Demographic effects of COVID-19: reflections on mortality

Gian Carlo Blangiardo
President of the Italian National Institute of Statistics - Istat
President of the Scientific Committee of the Rivista di statistica ufficiale

Abstract

The dynamics of the death rate in the first quarter of 2020 moved in a very different direction, highlighting a shock that led to a much higher annual value than expected. In particular, due to the COVID-19 epidemic, in March 2020 the number of deaths increased dramatically, with an intensity that in some Italian areas reached very high peaks. This sharp rise in mortality, which occurred during a year that had started with excellent prospects, was characterised on the one hand by a marked territorial localisation, on the other hand by a particular incidence of deaths among the elderly population, and especially among men.
In the light of this sudden and rapid development, this article illustrates a historical analysis, which is essential for evaluating "if and when" something similar occurred in the past.
Finally, a simulation exercise is used to design different scenarios.

Keywords: COVID-19 pandemic; trend in the number of deaths; risk of death; simulation models.

1. The storm after the quiet

In the month of March 2020, due to the COronaVIrus Disease 2019 (COVID-19) pandemic, the number of deaths in Italy increased dramatically, with unprecedented peaks in some territorial areas of the country. Using a subset of 5,069 municipalities as a reference[1], it emerged that the total number of deaths recorded between March 1st and April 4th 2020 is higher by 41% than that observed in the same period of 2019 (such value has been recently updated to 49% for the month of March, on a larger set of 6,866 municipalities). The territorial detail identifies areas (48 municipalities) where the frequency of deaths increased at least tenfold as compared to the previous year; in many others (no less than 140), such frequency was at least five times higher. In 37 small municipalities, that in the period March 1st - April 4th 2019 had not registered any cases, the count of 2020 reached 304 deaths (Istat, 2020*a*).

Comparing gender and age, a 44% growth was recorded among persons aged 65 and over, against 11% among the remaining age groups, with a gap largely unfavourable to men: +56% among men aged 65 and over and +34% among women in the same age group.

It is noteworthy that the sharp increase in mortality in the month of March 2020 occurred in a year that started with excellent prospects: overall, in the 5,069 municipalities under examination the first two months of 2020 recorded a 8% decrease of deaths between January 1st and February 2nd and a 9% decrease of deaths between February 3rd and 29th, as compared to 2019.

1 This subset is included in the National Register of the Resident Population, which groups those municipalities characterised by reliability and timeliness of the data provided. This set is indeed self-selected and therefore is not to be intended as a statistically representative sample of the Italian municipalities, despite the fact that it covers about two-thirds of the total Register.

2. Earlier cases in recent history

Since the end of the Second World War (WWII), relevant increases in mortality have been observed in Italy in at least a couple of occasions (Figure 1). The first in 1956, with about 50,000 extra deaths concentrated during the winter[2] and among the older population. The second time in 2015, with a similar annual increase (+50,000 deaths) also in this case largely due to the action of flu viruses during the wintertime, associated to the lethal effects of a particularly hot summer.

In more detail, 188,132 deaths were recorded in the January-March quarter of 2015, as compared to 164,590 and 166,590 of the same period of 2014 and 2016.

Nevertheless, what we are witnessing today often evokes, at least when emphasising consequences of social and health-related kind, something that occurred long before the end of WWII, one century ago.

It was the global pandemic known as *Spanish Flu*: an event that manifested its most dramatic effects by the end of 1918, in the context – certainly very different from the present – of a population worn out by the Great War and affected by precarious conditions in their physical state, infrastructures and knowledge.

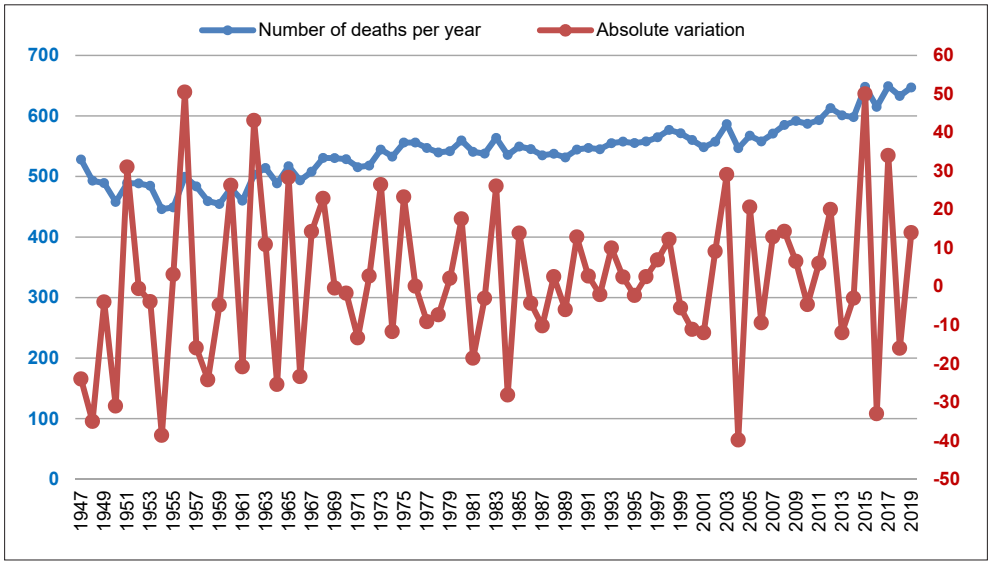
Upon reading the dramatic balance of what occurred in those times, we face figures greatly exceeding the 20-25,000 deaths – even if we should consider those as a default approximation – attributed so far to COVID-19 in 2020 (the current reference is the second half of April).

