From Theory to Telegram: Enabling Factors of Anti-vaccine Disinformation in Brazil

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Abstract. This study addresses two central questions: (1) What enabling factors associated with information disorder are identified in the literature? and (2) Which of these factors manifest in anti-vaccine Telegram communities in Brazil, facilitating the spread and normalization of related disinformation? Combining a systematic literature review with empirical analysis of nearly 10 million posts from Brazilian conspiracy theory groups on Telegram (2016–2024), the research identifies 18 enabling factors—classified into sociopolitical and informational ecosystem dimensions—that contribute to information disorder. Of these, 11 are empirically observed in the analyzed Telegram communities. Drawing on both qualitative and computational methods—including time series, content, and link analysis—the study proposes a conceptual model that illustrates how these conditions interact and reinforce one another, creating an environment in which disinformation can flourish. The findings contribute to ongoing theoretical analyses on the sociotechnical dynamics of disinformation.

Keywords. Disinformation, Information Disorder, Anti-vaccine, Telegram
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1. Introduction

Disinformation has become one of the most pressing challenges of our time, undermining not only the integrity of information ecosystems but also social cohesion and the foundations of democratic governance. While various taxonomies and definitions have been proposed (Celliers & Hattingh, 2020; Kapantai et al., 2021), much of the existing research remains fragmented—often focused on specific platforms, actors, or mechanisms in isolation. This limited scope constrains our understanding of the full life cycle of *information disorder*, a term encompassing disinformation, misinformation, propaganda, conspiracy theories, and other phenomena that pollute the information environment. As proposed by Ricard et al. (2025), this cycle is shaped by motivated agents, technological affordances, and broader structural conditions.

We argue that addressing information disorder requires a more holistic approach—accounting for the broader social, political, and economic factors that allow disinformation to take root and spread. Prior research suggests that certain enabling conditions—such as public health crises (Pickel et al., 2022; Edwards III, 2020), sociopolitical instability, and declining trust in institutions (Dowling & Legrand, 2023; Kweon, 2023)—foster environments in which disinformation flourishes. These factors not only make societies more susceptible to disinformation but, as part of a feedback loop, are often exacerbated by it, reinforcing the very tensions that allowed it to emerge in the first place.

This study addresses two guiding questions: (1) What enabling factors associated with information disorder are identified in the literature? and (2) Which of these factors manifest in anti-vaccine Telegram communities in Brazil? We focus on Telegram due to its central role in hosting ideologically driven, loosely moderated communities that have become key hubs for health-related disinformation. During the COVID-19 pandemic, anti-vaccine narratives gained significant traction in Brazil—frequently amplified by political figures, religious leaders, and health influencers. These narratives have since persisted and expanded, undermining public trust in routine immunizations, including childhood vaccines. As a result, combatting vaccine-related disinformation has become a public health priority for Brazil's federal government.

To address these questions, we adopt a mixed-methods approach that combines a systematic literature review of 95 scholarly articles with an empirical analysis of nearly 10 million posts from public Brazilian Telegram groups (2016–2024). The study identifies and analyzes 18 enabling factors—across sociopolitical and informational dimensions—and proposes a conceptual model illustrating how these conditions interact to support the spread and normalization of disinformation. The findings aim to contribute to theoretical debates on the sociotechnical dynamics of disinformation while offering practical insights for the design of more effective public policy responses.

2. Methodology

This study employs a mixed-methods design that integrates a systematic literature review with empirical analysis. These complementary methods strengthen the validity of the findings and allow for a multidimensional examination of information disorder and its enabling conditions.

2.1 Systematic Literature Review

The systematic review followed a rigorous and transparent protocol. Keyword selection was guided by established disinformation typologies, covering the phases of creation, dissemination, and impact. Searches were conducted across four academic databases—Web of Science, Scopus, SciELO, and AIS—applying thematic and temporal filters (2016–2024), as well as quality thresholds (Q1 by SJR). A double-blind screening process narrowed the initial pool to 95 peer-reviewed articles, which were then coded using MAXQDA software. Figure 1 shows the screening flow of the studies analyzed.

