COVID-19 cases before and after the "I stay at home" decree, Bologna Local Health Authority, Italy

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Summary. *Background and aim of the work:* Various measures have been taken by the Italian Government to contain and mitigate the COVID-19 outbreak and on March 11th a decree called "I stay at home" put the whole nation under lockdown. Our aim is to describe sociodemographic and transmission profile of COVID-19 cases that were transmitted before and after the introduction of the decree in the Bologna Local Health Authority. *Methods:* Cases were classified as transmitted before or after the decree according to the date of last contact with a COVID-19 case or, if this date was unavailable, we used the date of onset of symptoms considering the incubation period. Sociodemographic, clinical and epidemiological information was collected by using the infectious disease monitoring database, hospital discharge, deprivation index and long term care facility databases. *Results:* In the period after the publication of the decree, there were more elderly, females, strangers, retired, residents in nursing homes and deprived people than in the first period. There were also more health care personnel and less professionals/managers, sales or office workers. In both phases, family is mentioned as the first community attended although less frequently in the second group. *Conclusions:* The profile of the new COVID-19 cases changed during the outbreak suggesting a differential effect of lockdown measures on the population. An equity lens should be used when analyzing the impact of pandemia and the measures taken to curb it. (www.actabiomedica.it)

Key words: COVID-19, mitigation measures, containment measures, prevention, equity

Introduction

At the end of December 2019, China reported a cluster of pneumonia cases of unknown origin that would later be identified as severe acute respiratory syndrome coronavirus 2 (1). Since then, the disease, designed as Coronavirus Disease (COVID-19), spread to various countries and was declared a pandemia on March 2020 by WHO (2,3).

Measures to contain and mitigate the epidemics have been taken by different countries. Containing measures including case isolation, contact tracing, quarantine and mitigation measures including general lockdown and social distance, seem to have worked (4) during the COVID-19 outbreak in China. Systematic review suggested that social distancing measures can be effective interventions to reduce transmission and mitigate the impact of an influenza pandemic (5). Nevertheless, given the many uncertainties regarding pathogen transmissibility and virulence, the effectiveness and generalizability of these efforts are still unknown (5,6). Timing, duration and compliance of the implementation of these measures increase the variability and the delay of their effect. It is also unknown whether they impact differently on different populations and whether in some population subgroups their effect is more rapid.

In Italy the first local case of COVID-19 was diagnosed on 20 February and since then the epidemic spread in many regions disproportionately, hitting some northern areas with an exponential rise (7,8). The Italian Government took several restrictive measures during the following weeks, at the beginning at a local scale and with a containment goal and later at a national scale and with a mitigation goal: mandatory quarantine, active surveillance, suspension of all public events, banning of mass gatherings, closure of all educational institutes, and finally on 11 March a decree labeled "I Stay at home" was issued. This decree put the entire country under lockdown. All commercial and administrative activities that were considered not essential were suspended, all movement of people was forbidden unless for proven necessity (health, work or food supply) and self isolation when sick was highly recommended. The number of new cases kept on increasing till March 20 and then slightly decreased and as on April 14th they were 2972 new daily cases (9,10).

Our aim is to describe the sociodemographic and transmission profile of COVID-19 cases that were transmitted after the introduction of the "Stay at home" decree in the Bologna Local Health Authority (LHA), Northern Italy as of April 14thand compare them with the cases transmitted before the introduction of the decree.

Methods

Bologna LHA is in the Emilia Romagna Region, the Italian region that as of April 14th has the highest number of COVID-19 cases after Lombardy. Bologna LHA covers an area of about 880.000 inhabitants.

The new cases were classified into two groups: "before decree" group if the date of contact with a COVID-19 case was before 12 March (first day of the implementation of the decree) and as "after decree" group if the date of contact was 12 March or afterwards. If the date of the last contact with a confirmed case was unavailable we used the date of onset of symptoms. If the onset of symptoms occurred before 14 March we classified the case as transmitted before the lockdown, if the onset of symptoms occurred after March 25 (date of implementation of the decree + 14

days for the incubation period) we classified the case as transmitted after the decree. In order to avoid any misclassification, all other cases were excluded.