Quoting a famous Italian scholar of the time, Giorgio Mortara[3]: *"If we sum the extra deaths between August 1918 and March 1919, we obtain 532,457 deaths exceeding the normal figure. If we consider […] that for the invaded municipalities the number of deaths in the official statistics is lower than the real one, it is convenient to round the aforesaid figure up to 600,000 […]"* (Mortara, 1925).

2 From the comparison with the previous year, it is to be considered that the 1956 variation in the number of deaths was by over 80% concentrated in the first quarter of the year. In February 1956 a total of 69,739 deaths were recorded, with an increase of 30,730 and 29,919 cases respectively, as compared to the same month in 1955 and 1957 (Istituto Centrale di Statistica, 1957, 1958 and 1959).

3 Mortara,G., 1925: 121.

Figure 1 – Italy: variations of the number of deaths per year since the end of WWII (in thousands)



Source: Istat, Demographic balance

3. Key issues

As we have seen, figures from the remote past reflect the dramatic nature of an event that had huge consequences, today unconceivable and, we hope, totally non-repeatable.

However, in the light of the current experience, what could realistically be the effect of COVID-19 in terms of mortality? What consequences can we expect on the growth of life expectancy, a trend that we pleasantly came to take for granted? In addition, to what extent the evolution of demographic aging, so far defined by the scholars as "ineluctable", could show signs of a significant relenting, or even a reversed trend?

In order to respond to such questions, it is necessary to produce some valid estimations of the final balance of the extra deaths caused by the pandemic, as well as of their incidence on different age groups. To this purpose, a simple exercise of simulation may allow us to design a few hypothetic scenarios.

Starting with the age structure of the resident population in Italy on January 1st 2020, and submitting it to the probability of death resulting from the most recent life table produced for Italy (Istat, 2020*b*), we obtain 637,000 deaths, a figure that could be compared – in simulating the global effects of COVID-19 – to what we would obtain by making the same calculation after introducing the appropriate variations of the risk of death, expressed by the probabilities listed in the life table.

For instance, supposing that the COVID-19 effect during a quarter could determine a constant 50% increase of the probability of death for the older age groups – here defined from the 60th birthday on – we would obtain for 2020 an annual number of 710,000 deaths (+73,000). Alongside with that, life expectancy at birth would decrease as far as 82.11 years (-0.87), and that at the 65th birthday from 20.89 to 20.02.

4. Alternative scenarios

If we proceed likewise and introduce, one at a time, alternatives (or variants), both of intensity in risk increase (probability of death) and in its duration, we will obtain the following range of scenarios (results).

Table 1 – Consequences of the increased probability of death of different intensity and duration

Year 2020	Simulation model - Variants							
	I	II	III	IV	V	VI	VI	VIII
Months:	*Percent variations of the basic risk for every age from 60 years*							
January	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0
March	40	40	40	40	40	40	40	40
April	40	30	30	30	30	30	20	20
May	30	30	30	20	20	10	10	10
June	30	30	20	20	20	10	10	0
July	30	20	20	20	20	10	0	0
August	20	20	20	20	0	0	0	0
September	20	20	20	0	0	0	0	0
October	20	20	0	0	0	0	0	0
November	20	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0
	Corresponding total variations for 2020 - Results							
Deaths (in thousands)	+123	+103	+88	+74	+64	+49	+39	+34
(*) e_0	-1.40	-1.19	1.04	-0.87	-0.77	-0.60	-0.48	-0.42
(**) e_{65}	-1.38	-1.18	1.03	-0.86	-0.76	-0.59	-0.47	-0.42
Population aged 65+ (in thousands)	+60	+79	+93	+107	+117	+131	+141	+145
Population aged 85+ (in thousands)	+2	+13	+20	+28	+33	+41	+46	+49

Source: Processing on Istat data
(*) Life expectancy at birth (years and fraction); (**) Life expectancy at age 65 (years and fraction).

It can be seen that increases of mortality due to COVID-19 pandemic are destined to grow, as it is natural to expect, depending on the intensity and duration of the greater risk of death.

Moving from a situation characterised by a persistent high level of increased risk, where the rise, albeit reduced, lasts until November (model I), to the scenario of a relatively rapid containment, with a return to normality

within three months (model VIII), the annual frequency of deaths in 2020 would range from a maximum of 123,000 cases to a minimum of 34,000.

Alongside with this, life expectancy at birth would decrease by 1.4 years in the conditions of the most adverse model, and only by 0.42 in the least adverse one (Blangiardo, 2020).

In the two extreme cases, this would mean going back to life expectancy to be found in Italy, respectively, in the 2009-2010 and 2014 life tables calculated considering the total population.

5. Concluding remarks

Some further elements to complete this contribution.

Considering the effect on demographic aging, the models illustrate how the growth of the older population component – with regard to persons aged both 65 years and over and 85 and over – does not seem destined to stop in any case.

It rather results lower: +60,000 and +2,000, respectively, for the two aggregates, in the most adverse survival conditions; while it rises to +145,000 and +49,000 in the least dramatic hypothesis.

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