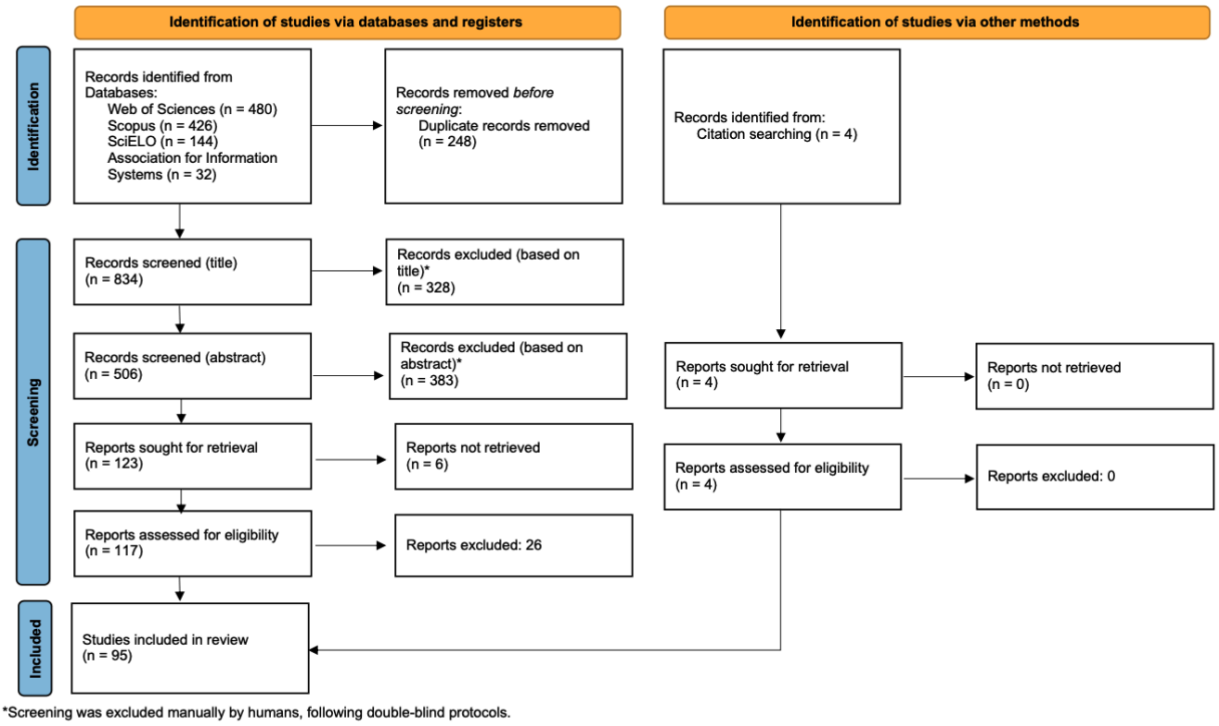

Fig. 1 - PRISMA Diagram

From this analysis, we identified 18 enabling factors that contribute to information disorder, grouped into two main dimensions: Sociopolitical Enabling Factors and Informational Ecosystem Enabling Factors. The first dimension includes the following factors: (i) Lack or loss of trust, (ii) Crises and periods of uncertainty, (iii) High levels of political polarization and ideology, (iv) Populism, (v) High levels of affective polarization, (vi) Social tensions, (vii) Historical traumas and grievances, (viii) Geopolitical tensions, (ix) Economic hardship, and (x)

Religion. The second category of factors include: (xi) Decline of traditional journalism and disintermediation, (xii) Fragmentation into partisan niches and audiences, (xiii) Infodemic, (xiv) Attention economy, (xv) New monetisation models, (xvi) Endogenous vulnerabilities of digital media, (xvii) Media consumption habits, and (xviii) Digital divide and unequal access. These 18 factors form the conceptual foundation for the empirical analysis and are discussed in detail in the subsequent sections.

2.2 Telegram Empirical Analysis

Guided by the enabling factors identified in the literature, we conducted an empirical analysis using a dataset of 10 million posts from Brazilian Telegram communities focused on conspiracy theories, spanning May 2016 to November 2024. The data were collected using TelegramScrap, an open-source tool developed by one of the authors and made publicly available with documentation for replication. The tool is publicly available, along with a whitepaper detailing its code and usage (Silva, 2023). From an initial pool of over 42 million posts from 1,612 public Latin American Telegram groups, we filtered 10,732,257 posts from 968 Brazilian communities, representing 69.8% of the dataset. Selection criteria included language, relevance of keywords, and thematic focus. All data were drawn from public groups and anonymized in accordance with Brazil's General Data Protection Law (LGPD).

Web scraping was conducted using customized Python scripts and libraries such as *requests*, *BeautifulSoup*, *Telethon*, and *gspread*. Communities were retained only if they showed consistent patterns of conspiratorial or disinformation-related activity. Posts under 10 characters or without semantic value were excluded. After processing, two core datasets were constructed: Dataset A: 10.7 million posts from general Brazilian conspiracy communities, and Dataset B: 2.2 million posts from communities explicitly focused on health disinformation (e.g., anti-vaccine, off-label drug promotion), which we refer to as "Health-related Telegram Communities (HRTC)" ahead.

This approach allowed us to trace the presence and evolution of key enabling factors across time, themes, and engagement metrics. Analyses included: Narrative and thematic mapping through keyword frequency and time series; Engagement metrics, including views, shares, and reactions; and Link-based analysis to identify dominant external domains and assess fragmentation. For enabling factors less directly measurable via quantitative metrics—such as loss of trust, populism, historical grievances, economic hardship, and grassroots information flows—we conducted qualitative observations.

3. Results: Enabling Factors of Information Disorder

3.1 Conceptual Framework

Despite a growing body of research on disinformation, there remains a lack of holistic frameworks that capture disinformation's full life cycle—from enabling sociopolitical and informational factors to impacts on society. Relatedly, while considerable attention has been paid to individual-level and psychological susceptibilities—such as cognitive biases or affective polarization—less emphasis has been placed on the broader structural dimensions that underpin information disorder.

To address this gap, we draw on the *Information Disorder Framework* (Ricard et al., 2025), that offers a holistic approach to explain how socio-political and informational vulnerabilities can be leveraged by agents of information disorder—whether politically, ideologically, or financially motivated—to strategically craft disinformation narratives responding to their interests. These narratives are disseminated through a range of tactics, impacting both the information ecosystem and society at large.

As part of this study, we focus on the first stage of the above-mentioned framework: the socio-political and informational ecosystem enabling factors of information disorder. The model posits that these factors are actively exploited by motivated agents of disinformation, who tailor narratives to resonate with existing grievances and societal divisions. Below, we outline findings from both the literature review and the empirical analysis, seeking to answer two central questions: (1) What enabling factors associated with information disorder are identified in the literature? and (2) Which of these factors manifest in anti-vaccine Telegram communities in Brazil, facilitating the spread and normalization of related disinformation?

3.2 Literature Review

This study focuses on just one of the phases of the conceptual framework presented above, the enabling factors that allow disinformation to take root and circulate. These conditions are categorized into two broad categories: (i) sociopolitical enabling factors and (ii) informational ecosystem enabling factors. The objective here is to synthesize how these factors are defined and discussed across the literature, in order to refine the conceptual model introduced above and offer a more comprehensive understanding of the structural foundations of

information disorder.

While our scope is limited to research in political science, public administration, and international relations, it is important to note that psychological and cognitive factors—such as motivated reasoning (Jiang, 2023; Enders & Smallpage, 2019), conspiratorial thinking (Yair et al., 2024; Martini et al., 2022), confirmation bias (Heckler & Ronquillo, 2019), and authoritarian dispositions (Yendell & Herbert, 2022)—are frequently cited as individual-level drivers of susceptibility to disinformation. However, such factors were intentionally excluded from our analysis, as this study prioritizes structural and collective mechanisms over individual predispositions.

The following typology summarizes the 18 enabling factors identified in the literature, categorized by their sociopolitical and informational dimensions. These factors provide the foundation for the subsequent empirical analysis of Brazilian Telegram groups and inform the development of the conceptual model described above.

