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#VACHINA: HOW POLITICIANS HELP TO SPREAD DISINFORMATION ABOUT COVID-19 VACCINES

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ABSTRACT

This paper focuses on how Brazilian politicians helped to spread disinformation about Covid-19 vaccines, discussing legitimization strategies and actors that played a significant role on Twitter and Facebook. Based on data gathered through CrowdTangle and Twitter API, we selected the 250 most shared/retweeted posts for each dataset (n=500) and examined if they contained disinformation, who posted it, and what strategy was used to legitimize this discourse. Our findings indicate that politicians and hyperpartisan accounts have a key influence in validating the Brazilian president's populist discourse through rationalization (pseudo-science) and denunciation (against the vaccine). The political frame also plays an important role in disinformation messages.

Keywords: anti-vaccine; Covid-19; disinformation; social media; discourse.

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1 INTRODUCTION

The Covid-19 pandemic was a catastrophic event around the world. However, some countries felt it harder than others. From the 5.4 million deaths the world experienced in two years, Brazil had, alone, over 600 thousand. The chaotic response to the disease was credited to the spread of disinformation, the populist discourse of the president, and uncoordinated actions from the country's Health Ministry¹. For example, because the pandemic spread so widely in Brazil, the country was a laboratory for the development of many Covid-19 vaccines². So, it was also given the chance to buy vaccines early on. However, the Brazilian's far-right president, Jair Bolsonaro, refused it³, arguing Brazilians already had "the cure"⁴ for Covid-19 (the usage of hydroxychloroquine, which was already a debunked claim by scientific experiments) (Hallal and Victora, 2021). This particular context also helped the spread of disinformation campaigns about the pandemic (Soares et al., 2021), similar to what was observed in other far-right countries (Palau, 2021). This disinformation phenomenon targeted many topics, including vaccines (Galhardi et al., 2020), which increased the hesitancy for some to get vaccinated (Bivar et al., 2021).

Because of these problems, Brazil did not acquire vaccines until the end of 2020 (Hallal and Victora, 2021). By then, there were two efforts to develop a vaccine available to Brazilians. One was made by João Doria, the governor of the state of Sao Paulo, that mobilized the Butantan institute (a biologic research facility located in Sao Paulo) to work with the Sinovac laboratory in China. The other was made by Fiocruz, another research institute, situated in the state of Rio de Janeiro, that was working with AstraZeneca for the same purpose. Doria is a political adversary of Bolsonaro, as he constantly challenged the conspiracy theories created by the president (Santos and Fossá, 2020). At the same time, Bolsonaro attacked the vaccines, claiming they were "Chinese"⁵, "water with sugar"⁶ and "didn't work"⁷. In fact, until now, Bolsonaro refuses to get vaccinated⁸.

¹ <https://www.newyorker.com/news/daily-comment/brazils-covid-19-crisis-and-jair-bolsonaros-presidential-chaos> (Accessed on 09/02/2021)

² <https://www.nytimes.com/2020/08/15/world/americas/brazil-coronavirus-vaccine.html> (Accessed on 09/02/2021)

³ <https://www.nytimes.com/2021/01/18/world/americas/brazil-covid-variants-vaccinations.html> (Accessed on 09/02/2021)

⁴ <https://www.nytimes.com/2020/06/13/world/americas/virus-brazil-bolsonaro-chloroquine.html> (Accessed on 09/02/2021)

⁵ <https://www.bloomberg.com/news/articles/2020-10-21/bolsonaro-slams-chinese-vaccine-his-government-said-it-would-buy> (Accessed on 09/02/2021)

⁶ <https://www.washingtonpost.com/world/2021/04/15/brazil-china-vaccine-coronavirus-coronavac/> (Accessed on 09/02/2021)

⁷ <https://www.theguardian.com/world/video/2021/jan/15/brazils-president-casts-doubts-on-covid-vaccine-as-second-wave-hits-video> (Accessed on 09/02/2021)

⁸ <https://www.washingtonpost.com/world/2021/09/19/jair-bolsonaro-unga-vaccine-honor-system/> (Accessed on 09/02/2021)

Bolsonaro, like many other politicians, relies on social media channels to mobilize their supporters and to talk to his audience (Silva, 2020), as he distrusts traditional media outlets as "fake news". Research has pointed this is a strategy used by populist leaders, as social media platforms offer affordances that are particularly important for this field, such as the possibility to influence more people (Cesarino, 2020), and has been used in western democracies for a long time (Boulianne, Koc-Michalska and Bimber, 2020). Some of these leaders, like Bolsonaro, have insufflated disinformation, as they use social media to antagonize real content (Soares et al., 2021). Thus, it is important to understand how, in political contexts such as this, disinformation discourse is legitimated and by whom. The Brazilian situation provides a unique opportunity to analyze how discursive strategies are mobilized to spread disinformation about Covid-19 vaccines. Although we look at one country, the issue we explore in this paper is relevant in a global sense. In the last few years, far-right populist politicians emerged in many countries (Wodak, 2015; Mudde and Kaltwasser, 2017; Rooduijn, 2019), as well as health-related and scientific disinformation turned out to be a key issue during the Covid-19 pandemic worldwide (Araujo and Oliveira, 2020; Brennen et al., 2020; Casarões and Magalhães, 2021). The intersection between discourse, populism, and disinformation that we explore in this research represents a real challenge for countries around the world – in particular, those that face a context like Brazil with populist politicians in positions of leadership.

