Novel Coronavirus (COVID-19)-related web search behavior and infodemic attitude in Italy: Infodemiological study

Alessandro Rovetta, Akshaya Srikanth Bhagavathula

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Abstract

Background: Since the beginning of the novel coronavirus (COVID-19) outbreak, fake news and misleading information are circulated all over the world, which can profoundly affect public health communication.

Objective: We investigated the online search queries behavior related to the COVID-19 outbreak and the attitude of infodemic monikers circulating in Italy.

Methods: By using Google Trends (GT) to explore the internet activity related to COVID-19 from January to March 2020. Titles of the articles of the most read newspapers, and government websites were mined to investigate the attitude of various infodemic monikers circulating across various regions and cities in Italy. Relative search volumes (RSVs) and average-peak comparison (APC) scale are used to quantify the results.

Results: Keywords such as "novel coronavirus", "china coronavirus", "COVID-19", "2019-nCOV", and "SARS-COV-2" are the top five search queries terms. Information related to face masks, amuchina (disinfectant), symptoms of the novel coronavirus, health bulletins, and vaccine for coronavirus were the top five searches related to health. The regions of Umbria and Basilicata recorded a high number of infodemic monikers (APC >140). Misinformation was widely circulated in Campania region and racism related information in Umbria and Basilicata. These monikers were more frequently pronounced (APC >100) in more than ten major cities in the Italy including Rome.

Conclusions: We identified a growing regional and population-level interest in COVID-19 in Italy, and a majority of the searches are related to amuchina (disinfectants), face maks, health bulletin, and symptoms related to COVID-19. As a large number of infodemic monikers were observed across Italy, we recommend the health agencies to use GT to address the misinformation circulating in Italy.

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Novel Coronavirus (COVID-19)-related web search behavior and infodemic attitude in Italy: Infodemiological study

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Abstract

Background: Since the beginning of the novel coronavirus (COVID-19) outbreak, several fake news and misleading information are circulated all over the world, which can profoundly affect public health communication.

Aim: We investigated the online search queries behavior related to the COVID-19 outbreak and the attitude of infodemic monikers circulating in Italy.

Methods: By using Google Trends to explore the internet search activity related to COVID-19 from January to March 2020, titles of the articles of the most read newspapers, and government websites are mined to investigate the attitude of various infodemic monikers circulating across various regions and cities in Italy. Search volume values and average-peak value (APC) are used to quantify the results.

Results: Keywords such as "novel coronavirus", "china coronavirus", "covid-19", "2019-ncov", and "sars-cov-2" were the top infodemic and scientific COVID-19 denominations trends in Italy. Information related to face masks, amuchina (disinfectant), symptoms of the novel coronavirus, health bulletins, and vaccine for coronavirus were the top five searches related to health. The regions of Umbria and Basilicata recorded a high number of infodemic monikers (weight total APC >140). Misinformation was widely circulated in Campania region and racism related information in Umbria and Basilicata. These monikers were more frequently pronounced (weight total APC >100) in more than ten major cities in the Italy including Rome.

Conclusion: We identified a growing regional and population-level interest in COVID-19 in Italy, and a majority of the searches are related to amuchina (disinfectants), face maks, health bulletin, and symptoms related to COVID-19. As a large number of infodemic monikers were observed across Italy, we recommend the health agencies can use Google Trends to predict the human behavior and also to exploit the misinformation circulating in Italy.

Keywords: Novel coronavirus, COVID-19, Google search, infodemiology, monikers, Italy

Introduction

The internet is the largest and fastest source to obtain health information daily, and millions of people seek health information online every day [1]. In the context of the novel coronavirus (COVID-19) pandemic, people around the world are forced to stay at home and turn to the internet to work and

stay connected to others. As the COVID-19 outbreak continues, the need to obtain information about the disease, its prevention, and risk communication has become greater for people.

