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

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In Italy, the Twitter debate on the green pass ignited a conflict between mainstream positions in favor of restrictions, and opposite opinions extremely critical of government measures, also characterized by disinformation. Drawing from the classic Katz and Lazarsfeld model of influence, this article investigates the role of opinion leaders as well as that of political social media influencers (PSMIs) in fueling disinformation on the green pass. Thanks to a computational analysis of Twitter contents (4 million+) and the use of critical metrics and social network analysis (SNA), we identified a limited number of influential profiles endorsing critical positions on the green pass. Their interaction networks analysis also showed how both opinion leaders and PSMIs spread disinformation and conspiracy theories through a dissemination strategy aimed at diverting their followers from Twitter toward "below-the-radar" channels (e.g., Rumble), where positions on political issues tend to be more hyper-partisan.

Keywords: political Twitter, disinformation, opinion leadership, political social media influencers, critical analytics

Disinformation's rise and social impact is a salient effect of the recent pandemic (Mian & Khan, 2020). The World Health Organization (2020) defined the recent crisis as both a pandemic and an *infodemic*, 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, Caputi, Dredze, Kesselheim, & Ayers, 2020). Social media data analysis has identified multiple forms of disinformation. Islam and colleagues (2020) found three main forms of disinformation that had potentially serious impacts on

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public health on Facebook, Twitter, in online newspapers, and on 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 and colleagues (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 reliable sources did 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 were often spread by sources considered reliable, such as mainstream media: Between January and March 2020, Papakyriakopoulos, Serrano, and Hegelich (2020) identified 11,023 unique URLs— representing 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* issue (Ministero della Salute, n.d.), noting a growing politicization of the discourse, especially on Twitter. This phenomenon was not surprising, given the green pass' political nature. It was initially introduced as a tool to allow some social and recreational activities to reopen, 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, and other related topics.

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, Jai-sung Yoo, & Murthy, 2021; Park, 2013). 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, Minaeian, Paquet-Labelle, & Beaudry, 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 public role: They are most of the time private citizens who actively 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 model of Katz and Lazarsfeld (1955), this article 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 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 was taken with the goal of identifying prominent profiles in the online debate. The Methodology section presents a detailed description of how various concepts related to opinion leadership and influence were operationalized for the computational analysis of Twitter data. Critical metrics such as *dominant voices* (Rogers, 2018), were used in the analysis aimed at describing the social networks around prominent profiles in the green pass debate. In addition, the analysis of the most Tweeted sources provides evidence of how, through links to conspiracy contents, interviews with contested public figures, and other such aspects., opinion leaders and influencers fueled 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, that definitely attested to hyper-partisan positions (Boccia Artieri, Brilli, & Zurovac, 2021).

Twitter, Opinion Leadership, and Political Social Media Influencers: A Literature Review

Since its 2006 launch, Twitter has become an important arena for public debate. With 436 million users worldwide (Kemp, 2022), Twitter is a key part of the social media landscape. In Italy, the platform has nearly 13 million active users (Starri, 2022). 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 & Boccia Artieri, 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 that 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 the diffusion of innovations studies (Rogers, 2003; Shah & Scheufele, 2006). 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, Cho, & Kim, 2017). Winter and Neubam's (2016) qualitative survey on Facebook showed that the social media realm facilitates a pronounced 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 (1955) 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, Haddadi, Benevenuto, & Gummadi, 2010) 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 "multistep flow" process rather than the traditional "two-step flow" process (p. 2). A two-step flow process moves information from the media to opinion leaders, and influences moving information from opinion leaders to their followers; a multistep flow distributes information through myriad intermediary channels. Twitter's well-connected users play a stronger role in creating and distributing information through a multistep flow than those with fewer connections. Moreover, online opinion leaders can now produce information and transfer it to mass audiences. As Walter and Bruggerman (2018) observed, 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 that 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 (e.g., Twitter, Facebook, etc.) toward the so-called below-the-radar or fringe platforms, where opinions and political positions tend to be hyper-partisan (Rogers, 2021, p. 6). Another aspect that 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 become 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: Both are 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 content. They are also heavily committed to engaging with their online followers 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 from in a comparable way. As a result, opinion leaders can exert influence drawing from their own reputation related to their public role (if any) or even to their competencies on specific issues.

In consideration of this complex scenario where different figures interact in the online political debate, it is reasonable to first hypothesize that, in the context of the green pass debate on Twitter, a "multistep 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 but 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 governmental 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 (1955) opinion leadership model such as *being considered an expert*, *being knowledgeable*, and *holding a central position within their networks* were 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?

Methodology

Data Collection[2]

We collected Twitter data to identify the opinion leaders and the PSMIs, their dissemination strategies, and their 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

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[2] Data collection was carried out thanks to—TCAT (Twitter Capture & Analysis Toolset), 4CAT—developed by Digital Methods Initiative, a research group from the University of Amsterdam.

government to enlarge the certification mandate. We collected 4,307,487 tweets from 217,978 unique users using the Application Program Interface (API) full-archive search. This Representational State Transfer (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." Through the use of the Application Program Interface (API) full-archive search, tweets deleted by the users profiles themselves may not be included in the response, and this may affect the search results. To avoid this bias, tweets were systematically collected and archived to prevent them from being deleted or their users profiles from being 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 a public debate arena, and political or social events occurring in certain periods: Grusin (2010) identifies this relation as a *pre-mediation* process, a process by which events are reported on social media before becoming real news and before being framed by the mainstream media.

We identified a number of socio-political events that corresponded with a significant flow of pre-mediated content on Twitter[3]; this flow of content gave us the opportunity to analyze which profiles were emerging from the debate as opinion leaders or as PSMIs. As a result, we considered the following discussion peaks (Figure 1):

A.   July 12–16, 2021: Debate held about the preannounced law decree on green pass mandates.
B.   July 20–30, 2021: On July 23, Prime Minister Mario Draghi issued a law decree about the green pass mandate to access recreational facilities, such as restaurants, bars, cinemas, and sports areas, and to allow international mobility.
C.   August 4–13, 2021: On August 6, the law decree became effective.
D.   September 14–21, 2021: Schools reopened.
E.   October 8–20, 2021: On October 15, the green pass became mandatory for workplaces; consequently, many street protests were held, especially in North Italy (Ruggiero, 2022).
F.   November 22–26, 2021: Debate about the super green pass mandate.[4]

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[3] In correspondence with the six peaks, we found approximately 48% of the total collected tweets.

