Characteristics of SARS-CoV-2 patients dying in Italy
Report based on available data on December 2nd, 2020

1. Sample

The present report describes characteristics of 55,824 SARS-CoV-2 patients dying in Italy*. Data are update to December 2nd, 2020. Geographic distribution across the 19 regions and 2 autonomous provinces of Trento and Bozen is presented in *Table 1*. Absolute number and percentage of deaths are reported in descending order of the total, according to the 3 periods since the beginning of the pandemic in 2020: the initial period (March-May), the second period (June-September), and the third (October-December), although the latter is still ongoing.

Table 1. *Geographic distribution of deceased patients SARS-CoV-2 positive, by period*

	March-May		**June-September**		**October-December**		**Total**	
REGION	**N**	***%***	**N**	***%***	**N**	***%***	**N**	***%***
Lombardia	16,360	*47.6*	606	*32.3*	5,286	*27.0*	22,252	*39.9*
Emilia Romagna	4,313	*12.6*	173	*9.2*	1,318	*6.7*	5,804	*10.4*
Piemonte	4,077	*11.9*	168	*9.0*	1,306	*6.7*	5,551	*9.9*
Veneto	1,950	*5.7*	248	*13.2*	1,701	*8.7*	3,899	*7.0*
Lazio	840	*2.4*	141	*7.5*	1,539	*7.9*	2,520	*4.5*
Liguria	1,516	*4.4*	138	*7.4*	764	*3.9*	2,418	*4.3*
Toscana	1,045	*3.0*	96	*5.1*	1,253	*6.4*	2,394	*4.3*
Campania	477	*1.4*	56	*3.0*	1,621	*8.3*	2,154	*3.9*
Sicilia	300	*0.9*	56	*3.0*	1,206	*6.2*	1,562	*2.8*
Puglia	524	*1.5*	75	*4.0*	947	*4.8*	1,546	*2.8*
Marche	981	*2.9*	7	*0.4*	169	*0.9*	1,157	*2.1*
Abruzzo	446	*1.3*	37	*2.0*	443	*2.3*	926	*1.7*
Friuli Venezia Giulia	343	*1.0*	20	*1.1*	373	*1.9*	736	*1.3*
Trento	402	*1.2*	4	*0.2*	256	*1.3*	662	*1.2*
Bolzano	290	*0.8*	2	*0.1*	270	*1.4*	562	*1.0*
Sardegna	131	*0.4*	24	*1.3*	269	*1.4*	424	*0.8*
Umbria	75	*0.2*	9	*0.5*	323	*1.7*	407	*0.7*
Valle d'Aosta	143	*0.4*	6	*0.3*	168	*0.9*	317	*0.6*
Calabria	96	*0.3*	4	*0.2*	152	*0.8*	252	*0.5*
Basilicata	29	*0.1*	2	*0.1*	105	*0.5*	136	*0.2*
Molise	22	*0.1*	2	*0.1*	104	*0.5*	128	*0.2*
Total	**34,360**	***100.0***	**1,874**	***100.0***	**19,573**	***100.0***	**55,807**	***100.0***

Note: *For 17 deceased persons, period was not possible to be evaluated*

* 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 23,596 (42.3%). *Figure 1* shows that median age of patients dying for SARS-CoV-2 infection was more than 30 years higher as compared with the national sample diagnosed with SARS-CoV-2 infection (median age 48 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 80).

Figure 1. *Median age of patients with SARS-CoV-2 infection and SARS-CoV-2 positive deceased patients*