The context we analyze exemplifies why studying the disinformation discourse, its legitimation process, and connections to populism are so important, as political leaders support disinformation campaigns that may harm the population. Our study explores a cross-platform context (Twitter and Facebook) based on the following research questions: (1) Who are the key users for disinformation spread? (2) How did they frame the disinformation about vaccines to gain legitimation? And (3) What are the connections of disinformation discourse to populist discourse?

2 DISINFORMATION DISCOURSE, COVID-19 AND SOCIAL MEDIA PLATFORMS

Disinformation has been a major problem during the Covid-19 pandemic, particularly because of how social media affordances end up fueling its spread. We define disinformation as the phenomenon based on the spread of false and misleading content to influence public discourse (Benkler, Faris and Roberts, 2018). This disinformation discourse is often mobilized through fabricated content, false claims mixed with truthful content, or false connections between truthful statements (Derakhshan and Wardle, 2017). Some authors have also pointed certain characteristics of disinformation discourse, such as “call to action” or a sense of “urgency to spread”, and the usage of discursive strategies to gain legitimation (Recuero, Soares and Vinhas, 2021). Disinformation discourse has been used for

political purposes, as public authorities may engage in sharing them for political gain (which was seen in Brazil by Ricard and Medeiros, 2020; Alcantara and Ferreira, 2020) or for the manipulation of public opinion in their favor (Rogers and Niederer, 2020).

The fast spread of disinformation on social media may be connected to how people legitimate these discourses online. Disinformation often circulates due to a very engaged audience (Vosoughi, Roy and Aral, 2018). Although most of this content may circulate among ordinary accounts, influencers such as politicians, celebrities and users with a great audience may increase its spread (Brennen et al., 2020). In fact, some authors found that politicians, celebrities, organizations, and other influencers played an important role in the circulation of disinformation about Covid-19 on Twitter (Recuero, Soares and Zago, 2021; Shahi, Dirkson and Majchrzak, 2021).

In this context, different studies have shown an alignment between populist discourse and disinformation about Covid-19, particularly from the far-right (Wondreys and Mudde, 2020; Stecula and Pickup, 2021). This means that characteristics of the populist discourse have been found in disinformation content. The contemporary right-wing populism has been studied by several authors, and particularly, by Wodak (2015). This form of populism, represented by leaders like Trump, Marie LePen and others, have a strong basis on the affordances and self-mediation allowed by social media (Wodak and Kryzanowski, 2017). The authors also explain that this type of populism relies on traditional media support through reports of scandals, as they often lack traditional parties' structures to promote them. When exploring these scandals, contemporary right-wing populists reinforce their anti-establishment rhetorics and survive on social media as an alternative space (Wodak, 2015). This populist discourse is based on elements such as the opposition to elites, the anti-science discourse, and the idea that people who align with populists are "virtuous people" that fight against the corruption of societal values (Roudjin, 2019; Mede and Schäfer, 2020; Mudde and Kaltwasser, 2012).

Jair Bolsonaro, current Brazilian president, is considered a far-right populist (Mendonça and Caetano, 2020; Watmough, 2021) with anti-science views (Oliveira, 2020). Besides, Bolsonaro is often linked to disinformation spread, particularly in the context of the Covid-19 pandemic (Araujo and Oliveira, 2020; Casarões and Magalhães, 2021; Ricard and Medeiros, 2020). In this context, disinformation in Brazil reproduced both political populism (Roudjin, 2019; Mendonça and Caetano, 2020) and science-related populism (Mede and Schäfer, 2020), which are important for the Covid-19 context. The first one was used to criticize political elites and the mainstream media who stand in Bolsonaro's way and to reinforce his "macho" image (Watmough, 2021), as he claimed the virus would not concern him given his "athletic history". The second one was used to criticize WHO and other health authorities, to reproduce anti-vaccine discourses and to promote unproven drugs (Araujo and Oliveira, 2020). Finally, like many other populist leaders, Bolsonaro also relies on social media for support and

disinformation on these platforms to influence public opinion in his favor (Soares et al., 2021; Kallil, 2019).

3 DISCOURSE AND LEGITIMATION

One key point to understand how disinformation circulates in contexts such as the Covid-19 pandemic is to find out how this type of content gains legitimation. The disinformation, like other types of discourse, often relies on strategies that articulate credibility to produce effects on society. Legitimation is a key concept for Critical Discourse Analysis (CDA), a perspective that focuses on how discourse builds and legitimizes power relations in society (Fairclough, 2001; Van Dijk, 2006, 2009). Legitimation strategies, in this sense, are tools used through discourse to build credibility. While often seen in a positive light (Vaara and Tienar, 2008), legitimation is a critical process that has effects in society as it helps naturalize the power (and dominant) relations built through discourse.