[4] 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.
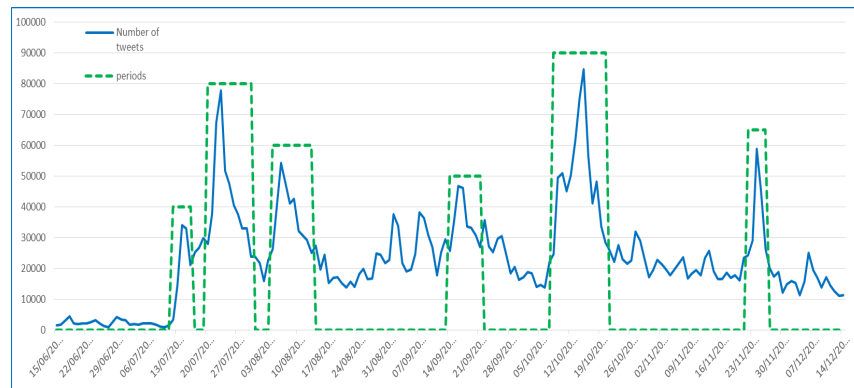
Figure 1. Twitter discussion peaks between June 15 and December 14, 2021.

Identifying Opinion Leaders and PSMIs Through Critical Analytics and Social Network Analysis

With the goals of responding to RQ1 and identifying opinion leaders and PSMIs in the Twitter debate, we started by using critical analytics that could operationalize some facets of influence as described by Katz and Lazarsfeld (1955) and specifically: *Being considered an exper*t and *being knowledgeable* or as the perceived authority and having a reputed 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. 455–456). The dominant voice metric was operationalized by the number of *mentions* in a given data set of tweets; the most *mentioned* profiles were considered the dominant voices in the considered debate. Thanks to the *mention* metric, we identified the profiles whose tweets 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; we then distinguished opinion leaders such as Claudio Borghi A. (n.d.) and Francesca Donato (n.d.) from PSMIs (Bause, 2021) on the basis of their formal affiliation to institutional political organizations or recognized media (e.g., national or European parties; news media) or their being private citizens without any formalized political status (e.g., Ortigia, n.d.; Valeria, n.d.). 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, Haddadi, Benevenuto, & Gummadi, 2010), we emphasized *interaction in the network* rather than mere visibility. Compared with 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, 2014).

To address RQ2, we applied the 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 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, Stovel, & Sacks, 2011). We applied social network analysis to a number of data subsets corresponding to the Twitter discussion peaks by using the tool Gephi. 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 period to highlight the addressees of their mentions and the relations among different opinion leaders and PSMIs.

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. Initially, we conducted a qualitative analysis of the top-mentioned user profiles to determine the following: Were they of the media, medical authorities, journalists, bloggers, political actors, or private citizens? And what was their position toward the green pass policies? Second, we used the Twitter Capture and Analysis Toolset (TCAT) 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 interactions among opinion leaders and questionable sources increased the general spread of fake news, conspiratorial theories, and suchlike. This analysis was based on the periods corresponding to a significant increase in the Twitter debate on the green pass issue (see Figure 1).

Data Analysis Results and Discussion

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 profiles[5] in the defined period (June–December 2021), which resulted in a short list of opinion leaders (Figure 2). Figure 3 shows the interactions among the opinion leaders and PSMIs included in the mentions network analysis over the six-month observation period.

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[5] Given the significant distance from the most mentioned profile—Claudio Borghi—we did not keep a huge number of less mentioned profiles because they would not have been that significant for our SNA. See Tumasjan, Sprenger, Sandner, and Welpe (2011).

Table 1. The Top Mentioned Profiles in the Overall Data Set.

@Username	@mentions received
borghi_claudio (n.d.)	174'864
Valy_s (n.d.)	72'353
FmMosca (n.d.)	69'079
Fdragoni (n.d.)	68'913
Dottorbarbieri (n.d.)	47'051
LaVeritaWeb (n.d.)	44'207
Ladyonorato (n.d.)	43'856
Byoblu (n.d.)	41'428
Lorenzo62752880 (n.d.)	41'417
ortigia_p (n.d.)	40'542
GiulioMarini2 (n.d.)	37'484
AzzurraBarbuto (n.d.)	34'287
Intuslegens (n.d.)	34'112
Matteosalvinimi (n.d.)	33'685
GuidoDeMartini (n.d.)	30'761
Repubblica (n.d.)	30'612
noitre32 (n.d.)	30'250
Pbecchi (n.d.)	30'223
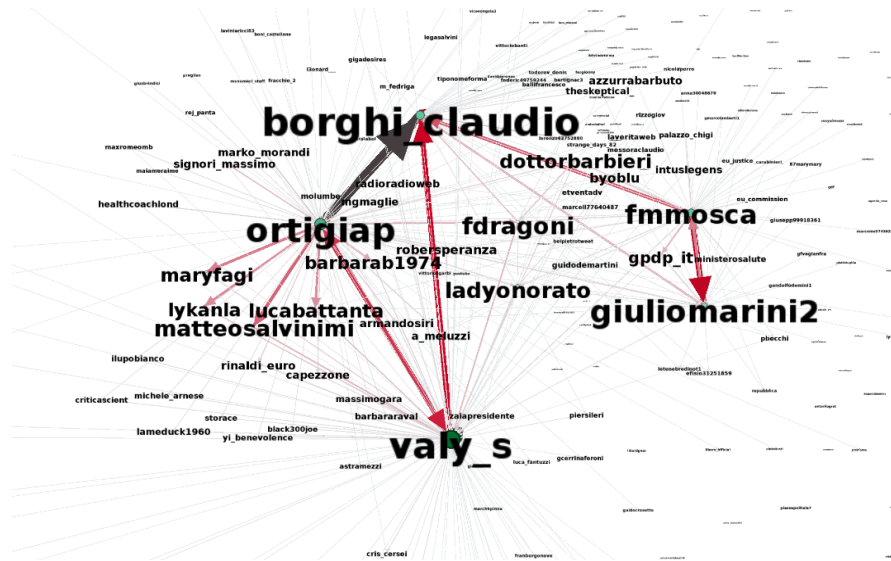
Figure 2. The mentions network analysis including the prominent profiles observed during the 6-month period.