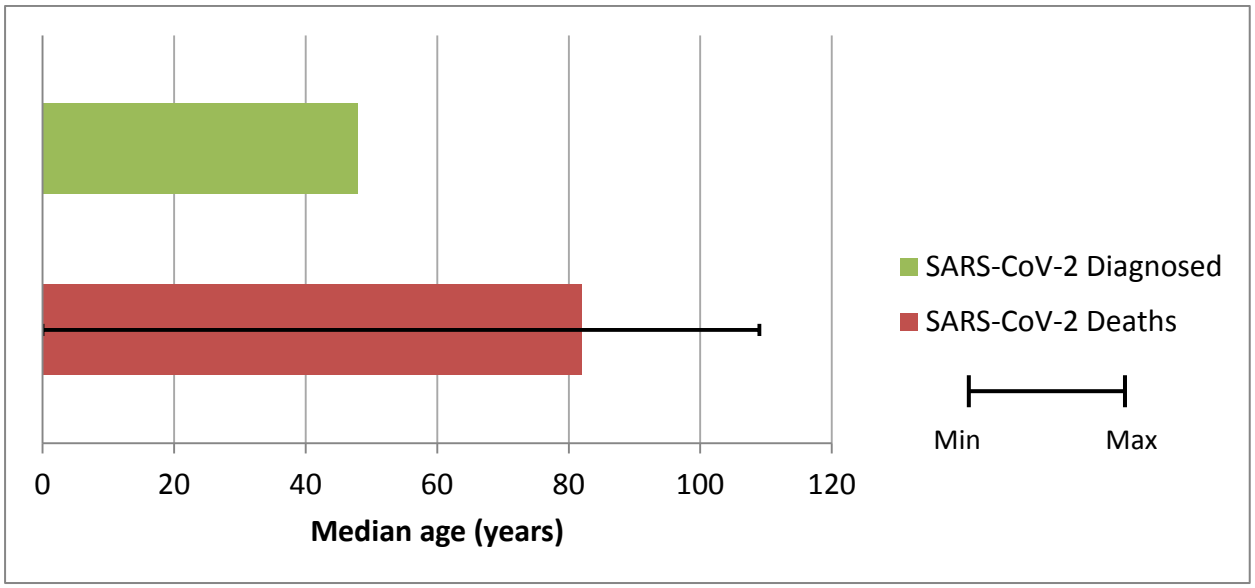


Figure 2. *Absolute number of deaths by age group*

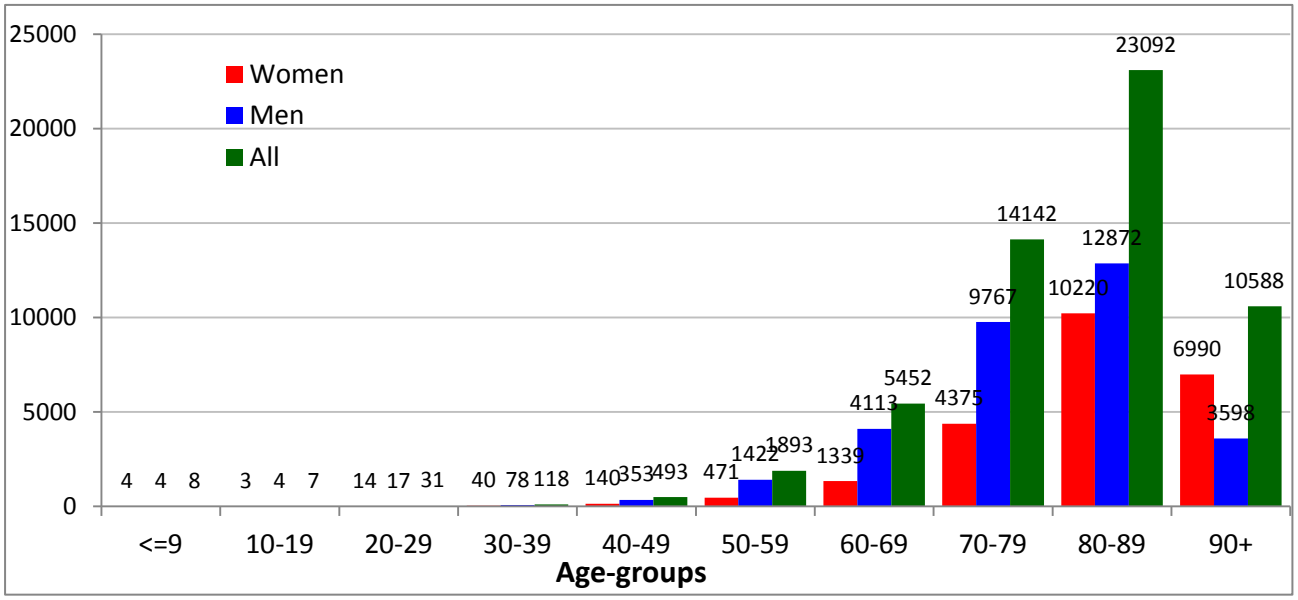
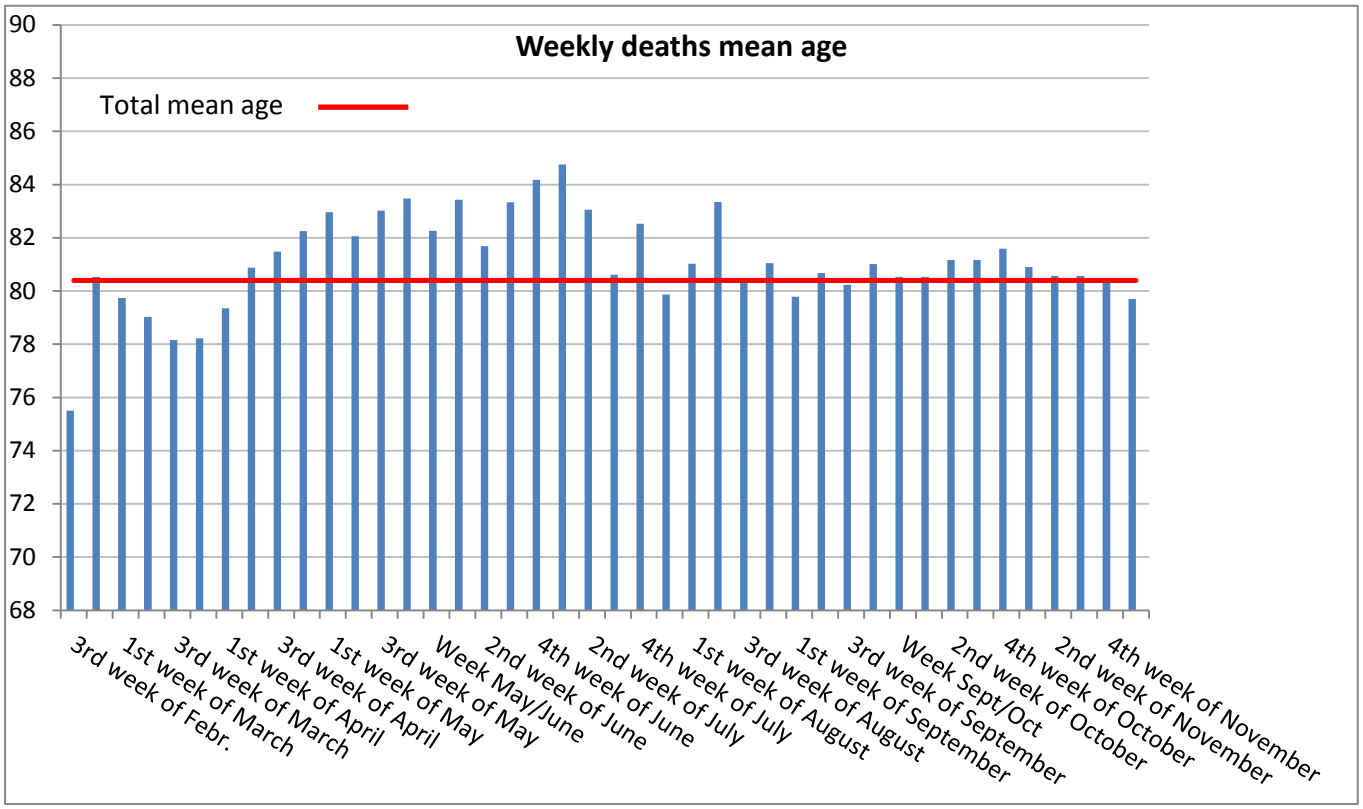


Figure 3 shows the trend in the average age of SARS-CoV-2 positive deceased patients per calendar week, starting from the 3rd week of February 2020 (the date of the first death dates back to 21st February 2020). The average age of weekly deceased persons has substantially increased up to 85 years (1st 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 5,726 patients dying in-hospital for whom it was possible to analyse clinic charts. Mean number of diseases was 3.6 (median 3, SD 2.1). Overall, 3.1% of the sample presented with a no comorbidities, 12.4% with a single comorbidity, 18.5% with 2, and 65.9% 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	*1591*	*27.8*
Atrial Fibrillation	*1388*	*24.2*
Heart failure	*936*	*16.3*
Stroke	*662*	*11.6*
Hypertension	*3779*	*66.0*
Type 2-Diabetes	*1671*	*29.2*
Dementia	*1323*	*23.1*
COPD (Chronic Obstructive Pulmonary Disease)	*992*	*17.3*
Active cancer in the past 5 years	*975*	*17.0*
Chronic liver disease	*268*	*4.7*
Chronic renal failure	*1207*	*21.1*
Dialysis	*121*	*2.1*
Respiratory failure	*390*	*6.8*
HIV Infection	*14*	*0.2*
Autoimmune diseases	*252*	*4.4*
Obesity	*591*	*10.3*
Number of comorbidities		
0 comorbidities	*180*	*3.1*
1 comorbidity	*712*	*12.4*
2 comorbidities	*1060*	*18.5*
3 comorbidities and over	*3774*	*65.9*