Confirmed cases and contacts are defined according to ECDC (11). Diagnostic testing is done in accordance with the Ministry of Health Guidelines (12). During the study period the test was performed only to subjects with an epidemiological link with another case and symptoms such as fever and/or cough and/or dyspnoea or to subjects with an interstitial pneumonia. In Bologna, since the beginning of the outbreak, all confirmed cases of COVID-19 occurring in the area are notified at the Public Health Department who carries out contact tracing and surveillance according to national protocols. People with confirmed COVID-19 are interviewed by telephone to collect information on profession, clinical and transmission characteristics (symptoms, date of onset, travel history, and close contacts with known COVID-19, attendance for any reason of community and dates of last contact with positive cases). All the information is registered in a regional electronic database (SMI: Infectious Disease Surveillance) that already contains the main demographic information (age, gender, residency, citizenship) of all residents. When cases are unable to be interviewed because of physical or cognitive problems, medical personnel or cares are involved.

The SMI database was the main tool we used to identify the new cases and to retrieve most of the sociodemographic and transmission characteristics. We grouped profession as: managers/professionals, sales workers/office staff, semiskilled and unskilled workers, all health personnel (physicians, nurses, assistants, chemists, laboratory and radiology personnel, cleaners, ambulance drivers and all other personal service), service workers (excluding health personnel), retired and other non working categories. Urban residency was attributed to cases with a residency in Bologna town. We grouped the community that the cases mentioned as attended, into five categories: family, hospital, work (excluding hospital environment), long term care facilities (LTCF) and others. As LTCFs include a broad spectrum of homes for elderly, to identify the residents in nursing home, we used the nursing home database. In addition to each case we attributed the Charlson Comorbidity Index to clinically characterize the popula-

tion. This index considers 19 categories of comorbidity that are defined by using the hospitalization discharge database of the two previous years (13). In this paper this index is expressed in 3 categories: no comorbidity, one comorbidity and two or more comorbidities.

To describe the socioeconomic feature we used the Deprivation Index. The Deprivation index is developed using variables from the 2011 General Census of Population and Housing (14). Five traits that represented the multidimensionality of the social and material deprivation concept were considered: low level of education, unemployment, non-home ownership, one-parent family and household overcrowding. The index is calculated by summing standardized indicators. The index is classified in 5 groups very rich, rich, average, deprived and very deprived.

Variables are presented as absolute and relative frequency. Person's chi-square test was used to compare variables.

The present is a retrospective study and no additional diagnostic tool or information was collected. As only routine and anonymized data were used, no informed consent was needed. Because the analysis was conducted as part of the surveillance activities of a public health institute, there was no need for approval by an institutional review board. Nevertheless, the study was conducted in accordance to the GDPR (General Data Protection Regulation) n° 679 07/04/2016, and Italian Law about personal data treatment (D. Lgs 30 giugno 2003).

Results

From 28 February to 14 April the Public Health Department of the Bologna LHA registered 2882 COVID-19 cases, corresponding to the 0.33% of the population.

Figure 1 shows the rapid increase in the number of cases by date of onset of symptom and date of diagnosis and the reduction of the number of new cases.

1034 cases were classified as transmitted before the decree and 1418 after the publication of the "I Stay at home" decree. 430 were excluded because the date of last contact with a positive case was missing and the onset of symptoms occurred between 14 and 25 March e.g. a period that does not allow to allocate the cases to one group or another.