"Infodemiological" methods such as an online search of traffic on Google, are widely used to understand the searching behavior of the public during the epidemic, as well as for public health surveillance purposes [2-7]. Several online sources such as Facebook, Twitter, and electronic health records are widely applied in infodemiological studies [8-10]. Indeed, the Google Trends tool provides both real-time and achieved information on trends and the variation of online interest in selected keywords and topics over time [11,12]. In particular, Google Trends enables the analysis and forecasting of sensitive health topics, such as AIDS, illegal drug use and metal health [12]. Therefore, trend data generated by the number of Google searches can offer valuable insights into population behavior and health-related phenomena, particularly during infectious disease outbreaks [7,13-16]. Since the beginning of the COVID-19 outbreak, fake news and misleading information have circulated all over the world, which profoundly affect public health communication and diminish preventive measures [17-20]. In this context, we investigated online search query behavior related to this pandemic and the extent of infodemic monikers circulating in Italy.

Methods

We used Google Trends to explore internet search activity related to COVID-19 from January to March 24, 2020. Titles of the articles of the most read national newspapers, and government websites are mined to investigate the extent and attitude of various infodemic monikers related to COVID-19 that are circulated in Italy.

Google Trends is an online tracking system of internet-hit search volume that determines the proportion of searches for user-specified terms among searches performed using Google. It provides information on the search query to a specific time period and location. The results of the number of search volumes are scaled on a range of 0 (very low) to 100 (very high).

Google trends allow retrieval of queries for any keyword entered and allowed up to five terms to explore the online interest each term. By using this technique, we retrieved the data from Google Trends using the keywords "Coronavirus" and "Coronavirus+" -related terms in English and local Italian languages. Each query with these keywords were also researched as the "search term" and "search topic". "Search term" provides the results for all keywords that fall within the category and "search topic" gives results of a group of terms that share the same concept in any language.

We used a previously described framework by Mavragani et al. for the region selection, and time period selection to retrieve the query data from Google Trends [21]. Firstly, we searched the COVID-19 and related terms at the country level to understand the online interest at the regional level.

Second, using this information, we retrieved the online interest by city across various regions in Italy. Each keyword was searched independently between the time frame from January 21, 2020 to March 24, 2020. The data showing high values were further investigated manually to identify any event linked to the top searches. These queries were also cross-checked with the news bulletins. By doing so, we identified various infodemic monikers circulating across the country. We defined "infodemic monikers" as information that was substantially erroneous which gave rise to interpretative mistakes, fake news, episodes of racism, or any other form of misleading information circulated on the Internet. The number of infodemic monikers circulating across regions and cities in Italy were also assessed.

Specifically, we reviewed the headlines of newspaper articles and government reports to identify the contribution in spreading the infodemic monikers to the public. In order to obtain the search information from the newspapers and government websites, we used specific keywords that are frequently used in the news and government report titles to quantify the average information values (AVs) of terms. The AVs are calculated as the number of monikers used in the headlines/every five days.

In order to characterize the obtained Infodemic monikers, we categorized the infodemic attitudes into four groups:

1. *Superficial attitude:* the user adopts words that can generate confusion since they do not uniquely identify the topic (example: coronavirus).
2. *Misinformative attitude:* the user adopts words that can lead to the spread of fake news (example: 5G coronavirus).
3. *Racist attitude:* the user adopts words that, voluntarily or not, generate or accentuate episodes of racism (example: chinese coronavirus).
4) *Definitive attitude:* the user adopts the most appropriate terms for the correct identification of the query (example: covid-19).

Results

The top five infodemic and scientific COVID-19 denominations trends in Italy at the Google levels were as "novel coronavirus", "China coronavirus", "COVID-19", "2019-nCOV", and "SARS-COV-2" [Figure 1] in Italy. The keyword that yielded the greatest search value was "coronavirus" from February 20 to March 24, 2020; it had the highest search volume: 59 ± 9. The other keywords APCs were neglected compared to the latter (Supplementary file 1). On March 22, 2020, excluding the term "*coronavirus*" from the cluster, the query related to "*novel coronavirus*" had the highest value of 100. On the previous day, Italy recorded the highest number new cases (6,577), and the government issued bans on any movement inside the country. In contrast, "*china coronavirus*" is the most commonly used query since the beginning of the COVID-19 outbreak in January 2020. Furthermore, the terms "*china coronavirus"* (value: 38 ± 4), "*novel coronavirus"* (value: 21 ± 6), and

"*COVID-19*" (value: 17 ± 3) were the most frequently used queries from February 20, 2020, when Italy become an epicenter of the COVID-19 cases.

