

Volume 40  
issue 1 / 2021

Contracampo e-ISSN 2238-2577  
Niterói (RJ), 40 (1)  
jan/2021-apr/2021

Contracampo – Brazilian Journal of Communication is a quarterly publication of the Graduate Programme in Communication Studies (PPGCOM) at Fluminense Federal University (UFF). It aims to contribute to critical reflection within the field of Media Studies, being a space for dissemination of research and scientific thought.

## Polarization, Hyperpartisanship, and Echo Chambers: How the disinformation about COVID-19 circulates on Twitter

**RAQUEL RECUERO**

Federal University of Rio Grande do Sul/ Federal University of Pelotas (UFRGS/ UFPEL) – Porto Alegre/Pelotas, Rio Grande do Sul, Brazil.  
E-mail: raquelrecuero@gmail.com  
ORCID: 0000-0002-7417-9782

**FELIPE SOARES**

Federal University of Rio Grande do Sul (UFRGS) – Porto Alegre, Rio Grande do Sul, Brazil.  
E-mail: felipebsoares@hotmail.com  
ORCID: 0000-0003-4850-9255

**GABRIELA ZAGO**

Federal University of Rio Grande do Sul (UFRGS) – Porto Alegre, Rio Grande do Sul, Brazil.  
E-mail: gabrielaz@gmail.com  
ORCID: 0000-0002-1229-9420

**PPG|COM** Programa de Pós-Graduação  
COMUNICAÇÃO MESTRADO E DOUTORADO **UFF**

TO REFERENCE THIS ARTICLE, PLEASE USE THE FOLLOWING CITATION:

Recuero, R., Soares, F., Zago, G. (2021). Polarization, hyperpartisanship, and echo chambers: how the disinformation about COVID-19 circulates on Twitter. *Contracampo – Brazilian Journal of Communication*, v. 40, n. 1.

**Submitted on: 08/28/2020 / Accepted on: 01/14/2021**

**DOI – <http://dx.doi.org/10.22409/contracampo.v40i1.45611>**



## Abstract

In this paper, we analyze the circulation of disinformative links about the COVID-19 pandemic on Twitter, using a dataset of 159,560 links collected using Twitter's API between the months of March and July 2020. By mapping the network and observing the neighborhood of links and the most shared links, we observed a polarization and reduction of the circulation of links according to their direction (either pro hydroxychloroquine or anti hydroxychloroquine). The results also show more activity in the dissemination of pro hydroxychloroquine links, a group where we could also find more disinformation and more hyperpartisan media. Likewise, the circulation of traditional and institutional media is quite reduced in this group, strengthening the association between hyperpartisan media and disinformation. Therefore, we identified how the circulation of links on Twitter created an echo chamber structure, and the cluster favorable to the use of the drug for COVID-19 is associated to disinformation spread.

### Keywords

Disinformation; Twitter; Hydroxychloroquine; Links; Echo chambers.

## Introduction

One of the major issues faced by public health policies in Brazil is the spread of misinformation, notably emerging as one of the major challenges in fighting the coronavirus pandemic. Previous research has shown the importance of social media in this process, for both legitimizing and spreading false or misleading content (Tucker et al., 2018; Soares et al., 2018). In this sense, this paper aims to analyze the circulation of disinformation on Twitter focusing on one specific case: the use of hydroxychloroquine as a cure or as a treatment of proven effectiveness against the virus.

Hydroxychloroquine was often presented in Brazil as an alleged cure for the pandemic, a prophylactic treatment, or even as a scientifically proven treatment, even though scientific evidence does not confirm any of those statements.<sup>1</sup> Thus, much of the content related to the subject was denied by fact-checking outlets and, therefore, considered disinformation. Even so, the circulation of misleading, fabricated, or simply false information increased during the first half of 2020 (Recuero & Soares, 2020). This increase in public channels, such as Twitter, might be important evidence of a possible increase within private channels (like WhatsApp and Facebook), resulting in a movement contrary and harmful to state information policies aimed at the collaboration of the population. In this sense, understanding the circulation of disinformation on Twitter can provide important clues to understand the disinformation ecosystem on social media, and the coordinated practices (Giglietto et al., 2020) that seek to influence public opinion against this collaboration, often for political purposes (Recuero & Soares, 2020; Alves, 2019).

In order to understand the phenomenon, we analyzed the circulation of links about hydroxychloroquine on Twitter between March and July 2020. Our main objective is to understand how the circulation of disinformative links about the topic occurs on the platform. Specifically, we aim to (1) explore the structure of this network of interactions, (2) observe the media diets (Benkler et al., 2018) of each group, and (3) analyze the dynamics of user participation in the circulation of links. Particularly, our work contributes to the analysis of link sharing on Twitter as a type of information circulation. This proposal is relevant because we were able to observe in a more specific way the sources and the content that circulates in this network as a way to analyze the media diets of clusters on Twitter.

## Disinformation, Polarization, and Echo Chambers

Collective action and cooperation are key to stop the spreading of Covid-19. In this sense, governmental actions aligned with communication policies are important to popularize measures to control the disease and to obtain the collaboration of the population to adopt them. However, political polarization and disinformation about the topics related to the disease have become a problem in the control of the virus in Brazil. In this sense, studies have shown that this political polarization affects individuals' attitudes and perceptions about the pandemic (Alcott et al., 2020). In the Brazilian context, the use of hydroxychloroquine also became a polarized discussion, following political views, which led to the spread of disinformation (Araújo & Oliveira, 2020; Recuero & Soares, 2020). Conspiracy theories related to Covid-19 are also popular and circulate on social media, often motivated by polarization and political discourse (Bruns et al., 2020; Gruzd & Mai, 2020; Papakyriakopoulos et al., 2020; Uscinski et al.,

---

<sup>1</sup> According to PAHO and WHO guidelines from December 2020, "(...) there is no scientific evidence until this moment that these drugs are effective and safe in the COVID-19 treatment. The available evidence on the benefits of chloroquine or hydroxychloroquine use is insufficient, most research so far suggests that there is no benefit and warnings about side effects of the drug have already been issued". The WHO claims that the drugs were withdrawn from official tests in May and June 2020, respectively, after several research results pointed to a lack of evidence that they could help fight COVID-19 and that they were never recommended as treatment. Retrieved January 29, 2021 from: <https://www.paho.org/pt/covid19#-cloroquina>.

2020). In this sense, in order to explore the spread of disinformation about hydroxychloroquine, we need to first discuss what we understand by disinformation and polarization, as well as contextualize political polarization on social media.

