diseases	Women N	%	Men N	%
Ischemic heart disease	432	23.1	931	30.9
Atrial Fibrillation	477	25.5	686	22.7
Heart Failure	348	18.1	437	14.3
Stroke	227	12.1	317	10.5
Hypertension	1270	67.8	1936	64.2
Type 2-Diabetes	504	26.9	927	30.7
Dementia	569	30.4	471	15.6
COPD (Chronic Obstructive Pulmonary Disease)	249	13.3	577	19.1
Active cancer in the past 5 years	303	16.2	532	17.6
Chronic liver disease	79	4.2	148	4.9
Chronic renal failure	355	19.0	663	22.0
Dialysis	29	1.5	74	2.5
Respiratory failure	124	6.6	185	6.1
HIV Infection	0	0.0	10	0.3
Autoimmune diseases	116	6.2	92	3.1
Obesity	194	10.4	310	10.3
Number of comorbidities				
0 comorbidities	40	2.1	130	4.3
1 comorbidity	214	11.4	433	14.4
2 comorbidities	342	18.3	603	20.0
3 comorbidities and over	1276	68.2	1850	61.3

4. *Diagnosis of hospitalization*

In 91.0% of hospitalizations, conditions (e.g. pneumonia, respiratory failure) or symptoms (e.g. fever, dyspnoea, cough) compatible with SARS-CoV-2 were mentioned. In 405 cases (9.0% of cases) the diagnosis of hospitalization was not related to the infection. In 60 cases the diagnosis of hospitalization concerned exclusively neoplastic pathologies, in 138 cases cardiovascular pathologies (for example Acute Myocardial Infarction-AMI, heart failure, stroke), in 54 cases gastrointestinal pathologies (for example cholecystitis, perforation of the intestine, intestinal obstruction, cirrhosis), in 153 cases other pathologies.

5. Symptoms

Figure 4 shows symptoms most commonly observed at hospital admission. Fever, dyspnoea and cough were the most commonly observed symptoms, while diarrhoea and haemoptysis were less commonly observed. Overall, 7.6% of patients did not present any symptoms at hospital admission.

Figure 4. *Most common symptoms observed in SARS-CoV-2 positive deceased patients*

6. Acute conditions

Acute Respiratory Distress syndrome was observed in the majority of patients (94.0% of cases), followed by acute renal failure (23.2%). Superinfection was observed in 19.1% and acute cardiac injury in 10.9 % of cases.

7. Treatments

Antibiotics were used by 86.4% of patients during hospital stay, while less used were antivirals (55.8%) and corticosteroids (45.6%). Concomitant use of these 3 treatments was observed in 26.4% of cases.

Out of SARS-CoV-2 positive deceased patients, 4.6% were treated with Tocilizumab during hospitalization.

8. Time-line

Figure 5 shows, for SARS-CoV-2 positive deceased patients, the median times, in days, from the onset of symptoms to death (12 days), from the onset of symptoms to hospitalization (5 days) and from hospitalization to death (7 days). The time from hospitalization to death was 6 days longer in those who were transferred to intensive care than those who were not transferred (12 days vs. 6 days).
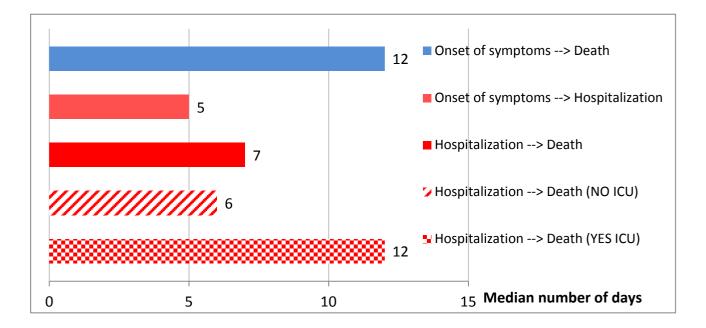
Figure 5. *Median hospitalization times (in days) in SARS-CoV-2 positive deceased patients*

9. Deaths under the age of 50 years

As of October 28th, 4202 out of the 37,468 (1.1%) positive SARS-CoV-2 patients under the age of 50 died. In particular, 93 of these were less than 40 years (62 men and 31 women), age range between 0 and 39 years. For 15patients under the age of 40 years no clinical information is available; out of the remaining ones, 64 had serious pre-existing pathologies (cardiovascular, renal, psychiatric pathologies, diabetes, obesity) and 14 had no major pathologies.

10. Comparison of death characteristics in the 2 quarters March-May and June-August 2020

Table 4 summarizes the main characteristics of deaths with COVID-19 that occurred in 3 periods of time from the beginning of the pandemic in 2020: the initial quarter, March-May, the second quarter, June-August, and the third period September-October. Overall, the sample represents 13.3% of all deaths from the beginning of the pandemic; in particular, the 12.9% of those who died between March and May, 26.1% of those who died between June and August, and 11.4% of those who died between September and October.

In the second and third periods, the average age of deaths and the proportion of women slightly increased (particularly in the second period) in comparison to the first period; deaths of people with 3 or more pre-existing pathologies increase and those of persons with fewer pathologies or none decrease: this seems to indicate that in the second and third period deaths concern older people and persons with a pre-existing health condition worse than those dying in the first quarter (*table 4*).

The use of drugs is also extremely different in the three periods, with a clear reduction in the use of antivirals and an increase in the use of steroids in the second and third periods.