With respect to public restlessness in Italy, face masks, amuchina (disinfectant) (value: 23 ± 6), symptoms of the novel coronavirus, health bulletin, and vaccine for coronavirus were the top five searches related to health. During the early period of the COVID-19 outbreak, there was a spike in queries on the symptoms, followed by face masks and disinfectants [Figure 2]. In particular, on February 22, 2020, disinfectant related searches in Italy reached the Breakout stage (search value:100). Later, public restlessness appeared to drive an immense raise of queries related to the symptoms of COVID-19. Moreover, on March 11, 2020, there was a tremendous increase in the top five searches related to the COVID-19.

We also referred to two widely read Italian newspapers "*Il Sole 24 Ore*" and *"La Repubblica",* that are publishing a large number of articles related to COVID-19 and government websites to investigate the AVs. We found that most of the Italian public used the keyword "*coronavirus*" to obtain the information in the *La Repubblica (*AV: 127 ± 50) and *Il Sole 24 Ore (*AV: 113 ± 46), while the government bulletins were not routinely used (AV: 22 ± 9). Detailed information on the keywords used to identify the COVID-19 information during the pandemic period is shown in Figure 3 and Supplementary file 2.

At a regional level, we identified that the regions with the most COVID-19 cases were not always the first to circulate key infodemic monikers. For instance, regions such as Umbria and Basilicata had the highest number of infodemic monikers (weighted total APC >140), while the number of cases reported in these regions was limited from January to March 2020 [Figure 4]. Furthermore, these monikers were particularly pronounced (weighted total APC >100) across several cities in Italy, in particular, Pescara and Bologna remained top [Figure 5].

Infodemic attitudes

The infodemic attitude of various types of information circulated across Italy are presented in Table 1. Most of the information related to COVID-19 circulated in the regions of Basilicata, Umbria, and Emilia are found to be superficial, does not provided clearer information related to COVID-19. The misinformation was widespread frequently in Umbria and Basilicata region. As the COVID-19 spread across the world from China, most of the racist information such as *"China coronavirus"*, *"Chinese virus"*, *"Chinese coronavirus"* and *"Wuhan virus"* were more frequently pronounced in Campania and Friuli Venezia Giulia region.

Discussion

This is the first study to investigate the online search query behavior related to COVID-19 and

uncover the extent and the attitude of infodemic monikers circulated in Italy. Previously published studies have investigated Google Trends and twitter activities related to the COVID-19 epidemic, but these are conducted in China [22,23], Taiwan [24], the United States of America [25], and Spain [26]. In summary, we identified "novel coronavirus", "China coronavirus", "COVID-19", "2019-nCOV", and "SARS-COV-2 are the top infodemic and scientific COVID-19 denominations trending in Italy. Information related to face masks, amuchina (disinfectant), symptoms of the novel coronavirus, health bulletins, and vaccines for coronavirus were the top five searches related to health. Several infodemic monikers are widely circulated across major cities in Italy. In particularly, misinformation was widely circulated in Campania region and racism related information in Umbria and Basilicata.

Our study had some limitations to consider. Google Trends captures the search behavior of those people who use Google search engine, and people using other search engines were not investigated. Also, we relied on the data information provided by the Google Trends and do not have any information about the methods used by Google to generate search data and algorithms.

The current COVID-19 pandemic has threatened global public health and has generated millions of internet searches worldwide. In Italy, "China coronavirus" was the most frequently used term in the internet searches, coinciding with the first COVID-19 cases among two Chinese tourists confirmed by the Italian Prime Minister Giuseppe Conte at the end of January 2020 [27]. However, the increasing number of cases did not generate a valuable number of web searches until the WHO declared the COVID-19 outbreak as a global pandemic [28], and the Italian government imposed draconian rules to stop spreading of coronavirus in the early March 2020 [29]. Notably, queries related to COVID-19 symptoms, disinfectants, masks, and vaccines were relatively high in the fourth week of February 2020 and stabilized in 20 values during the early March and quickly increased as the number of cases increased in Italy. This condition indicates the peoples' restlessness in gathering information about necessary personal protection and hygiene practices as the COVID-19 cases continue to rise in Italy. Of note, around 40,000 people are charged for violating the lockdown and the most often mentioned reasons to go out were "amuchina", "face-masks", and other casual reasons [30]. These reasons are also confirmed in our research and, thus, diminish countermeasures for the outbreak in Italy. To curtail this, the government has initiated a "*self-certification*" form to declare a valid reason such as work, health reasons, or buying food that necessitates leaving the house.