The study of legitimation strategies focuses on the linguistic characteristics of the discourse. These strategies have been studied by several authors. Van Leeuwen (2007), for example, explains four major categories of legitimation, which are: (1) Authorization, which is the legitimation through authority; (2) Moral Evaluation, the legitimation through the reference to moral values; (3) Rationalization, which refers to the cognitive validity, the social knowledge, and other rational arguments; (4) Mythopoesis, which is the legitimation through narratives and stories, which build upon legitimate and non-legitimate actions. These categories can be used to legitimate or de-legitimate a topic. Reyes (2011), on the other hand, analyzes the strategies specifically used by politicians during their public discourse, which he classifies as: (1) the usage of emotions (and particularly fear). Legitimation through emotions is built upon skewing the involved actors to the audience. Politicians often represent their opponents with negative attributes, creating a narrative of "us" versus "them", the others. (2) The construct of a hypothetical future. In this case, the discourse predicts an imminent threat that requires action to preserve the future. (3) Rationality, when the discourse is based on "rational" arguments, logic. (4) Voices of the experts, a strategy directly connected to "authorization" (Van Leeuwen, 2007), where the legitimation comes from the expertise, the authority that legitimates de discourse. (5) Altruism, when the legitimation is proposed through an altruistic, not driven by personal interest's discourse. While Van Leeuwen's (2007) typology focuses on general strategies, Reyes' (2011) work, however, focuses on the discourse produced by politicians to convince their audience. These two classifications provide some light on the discussion of how discourse gains legitimation and thus, how it can be used to manipulate and influence social practices that are not beneficial to people.

In a broader political context, other specific discursive strategies are used to build legitimation. One relevant strategy is the use of humor. Humor is key to the rhetoric of political memes, as humor contributes to the consolidation of shared

meanings on social media (Chagas et al., 2019). In this context, Chagas et al. (2019) argue that the trivialization of socially relevant topics is often a way to solve problems of adequacy in political discourse – consequently, engaging more actors and fueling political participation. In the context of disinformation spread, Crilley and Chatterje-Doody (2020) identified that humor was a fundamental legitimation strategy used by RT (Russia Today), especially in content related to Russian foreign policy. In addition, during the Covid-19 pandemic, Basch et al. (2021) identified that memes and parodies were used to spread anti-vaccine content on TikTok.

Social media platforms, in this context, offer an interesting setting to study how discourse is articulated, particularly because they play an important role in disinformation spread (Allcott and Gentzkow, 2017; Vosoughi, Roy and Aral, 2018). Also, the interaction tools provided by these platforms, such as "likes" or "retweets", for example, may provide insights on how much of an impact each post has on a particular community, and are also often seen as a form to legitimate discourses (Metaxas et al. 2018; Glozer, Caruana and Hibbert, 2019).

Several studies have discussed how disinformation is legitimized on social media platforms based on these ideas. Igwebuike and Chimuanya (2021), for example, studied which were the recurrent strategies used by Nigerian "fake news" producers on social media. They discussed how Van Leeuwen's (2007) strategies were used, suggesting that authorization and appeal to emotion, using moralization and rationalization were key for the phenomenon. Similarly, Recuero, Soares and Vinhas (2021), discussing legitimation strategies for disinformation on WhatsApp and Twitter, found that they were mostly based on emotional framing and incentives to share, but also that the most used strategies (again, based on Van Leeuwen, 2007) differ on each platform. While Twitter had more authorization and moral evaluation, WhatsApp messages used mostly mythopoesis. These works show that the disinformation discourse on social media platforms relies on different forms of legitimation. However, while they point to the disinformation strategies used, they do not explore how these strategies are mobilized and by whom. Finally, it is important to understand how discourse is articulated to gain legitimation to disinformation about Covid-19 in different contexts and, particularly, among the ones where governments favor disinformation, like Brazil.

4 METHODS

In this paper, we focus on discussing the strategies used to legitimate disinformation about the Covid-19 vaccines and the usage of political influence to circulate them in Brazil. We focus on Twitter and Facebook to explore three research questions: (1) Who are the key users for disinformation spread? (2) How did they frame the disinformation about vaccines to gain legitimation? And (3) What are the connections of disinformation discourse to populist discourse?

To explore these questions, we collected tweets through Twitter API (n=890,501) and Facebook public posts through CrowdTangle (n=111,807)

containing the expression “Vacina” + “chinesa” or + “China” (Chinese or China plus Vaccine, in Portuguese) between July 2020 and April 2021. These keywords were selected to focus on a particular public debate that was often fueled by disinformation. The expression “Chinese vaccine” was heavily used by actors spreading disinformation, but it was also by other users and the Brazilian mainstream media to refer to the Sinovac vaccine – similarly to how they used “Oxford Vaccine” to refer to the AstraZeneca vaccine. Sinovac vaccine (which was produced in a collaboration with the Brazilian Butantan Institute, as we explained) was the first and the most widely available vaccine in Brazil (and most of South America) for a long time, differently from the countries of the north global. Disinformation narratives often focused on the role of China in the pandemic, emphasizing that China is a Communist country, and reproducing the “Chinese virus” narrative and conspiracy theories that the virus was intentionally created by China. Because of this connection between politics and health (the vaccine), we believe this case provides important insights to understand how political discourse influenced disinformation about the pandemic.

From these original datasets, we selected the 250 most retweeted tweets and the 250 most shared Facebook posts to analyze. Although limited in number, this sample of 250 tweets represented 45.5% of the total retweets and the 250 Facebook messages accounted for 50.4% of the total shares on Facebook. The creation of a sample is a limitation, as we do not look at less prevalent tweets and Facebook posts, but our sample provides fair representativeness of our dataset, as it accounts for over 400,000 RT and almost 1.5 million FB shares. Besides, we chose the most shared/retweeted messages because, as we explained in the previous section, retweets and shares can indicate discourses that received more attention and were perceived as more legit by the audience (Metaxas et al. 2018; Glozer, Caruana and Hibbert, 2019).