Table 1 shows the profile of the two groups, before and after decree. In the first group there were more males than females and the most common age-group was 45 to 64 years. In the second period there
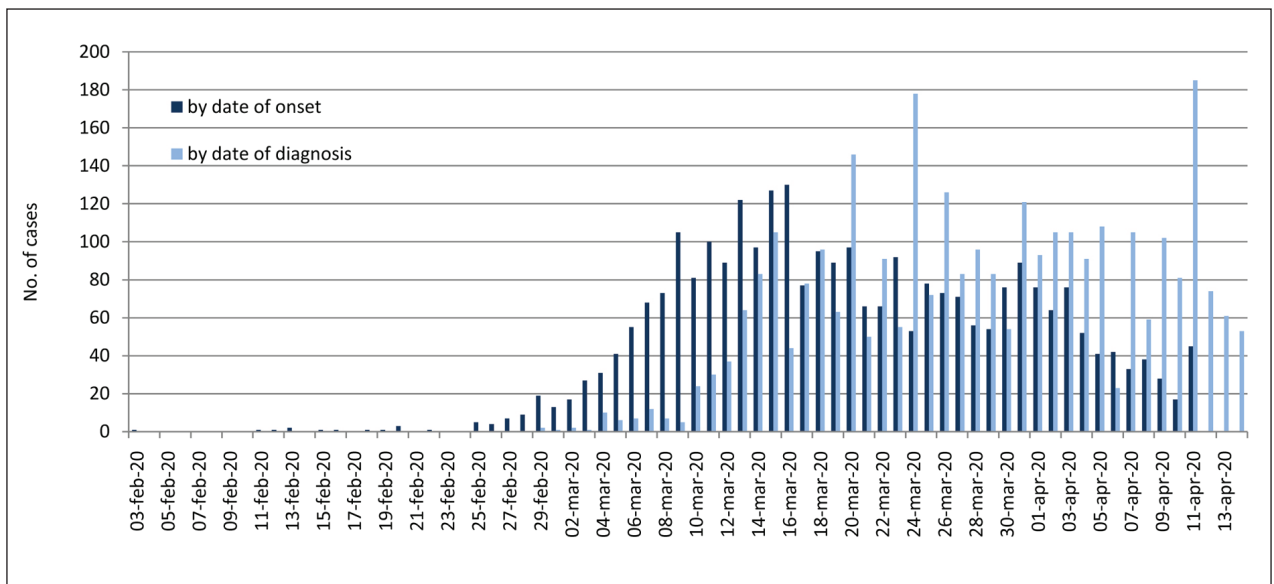

Figure 1.

Table 1. Sociodemographic, clinical characteristics and community attended before and after the decree, Bologna LHA, 28 February − 14 April

	Before decree		After decree		P
	n	%	n	%	
Total cases	1034	100	1418	100	
Gender					
F	463	46,49	829	59,34	
M	533	53,51	568	40,66	<0.0001
Agegroup, years					
<15	14	1,35	25	1,76	0.4242
15-24	23	2,22	52	3,67	0,0405
25-44	218	21,08	313	22,07	0,5566
45-64	425	41,10	388	27,36	<0.0001
65-75	151	14,60	135	9,52	0.0001
>75	203	19,63	505	35,61	<0.0001
Citizenship					
Italian	963	93,13	1272	89,70	
Non italian	71	6,87	146	10,30	0,003
Urban residency	515	49,81	655	46,19	0,077
Residency in nursing homes	15	1,45	190	13,40	<0,0001
Profession					
Professionals/mangers	87	8,41	30	2,12	<0.001
Sales workers/office staff	197	19,05	112	7,90	<0.001
Unskilled and semiskilled workers	65	6,29	54	3,81	0.005
Health Personnel	222	21,47	433	30,54	<0,001
Service workers (excl health personnel)	19	1,84	18	1,27	0,245
Retired	355	34,33	668	47,11	<0,001
Other (non working categories)	82	7,93	100	7,05	0,413
Community[§]					
Work	207	20,02	112	7,90	<0,001
Long term care facility	43	4,16	469	33,07	<0,001
Family	507	49,03	599	42,24	0,001
Hospital	196	18,96	343	24,19	0,002
Other	64	6,19	82	5,78	0,674
None	189	18,28	80	5,64	<0,001
Charlson Index[*]					
0	895	94,81	1189	90,83	0.004
1	19	2,01	68	5,19	<0,0001
2	30	3,18	52	3,97	0.3204

Table 1. Sociodemographic, clinical characteristics and community attended before and after the decree, Bologna LHA, 28 February – 14 April

	Before decree		After decree		P
	n	%	n	%	
Deprivation index*					
Very rich	257	28.34	237	18.87	<0,0001
Rich	194	21.39	227	18.07	0,0546
Average	144	15.88	202	16,08	0,8972
Deprived	157	17,31	319	25.40	<0.001
Very deprived	155	17.09	271	21.58	0.0096

*only on residents; §the sum is different from total because some gave multiple answers

were more women than men and the most common agegroup was the 75 years and over.

Italians were by far the majority of cases in both groups though non Italian citizenship was higher in the "after decree" group (P=0,003).

In the first period about 50% of the persons were rich or very rich according to the Deprivation Index, in the second period 36,9% were rich and very rich, while deprived and very deprived increased from 34% to the 47%. This distribution is maintained also after excluding residents in nursing homes (data not shown).

