

Bolsonaro and the Far Right: How Disinformation About COVID-19 Circulates on Facebook in Brazil

RAQUEL RECUERO¹

Federal University of Pelotas, Brazil
Federal University of Rio Grande do Sul, Brazil
MIDIARS Research Lab, Brazil

FELIPE BONOW SOARES
MIDIARS Research Lab, Brazil

OTÁVIO VINHAS
University College Dublin, Ireland
MIDIARS Research Lab, Brazil

TAIANE VOLCAN
Federal University of Pelotas, Brazil
MIDIARS Research Lab, Brazil

LUIZ RICARDO GOULART HÜTTNER
Federal University of Rio Grande do Sul, Brazil
MIDIARS Research Lab, Brazil

VICTÓRIA SILVA
Federal University of Pelotas, Brazil
MIDIARS Research Lab, Brazil

Raquel Recuero: raquelrecuero@gmail.com

Felipe Bonow Soares: fbonowsoares@gmail.com

Otávio Vinhas: otavio.vinhas@gmail.com

Taiane Volcan: taivolcan@gmail.com

Luís Ricardo Goulart Hüttner: luizricardohuttner@gmail.com

Victória Silva: victsilva29@gmail.com

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This article tackles the circulation of disinformation and compares it to fact-checking links about COVID-19 on Facebook in Brazil. Through a mixed-methods approach, we use disinformation and fact-checking links provided by the International Fact-Checking Network/Poynter, which we looked for in CrowdTangle. Using this data set, we explore (1) which types of public groups/pages spread disinformation and fact-checking content on Facebook; (2) the role of political ideology in this process; and (3) the network dynamics of how disinformation and fact-checking circulate on Facebook. Our results show that disinformation tend to circulate more on political pages/groups aligned with the far right and Brazilian President Jair Bolsonaro, on religious and conspiracy theory pages/groups and alternative (hyperpartisan) media. On the other hand, fact-checking circulates more on leftists' pages/groups. This implicates that the discussion about COVID-19 in Brazil is influenced by a structure of asymmetric polarization, as disinformation spread is fueled by radicalized far-right groups.

Keywords: disinformation, fact-checking, Facebook, COVID-19

Brazil is one of the worst affected countries by COVID-19 in the world. By April 2021, Brazil's death rate reached a record of more than 4,000 people per day, with the health system collapsing all over the country (Phillips, 2021). Part of this chaotic situation was due to how the Brazilian government dealt with the pandemic, which led to the uncontrolled spread of the virus and the development of new variants. Another part of it was connected to the massive spread of disinformation about COVID-19, particularly on social media platforms (Araujo, Silva, & Santos, 2020).

For the scope of this article, we understand disinformation as misleading information that is created to obtain political advantage (Benkler, Faris, & Roberts, 2018). The phenomenon influenced people not to comply with the health measures that would prevent the spreading of the virus in the country (Galhardi, Freire, Mynaio, & Fagundes, 2020).

Brazil's far-right president, Jair Bolsonaro, and other government authorities also played an important role in the spread of problematic content, often by using social media platforms to undermine the gravity of the situation and minimize the health policies proposed by governors and mayors to reduce the spread of the virus (Ricard & Medeiros, 2020). These statements often reinforced disinformation and fueled their spread (Recuero, Soares, & Zago, 2021), although several efforts were made through fact-checking agencies and local governments to combat this content. Fact-checking is often pointed to as a key tool to fight disinformation crises such as the one in Brazil (López-García, Costa-Sánchez, & Vizoso, 2020). However, studies also showed that it often does not circulate in the same groups as disinformation (Recuero, Zago, & Soares, 2019).

To understand how Brazil entered this situation, and to find solutions to avoid similar futures, we need to understand the role disinformation played, particularly on social media, where it was easily spread and legitimated (Menczer & Hills, 2020), and how it compares to fact-checking. In this article, we focus on the networks that spread disinformation and fact-checking about COVID-19 on Brazilian Facebook's public

pages and groups. Brazil currently has 150 million social media users (more than 70% of the population; Kemp, 2021). We chose to study Facebook because it is one of the most used social media channels (around 136 million users) and the most popular social media channel for Brazilians to access news (Newman, Fletcher, Schultz, Andi, & Nielsen, 2020).

For this research, we used a data set of 568 fact-checked disinformation links about COVID-19 provided by the International Fact-Checking Network (IFCN)/Poynter, collected between March and September of 2020. We used CrowdTangle (CrowdTangle Team, 2021) to trace the circulation of these disinformation links and their correspondent fact-checking links on public Facebook groups and pages, which were further analyzed in this study. We aim to discuss (1) which types of public groups/pages spread disinformation and fact-checking content on Facebook; (2) the role of political ideology in this process; and (3) the network dynamics of how disinformation and fact-checking circulate on Facebook

Disinformation and COVID-19

Since the beginning of the COVID-19 pandemic, researchers all over the world have also identified the emergence of a parallel “infodemic”: a “viral” increase in the spread of disinformation about COVID-19, particularly on social media. In Brazil, rather than simply having low-quality content, hoaxes, and false information circulating, public authorities and the president actively engaged in spreading and legitimating disinformation about the pandemic—going as far as, for example, questioning the gravity of the disease, not wearing masks, and even stimulating people to use ivermectin and hydroxychloroquine as a cure or effective treatments to COVID-19 (Ricard & Medeiros, 2020; Soares, Recuero, Volcan, Fagundes, & Sodré, 2021).

The actions of political authorities in fueling disinformation are important because political leaders strongly influence other people, especially their followers on social media (Parmelee & Roman, 2020). This is key for polarized contexts, as some studies have found a connection between political ideology and the perception of the pandemic. Calvillo, Ross, Garcia, Smelter, and Rutchick (2020), for example, found a connection between conservative ideological views and the difficulty to discern between disinformation and real content, particularly associated with political authorities that legitimate disinformation in the United States. Similar observations were made by Allcott and colleagues (2020) in the same context, where political views could impact the pandemic response. In other countries, such as Australia, connections were found between right-wing ideology and disinformation about COVID-19 (Clarke, Klas, & Dyos, 2021).

Brazilian President Jair Bolsonaro is considered a far-right leader (Mendonça & Caetano, 2021; Watmough, 2021). Far-right governments all over the world have been connected to the spread of disinformation about COVID-19 (Stecula & Pickup, 2021). In Brazil, for example, Bolsonaro criticized the World Health Organization (WHO) and other health authorities several times during the pandemic, which was reverberated by some of the disinformation in the country (Soares et al., 2021). Bolsonaro’s discourse also blamed local and international elites for the COVID-19 crisis (Watmough, 2021), defended the usage of unproven drugs as a “cure” for the virus (Recuero & Soares, 2020), and discredited both scientists and traditional media.