We used Content Analysis (Krippendorff, 2012) to identify disinformation and to explore the data. At first, we visited the messages and the profiles qualitatively to think about the categories to code the messages. We then created the coding framework. After that, two authors independently classified all the messages from the dataset. That is, each message of the dataset was double-coded (independently). We classified the messages based on (1) the presence of disinformation; (2) the type of account that posted the message, and (3) the discursive strategy.

In the first step, we visited each tweet and each Facebook post, examined the content, and searched for fact-checking about it. Then we classified each message regarding the presence of disinformation. Our second step was to classify the type of account that posted the message. To discuss the type of account, we created the following categories: (1) politicians, (2) activists, (3) media; (4) hyperpartisan media, (5) celebrities, and (6) others. These categories were created based on how the account identifies itself (see Table 1).

Table 1. Categories for accounts

Category	Characteristics
Politicians	Politically affiliated users. Example: political candidates, congressmen, president, ministers, etc.
Celebrities	Famous users not politically affiliated. Example: actors, humorists, artists etc.
Media	Traditional media: News outlets, journalists etc.
Hyperpartisan media	Accounts that claimed to be media outlets or to share "news" but were clearly politically affiliated.
Activists	Users and organizations with a purpose of political activism. Ex.: political parties.
Others	Ordinary accounts and users that did not fit in any of the previous categories.

Finally, we classified the discourse strategy that framed the message. This classification was based on the following categories: (1) rationalization, (2) humor, (3) opinion, (4) denunciation, and (5) other (see Table 2). These categories emerged from the original analysis of the data collected through Van Leeuwen's (2007) and Reyes' (2011) strategies. We first examined the dataset and discussed how the data was legitimized, creating the categories that were further tested through independent coding.

Table 2. Categories for Legitimation Strategies

Type of strategy	Characteristics
Rationalization	Rational argument, logical, based on theories or facts to legitimate the discourse.
Humor	Legitimation through a joke, irony, or other forms of humor.
Opinion	Opinion as the strategy to legitimate the discourse.
News	Neutral tone, presented as "news".
Denunciation	Denounces something.
Other	The message did not present any of the categories. For example: surveys.

We calculated Cohen's Kappa to test the reliability of our independent classification of the three categories in the 500 messages (Freelon, 2010). Table 3 provides a

breakdown of the coding reliability. The Kappa is considered high for most of the classifications, and substantial for the strategies, which was expected as this was a more subjective evaluation. We discussed the classifications that we did not agree on in the independent coding to reach a final classification for those messages.

Table 3. Categories for Legitimation Strategies

Category	Cohen's Kappa	
	Twitter	Facebook
Type of account	0.89	0.87
Disinformation	0.76	0.75
Legitimation strategies	0.65	0.72

Finally, we also examined the messages through Connected Concepts Analysis (Lindgren, 2016), focusing on disinformation and non-disinformation discourses to better understand their content. CCA is a method that uses content analysis as the basis. The messages are initially examined in terms of the frequency of words. To make this analysis more meaningful, similar words are classified into concepts (for example: president and Bolsonaro were put in the same category). Therefore, in the first step of CCA, we can identify the most prevalent concepts for each group of messages (disinformation and non-disinformation). This step is relevant because it provides clues to interpret the discourse of a group based on the main topics and concepts. Further on, we use CCA to identify the co-occurrences of these concepts. In this step, we understand how the topics are framed by each group based on the connections between concepts (for example, a strong connection between “China” and “Communism” indicates a particular way to frame the discussion). We created network graphs to better visualize the co-occurrences of concepts and explore to which discourse they are associated with. These graphs were created using Social Network Analysis metrics (Wasserman and Faust, 1994), to represent the most central concepts (biggest nodes) and their co-occurrences (through connections), as well as their tendency to appear together (color). In summary, CCA is a useful method to make sense of a large corpus by identifying key concepts and discursive frames based on quantitative elements (frequency and co-occurrences) and visual resources (network graph). Therefore, based on CCA, we can explore how each group of messages generally framed the discussion about vaccines on Twitter and Facebook.

5 ANALYSIS

In this section, we present our results and further discuss them. For this discussion, we compare the strategies used by disinformation and “information” content, to understand how disinformation is different for each platform.

5.1 Twitter

Most of the tweets in our sample contained disinformation. While tweets that shared “information” were more retweeted on average, the median of RT is higher for disinformation tweets. This indicates that some tweets that challenged disinformation were heavily shared but were outliers in our dataset. On the other hand, the similarities between the mean and median RT for disinformation tweets indicate that this category had a larger number of accounts with high visibility, possibly motivated by a very engaged audience, as pointed by other authors (Vosoughi, Roy and Aral, 2018). Table 4 summarizes the data.

Table 4. Breakdown of tweets in our sample per type of account

Type of account	Disinformation			Information		
	Tweets	Mean RT	Median RT	Tweets	Mean RT	Median RT
Politicians	31 (17.7%)	1468	917	11 (13.3%)	1134	790
Celebrities	32 (18.2%)	1172	802.5	12 (16%)	1956	570
Traditional Media	0	-	-	17 (22.6%)	2019	754
Hyper-partisan media	76 (43.3%)	1152	855	6 (8%)	1198	662
Activists	2 (1.1%)	701	701.5	1 (1.3%)	722	722
Others	33 (18.9%)	1098	796	29 (38.6%)	4208	1173
Total	175 (70%)	1197	825.5	75 (30%)	2623	794

Note: The percentage for the categories was separated based on the presence of disinformation (i.e., 17.7% of the tweets containing disinformation were posted by politicians). The percentage for the total considered the entirety of our sample (70% of the tweets in our sample contained disinformation).