The prominent role of Claudio Borghi's (n.d.) profile is evident: He gained more than 170,000 mentions. Borghi's profile is followed by a number of profiles with substantially smaller mentions volumes. Borghi is a political actor and a member of the Italian Parliament as a representative of the Lega Nord political party.[6] 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 his profile is the most retweeted and mentioned. His profile also had the highest number of interactions such as comments and replies. In short, he has been perceived as an expert on the considered topic; moreover, he can be considered "the opinion leader" according to Bause's (2021) definition since his reputation is not merely dependent on social media popularity but is related to his well-known position on the green pass and to his being a legitimized representative of one of Italy's major political parties. Similar to Borghi (n.d.), other opinion leaders' voices emerge on Twitter, such as that of Francesca Donato (n.d.), a member of the European Parliament, and Matteo Salvini (n.d.), the leader of the Lega Nord party. At a significant distance from Borghi, the most mentioned profiles are those of private citizens (Dragoni, n.d.; Marini, n.d.; Mosca, n.d.; Ortigia, n.d.; Valeria, n.d.): They identify PSMIs with hyper-partisan positions critical of the green pass, actively endorsing Borghi's voice and interacting significantly with other less-prominent profiles. Unlike Borghi, the PSMIs' reputation and visibility do 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 previously it emerges that they are particularly engaged in retweeting the content of Borghi or other opinion leaders, in systematically interacting with their followers through comments, mentions, emojis, and suchlike, 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 (n.d.), a news profile—a popular source of disinformation and conspiratorial theories in Italy (Pili, Pili, Ridolfi, & Noto, 2022)—which counts more than 41,000 mentions. We found only La Repubblica (n.d.), a national newspaper for mainstream media-accredited profiles, with 30,600 mentions. A qualitative analysis of the most mentioned content tweeted by the prominent profiles[7] showed that all analyzed profiles—except that of La Repubblica—were extremely critical of 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.

RQ2: Opinion Leaders' and PSMIs' Interaction Networks and Dissemination

To analyze possible interactions among the opinion leaders' and PSMIs' profiles, we applied an SNA 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 Graphic Data Files (GDF) to upload into Gephi. Second, we modeled the graph with Gephi, performing


[6] Lega Nord is a right-wing, populist, and conservative political party in Italy.

