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Original

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The COVID-19 vaccination campaign and disinformation on Twitter: the role of opinion leaders and political social media influencers in the Italian debate on green pass

1. Introduction

Disinformation's rise and social impact is a salient effect of the recent pandemic (Mian & Khan, 2020). The World Health Organization defined the recent crisis as both a pandemic and an *infodemic* (World Health Organization, 2020), which is a pandemic of false information or information that lacks scientific evidence, such as the alleged links between COVID-19 and 5G technologies, or the effects of pseudo-cures advertised by prominent figures through social media (Limaye et al., 2020; Liu et al., 2020). Social media data analysis has identified multiple forms of disinformation. Islam et al. (2020) found three main forms of disinformation with potentially serious impacts on public health on Facebook, Twitter, in online newspapers, and on the fact-checking agencies' websites. These forms included rumors, content stigmatizing individuals or institutions, and conspiracy theories. Studies also found that disinformation sources included private citizens, independent organizations, official sources (e.g., mainstream online newspapers) and public figures (e.g., politicians, commentators, bloggers etc.) (Cinelli et al., 2020). Cinelli et al. (2020) analyzed dissemination of COVID-19 content on social platforms, such as Twitter, Instagram, YouTube, Reddit, and Gab, and found that the volume of disinformation produced by the reliable sources does not differ much from that attributable to alternative and unreliable sources: as a matter of fact, both sources such as mainstream online newspapers or public figures, and unreliable sources (hyper-partisan, conspiracy theories websites, etc.) shared approximately the same amount of disinformation contents. Another study found that conspiracy theories were among the most widespread disinformation contents during pandemics, and that they are often spread by sources considered reliable, such as mainstream media:

between January and March 2020, Papakyriakopoulos et al. (2020) identified 11,023 unique URLs—where URLs represent online information sources—that referred to COVID-19 causes and appeared in 267,084 posts across Facebook, Twitter, Reddit, and 4chan. Among these URLs, alternative sources generated more information to reinforce conspiracy theories than traditional sources; however, conspiracy stories from reliable sources reached far more users. The researchers further quantified conspiracy theories' dynamics in the social media ecosystem, noting that stories reinforcing conspiracy theories generally had greater virality than neutral stories or stories aimed at discrediting conspiracy theories.

Recently, the Italian debate became particularly polarized on the *green pass* issue¹, noting a growing politicization of the discourse, especially on Twitter. This phenomenon was not surprising, given the green pass's political nature. It was initially introduced as a tool to allow some social and recreational activities to re-open, then was gradually adopted to allow access to various working sectors. However, the recent Twitter debate shows the prevalence of critical positions endorsed by a very limited number of Twitter profiles who act as *opinion leaders* in the online debate. Along with political opposition to governmental measures associated with the green pass, the Twitter debate shows an increasing volume of disinformation regarding vaccine efficacy, the role of big-pharma, etc.

The relevant literature asserts that the role of social media opinion leaders is particularly important for encouraging individuals to engage in political and civic debates (Alexandre et al., 2021; Park, 2013; Vicari et al., 2020). Opinion leaders may be a trusted information source and thus have the potential to protect their followers from disinformation, but they could also amplify disinformation and fake news (Dubois et al., 2020). On the other side, the contemporary social media landscape enables the emergence of multiple different *influencers* who are not necessarily individuals with a formal political status or a with a public role: they're most of the time private citizens who actively

¹ *Green pass* is the name of the Italian certification which attests the full anti-COVID-19 vaccination cycle or the recovery from COVID-19; <https://www.dgc.gov.it/web/>

engage with other people on social media platforms; they exert their influence to advertise brands or to guide the opinions of their followers in relation to issues of politics and current affairs (Bause, 2021; McCorquodale, 2019).

Drawing from the classic opinion leadership's model of Katz and Lazarsfeld (1955), the essay intends to reflect, on the role of *opinion leaders* and their relationship with other influencers - with the aim of describing their social networks and their content dissemination strategies as well as how do they contribute to green pass disinformation in general and in relation to the COVID-19 health emergency. A computational approach to the analysis of Twitter social networks will be taken with the goal of identifying prominent profiles in the online debate. To do so, the methodology section will present a detailed description of how various concepts related to opinion leadership and influence will be operationalized for the computational analysis of Twitter data. Critical metrics such as *dominant voices* (Rogers, 2018), will be used by the analysis aimed at describing the social networks around prominent profiles in the green pass debate. In addition, the analysis on the most Tweeted sources will be able to make evidence of how, through links to conspiracy contents, interviews with contested public figures etc., opinion leaders and influencers fuel disinformation by shifting the attention of their followers from mainstream social platforms to the *below-the-radar* online environments such as Rumble or specific YouTube channels, definitely attested to hyper-partisan positions (Boccia Artieri et al. 2021).

2. Twitter, opinion leadership and social media political influencers: a literature review

Since its 2006 launch, Twitter has become an important arena for public debate. With 436 million users worldwide², Twitter is a key part of the social media landscape. In Italy, the platform has

² <https://www.hootsuite.com/resources/digital-trends>

nearly 13 million active users³. Although less popular than Facebook and Instagram, it is considered the privileged arena for political debate by private citizens, journalists, governmental and non-governmental organizations, and political party representatives (Bentivegna et al., 2021). Twitter is particularly evident when Italian political actors' opinions become dominant during a certain period or with respect to a certain issue.

Research on the relationship between media and opinion leadership refers to the fundamental contribution of Katz and Lazarsfeld (1955) and their two-step model of communication, where influential members of the public—known as *opinion leaders*—play a prominent role in transferring information from news media to the public. The model emphasizes interpersonal communication's role in overcoming some of the limitations regarding mass media's direct reach toward audiences. Moreover the model describes the different dimensions of influence which characterize the opinion leader: having a large following, being considered an expert, being knowledgeable, and holding a central position within their networks to influence social pressure and support. Therefore, the model has had a profound influence on marketing, political science, and diffusion of innovations studies (Rogers, 2003; Shah & Scheufele, 2006; Van den Bulte & Joshi, 2007). Katz and Lazarsfeld suggested four major traits for opinion leaders: Social media's emergence as a public debate arena has raised questions about the continued utility of the Katz and Lazarsfeld model. A first observation, also emphasized by Dubois and Gaffney (2014), asserts that the influence's dimensions were operationalized by social media platform affordances (and Twitter affordances) by the follower/following functionalities, the audiovisual features that enhance the dimension of subjects' visibility, and the interaction networks they form around prominent individuals or opinion leaders. Recent studies discussed the model's role in opinion leadership's objectives and motivation (Song et al., 2017; Winter & Neubam, 2016). Winter and Neubam's (2016) qualitative survey on Facebook showed that the social media realm facilitates a pronounced

³ <https://wearesocial.com/it/blog/2021/02/digital-2021-i-dati-italiani/>

role for self-presentational motives, in contrast to classic conceptualizations of opinion leadership that include information and persuasion as predominant goals. Other studies focused on Katz and Lazarsfeld's message dissemination process to analyze how the model could be applied to social media environments. Nisbet and Kotcher (2009) examined the two-step flow model in the context of climate change campaigns. Other studies (Cha et al., 2010, 2012; Wu et al., 2011) found empirical support for two-step flow as a general model for media dissemination on Twitter.

Nevertheless, the contemporary social media landscape raises multiple questions about the original model, especially regarding the role of opinion leaders as gatekeepers of privileged information. Although traditional opinion leaders had greater access to information than their followers, digital media radically changed the dynamics of information flow. According to Park (2013), opinion leaders on Twitter are more likely to be involved in a 'multi-step flow' process, rather than the traditional 'two-step flow' process. A two-step flow process moves information from the media to opinion leaders, and influences moving information from opinion leaders to their followers; a multi-step flow distributes information through myriad intermediary channels. Twitter's well-connected users play a stronger role in creating and distributing information through a multi-step flow than those with fewer connections. Moreover, online opinion leaders can now produce information and transfer it to mass audiences. As Walter and Bruggerman observed (2018), under certain circumstances, people might be able to become opinion leaders on social media without having previously been exposed to news media content at all. They must have access to first-hand information that they can share within their networks and which gives them a structural advantage to become opinion leaders in the debate. Besides, opinion leaders on Twitter could deliberately ignore mass media sources or mainstream platforms to divert their followers' attention from the main social media platform (eg. Twitter, Facebook etc..) toward the so-called "below the radar" (Boccia Artieri et. al., 2021) or "fringe" platforms where opinions and political positions tend to be hyper-partisan (Rogers, 2021). Another aspect which seems to problematize the classic model of opinion leadership on social media is related to the rise of *social influencers*. McCorquodale (2019)

suggested that social influencers do share information from traditional media, but their online information sharing activities reflect their own views and perspectives. Influencers have more direct engagement with their audiences than traditional opinion leaders, and their social media activities can lead their audiences away from traditional media toward social platforms. Nevertheless, substantial differences remain between opinion leaders and social influencers, especially if we consider the political online debate. In this context it is possible to identify the so-called *political social media influencers* (PSMIs): Bause (2021) defines PSMIs as users who became well known in social media and, as self-created personal brands, regularly distribute self-produced political content with which they reach and potentially influence a dispersed audience. PSMIs and political opinion leaders share similar characteristics: they are both extroverted, self-confident, and communicative individuals who occupy central positions within larger social (online) networks. They talk about political topics with people in their social networks who perceive them as credible communicators. This gives both political opinion leaders and PSMIs potential for political influence. Nevertheless the role of PSMIs is much more preconditioned than that of opinion leaders. PSMIs are in principle public communicators who are dependent on social media platforms and their logics and algorithms. In the quest for visibility and attention, they must build an authentic personal brand capable of reaching an audience that systematically consumes their contents. They're also heavily committed to engaging with their online followers in order to reinforce their social networks. Opinion leaders, on the other hand, are not strictly dependent on publicity or technology, and can exert influence without any personal brands; because the trust placed in them depends not only on their communication, but also on personal relationship structures, which PSMIs cannot draw on in a comparable way (Bause, Ib.). As a result opinion leaders can exert influence drawing from their own reputation related to their public role (if any) or even to their competences on specific issues. In consideration of this complex scenario where different figures interact in the online political debate, it is reasonable to suppose that, in the context of the green pass debate on Twitter a “multi-step flow” of communication would engage both opinion leaders considered as political actors with

a public role (e.g., political party representatives) and PSMIs: private citizens without any specific formal role who are influential because of their intense interaction with their followers and with the public political actors' online networks.

A second hypothesis relates to the role of opinion leaders and PSMIs in fueling disinformation.

The COVID-19 health emergency, in all its gravity, raised the role of disinformation through a growing social fragmentation and in some cases polarization between conflicting opinions on multiple issues: COVID-19 causes, the vaccination campaign, and the government measures to contain and manage the pandemic, including the green pass debate. In Italy, the debate on social media ignited a conflict between mainstream opinions supporting restrictions and more libertarian positions radically critical of the government measures they considered detrimental to freedom of opinion, freedom of movement and individual privacy.