Hyperpartisan media (highest number of tweets) and politicians (highest mean and median of retweets) played a key role in spreading disinformation. Celebrities also account for many tweets and received a high average of RT. The high number of RT of tweets posted by politicians and celebrities is likely caused by their well-established audience, as Shahi, Dirkson and Majchrzak, (2021) argued.

Tweets without disinformation were mostly shared by “others”. While this may seem odd, it happened because these were usually viral tweets from common users, which explains why their mean and median are also the highest. Traditional media, celebrities and politicians played important roles in challenging disinformation.

We also identified differences in the legitimization strategies. Table 5 provides a breakdown of how these strategies were used in each group of tweets. While

disinformation relied mostly on denunciation and rationalization, tweets without disinformation mostly used humor as a legitimation strategy.

Table 5. Legitimation strategies on Twitter

Type of account	Disinformation			Information		
	Tweets	Mean RT	Median RT	Tweets	Mean RT	Median RT
Rationalization	54 (30.8%)	1667	853	14 (18.6%)	1576	788.5
Humor	16 (9.1%)	939	661.5	32 (42.6%)	3854	1614.5
Opinion	24 (13.7%)	1042	845.5	6 (8%)	713	677
News	4 (2.2%)	723	658.5	11 (14.6%)	1274	622
Denunciation	76 (44%)	990	830	8 (10.6%)	777	570
Other	-	-	-	4 (5.3%)	1262	1029.5

Note: The percentage for the categories was separated based on the presence of disinformation (i.e., 30.8% of the tweets containing disinformation used rationalization).

Disinformation messages that relied on denunciation as a strategy often denounced the vaccine as something untested and unreliable since it "came from China, who also created the virus", putting the origin of the vaccine as a relevant and negative matter. These messages also urged the audience to share this content to inform "everyone else". Tweets that used rationalization often relied on a pseudo-scientific argument, connected to conspiracy theories (for example, citing doctors who defended the use of ivermectin and hydroxychloroquine as the cure for covid, so that vaccines were not necessary). Many of these tweets reproduced Bolsonaro's discourse about vaccines. While denunciation was the most common strategy used in disinformation tweets, rationalization was the most effective in terms of retweets. This data seems to suggest that while denunciation may raise awareness, it was the pseudo-scientific rationalization that got more endorsements on Twitter. The relevance of rationalization might be related to the affordances of Twitter as a platform that provides proper space for social or macro-level discussion, which favors the use of "logical" arguments (Recuero, Soares and Vinhas, 2021).

The use of opinion was also a relevant strategy for disinformation, as it was the third most frequent category and received the second-highest mean and median of retweets. This strategy was often linked to celebrities and politicians, who generally have many followers and thus, receive more retweets (Brennen et al., 2020). Hyperpartisan media accounts also contributed to this category by reproducing others' opinions. Opinion tweets would reproduce some falsehood claiming that it was "the opinion" of the user (this was often connected to the decision to vaccinate with the "Chinese vaccine" or "Doria's vaccine" or not).

Of the tweets with "information", the most common category was humor, which was also the category with the highest mean and median of retweets. Humor was the most frequent legitimation used by ordinary users' tweets that went viral

(“others”), although traditional media and celebrities also reproduced some of this strategy. These tweets relied on humor to challenge disinformation and seem to succeed. Many tweets made fun of people discussing the vaccine origin as a reason to not get vaccinated, for example "I don't trust the Chinese vaccine'- My dear, you trust MEN", or "Do you trust the Chinese vaccine?'- I've eaten too much highway gas station food to have this type of frills". These strategies might be effective because they use trivialization and humor to engage other users that shared similar beliefs (Chagas et al., 2019).

The second most common category was rationalization, a strategy that also received the second-highest mean of retweets. Rationalization was used to promote scientific and technical arguments to defend the vaccines. This strategy was employed mostly by politicians, but there were also viral tweets from ordinary users and some tweets from traditional media. News was mostly mobilized by the mainstream media and turned out to be a relevant strategy to challenge disinformation.

This data shows some interesting information. While humor is used as a legitimation strategy both by information and disinformation tweets, it is among real content that this approach thrives. On the other hand, opinion and denunciation had a stronger presence on the disinformation group, suggesting they are more relevant strategies for disinformation discourse. Finally, rationalization is a category that appears on both groups and seems to be equally legitimated by both, although it had a stronger impact on disinformation.