The embeddedness formed between disinformation, the radical right-wing, and social media is often connected to polarization and the rise of echo chambers (Benkler et al., 2018; Törnberg, 2018). Although the concept of echo chambers is controversial, we use it to describe the phenomena in which two opposite groups preferentially share content that reinforces their narratives or political ideology, strengthening polarization. We do not look at one user's media diet to measure how exposed they are to different information. We understand that an echo chamber is created by a group of nodes (pages and users within groups in the case of this article) that consistently share one type of content (disinformation) and do not share another (fact-checking). Users that follow the pages and are within the groups might be exposed to diverse content—and researchers found evidence of that (Flaxman, Goel, & Rao, 2016). Nevertheless, the pages and users posting within the groups opt to echo one discourse/narrative instead of another.

Previous research has found evidence of the presence of echo chambers in the network level in political discussions (Bastos, Mercea, & Baronchelli, 2018; Benkler et al., 2018) and in information consumption and sharing about COVID-19 (Jiang, Chen, Yan, Lerman, & Ferrara, 2020; Recuero et al., 2021). This structure may help far-right groups contribute to the spread of disinformation on social media, often by filtering or rejecting content that could help debunk false claims (Benkler et al., 2018; Recuero et al., 2021).

Fact-Checking

One promising tool to mitigate the effects of disinformation is fact-checking. Originally designed as a procedure to evaluate the accuracy of politicians' public claims and input a more analytical sense to journalism (Graves, 2016), fact-checking has also been developing as an essential resource to correct false beliefs and provide trustworthy information on social media. In today's media environment, the preeminence of the fact-checking environment is evidenced by data from the Duke Reporters' Lab (Stencel & Luther, 2020), showing that initiatives have more than doubled since 2016, reaching a total of 341 projects in at least 102 countries. At this point, fact-checking has reached the status as a global movement, mostly settled in the IFCN led by Poynter. Thus, the risks and uncertainty brought by the COVID-19 pandemic have posed extraordinary challenges for fact-checkers, particularly in countries like Brazil, where most governments' policies contrasted with the guidelines from WHO.

As fact-checking demonstrates an overall positive impact against false or misleading beliefs, its potential to correct and contain the spread of disinformation still represents a difficult challenge (Walter, Cohen, Holbert, & Morag, 2019). Besides its acclaimed potential as a counterforce against falsehoods in online settings, fact-checking's effectiveness in combating disinformation still presents substantial shortcomings, particularly when engaging with politically motivated groups (Nieminen & Rapeli, 2018). For instance, previous work has showed that the sharing of fact-checking content is usually selected according to partisanship identification (Shin & Thorson, 2017). Additionally, evidence demonstrates that even when fact-checking penetrates disinformation networks, it is mostly framed by misleading wording or attacks against fact-checkers (Shao et al., 2018).

In the context of the COVID-19 crisis, these issues tend to replicate or even get exasperated. One key aspect that characterizes the current infodemic is how groups may perceive risks differently and,

therefore, respond to them following conflicting measures (Krause, Freiling, Beets, & Brossard, 2020). Remarkably in countries where public authorities consistently questioned the credibility and legitimacy of WHO and local health experts recommending social isolation to contain the spread of the virus, fact-checkers' attempt to balance public narratives were further undermined (Luengo & García-Marín, 2020). Although Facebook created partnerships with more than 80 independent fact-checking initiatives worldwide, the polarizing environment facing the pandemic limited fact-checkers to fight the spread of disinformation, especially on a large scale (Burel, Farrell, Mensio, Khare, & Alani, 2020).

In Brazil, these obstacles tend to go even further since disinformation and political content are also attained through infrastructural factors. As observers demonstrate, the rise of the far right in Brazil is associated with intensive microtargeting and zero-rating policies for mobile access, which incites the usage of social media platforms with private affordances, such as WhatsApp and groups on Facebook (Evangelista & Bruno, 2019). It has already been demonstrated that accessing mobile plan news exclusively limits exposure to different news sources, facilitating ideological segregation (Yang, Majó-Vásquez, Nielsen, & González-Bailón, 2020). As expected, this has been favoring the emergence of radical right echo chambers formed by identity and affective measures around the image of Jair Bolsonaro (Soares et al., 2021). Thus, besides having well-established fact-checking organizations such as Aos Fatos and Lupa, among other initiatives, the rise of the far right in Brazil provides a particularly critical challenge against COVID-19 disinformation.

Research Questions

To explore how disinformation and fact-checking about COVID-19 circulated on Facebook, we follow three research questions.

RQ1: What types of groups and pages post disinformation and fact-checking links on Facebook?

In this research question, we seek to explore the role played by different types of groups/pages on Facebook. Disinformation is often associated with political discussions (Törnberg, 2018). In the context of the pandemic, disinformation politically framed the issue and political leaders often fueled disinformation about COVID-19 (Ricard & Medeiros, 2020; Soares et al., 2021). Therefore, we aim to explore the role of political groups in spreading disinformation about COVID-19, as well as how other (different) types of groups/pages might also engage in information sharing about the pandemic.

RQ2: How does political ideology play a role in link-sharing about COVID-19 on Facebook?

In this research question, we aim to further explore the influence of political leaning in sharing disinformation about COVID-19. Previous research found out the pandemic is often politically framed, and both disinformation spread and consumption are related to right-wing ideology (Calvillo et al., 2020; Clarke et al., 2021; Rossini & Kalogeropoulos, 2021; Soares et al., 2021). Besides, Bolsonaro's far-right discourse might play a role in fueling disinformation about COVID-19 (Stecula & Pickup, 2021). We aim to understand whether Facebook pages and groups sharing disinformation and fact-checking are connected to different political views.

RQ3: How does disinformation compared with fact-checking about COVID-19 circulate on Facebook?

For this research question, we aim to explore the networks of disinformation and fact-checking on Facebook based on the dynamics of link-sharing on the platform. Previous research has found that social media users and groups that share disinformation are often more active and interconnected, which might lead to the echo chamber effect (Bastos et al., 2018; Benkler et al., 2018). Therefore, we aim to compare how disinformation and fact-checking links spread on Facebook in the context of the pandemic.