Starting from this complex scenario, this study examined the role of Italian opinion leaders as well as that of PSMIs on Twitter and their social networks in actively fueling disinformation around the green pass political debate. In particular, some dimensions of Katz and Lazarsfeld's opinion leadership model such as *being considered an expert*, *being knowledgeable*, and *holding a central position within their networks* will be operationalized through *critical metrics* (Rogers, 2018) and used in the computational analysis of Twitter contents to answer the following research questions:

- RQ1: Who are the Italian opinion leaders and the PSMIs in the green pass debate on Twitter?
- RQ2: How do they interact with each other in their social networks and what are their content dissemination strategies?
- RQ3: How do they contribute to green pass disinformation in general and in relation to the COVID-19 health emergency?

3. Methodology

3.1. Data collection⁴

We collected Twitter data to identify the opinion leaders and the PSMIs, their dissemination strategies and the relation with disinformation over a period of six months, from June 15 to December 14, 2021. The period corresponds to the first governmental measures taken by the Italian Prime Minister, Mario Draghi, in relation to the green pass and the subsequent regulations applied by the government to enlarge the certification mandate. We collected 4,307,487 tweets from 217,978 unique users using the API full-archive search allowed by Academic Research access⁵. This REST endpoint allows you to programmatically access public Tweets from the complete archive dating back to the first Tweet in March 2006 using a single search query to filter for Tweets around a specific topic. The tweets were in Italian and contained the keywords “green pass” or “greenpass” or “supergreenpass”. Using the Search API deleted tweets may not be included in the response and this can impact the results. In order to avoid this bias it is important to collect data periodically in order to archive the tweets before they are deleted or accounts suspended. Within the six-month study period we identified a number of “discussion peaks,” where tweeting activity was particularly intense in relation to the legislative activities related to the green pass (e.g., the Law Decree on July 23, 2021), or a number of events particularly debated in the Italian Twitter sphere (e.g., the no-green pass demonstration in Trieste in October 2021 or the multiple no-vax street demonstrations). Discussion peaks could be the results of the particular relation between Twitter, considered as a public debate arena, and political or social events occurring in certain periods of time: Grusin (2010) identifies this relation as a *pre-mediation* process, a process by which events

⁴ Data collection has been carried out thanks to multiple open source software tools - TCAT (Twitter Capture and Analysis Toolset), 4CAT - developed by Digital Methods Initiative, University of Amsterdam; <https://wiki.digitalmethods.net/Dmi/ToolDmiTcat>

⁵ <https://developer.twitter.com/en/docs/twitter-api/tweets/search/introduction>

are reported on social media before becoming real news and before being framed by the mainstream media. In this case the different events related to the six periods of time, produce on Twitter a significant flow of *pre-mediated* contents⁶ which could be particularly interesting to be analysed in order to understand who's emerging as opinion leader or PSMI in the debate. As a result, we considered the following discussion peaks (Fig. 1):

- A. July 12–16, 2021; Debate about the preannounced law decree on green pass mandates.
- B. July 20–30, 2021; On July 23rd the Prime Minister, Mario Draghi issued a law decree about the green pass mandate to access recreational activities, such as restaurants, bars, cinemas, sport areas, and for international mobility.
- C. August 4–13, 2021; On August 6th the law decree became effective.
- D. September 14–21, 2021; schools reopened.
- E. October 08–20 2021; on October 15th, the green pass became mandatory for workplaces; consequently, many street protests were held, especially in North Italy⁷.
- F. November 22–26, 2021; debate about the super green pass mandate⁸.

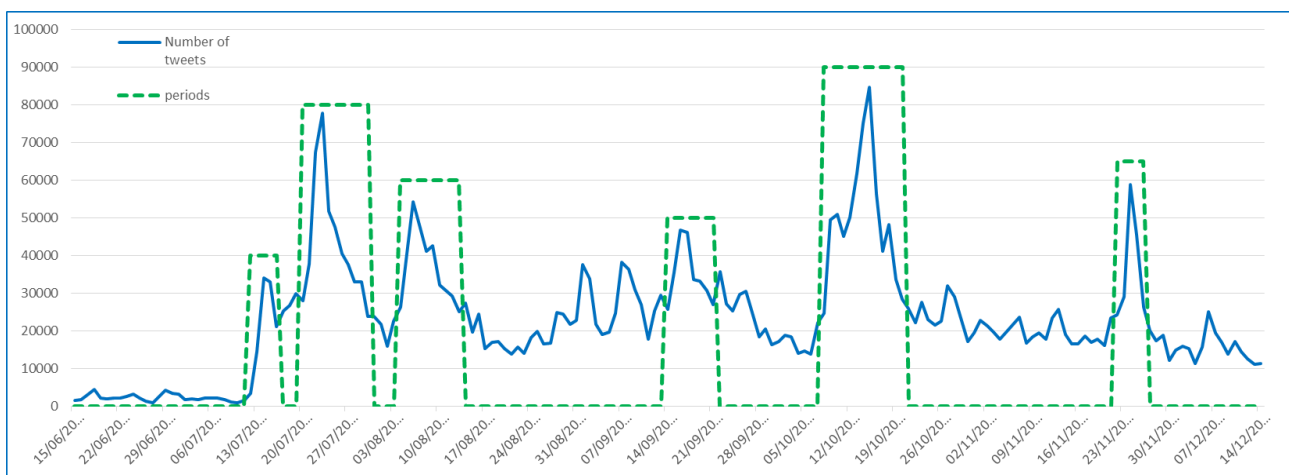


Fig. 1 Twitter discussion peaks between June 15 and December 14, 2021

⁶ In correspondence with the 6 peaks we found approximately the 48% of the total collected tweets.

⁷ <https://www.open.online/2021/10/21/trieste-manifestazione-venerdi-22-ottobre-allarme-infiltrati-violenti/>

⁸ The super green pass could be obtained only after a full COVID-19 vaccination cycle or after recovery from COVID-19. The green pass could be obtained by a negative COVID-19 test.

3.2 Identifying opinion leaders and PSMIs through critical analytics and social network analysis

With the goal of responding to RQ1 and to identifying opinion leaders and PSMIs in the Twitter debate, we started by using critical analytics that can operationalize some facets of influence as described by Katz and Lazarsfeld (1955) and specifically: *being considered an expert* and *being knowledgeable* or the perceived authority and reputation of an online profile regarding a specific context or debate. We applied the critical analytics described by Rogers (2018) as *dominant voices*: “the specific actors that give voice to the issue with the greatest strength”; also “which sources are given in an (authoritative) issue space, and of those, which dominate and which speaking subjects are cut down or marginalized” (Rogers, 2018, p. 468). The dominant voice metric was operationalized by the number of *mentions* in a given dataset of tweets; the most *mentioned* profiles were considered the dominant voices in the considered debate. By choosing the *mentions* metric, we identified the profiles who were the most retweeted, had the highest number of interactions (e.g., tweets in response to their messages), and were most mentioned by other profiles.

As a result we identified a number of influential profiles on the green pass debate: among those dominant voices we then distinguished opinion leaders (eg. Claudio Borghi, Francesca Onorato) from PSMIs on the basis of their formal belonging to institutional political organizations or to recognised media (eg. National or European parties; news media) or their being private citizens without any formalized political status (eg. @OrtigiaP, @valy_s) (Bause, Ib.). Methodologically, we proceeded by *scraping* the Twitter profiles of the most mentioned voices and by analyzing the content of their most mentioned tweets: thanks to this qualitative approach we were able to identify the opinion leaders and PSMIs and to understand their general attitude toward the green pass policies.

Consistent with other studies in the Twitter domain (Cha & Gummadi, 2010; Sousa, 2010), we emphasized *interaction in the network* rather than mere visibility. Compared to the *followers*

dimension, the *mention* metric in fact better describes the influence of a Twitter profile on a specific topic or political issue. Although the number of followers may reflect the general visibility of a profile, the *mention* metric sheds particular light on the profile's influence on a given issue. The main influence facet these studies focus on is *being seen as an expert* (Dubois & Gaffney, ib., 1263).

In order to address RQ2, we applied social network analysis (SNA) to systematically identify connections among dominant voices to investigate their positions in their social networks. In this way we tried to analyze if the third facet of influence - *holding a central position within their social networks* - would apply to the opinion leaders or to the PSMIs identified by the dominant voices. SNA can be used to study individual nodes (actors including persons or organizations), ties (an edge or connection among nodes), and subnetworks (parts of a larger network) (Ward et al., 2011; Wasserman & Faust, 1994). We applied the SNA to a number of data subsets corresponding to the Twitter discussion peaks through GEPHI⁹. For each identified discussion peak, we performed a mentions network analysis, focusing on users who interacted with the highest number of other Twitter profiles during the study periods to highlight the addressees of their mentions and the relations among different opinion leaders and PSMIs¹⁰.

3.3 Opinion leaders, PSMIs and disinformation

We applied two approaches to address RQ3 and to examine whether and in what measures the identified opinion leaders and PSMIs facilitated disinformation spread, conspiratorial theories, and fake news. First, we conducted a qualitative analysis of the top mentioned user profiles: were they

⁹ GEPHI is the leading visualization and exploration software for all kinds of graphs, especially suitable for visualization and analysis of social networks; <https://gephi.org/>

¹⁰ Focusing on only certain facets of influence could be limiting, nevertheless we left out the one related to "having a large following" because we think this may be distorted by the possibility of being able to buy paid followers and because, as stated above, we decided to emphasize more *interaction in the network* rather than on mere visibility.

media, medical authorities, journalists, bloggers, political actors, private citizens, etc.; and what was their position toward the green pass policies. In the second phase, we used TCAT¹¹ to analyze the source types (e.g., links to YouTube or other platforms videos) shared by the prominent Twitter profiles. Analyzing how opinion leaders and PSMIs enriched their tweets through external links relates to at least two platform aspects: the 280-character tweet limit, which encourages individuals to include hyperlinks to provide broader sources for their thesis, especially those against vaccination policies (Chen, & Milojevic, 2018). The second aspect, related to the first, leads to the hypothesis that hyperlinks shared by the vaccination opponents may lead to questionable COVID-19 arguments and sources. Moreover, we applied SNA to identify whether the interactions among prominent profiles or the interaction among opinion leaders and questionable sources increased the general spread of fake news, conspiratorial theories etc. This analysis was based on the periods corresponding to a significant increase in the Twitter debate on the green pass issue (see Fig. 1).