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

the same steps for each time period. We applied a filter by degree to focus on users who received or initiated more mentions, dimensioning nodes by the number of tweets published in the period, and dimensioning labels by the 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 (n.d.) along with a limited number of other profiles whose users tweeted with particular intensity, as shown by the significant dimension of their nodes in Figures 3 to 8. The profiles referred to the no-green pass private citizens already mentioned in the general graph (e.g., Mosca, n.d.; Ortigia, n.d.; Valeria, n.d.) along with other profiles, such as those of prominent political actors Giorgia Meloni (n.d.) and Daniele Capezzone (n.d.) and disinformation sources such as Byoblu (n.d.) and Imola Oggi (n.d.).
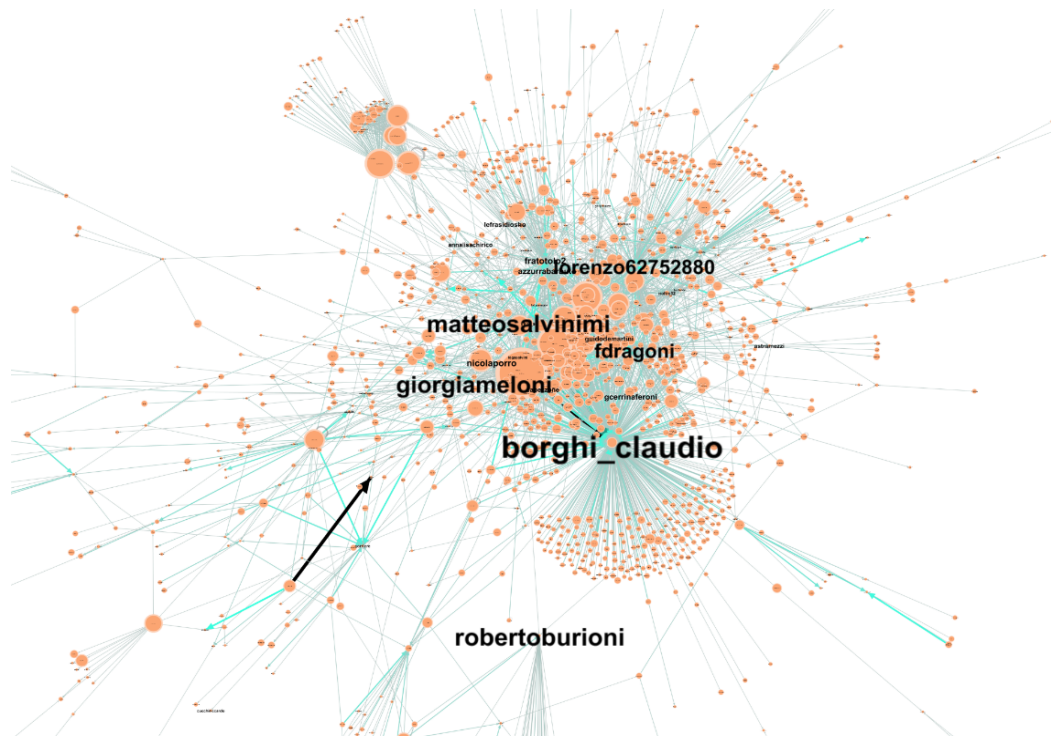
Figure 3. The mentions network analysis related to period A: July 12−16, 2021.
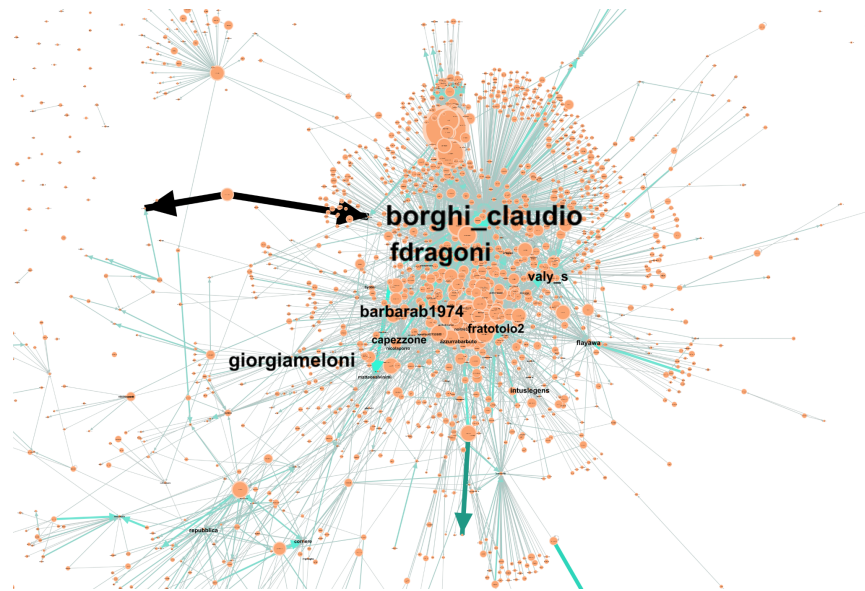
Figure 4. The mentions network analysis related to period B: July 20–30, 2021.
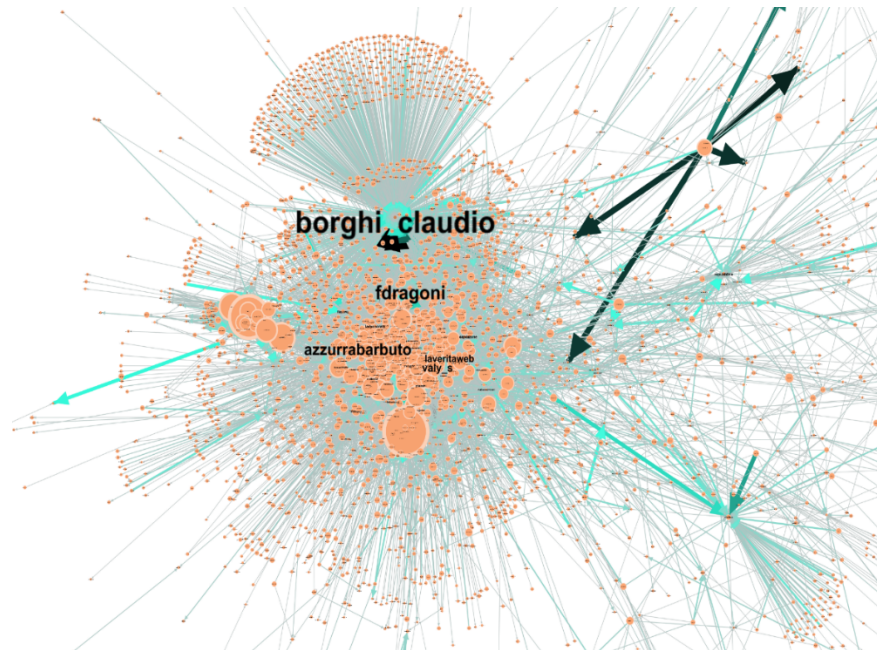
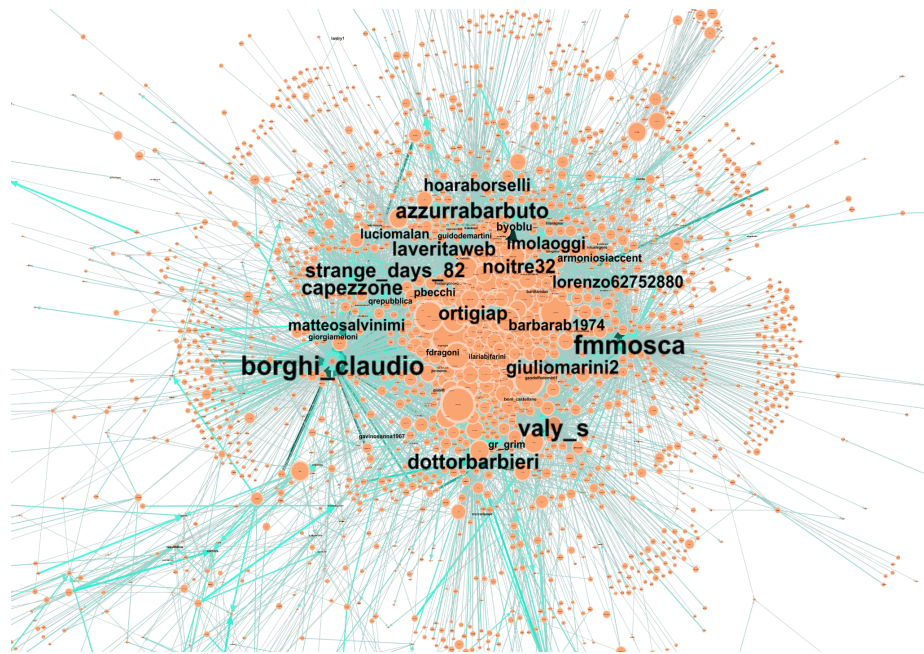*Figure 5. The mentions network analysis related to period C: August 4–13, 2021.*