In this paper, we understand disinformation as misleading, manipulated, or entirely fabricated information that is intentionally and has the function of deceiving to obtain some kind of political gain (Fallis, 2015; Born & Edgington, 2017; Jack, 2017; Benkler et al., 2018). Disinformation is part of a context of information problems (Born & Edgington, 2017) or information disorders (Wardle & Derakhshan, 2017; Wardle, 2019), which, together with other information problems, cause damage to the political debate and the public sphere (Tucker et al., 2018). Disinformation takes advantage of the dynamics of information circulation on social media and is therefore often associated with social media platforms (Jack, 2017; Wardle & Derakhshan, 2017). Additionally, disinformation is also favored by political polarization and radicalization of users (Benkler et al., 2018; Tucker et al., 2018; Recuero et al., 2020).

Political polarization does not take place only on social media. There are authors like Andris et al. (2015), for example, who identify a historical process of polarization in political contexts. However, research has observed that political conversations on social media have a strong tendency towards polarization (Adamic & Glance, 2005; Gruzd & Roy, 2014; Smith et al., 2014; Barberá et al., 2015; Himelboim et al., 2017; Recuero et al., 2017).

Polarization can refer to either ideological polarization, when two groups have divergent opinions; as well as affective polarization, when in addition to divergent opinions those two groups also have aversion to each other (Barberá, 2020). In the case of the present study, our focus is mainly on the structure of the polarization in network conversations, which presents a divided disposition, with two groups that have several internal connections but few external connections (Smith et al., 2014; Himelboim et al., 2017).

It is important to also highlight that intense affective polarization can lead to individual radicalization due to increased aversion between groups. This is part of the argument used by Sunstein (2001) to propose the idea of echo chambers. Sunstein understands that political groups can create echo chambers, in contexts in which individuals with similar political views isolate themselves from the rest of the society and have access only to opinions and information that reinforce their group views. Sunstein's proposition has some flaws, starting with the lack of a clear definition of the concept, besides, evidence suggests that completely isolated groups, like the ones mentioned by Sunstein, are extremely rare (Bruns, 2019).

In this context, several studies show that social network platform users are exposed, to a greater or lesser degree, to content that is somehow heterogeneous – Guess et al. (2018) and Barberá (2020) discuss some of them, while Bakshy et al. (2015), Barberá (2015), Flaxman et al. (2016), Dubois & Blank (2018) and Eady et al. (2019) present empirical evidence. On the other hand, Bail et al. (2018) show that exposure to heterogeneous information in a scenario of fierce polarization can actually increase the polarization - yet this is a phenomenon that needs more study, since the evidence so far is controversial (Barberá, 2020).

In this study, we understand echo chambers as groups that filter the content they share, favoring information that reinforces a specific political narrative (similarly to Barberá et al., 2015; Recuero et al., 2017). As highlighted above, we know that those users are exposed at some level to antagonistic information, and even criticize them in order to reinforce their views (as seen by Larsson, 2019; and Soares et al., 2019). Still, information shared by users in an echo chamber represents a media diet that is distinct from those that are not part of the group. In this sense, the formation of the echo chamber is problematic because it can create what Benkler et al. (2018) call Propaganda Feedback Loop, that is, an information ecosystem in which a variety of users (including opinion leaders, hyperpartisan media, etc.) seek ways to reinforce a specific narrative, often generating more radicalization of users and increasing the circulation of disinformation.

These phenomena of reinforcing a specific narrative and reducing the circulation of heterogeneous content are also connected to hyperpartisanship – as discussed, for example, by Benkler et al. (2018) and Barberá (2020). In these cases, users who are more radicalized in their political views tend to be more active in reinforcing a single narrative and share with their networks only information that confirms this narrative (Soares et al., 2018).

In this context, hyperpartisanship can also affect the polarization structure, making it asymmetric. This concept proposed by Benkler et al. (2018) is based on the media consumption by some polarized groups. In asymmetric polarization, one of the groups favors hyperpartisan content and the circulation of disinformation, while the other group tends to have a more varied information diet and less radicalized positions. This concept is important for our study since we seek to observe the circulation of disinformation in a polarized context.

## Circulation of disinformation on social media

The study of information circulation aims to map how information spreads. For that, we can study it from the content that circulates, from the ways the information is shared, or from the role of influencers (Guille et al., 2013). Online social networks present some features that affect how information circulates in those places (Guille et al., 2013). Social media platforms can be appropriated for information circulation, which can be put into circulation either by journalistic outlets or by users. News outlets appropriate these platforms, as one of the strategies for distributing their content, while users participate in the distribution process by sharing and commenting on journalistic contents, in an information recirculation (Zago, 2014). This recirculation results in an effect of spreadable media (Jenkins et al., 2013), which spreads through different channels and shows up in different timelines. Thus, information circulation on social media relies on the action of users (Zago & Bastos, 2013), which adopt the resources provided by the social media platforms (like a retweet or share button) to amplify the visibility of certain contents. On Twitter, in particular, the retweet is important in the information circulation, since it makes the content circulate in different user networks (Recuero et al., 2011; Bruns & Moe, 2014). Since Twitter networks are different (each user chooses who to follow, and this choice influences the content they see), it makes sense to retweet contents to increase their visibility. Besides, Twitter is a place where social and political events can be reframed through interpretation and discussion by users (Maireder & Ausserhofer, 2014; Aquino Bittencourt, 2015). This reframing can be important for the construction of opposing narratives to the pandemic fighting institutions, offering an alternative narrative justified by disinformation to legitimate dissonant behaviors (like not using masks or denying the existence of the virus, for example).

The same channels and strategies used to circulate journalistic content can also be used to spread disinformation. Thus, the very affordances of social media platforms can facilitate the circulation of disinformation on those platforms. One of the strategies that contributes to this spreadability is the fact that messages are short, with a limited length (on Twitter, for example, there's a limit of 280 characters). Often, what circulates is just the news headline. Clickbaits end up being a strategy widely used in these spaces, which helps to increase the visibility of disinformation.

The dynamics of information propagation on social media also affect the circulation of political content. The hegemonic role of journalism in the political debate (Maia, 2008) is challenged, as political actors and pages of alternative content take part of the visibility from the traditional press in political discussions on social media (Alves & Albuquerque, 2019; Larsson, 2019). Hyperpartisan media emerges in this context.