The findings of our study suggest that web search interest in COVID-19, both the regional and in cities in Italy, were influenced by tradition, electronic newspapers, and print media coverage. For instance, people preferred to use the term "*Coronavirus*" to obtain the information more frequently in

the newspapers than using *"COVID-19"* or *"2019-nCOV"* and *"novel coronavirus"*. Data from previous research suggest that traffic of delivering through twitter and electronic news outlets frequently focus more on spreading news disproportionately than awareness and educational campaigns [31-33]. These observations have important implications in generating the COVID-19 restlessness among general public health in Italy, and further research is warranted.

Speculating misinformation during an outbreak can profoundly affect public health communication and create xenophobia between the nations [34-38]. Disseminating fake news and racism across social media has become a widespread practice, and the COVID-19 outbreak is no exception [38,39]. Through our investigation, we identified several infodemic monikers of COVID-19 that impinged public communication across various cities in Italy. The amount of misinformation and racism promoting information among Chinese people appeared around the world [38,40,41]. In Italy, several incidences of discrimination and anti-Chinese racism were reported [42,43,44]; however, we believe that the rate of racial bullying information circulated could be the true confounding factor contributing to xenophobia.

The failures of Chinese authorities handling the virus at an early stage has resulted in the spillover of the COVID-19 across the world, with confirmed ongoing human-to-human transmission and also from asymptomatic individuals [45]. Besides, the world health organization (WHO) also denied the possibilities of human-to-human transmission of COVID-19 [46]. We assume that these misleading information's may have resulted in the stirring up of angry online conversation among netizens in Italy. Although we did not delve deeper into the type of potential misinformation spread across Italy, we believe that dispersing misinformation can create agitation, cause fear, and ultimately diminish preventive measures for the outbreak. The journalists and mass media regulators have an important role in delivering comprehensive information among citizens, as well as and also taking serious actions on those spreading the misinformation.

Conclusion

Using Google Trends, the present study identified that google search query data reflect a growing regional and population-level interest in COVID-19. Searches related to disinfectants, masks, health bulletin, vaccine. and symptoms related to COVID-19 were top search keywords. However, a large number (weighted total APC >140) of infodemic monikers were circulating across Italy. Therefore, health agencies can use Google Trends to predict the human behavior and also to exploit the misinformation circulating in Italy.

Consent for publication: Not applicable.
Competing interests: The authors declare that they have no competing interests.

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Table 1: Attitude of Infodemic monikers on COVID-19 circulating across Italy*

Regions	COVID-19 cases*	Total APCs	APCs of infodemic attitude**			
			Superficial	Misinformation	Racial	Definitive
Lombardia	30703	275	95	68	83	71
Emilia Romagna	9254	296	97	79	89	69
Veneto	5948	256	84	61	82	71
Piemonte	5515	286	96	76	89	75
Marche	2736	279	93	78	88	80
Toscana	2699	293	94	88	89	78
Liguria	2116	270	88	74	90	82
Lazio	1728	269	89	76	79	75
Campania	1101	281	88	75	100	82
Trentino-Alto Adige	1110	228	80	63	57	72
Puglia	1005	268	87	78	87	84
Friuli V.G.	992	267	94	75	98	100
Sicilia	846	268	81	68	84	65
Abruzzo	689	292	92	84	97	81
Umbria	648	312	97	100	92	77
Valle d'Aosta	400	239	89	70	36	56
Sardegna	421	255	89	64	95	93
Calabria	319	281	91	86	87	83
Basilicata	92	306	100	92	96	82
Molise	73	237	87	84	66	92