Figure 6. The mentions network analysis related to period D: September 14–21, 2021.
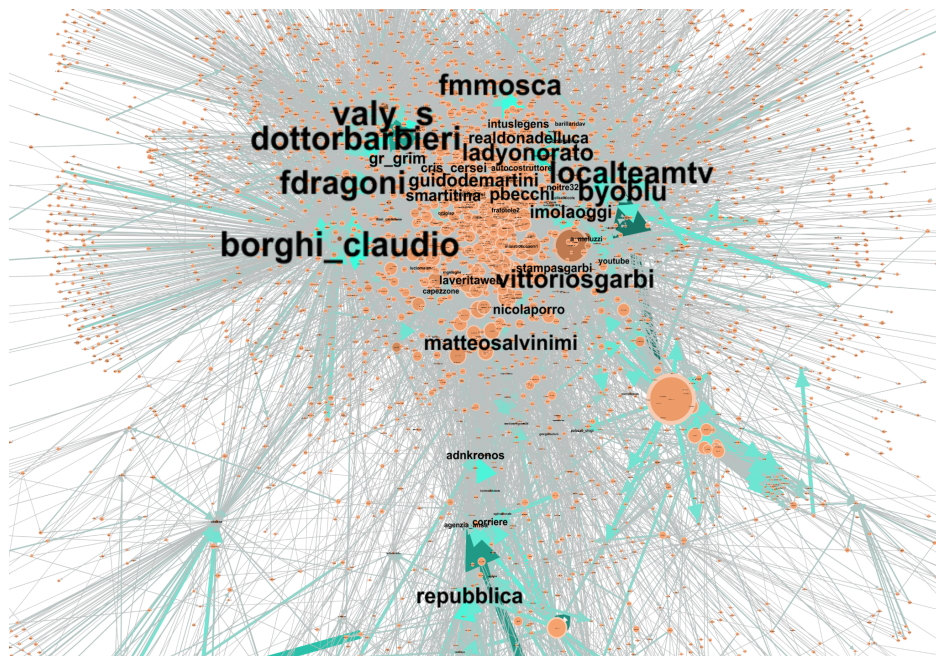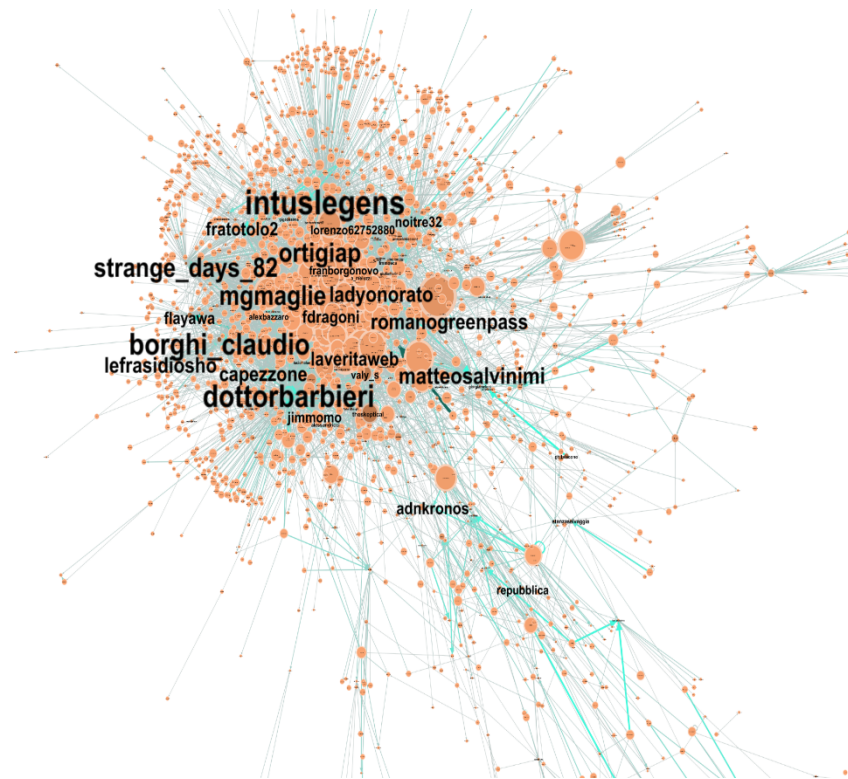

Figure 7. The mentions network analysis related to period E: October 8–20, 2021.

Figure 8. The mentions network analysis related to period F: November 22–26, 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 voices of the dominant opponents. The period A (Figure 3) reflects the significance of the presence of the Italian virologist Roberto Burioni's (n.d.) profile in the network although he completely disappears in the subsequent periods. The same process affects mainstream media profiles, such as the Italian national newspapers *La Repubblica* (n.d.) and *Corriere della Sera* (n.d.), which were barely visible in the first period. In period B (Figure 4), Borghi (n.d.) maintains centrality and other political actors' profiles rise, such as those of Meloni (n.d.), leader of the right-wing party Fratelli d'Italia, and Capezzone (n.d.), 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 green pass. In periods D and E (Figures 6 and 7), it is worth noticing Byoblu's (n.d.) 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 Imola Oggi (n.d.) and Local Team (n.d.). The last profile, Local Team, is an information magazine giving voice to the protests against the green pass. In the last period, F (Figure 8), Byoblu and LocalTeamtv are less prominent, but a very disputable profile rose in close connection to the main network (Maglie, 2021) whose profile was deeply analyzed in the next step.

An in-depth examination of the relationships identified in the SNA 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 (Figure 9).
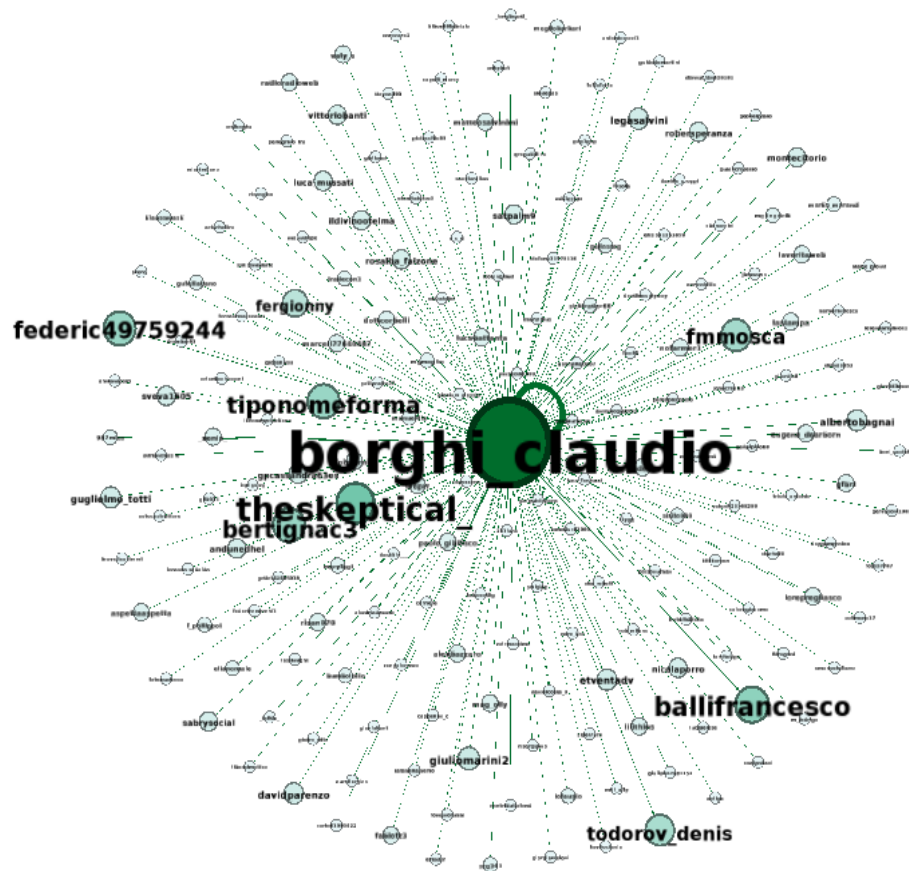
Figure 9. The green nodes denote the top users whose tweets were retweeted by Claudio Borghi.