The idea of hyperpartisan media refers to media outlets, normally digital natives, that engage in political discussion by producing content that is not committed to the ethical norms of journalism, often using false or manipulated information for political purposes (Benkler et al, 2018; Larsson, 2019; Mourão

& Robertson, 2019). Among the main strategies for the circulation of disinformation, hyperpartisan media tend to present what they call an alternative version to traditional journalism (Larsson, 2019). Additionally, they often join campaigns that aim to defame traditional media, stating that the information shared by them is untrustworthy (Marwick & Lewis, 2017; Benkler et al., 2018). Other common features of the hyperpartisan media discourse are sensationalism and clickbaits (Mourão & Robertson, 2019).

In addition to hyperpartisan outlets, other actors are important in the circulation of disinformation on social media. Opinion leaders impact the spread of disinformation because they have a reputation with their audiences (Brennen et al., 2020), thus, opinion leaders end up legitimizing disinformation (Soares et al., 2018). Political activists, trolls, and bots, on the other hand, help the circulation of disinformation due to their activities in the network, since they are usually very active, often sharing monothematic content (Soares et al., 2018; Tucker et al, 2018).

Mapping the sharing of URLs is one way to explore the circulation of disinformation on Twitter, as they reflect the actions of users engaged in the spread of disinformation, as well as the content generated by hyperpartisan outlets. In this way, it is possible to explore topics like polarization, echo chambers, and information consumption in conversation networks about hydroxychloroquine in Brazil. As we have already mentioned, this is important because the discourse about the topic can influence the individual perceptions and attitudes towards the pandemic, thus affecting the collective response to stop the spread of COVID-19.

## Methods

As we mentioned, our objective in this paper is to understand the circulation of disinformative links regarding hydroxychloroquine on Twitter. For that, using the Twitter API, and with the help of Social Feed Manager (GWU, 2016), we collected a total of 925,537 tweets with the combinations of words hydroxychloroquine + coronavirus (302,897) and chloroquine + coronavirus (622,640). We collected the data between March 1st and July 20th, 2020. From this dataset, we filtered 159,560 tweets with URLs, with a total of 106,222 unique links. From this dataset, we started our analysis.

One of the objectives of this paper is to analyze how the links were shared and if there is a presence of polarized clusters, that is, to map which groups of users share similar links on the topic. To that end, we used social network analysis (Wasserman & Faust, 1994; Degenne & Forsé, 1999) on the data we obtained through Social Feed Manager. This way, we created a bipartite network, with nodes that represent the URLs and nodes that represent the users who shared them. The edges represent citations to the links. Thus, if the same user mentioned more than one link, the user will appear connected to several nodes. The number of mentions to each link was also measured to compose the indegree, as well as the number of times that users mentioned the links (outdegree). We calculated indegree and outdegree to observe the visibility structure created for these different contents, as well as the node activity and the possible presence of groups of nodes mentioning more than one link.

Then, we used a community algorithm (Blondel et al., 2008) to aggregate the communities of most shared URLs and those users who shared them. Thus, users that shared the same URLs composed the clusters. Our objective was to understand which links are shared by different groups and whether there is some type of polarization. We also examined more closely the most popular clusters. This specific analysis of each cluster allowed us to analyze the dynamics of user participation, that is, how their activity affects the circulation of links.

In order to understand how the links circulated, we analyzed the 100 URLs most shared on the main clusters of the graph. This subset was arbitrary, based on the most shared links in the dataset. These links were analyzed and classified (1) according to the type of outlet they came from (hyperpartisan, journalistic, institutional, or social media links – which point to other channels); (2) according to the

content (whether or not it included disinformation), based on manual coding; (3) whether or not they supported the discourse of using hydroxychloroquine as treatment or prevention for COVID-19. With this analysis, we could explore the media diets of each group.

Tests with hydroxychloroquine showed promising results at the beginning of the pandemic; however, further studies showed the ineffectiveness of the drug in the treatment of COVID-19 and the World Health Organization decided to end the tests with the drug.<sup>2</sup> We considered this situation in the analysis of the links, particularly regarding information from the time that the ineffectiveness of hydroxychloroquine was still uncertain. This appears on the examples below, that we selected to illustrate how we coded the data:

GaúchaZH: “Brazil supplies hydroxychloroquine for severe cases of coronavirus, says Mandetta” (03/20/2020).<sup>3</sup>

Jornal da Cidade Online: “RBS owner, Globo affiliate, heals from Coronavirus with drug defended by Bolsonaro” (03/26/2020).<sup>4</sup>

Even though both links bring a discourse favorable to hydroxychloroquine for treatment or prevention of COVID-19, there are important differences between them. The first link is from GaúchaZH, a traditional media outlet, and only reproduces the information from the then Minister of Health, Henrique Mandetta. Therefore, this was not considered disinformation because the medication was still being tested, and the news piece itself highlights another statement from Mandetta: “The Minister warns that the medication is experimental, has strong side effects, and that the population should not go out and buy the product”. The second link, however, comes from a hyperpartisan outlet, Jornal da Cidade Online. Further, the framing is used to favor a pro-Bolsonaro narrative and presents hydroxychloroquine as a cure for COVID-19. The same framing is reproduced throughout the text from this link, so we considered it disinformation.

## Analysis

The first thing we observed after drawing the network based on the community algorithm is the presence of two groups (two clusters) strongly demarcated on the network (Graph 1). In this graph, we have the network demarcated with red nodes (users) and blue nodes (links). The red nodes are the majority; however, we also have several blue nodes, that is, the network is composed mostly of users that mentioned a lower number of URLs. The graph based on community shows two clusters of nodes that tend to share the same URLs within their groups, and that the URLs that circulate in one group usually do not circulate in the other. Thus, the algorithm indicates that even though we have a few connections between both groups, most connections take place within the clusters and not between them. This is the typical structure of a polarized network (Smith et al., 2014; Hibelboim et al., 2017). It also implies that, in the period we analyzed, there are quite explicit limitations on the circulation of content between different groups of users.