*Assessed from January 21 to March 24, 2020. APCs: average-peak comparison value** (1-100)
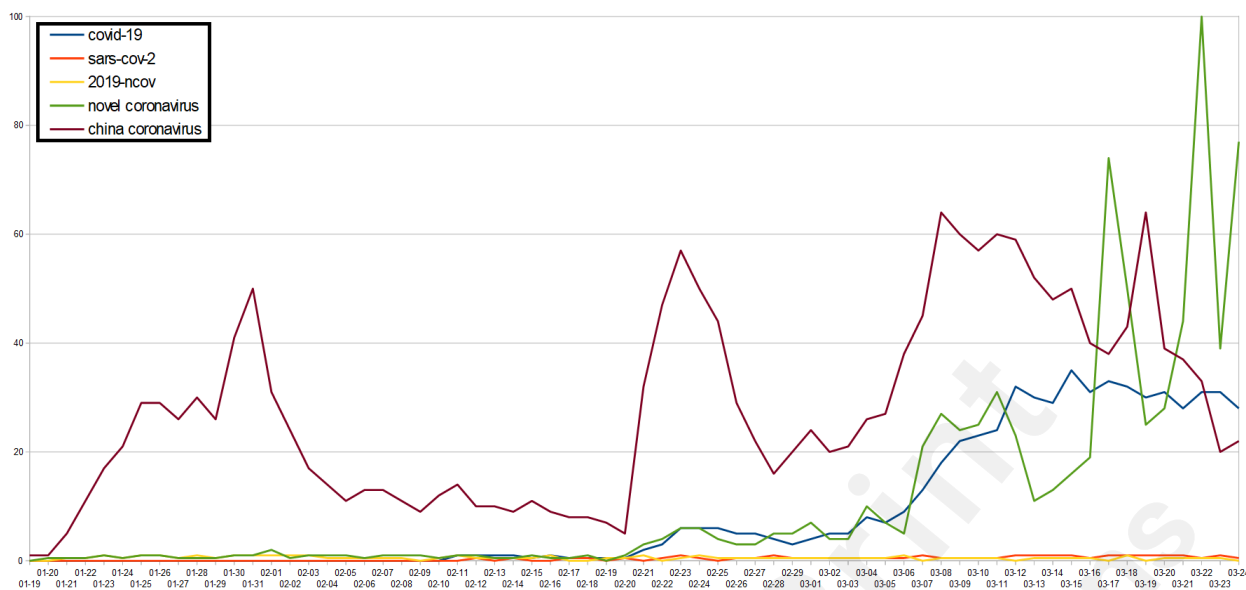
Figure 1: Most popular