In the second period there is a lower proportion of professionals/managers, sales or office workers (P<0,0001) and a higher proportion of health personnel and retired people (P<0,0001). In both groups family is mentioned as the first community attended even if the frequency is lower in the "after decree" group (P=0,001).

In the second period work was mentioned less frequently as community attended (P<0,0001) whereas hospital was mentioned more often (P=0,002). Residents in nursing homes were more frequent in the second period and this was confirmed by the attendance to all types of LTCFs (P<0,0001).

In the second period there were less cases without morbidities (P=0,004).

Discussion

In this work we describe retrospectively all new cases of COVID-19 that were likely transmitted be-

fore or after the "I Stay at home" decree in Bologna LHA area from the beginning of the outbreak to April 14th.

We identified 1418 cases transmitted after the introduction of the decree and show that these cases differ in terms of various features when compared to the initial cases of the outbreak. During the second period there are more women, vulnerable people because of age or comorbidities and more health personnel but less professionals, managers and sales workers/office staff than in the first period. In addition we observed also a change in the distribution of socioeconomic categories over time.

The higher prevalence of males that is observed during the first period is in line with other studies on COVID-19 (15). The change in gender distribution over time suggests that the measures to control transmission had a differential effect according to gender. Women provide most of the informal care within family and given their predominant role as front line health care workers (16) are more exposed to the disease similarly to what happened in previous outbreaks (17).

After the decree, there were more elderly and residents in LTCFs. The decree did not address the problem of LTCFs directly, visits to these facilities were already banned since the beginning of March. Though, as Mc Michael has recently reported, once COVID-19 has been introduced into a LTCFs has the potential to spread rapidly and widely (18). Residents of LTCF are at higher risk of infections and exposure (19) the nursing home provides a milieu that is conductive to

outbreaks of infectious diseases due to the close proximity of susceptible patients in the institutional setting and subsequent cross transmission of organisms among patients through contact with staff members or environmental contamination (20). Very recent studies show that a large proportion of COVID-19 infections are undocumented and that the total force of infection is mediated through these undocumented infections. Identification and isolation of currently undocumented infections has in fact been recommended by some authors to fully control the epidemics (6,21).

The changes in professions during the two phases directly stems from the decree, most commercial and administrative activities were suspended and teleworking was enhanced for professionals or office staff whereas health personnel had to continue working maintaining the risk of being exposed.

Rich and very rich were more frequent among cases of the first period than among cases of the second period whereas deprived or very deprived were more frequent among cases of the second period. This change could arise from different factors and not only from the lockdown. For example, rich people likely own larger and bigger houses where transmission within household during lockdown is more difficult, and besides the lockdown, they also have more tools to adopt behavioral changes to protect themselves and their relatives as the epidemic spread. Research on risk of transmission across population of different socioeconomic level is needed. Authors underscores that COVID-19 exacerbates inequalities in some countries and that part of the disproportionate impact of the COVID-19 pandemic on some community is due to structural factors that prevent those communities from practicing social distancing. In addition, front line workers are disproportionately the poorer belonging to segregated communities (22).

This is a descriptive study of two groups of COVID-19 cases with a transmission before and after the "I stay at home" decree. Given this type of study we cannot infer that changes between the two groups are attributable to the decree. Modification in the groups profile depends also on other decrees, measures and on behavioral changes that might have been adopted at different speed across the population. Nevertheless it is clear that the profile of the new cases changed over

time and in some population subgroups COVID-19 transmission has slowed down more rapidly than in others. Further, the accuracy of respondents in reporting information is questionable, and in particular, the degree to which cases were able to accurately recall the date of last contact and date of onset of symptom is unclear.

As Sjödin et al. underline transmission continues to occur during lockdown especially when the reduction of activities is not complete and the household size is large (23). Specific stringent protective measures and public health strategies should be implemented for all categories that remain on the front line or for person such as residents of LTCF that cannot enjoy the benefits of general lockdown measures. Last but not least, efforts should be made to address gender and health inequity aspects and identify solutions to practice measures such as social distance or proper quarantine with an equity approach. To ensure that COVID-19 work is grounded in health justice, we must generate and publicly report data on how it affects different populations and social groups and use a health equity lens to examine if and how the pandemic (and the measures taken to control it) is exacerbating inequities.

Acknowledgment

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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