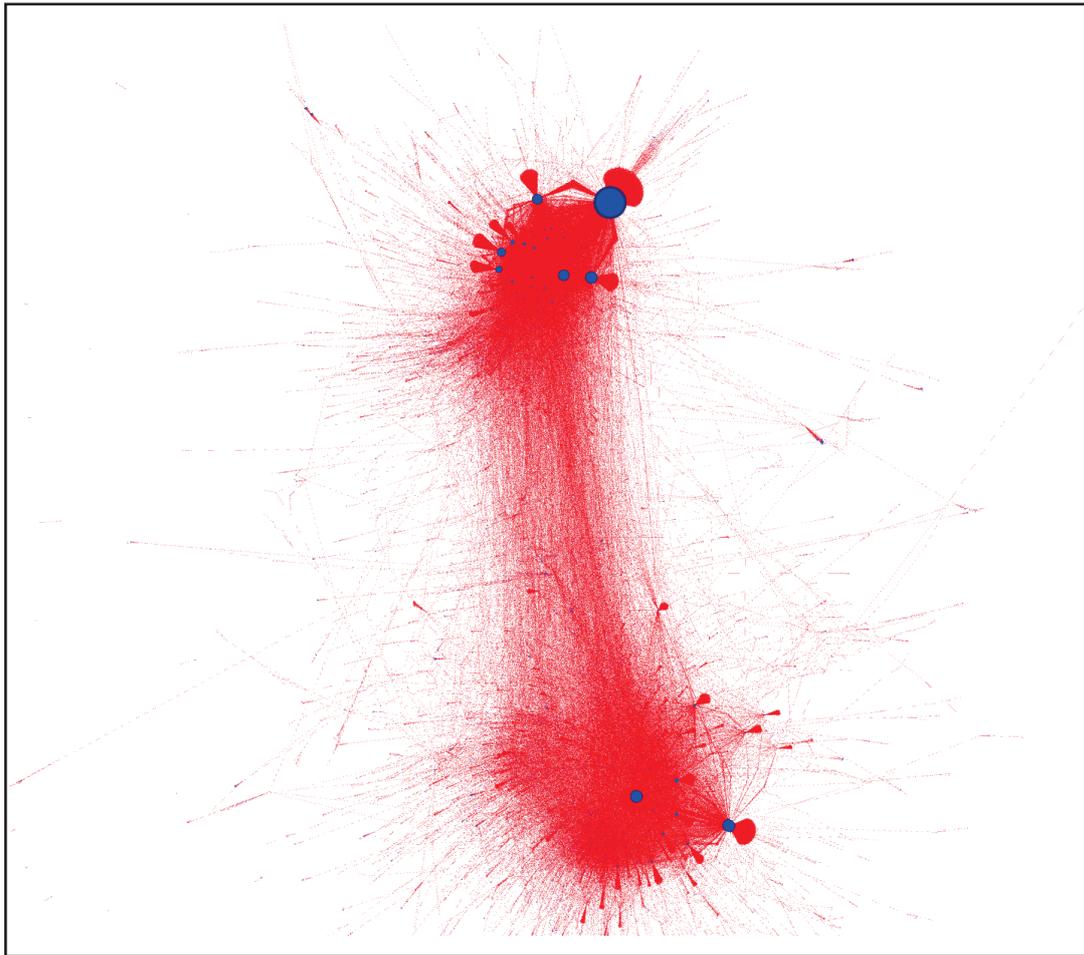
---

<sup>2</sup> Retrieved January 29, 2021 from: <https://www.bbc.com/portuguese/internacional-53341198>.

<sup>3</sup> Retrieved January 29, 2021 from: <https://gauchazh.clicrbs.com.br/coronavirus-servico/noticia/2020/03/brasil-fornece-hidroxicloroquina-para-casos-graves-de-coronavirus-diz-mandetta-ck80u64bc00ft01o9dz-bf48rs.html>.

<sup>4</sup> Retrieved January 29, 2021 from: <https://www.jornaldacidadeonline.com.br/noticias/19554/dono-da-rbs-afiliada-da-globo-cura-coronavirus-com-remedio-defendido-por-bolsonaro>.

Graph 1 – Clusters that circulated tweets with URLs. Rede nodes are Twitter accounts. Blue nodes are URLs



Source: created by the authors

In order to better understand both clusters, we analyzed the top 100 URLs that circulated the most within each of them. We will call the first cluster pro-hydroxychloroquine, since the discourse that circulated on it was favorable to authorizing the use of the drug to treat coronavirus. From the 100 links, 97 defended, to some extent, the use of the drug, either as a cure or as a treatment, or implied that people that received treatment with hydroxychloroquine only survived because they used the drug. Only three URLs, from institutional and journalistic outlets, pointed to the lack of data to support the indiscriminate use of the drug.

In this cluster, among the 100 most circulated URLs, we have 72 with some type of disinformation, and 28 without it. All the URLs that contained disinformation came either from hyperpartisan media (N=64) or social media (N=14), while the URLs with verified information came mostly from traditional media (N=20) and institutional pages (N=2). Only two URLs from hyperpartisan media did not contain any type of disinformation, which means that all other 62 URLs contained disinformation. Noteworthy, URLs from journalistic outlets that circulated on this cluster featured news supporting the pro-hydroxychloroquine discourse (for example, news pieces about politicians who claimed that they were cured of the virus by using the drug). That is, even though they were not strictly false information, they contribute to the disinformative discourse in the sense that they do not make any type of remark about this content that frames the use of the drug as a cure.

Among the hyperpartisan media that circulated in the pro-hydroxychloroquine group, we identified, for example, *Jornal da Cidade Online*, *Conexão Política*, and *Brasil sem Medo*. Those outlets are frequently associated with a far-right discourse, particularly linked to Jair Bolsonaro. Thus, we see the hyperpartisan character of the discussion about hydroxychloroquine in the group that is favorable to its use, in addition to the influence of political polarization in the discussion (as also seen on Recuero & Soares, 2020).

In the other cluster, which we will call anti-hydroxychloroquine, we see mostly a discourse that discredits the use of the drug in the treatment of coronavirus. In this group, we observe a greater circulation of journalistic outlets (N=80) and institutional media (N=10), with only five hyperpartisan media and five tweets with content from social media. We can also see a smaller presence of disinformation (only seven links), from which four come from hyperpartisan media, two from institutional media (which reproduced disinformation from hyperpartisan websites), and one content from social media.

The majority of the sources in the anti-hydroxychloroquine group are traditional media outlets (like *G1*, *Exame*, *UOL*, *Folha de S.Paulo*, and others). Among the hyperpartisan media, we can see pages associated with a discourse from the left, like *Diário do Centro do Mundo* and *Carta Campinas*, which are also responsible for a portion of the disinformative links in this groups. This reinforces the influence of political polarization on the discussion and its association with hyperpartisanship. Table 1 summarizes the findings.