4 Data analysis results and discussion

4.1 RQ1: Opinion leaders and PSMIs' dominant voices

The *mentions* analysis revealed a very limited number of dominant voices in the green pass debate on Twitter. We selected the most mentioned profiles¹² in the defined period (June - December 2021), which resulted in a short list of opinion leaders (Fig. 2). Figure 3 shows the interactions among the opinion leaders and PSMIs included in the mentions network analysis over the six-month observation period.

¹¹ TCAT allowed us to translate 95.77% of the URLs (the remaining 4.23% were bad links) and put this entity in relation to the users we focused on.

¹² Given the significant distance from the most mentioned profile – Claudio Borghi – we didn't keep a huge number of less mentioned profiles because they wouldn't have been so significant for our SNA analysis. Moreover we assumed the threshold value of 30,000 mentions in consideration of Tumasjan et al. (2011) and their study of Twitter "mentions" as a predictive metric with respect to the likelihood of winning political election in Germany's 2009 campaign. The threshold value of Twitter mentions to the winning party - CDU - was then 30,000. See: Tumasjan, A., Sprenger, T. O. , Sandner P. G, Isabel M. Welp. "Election Forecasts With Twitter." *Social Science Computer Review*, 29.4 (2011). p. 417.

@Username	@mentions received
borghi_claudio	174'864
valy_s	72'353
FmMosca	69'079
fdragoni	68'913
dottorbarbieri	47'051
LaVeritaWeb	44'207
ladyonorato	43'856
byoblu	41'428
Lorenzo62752880	41'417
OrtigiaP	40'542
GiulioMarini2	37'484
AzzurraBarbuto	34'287
intuslegens	34'112
matteosalvinimi	33'685
GuidoDeMartini	30'761
repubblica	30'612
noitre32	30'250
pbecchi	30'223

Fig. 2 The top mentioned profiles in the overall dataset

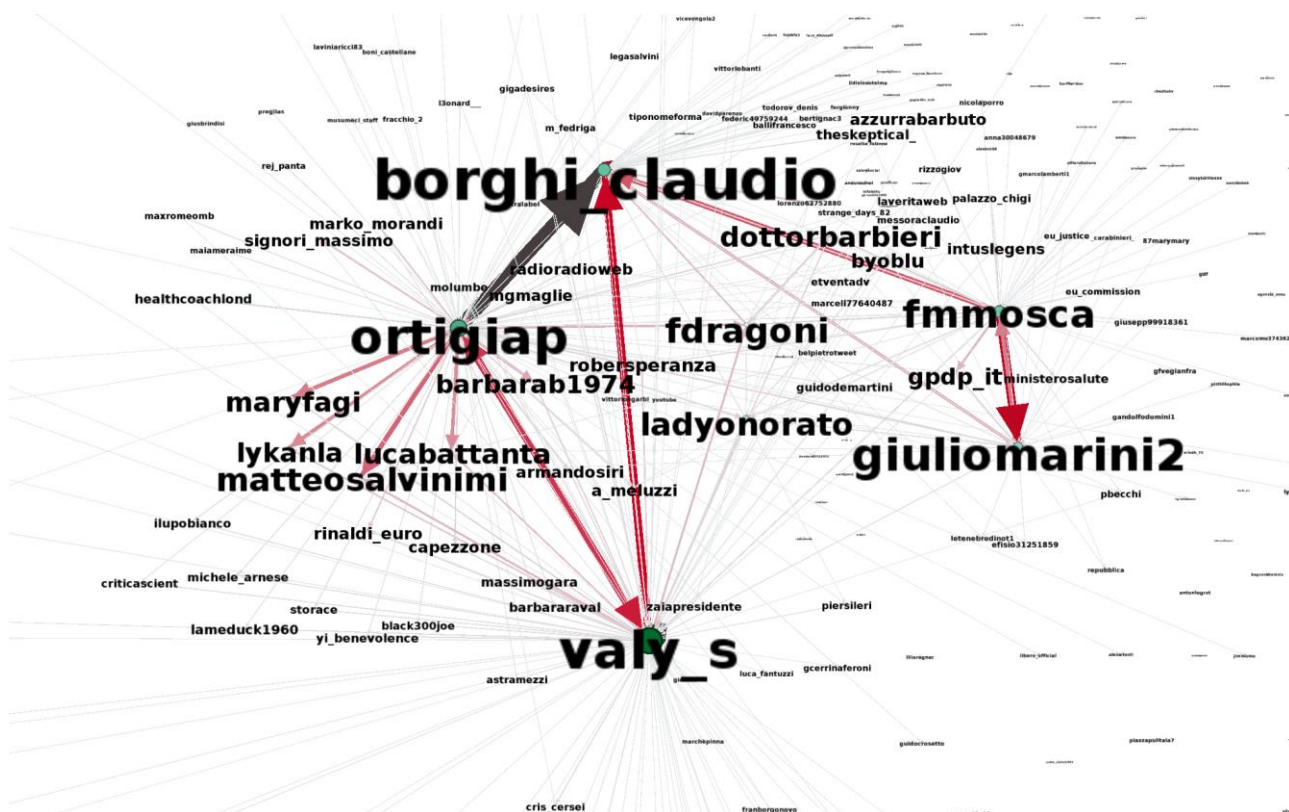


Fig.3 The mentions network analysis including the prominent profiles observed during the 6-month period

The profile `borghi_claudio`'s dominant role is evident, with more than 170,000 mentions. It is followed by a number of profiles with substantially smaller mentions volumes. Claudio Borghi is a political actor and a member of the Italian Parliament as a representative of Lega Nord political party¹³. He has a solid legal background and his highly critical positions with respect to the green pass regulatory instrument, are known in both the institutional and mainstream media debates. His relevance as an accredited expert on the green pass issue emerges predominantly on Twitter, where he is the most retweeted and mentioned profile. His profile also had the highest number of interactions such as comments, replies etc. In short, he is perceived as an expert within the considered debate; moreover he can be considered as “the opinion leader” according to Bause’s (Ib.) definition since his reputation is not merely dependant on social media popularity but it’s related to his well known position on the green pass and to his being a legitimized representative of

¹³ Lega Nord is a right-wing, federalist, populist and conservative political party in Italy. Its current leader is Matteo Salvini; https://en.wikipedia.org/wiki/Lega_Nord

one of Italy's major political parties. Similarly to Claudio Borghi, other opinion leaders' voices emerge such as the Twitter profile of Francesca Donato (@ladyonorato), member of the European Parliament and @matteosalvinimi which belongs to Matteo Salvini, the leader of Lega Nord political party. At a significant distance from Claudio Borghi, the most mentioned profiles are private citizens such as @valy_s, @FmMosca, @ortigia_p, @fdragoni, @giuliomarini2: they identify PSMIs with hyper-partisan positions critical of the green-pass who actively endorse Claudio Borghi's voice and interact significantly with other less prominent profiles. Unlike Claudio Borghi, the PSMI's reputation and visibility does not depend on a recognized authority outside network environments, but it is precisely on Twitter that they build their political identity and popularity. In fact, thanks to the content analysis of their profiles described in par. 3.2 it emerges that they are particularly engaged in retweeting the content of Claudio Borghi or other opinion leaders, in systematically interacting with their followers through comments, mentions, emojis etc., in short, in reinforcing a hyper-partisan position that is highly critical of the green pass and is often expressed with sensational and aggressive language.

Among the other most mentioned profiles, it could be also worth noticing the relevant presence of @byoblu news profile - an Italian popular source of disinformation and conspiratorial theories¹⁴ - which counts more than 41,000 mentions. We found only @repubblica (La Repubblica national newspaper) for mainstream media accredited profiles, with 30,600 mentions. A qualitative analysis of the most mentioned content (see section 3.2) tweeted by the prominent profiles¹⁵ showed that all analyzed profiles (except @repubblica) were extremely critical about the green pass adoption. Moreover, most also expressed their opposition to the COVID-19 vaccination policies, and to the restrictions imposed by the government to manage the pandemic.

¹⁴ ByoBlu is listed on different Italian fact-checkers black list such as BUTAC <https://www.butac.it/tag/the-black-list/>, or Open <https://www.open.online/2020/08/07/mini-bomba-atomica-nel-porto-di-beirut-tre-fisici-rispondono-ad-alessandro-meluzzi-chef-rubio-e-byoblu/>

¹⁵ By "qualitative analysis" we meant thoroughly reading the opinion leaders' Twitter profiles to identify their opinions.

4.2 RQ2: Opinion leaders' and PSMIs interaction networks and dissemination

To analyze possible interactions among the opinion leaders' and PSMIs profiles, we applied a social network analysis supported by the tool GEPHI. For each period, we performed a network analysis based on mentions the users initiated or received. First, using TCAT we selected "social graph by mentions" including all users, to generate the six .GDF files to upload into GEPHI. Second, we modeled the graph with GEPHI, performing the same steps for each time period. We applied a filter by degree to focus attention on users that received or initiated more mentions, dimensioning nodes by number of tweets published in the period, and dimensioning labels by number of mentions received. To create the final layout, we applied OpenOrder and the Yifan Hu algorithms in sequence, using standard parameters for both.

We found a continuous and prevailing presence of @claudio_borghi along with a limited number of other profiles who tweeted with particular intensity, as shown by the significant dimension of their nodes in Figures 4, 5, 6, 7, 8, and 9. The profiles referred to the no-green pass private citizens already mentioned in the general graph (e.g., @valy_s, @FmMosca, @ortigia_p etc.) along with other profiles, such as prominent political actors (@giorgiameloni @capezzone etc.), and disinformation sources, such as @byoblu and @imolaoggi.