Table 3 presents the most common pre-existing chronic pathologies in patients who died, separately in men (n = 3,441) and women (n = 2,285). The average number of pathologies observed in women is 3.8 (median 4, Standard Deviation 2.0). In men the average number of pathologies observed is 3.5 (median 3, Standard Deviation 2.1).

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

	Women		**Men**	
Diseases	***N***	***%***	***N***	***%***
Ischemic heart disease	534	*23.4*	1057	*30.7*
Atrial Fibrillation	588	*25.7*	800	*23.2*
Heart Failure	434	*18.5*	502	*14.4*
Stroke	286	*12.5*	376	*10.9*
Hypertension	1570	*68.7*	2209	*64.2*
Type 2-Diabetes	614	*26.9*	1057	*30.7*
Dementia	733	*32.1*	590	*17.1*
COPD (Chronic Obstructive Pulmonary Disease)	318	*13.9*	674	*19.6*
Active cancer in the past 5 years	360	*15.8*	615	*17.9*
Chronic liver disease	93	*4.1*	175	*5.1*
Chronic renal failure	438	*19.2*	769	*22.3*
Dialysis	36	*1.6*	85	*2.5*
Respiratory failure	161	*7.0*	229	*6.7*
HIV Infection	2	*0.1*	12	*0.3*
Autoimmune diseases	142	*6.2*	110	*3.2*
Obesity	232	*10.2*	359	*10.4*
Number of comorbidities				
0 comorbidities	47	*2.1*	133	*3.9*
1 comorbidity	246	*10.8*	466	*13.5*
2 comorbidities	390	*17.1*	670	*19.5*
3 comorbidities and over	1602	*70.1*	2172	*63.1*