Table 1 – Content and outlets data

Types of Content	Pro-hydroxychloroquine Cluster	Anti-hydroxychloroquine Cluster
Disinformation	72	7
Verified information	28	93
Types of outlets		
Hyperpartisan media	64	5
Journalistic outlets	20	80
Institutional media	2	10
Social media	14	5

Source: created by the authors

These data show important asymmetries in the information diet (Benkler et al., 2018) of those who consume and share content related to COVID-19 on Twitter. In the first case, the disinformation is strongly associated with the consumption of hyperpartisan media (since almost all disinformation we found is related to them) and with social media content (notably YouTube). In the second group, however, most of the links that circulated came from journalistic outlets and institutional media (for example, websites for companies, universities, and ministries). In this group, we can see a much lower consumption and circulation of hyperpartisan media which, although they are typically associated with disinformation, also circulate true content. Compared to the first group, this group is less exposed to disinformation.

Among the links that support the use of hydroxychloroquine, we see mainly references to statements by president Bolsonaro, health ministers, and other authorities, as well as content in a format that points to studies that, allegedly, would show that the drug kills the virus. Among the links that disprove this use, on the other hand, we see, mainly, factual content, such as the withdrawal of the French study that allegedly proved the effectiveness of hydroxychloroquine, the fact that WHO did not recommend using the medication for trials, and links to scientific journals.

When we observe the most circulated outlets in each cluster, we see that the one with more

disinformative URLs has more hyperpartisan media circulating, and, also, a reduction (or replacement) of the circulation of journalistic outlets, similarly to what was observed by other authors (Alves & Albuquerque, 2019; Larsson, 2019). The presence of hyperpartisan media, thus, seems to be strongly associated with the circulation of disinformation.

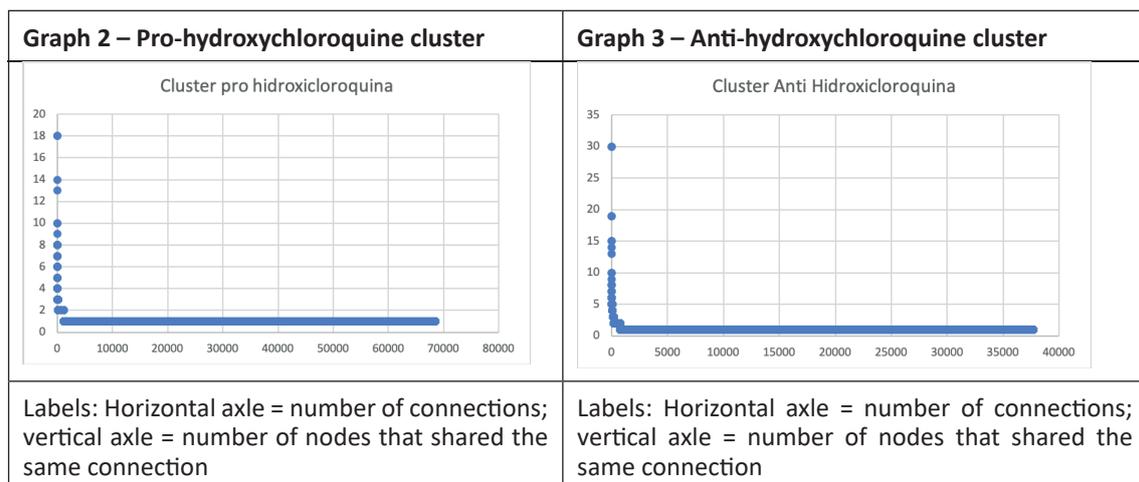
From this dataset, we can also observe that there are important differences in the structure of both clusters. The first cluster, pro-hydroxychloroquine, for instance, is larger than the second (Table 2). This indicates that more nodes shared the same links in the first cluster when compared to the second group. That is, there is a stronger concentration of connections to the same URLs in the pro-hydroxychloroquine group. While the first cluster has an average of 1.7 connections per node, the second has an average of 1.5 connections per node.

Table 2 – Data for the clusters on the network

	Pro-hydroxychloroquine Cluster	Anti-hydroxychloroquine Cluster
Nodes	41,601	25,849
Unique Connections	70,030 (68,507 unique connections)	38,954 (37,715 unique connections)

Source: created by the authors

This difference is also present in the distribution of connections by node (Graphs 2 and 3).

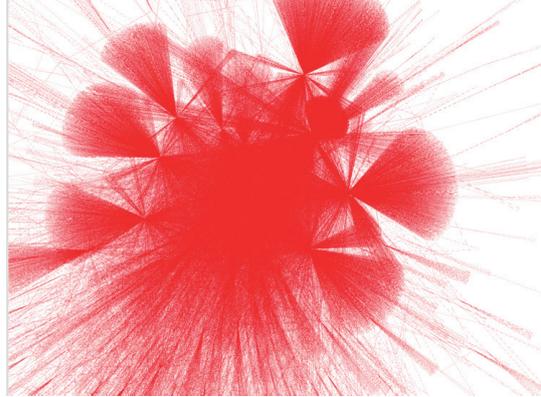
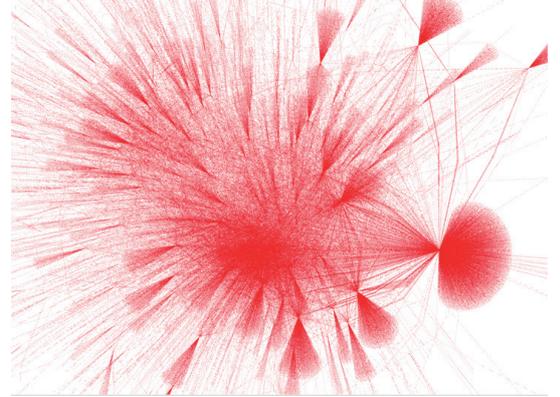


Source: Created by the authors

Additionally, both clusters have a very active group of nodes, which posted more than five tweets with links to different outlets during the period we analyzed. This means that there are actors that are involved in the spread of disinformation, however, not sharing the same content several times, but instead sharing several different URLs with similar disinformative content. In the anti-hydroxychloroquine group, some users shared several different URLs that disprove the effectiveness of the use of the drug.

In the anti-hydroxychloroquine cluster, we identified 764 URLs with more than one connection (Graph 3) and a total of 68,506 links. In the pro-hydroxychloroquine cluster, we identified 1,172 URLs with more than one connection (Graph 2), with a total of 37,716 links. That is, the pro-hydroxychloroquine cluster is more active in sharing the same URLs, which can also be seen on the network showing the most active users (Graphs 4 and 5). These data can indicate a greater activity in terms of sharing different links that reproduce the same story, which could be a possible strategy employed by the pro-hydroxychloroquine cluster to reduce the visibility to spam and coordination filters from Twitter. Thus, we observed that the

pro-hydroxychloroquine cluster has a larger number of very active nodes, which are responsible for mentioning several of the most shared URLs, increasing the closure of the network.