Socio-political Enabling Factors

This category refers to the social, economic, political, and cultural conditions that disinformation actors can exploit to exacerbate existing societal divisions. It is consistently identified in the literature as a foundational dimension of information disorder. Historical grievances, political tensions, and cultural cleavages are frequently instrumentalized, shaping persuasive narratives that anchor and legitimize disinformation.

Lack or loss of trust: The erosion—or absence—of trust in key institutions is one of the most widely cited enabling factors of disinformation. Declining trust in government (Islam et al., 2023; Dowling & Legrand, 2023; Zimmermann, 2020), public institutions (Koc-Michalska et al., 2023), and the media (Freiling et al., 2023) reduces societal resilience and renders populations more susceptible to misleading narratives. Critically, trust erosion functions both as a condition that enables disinformation and as a consequence of its spread, reinforcing a feedback loop that deepens democratic fragility.

Crises and periods of uncertainty: Disinformation thrives in moments of social, political, or health-related crisis. The literature documents a marked increase in conspiracy beliefs and disinformation susceptibility during the COVID-19 pandemic (Kweon, 2023; Pickel et al., 2022). Edwards III (2020) emphasizes that global uncertainty heightens public anxiety, which disinformation actors exploit. These dynamics are especially visible in electoral periods, where pre-election uncertainty amplifies public vulnerability (Karekwaivanane, 2019).

High levels of political polarization and ideology: High levels of political polarization—whether ideological or affective—consistently correlate with increased exposure to and circulation of disinformation (Faris et al., 2017, cited in Keller et al., 2020; Jian, 2023; Lombana-Bermudez et al., 2022; Jungherr & Rauchfleisch, 2024). Mauk and Grömping (2023) link disinformation exposure to shifting beliefs about electoral legitimacy. Outside the electoral context, De Zuniga et al. (2023) show that different types of polarization—affective, ideological and perceived in society—play a negative role in political persuasion through socio-digital media. Research also finds that conservatives tend to be particularly susceptible to accepting and sharing disinformation (Guess, Nyhan & Reifler, 2020, as cited in Hughes and Waismel-Manor, 2021; Kweon & Choi, 2023; Enders & Smallpage, 2019; Jungherr & Rauchfleisch, 2024).

High levels of affective polarization: Defined by intense identification with one's political group and hostility toward out-groups, affective polarization increases susceptibility to disinformation that aligns with partisan worldviews (Jenke, 2022). Importantly, Jenke notes that even politically sophisticated individuals are vulnerable when content reinforces their in-group identity. Hate speech and "us vs. them" narratives, as described by Ndahinda and Mugabe (2024), are examples of this dynamic, particularly in ethnically or politically charged contexts, such as that of the Democratic Republic of Congo.

Populism: Populism both enables and is enabled by disinformation. Populist governments are associated with environments where disinformation circulates more easily (Arceneaux & Truex, 2023; Massari, 2018, as cited in Lôbo & Bolzan de Morais, 2019). Studies also suggest that belief in disinformation fosters support for populist leaders (Serani, 2023), while populist rhetoric often includes narratives conducive to misinformation, such as anti-elitism or anti-scientific sentiment (Kweon & Choi, 2023).

Social tensions: Disinformation often targets emotionally charged social issues—such as minority rights, gender roles, or race relations—amplifying polarization and outrage (Bjola & Papadakis, 2020; Balfour, 2020). Studies show how racial tensions (Yendell & Herbert, 2022; Gunther et al., 2019; Pickel et al., 2022), gender norms (Stabile et al., 2019), and broader societal inequalities are weaponized to generate conflict and undermine consensus.

Historical traumas and grievances: Disinformation narratives frequently invoke historical traumas to heighten

emotional impact and legitimacy. This includes both local and international examples, such as narratives among Vietnamese-American communities (Nguyen et al., 2023) or appeals to long-standing geopolitical distrust, as seen in Russian-Western tensions (Perl et al., 2018).

Geopolitical tensions: Disinformation narratives are often anchored in geopolitical tensions, such as the conflicts between NATO, the US, Russia and Ukraine (Bolton, 2021). These types of narratives are used to promote specific agendas or foreign interference (Dawson & Innes, 2019).

Economic hardships: Economic precarity, including unemployment, inflation, and sanctions, can intensify social frustration and reduce critical engagement with information sources. These grievances are frequently mobilized to build disinformation narratives that position specific groups or institutions as responsible for economic decline (Kermani, 2023; Hughes & Waismel-Manor, 2021).

Religion: Religiosity—particularly in its authoritarian or fundamentalist forms—is linked in the literature to increased susceptibility to disinformation and conspiratorial beliefs (Yendell & Herbert, 2022; Czech, 2022). Religious frameworks can operate as moral and political systems resistant to scientific or empirical counter-narratives, further entrenching disinformation (Hidalgo, 2022).

Informational Ecosystem Enabling Factors

These factors refer to structural weaknesses in the way information is produced, disseminated, and consumed—often shaped by technological affordances, market logics, and shifts in media habits. The weakening of traditional journalism and the consolidation of fragmented, algorithm-driven media environments that prioritize inflammatory narratives that feed the “attention economy” have altered the flow of information in ways that facilitate the spread and credibility of disinformation.

Infodemic: The sheer volume of online content—often referred to as the "infodemic"—creates challenges for information discernment. As Maati et al. (2023) note, information overload can overwhelm users, blurring the line between credible and misleading content and increasing cognitive fatigue.

Attention economy: In the digital era, information disorder is fueled by the "attention economy," which rewards content that maximizes user engagement. Algorithms—acting as gatekeepers—prioritize sensationalism and emotionally charged narratives over accuracy, systematically favoring divisive content that drives traffic (Torreblanca, 2023; Bolton, 2021; Wu, 2016).

New monetization models: Driven by the logic of the attention economy, platforms’ automated advertising systems not only permit but actively encourage the creation of websites that resemble legitimate media outlets (Torreblanca, 2023). These sites blend authentic news stories with misleading content to attract audiences and capture advertising revenue.

Decline of mainstream journalism and disintermediation: The diminishing role of traditional journalism—once the primary gatekeeper of verified information—is widely recognized as a key enabling factor (Dahlgren, 2018, cited in Bolton, 2021). As Torreblanca (2023) explains, this disintermediation has displaced professional editors and fact-checkers, allowing unverified content to circulate freely. While this shift has democratized information access, it has also increased exposure to misleading or harmful narratives (Balfour, 2020).