Claudio Borghi (n.d.) was particularly committed in tweeting original content or retweeting his own. He 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 content from other profiles. In total, 70% of his vocality was concentrated on multiplying his anti–green pass position.

It is worth noticing how the PSMIs in his cluster such as ortigia-p (Ortigia, n.d.) and valy_s (Valeria, n.d.) massively interacted with him and with a few others (Figure 10).
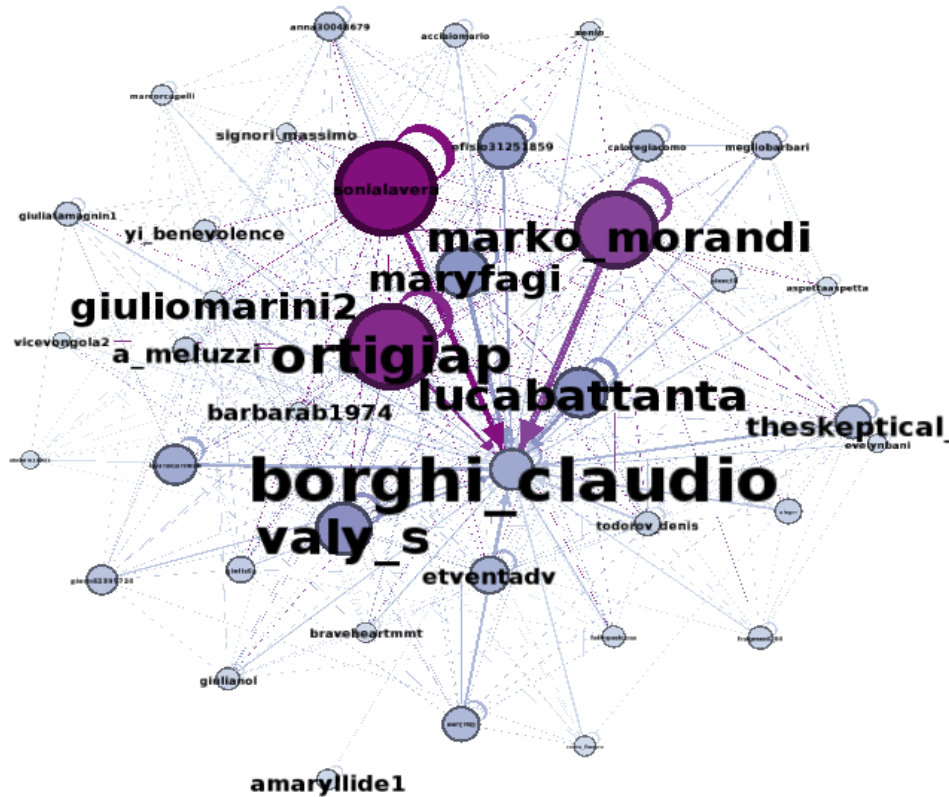
Figure 10. The purple nodes denote the profiles whose users retweeted Claudio Borghi's tweets.

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

In general, the interaction around 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.

RQ3: Opinion Leaders and PSMIs' Social Networks, and the Spread of Misinformation

To trace the links between opinion leaders and PSMIs' 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, Borghi tweeted at least 40 hyperlinks to videos from two YouTube channels, Inriverente (n.d.) and L'Anticonformista (n.d.), 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. The two YouTube channels presented also multiple contributors, such as Maria Giovanna Maglie (n.d.),[8] who hold even more radical positions. The L'Anticonformista (n.d.) channel showed a video where Borghi and Maglie introduced her book *Italiani dannati* and the author reiterates the need, "to fight the Taliban-vaccinist television [. . .] to rebel against the health dictatorship," and to demand "mass screening campaigns prior to vaccination to assess the potentially harmful effects of vaccines" (Inriverente, 2021, 49:50). 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, and other such issues, and presents the same hyper-partisan views, repeatedly invoking "resistance" to the "no-vax people" (Inriverente, 2022, 1:48:45). 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 the profiles of other opinion leaders or PSMIs, but we traced a notable number of links, more than 5,000, retweeted from the Rumble video platform (Coster, 2021). Among the most tweeted videos was the one entitled "Green pass = home expropriation" (Il_ficcanaso, 2021), with the main thesis focusing on COVID-19 mass vaccinations involving the insertion of a digital chip in each patient, allowing total surveillance of vaccinated individuals.

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 (Donato, n.d.; Marini, n.d.; Mosca, n.d.) among the most mentioned profiles in relation to these misinformation sources (Figure 11).