Graph 4 – Pro-hydroxychloroquine cluster	Graph 5 – Anti-hydroxychloroquine cluster
	
<p>Label: Nodes with more than 5 tweets with links in the pro-hydroxychloroquine cluster.</p>	<p>Label: Nodes with more than 5 tweets in the anti-hydroxychloroquine cluster.</p>

Source: Created by the authors.

The data also point to the formation of echo chambers (Sunstein, 2001) that seem to foster a certain opposition to each other (Barberá, 2020), an indication of affective polarization. For example, in the cluster that circulates the discourse that supports the use of hydroxychloroquine as a scientific cure or treatment against COVID-19, the absence of content that dispute this affirmation is notable. It is not that those links don't exist; there are three links that frame hydroxychloroquine as harmful. However, those links have an outdegree of 6, 3, and 3 (a total of 12 connections), which means that they received very few retweets when compared to the other links (which have a total of 511 connections). On the other hand, in the group where links against the use of the drug circulate, we can also see a total of three links that support the use of the medication, with a total of 14 connections (5, 5, and 3), out of a total of 624. This shows the strength in replicating content that agrees with one point of view on the pro-hydroxychloroquine cluster, reducing the circulation of content that disproves the disinformation.

Thus, one important feature of this network is the existence of a great difference between the two groups, in which those users that circulate disinformation do not circulate verified information. This also means that the audience of those users that share disinformation has reduced contact to the content that could deny it – maybe this contact, when it happens, ends up precisely increasing the polarized feeling (Bail et al., 2018). Our results show that polarization fosters opposite feelings towards hydroxychloroquine, to the point that one group has to rely on disinformation to support the use of the drug, mainly through the circulation of hyperpartisan URLs that reinforce the disinformative discourse. Therefore, we can say that the polarized structure and the differences in the media diet of the groups can result in a lack of coordination in fighting the pandemic, since opposing groups seem to nurture opposing feelings about the topics related to COVID-19, similarly to what was observed by Allcott et al. (2020).

## Final remarks

In this research, we analyzed the circulation of disinformative links about the use of hydroxychloroquine as a cure or treatment for COVID-19. To do so, we analyzed how the URLs related to both truthful information and misleading or false information were shared, what types of content appeared, and if there were clusters in the network.

Our results point to a polarized network, in which anti or pro-hydroxychloroquine links practically do not circulate in a different neighborhood. This result contemplates our first objective, which was to observe the network structure. This element strongly suggests the presence of echo chambers, which act towards an affective polarization. The increased activity of sharing links associated with disinformation and favorable to the use of hydroxychloroquine also suggests a collective action to give visibility to a particular disinformative discourse, which is backed by alternative or hyperpartisan outlets, where there is an absence of traditional media outlets. Thus, we can also see important evidence of the connection of this type of outlet with the spread of false or misleading content. These results contemplate our second and third objectives: to analyze the media diet of the identified clusters and the participation dynamics of the users in each group.

This study contributes to understanding how partisanship, polarization, and the action of very active users can negatively influence the circulation of truthful content, which would allow the population to engage with public policies to fight the disease. Another important contribution of our research is the fact that the links circulate within neighborhoods, in which informational links circulate among actors that shared other informational links, whereas disinformative links circulate near other disinformative links. Thus, we identified that groups with polarized feelings towards hydroxychloroquine only reproduce (share) URLs aligned with their positions. Particularly, we contribute with the use of a methodology that analyzes link circulation on Twitter. This type of analysis is important to understand how journalistic information and disinformation circulate on Twitter and can be used to explore other similar cases. Moreover, we were able to analyze media diets in a more specific way, since we could identify the sources and characterize the content of the most shared links on the network. Unlike tweets in general, which may include several types of content, the links we found are closer to information, since, mostly, they are used to provide access to journalistic outlets, hyperpartisan media, and institutional sites.

Mapping how links are shared is a way of understanding information circulation (Guille et al., 2013), although limited in the sense of studying only a snapshot of the network over time. Future studies can identify the role of influencers and users who share this information – as observed by Jenkins et al. (2013), the boundaries between the roles of producers, distributors, and consumers become blurred in the spreadable media. Thus, identifying who are those actors can contribute to a better understanding of the process of spreading disinformation on social media. As we showed in this paper, some actors are very active in the practice of sharing different disinformative links, which may imply a different strategy for coordinating the spread of disinformation (which has been shown by other authors as something usually related to the automatic replication of a single link).

## References

- Adamic, L.A., & Glance, N. (2005). The political blogosphere and the 2004 US election: divided they blog. *Proceedings of the 3rd international workshop on Link discovery*, Chicago, p. 36-43. Retrieved January 29, 2021 from: <https://dl.acm.org/doi/10.1145/1134271.1134277>.
- Allcott, H., Boxell, L., Conway, J., Gentzkow, M., Thaler, M., & Yang, D. (2020). Polarization and Public Health: Partisan Differences in Social Distancing during the Coronavirus Pandemic (Working Paper No. 26946; Working Paper Series). *National Bureau of Economic Research*. Retrieved January 29, 2021 from: <https://doi.org/10.3386/w26946>.
- Alves, M. (2019). Desarranjo da visibilidade, desordem informacional e polarização no Brasil entre 2013 e 2018. [Doctoral dissertation, Fluminense Federal University]. Retrieved from: 10.13140/RG.2.2.20523.80169.
- Alves, M., & Albuquerque, A. (2019). Perda da hegemonia da imprensa: a disputa pela visibilidade na eleição de 2018. *Lumina*, 13(3), 5-27.

Andris, C., Lee, D., Hamilton, M., Martino, M., Gunning, C., & Selden, J.A. (2015). The Rise of Partisanship and Super-Cooperators in the U.S. House of Representatives. *PLoS ONE*, 10(4). Retrieved January 29, 2021 from: <https://doi.org/10.1371/journal.pone.0123507>.

Aquino Bittencourt, M.C. (2015). Ciberacontecimento e jornalismo digital: o impacto do compartilhamento e da produção de sentidos nas práticas jornalísticas. *Estudos em Jornalismo e Mídia*, 12(2), 342-358.

Araujo, R.F., & Oliveira, T.M. (2020). Desinformação e mensagens sobre a hidroxicloroquina no Twitter: da pressão política à disputa científica. *Atoz*, 9(2), 196-205. Retrieved January 29, 2021 from: <http://dx.doi.org/10.5380/atoz.v9i2.75929>.

