O R I G I N A L   A R T I C L E

Monitoring emergency calls and social networks for COVID-19 surveillance. To learn for the future: The outbreak experience of the Lombardia region in Italy

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Abstract. On 18th February the first Italian case of Coronavirus Induced Disease 2019 (COVID19) due to secondary transmission outside China was identified in Codogno, Lombardia region. In the following days the number of cases started to rise not only in Lombardia but also in other Italian regions, although Lombardia remained and it is still the most affected region in Italy. At the moment, 234801 cases have been identified in Italy, out of which 90070 in Lombardia region. The (Severe Acute Respiratory Syndrome Coronavirus 2) SARS CoV 2 outbreak in Italy has been characterized by a massive spread of news coming from both official and unofficial sources leading what has been defined as infodemia, an over-abundance of information – some accurate and some not – that has made hard for people to find trustworthy sources and reliable guidance needed. Infodemia on SARS CoV 2 created the perfect field to build uncertainty in the population, which was scared and not prepared to face this outbreak. It is understandable how the rapid increase of the cases' number , the massive spread of news and the adoption of laws to face this outbreak led to a feeling of anxiety in the population whose everyday life changed very quickly. A way to assess the dynamic burden of social anxiety is a context analysis of major social networks activities over the Internet. To this aim Twitter represents a possible ideal tool since the focused role of the tweets according to the more urgent needs of information and communication rather than general aspects of social projection and debate as in the case of Facebook, which could provide slower responses for the fast individual and social context evolution dynamics. Aim of the paper is to analyse the most common reasons for calling and outcomes. Furthermore, the joint analysis with Twitter trends related to emergency services might be useful to understand possible correlations with epidemic trends and predict new outbreaks. (www.actabiomedica.it)

Key words: emergency calls and social networks for COVID-19 surveillance

Background

On 18th February the first Italian case of Coronavirus Induced Disease 2019 (COVID19) due to secondary transmission outside China was identified in Codogno, Lombardia region (1). In the following days the number of cases started to rise not only in Lombardia but also in other Italian regions, although Lombardia remained and it is still the most affected region in Italy. At the moment, 234801 cases have been identified in Italy, out of which 90070 in Lombardia region (2,3).

The (Severe Acute Respiratory Syndrome Coronavirus 2) SARS CoV 2 outbreak in Italy has been characterized by a massive spread of news coming from both official and unofficial sources leading what has been defined as infodemia, an over-abundance of information – some accurate and some not – that has made hard for people to find trustworthy sources and reliable guidance needed (4).

Infodemia on SARS CoV 2 created the perfect field to build uncertainty in the population, which was scared and not prepared to face this outbreak. It is understandable how the rapid increase of the cases' number, the massive spread of news and the adoption of laws to face this outbreak led to a feeling of anxiety in the population whose everyday life changed very quickly.

A way to assess the dynamic burden of social anxiety is a context analysis of major social networks activities over the Internet. To this aim Twitter represents a possible ideal tool since the focused role of the tweets according to the more urgent needs of information and communication rather than general aspects of social projection and debate as in the case of Facebook, which could provide slower responses for the fast individual and social context evolution dynamics (5,6).

Taking into account this specific context, it is easy to understand why the emergency number - 112 - was suddenly overwhelmed by an enormous number of calls that rapidly overcame its capacity to cope and compromised the possibility to identify those patients who needed immediate medical assistance.

As pointed out by the Scientific Italian Society for Medical Emergency (SIEMS), number of calls to 112 for the Milan province were 5086 on 16th February, before the outbreak, and rapidly increased to 6798 on 21st and 10657 on 22nd February (7).

The emergency service in Lombardia region is organized through 3 first-level PSAPs (public-safety answering points) called CUR-NUE (Unique answering operating room / point – European emergency number) that send the call to the most appropriate service, i.e. Police, Fire or medical department. After the first assessment, calls requiring medical assistance are sent to one of the four *second-level* PSAPs called SOREU (Regional Operating Rooms for Medical Emergency and Urgency), depending on the area the call is com-

ing from in order to evaluate the patient and decide the most appropriate intervention.