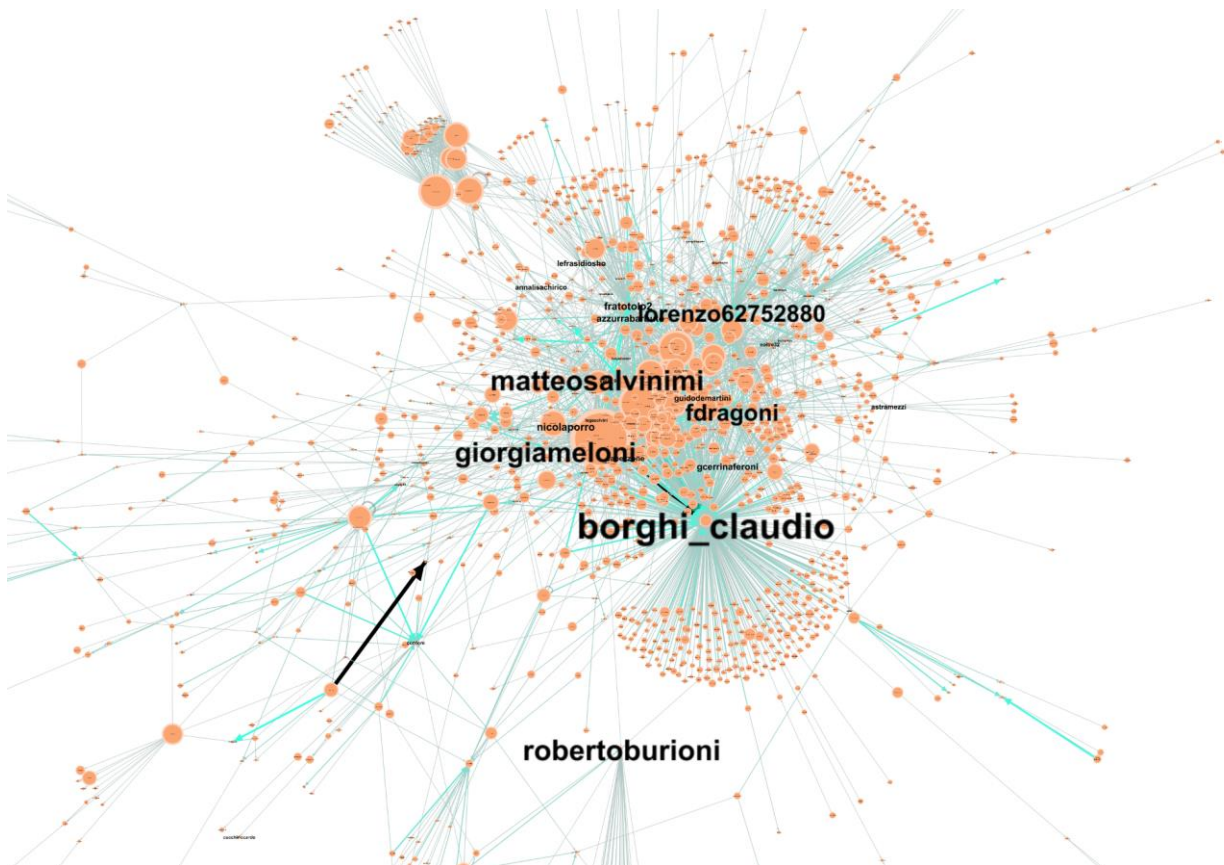


Fig. 4 The mentions network analysis related to period A: 12–16 July 2021

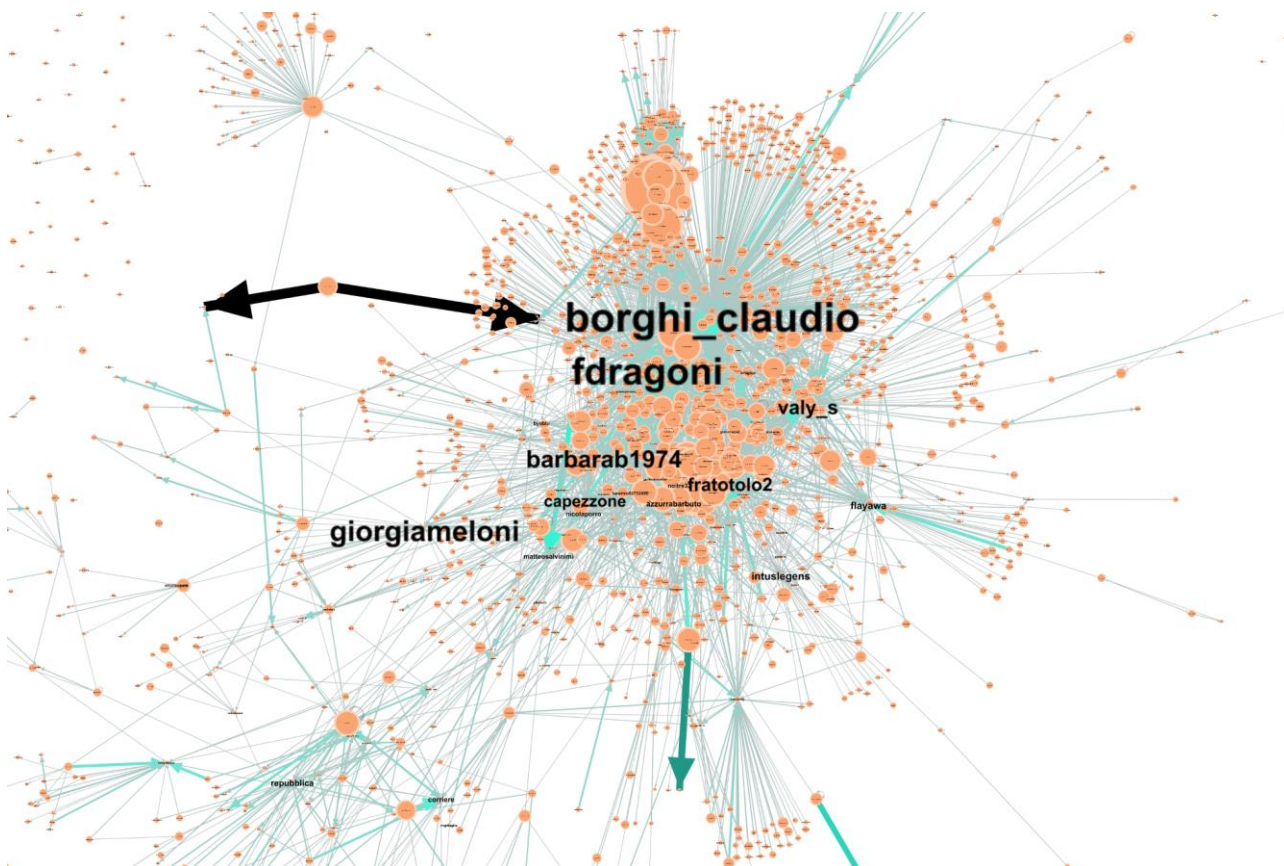


Fig. 5 The mentions network analysis related to period B: 20–30 July 2021

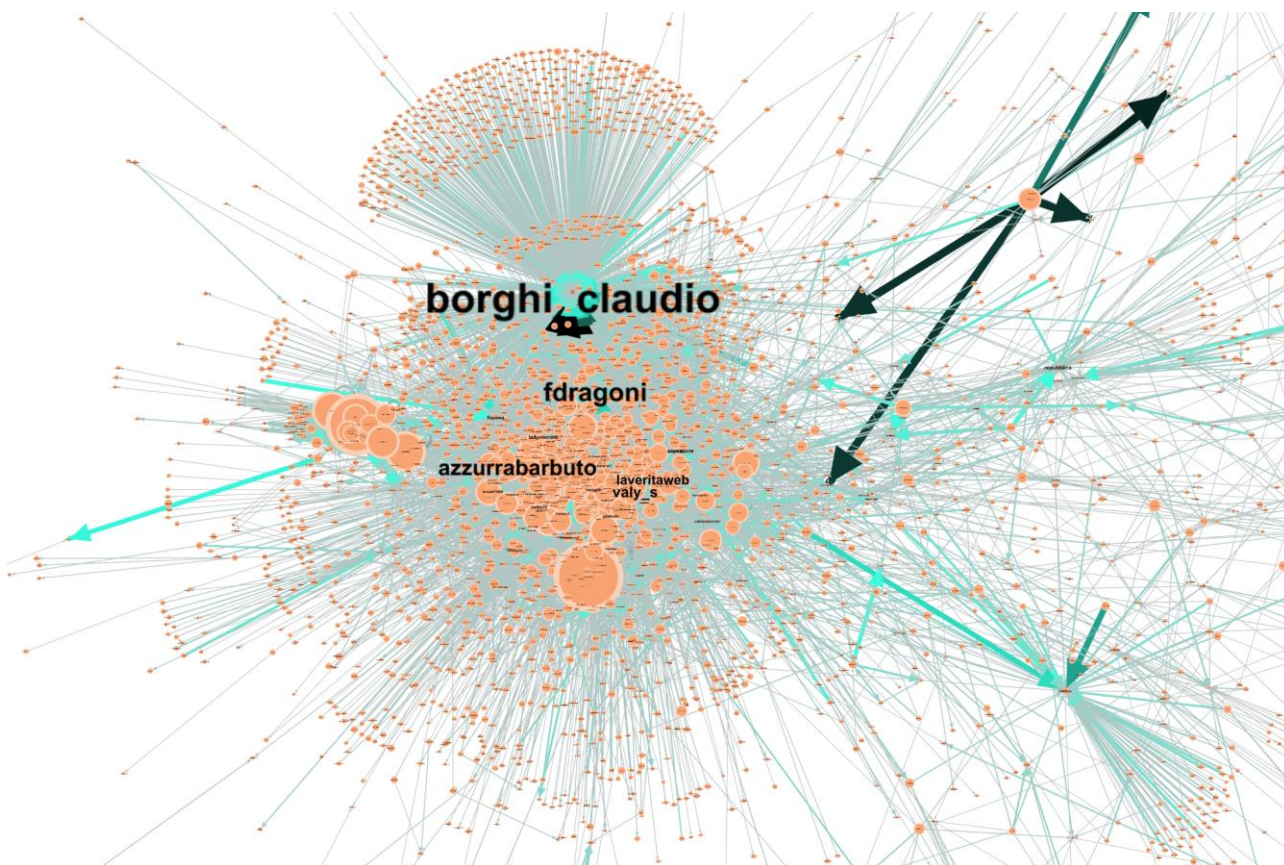


Fig. 6 The mentions network analysis related to period C: 4–13 August 2021

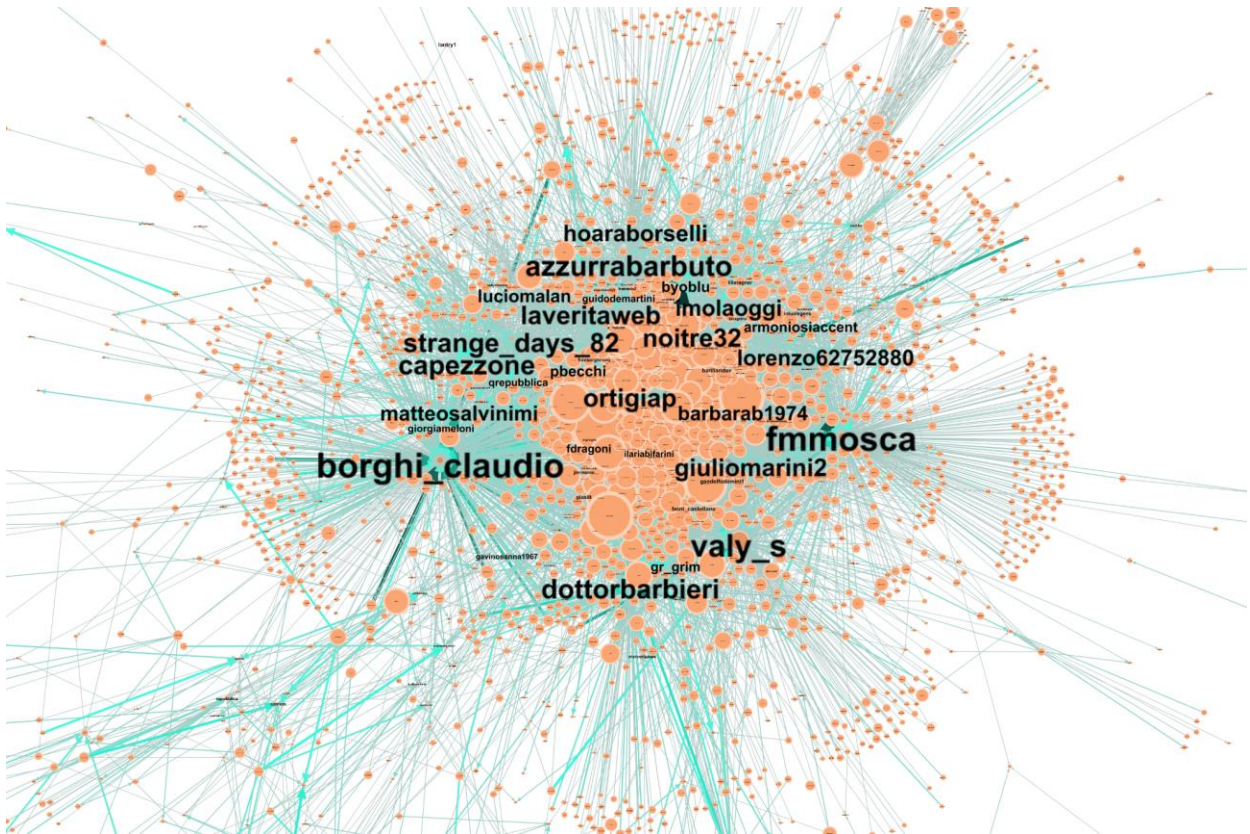


Fig. 7 The mentions network analysis related to period D: 14–21 September 2021

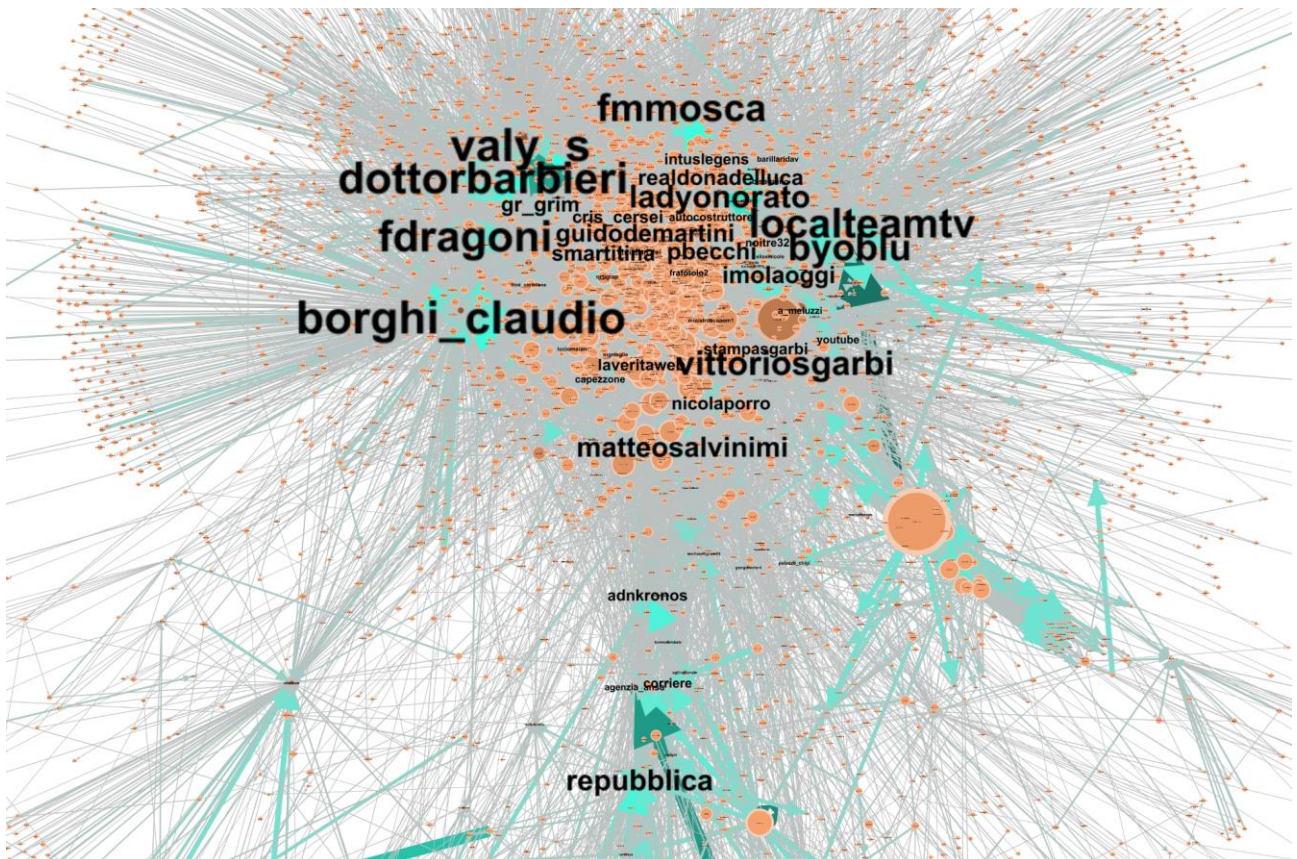


Fig. 8 The mentions network analysis related to period E: 8–20 October 2021

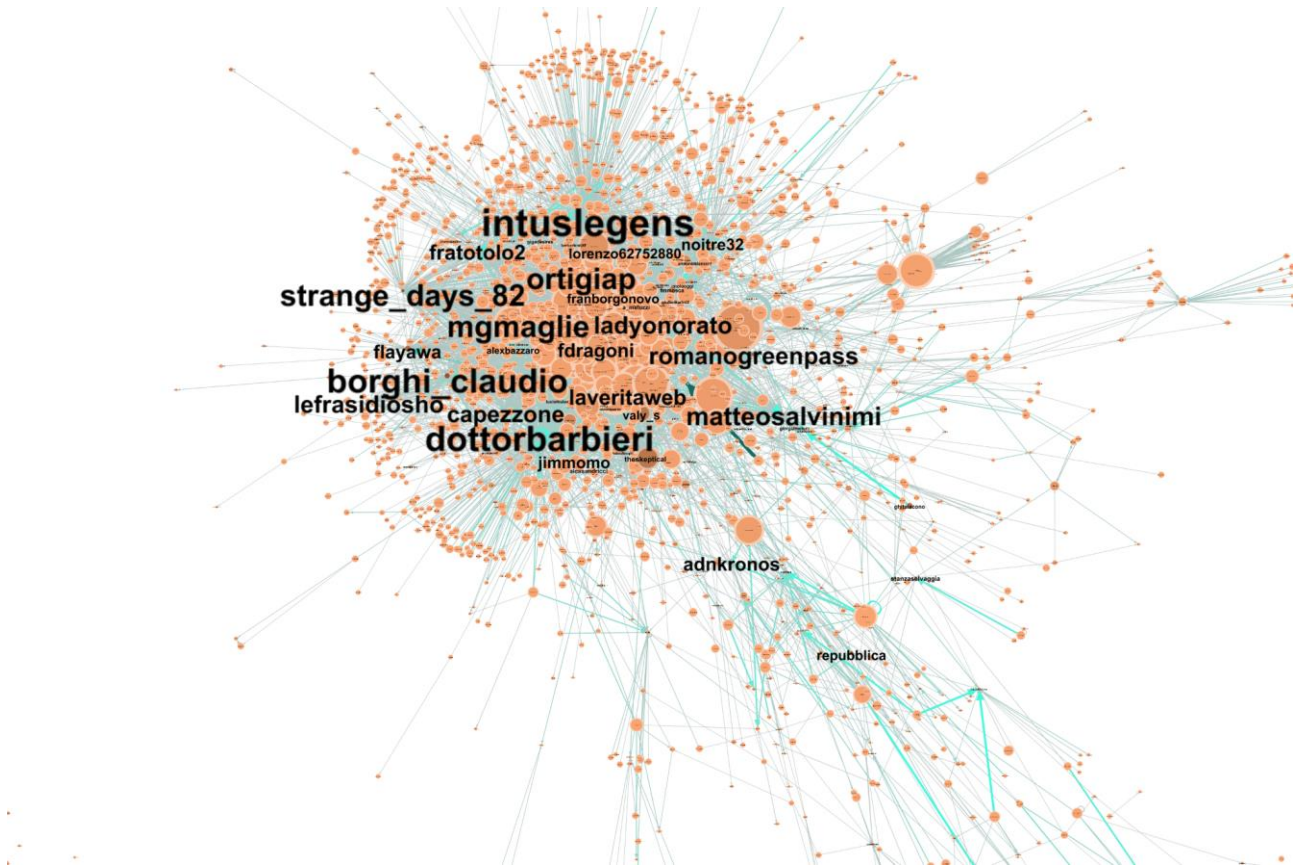


Fig. 9 The mentions network analysis related to period F: 22–26 November 2021

The mentions network analysis of different discussion peaks highlights the developing debate and the different opinion leaders' and PSMIs' positions. Moreover it also highlights the progressive marginalization of the pro-green pass voices compared with the dominant opponents. Period A (Fig. 4) reflects the prominent virologist Roberto Burioni's significant presence in the network, although he completely disappears in the following periods. The same process affects mainstream media profiles, such as @repubblica and @corriere¹⁶, which were barely visible in the first period. In period B (Fig. 5), @borghi_claudio maintains centrality and other political actors profiles rise, such as @giorgiameloni and @capezzone (the former belonging to Giorgia Meloni, leader of the right-wing party Fratelli d'Italia, and the latter to Daniele Capezzone, member of Silvio Berlusconi's Forza Italia party). Both opinion leaders represent firm opposition, both online and in their parliamentary activities, to Prime Minister Draghi's decree approving the mandatory nature of the

¹⁶ The profiles refer respectively to the Italian national newspapers La Repubblica and Il Corriere della Sera.

green pass. In Periods D and E (Fig. 7 and 8), it is worth noticing @byoblu's growing disinformation profile. In Period E, various other information profiles that reflect a conspiracy nature and are openly opposed to the green pass are highlighted, such as @imolaoggi and @localteamtvt. The last profile, @localteamtvt, is an information magazine giving voice to the protests against the green pass. In the last period, F (Fig. 9), Byoblu and Localteamtvt are less prominent, but a very disputable profile rose in close connection to the main network, @mgmaglie, whose profile was deeply analyzed in the next step.