Media consumption habits: The relationship between media consumption habits and vulnerability to disinformation is complex and not fully agreed upon in the literature. Some studies suggest that consuming news via social media increases vulnerability to disinformation due to the platform’s structure and the prevalence of misleading information (Bjola and Papadakis, 2020; De Zúñiga, 2023; Keller, 2020). Others emphasize that indirect exposure may be similarly problematic (Gadjanova et al., 2022).

Fragmentation into partisan niches and audiences: The current information landscape is increasingly fragmented, with users engaging primarily within ideological "echo chambers" (Mauk & Grömping, 2024; Lombana-Bermudez, 2022; Krafft & Donovan, 2020). This segmentation reinforces pre-existing biases, reduces exposure to diverse viewpoints, and facilitates the uncritical circulation of disinformation.

Endogenous vulnerabilities of digital media: Digital platforms introduce unique vulnerabilities that facilitate rapid and targeted disinformation. The speed, personalization, and emotional resonance of content in socio-digital environments make it particularly potent. Torreblanca (2023) and Vićić and Gartzke (2023) emphasize how the immediacy and interactivity of digital media personalize content consumption, heightening individual susceptibility. Chernobrov (2022) further highlights dimensions such as intimacy and emotional

proximity that make users more vulnerable.

Digital divide and unequal access: Inequitable access to the internet and digital tools also shapes exposure to information disorder. In contexts such as Ghana, the digital divide creates a distinction between direct and indirect internet users, with the latter often relying on secondhand information shared by family or community members (Gadjanova et al., 2022). Limited connectivity and digital literacy compound vulnerability by reducing users' capacity to verify or contextualize content.

3.3 Empirical Analysis

To complement the literature-based typology of contextual vulnerabilities, we conducted an empirical analysis of over 10 million public posts shared in Brazilian conspiratorial Telegram groups between 2016 and 2024—including 2.2 million posts specifically from Health-Related Telegram Communities (HRTC). The aim was to assess how the vulnerabilities identified in the literature manifest in real-world disinformation ecosystems. Focusing on Telegram, one of the most active platforms for disinformation circulation in Brazil, this section examines how sociopolitical and informational vulnerabilities are referenced, reinforced, or exploited over time. The findings offer empirical grounding for the conceptual model and demonstrate that these enabling factors are not only theoretical constructs, but actively leveraged in disinformation campaigns.

Socio-political Enabling Factors

Lack or loss of trust: Although no direct empirical test was conducted for this factor, the scale and persistence of conspiracy theory communities on Telegram—reaching over 2.5 million users—already reflect a broader climate of institutional distrust. Data from the Edelman Trust Barometer show significant fluctuations in institutional trust in Brazil from 2016 to 2024, with media trust dropping from 54% in 2016 to 41% in 2019. Government trust followed a more complex trajectory: starting at 21% in 2016, rising thereafter, but falling again in 2022—an election year—to just 34%, before slightly recovering.

Crises and periods of uncertainty: We analyzed publication frequency in HRTC to evaluate surges in content during two key periods: (1) the COVID-19 pandemic (2020–2021) and (2) the 2022 general elections. As shown in Figure 2, both periods corresponded with sharp increases in activity—rising from 3,184 posts in January 2020 to 17,322 in January 2021, and peaking at 141,848 in January 2022. Importantly, post-election publication volume stabilized at a significantly higher baseline than pre-pandemic levels (e.g., 42,376 posts in January 2024 vs. 3,184 in January 2020). These findings support the notion that crises and electoral uncertainty act as catalysts for information disorder.

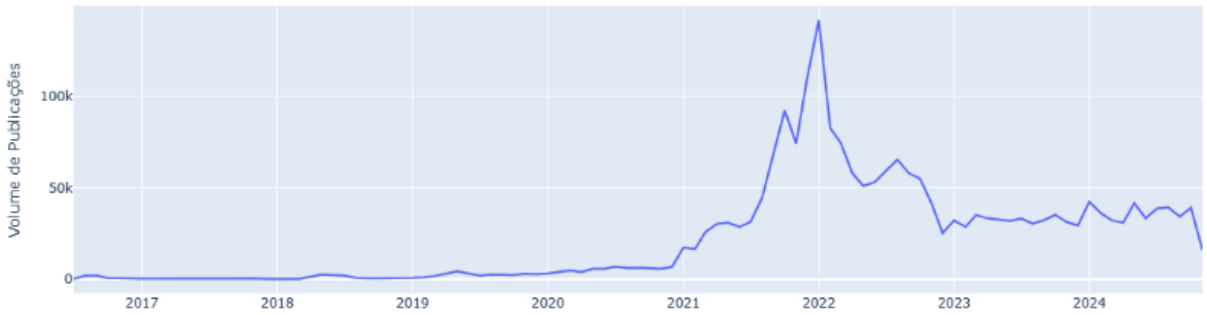

Fig. 2 - Monthly Publications in Health-related Telegram Communities (HRTC)

High levels of political polarization and ideology: To assess this factor, we conducted keyword-based semantic filtering within the HRTC dataset. More than 21% of posts (475,830) included terms linked to political affiliation or ideological bias. As shown in Figure 3, prominent keywords included "against covid," "covid vaccine," "government," "Brazil," and "United States"—frequently used in narratives alleging that authorities were concealing effective treatments or promoting globalist agendas. These narratives spiked notably during the 2022 election period (Figure 4), reinforcing the connection between political polarization and disinformation, and echoing the earlier findings on the role of Crises and periods of uncertainty.