To reduce the burden of calls of the first days of the outbreak to the emergency number it was necessary to redirect non urgent calls, especially those asking for information, to other services. According to European Emergency Number Association guidelines (5), Lombardia region created a regional toll-free number for COVID19, the first one in Italy. Other Italian regions created their own one in the following weeks, as well as other European countries like Spain, Germany, Croatia etc. that were facing similar issues (8).

The main goals of the regional toll-free number were:

- Reduce the burden of calls for emergency line (112)
- Give information about the outbreak and how to manage influenza-like symptoms and emphasize good behaviours to avoid the risk of infection
- Identify people who had close contacts with confirmed cases in order to isolate them at home and notify them to local health authority

The 24/24 hour toll-free number was settled on 23rd February by AREU (Regional Emergency Service Agency) in collaboration with residents in preventive medicine and public health from University of Milan. The first location was opened in Milan, but a second one was opened after some days due to the overwhelming number of calls received.

Volunteers belonging to different associations of civil society kindly provided their support in this moment of crisis and were recruited as telephone operators. Residents were in charge of training volunteers in order to prepare them to answer to most common doubts about SARS CoV 2. Flowcharts, infographics, and frequently asked questions sheets were developed to help volunteers give standardised and evidence-based answers to the population, furthermore they were provided with contacts of other public institutions like social services, medical service for continuity of care and local health authorities to guide population to refer to the right service.

Although the regional info line helped to funnel non urgent calls it was not enough because of the huge number of calls, for example on the first day it received about 400000 calls.

Each call was documented with a report containing important information such as brief anagraphic, reason for calling, and the outcome.

Aim of the paper is to analyse the most common reasons for calling and outcomes. Furthermore, the joint analysis with Twitter trends related to emergency services might be useful to understand possible correlations with epidemic trends and predict new outbreaks.

Materials and methods

We analysed all the calls made by *second-level* PSAP from 21st February to 11th March 2020. These calls were made to those who did not received an answer from 112 due to clogged phone line or were evaluated as non-urgent calls by a first NUE rapid assessment.

Each call had a report with time and date, municipality from which the call was coming from, brief information about the patient and the reason of the call. The final outcome was codified according to the SOREU usual system as: information, consultation, first aid or other.

As for Twitter analysis it was made collecting all tweets in Italian language with "112" or "118" in the text from 21st February to 11th March 2020. Further analysis on the text of the tweets was made in order to

identify most common keywords related to the emergency bringing to the identification of 290 keywords. All tweets that did not contain any keyword in the text were excluded from the final analysis as non relevant, leading to 5989 twitters used for the purpose of this article.

Results

Table 1 shows the total number of calls and their classification for each SOREU made by *second-level PSAPs* and their classification. The most outstanding data is that only 2.89% of calls made were classified as first aid and therefore needed urgent medical assistance. shows number of calls

Concerning Twitter analysis, in Fig. 2a we reported the trends in the number of tweets produced daily and the number of replies they received. In the time series of the number of tweets we can identify two periods associated with increases in activity. The first period from 21/02 to 25/02 is associated with the days preceding the establishment of the red areas of Codogno and Vò Euganeo, while the second moment is 09/03, the day between the measures of regional and national lockdown. Concerning the number of replies, we observe a first increase in the same period indicated by the number of tweets and a peak on 02/29.

