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Spatial inequalities of COVID-19 in Italy

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Abstract

A critical analysis was conducted on data relating to the COVID 19 infection in Italy. Looking at the official figures in our country, regional differences make data comparison and interpretation quite challenging. Differing health policy strategies (hospital assistance vs. local health assistance, swab tests to very specific population groups vs. screening of larger groups) add another layer of complexity when comparing data. The different levels of susceptibility to the infection among Italian regions can be partially explained by analysing many factors. We have grouped such factors into two subject areas (Social policies and healthcare strategies; Climate and geography) and listed some of the causes that could have led to different levels of susceptibility to the infection. Reflection on and awareness of the mistakes made will allow us to prevent the re-occurrence of health protection inequalities.

Keywords: COVID-19, Climate and Geography, Healthcare Strategies, Social Policies, Spatial Inequalities

1. Introduction

Coronaviruses are a family of viruses widely distributed in the world. They typically cause moderate symptoms like coughing, a fever, and shortness of breath. However, people at higher risk may develop severe pneumonia. Acute health implications are due to the fact that COVID-19 is highly contagious, and its genomic structure underwent adaptations during its transition from animal to human (spill-over). The main route of transmission of the virus is airborne (through droplets).

On December 31st 2019, the health authorities of Wuhan, a city in the province of Hubei in China, reported to the WHO an outbreak ("cluster") of interstitial pneumonia of unknown aetiology. On January 9th 2020, the Chinese Center for Disease Control and Prevention attributed the aetiology of this illness to a coronavirus resembling the one responsible for the SARS epidemic (Severe Acute Respiratory Syndrome of 2002), and the Coronavirus responsible for the MERS outbreak (Middle Eastern Respiratory Syndrome of 2012). This is why the current reference name

for the coronavirus is SARS-CoV-2 and the official name of the novel disease is COVID-19 (Coronavirus Disease-19)[1].

On April 17th 2020, 213 countries reported Sars-CoV-2 cases with a total of 2,034,802 confirmed infections. The WHO then declared the coronavirus outbreak a global pandemic.

On April 25th, Italy had reported over 195,000 cases and 26,000 fatalities, overtaken in number of infections only by the US and Spain[2].

2. Italy coronavirus

Looking at the official figures in Italy, regional differences make data comparison and interpretation quite challenging.

The Table 1 contains data relating to 5 regions in the north of Italy, 5 in central Italy and 5 in the south of Italy. As reported on the Italian Department of Civil Protection's website, the Table shows population estimates by region (Column 1) and the associated number of infections (Column 2). This latter figure does not accurately depict a full picture of the COVID-19 activity, as it is estimated by adding the number of hospitalised patients who have developed the disease, and the number of those who self-isolated at home as a result of positive swab tests. The resulting figure, as experts have reported, appears incomplete as it does not account for the true total number of those who have actually been infected, but only for a small portion.

Differing health policy strategies (hospital assistance vs. local health assistance, swab tests to very specific population groups vs. screening of larger groups) add another layer of complexity when comparing data between countries. Italy favours reporting data relating to inpatients, as they are reliable and attest to the certainty (and severity) of the disease. Death toll numbers could also be considered accurate figures, however, different countries follow different reporting protocols (e.g. Italy calculates it on the basis of the number of patients who tested positive and then died) which could explain the differing COVID-19 fatality rates between countries.

In this respect, it is useful to point out that there is a substantial difference between case fatality and mortality rates. The first is the number of infected cases divided by the number of deaths as a result of COVID-19, while the mortality rate is the number of deaths due to COVID-19 divided by the total population.

3. Data analysis and specific considerations

Grouping data by macro geographical regions, we observe that the north of Italy has a combined population of over 24,500,000 people, central Italy of over 13,000,000 people, and the south of Italy of about 18,000,000 people.

Columns 2 and 3 highlight differences between regions and macro geographical areas in the occurrence of COVID-19 in Italy. Such differences can be partially explained by analysing a number of factors.

We have grouped such factors into two themes and listed some of the causes that could have led to different levels of susceptibility to the infection.

We should be aware that only time will allow for a more thorough analysis and validation of our assumptions.

3.1 Social policies and healthcare strategies

As far as concerns a first set of causes that could have led to different levels of susceptibility to the infection, we have to underline the importance of social policies and healthcare strategies.

[1] For insights see: Pesaresi et al., submitted.

[2] For insights regarding clinical characteristics of coronavirus disease, outbreak and present data see: Kamps and Hoffmann, 2020; Wu and McGoogan, 2020; Guan et al., 2020.

Region (population)	Total infected and recovered		Deaths	
Lombardy (>10,000,000)	34,473	9,213	13,269	North Italy
Piedmont (>4,350,000)	15,502	3,175	2,767	North Italy
Emilia-Romagna (>4,500,000)	12,347	2,964	3,347	North Italy
Veneto (>4,900,000)	9,432	1,234	1,288	North Italy
Liguria (>1,550,000)	3,433	842	1,093	North Italy
Tuscany (>3,729,000)	6,146	853	760	Central Italy
Lazio (>5,800,000)	4,561	1,604	387	Central Italy
Marche (>1,500,000)	3,272	747	871	Central Italy
Abruzzo (>1,300,000)	2,061	349	293	Central Italy
Umbria (<900,000)	297	113	63	Central Italy
Campania (>5,800,000)	2,935	598	341	South Italy
Apulia (>4,000,000)	2,919	517	391	South Italy
Sicily (>5,000,000)	2,272	485	224	South Italy
Calabria (>1,950,000)	811	132	80	South Italy
Basilicata (>600,000)	218	65	25	South Italy

Table 1. Table of COVID-19 activity by region referred to April 25. Source: Istat and Civil Protection Department data (www.protezionecivile.gov.it).