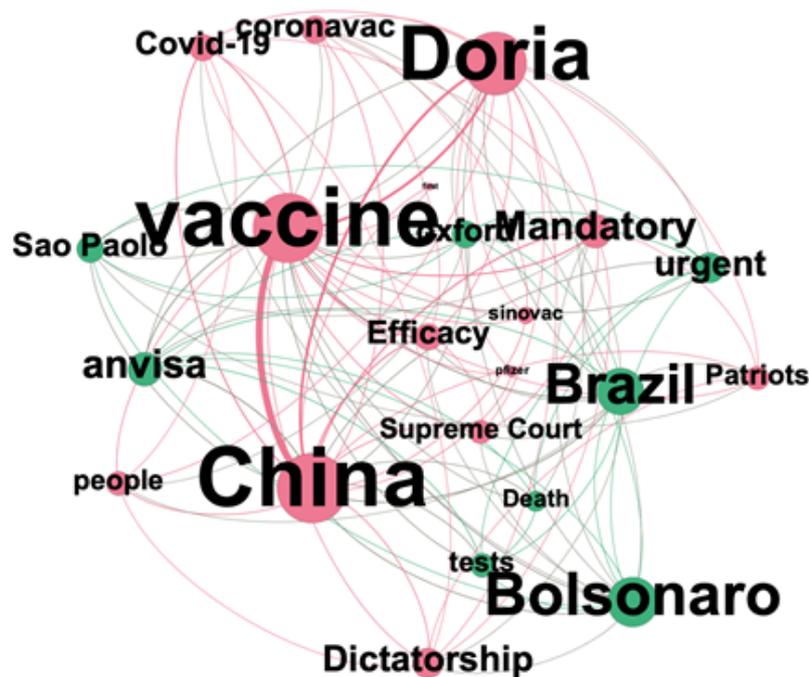


Figure 1. Connected component analysis for disinformation tweets.

To better understand the context of these tweets, we use Connected Concept Analysis to explore the main themes in the tweets to better understand the use of legitimization strategies. Figure 1 provides a systematization of these connections in the tweets containing disinformation.

When looking into these themes, we first see that the vaccine is strongly associated with Doria, Sao Paulo governor, and China, which was expected. They are also connected to concepts such as "dictatorship" and "mandatory", indicating a negative frame in disinformation tweets. Many of these tweets claimed that Doria would make vaccination mandatory in Brazil (which was false) and only "Bolsonaro" could stop this. These connections are mainly associated with tweets that relied on opinion and denunciation.

We also found a strong connection between "China" and the "efficacy" of the "vaccine", which was associated with rationalization and denunciation. In this case, we found conspiracies associating China as the "creator" of the virus to sell the "ineffective" "vaccine". Associations between "China" and the low quality of the vaccine "coronovac" and "sinovac", as well as comparisons to "Oxford" (the AstraZeneca vaccine) and "Pfizer" were also strong in this dataset. These tweets would present the origin of the vaccine as an indication of its quality.

Another important concept was "patriots", a word often used by the far right and Bolsonaro's supporters, to refer to his nationalist anti-elite discourse (Mendonça and Caetano, 2020; Watmough, 2021). In this case, we found that most tweets connected to an anti-vaccination discourse, connecting to concepts such as "individual rights". These tweets underline the far-right rhetoric present on the disinformation dataset, as many of these actors recognize themselves as "the good people" that fight for the president against the conspiracies and the "corrupted" institutions such as the Brazilian "Supreme Court". In this sense, both opinion and denunciation rely on nationalist arguments, supporting Bolsonaro and portraying China as untrustworthy. Many tweets reinforce Bolsonaro's image and rely on populist anti-establishment rhetoric (Wodak, 2015; Mudde and Kaltwasser, 2017; Rooduijn, 2019) to criticize democratic institutions such as the Brazilian agency who authorized the vaccines to be used (ANVISA) and the Supreme Court (both amongst the most central themes in disinformation tweets).

When we look at the content of the most shared tweets with real content, there is a different picture (see Figure 2). In this dataset concepts such as "American", "English", "Russian", "Oxford" and "China" are often mentioned. These concepts come from different tweets that made fun of people who wanted to choose the vaccine based on its origin, claiming that the origin did not matter. Although these tweets directly challenged the disinformation content, they also focused on the origin of the vaccine as something important. Other tweets ridicule one of the pseudo-scientific treatments defended by the anti-vaccine discourse, "ozone" therapy. There are also concepts connected to the "trust" in vaccines and referring to the Bolsonaro versus Doria political fight.

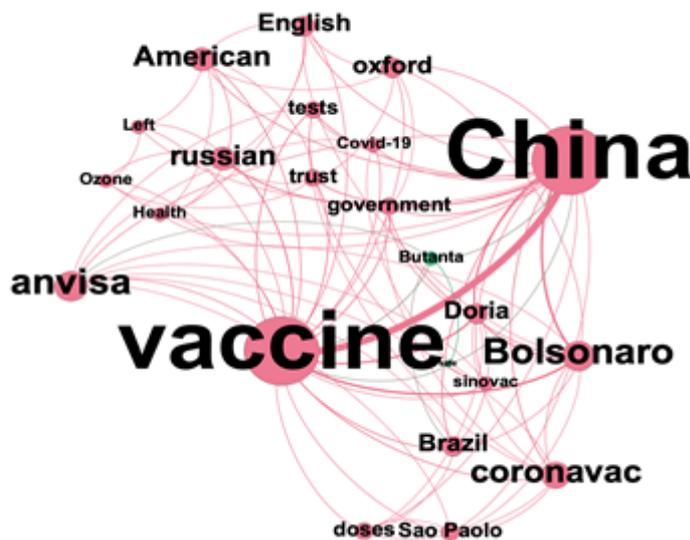


Figure 2. Connected concept analysis for tweets without disinformation.

5.2 Facebook

We now focus on the sample of Facebook posts. While the Facebook dataset had more equally distributed types of content, disinformation had a higher mean and median of shares. Table 6 summarizes the data.