Methods

We used a data set provided by IFCN/Poynter for data collection. This data set comprised 8,623 fact-checked disinformation links about COVID-19 shared on social media between January and August 2020. The data set included both the disinformation link and the fact-checking link for each debunked piece of information. The data set also included information on the countries where the disinformation spread. We filtered only disinformation links shared in Brazil ($N = 568$).

We further used CrowdTangle (CrowdTangle Team, 2021) to collect posts from public groups and pages on Facebook that included these disinformation links ($N = 12,040$ posts), and posts containing the correspondent fact-checking links ($N = 3,205$ posts). We collected data based on which pages/groups posted each different piece of disinformation/fact-checking. Thus, one page may have shared several disinformation links in different posts or several fact-checking links on different posts. We chose not to separate pages and groups for this analysis, since our main goal was to observe how these public spaces contribute to the disinformation spread. Although pages and public groups mobilize different affordances, Facebook users can equally share content from both spaces, contributing to the spread of disinformation and fact-checking.

Data collection through CrowdTangle has limitations. CrowdTangle is a tool owned and operated by Facebook that tracks interactions on public content from Facebook groups/pages. Therefore, it does not track posts from all Facebook, but only posts from a sample of monitored groups/pages. This means that CrowdTangle data are not representative of everything that circulates on Facebook, but only of a set of public posts. Nevertheless, CrowdTangle tracks all large groups and popular pages on Facebook (more than 50k members or followers), which accounts for the most influential groups/pages on the platform. Besides, we used CrowdTangle to search and collect public posts that shared the links from the IFCN/Poynter data set, which allows us to map and explore disinformation about COVID-19 sharing behavior on Facebook. It is also important to point that CrowdTangle does not provide information about followers of the pages and members of the groups. Therefore, we analyzed posts from different pages/groups, but we cannot infer about the followers/members of the pages/group and whether they overlap or not.

To discuss RQ1 and RQ2, we used content analysis (Krippendorff, 2012) to classify the themes for groups/pages, and the ideology for political pages/groups. In total, our data set comprised 5,460 groups/pages. We classified the groups/pages based on the name. Table 1 provides a breakdown of each thematic category, and Table 2 details how we identified the ideology of political groups/pages.

Table 1. Coding Framework for Groups/Pages Themes.

Theme	Description
Politics	Names that included politicians, political parties, political ideologies, and/or references to political discussion. Ex: "Bolsonaro 2022," "Workers," "Party Brazil."
Alternative media	References to local news, information sharing, and alternative outlets. Ex: "News Hunters," "News from Northeast."
Media	Mainstream media outlets. Ex: "Estadão," "UOL Notícias."
Fact-checking	Fact-Checking agencies and pages/groups focused on fact-checking content. Ex: "Agência Lupa," "Fighting Fake News."
Health	Names focusing on health topics, such as Health Organizations and diseases. Ex: "Coronavirus Brazil," "Hospital Centenário."
Religion	Names that mentioned religious topics and religious leaders. Ex: "Christian Life Center," "Pr. Silas Malafaia."
Organizations	Names containing reference to any social group or organization, such as social movements, schools and Universities, and professional organizations. Ex: "UFMG," "Military and Civil Police."
Localization/place	Names that mention a particular location or place, usually in groups to gather people from a particular city or State. Ex: "Friends from Fortaleza," "Belo Horizonte."
Culture	Pages/groups focused on cultural topics, such as music, celebrities, sports, etc. Ex: "Augusto Cury's quotes," "Facebook Music Promoters."
Conspiracy theories	Names that mention known conspiracy theories. Ex: "Flat Earth Connection," "Conspiracy Theories (Right-Wing)."
Market/selling	Groups/pages created for selling and trading. Ex: "Buy and Sell Santarém," "Marketplace Brazil."
Other	In case the coder is unable to identify any of the categories above, the group/page is classified as other.

Table 2. Coding Framework for Ideology.

Ideology	Description
Far right	Names that mention far-right politicians or refer to conservative ideology. Ex: "President Bolsonaro," "Traditional Conservative Right Wing ."
Left wing	Names that mention left-wing politicians or refer to left-wing ideology. Ex: "Lula 2022," "Left-wing activists."
Other	Names that do not include clear support for any ideology. Ex: "Political debate," "Politics in Brazil."

Because of the many groups/pages, we divided them into three lists for the content analysis: one comprising groups/pages that only shared fact-checking links and groups/pages that shared both disinformation and fact-checking links ($N = 1,624$), and the other two each comprising half of the groups/pages that only shared disinformation links each ($N = 1,918$ each). Two independent analysts coded all groups/pages in each list (a different pair of coders for each list). We calculated Cohen's kappa (κ) to

assure the reliability of the content analysis. Table 3 details the intercoder agreement for each pair of coders. All κ are between 0.6 and 0.8, which is considered substantial agreement (Cohen, 1960). In both steps of the content analysis (themes and ideology), we used a tiebreaker to solve disagreements among the original pair of coders for each list. Therefore, two coders agreed on the final classification of every single group/page.

Table 3. Intercoder Agreements.

Coders	Groups/Pages Theme		Political Groups/Pages Ideology	
Pair 1	$n = 1,624$	$\kappa = 0.656$	$n = 748$	$\kappa = 0.738$
Pair 2	$n = 1,918$	$\kappa = 0.703$	$n = 837$	$\kappa = 0.650$
Pair 3	$n = 1,918$	$\kappa = 0.649$	$n = 509$	$\kappa = 0.751$
Overall	$n = 5,460$	$\kappa = 0.675$	$n = 2,094$	$\kappa = 0.741$

We also calculated the interpair reliability to assure that our classification followed the same criteria along the entire data set. For this, we created a random sample of 5% of the groups/pages, following the distribution according to the type of link they posted (5% of groups/pages that posted disinformation links, 5% of groups/pages that posted fact-checking links, and 5% of groups/pages that posted both). Each pair coded this sample, and disagreements were solved by tiebreakers (the same method used for the classification of each list of groups/pages). After the final classification, we calculated interpair agreement, as described in Table 4. The overall κ is over .8 for both theme and ideology, which indicates that we reached an almost perfect agreement (Cohen, 1960). Therefore, this result indicates that the pairs coded the categories similarly.

Table 4. Interpair Agreements.