Table 1. Number of calls, their total and their classification for each SOREU

	Second-level PSAPs - SOREU				Total number of calls
	SRM	SRA	SRP	SRL	7436
Time period	21/02/2020 - 11/03/2020	21/02/2020 - 11/03/2020	23/02/2020 – 11/03/2020	23/02/2020 - 11/03/2020	
Number of calls	2340	2318	2029	749	
Classification					
Information	2128 (90.9%)	156 (6.7%)	108 (5.3%)	102 (13.6%)	2494 (33.54%)
Consultation	162 (6.9%)	2073 (89.4%)	1853 (91.3%)	632 (84.4%)	4720 (63.47%)
First aid	50 (2.1%)	88 (3.8%)	63 (3.1%)	14(1.9%)	215 (2.89%)
Other		1	5 (0.02%)	1 (0.1%)	7 (0.09%)

Legend
SRM: SOREU Area Metropolitana (Milan and Monza-Brianza); SRA: SOREU Area Alpina (Bergamo, Brescia and Sondrio);
SRP: SOREU Area della Pianura (Lodi, Pavia, Cremona and Mantova); SRL: SOREU Area dei Laghi (Varese, Como and Lecco)
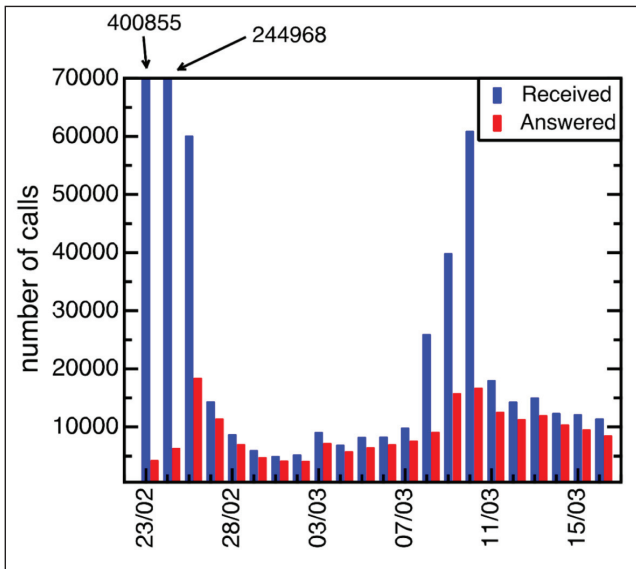
Figure 1. Number of calls received and answered by regional toll-free information number

A similar analysis was carried out for the retweet and like trends - see Fig. 2b - in which the increases in the period 21/03 - 23/03, and on 25/02, 06/03 and 09/03 are evident.

Concerning the semantic analysis of tweets, a set of 290 keywords has been identified relating to the relevant areas. In Fig. 3 a word cloud is reported relating to the set of keywords, where the word size is proportional to the frequency of the word in the bulk of tweets.