infodemic and scientific novel coronavirus denominations trends in Italy.
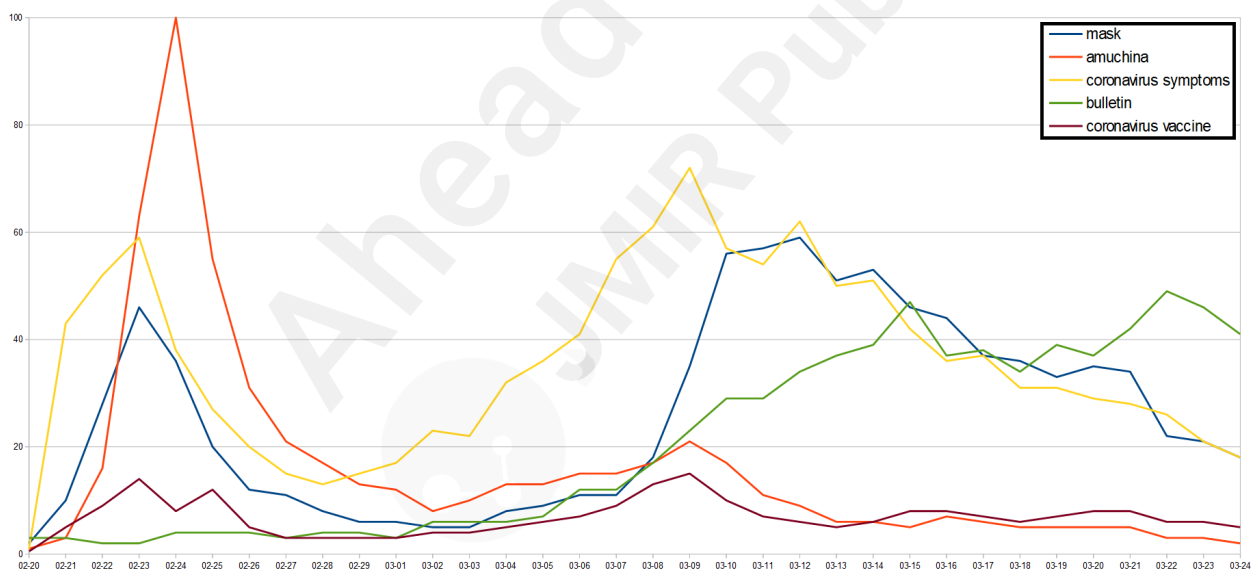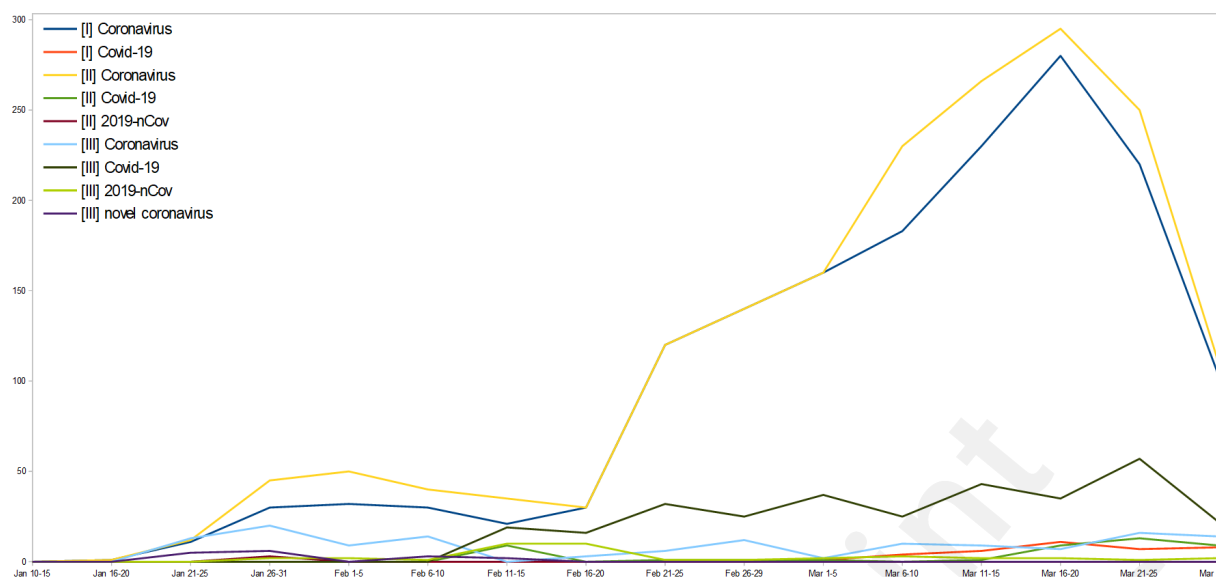