A more in-depth analysis of the relationships identified in the social network analysis, described the opinion leaders' and PSMIs' content dissemination processes. Claudio Borghi was certainly the most mentioned by other users, but he hardly mentions the other PSMIs (Fig. 10).

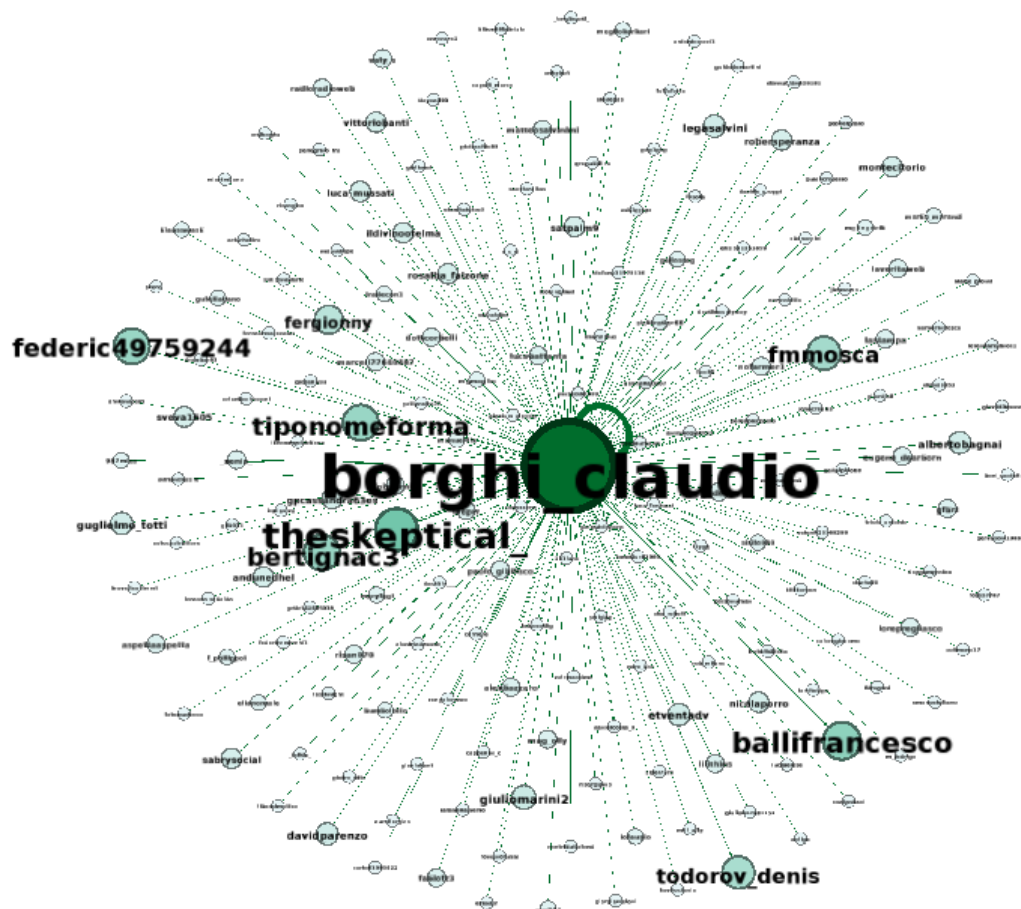


Fig. 10 The green nodes are the top users retweeted by Claudio Borghi

@borghi_claudio was particularly busy tweeting original content or retweeting himself. Borghi produced nearly 1,000 tweets in the period analyzed, of which 50% were original tweets, 20% retweets of his own tweets, and the remaining 30% retweets of other profiles. In total, 70% of his vocalicity was concentrated on multiplying his anti-green pass position.

That's worth noticing how the PSMIs in his cluster (es. private citizens such as @ortigiap, @valy_s) massively interacted with him and with a few others (Fig. 11).

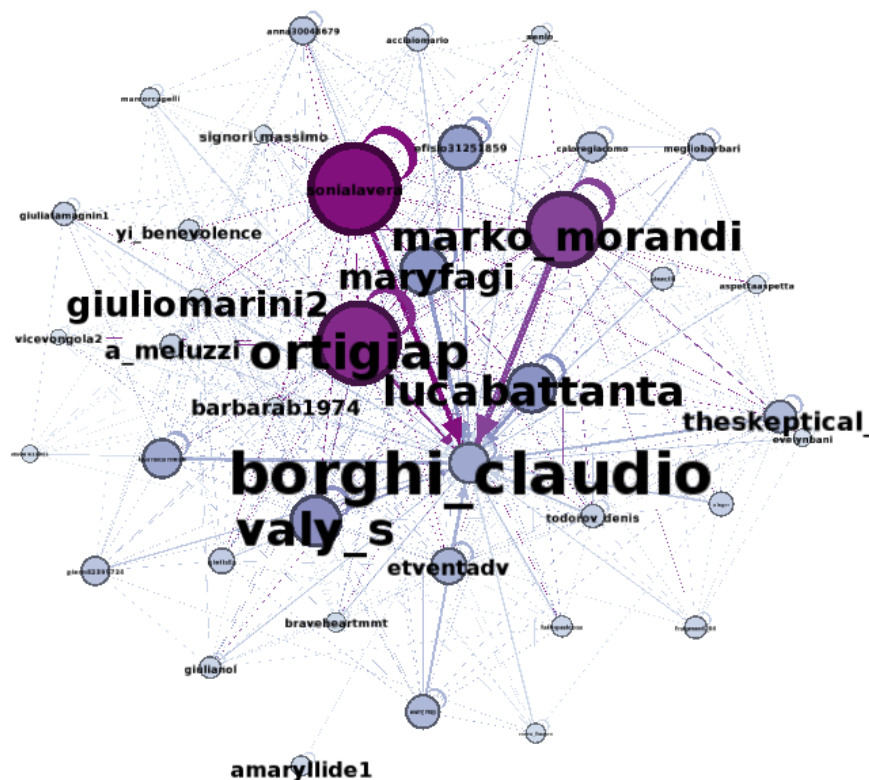


Fig. 11 The purple nodes are the profiles who retweeted Claudio Borghi

It is possible that PSMIs used Claudio Borghi's visibility to increase their own popularity, using a hashtag hijacking strategy (Mousavi, & Ouyang, 2021); or in a more general sense using "reinforcement," which is crucial in political influence dynamics.

In general, the interaction around Claudio Borghi's profile reveals a segregated debate that was articulated in a small number of PSMIs profiles that interacted mostly with each other and with a

number of less significant profiles (the smaller nodes in the network). The debate was strongly cohesive around a common critical position toward the green pass.

4.4 RQ3: Opinion leaders and PSMI's social network, and the spread of misinformation

To trace the links between opinion leaders and PSMI's role in spreading disinformation and false or conspiratorial news, we analyzed both the direct relationships between a profile and questionable sources, and the relationships mediated by other profiles. In the first case we analyzed external links to YouTube or other web pages present in the content tweeted. For example, Claudio Borghi tweeted at least 40 hyperlinks to videos from two YouTube channels, Inriverente¹⁷ and L'Anticonformista¹⁸, which featured Claudio Borghi himself during different parliamentary debates or at other public events. Both channels seemed to function merely as a sounding board for the parliamentarian, who reaffirmed his critical positions on green pass policies. Alongside these videos, the two YouTube channels presented multiple contributions from subjects, such as Maria Giovanna Maglie¹⁹, holding even more radical positions. The L'Anticonformista channel showed a video where Borghi and Maglie introduced the book "Italiani dannati" and the author reiterates the need, "*to fight the Taliban-vaccinist television, [...] to resist the dictatorship health care,*" and to demand "*mass screening campaigns prior to vaccination to assess the potentially harmful effects of vaccines*"²⁰. The same arguments are contained in a live session four-hour video on the Inriverente channel, where Maglie debates with the online audience about vaccines, green pass etc., and presents the same hyper-partisan views, repeatedly invoking "*resistance*" to the "*no-vax people*"²¹.

¹⁷ https://www.youtube.com/results?search_query=Inriverente

¹⁸ <https://www.youtube.com/c/Lanticonformista>

¹⁹ Maria Giovanna Maglie is a well known Italian journalist and opinionist; during the nineties worked for the main TV networks and collaborated with multiple national newspapers. In 1993 she resigned from Rai due to a scandal concerning alleged reimbursements of expenses inflated during her stays abroad;
https://it.wikipedia.org/wiki/Maria_Giovanna_Maglie

²⁰ <https://www.youtube.com/watch?v=uyflQOb136E&t=1822s>

²¹ <https://youtu.be/AlzHjD1ilCk>

Borghi's tweets, with links to the two YouTube channels, were retweeted 2,461 times during the period analyzed.

We could not find any significant YouTube links engaging this much attention in other opinion leaders or PSMIs profiles, but we traced a notable number of links, more than 5,000, retweeted from the Rumble²² video platform. Among the most tweeted videos was “green pass-home expropriation” with the main thesis focusing on COVID-19 mass vaccination inserting a digital chip in each patient, allowing total surveillance of vaccinated individuals. The video claims that “*the digital identity will be exploited by the European Community to expropriate the citizens private properties. That will occur if the 95% of population will receive the green pass or the unique digital code [...].*”

Along with this conspiracy inspired video, other videos urge the online audience to subscribe to a petition against the European Commission responsible for green pass adoption. We found several of the opinion leaders and PSMIs encountered in the previous analysis among the most mentioned profiles in relation with these misinformation sources, e.g., @giulioamarini2, @fmMosca, @ladyonorato etc. (Fig.12).

²² The video sharing platform (<https://rumble.com/>) had an impressive increase during the last two years and has been repeatedly accused of fuelling misinformation and conspiracy theories, such as QAnon. <https://www.wired.com/story/rumble-sends-viewers-tumbling-toward-misinformation/>; <https://globalnews.ca/news/8451636/donald-trump-social-media-canada-rumble/>.