Fig. 3 - Word Cloud illustrating Political Polarization and Ideology Terms in HRTC

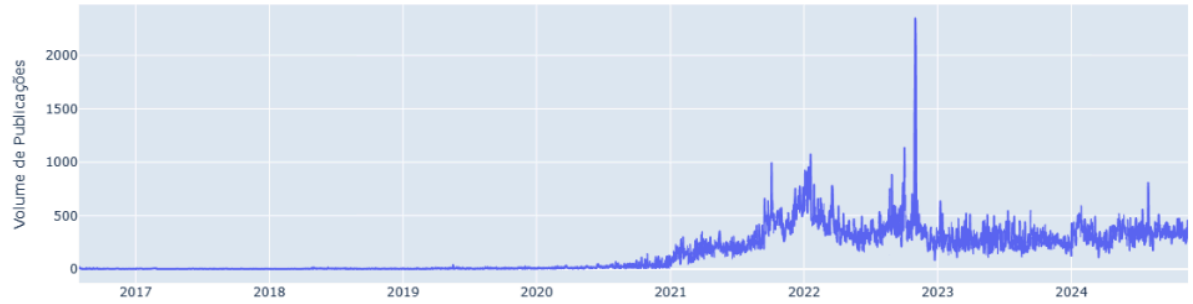

Fig. 4 - Daily Publications Including Terms Associated with Political Polarization and Ideology in Health-related Telegram Communities (HRTC)

High levels of affective polarization: We also examined how anti-vaccine content conveyed hostility toward perceived out-groups, using keyword-based filtering focused on political ideologies, social identities, and polarizing narratives. Over 13% of posts (293,522) in HRTC reflected affective polarization, frequently referencing the "new world order"—often linked to the "covid vaccine" and framed as part of a global plan to undermine "family" values (Figure 5). The term "Time" also appeared as a rhetorical device to create urgency and mobilize audiences. Like political polarization, affective polarization intensified around the 2022 elections (Figure 6), underscoring its role in reinforcing disinformation narratives.

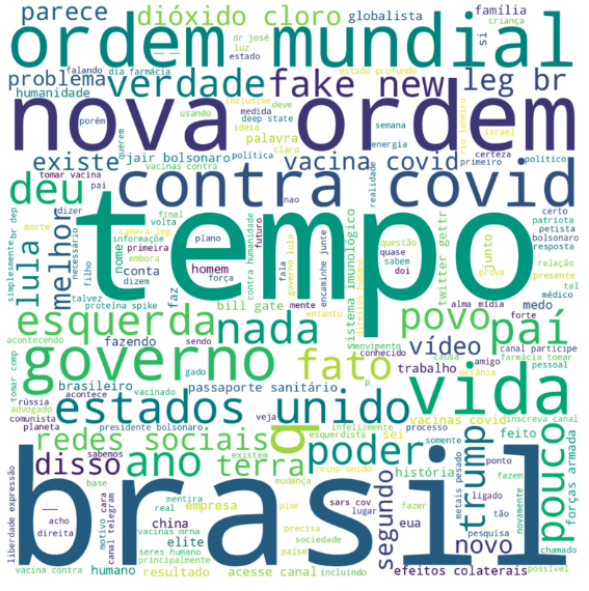

Fig. 5 - Word Cloud illustrating Affective Polarization Terms

in HRTC

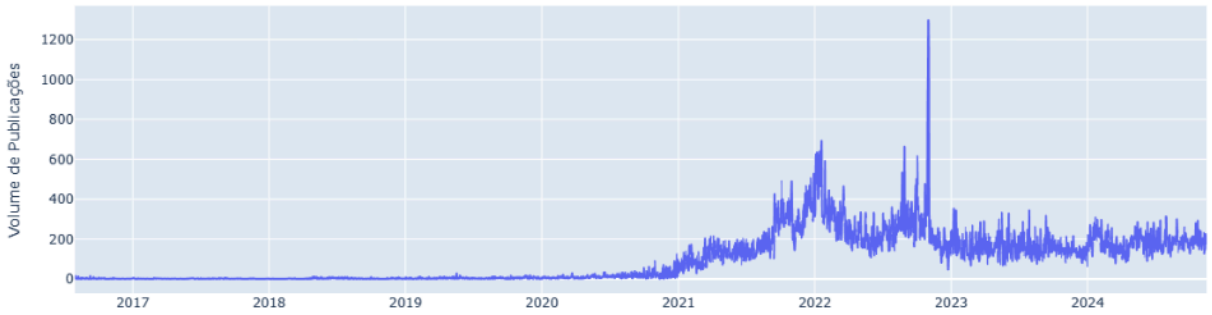

Fig. 6 - Daily Publications Including Terms Associated with Affective Polarization in Health-related Telegram Communities (HRTC)

Populism: Considering that assessing populism at scale would require a tailored methodological approach—such as discourse analysis or computational text classification—, no dedicated empirical experiment was conducted for this factor. Nonetheless, discourse patterns in the HRTC dataset suggest a populist framing. The term "elite" appeared 9,817 times, often within narratives portraying a powerful group allegedly suppressing natural or miraculous cures while coercing the public into accepting harmful vaccines. This rhetorical style aligns with the anti-elitist sentiment characteristic of populist discourse.

Social tensions: Disinformation often exploits social divisions, identity-based grievances, and cultural tensions to heighten emotional resonance and deepen polarization (Bjola & Papadakis, 2020; Vićić & Gartzke, 2024). To examine this dynamic, we analyzed the intersection of anti-vaccine narratives with moral and identity-based agendas in HRTC posts. Keywords were grouped into categories such as Racism and Ethnic Issues, Homophobia and Gender, Machismo and Women, Human Rights, Morality and Cultural Values, and Violence and Crime. Nearly 8% of posts (175,286) included terms associated with these themes. As illustrated in Figure 7, frequently occurring words such as "woman," "life," "family," and "thank God" suggest efforts to frame vaccine resistance within moral or religious discourses—indicating how disinformation narratives in Brazil are often intertwined with broader cultural and ideological fault lines.

Fig. 7 - Word Cloud illustrating Terms associated with Social Tensions in HRTC

Historical traumas and grievances: No quantitative experiment was conducted for this factor, as our methodological approach does not allow for the depth and specificity required to capture such nuanced dynamics on Telegram. Analyzing historical trauma would likely require isolating particular events and tracing their resonance within defined subgroups—an approach that is difficult to implement on a fragmented, pseudonymous platform like Telegram. Nevertheless, prior research supports the enabling role of historical grievances in the spread of disinformation. For example, vaccine resistance in Acre, Brazil, has been linked to local incidents of alleged harm from HPV vaccines (Pinheiro, 2022), while vaccine hesitancy among African-American communities in the U.S. is often rooted in a legacy of structural racism and unethical medical practices (Willis et al., 2021).