Pairs	Groups/Pages Theme	Political Groups/Pages Ideology
Pair 1 × Pair 2	$\kappa = 0.757$	$\kappa = 0.783$
Pair 1 × Pair 3	$\kappa = 0.759$	$\kappa = 0.817$
Pair 2 × Pair 3	$\kappa = 0.889$	$\kappa = 0.853$
Overall	$\kappa = 0.801$	$\kappa = 0.818$

To explore RQ3, we used social network analysis (Wasserman & Faust, 1994). We created three separate networks: one containing groups/pages that only shared disinformation links, one containing groups/pages that only shared fact-checking links, and one containing groups/pages that shared both disinformation and fact-checking links. For each of these, we created bipartite networks in which nodes represent Facebook groups/pages, and links; and edges represent when a group/page post a link. In our graphs, nodes in red represent pages and groups, and nodes in blue represent links. The connections represent the number of times each link was posted by each page/group.

To understand the networks, we used indegree and outdegree metrics. In our analysis, indegree means how many groups/pages posted a particular link—the most posted links are those with the highest indegree and outdegree means how many links a page or group posted—groups/pages with high outdegree are those that posted many links from our data set. These measures allowed us to understand which nodes

were key for disinformation spread. Finally, we qualitatively analyzed the 10% most active groups/pages (by outdegree) by accessing their pages to explore what type of content they shared.

Discussion

In this section, we describe and discuss the results of the analysis following the three research questions we proposed. For the analysis, we divided our data set according to which links the pages/groups shared: disinformation, fact-checking, and both.

RQ1: Types of Pages/Groups

To explore RQ1, we investigated the types of groups/pages that shared each type of content. We classified each one based on their main theme, as explained in the Methods section. Table 5 provides a breakdown of the categories of groups/pages coders found on our data set, based on the links that they shared.

Table 5. Types of Pages/Groups.

Theme	Disinformation	Fact-Checking	Both
Politics	1,346 (35%)	523 (43.4%)	226(53.8%)
Alternative media	497 (12.9%)	172 (14.2%)	73 (17.4%)
Media	57 (1.4%)	14 (1.16%)	5 (1.1%)
Fact-checking	0	14 (1.16%)	0
Health	38 (0.9%)	30 (2.49%)	1 (0.2%)
Religion	155 (4%)	10 (0.83%)	4 (0.9%)
Organizations	34 (0.8%)	13 (1.07%)	0
Localization/place	516 (13.4%)	252 (20.9%)	81 (19.3%)
Culture	160 (4.1%)	34 (2.8%)	4 (0.9%)
Conspiracy theories	28 (0.7%)	10 (0.8%)	5 (1.1%)
Market/selling	199 (5.1%)	19 (1.5%)	9 (2.1%)
Other	806 (21%)	113 (9.3%)	12 (2.8%)
Total	3,836	1,204	420

This analysis shows that although the main categories remain the same for all groups, disinformation spreads through a more diverse number of groups/pages. The group of groups/pages that shared both (disinformation and fact-checking) is like the fact-checking group, with less diversity of themes.

The main type of groups/pages that shared disinformation about the pandemic of COVID-19 in this data set is those focused on politics. This finding is in line with other studies that concluded that the political framing of the COVID-19 crisis was key for disinformation to spread (Galhardi et al., 2020; Recuero et al., 2021; Ricard & Medeiros, 2020; Rossini & Kalogeropoulos, 2021).

Among other types of groups/pages, alternative media, which comprises hyperpartisan websites, was a major category found on all three types of content (between 12.9% and 17.4%). Hyperpartisan media also has a connection to political framing, often reproducing content because it supports their views. Another

category that appears in all three groups was localization/place (13.4%–20.9%), which refers to groups/pages that focus on providing a space for people from a certain location to find each other.

Disinformation spreads four times more than fact-checking through religious groups/pages. The connection between politics, particularly the far right, and some conservative religious groups/pages has been shown in the literature as well (Benkler et al., 2018). Disinformation also appears two times more than fact-checking on cultural groups/pages, also underlying the importance of cultural influencers in the phenomenon; and three times more in market/selling groups/pages.

The larger variety of groups sharing disinformation in our data set also reflects in the number of posts. Table 6 shows the comparison of how nonpolitical pages/groups influenced the spread of each content. The number of posts containing disinformation links in nonpolitical pages/groups is almost three times higher than the number of posts containing fact-checking links.

Table 6. Number of Posts from Nonpolitical Pages/Groups.

Cluster	Disinformation	Fact-Checking	Both
Number of groups/pages	2,490	681	195
Number of posts	4,763	1,860	943

These findings reinforce that discussion about COVID-19 followed political discourse (Allcott et al., 2020), as disinformation often framed the pandemic as a political issue (Soares et al., 2021). Nevertheless, we also identified that other groups/pages, such as local, alternative media, selling, culture, religion, and others play a role in the spread of disinformation on social media. Therefore, although disinformation may frame COVID-19 as a political issue (Soares et al., 2021), other discourses are also important to legitimate it and to fuel its spread on Facebook.

RQ2: Ideology of the Pages/Groups

For this research question, we further analyzed the ideology of the political groups/pages. As described in Table 7, we found that disinformation spread more through political groups/pages affiliated with the right wing (76.3%). However, fact-checking also spread through many groups/pages affiliated with the right wing (43.3%) as well, though not as much as disinformation. On the data set of groups/pages that shared both, there is also a high prevalence of right-wing affiliated pages/groups.

Table 7. Political Pages/Groups Data.

	Disinformation	Fact-Checking	Both
Left	84 (6.24%)	203 (38.81%)	21 (9.3%)
Right	1,027 (76.3%)	227 (43.4%)	184 (81.7%)
Other	235 (17.4%)	93 (17.7%)	20 (8.8%)
Total	1,346	523	225

We further explored this question by looking at the number of posts from each of these pages/groups (see Table 8). In this case, the prevalence of right-wing groups/pages posting disinformation

is even larger (93.03%). On the other hand, we identified that left-wing groups/pages are more active in posting fact-checking information. Although they account for 38.81% of the groups/pages that posted fact-checking links, left-wing groups/pages were responsible for 54.32% of the posts containing fact-checking links. The opposite happens with the right-wing groups/pages that are most groups/pages (43.4%), but only account for 28.89% of the total posts containing fact-checking links.

Table 8. Political Pages/Groups Posts Data.