Bail, C.A., Argyle, L.P., Brown, T.W., Bumpus, J.P., Chen, H., Hunkazer, M.B., Lee, J., Mann, M., Merhout, F., & Volfovsky, A. (2018). Exposure to opposing views on social media can increase political polarization. *PNAS*, 115(37), 9216-9221.

Bakshy, E., Messing, S., & Adamic, L.A. (2015). Exposure to ideologically diverse news and opinion on Facebook. *Science*, 348(6239), 1130-1132. Retrieved January 29, 2021 from: 10.1126/science.aaa1160.

Barberá, P. (2015). How Social Media Reduces Mass Political Polarization. Evidence from Germany, Spain, and the U.S. *Proceedings of the 2015 APSA Annual Meeting*, San Francisco. Retrieved January 29, 2021 from: [https://convention2.allacademic.com/one/apsa/apsa15/index.php?cmd=Online+Program+View+Paper+selected\\_paper\\_id=997865ePHPSESSID=ai1fh85m28gqmu9vd308q3ef6r](https://convention2.allacademic.com/one/apsa/apsa15/index.php?cmd=Online+Program+View+Paper+selected_paper_id=997865ePHPSESSID=ai1fh85m28gqmu9vd308q3ef6r).

Barberá, P. (2020). Social Media, Echo Chambers, and Political Polarization. In Persily, N., & Tucker, J. (Eds.). *Social Media and Democracy: The State of the Field and Prospects for Reform*. Cambridge, UK: Cambridge University Press, 34-55.

Barbera, P., Jost, J.T., Nagler, J., Tucker, J.A., & Bonneau, R. (2015). Tweeting From Left to Right: Is Online Political Communication More Than an Echo Chamber?. *Psychological Science*, 26(10), 1531-1542. Retrieved January 29, 2021 from: 10.1177/0956797615594620.

Benkler, Y., Faris, R., & Roberts, H. (2018). *Network Propaganda: Manipulation, disinformation, and radicalization in american politics*. New York: Oxford University Press.

Born, K., & Edgington, N. (2017). *Analysis of philanthropic opportunities to mitigate the disinformation/propaganda problem*. Menlo Park, CA: Hewlett Foundation.

Brennen, S., Simon, F., Howard, P.N., & Nielsen, R.K. (2020). *Types, sources, and claims of COVID-19 misinformation*. Oxford: Reuters Institute Factsheet. Retrieved January 29, 2021 from: <https://reutersinstitute.politics.ox.ac.uk/types-sources-and-claims-COVID-19-misinformation>.

Blondel, V.D., Guillaume, J.L., Lambiotte, R., & Lefebvre, E. (2008). Fast unfolding of communities in large networks. *Journal of Statistical Mechanics: Theory and Experiment*, 2008(10), P10008. Retrieved January 29, 2021 from: <https://doi.org/10.1088/1742-5468/2008/10/P10008>.

Bruns, A. (2019). *Are Filter Bubbles Real?*. Cambridge, UK: Polity Press.

Bruns, A., Harrington, S., & Hurcombe, E. (2020). 'Corona? 5G? or both?': the dynamics of COVID-19/5G conspiracy theories on Facebook. *Media International Australia*, 177(1) 12-29. Retrieved January 29, 2021 from: <https://doi.org/10.1177/1329878X20946113>.

Bruns, A., & Moe, H. (2014). Structural Layers of Communication on Twitter. In Weller, K., Bruns, A., Burgess, J., Mahrt, M., & Puschmann, C. (Eds). *Twitter and Society*. Nova York: Peter Lang Publishing, 15-28.

Degenne, A., & Forse, M (1999). *Introducing Social Networks*. London: SAGE Publications Ltd..

Dubois, E., & Blank, G. (2018). The echo chamber is overstated: the moderating effect of political interest and diverse media. *Information, Communication e Society*, 21(5), 729-745. Retrieved January 29, 2021

from: <https://doi.org/10.1080/1369118X.2018.1428656>.

Eady, G., Nagler, J., Guess, A., Zilinsky, J., & Tucker, J. A. (2019). How Many People Live in Political Bubbles on Social Media? Evidence From Linked Survey and Twitter Data. *SAGE Open*. Retrieved January 29, 2021 from: <https://doi.org/10.1177/2158244019832705>.

Fallis, D. (2015). What Is Disinformation?. *Library Trends*, 63(3), 401-426..

Flaxman, S., Goel, S., & Rao, J. M. (2016). Filter Bubbles, Echo Chambers and Online News Consumption. *Public Opinion Quarterly*, 80, 298-320.

Giglietto, F. Righetti, N., Rossi, L., & Marino, G. (2020). It takes a village to manipulate the media: coordinated link sharing behavior during 2018 and 2019 Italian elections. *Information, Communication & Society*, 23(6), 867-891. Retrieved January 29, 2021 from: 10.1080/1369118X.2020.1739732.

Guille, A., Hacid, H., Favre, C., & Zighed, D. A. (2013). Information Diffusion in Online Social Networks: A Survey. *ACM Sigmod Record*, 42(2), 17-28.

Gruzd, A., & Mai, P. (2020). Going viral: How a single tweet spawned a COVID-19 conspiracy theory on Twitter. *Big Data e Society*, 7(2), 1-9.

Gruzd, A., & Roy, J. (2014). Investigating Political Polarization on Twitter: A Canadian Perspective. *Policy and Internet*, 6(1), 28-45.

Guess, A., Lyons, B., Nyhan, B., & Reifler, J. (2018). *Avoiding the echo chamber about echo chambers: Why selective exposure to like-minded political news is less prevalent than you think*. Miami: John S. and James L. Knight Foundation.

GWU-libraries/sfm-ui: Version 2.3.0 (2020). Social feed manager. *Zenodo*, 04 May 2020. Retrieved January 29, 2021 from: <https://doi.org/10.5281/zenodo.597278>.

Himmelboim, I., Smith, M. A., Rainie, L., Schneiderman, B., & Espina, C. (2017). Classifying Twitter Topic-Networks Using Social Network Analysis. *Social Media + Society*, 3(1), 1-13. Retrieved January 29, 2021 from: <https://doi.org/10.1177/2056305117691545>.

Jack, C. (2017). *Lexicon of Lies: Terms for Problematic Information*. New York: Data & Society Research Institute.

Jenkins, H., Ford, S., & Green, J. (2013). *Spreadable Media*. New York: NYU Press.

Larsson, A. O. (2019). News Use as Amplification – Norwegian National, Regional and Hyperpartisan Media on Facebook. *Journalism e Mass Communication Quarterly*, 96(3), 721-741. Retrieved January 29, 2021 from: <https://doi.org/10.1177/1077699019831439>.