Figure 2: Italy keywords cluster 2 (principal comparable queries).

Figure 3: Italy "Il Sole 24 Ore" [I], "La Repubblica" [II] newspapers and "Government bulletins" [III] (*title keywords* vs *days range*)
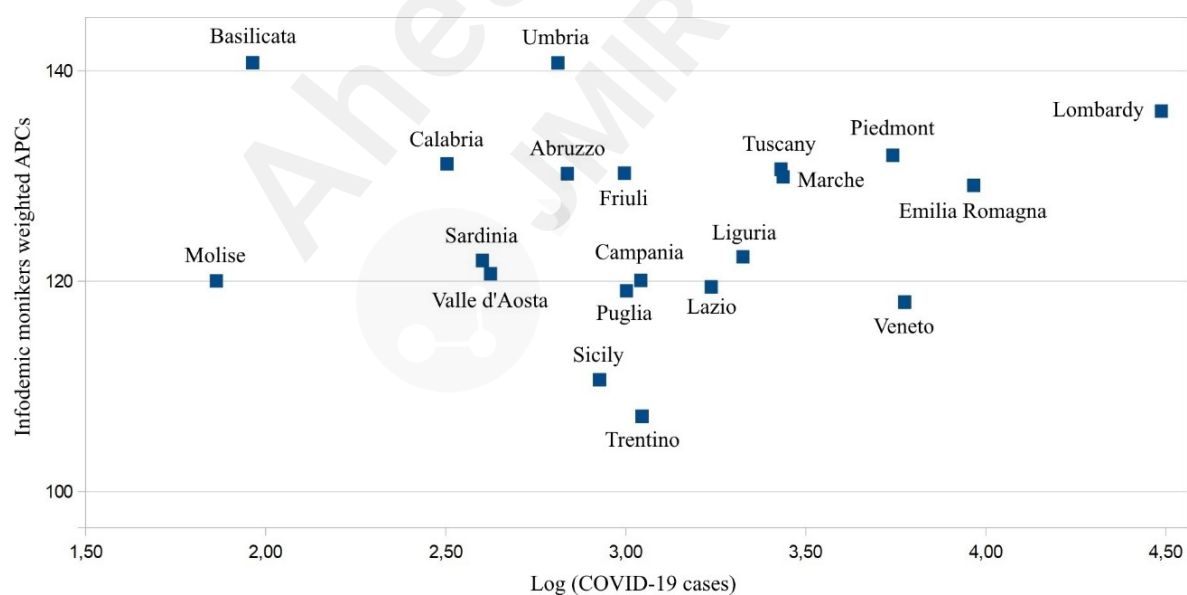