	Disinformation	Fact-Checking	Both
Left	103 (1.41%)	722 (54.32%)	185 (4.22%)
Right	6,755 (93.03%)	384 (28.89%)	3,976 (90.75%)
Other	403 (5.55%)	223 (16.77%)	220 (5.02%)
Total Posts	7,261	1,329	4,381

These findings indicate that political polarization influences the disinformation spread on social media, as well as the spread of fact-checking information. Our results are in line with other studies that identified a stronger influence of disinformation among the right-wing ideology, and particularly, with Bolsonaro's far right (Calvillo et al., 2020; Clarke et al., 2021; Rossini & Kalogeropoulos, 2021). Furthermore, this suggests that the discussion about COVID-19 on Facebook in Brazil follows asymmetric patterns of polarization (Benkler et al., 2018). That is, right-wing and left-wing groups/pages are, in general, fundamentally different in information-sharing behavior. Right-wing pages/groups are strongly associated with disinformation spread, while left-wing groups/pages are generally responsible for posting fact-checking links. The larger presence of left-wing groups/pages among those sharing fact-checking links might also be related to the political framing of the pandemic, as sharing fact-checking content is also associated with partisanship identification (Shin & Thorson, 2017).

This result might be a consequence of how Bolsonaro addressed the pandemic in Brazil, often reproducing disinformation (Ricard & Medeiros, 2020; Soares et al., 2021). Bolsonaro himself is a representant of the authoritarian far-right ideology (Mendonça & Caetano, 2021; Watmough, 2021). Besides, Rossini and Kalogeropoulos (2021) also showed evidence that right-wing Brazilians are more likely to believe in false claims. This may influence how Brazilians perceive the pandemic, as well as how they complied with the measures to contain it, as proposed by Allcott and colleagues (2020).

RQ3: Circulation on Facebook

To explore this RQ, we rely on social network analysis. We focus on three networks: The Facebook groups/pages that only shared disinformation ($N = 3,836$), the ones that only shared fact-checking information ($N = 1,204$), and the ones that shared both ($N = 420$).

Before we describe the results based on each network, we explore some general information based on our data set, including metadata based on Facebook engagement to measure the spread of the posts on the platform. For this, we calculated the average and the total number of shares received by the Facebook posts that included the links from each of our data sets. Table 9 provides a breakdown of the circulation of links on Facebook.

Table 9. Circulation of Links on Facebook.

	Disinformation	Fact-Checking	Both
Groups/Pages	3,836	1,204	420
Number of posts	7,580	2,345	5,320 (4,460 disinformation, 860 fact-checking)
Number of unique links	1,585	897	484 (213 disinformation, 271 fact-checking)
Average Facebook shares per post	83.1	85.4	16 (17.6 disinformation, 7.46 fact-checking)
Total Facebook shares	630,067	200,330	85,074 (78,654 disinformation, 6,420 fact-checking)

As detailed in Table 9, fact-checking links reach only a few of the groups/pages that also shared disinformation (7.7% of the total number of groups/pages). Although posts containing fact-checking information have a slightly higher average number of shares on Facebook, the total shares of disinformation are more than three times higher than of fact-checking (708,721 vs. 206,750) because disinformation links are posted by more groups/pages than fact-checking links. Consequently, disinformation spreads more on Facebook.

The data also show that the groups/pages that posted disinformation were more active, with 3.14 posts per page/group versus 2.66 in the groups/pages that posted fact-checking links, but the difference was not statistically significant—Welch's $t(2,043.56) = 1.310$, $p = .190$ (we used Welch's t test to correct the violations of normality and equality of variances). The difference was particularly strong among the groups/pages that shared both fact-checking and disinformation: 10.6 posts containing disinformation per page/group versus 2.04 containing fact-checking information—Welch's $t(429.09) = 6.503$, $p < .001$. On average, each disinformation link was posted 4.78 times by the groups/pages that only shared disinformation links, while each fact-checking link was posted 2.61 times—Welch's $t(1773.86) = 3.712$, $p < .001$. On the group that shared both, each fact-checking link was shared 3.17 times versus 20.94 times each disinformation link—Welch's $t(219.55) = 5.608$, $p < .001$. Thus, even when fact-checking circulate in the same group as disinformation, the advantage is still for the latter. This data suggests that disinformation links were most links posted on Facebook and posted more actively by pages/groups. This result is in line with previous studies that indicate that users sharing disinformation are often more active (Recuero et al., 2021; Törnberg, 2018). This might also lead to a network dynamic that favors the emergence of echo chambers, as these users tend to be highly active in echoing disinformation and avoid posting other information (Benkler et al., 2018; Recuero et al., 2021; Törnberg, 2018), as we explore below in the analysis of each network.

The Disinformation Network

The following network map shows how the disinformation ecosystem is structured (see Figure 1). As we described in the Methods section, we use bipartite networks to explore our data. Red nodes are pages/groups, and blue nodes are links; edges connect groups/pages to links they posted. Therefore, red nodes (pages/groups) that are close in the network have shared the same links.

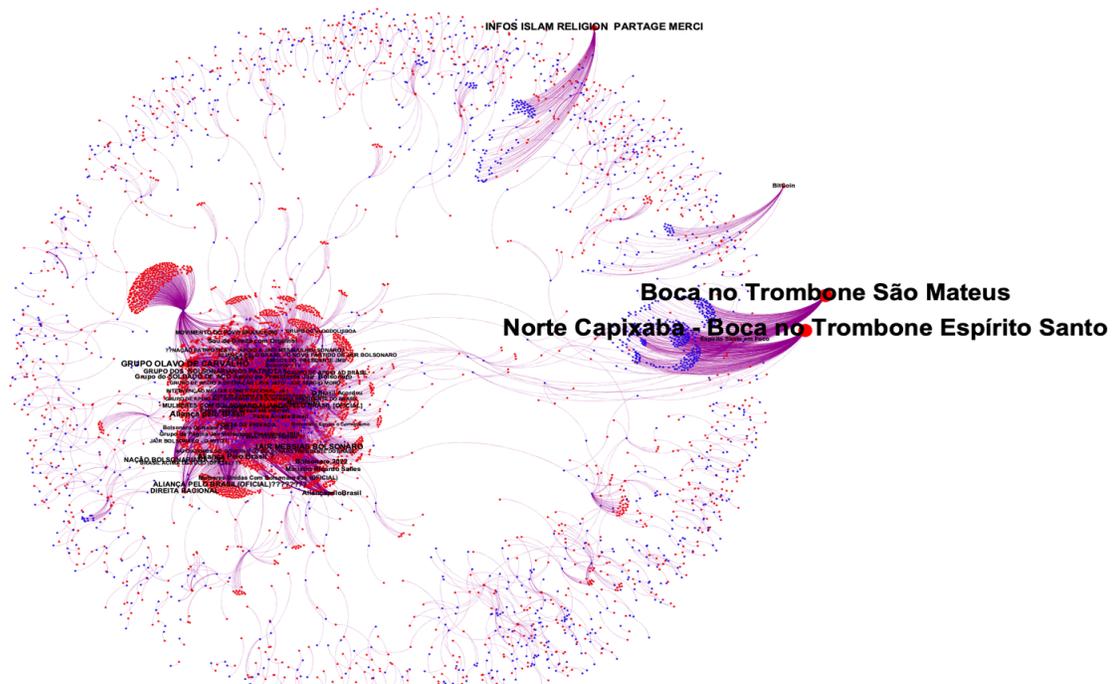


Figure 1. Disinformation network.