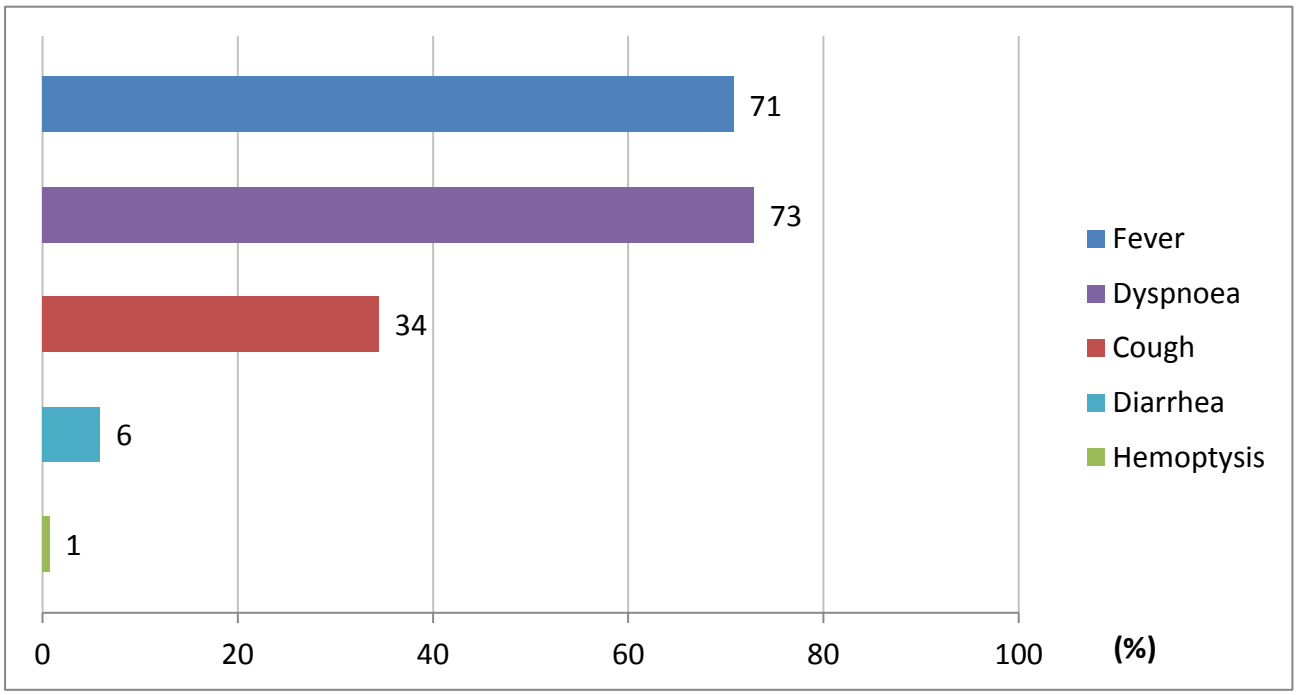
4. Diagnosis of hospitalization

In 90.8% of hospitalizations, conditions (e.g. pneumonia, respiratory failure) or symptoms (e.g. fever, dyspnoea, cough) compatible with SARS-CoV-2 were mentioned. In 491 cases (9.2% of cases) the diagnosis of hospitalization was not related to the infection. In 72 cases the diagnosis of hospitalization concerned exclusively neoplastic pathologies, in 165 cases cardiovascular pathologies (for example Acute Myocardial Infarction-AMI, heart failure, stroke), in 70 cases gastrointestinal pathologies (for example cholecystitis, perforation of the intestine, intestinal obstruction, cirrhosis), in 184 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, 8.1% 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 (**94.1% of cases**), followed by acute renal failure (23.6%). Superinfection was observed in 19.3% and acute cardiac injury in 10.8% of cases.

7. Treatments

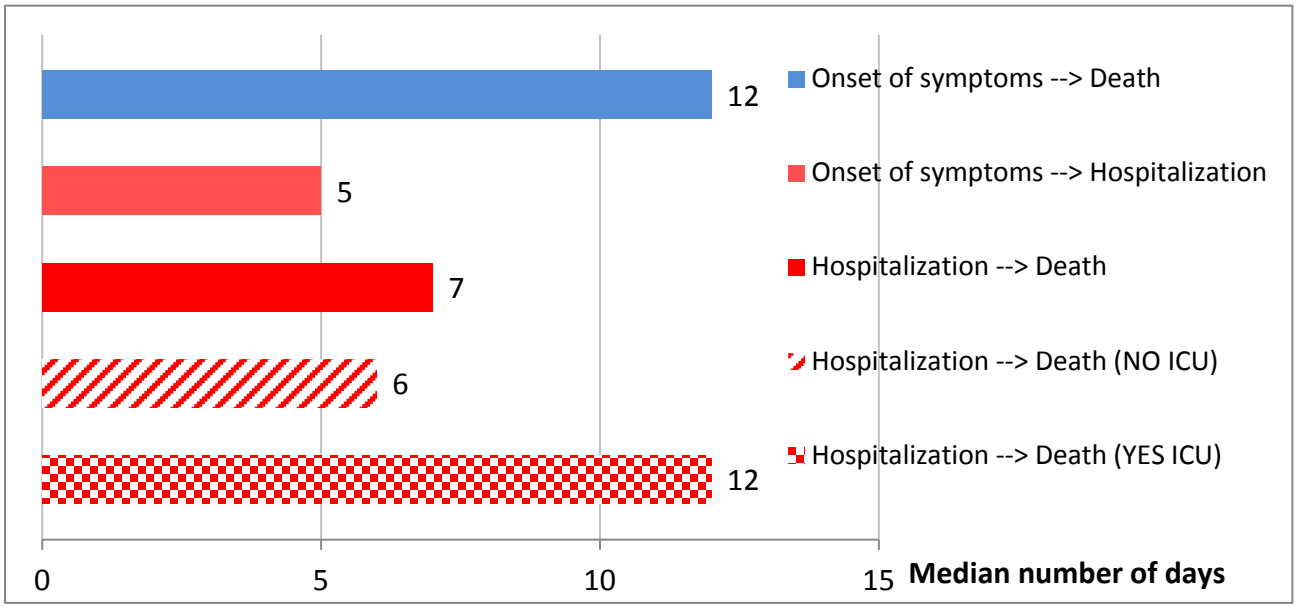
Antibiotics were used by 85.9% of patients during hospital stay, while less used were antivirals (50.2%) and corticosteroids (49.8%). Concomitant use of these 3 treatments was observed in 24.5% of cases.

