Perspective

COVID-19 in Italy: Considerations on official data

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ABSTRACT

COVID-19 represents a major public health issue in Italy; estimating the size of the outbreak could direct public health policies and inform us of the extent of the reorganization needed in the healthcare system, the efficacy of quarantine measures, and eventually on the achievement of herd immunity. To chart the real extent of COVID-19 infection in Italy official data need to be interpreted, considering various aspects such as the "suspected-case" definition that changed during recent months, the management of asymptomatic and untested symptomatic cases, the system for reporting deaths, and short-term fluctuations. All these aspects should be considered when reflecting on the meaning of the official COVID-19 figures in Italy. Regionalization of the healthcare system and fragmentation of data represent real challenges in the management of the COVID-19 outbreak in Italy. The authors' opinion is that transparent and accurate reporting could guide policy-making and help reorganize health services.

Introduction

COVID-19 represents a significant public health issue. Mar 11, 2020, the World Health Organization (WHO) officially declared the COVID-19 outbreak a pandemic (World Health Organization (WHO), 2020). This virus can easily spread (Wang et al., 2020; Li et al., 2020) and can lead to asymptomatic cases (Tian et al., 2020; Mizumoto et al., 2020), mild syndromes (Guan et al., 2020; Wu and McGoogan, 2020) as well as severe manifestations, requiring hospitalization and Intensive Care Units (ICU) (Wu and McGoogan, 2020). Italy is among the world's worst-hit countries (Ministry of Health, Italy, 2020) and the first among Western countries to order a national lockdown.

Accurate estimates of the size of the outbreak could influence public health policies. They could inform Covid-19 research on the necessary reorganization of a healthcare system and on the efficacy of quarantine measures. Finally, accurate estimates could improve our understanding of how close we are to the acquisition of herd immunity.

National bulletins provide us with official data on analyzed swabs, confirmed cumulative cases, home isolation cases, hospitalized cases, ICU cases, and deaths (Ministry of Health, Italy, 2020). However, Russel et al. estimate that Italy is one of the countries with the highest percentage of unreported cases of COVID-19 (Russel et al., 2020). The regionalization of data flow represents another challenge. Data is communicated daily – in an aggregate fashion - by every region to the national authorities; however, there is no standardized collection of data. In parallel, public health services upload individual data to a surveillance system's online platform. While the first data flow is region-dependent and has the advantage of being updated daily, the second is more standardized but notifications refer to cases diagnosed on previous days. In this paper, we will refer to the first data flow, which has extensively been used by scientists and media to analyze the pandemic's evolution. Regarding this data flow, the lack of uniformity among Italian regional data raised the unconvincing hypothesis of differently virulent SARS-CoV-2 types. Thus, to track the real extent of COVID-19 infection in Italy, it needs to be interpreted according to the following points.

Suspected case definition

At the beginning of the epidemic, the definition of "suspected case" to be tested for SARS-CoV-2 was based on symptoms (fever, cough, and flu-like symptoms) and a history of traveling or residence in China or Italian "red areas." This testing policy explains why the regions of Lombardy and Veneto initially collected more samples. The definition was later revised as a person with acute respiratory infection associated with either a history of travel or residence in an area reporting local transmission of COVID-19, close contact with a confirmed or probable COVID-19 case, or requiring hospitalization (Italian Ministry of
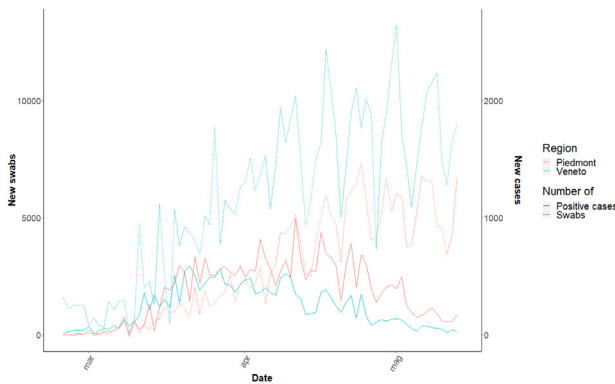

Figure 1. Number of daily swabs and daily new cases in Piedmont and Veneto.

Health, 2020). Nonetheless, Veneto decided to extend testing to asymptomatic people with close contact with confirmed cases or asymptomatic people in red areas.

The result is that the proportion of the population tested varies among regions. The percentage of samples over the total population ranges from 0.92% in Campania to 5.46% in Veneto (data updated Apr 21) (Ministry of Health, Italy, 2020).

Taking the proportion of the tested population into consideration helps us interpret official data. For example, Veneto (the region that tested the most) and Piedmont have recorded similar numbers of confirmed cases until mid-April. However, the number of deaths and the number of hospitalized and ICU patients was much higher in Piedmont. This suggests that a vast number of infections went undetected in Piedmont. Even though most of these undetected cases probably presented mild or moderate symptoms, some critical patients might have died without a confirmed diagnosis.

Short-term fluctuations

Short-term fluctuations might compromise the reliability of daily data. These fluctuations are due to laboratory delays – e.g., results from delays due to laboratory saturation – or calendar effects. The number of swabs tends to drop on weekends, and thus we notice a weekly pattern in the time series of the number of swabs and positive cases (Figure 1). Techniques, such as moving averages, should be considered in order to account for this variability.

Asymptomatic and untested symptomatic cases

The number of asymptomatic and untested symptomatic subjects is essential to track the size of the outbreak. In the literature, there remains a high level of uncertainty in the estimates of the percentage of asymptomatic carriers (Centre for Evidence-Based Medicine (CEBM), 2020). We hypothesize that untested symptomatic subjects develop mostly mild or moderate syndromes. Tabata et al., for example, found that 43 out of 104 patients were mildly symptomatic on the "Diamond Princess" (Tabata et al., 2020).