The center of the map shows the group of nodes that shared many disinformation links. This central cluster has 68.9% of all connections in the network, showing a high activity with 2,087 nodes and 195 links. These groups/pages shared each of these links an average of 31.8 times per link. The average for the whole network, in comparison, was 4.12 times per link. The high activity of this central cluster indicates that these groups/pages were particularly active in spreading disinformation links. This may be due to the nature of the groups/pages (many of them political, defending far-right views, as we discuss below) and the content of the disinformation.

To explore the role of the most active groups/pages in posting disinformation links, we analyzed those with the highest outdegree in the network (see Table 10), which indicates the number of connections (links mentioned in the posts) made by a page/group. Among the top 10% outdegree nodes (383), there are 277 (72%) political groups/pages, which concentrate 3,069 connections, an average of 11.1 links per node. This group is composed of 263 nodes connected to right-wing politicians and parties, and 14 nodes

without a clear political alignment. Among these nodes, we find several groups/pages that support President Bolsonaro, such as “Bolsonarian Nation 2022,” “Bolsonaro 2022,” as well as “Rational Right-Wing,” and “Proud conservatives.” Disinformation about COVID-19 in Brazil was largely used to portray a pro-Bolsonaro narrative of the pandemic (Galhardi et al., 2020; Ricard & Medeiros, 2020; Soares et al., 2021). Therefore, this result is in line with previous studies which also identified that social media users share disinformation to reinforce their political narrative (Bastos et al., 2018; Benkler et al., 2018). The alternative media groups/pages have the highest average outdegree (23.9) and are the second in number of connections. Two alternative media nodes are the most active in our data set, with 221 connections each. Religious and media groups/pages are fewer in number, but they also average more than 10 outdegree. It is important to notice the presence of these religious groups/pages, which have very conservative views often associated with Bolsonaro’s far-right discourse.

Table 10. Types of Groups/Pages in the Disinformation Network.

Category	Number of Nodes	Number of Connections	Average Outdegree
Political	277	3,069	11.1
Alternative media	26	621	23.9
Others	34	285	8.4
Religion	10	129	12.9
Media	8	81	10.1
Localization	13	70	5.4
Culture	10	66	6.6
Market	2	13	6.5
Conspiracy	1	6	6
Health	1	5	5
Organization	1	4	4

In the network, except for two alternative media outlets and one religious outlet, the majority of the nodes with the highest outdegree are interconnected, showing a tendency to spread similar content on Facebook. This finding reinforces the hypothesis of echo chambers, as these highly active groups/pages are tightly connected to the same disinformation links, which strengthen the borders of the cluster (Benkler et al., 2018; Recuero et al., 2021; Törnberg, 2018). That is, the central cluster composed of highly active groups/pages echoes disinformation discourse by posting several disinformation links, which end up fueling the spread of this content.

We also explored the types of links in the network. Out of the 1,585 unique disinformation links, the majority were native to Facebook ($N = 746\%$ – 47%)—that is, links to other original posts on Facebook, which could include videos, photos, or simply status posted by users/pages. Some of these native links could also include external links; however, in these cases, the original Facebook post was shared by pages/groups rather than only the external link. There were also 129 links from Twitter and 71 from YouTube. Most of the other links were from alternative outlets. Most of them were from Portal Boca no Trombone ($N = 346$), which was also the most active page in our data set. Other alternative outlets in our data set are Carta Piauí (29), Estibordo (8), and MidiaFive (8). This means that rather than share the original disinformation link, the groups/pages in our data set would share a Facebook native post from another

user/group/page and sometimes tweets or YouTube videos. Besides, out of the 10% most posted links (158), the majority was native to Facebook (104%–65.9%), accounting for 5,373 posts. Ten YouTube videos (333 posts) and four tweets (30 posts) were also among the most posted links. There were also 33 links from alternative media (1,324 posts). This finding implicates that disinformation native to Facebook tends to spread more than disinformation links from the Web.

The Fact-Checking Network

The dynamics of the fact-checking network are different from the disinformation network. While there is also one main cluster, it is far less active than the disinformation one. This cluster is responsible for 39.19% of the activity in the network. It has 379 nodes and shared 300 links. Each fact-checking link was shared about 4.29 times, much closer to the network general average of 2.03 times. This group was also composed of less homogeneous nodes, such as political nodes affiliated both with the left and right, traditional media, and fact-checking pages (see Figure 2). The fact-checking network has two major clusters—one around a fact-checking outlet (left) and another one with two fact-checking outlets very central to it (on the right). Political nodes are also central to the second cluster, as we discuss below.

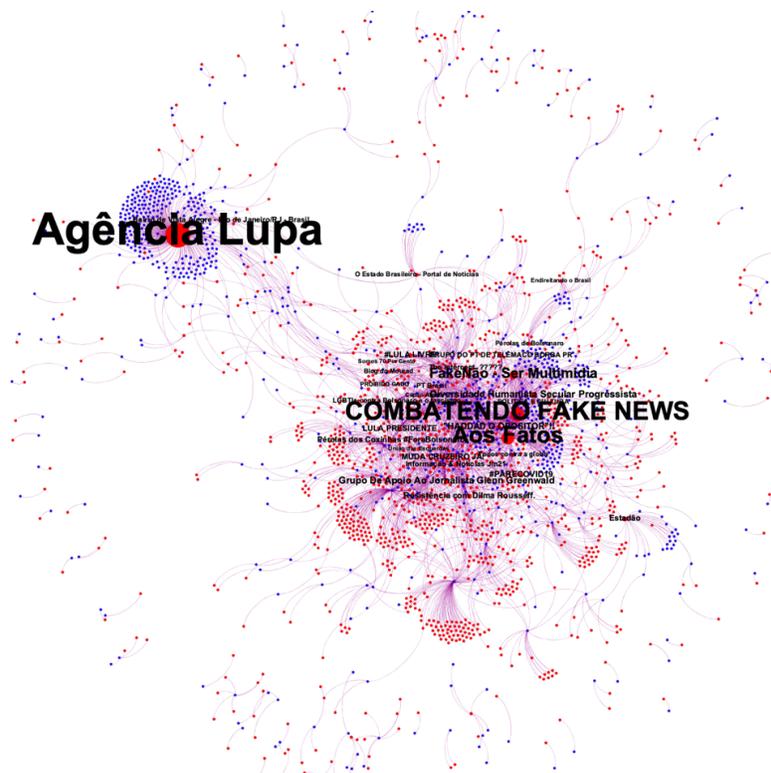


Figure 2. Fact-checking network.