After all, many works have: focussed the attention on the recommendations for the prevention, mitigation and containment of the virus (Basile et al., 2020); discussed various approaches for tackling emergency, with different results (Buffagni, 2020); analysed the influence of the clinical features of the patients infected (Huang et al., 2020) and the relation with cardiovascular disease (Clerkin et al., 2020); spoken about the economic aspects of the pandemic (Surico and Galeotti, 2020).

In these perspectives, we have systematized and synthetized specific considerations according to the following.

a) The Italian government managed the coronavirus pandemic by issuing a series of decrees that progressively increased restrictions within certain regions until they were ultimately applied to the whole country. Local interpretations and autonomies, as well as uneven approaches to duration and intensity of social distancing measures[3], allowed citizens of different regions to act and behave differently, making it difficult to ensure equal levels of health protection.
b) Long decision-making times for the implementation of social distancing measures impacted on the spread of the disease.
c) Healthcare resources: over the past 15 years budget policy decisions promoting spending cuts, have led to a reduction of hospital beds in all departments but more specifically in intensive care units. Lower staff turnover and reduced public recruitment competitions have impacted on the number of the health care practitioners (doctors and nurses). Funding cuts have affected the adequacy of diagnostic and treatment technology. All these factors combined have reduced the ability of the healthcare system to respond efficiently and effectively to the sudden outbreak of the pandemic.
d) Family living arrangements in Italy with many elderly people living in in close contact with young people (less susceptible to long-term implications from the disease) may have facilitated the transmission of the virus to the most vulnerable leading them to an adverse outcome.
e) Older people with pre-existing medical conditions such as hypertension, cardiovascular diseases, chronic respiratory diseases, diabetes, obesity, neoplasms and immunodepression appear to have been more vulnerable to becoming severely ill with the virus. In certain areas where the most infected were elderly people who had to resort to hospital treatment, this resulted in overcrowded healthcare facilities which in turn helped the spread of the virus.
f) Management and treatment of COVID-19: opting for a centralised, hospital-centred healthcare system, whereby all infected patients are directed to emergency rooms and hospital facilities, have facilitated the spread of the virus. The hospitals themselves, under extreme pressure, have become hubs of infection. A different model based on a more decentralised approach could have led to a different outcome. A community-centred care in which more health care is delivered outside of the hospital through home care and mobile clinics, could have facilitated patient isolation and decreased the transmission, reserving hospital treatment to those who needed more intensive care.
g) Swab tests have been inconsistently carried out due to different approaches taken at territorial level: 1) tests reserved for people probably positive because showing symptoms, 2) tests only directed to people at high risk or to those that have been in contact with individuals who resulted positive, 3) screening arranged for all social care staff for prevention and control. A holistic testing strategy for COVID-19 including screening for asymptomatic infections has not been adopted. We are still waiting for completion of antibody tests pending definition of types, and identification of suitable manufacturers.
h) Provision of PPE (Personal Protective Equipment) to health care workers (doctors and nurses) has been inconsistent in the various regions, potentially exposing health care providers to higher risks for contacting the virus. Individuals were also given different recommendations: wearing face masks in confined spaces only vs. extending the advice for public areas, making it difficult

[3] Some examples: requiring people to stay home, except for very limited purposes; closing certain businesses, schools and universities, to help limit the spread of the virus in such environments; stopping public gatherings.

to ensure equal levels of health protection. Now we are waiting for a COVID-19 tracking app which has the potential to further contain the pandemic if adopted by at least 60% of the population.

3.2 Climate and geography

As far as concerns a second set of causes that could have led to different levels of susceptibility to the infection, we have to consider the relevance of climate elements and geographical aspects according to the following.

a) COVID-19 hubs have developed in places with high population density. Urbanisation and mobility, as well as those areas characterised by a high number of commuters around large cities, could have catalysed the spread of COVID-19 (to be scientifically confirmed/verified).
b) Different regional climates (regarding elements as temperature and humidity) seem to have an influence on the spread of respiratory diseases. The combination of temperature and humidity may affect the vulnerability of the nasal mucus membranes allowing for greater penetration of the virus. Warmer weathers with higher humidity seem to slow the rate of infection – the R transmission value decreases in warmer seasons, though no countries in the world seem to be coronavirus-free.
c) Higher levels of air pollution in certain areas (e.g. the Po valley and China) may have contributed to the spread of COVID-19. Air pollution represents a risk for chronic respiratory diseases and related infections, as it can act as a carrier of pathogenic microorganisms. There seems to be a correlation between concentration levels of atmospheric particulate matter (PM10; PM2.5), nitrogen dioxide (NO2), carbon monoxide (CO) and severe COVID-19 outbreaks as such air pollutants could act as a carrier substrate for the transport of the virus. This could contribute to providing input about why some areas in the north of Italy with low air-quality present high rates of contagion.

Environmental factors such as climate elements (Qi et al., 2020) and air pollution (Zhu et al. 2020; Martelletti and Martelletti, 2020) can facilitate the spread of the virus, however, human-to-human transmission still remains the determining factor of this global pandemic. And therefore, the current guidelines should above all focus the attention on reducing physical contact within communities and related possibilities of transmission; COVID-19 risk hypothesis and predictions based on climate data and materials alone must be interpreted with caution (O'Reilly et al., 2020), but they must be investigated, in a framework of relational data, in order to have further useful inputs and elements.

Time will have to pass and this pandemic will have to pass for us to attain clarity and put together a critical analysis of the situation. Reflection and awareness of the mistakes made will allow us to prevent the re-occurrence of health protection inequalities, in the hope of not having to face another pandemic.

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