Geopolitical tensions: To study this factor, we analyzed how frequently anti-vaccine content was framed through political or geopolitical narratives, such as foreign influence or threats to national sovereignty. Unlike other analyses, we reversed our usual method by identifying health-related terms within "Globalism" and Geopolitics focused Telegram communities. Keywords were grouped into four categories: Pandemic and Vaccination; Off-Label Treatments; Anti-Vaccine Narratives; and Institutions and Authorities. Results show that over 15% of posts (104,297) in these communities connected anti-vaccine discourse to geopolitical frames—such as portraying mandatory vaccination as part of a "communist" or "fascist" agenda. Terms like "plandemic," "deep state," and "vachina" (a portmanteau of vaccine and China) were common, illustrating how global political tensions are embedded within localized disinformation narratives (Figure 8).

Fig. 8 - Word Cloud illustrating Terms associated with health in "Globalism" and Geopolitics Telegram Communities

Economic hardships: This factor was not empirically tested due to the lack of user demographic data. Without socioeconomic indicators, we can not assess how financial precarity may enhance susceptibility to disinformation.

Religion: Religious thinking—particularly in its dogmatic or fundamentalist forms—has been widely identified as an enabling factor of disinformation (Czech, 2022; Hidalgo, 2022; Yendell & Herbert, 2022). Among the sociopolitical vulnerabilities analyzed in HRTC, religious framing emerged as the most prominent. A comprehensive keyword-based thematic analysis—including terms related to Christianity, Afro-Brazilian religions, Orientalism, Judaism, and Islam—found that over 26% of posts (586,786) contained one or more religious references. The volume of such content increased significantly after the onset of the COVID-19 pandemic (Figure 9). As with the Political polarization and ideology analysis, some of the most frequent keywords were "chlorine dioxide," "against covid," and "covid vaccine" (Figure 10). These terms often appeared in narratives portraying chlorine dioxide as a "miraculous" alternative to vaccines, framed within faith-based appeals.

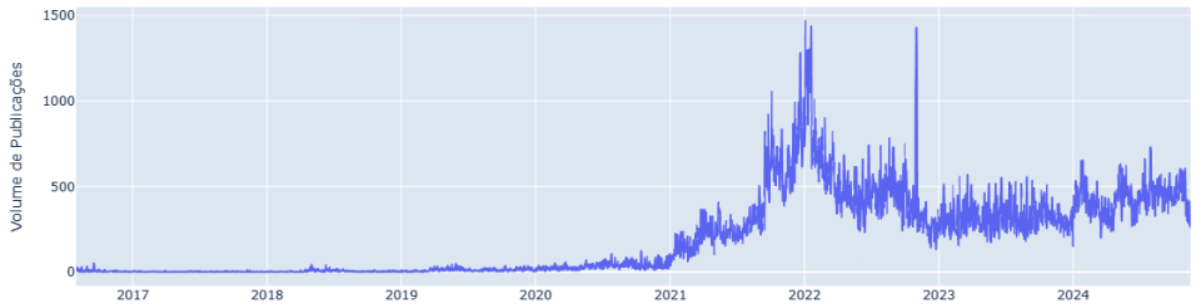

Fig. 9 - Daily Publications Including Terms Associated with Religion in Health-related Telegram Communities (HRTC)

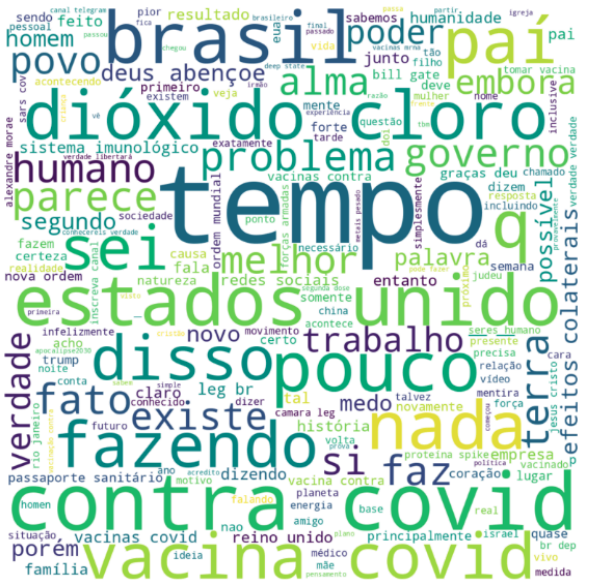

Fig. 10 - Word Cloud illustrating Terms associated with Religion in HRTC

Informational Ecosystem Enabling Factors

Infodemic: To assess the scale and dispersion of health-related disinformation, we analyzed the presence of health-related terms across the full dataset of over 10 million posts (Figure 11). Nearly 13% (1,356,611) contained health misinformation, often framed through conspiracy theory narratives. As shown in Figure 12, these posts were distributed across a wide range of communities. While anti-vaccine groups predictably accounted for the largest share, health-related disinformation was present across all thematic categories of conspiracy-oriented Telegram channels. This suggests that such content is not confined to niche spaces but circulates broadly across disinformation ecosystems. The sheer volume and diversity of topics—ranging from "covid vaccine" to "new world order," "deep state," "Lula government," and "Nazi communist"—highlight how these narratives converge and proliferate within an overloaded and chaotic digital environment.