The 10% nodes (120) with the highest outdegree are mostly political (60.8%), with an average outdegree of 9.08. Most of these nodes ($N = 42$) are connected to leftist parties and authorities, with an average outdegree of 5.5. The right-wing nodes ($N = 13$) have an average outdegree of 4. The others are nodes without a clear political affiliation ($N = 19$), but they also have a strong impact on the network (average outdegree of 19.7). Another important category is fact-checking nodes, as they have the highest average outdegree (128.5). There are also fewer traditional media and health nodes, but with a high impact (average outdegree of 17.6 and 10.5). Alternative media also has some influence, with a 7.3 average outdegree. As we describe in Table 11, this network does not have many of the different categories found in the disinformation network—thus, it is a less plural network.

Table 11. Types of Groups/Pages in the Fact-Checking Network.

Category	Number of Nodes	Number of Connections	Average Outdegree
Political	73	663	9.08
Fact-checking	5	642	128.4
Alternative media	16	118	7.3
Localization	12	105	8.7
Media	3	53	17.6
Health	5	52	10.4
Others	5	29	5.8

Out of the 897 unique fact-checking links, the vast majority (807%–89.9%) are from fact-checking outlets. Agência Lupa accounts for most of it, with 558 unique links (Agência Lupa was also the most active node in the network—285 outdegree). Aos Fatos (177 links) and Estadão Verifica (66 links) are also among the fact-checking outlets with the most unique links in our data set. This time, there were only 78 native links from Facebook and one YouTube video. Fact-checking outlets are also the majority among the 10% most posted links (89), accounting for 86 links and 1,560 posts. The other three links are native to Facebook and were posted 37 times. This implicated that fact-checking information tends to spread on Facebook through links from the outlets.

The Network That Shared Both Fact-Checking and Disinformation

Finally, we examined the network of groups/pages that shared both disinformation and fact-checking links (see Figure 3).

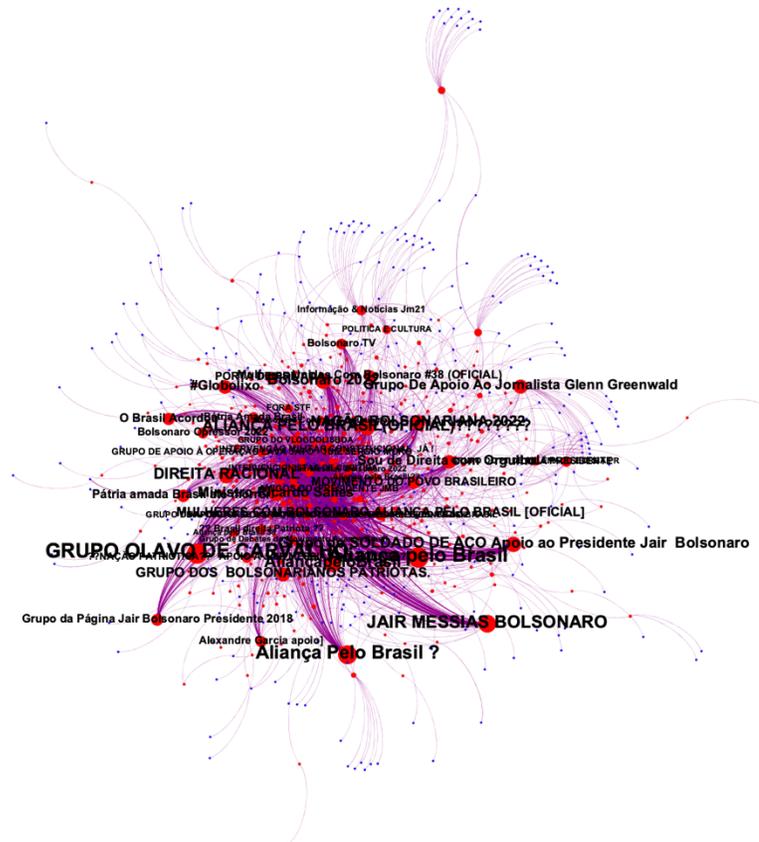


Figure 3. Fact-checking and disinformation network.

As described in Table 12, the 10% nodes with the highest degree ($N = 42$) were mostly political ($N = 39$). From these, 35 were nodes affiliated with the right wing (89.75%), which posted a link 1,195 times, with an average outdegree of 34.1. The nodes affiliated with the left were only three, posted a link 86 times with an average of 28.6 times. The affiliation of one node was not identified (outdegree of 38). Alternative media also was important in this case, with an average outdegree of 25.3.

Table 12. Types of Groups/Pages in the Network That Shared Both Types of Content.

Category	Number of Nodes	Number of Connections	Average Outdegree
Political	39	1,319	33.8
Alternative Media	3	76	25.3

We further examined the links that circulated on these groups/pages. There were 484 unique links—271 fact-checking links and 213 disinformation links. Most disinformation links were also native to Facebook (108 links; 50.7%), followed by 22 links from YouTube, five from Twitter, and 73 from far-right alternative media.

Our data implicates that fact-checking circulates (on a smaller scale) on groups/pages that also share disinformation. The fact that many links are from the far right, however, seems to indicate that there might be a catch, such as the framing of the fact-checking (e.g., as something false or a conspiracy). However, since we did not examine the posts, this remains a suggestion for a future study.

Returning to RQ3, we first identified that disinformation circulates much more than fact-checking on Facebook, based on this data set. In fact, there were more links, and the groups/pages that shared them were more active than fact-checking ones. Besides, posts containing disinformation received more than three times more shares on Facebook than posts containing fact-checking links. Both disinformation and fact-checking links also seem to spread through clusters, which suggests that there are some usual paths (or types of groups/pages) through which they circulate on Facebook. The fact that we also found very active nodes also suggests that some pages/groups have an active role in spreading these contents on Facebook.

In general, groups/pages that share disinformation do not share fact-checking links, and vice versa. This indicates the structure of echo chambers as groups that preferentially share a particular type of content. Based on the previous findings, we notice that the echo-chamber effect usually is created to reinforce the disinformation cluster political narrative. This result is in line with studies that associate disinformation spread with the structure of polarized groups/pages and echo chambers (Bastos et al., 2018; Benkler et al., 2018; Jiang et al., 2020).