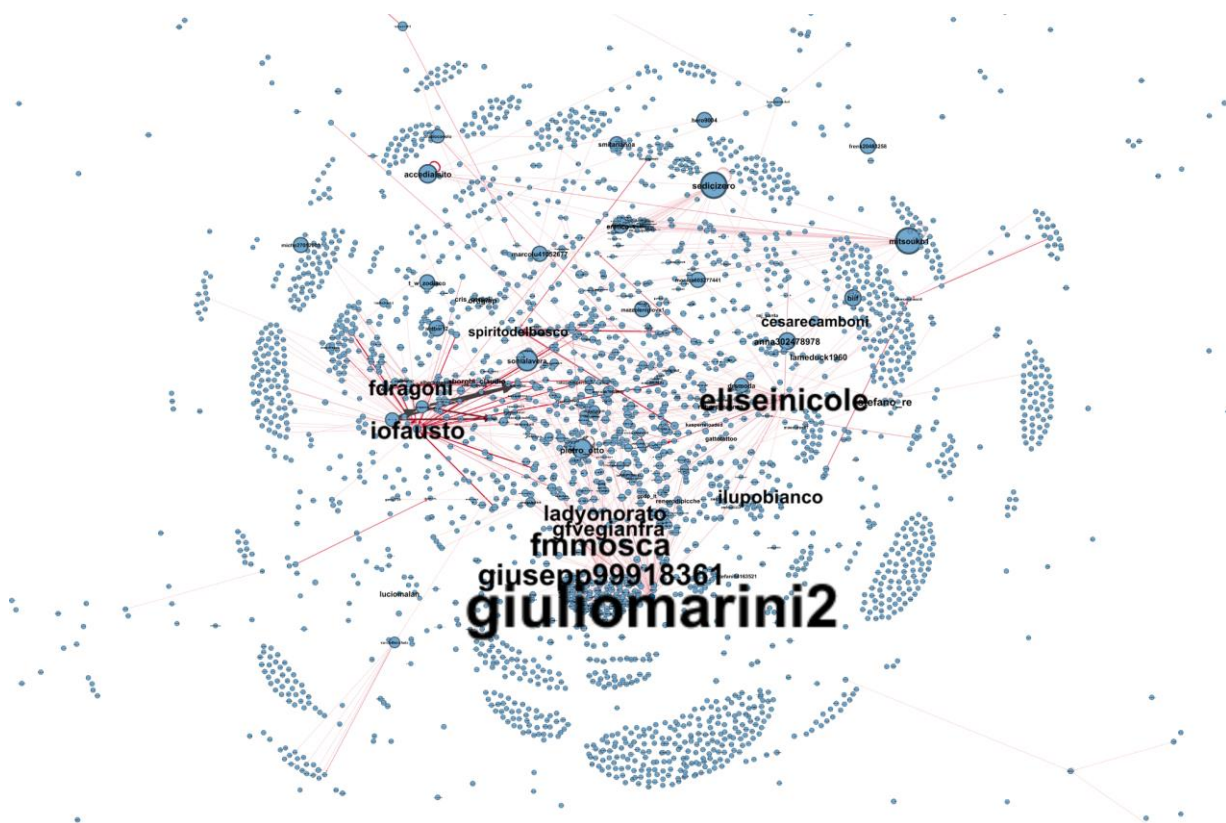


Fig. 12 The mentions networks of the profiles related to the Rumble's videos

Another direct link between Borghi and sources related to disinformation was a tweet by @byoblu sharing an interview released on ByoBlu web TV by Borghi and anesthetist Barbara Balanzoni (whose Twitter profile is @Barbara Balanzoni RESISTENZA) on July 26, 2021, shortly after the Draghi decree on the green pass²³. In this case, @byoblu mentions Borghi and not vice versa; the tweet with the link to the interview was retweeted more than 1,000 times over four days, from July 24 to 29, 2021.

Among Balanzoni's arguments was her self-legitimation as an accredited voice in the vaccine debate because of her former role as a medical officer in the Italian army during the Balkans²⁴ mission. Second, she argued that: "*since anti-Covid vaccines had no scientific coverage, they cannot be imposed and therefore the resulting green pass cannot be made mandatory in turn.*" The

²³ <https://www.byoblu.com/2021/07/26/green-pass-e-vaccini-giu-le-mani-dai-minorenni-claudio-borghi-e-barbara-balanconi/>

²⁴ Is it worth noting that Barbara Balanzoni is a specialized anaesthesiologist and not a virologist or an epidemiologist; <https://barbarabalanconi.it/>

weakness in her reasoning is clear; her argument was based on a generic idea of “lack of scientific coverage,” which is widely denied by many authoritative sources. Balanzoni also accused medical colleagues in the mainstream media of “*Nazi-Communism*” because of their effort to impose mass vaccination. Claudio Borghi's arguments went even further; regarding the possibility of extending the vaccination to minors, Borghi accuses: “*the Left - a certain Left - of having always had a fixation with children*” - highlighting “[...] *the greed with which our kids are stared at by the left-wing parties.*” Building on the conspiracy trend echoing the 2016 American Pizzagate ²⁵, Borghi also identified a vexatious intention against traders, especially restaurateurs whose businesses could be damaged by the mandatory green pass, especially by the Minister of Health Roberto Speranza who “*is particularly happy to burden the entrepreneurs.*” Both respondents then continued to accuse the government of equating the unvaccinated with the *sick* and pursuing racist and discriminatory policies against no-vaxers, considered “*mice or rats in the sewer.*”

To examine indirect relationships, or those mediated by other profiles, we analyzed points of contact between Claudio Borghi's and Byoblu's profiles, mediated by PSMI's profiles in the identified time periods (see section 3.1). GEPHI allowed us to identify social networks of profiles around both Claudio Borghi's and Byoblu's profiles. Considering the mentions network, we focused on the borghi_claudio and byoblu profiles, and applied a filter to calculate their ego networks with depth 1, which included users who directly mentioned them or were mentioned by them. The intersection between these ego networks is highlighted with different colors (Borghi's in red, Byoblu's in yellow, and the intersection between the two in orange), dimensioning nodes by degree, and labels by number of mentions received. The chart was developed using OpenOrd and Yifan Hu algorithms in sequence, with standard parameters. We then analyzed the overlap between the two networks in the studied periods to identify to what extent and how the intersection between the two networks favored expanding one of the two networks, and therefore, the spread of disinformation.

²⁵ https://en.wikipedia.org/wiki/Pizzagate_conspiracy_theory

The following graphs show three different time periods: Period A (Fig. 13), Period B (Fig. 14) and Period E (Fig. 15). The first period provides a frame of reference for the following two periods, which present a significant overlap between Borghi's and Byoblu's networks.

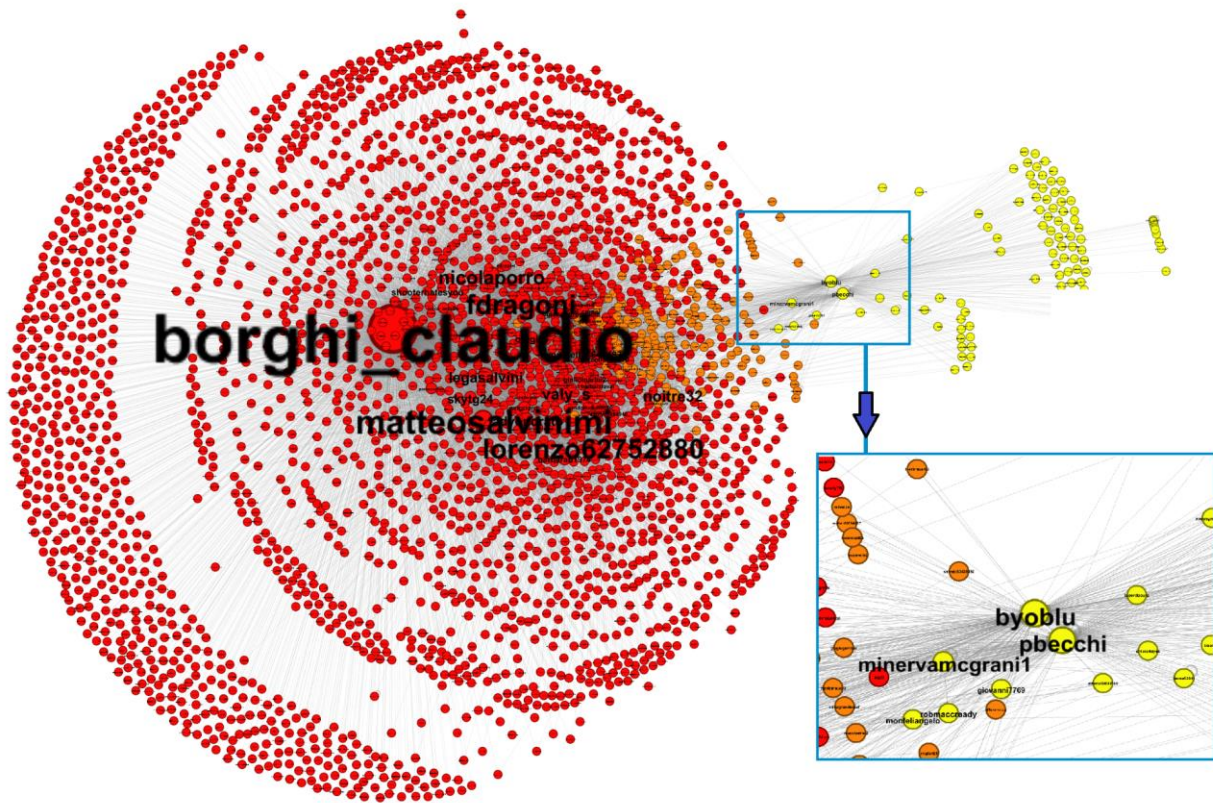


Fig. 13 In period A, the two networks are relatively detached and the Byoblu network is relatively small