Out of SARS-CoV-2 positive deceased patients, 4.1% 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. *Provenience*

Most of the SARS-CoV-2 positive deceased patients, at the time of the hospital admission, came from their home (53.3%); 22.9% came from social-health or social-welfare residential structures (nursing homes, hospices, wards or long-term care facilities); 18.6% had been transferred from another hospital and 5.2% from other unspecified facilities.

10. *Deaths under the age of 50 years*

As of December 2nd 2020, 657 out of the 55,824 (1.2%) positive SARS-CoV-2 patients under the age of 50 died. In particular, 163 of these were less than 40 years (102 men and 61 women), age range between 0 and 39 years. For 29 patients under the age of 40 years no clinical information is available; out of the remaining ones, 119 had serious pre-existing pathologies (cardiovascular, renal, psychiatric pathologies, diabetes, obesity) and 15 had no major pathologies.

11. *Comparison of death characteristics in the 3 quarters March-May, June- September, and October-December 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-September, and the third period October-December. Overall, the sample represents 10.5% of all deaths from the beginning of the pandemic; in particular, the 13.3% of those who died between March and May, 26.9% of those who died between June and September, and 4.0% of those who died between October and December.

Both the mean age of deaths and the proportion of women increase only in the second 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 periods 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- September, and October-December 2020*

All deaths	**All (n=55,807) (Missing=17)**	**March-May 2020 (n=34,360)**	**June- Sept 2020 (n=1,874)**	**Oct-Dec 2020 (n=19,573)**	***p-value****
Mean age (years)	80.3	80.1	82.3	80.7	*<0.001*
	n (%)	**n (%)**	**n (%)**		
Women	23,587 (42.3)	14,421 (42.0)	1087 (58.0)	8079 (41.3)	*<0.001*
Sample of the evaluated clinical charts	**All (n=5,726)**	**March-May 2020 (n=4,466)**	**June- Sept 2020 (n=499)**	**Oct-Dec 2020 (n=761)**	***p-value****
N of comorbidities					
0	180 (3.1)	169 (3.8)	5 (1.0)	6 (0.8)	*<0.001*
1	712 (12.4)	605 (13.5)	44 (8.8)	63 (8.3)	
2	1060 (18.5)	894 (20.0)	66 (13.2)	100 (13.1)	
3 or more	3774 (65.9)	2798 (62.7)	384 (77.0)	592 (77.8)	
Provenience					
Nursing homes, hospices, wards or long-term care facilities	285 (22.9)	93 (25.1)	45 (26.0)	147 (21.0)	*0.181*
Home	664 (53.3)	200 (53.9)	78 (45.1)	386 (55.1)	*0.060*
Other Hospital	231 (18.6)	54 (1.2)	43 (24.9)	134 (19.1)	*0.013*
Other	65 (5.2)	24 (0.5)	7 (4.0)	34 (4.9)	*0.398*
Complications during hospitalization					
Acute Respiratory Distress Syndrome	5274 (94.1)	4138 (95.1)	410 (83.2)	726 (95.0)	*<0.001*
Acute renal failure	1323 (23.6)	1001 (23.0)	133 (27.0)	189 (24.7)	*0.106*
Acute cardiac injury	608 (10.8)	471 (10.8)	49 (9.9)	88 (11.5)	*0.678*
Superinfection	1081 (19.3)	721 (16.6)	201 (40.8)	159 (20.8)	*<0.001*
Treatments					
Antibiotics	4854 (85.9)	3810 (86.7)	422 (85.9)	622 (81.5)	*0.001*
Antivirals	2835 (50.2)	2597 (59.1)	156 (31.8)	82 (10.7)	*<0.001*
Steroids	2816 (49.8)	1901 (43.3)	319 (65.0)	596 (78.1)	*<0.001*
Tocilizumab	210 (4.1)	170 (4.4)	28 (5.9)	12 (1.6)	*<0.001*

* *p-value* for difference between the 3 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, COPD, 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*).