On the other hand, we identified a few groups/pages that shared both disinformation and fact-checking. This finding is relevant to show that these cases do exist. These groups/pages might not have shared the fact-checking link corresponding to the disinformation link they posted; nevertheless, they posted some fact-checking information, which shows that somehow the users within these groups and following these pages have some access to debunked information. Therefore, our findings indicate that the echo chamber structure is particularly related to the preferences of pages/groups to share only disinformation. That is, the action of these pages/groups in echoing disinformation on Facebook creates the delimited structure of online echo chambers (Bastos et al., 2018; Benkler et al., 2018; Recuero et al., 2021).

We also identified a key difference in the types of links associated with disinformation and fact-checking. Most disinformation links from our data set are native to Facebook—they are also most of the most shared links. On the other hand, most of the fact-checking links are from fact-checking outlets. This result is relevant because disinformation studies often focus on the role of hyperpartisan outlets and alternative media, but we identified that social media content, particularly native to the platform, plays a central role in disinformation spread on Facebook. This finding may have connections to how accessing fact-checking or any trustworthy news source outside Facebook may be too expensive for Brazilians relying on zero-rating mobile plans to access the Internet (Evangelista & Bruno, 2019).

Conclusions and Limits

From the analysis of a set of data provided by the IFCN/Poynter, we approached the circulation of disinformation about COVID-19 on Facebook in Brazil, with the objective of analyzing (1) which types of groups/public pages spread disinformation and fact-checking content on Facebook; (2) the role of

political ideology in this process; and (3) the network dynamics of how disinformation and fact-checking circulate on Facebook.

Our findings suggest there is a marked difference among disinformation and fact-checking links networks on Facebook, which we summarize below.

Political Influence

Our data indicate political framing is a key feature for COVID-19 disinformation to spread, particularly right-wing framing, as also suggested by other studies (Benkler et al., 2018; Rossini & Kalogeropoulos, 2021). We identified that pages/groups associated with the right wing (many of which supported Bolsonaro), religious topics, alternative media, and even some that focused on conspiracy theories played a key role in the network dynamics of disinformation links, a result that is similar to what Calvillo and colleagues (2020) and Clarke and colleagues (2021) identified in other countries. However, we also found that the association of these disinformation with other categories, such as “alternative media,” “conspiracy theories,” and, mostly, “religion.” Besides, we identified the influence of hyperpartisan media, which is also very important, as many leaders (and particularly Bolsonaro’s supporters) point to them as “alternative news sources” more trustworthy than mainstream media (Benkler et al., 2018; Recuero et al., 2021). Hyperpartisan media has been using disinformation to support Bolsonaro’s actions (Recuero et al., 2019), which may explain its high prevalence. These categories, which have a higher engagement in sharing problematic content, suggest there is a bigger ecosystem of themes associated with COVID-19 disinformation on Facebook—larger than only political pages. Thus, other spaces associated with highly conservative views, the far right and populism, may be important roads for disinformation about the pandemic (Benkler et al., 2018). This is a pattern that has been observed in other countries as well (Calvillo et al., 2020; Clarke et al., 2021).

Political pages/groups are also very important for the fact-checking network, suggesting fact-checking links about the pandemic are also politically framed. However, differently from disinformation, they circulate mostly on pages affiliated with the left wing. The presence of alternative media indicates that hyperpartisan groups/pages are very engaged with this type of content, reinforcing the connections between content spread and political frame.

Asymmetric Polarization and Radicalization

We identified that content about COVID-19 follows an asymmetric polarization pattern (Benkler et al., 2018), as right-wing groups/pages were strongly connected to disinformation spread while left-wing groups/pages were generally associated with the spread of fact-checking content. This result is also in line with previous research (Calvillo et al., 2020; Clarke et al., 2021; Recuero et al., 2021; Rossini & Kalogeropoulos, 2021) and sheds light on how political polarization affects disinformation spread about COVID-19. This is particularly important in the Brazilian context, as Brazilian President Jair Bolsonaro is a major spreader of disinformation about the pandemic (Ricard & Medeiros, 2020; Soares et al., 2021). This asymmetric polarization created by the far-right radicalization and its connection to disinformation may influence Brazilians attitudes toward the pandemic (Allcott et al., 2020). Therefore, preventive actions—

such as wearing a mask, social distancing, and getting a vaccine—might be interpreted as ideological actions, as disinformation mirrors political (asymmetric) polarization.

Fact-Checking Does Not Circulate Where Disinformation Circulates

Disinformation circulates more and has more engagement than fact-checking. Although fact-checking content circulates to a certain extent on Facebook, it is less effective than disinformation in reaching people. Some aspects contribute to this difference in circulation, such as the asymmetric polarization, how disinformation frames fact-checking (as leftists), and zero-rating Internet plans (Evangelista & Bruno, 2019). It is also important to notice that disinformation spreads mostly by the same pages/groups that post several links among the same spaces, while the fact-checking network has a less clusterized form. These pages/groups created an echo-chamber network dynamic by constantly posting disinformation on Facebook. This echo-chamber effect may increase disinformation discourse impact (Bastos et al., 2018; Benkler et al., 2018; Jiang et al., 2020; Recuero et al., 2021). Finally, less than 10% of the links examined circulate on both groups, suggesting that many Facebook pages/groups are spaces where disinformation thrives, and fact-checking does not reach. This result suggests that fact-checking links are not shared in clusters of disinformation, so other actions are necessary to penetrate the echo chambers (e.g., flagging disinformation as such and pointing to fact-checking content).

This study has several limits. First, we did not examine all the posts published, so even when fact-checking circulates on disinformation clusters, it may be framed as “fake news” or even as a conspiracy. Thus, our finding that fact-checking circulates on a few disinformation groups/pages needs to be perceived carefully. Disinformation may also circulate with a debunking frame, although it seems unlikely as many of the posts were removed by Facebook, and other studies showed similar results as ours. Also, the role religious pages/groups have on this spread and legitimation of disinformation needs to be further explored, as they may be an important part of the disinformation ecosystem on Facebook. Finally, there are limitations concerning CrowdTangle data, as we explained.

Nevertheless, we consider that the findings and conclusions presented here represent a relevant contribution to the complex and extensive field of studies on the phenomenon of disinformation on digital platforms. We believe that with this analysis we contribute to the progress of our studies, as well as those of other researchers with objects of analysis similar to ours.

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