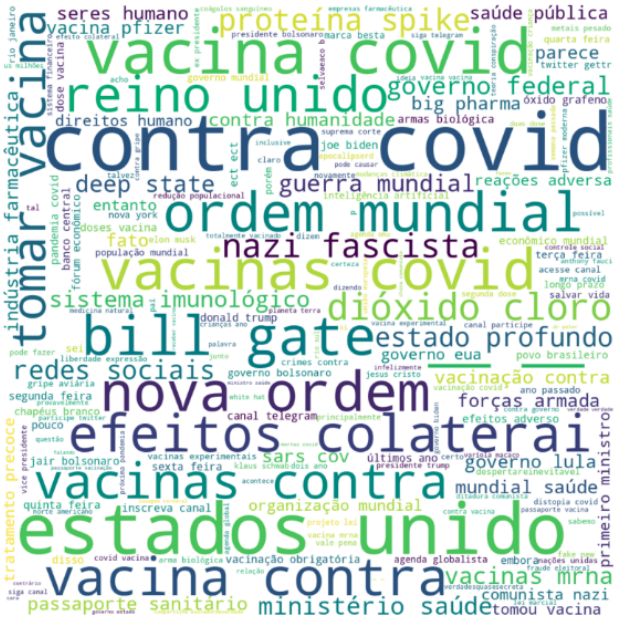

Fig. 11 - Word Cloud illustrating Terms associated with Health in all Communities from the Database

Conspiracy Theory	Volume of Health-Related Posts	Percentage of Health-Related Posts	Conspiracy Theory	Volume of Health-Related Posts	Percentage of Health-Related Posts
Anti-vaccine (Antivax)	363,745	24.28%	UFO and Universe	34,313	5.28%
New World Order (NWO)	256,611	13.83%	Climate Change	34,253	15.32%
General Conspiracies	217,708	9.83%	Revisionism and Hate Speech	17,797	7.87%
Off-label Medications	133,489	18.03%	Anti-Woke and Gender	12,324	6.32%
Globalism	104,297	15.16%	Flat Earth	10,826	3.80%
Apocalypse and Survival	80,119	10.50%	Anti-Science	10,014	6.92%
Occultism and Esotericism	39,977	5.02%	Reptilians and Creatures	3,723	6.39%
QAnon	37,415	9.40%			

Fig. 12 - Volume of Health Disinformation Publications in all Communities from the Database

Attention Economy: No empirical analysis was conducted for this factor, given that it is structurally embedded in platform logic and opaque by algorithmic design. Nonetheless, other aspects presented here—particularly the dominance of virality over interaction—offer indirect evidence of engagement-driven visibility.

New Monetization Models: Aligned with the logic outlined in the previous factor, we did not conduct an empirical analysis of monetization dynamics. Additionally, emerging monetization models—such as those used by disinformation websites that mimic legitimate outlets—fall outside the scope of the Telegram communities analyzed in this study.

Decline of Mainstream Journalism and Disintermediation: To explore the diminishing role of traditional journalism and the rise of alternative content flows, we analyzed the proportion of links shared within HRTC that pointed to social media versus other web domains. Social media platforms accounted for 53% of all shared links (453,531), while 47% (407,225) linked to websites such as blogs or news portals (Figure 13). This pattern underscores the shift away from traditional gatekeepers, with platforms now serving as primary conduits for information exposure and circulation.

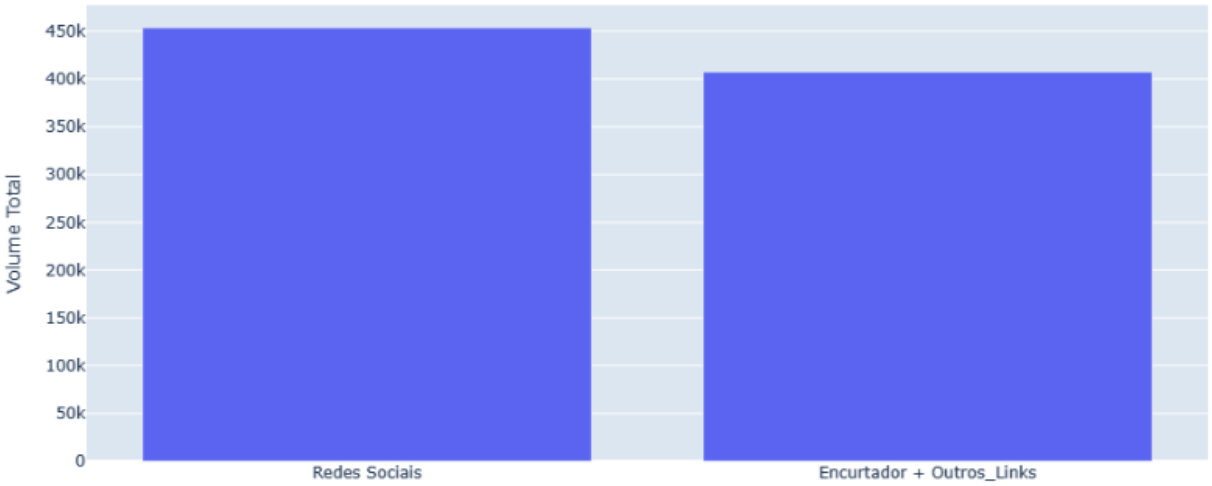

Fig. 13 - Volume of Publications with Links to Social Media and Shorten URLS / Other links in Health-related Telegram Communities (HRTC)

Media consumption habits: As noted in the literature review, the relationship between media consumption habits and information disorder is nuanced and multifaceted. Our findings reflect this complexity, with media consumption patterns in HRTC pointing to a fragmented, multi-platform ecosystem spanning both algorithmically mediated platforms (YouTube, Instagram, TikTok, Facebook, etc.) and private messaging apps like Telegram and WhatsApp. As shown in Figure 15, Telegram and YouTube were the most frequently linked platforms (164,083 and 157,184 links, respectively), together accounting for over 920 million views and 7.6 million shares. This suggests that health disinformation is primarily consumed through audiovisual and closed-loop channels—emphasizing intentional engagement within ideologically cohesive communities, rather than incidental exposure to diverse perspectives.

Fragmentation into partisan niches and audiences: Niche partisan outlets and websites tend to reinforce pre-existing beliefs rather than broaden the debate, fostering echo chambers and facilitating the spread of disinformation (Mauk & Grömping, 2024; Krafft & Donovan, 2020). To examine this dynamic, we mapped and classified the most frequently shared domains—excluding links to social media platforms—into four categories: mainstream media, partisan media, institutional websites, and e-commerce/other. The results (Figure 14) show that 75% of the most circulated domains belong to partisan media outlets, while the remaining 25% are distributed among institutional or government websites, mainstream news sources, and off-label e-commerce platforms. Notably, only five of these domains were associated with traditional media outlets (e.g., Globo and

Revista Oeste) or mainstream institutions (e.g., Instituto Butantan, PubMed, and the Brazilian Senate). The overwhelming prevalence of partisan and alternative sources suggests that information consumption in these health-related communities is shaped primarily by ideological segmentation, with users gravitating toward content that affirms their existing views.