Maia, R. C. M. (2008). Visibilidade midiática e deliberação pública. In: Gomes, W., & Maia, R. C. M. (Eds.). *Comunicação e democracia: problemas e perspectivas* (117-162). São Paulo: Paulus.

Maireder, A., & Aussenhofer, J. (2014). Political Discourses on Twitter: Networking Topics, Objects, and People. In: Weller, K., Bruns, A., Burgess, J., Mahrt, M., & Puschmann, C. (Eds.). *Twitter and Society* (305-318). Nova York: Peter Lang Publishing.

Marwick, A., Lewis, R. (2017). *Media Manipulation and Disinformation Online*. New York: Data & Society Research Institute.

Mourão, R. R., & Robertson, C. T. (2019). Fake News as Discursive Integration: An Analysis of Sites That Publish False, Misleading, Hyperpartisan and Sensational Information. *Journalism Studies*, 20(14), 2077-2095.

Papakyriakopoulos, O., Serrano, J. C. M., & Hegelich, S (2020). The spread of COVID-19 conspiracy theories

on social media and the effect of content moderation. *Harvard Kennedy School Misinformation Review*. Retrieved January 29, 2021 from: <https://doi.org/10.37016/mr-2020-034>.

Recuero, R., Araújo, R., & Zago, G. (2011). How does Social Capital affect Retweets?. In Proceedings of the V *International AAAI Conference on Weblogs and Social Media*, Barcelona, Spain.

Recuero, R., & Soares, F. (2020). O Discurso Desinformativo sobre a Cura do COVID-19 no Twitter: Estudo de caso. *E-Compós*, Ahead of Print. Retrieved January 29, 2021 from: <https://doi.org/10.30962/ec.2127>.

Recuero, R., Soares, F. B., Gruzd, A. (2020). Hyperpartisanship, Disinformation and Political Conversations on Twitter: The Brazilian Presidential Election of 2018. In Proceedings of the XIV *International AAAI Conference on Web and Social Media*, Atlanta, US.

Recuero, R., Zago, G., & Soares, F. B. (2017). Mídia social e filtros-bolha nas conversações políticas no Twitter. In Proceedings of the XXVI *Encontro Anual da Compós*, São Paulo, Brazil. Retrieved January 29, 2021 from: [http://www.compos.org.br/data/arquivos\\_2017/trabalhos\\_arquivo\\_XH5ITTDY1PYGE7PDUQJM\\_26\\_5374\\_18\\_02\\_2017\\_12\\_53\\_33.pdf](http://www.compos.org.br/data/arquivos_2017/trabalhos_arquivo_XH5ITTDY1PYGE7PDUQJM_26_5374_18_02_2017_12_53_33.pdf).

Smith, M., Rainie, L., Himelboim, I., & Schneiderman, B. (2014). *Mapping Twitter Topic Networks: From Polarized Crowds to Community Clusters*. Washington: Pew Research Center.

Soares, F. B., Recuero, R., & Zago, G. (2018). Influencers in Polarized Political Networks on Twitter. In Proceedings of the 9th *International Conference on Social Media e Society*, Copenhagen, Denmark. Retrieved January 29, 2021 from: <https://doi.org/10.1145/3217804.3217909>.

Soares, F. B., Viegas, P., Sudbrack, S., Recuero, R., & Hüttner, L. R. (2019). Desinformação e esfera pública no Twitter: disputas discursivas sobre o assassinato de Marielle Franco. *Revista Fronteiras – estudos midiáticos*, 21(3), 2-14. Retrieved January 29, 2021 from: 10.4013/fem.2019.213.01.

Sunstein, C. (2001). *Echo Chambers*. Princeton: Princeton University Press.

Tucker, J. A., Guess, A., Barbera, P., Vaccari, C., Siegel, A., Sanovich, S., Stukal, D., & Nyhan, B. (2018). *Social Media, Political Polarization, and Political Disinformation: A Review of the Scientific Literature*. Menlo Park, CA: Hewlett Foundation, 2018. Retrieved January 29, 2021 from: <http://dx.doi.org/10.2139/ssrn.3144139>.

Uscinski, J. E., Enders, A. M., Klofstad, C., Seelig, M., Funchion, J., Everett, C., Wuchty, S., Premaratne, K., & Murthi, M. N. (2020). Why do people believe COVID-19 conspiracy theories?. *Harvard Kennedy School Misinformation Review*. Retrieved January 29, 2021 from: <https://doi.org/10.37016/mr-2020-015>.

Wardle, C. (2019). *Understanding Information Disorder*. Brighton: First Draft.

Wardle, C., & Derakhshan, H. (2017). *Information disorder: Toward an interdisciplinary framework for research and policy making*. Strasbourg: Council of Europe.

Wasserman, S., & Faust, K. (1994). *Social Network Analysis: Methods and Applications*. Cambridge, UK: Cambridge University Press.

Zago, G., & Bastos, M. T. (2013). Visibilidade de Notícias no Twitter e no Facebook: Análise Comparativa das Notícias mais Repercutidas na Europa e nas Américas. *Brazilian Journalism Research*, 9(1), 116-133.

Zago, G. (2014). *Circulação e recirculação de narrativas do acontecimento no jornalismo em rede: a Copa do Mundo de 2014 no Twitter*. [Doctoral dissertation, Federal University of Rio Grande do Sul].

---

*Raquel Recuero is a professor and researcher at the Center for Languages and Communication at the Federal University of Pelotas and the Post Graduate Program in Communication at Federal University of Rio Grande do Sul and coordinator and researcher at MIDIARS (Research Laboratory in Media, Discourse, and Social Network Analysis). In this paper, she contributed with conception of research design; development of theoretical discussion; data interpretation; writing of the manuscript; support in proofreading; revision*

*of the foreign language version.*

---

*Felipe Soares has a PhD in Communication and Information from Federal University of Rio Grande do Sul and is a coordinator and researcher at MIDIARS (Research Laboratory in Media, Discourse, and Social Network Analysis). In this paper, he contributed with conception of research design; development of theoretical discussion; data interpretation; writing of the manuscript; support in proofreading; revision of the foreign language version.*

---

*Gabriela Zago has a PhD in Communication and Information from Federal University of Rio Grande do Sul and is a coordinator and researcher at MIDIARS (Research Laboratory in Media, Discourse, and Social Network Analysis). In this paper, she contributed with conception of research design; development of theoretical discussion; data interpretation; writing of the manuscript; support in proofreading; revision of the foreign language version.*