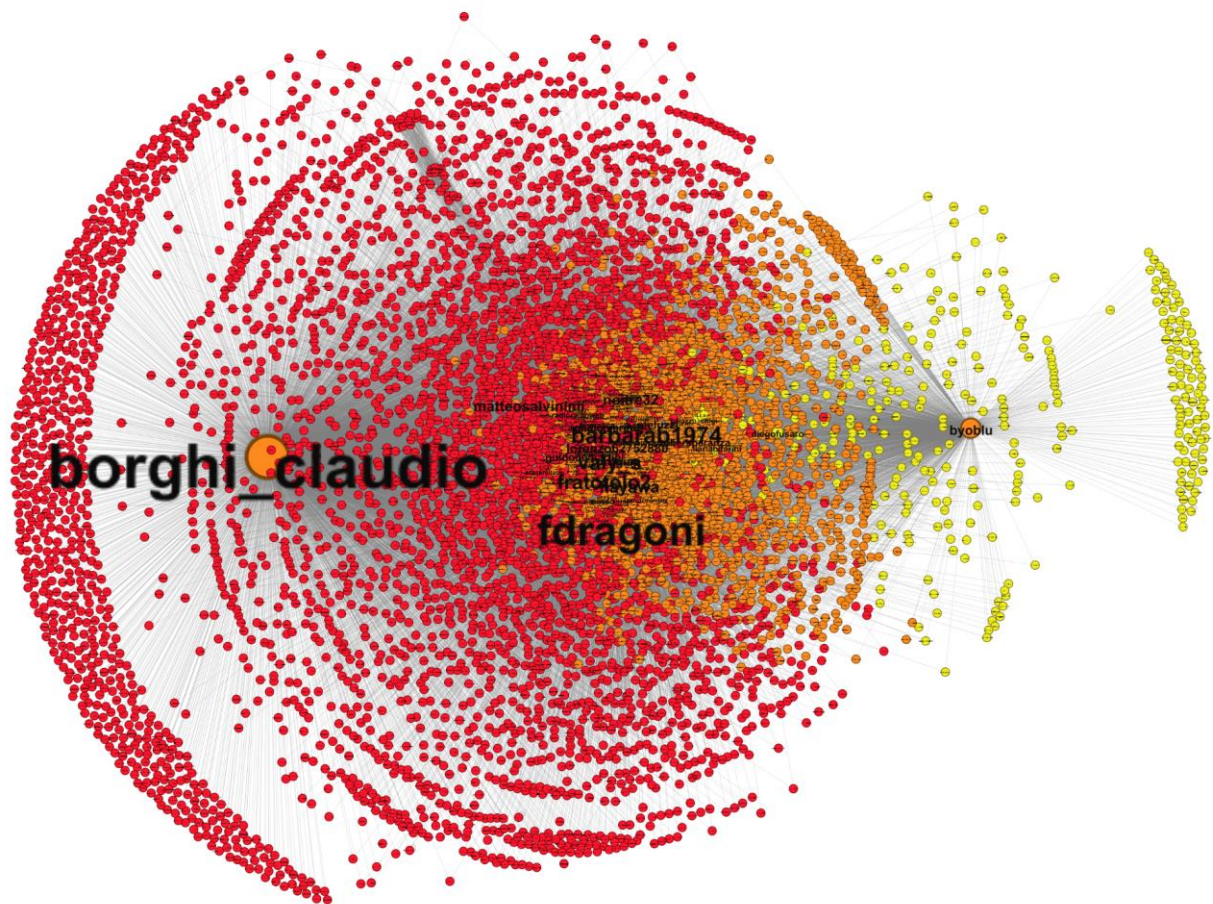


Fig. 14 In period B, the two networks increasingly overlap and the Byoblu network is growing

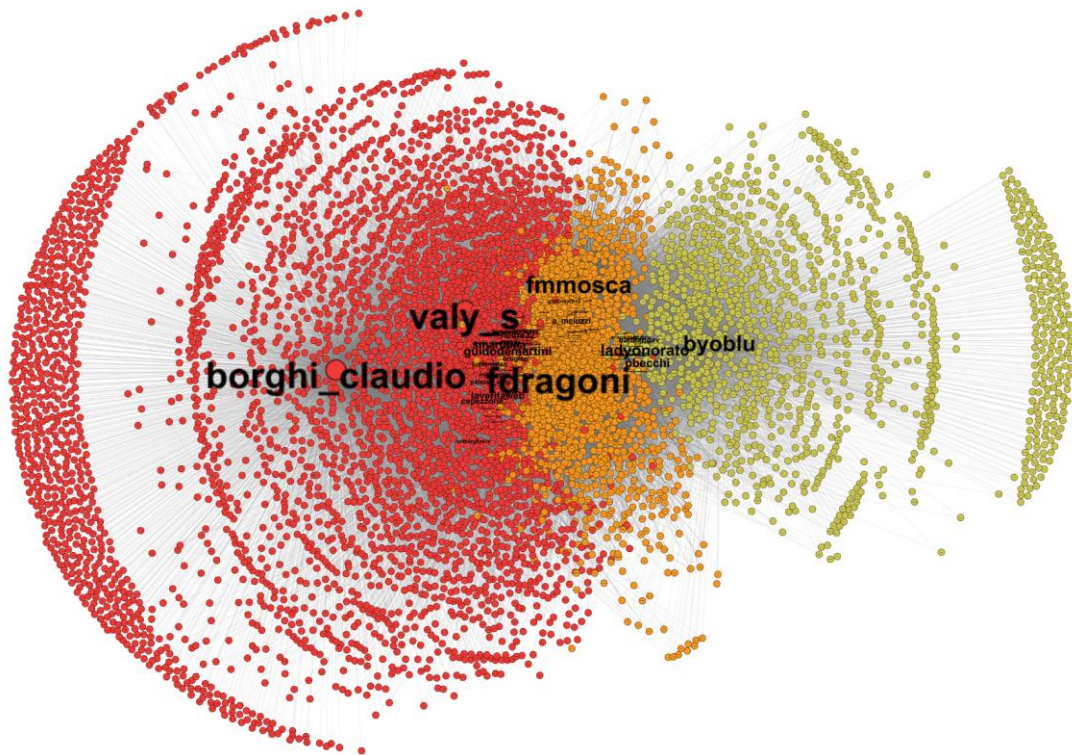


Fig. 15 In period E, the two networks significantly overlap with an evident increase of the network around Byoblu

As described earlier, on July 26 (Period B), Byoblu published an interview with Borghi and advertised the interview on its channels. The analysis showed that Borghi's ego network remained almost stable compared to Period 1; the number of nodes doubled, but the analyzed period was twice as long. At the same time, Byoblu significantly increased (more than tripled), and the intersection also increased by 4.75 times (from 28 to 133; normalized values) (Fig. 16). In other words, profiles mentioning Byoblu in connection with Borghi significantly increased in that period, thus expanding both the visibility of the disinformation profile and the spread of the related content. In Period E (October 8–20) the intersection increased again, and the Borghi and Byoblu networks “get closer.” Fig. 16 shows the rapprochement benefits above the Byoblu network, which again increased the number of mentions, both in relation with Borghi and not.

Period	Lenght (days)	Dimension		Union U	Intersection \cap	Normalized \cap \cap_{norm}
		EGO_borghi	EGO_byoblu			
A	5	2.626	247	2.729	144	28,8
B	11	5.444	1.788	5.761	1.471	133,7
C	10	5.275	1.160	5.662	773	77,3
D	8	3.365	985	3.890	460	57,5
E	13	5.285	2.659	6.499	1.445	111,2
F	5	1.884	452	2.164	172	34,4

Fig. 16 The evolution of ego networks over the periods, highlighting the size of both ego networks related to borghi_claudio and byoblu, their size as a whole, and their intersection, normalizing the latter value for the duration of each period in days

5. Discussion and conclusions

The COVID-19 health emergency increased disinformation's role and fostered a growing fragmentation between conflicting opinions on multiple issues, including COVID-19 causes, vaccination policies, and the government's measures for managing the pandemic, including the green pass debate. In Italy, the debate on social media ignited a conflict between mainstream positions in favor of restrictions, and more libertarian or radical positions extremely critical of government measures, which they considered detrimental to freedom of opinion, movement, and individual privacy. Our Twitter research investigated the role of opinion leaders and PSMIs in the green pass debate that surfaced in the second half of 2021, along with the mass vaccination campaign, and is still ongoing.

In response to RQ1, our analysis identified a very limited number of opinion leaders and PSMIs, which evolved around Claudio Borghi, a prominent political actor in the Italian Parliament. In consideration of his dominant voice, Borghi is perceived as an expert within the considered debate; moreover he can be considered as “the opinion leader” according to Bause's definition (Ib.) since his reputation is not merely dependant on social media popularity but it's related to his being a legitimized representative of one of Italy's major political parties. At a significant distance from Claudio Borghi, the most mentioned profiles are private citizens such as @valy_s, @FmMosca,

@ortigia_p, @fdragoni, @giulimarini2: they identify PSMIs with hyper-partisan and critical positions on the green-pass, who actively endorse Claudio Borghi's voice and interact significantly with other less prominent profiles.

In relation with RQ2, we identified a narrow cluster of users around Claudio Borghi, including other opinion leaders such as @ladyonorato and @capezzone, but especially PSMIs: a number of private citizens with an influential position and a very critical perspective on green pass policies; this cluster of PSMIs was highly committed in retweeting and amplifying Borghi's voice. It is worth noting that the most prominent political actors in the Italian Parliament, Matteo Salvini and Giorgia Meloni, were relatively marginal in the Twitter debate. The majority of the debate content was produced in fact by a limited number of engaged individuals, such as @FmMosca, @fdragoni, @valy_s, @giulimarini2, and @ortigia_p, who acted as PSMIs and amplifiers in close connection with the leaders. Moreover, both opinion leaders and PSMIs seem to be rather independent from mainstream media sources, relying massively on self-produced contents disseminated through multi-step flows of information. This observed content dissemination, deployed by opinion leaders on one hand and by PSMIs on the other, may produce what Sunstein (2018) defines "a reputational cascade phenomenon" wherein content is disseminated and multiplied only through consideration of the issuer's authority. Nevertheless the volume of data analysed were not giving a substantial solid argument to endorse this hypothesis²⁶.

In response to RQ3, we found that such content often involved spreading disinformation and conspiracy theories, such as those retweeted by Borghi through the YouTube videos that focused on Maria Giovanna Maglie, and by opinion leaders through the Rumble video platform. This also highlights a dissemination strategy aimed at diverting the audience from a main platform, such as Twitter, toward "below the radar" (Boccia Artieri et al., 2021) channels, where positions tend to be

²⁶ A cascade is measured, among other criteria, by the quantitative volume of content produced in relation to a certain tweet; in our case the number of tweets was too small. cfr. https://cs.stanford.edu/people/hongyang/viral_twitter.pdf

hyper-partisan. Our findings also revealed that disinformation sources, such as Byoblu, openly operate and interact with opinion leaders and PSMIs on Twitter to increase their visibility and popularity, which multiplies the overall volume of disinformation content. This relationship could be direct or mediated by the PSMIs who serve as amplifiers to the original messages.

Our findings show significant implications concerning the political social media debate: on a general level they highlight the emerging role of political influencers on Twitter (Dubois & Gaffney, 2014), such as the PSMIs, who actively interact with opinion leaders and endorse their dominant positions. Those actions could be referred both to a “reinforcement strategy” related to a substantial sharing of opinions, but that could also be related to an opportunistic exploitation of leaders' reputation aimed at increasing the PSMIs popularity on Twitter. A more in depth and comparative analysis of the intertwining effect of opinion leaders and PSMIs social networks behavior, may offer more solid evidence to support those hypotheses. Another implication relates to how social media and Twitter in particular privilege political information (Rogers, 2021): in relation to disinformation issue it is proven that Twitter highlights hyper-partisan contents rather than, for example, fake news (ib.: p. 5). Moreover, the political Twitter contributes to “mainstreaming the fringe” or enabling below the radar platforms to become significant in the political debate (ib.). In line with Rogers then, we identified similar dissemination strategies endorsed both by opinion leaders and by PSMIs: nevertheless given the specific debate analyzed we can't generalize this evidence to the political debate as a whole.

Our study also presents limitations concerning the dataset's national dimension. Because the Italian green pass policies are particularly restrictive compared with those of English-speaking countries, we focused only on Twitter contents in Italian. Since most European countries adopted similar policies, along with national vaccination campaigns, it would be interesting for further research to enlarge the dataset to include other languages, such as French, Spanish, English, etc. to analyze the impact of the opinion leadership dynamic and related disinformation spread in other countries.

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