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[8] Maria Giovanna Maglie is a well-known Italian journalist and opinionist; during the 1990s she 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.
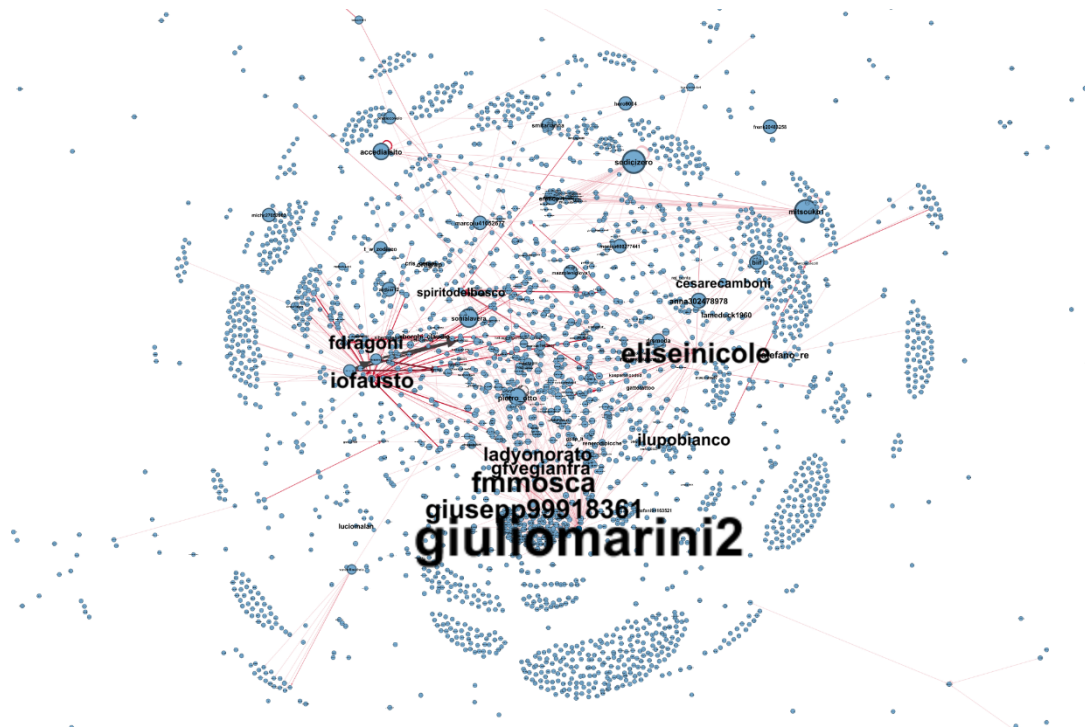
Figure 11. The mentions networks of the profiles related to the Rumble's videos.

Another direct link between Borghi and sources related to disinformation was a tweet by Byoblu (n.d.) sharing an interview (Crudelini, 2021) released on ByoBlu Web TV by Borghi and anesthetist Barbara Balanzoni (n.d.) on July 26, 2021, shortly after the Draghi decree on the green pass. In this case, it is Byoblu who 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 (n.d.) 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 Balkans 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" (Crudelini, 2021, 10:30). The 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 accused "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" (Crudelini, 2021, 17:15). Building on the conspiracy trend echoing the 2016 American Pizzagate, 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" (Crudelini, 2021, 18:00). 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" (Crudelini, 2021, 24:10).

To examine indirect relationships, or those mediated by other profiles, we analyzed points of contact between Borghi's (n.d.) and Byoblu's (n.d.) profiles, mediated by PSMIs' profiles in the identified time periods. Gephi allowed us to identify social networks of profiles around both 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 the degree, and labels by the 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. The following graphs show three different time periods: Period A (Figure 12), period B (Figure 13), and period E (Figure 14). 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.
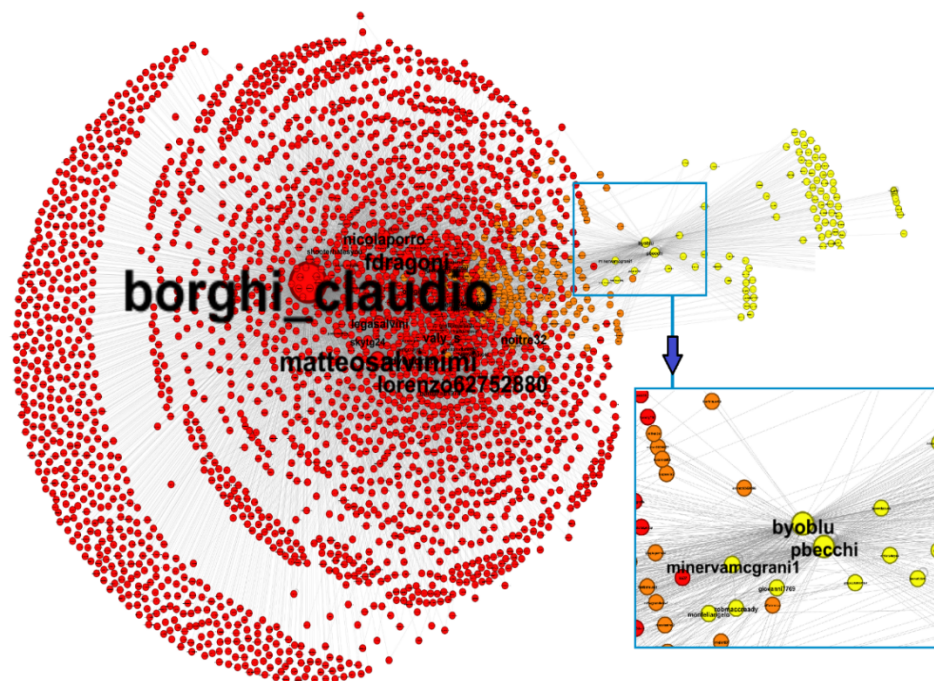
Figure 12. In period A, the two networks are relatively detached, and the Byoblu network is relatively small.
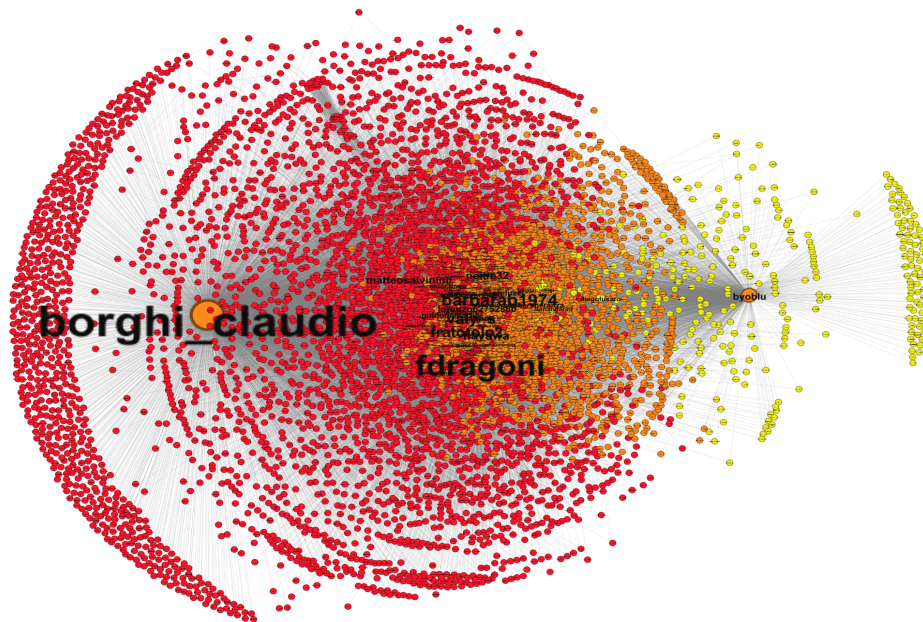
Figure 13. In period B, the two networks increasingly overlap, and the Byoblu network is growing.
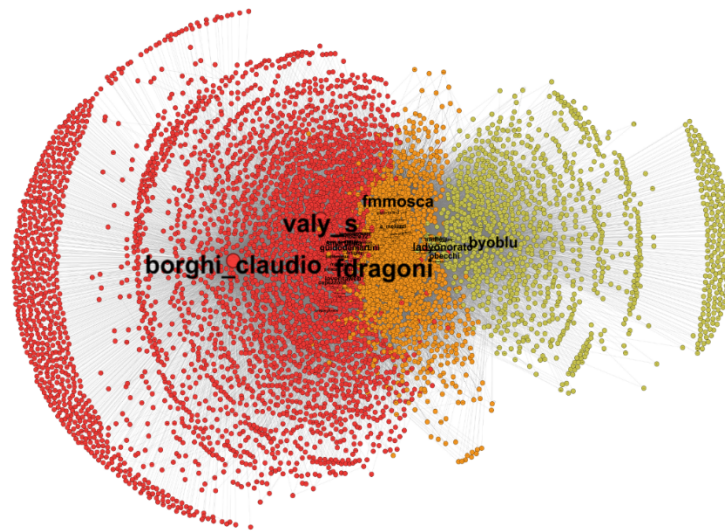
Figure 14. In period E, the two networks significantly overlap, with an evident increase of the network around Byoblu.