Table 6. Breakdown of Facebook posts in our sample per type of account

Type of account	Disinformation			Information		
	Posts	Mean shares	Median shares	Posts	Mean shares	Median shares
Politicians	72 (56.2%)	7816.3	3605.5	62 (50.8%)	4561	3479
Celebrities	6 (4.6%)	8216	2670	9 (7.3%)	7281	7067
Traditional Media	0	-	-	20 (16.3%)	5071	2644.5
Hyperpartisan media	30 (23.4%)	5531.9	4439.5	17 (13.9%)	8351	4010
Activists	15 (11.7%)	4841.4	3149	7 (5.7%)	3041	2887
Others	5 (3.9%)	3746.6	2682	6 (4.9%)	9225	2548
Total	128 (51%)	6793	3660	122 (49%)	5554	3372

Note: The percentage for the categories was separated based on the presence of disinformation (i.e., 56.2% of the posts containing disinformation were posted by politicians). The percentage for the total considered the entirety of our sample (51% of the posts in our sample contained disinformation).

When we examined the types of accounts that shared disinformation, we found that most of them were politicians, all of them clearly stating their support for Bolsonaro on their pages. Similarly, the hyperpartisan media category comprised mostly far-right outlets and activists accounts were usually groups/pages focused on Bolsonaro or the far-right (for example: "[City's] Conservative Right"). In terms of shares, celebrities and politicians had the two highest averages, which indicates how much

disinformation is influenced by users with a large audience on Facebook. Hyperpartisan media had the highest median, indicating that this category had the more equally engaged audience.

On the "information group", politicians were also the most present category. We also found in this category three pages of Bolsonaro's supporters. In this case, the pages shared real content when it was framed according to their political agenda (for example, the news that ANVISA, the Brazilian regulatory agency for vaccines had halted the tests for Coronavac because there was a death among volunteers. However, it was omitted that the volunteer death had occurred by suicide). While the information was not false, it was used to hurt the vaccine's credibility. Among hyperpartisan accounts that shared real content, we also identified five that worked in the same light as the pro-Bolsonaro's politicians accounts.

This data suggests that politicians and hyperpartisan accounts are key for both disinformation and information spread, which indicates that the debate around vaccines was politically framed on Facebook (similar to the findings of other studies – see Recuero, Soares and Zago, 2021; Soares et al., 2021; Araujo and Oliveira, 2020). Although in small numbers, celebrities also played an important role in terms of shares (the highest average for disinformation and the highest median for information). These categories underly the importance of pages from individuals with high visibility to spread content about vaccines.

Table 7. Legitimation strategies on Facebook

Type of account	Disinformation			Information		
	Tweets	Mean RT	Median RT	Tweets	Mean RT	Median RT
Rationalization	40 (31.2%)	8030	5084.5	17 (15.7%)	6598	3768
Humor	7 (5.7%)	20126	2664	16 (12.5%)	8119	4584
Opinion	26 (20.3%)	6633	3452.5	13 (10.6%)	6633	3714
News	11 (8.5%)	4496	7305	26 (21.3%)	4496	2691.5
Denunciation	44 (34.3%)	4634	3174.5	50 (40.9%)	4650	2885
Other	0	-	-	0	-	-

Note: The percentage for the categories was separated based on the presence of disinformation (i.e., 31.2% of the posts containing disinformation used rationalization).

Rationalization and denunciation were the most used strategy in the disinformation group on Facebook. Usually, these posts articulate conspiracies against the president and focus on the Chinese origin of the vaccine and the pandemic. Rationalization often relied on pseud-scientific arguments. These posts articulate scientific-related populism to criticize pharmaceutical companies and health organizations (Oliveira, 2020), suggesting they are involved in a conspiracy.

6 DISCUSSION

In this paper, we focus on three research questions. We will organize the discussion section based on exploring these questions based on our findings. Regarding the first one, "Who are the key users for disinformation spread?", we found out that politicians, celebrities and hyperpartisan accounts were very important to the spread of disinformation on Facebook and Twitter.

Politicians were key for disinformation spread on Facebook, while hyperpartisan media was the most central category on Twitter. Their presence underlines the politically framed discussion about the vaccine and the support of the far-right for disinformation discourse in Brazil. Although less central in terms of number of tweets and posts, celebrities were also relevant to spread disinformation in terms of number of retweets and shares received. The relevance of politicians and celebrities in retweets and shares highlights the influence of prominent public figures in the top-down spread of disinformation about vaccines – a result that is in line with Brennen et al. (2020). As for actors challenging disinformation, traditional media was important on both platforms, while others (mostly common users) were central on Twitter and politicians were important on Facebook. This also points to the relevance of the affordances of each platform. The presence of viral tweets from ordinary users in our sample is due to Twitter's more public nature, where messages are more easily spread because they are not locked into groups or pages. Facebook, on the other hand, had more shares on tweets from celebrities' pages and groups, probably because these already have a large audience.

Our second research question was about "how did these accounts frame the disinformation about vaccines to gain legitimation?". We observed that **denunciation and rationalization were the strategies most frequently used for disinformation.** Denunciation messages usually referred to conspiracies about China and the vaccines, framing these through the political fight between Governor Doria and president Bolsonaro. Denunciation was also used to alert against the mandatory vaccination that would be determined by Doria (which was not true), calling people to protest "the dictator". Denunciation uses emotion to engage other users by appealing to a "possible" future where people would be coerced by the government to take the "Chinese" vaccine (a key discursive strategy identified by Reyes, 2011). Our findings indicate that **denunciation may be a key form to obtain legitimation from far-right populists' discourses in the pandemic context**, where "the virtuous" need to fight against the corruption of the political elites and "globalism" in particular (Roudjin, 2019; Mede and Schäfer, 2020; Mudde and Kaltwasser, 2012).