Figure 4: Regional dispersion of infodemic monikers about COVID-19 in Italy
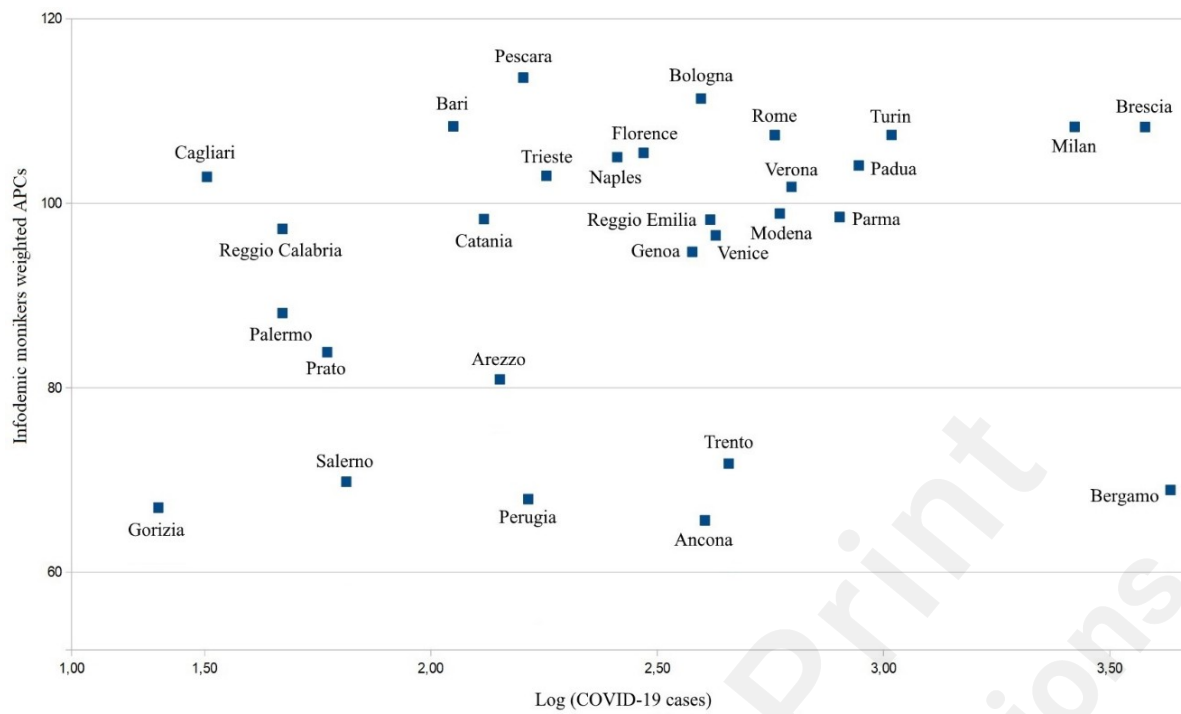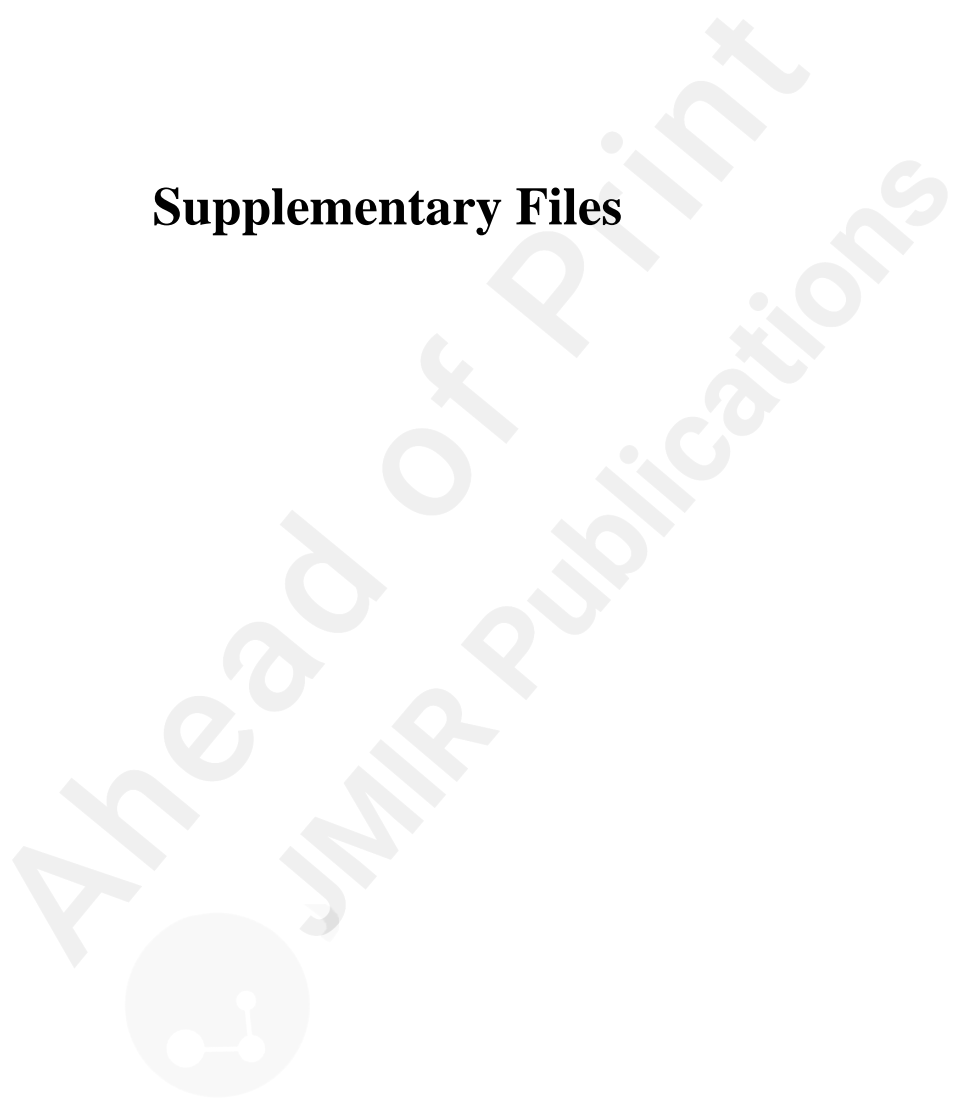
Figure 5:
Dispersion of infodemic monikers about COVID-19 circulating across various cities in Italy

Supplementary Files

Other materials for editor/reviewers onlies