Figure 6. *Pre-existing pathologies in deaths with COVID-19 in the 3 periods*

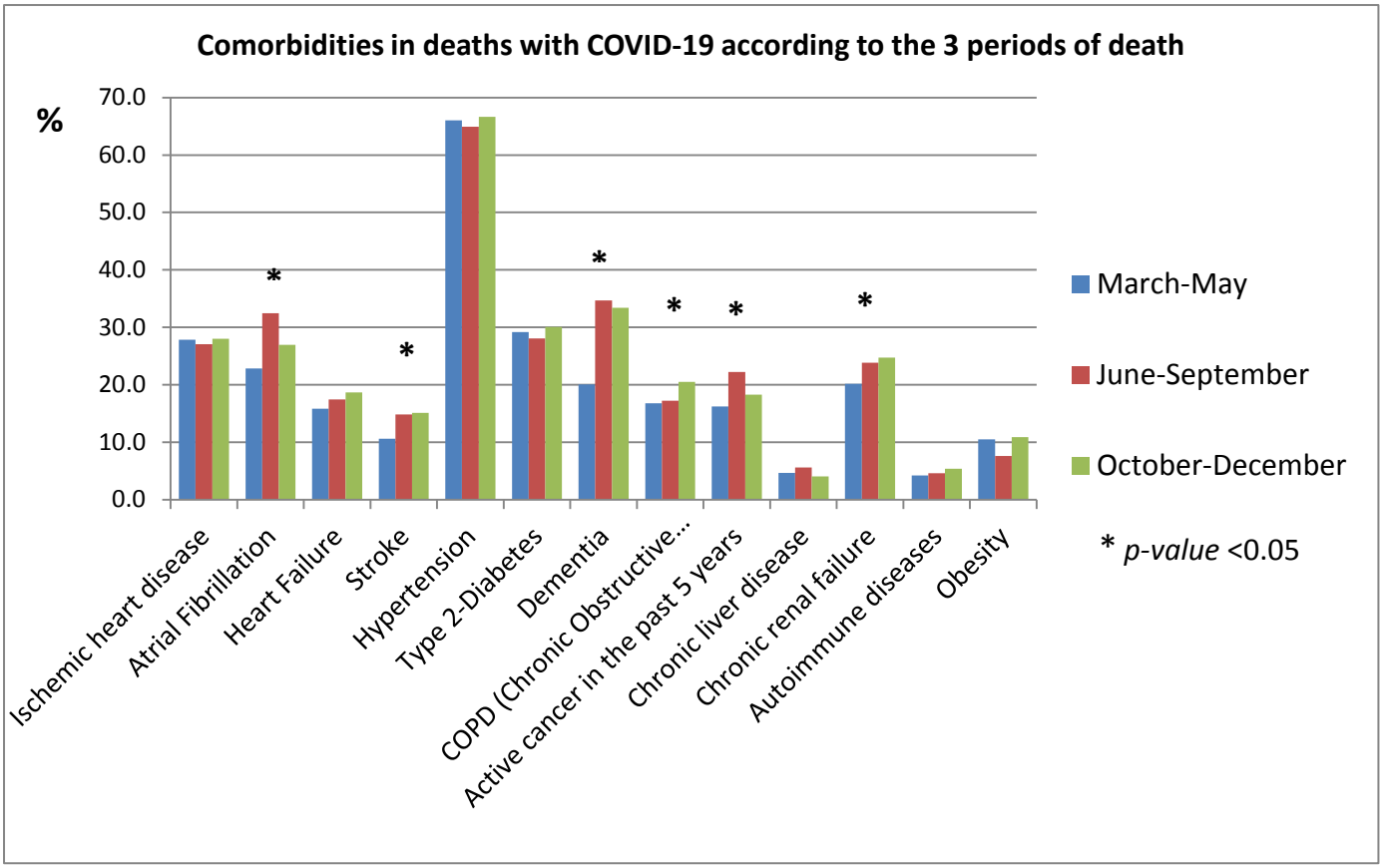


Table 5 shows the durations, as median times (in days), from the symptoms onset to death, SARS-CoV-2 testing, and hospitalization, and from the hospitalization to death, in the 3 periods considered. Between the first and second period doubles the time that passes from the onset of symptoms to death, 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; the median duration in days from hospitalization to death between the first and second period doubles; it decreases again in the third 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 in the 3 periods*

	All (n=5,726)		**March-May 2020 (n=4,466)**		**June- Sept 2020 (n=499)**		**Oct-Dec 2020 (n=761)**		***p-value****
Times(in days)	**Median**	**IQR**	**Median**	**IQR**	**Median**	**IQR**	**Median**	**IQR**	
From symptoms onset to death	12	7-20	12	7-19	22	9-55	11	6-18	*<0.001*
From symptoms onset to SARS-CoV-2 testing	5	2-8	5	2-9	3	1-7	3	1-6	*<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	3-14	7	3-13	15	5-43	7	3-12	*<0.001*

* *p-value* for difference between the 3 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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