In addition to the keywords "112" and "118" which constituted the initial search set, it is rather frequent the phone number "1500" relating to the public utility service activated at the end of January 2020 to offer citizens information on COVID-19, the word "symptom" and some terms related to the emergency situation such as "emergenza" (emergency) or "soccorso" (rescue).
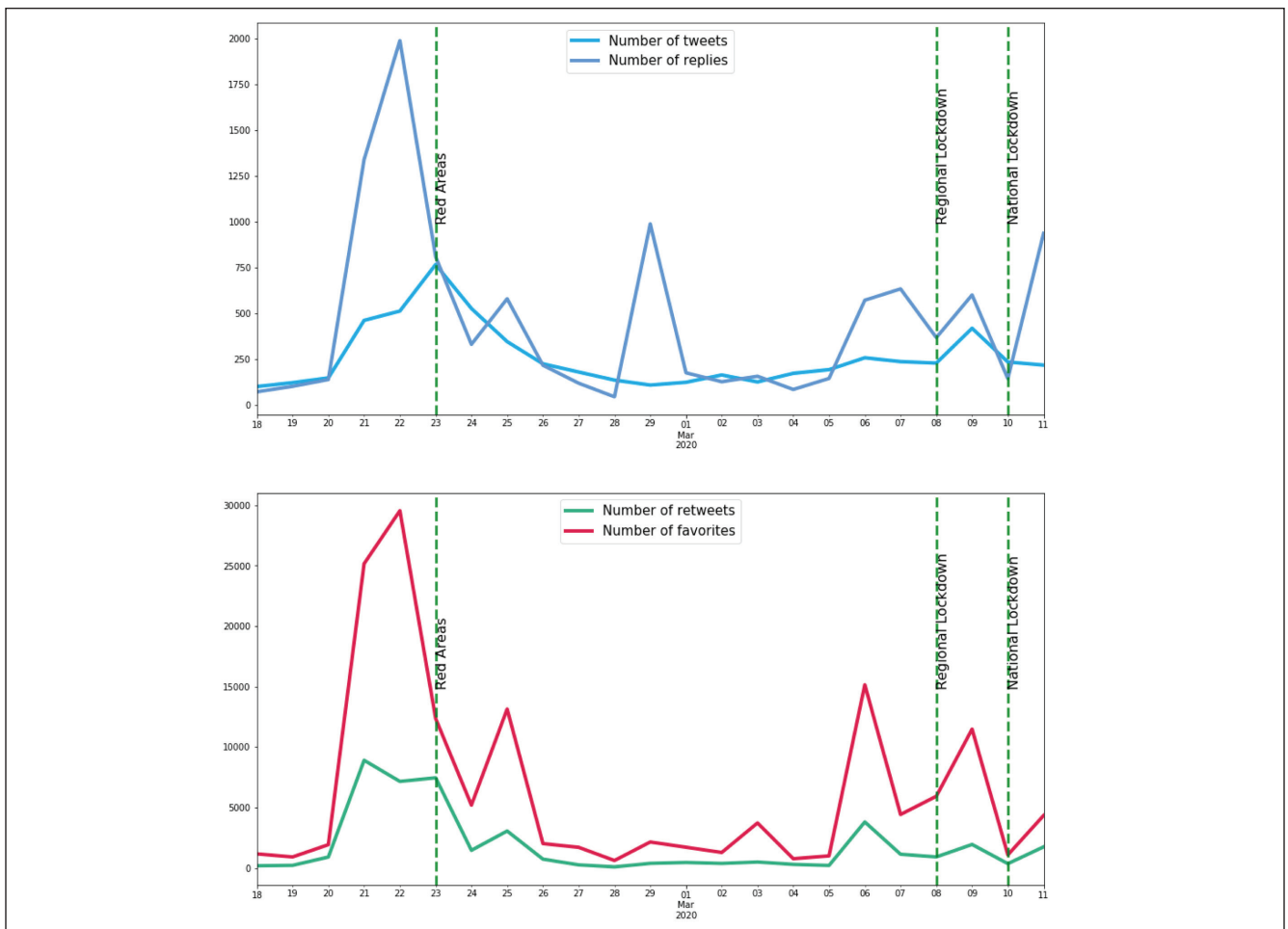

Figure 2. a) Number of daily tweets and replies; b) Number of daily retweets and likes. National and Regional lockdown events have also been reported together with the establishment of the red areas of Codogno and Vò Euganeo

Figure 3. Word Cloud of the keywords

Discussion

These data confirm that the overwhelming number of calls received to the emergency service was not due to the necessity of first aid but to the need of information or medical assistance for non urgent conditions. It's important to point out that this consideration does not apply to all the calls received by emergency service because these data are referred only to those calls that did not received an answer or were already filtered by first level PSAPs as non-urgent. Nevertheless it is remarkable how the panic induced by the increasing number of cases of COVID 19 brought a huge number of people to call the emergency service even if not necessary, seriously compromising its ability to answer to real urgent calls. This consideration is confirmed by data coming from the regional toll-free number showed in fig. 1, in fact it is possible to see how it received hundreds of thousands of calls in less than a month. Such an evidence is associated also to the dynamic patterns of the Twitter analysis showing the need of information related to the social anxiety. Further ongoing work is involving the first calls to the to the emergency service according to the predictive value over the spread of infections. Overall the joint

active monitoring of the communication dynamics over emergency calls and social networks like Twitter could provide an integrated mean for the adaptive management of information delivery as well as well as the optimization of the rescue logistic and finally it could provide relevant anticipation on the outbreak. Overall these aspects appears of critical importance for COVID-19 surveillance, and for the preparedness of emergency and strategic plans (9).

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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