As described earlier, on July 26 (period B), Byoblu (n.d.) published an interview with Borghi (n.d.) and advertised it on their channels. The analysis showed that Borghi's ego network remained almost stable compared with that in period A; the number of nodes doubled, but the analyzed period was twice as long. At the same time, Byoblu 's network increased significantly (more than tripled), and the intersection also increased by 4.75 times (from 28 to 133 of normalized value; Figure 15). 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." Table 2 shows the rapprochement benefits above the Byoblu network, which again increased the number of mentions, both in relation with Borghi and not.

Table 2. The Evolution of Ego Networks Over the Time Range Analyzed.

Period	Length (days)	Dimension		Union	Intersection	Normalized ∩
		EGO_borghi	EGO_byoblu	U	∩	∩norm
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

Discussion and Conclusions

The COVID-19 health emergency increased disinformation's role and fostered a growing fragmentation among 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 the 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 "the opinion leader" according to Bause's (2021) definition since his reputation is not merely dependent on social media popularity but it is 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 those of private citizens (Dragoni, n.d.; Marini, n.d.; Mosca, n.d.; Ortigia, n.d.; Valeria, n.d.): 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 to RQ2, we identified a narrow cluster of users around Claudio Borghi, including other opinion leaders such as Francesca Donato and Daniele 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 to 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 (Dragoni, n.d.; Marini, n.d.; Mosca, n.d.; Ortigia, n.d.; Valeria, n.d.), who acted as PSMIs and amplifiers in close connection with the leaders. Moreover, both opinion leaders and PSMIs seem to be rather independent of mainstream media sources, relying massively on self-produced content disseminated through multistep flows of information. This observed content dissemination, deployed by opinion leaders on the one hand and by PSMIs on the other, may produce what Sunstein (2018) defines as "a reputational cascade phenomenon" (p. 130) wherein content is disseminated and multiplied only through consideration of the issuer's authority. Nevertheless, the volume of data analyzed did not give a substantial solid argument to endorse this hypothesis.[9]

In response to RQ3, we found that such content often involved spreading disinformation and conspiracy theories, such as those retweeted by Borghi (n.d.) through the YouTube videos that focused on Maria Giovanna Maglie (n.d.) 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 channels, where positions tend to be 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 to a "reinforcement strategy" related to a substantial sharing of opinions, but that could also be related to an opportunistic exploitation of the reputation of leaders 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, Twitter in particular, privilege political information: In relation to the disinformation issue it is proven that Twitter highlights hyper-partisan contents rather than, for example, fake news. Moreover, the political Twitter contributes to "mainstreaming the fringe" or enabling below-the-radar platforms to become significant in the political debate (Rogers, 2021, p. 5). We identified in fact similar dissemination strategies endorsed both by opinion leaders and by PSMIs; nevertheless, given the specific debate analyzed this evidence cannot be extrapolated to political debates in general.

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[9] 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 (Goel, Munagala, Sharma, & Zhang, 2015).

Our study also presents limitations concerning the data set's national dimension. Because the Italian green pass policies are particularly restrictive compared with those of English-speaking countries, we focused only on Twitter content in Italian. In consideration of the fact that many countries adopted similar policies, along with national vaccination campaigns, it would be interesting for further research to enlarge the data set to include other languages, such as French, Spanish, and English, among others, to analyze the impact of the opinion leadership dynamics and related disinformation spread in those countries.

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