Table 4. *Mean age, prevalence of women, number of pre-existing diseases, complications and treatments in deaths with COVID-19 in the 3 periods March-May, June-August and September-October 2020*

All deaths	All (n=37,459) (Missing=9)	March-May 2020 (n=34,225)	June-August 2020 (n=1,392)	September-October 2020 (n=1,842)	p-value*
Age (years)	80.3	80.1	82.8	81.3	<0.001
	n (%)	n (%)	n (%)		
Women	16000 (42.7)	14337 (41.9)	860 (61.8)	803 (43.6)	<0.001
Sample of the evaluated clinical charts	**All (n=4,888)**	**March-May 2020 (n=4,322)**	**June-August 2020 (n=358)**	**September-October 2020 (n=2081)**	*p-value**
N of comorbidities					
0	170 (3.5)	166 (3.8)	2 (0.6)	2 (1.0)	
1	647 (13.2)	591 (13.7)	33 (9.2)	23 (11.1)	<0.001
2	945 (19.3)	866 (20.0)	47 (13.1)	32 (15.4)	
3 or more	3126 (64.0)	2699 (62.4)	276 (77.1)	151 (72.6)	
Complications during hospitalization					
Acute Respiratory Distress Syndrome	4480 (94.0)	4006 (95.3)	288 (80.9)	186 (90.3)	<0.001
Acute renal failure	1108 (23.2)	973 (23.1)	96 (27.0)	39 (18.9)	0.085
Acute cardiac injury	518 (10.9)	459 (10.9)	35 (9.8)	24 (11.7)	0.765
Superinfection	910 (19.1)	701 (16.7)	169 (47.5)	40 (19.4)	<0.001
Treatments					
Antibiotics	4157 (86.4)	3683 (86.7)	301 (85.3)	173 (83.6)	0.362
Antivirals	2685 (55.8)	2516 (59.2)	128 (36.3)	41 (19.8)	<0.001
Steroids	2194 (45.6)	1825 (42.9)	216 (61.2)	153 (73.9)	<0.001
Tocilizumab	198 (4.6)	168 (4.5)	24 (7.0)	6 (3.0)	0.050

* *p-value* for difference between the two quarters

The distribution of the main pre-existing diseases in the different periods is presented in figure 6. The prevalence of atrial fibrillation, stroke, dementia, cancer and renal insufficiency varies significantly in the three periods. These pathologies are more frequently diagnosed in the deceased in the second and third period than in the first (*Figure 6*).
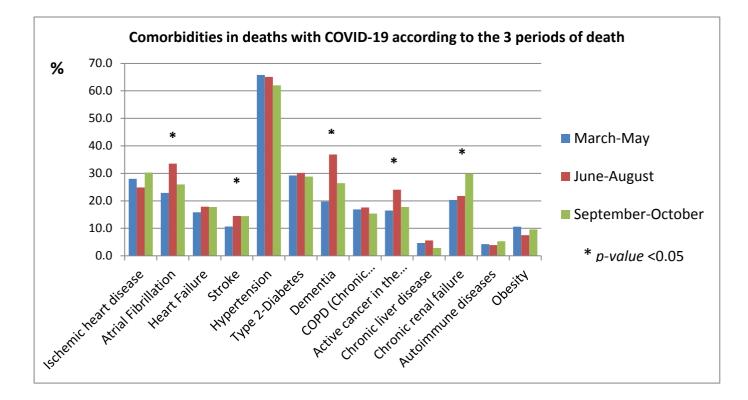
Comorbidities in deaths with COVID-19 according to the 3 periods of death

Table 5 shows the durations, as median times (in days), from the symptoms onset to death, SARS-CoV-2 testing, and hospitalization, and from the hospitalization to death, in the 3 periods considered. Between the first and second period triples the time that passes from the onset of symptoms to death, while it returns to the initial levels in the third period; decreases the time from the onset of symptoms to the swab for the detection of SARS-CoV-2 infection in both the second and third period, as well as the time between the onset of symptoms and hospitalization ; triples the median duration in days from hospitalization to death between the first and second period; it decreases again in the third period, even if it remains above the levels of the first period. These results seem to suggest a greater reactivity of the Health System evidenced by the greater speed in carrying out diagnostic tests and hospitalization..

Table 5. *Median times (in days) between symptoms onset, PCR test, hospitalization and death*

Times(in days)	All (n=4,888)		March-May 2020 (n=4322)		June-August 2020 (n=358)		September-October 2020 (n=208)		*p-value**
	Median	IQR	Median	IQR	Median	IQR	Median	IQR	
From symptoms onset to death	12	8-20	12	7-19	38	10-67	13	7-20	*<0.001*
From symptoms onset to SARS-CoV-2 testing	5	2-9	5	2-9	3	1-10	2	0-5	*<0.001*
From symptoms onset to hospitalization	4	2-7	4	2-7	3	1-7	3	1-6	*<0.001*
From hospitalization to death	7	3-15	7	3-13	22	6-52	9	4-14	*<0.001*

* *p-value* for difference between the two quarters

IQR=Inter-Quartile Range

The data here presented can be explained by a greater knowledge about the infection and a greater ability and timeliness of treatment in the period June-August in comparison to the previous quarter. In addition, it is likely that in the months of March and April SARS-CoV-2 infection was under-diagnosed in many frail elderly who died (such as those living in RSA). This may have led to an underestimation of the burden of the diseases in persons dying in that period

This report was produced by SARS-CoV-2 Surveillance Group

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