Rationalization, while also referring to the same conspiracy theories, used a logical strategy to reinforce pseud-scientific claims. **Rationalization suggests that anti-science populism was also very important in this context because of how these messages framed companies producing the vaccines and health authorities as**

untrustworthy (Mede and Schäfer, 2020; Oliveira, 2020). Although it accounted for fewer messages than denunciation, rationalization was key in terms of retweets and shares, which indicates that other users are more likely to endorse posts containing logical arguments to promote anti-vaccine discourse.

Another important point in this discussion is that some politicians and hyperpartisan accounts shared real content. However, **this content was framed to support disinformation**. For example, headlines (often from the mainstream media) that reproduced Bolsonaro's statement that "the government won't buy any vaccines that weren't tested and approved" are not disinformation. Nevertheless, in the context that Bolsonaro frequently discredited vaccines (especially Sinovac), these messages are framed to support disinformation discourses. This finding also indicates a concern with the journalistic practice of simply reproducing politicians' statements on headlines that might end up favoring disinformation discourses.

As for strategies to challenge disinformation, **the usage of humor was one of the most important findings**. Tweets and Facebook posts that used humor to legitimate real content had the highest average and median of retweets and shares in our sample. This is also a strategy based on the appeal to emotion (Reyes, 2011), as they make fun of disinformation content and use a strategy of trivialization to reject anti-vaccine discourse (Chagas et al., 2019). Humor was also the most prevalent strategy in the most retweeted tweets without disinformation, which is related to the discussion about Twitter's affordances and the virality of tweets from ordinary users. On Facebook, denunciation was also an important strategy that relied on criticizing Bolsonaro and his supporters for reproducing anti-vaccines discourse and boycotting Coronavac in Brazil. This strategy was associated with the high presence of politicians in our Facebook sample, which indicates the relevance of political polarization in fueling the discussion about vaccines in Brazil. This result is in line with other studies about the role of political polarization in the discussions about the pandemic on social media (Calvillo et al., 2020; Clarke et al., 2021; Gramacho and Turgeon, 2021).

Focusing on the third question, the connections between disinformation and populism, we found that **most of the legitimation strategies for disinformation relied on populist themes and concepts**, such as the "patriots" that were ready to fight against the elites (the Supreme Court, the corrupt communist governor Doria) and would fight for their leader (Bolsonaro). These discourses have a strong connection to populism, as they are also legitimated by the discursive formations that they refer to – such as the communist conspiracy against the "good people" (Wondreys and Mudde, 2020; Stecula and Pickup, 2021). These discourses often relied on denunciation strategy to legitimate their claims. We also found several pseudo-scientific claims connecting conspiracy theories about China, the virus, and scientists who developed a vaccine to mislead the public. These conspiracy theories were backed by populist discourse through opposition to traditional scientists who are framed as corrupted (Roudjin, 2019; Mede and Schäfer, 2020).

Most of the disinformation posts in our sample were framed to support Bolsonaro's claims about vaccines, which underlies the **appropriation of social media by the far-right** (Wodak, 2015) and the **usage of disinformation as a strategy to support populist leaders**. Many of these messages questioned the origin of the vaccine (China) and associate it with Communism, corruption, and conspiracies against the “virtuous people” (Wondreys and Mudde, 2020; Wodak, 2015; Oliveira, 2020). These arguments are in line with the far-right discourse in Brazil, mostly fueled by the struggle between Bolsonaro and Doria.

7 CONCLUSION

Our results point to far-right politicians, hyperpartisan outlets and celebrities as key actors in spreading and amplifying disinformation about vaccines on Facebook and Twitter. The political framing was decisive for the disinformation campaign against the vaccines. As for discursive strategies, denunciation was often used to fuel political polarization by criticizing politicians and democratic institutions that promoted vaccines. Besides, the usage of pseudo-scientific discourse (rationalization) was central to questioning vaccines' safety and efficacy and promoting distrust in vaccines.

Our findings also shed light on how populist leaders are using disinformation to support their discourse, as populism was often used to reinforce an “us” versus “them” context. This was used to oppose Bolsonaro and Communist China, Sao Paulo governor Joao Doria and the Brazilian Supreme Court (political populism); and to challenge Brazilian health authorities such as ANVISA and scientific institutions by promoting anti-vaccine discourse (scientific populism).

Another important finding is the usage of humor as an important strategy to fight disinformation. It seems that humor can legitimize the pro-vaccine discourse much more than other strategies and other actors, resulting in more spread both on Twitter and Facebook (although it was less prevalent in the latter). Denunciation was also a relevant strategy to challenge disinformation on Facebook. Both humor and denunciation deal with emotions, which might be a key element in challenging disinformation. Future studies may focus on this type of appeal to emotion to investigate how it can help fight disinformation.

This study has limitations. We used specific keywords for data collection that might have favored messages containing disinformation, as framing Coronavac as “Chinese vaccine” was part of disinformation discourses in Brazil. Besides, Twitter API and, especially, CrowdTangle have limitations, as we collect limited samples of tweets and Facebook posts. Therefore, the generalizations made in this study are based on a limited sample of tweets and Facebook posts in a particular period. Consequently, certain messages might have received more interactions after data collection. Besides, tweets and Facebook posts that were excluded or removed before data collection are missing in our dataset. Furthermore, our decision to analyze the most shared tweets and Facebook posts was due to the aim of this study,

but this also means that we did not analyze a large part of our datasets. In addition, some accounts were suspended, and posts excluded, therefore we relied only on the data provided by Twitter API and CrowdTangle to evaluate their content.

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