The reasons for underdiagnosis of asymptomatic and mildly/moderately symptomatic patients may be:

a) political and healthcare choices;

b) geographic proximity to "red areas" (Giordano et al., 2020);

c) strength and flexibility of public health services and primary care services;

d) availability of swabs and/or laboratories to analyze samples (Rubino et al., 2020).

Saturation of ICU

It is worth remarking that the number of ICU patients is given as daily prevalence data, while the total number of positive cases and deaths is cumulative. We should consider that the total number of ICU cases may reflect the saturation of ICU capacity and not the total need for ICU beds (Grasselli et al., 2020). Moreover, some of the dead and healed subjects must have previously been taken care of in ICU. Zhou et al. found that out of 54 deaths in a hospital setting, 42 had been treated in ICU, i.e., 77.7%) while 12 were never admitted to ICU - 22.3%, probably because of old age, comorbidities or lack of ICU beds (Zhou et al., 2020). However, deaths do not always occur in hospital wards or ICUs. Particularly in those areas where deaths and recoveries now significantly outnumber prevalent ICU cases, the percentage of subjects who would need intensive treatment over the total of infected cases is underestimated.

Deaths reporting

The Italian National Institute of Statistics (ISTAT) adopted the WHO ICD-10 codes 'U07.1 COVID-19, virus identified' and 'U07.2 COVID-19, virus not identified' to code deaths from COVID-19 as confirmed or not by laboratory testing. Nonetheless, we expect underreporting and misclassification.

In Nembro (province of Bergamo), one of the most affected municipalities, the number of expected deaths in the first three months of 2020 under normal conditions was 35. 158 deaths were instead registered by municipal offices. The number of deaths officially attributed to COVID-19 is 31. It is reasonable to expect that the deaths in excess occurred at home or in nursing care homes (Corriere della Sera (CdS), 2020).

However, we cannot exclude some cases of misclassification due to ascertainment bias, i.e., coding deaths from severe respiratory syndrome with 'U07.2 COVID-19, virus not identified'.

Table 1

Regional population, number of samples, percentage of samples over the population, the cumulative number of reported cases, percentage of cases over population, percentage of collected samples over cases, hospitalization ratio, and hospital vs. home care ratio. Hospitalization ratio is the percentage of hospitalized cases over total cases (this value is the mean of the ratios calculated daily since the beginning of the pandemic). Hospital vs. Home Care ratio is the percentage of hospitalized cases over cases managed at home (this value represents the mean of the ratios calculated daily since the beginning of the pandemic) (Anon, 2020).

OFFICIAL DATA Apr 21	Population	Samples	Samples*100 /population	Cumulative Cases	Cases*100 /population	Samples/ Cases	Hospitalization ratio (mean)	Hospital vs Home Care ratio (mean)
Emilia-Romagna	4,459,477	134,878	3.02	13,244	0.30	10.18	0.34	0.48
Lazio	5,879,082	100,031	1.07	4,402	0.07	22.72	0.45	0.76
Lombardy	10,060,574	277,197	2.76	33,978	0.34	8.16	0.46	0.80
Marche	1,525,271	44,332	2.91	3,218	0.21	13.78	0.34	0.46
Piedmont	4,356,406	105,434	2.42	14,811	0.34	7.12	0.39	0.63
Veneto	4,905,854	268,069	5.46	10,077	0.21	26.60	0.21	0.23
Italy	60,359,546	1,450,150	2.40	78,671	0.18	18.43	0.35	0.46

Case fatality ratio (CFR)

According to official statistics, 13.40% of confirmed cases died by Apr 21, varying between 4.43% in Umbria and 18.52% in Lombardy. Mizumoto et al. suggest that elevated death risk estimates can be the consequence of a breakdown of the healthcare system (Mizumoto and Chowell, 2020). This is consistent with the Italian figures indicating that Northern regions of Lombardy and Emilia Romagna have both the highest cumulative incidences and highest CFRs. However, a time lag occurs between infections and deaths. If the curve of deaths follows the curve of cases, the death curve in first-hit regions (Lombardy and Emilia Romagna) might precede those of other regions.

The Italian official CFR is higher than those of South Korea and Germany. Both South Korea and Germany analyzed a lot of samples and, as a result, have a wider coverage of diagnosis, increasing the denominator of the CFR (Rodriguez-Morales et al., 2020). Verity et al. found CFR values ranging from 2.7% to 3.6% (Verity et al., 2020). As noted by Onder et al., the proportion of positive cases over total samples positively correlates with the CFR (Onder et al., 2020).

Conclusions

Regionalization of the healthcare system and fragmentation of data represent challenges in the management of the COVID-19 outbreak in Italy. The lack of a strong centralized response to the emergency resulted in different regional policies, especially in terms of testing strategies.

Table 1 shows regional differences in surveillance and containment strategies and measures. In particular, it emerges how some regions tested more than others (e.g., Veneto collected 26.60 samples for each case while Piedmont only 7.12 for each case) and how different was the management of the disease among different areas (e.g., Veneto hospitalized, on average, 21% of COVID-19 patients, while Lombardy hospitalized, on average, 46% of COVID-19 patients). It is of utter importance to develop a system for informing infectious diseases based on a constantly updated and unique platform at a national level, possibly fed by laboratory data and linked to clinical records and other administrative databases. A transparent and accurate reporting could guide policy-making and help reorganize health services (Rodriguez-Morales et al., 2020).

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Ethical Approval

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Conflict of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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