Media Type	Domain	Frequency	Views	Shares	Media Type	Domain	Frequency	Views	Shares
Partisan Media	jornaldacidadeonline.com.br	11,643	6,298,965	28,908	Mainstream Media	g1.globo.com	3,385	3,722,605	36,827
Partisan Media	planetaprisao.com.br	9,88	6,437,356	89,643	Partisan Media	redemption.news	3,022	265,924	1,624
Partisan Media	terrabrasilnoticias.com	7,173	6,079,189	35,368	Partisan Media	reversaohumana.com.br	2,784	194,68	4,088
Partisan Media	pleno.news	6,256	3,538,826	14,758	Partisan Media	contrafatos.com.br	2,74	5,306,061	52,829
Partisan Media	tribunanacional.com.br	5,621	2,704,518	46,68	Institutional Site	www12.senado.leg.br	2,642	4,314,811	51,54
Institutional Site	butantan.gov.br	4,846	48,683	759	Partisan Media	starday.com.br	2,429	7,106,531	42,527
Partisan Media	verdadeconspurada.com.br	3,892	1,692,526	19,586	Partisan Media	revistaoeste.com	2,338	3,148,659	21,619
E-commerce	farmaciaviva.com.br	3,612	743,143	10,708	Partisan Media	gazetabrasil.com.br	2,329	1,792,147	12,172
Others	pubmed.ncbi.nlm.nih.gov	3,459	2,339,241	44,62	Partisan Media	redemption3301.blogspot.com	2,247	96,308	1,297
Partisan Media	childrenshealthdefense.org	3,404	6,292,476	78,15	Partisan Media	atrombetanews.com.br	2,152	71,549	553

Fig. 14 - Top #20 Domains Circulated in Health-related Telegram Communities (HRTC)

Endogenous vulnerabilities of digital media: We explored how Telegram's platform structure itself enables disinformation diffusion by analyzing outbound links in HRTC posts. While many links led to external platforms like YouTube, the majority redirected users to other Telegram groups—demonstrating a self-reinforcing architecture that keeps users within a closed information loop (Figure 15). Engagement metrics further emphasize this dynamic: of the recorded interactions, shares (202,134,432) vastly outnumbered comments (155,986) and reactions (563,849). This suggests that disinformation spreads primarily through passive replication rather than critical dialogue. Users act less as evaluators of content and more as amplifiers within a high-velocity, closed-circuit network.

Platform	Volume	Views	Reactions	Shares	Comments
Telegram	164,083	544,756,218	290,369	5,251,922	80,865
YouTube	157,184	376,059,835	79,73	2,425,423	36,583
Instagram	23,875	23,588,897	65,607	254,351	20,618
Twitter	19,4	39,781,885	56,49	579,712	14,339
Facebook	7,94	7,529,877	36,948	84,492	12,837
WhatsApp	4,649	4,475,881	1,755	21,735	619
TikTok	343	1,717,883	399	5,819	127
LinkedIn	205	1,418,588	117	23,682	16
Kwai	7	132	3	1	0

Fig. 15 - Volume of posts with links to Social Media in Health-related Telegram Communities (HRTC)

Digital divide and unequal access: We did not conduct empirical testing for this factor, as it requires demographic and access-related data beyond the scope of this dataset. However, prior literature strongly links limited digital access and literacy with increased exposure to second-hand, unverifiable information—particularly in regions with high reliance on interpersonal or offline information flows.

4. Discussion

Based on the 18 enabling factors identified in the systematic literature and explored in the empirical analysis, Tables 1 and 2 present a systematization of the analysis, integrating both theoretical and empirical insights. Notably, we found empirical evidence for 11 out of the 18 factors identified in the literature, suggesting that (1) socio-political and ecosystem vulnerabilities indeed contribute to information disorder, and (2) they are significantly present in anti-vaccine discourse in Brazilian Telegram communities. Although the feedback dynamics between vulnerabilities and disinformation were not the primary focus of this article, our findings underscore the importance of adopting a holistic and systemic approach to the problem.

Indeed, we observe that certain socio-political vulnerabilities may simultaneously function both as facilitators and consequences of disinformation. For example, lack of trust in institutions is widely recognized as a factor facilitating the spread of disinformation, yet it is also one of the most frequently cited outcomes of sustained exposure to disinformation (Dowling & Legrand, 2023; Kweon, 2023). Similarly, while high levels of political polarization intensify the circulation of false or misleading content, enhanced polarization is also a deliberate outcome of many orchestrated disinformation campaigns. Other vulnerabilities, while not displaying the same cyclical pattern, still illustrate how enabling vulnerabilities are leveraged by agents of information disorder. For instance, our findings suggest that both social and geopolitical tensions are used to frame anti-vaccine discourse

in Brazil.

Turning to the informational ecosystem enabling factors, the findings confirm that a weakened information environment can both enable and sustain disinformation. Overall, the infodemic — the overwhelming volume of information in today's digital societies — which blurs the line between credible and misleading content (Maati et al., 2023), acts both as a condition for and an impact of information disorder. As anticipated, the decline of mainstream journalism and disintermediation — driven by the rise of digital platforms and changes in media consumption behavior — together with platforms' affordances both contribute to information disorder.

Tab. 1 - Overview of Socio-political Enabling Factors.

Enabling Factors	Reference in the Literature	Empirical Finding
Lack or Loss of Trust	Loss of trust in the government (Islam et al., 2023; Dowling & Legrand, 2023), in public institutions (Koc-Michalska et al., 2023), and in the media (Freiling et al., 2023) enables information disorder.	No direct test conducted; presence of 2.5M users in conspiracy communities indicates trust erosion. Edelman Barometer data shows fluctuating trust in government and media (2016–2024).
Crises and Periods of Uncertainty	Crises –such as the COVID-19 pandemic– and moments of uncertainty –particularly election periods– act as catalysts for information disorder (Kweon, 2023; Pickel et al., 2022; Edwards III, 2020; Karekwaivanane, 2019).	Temporal analysis shows peaks of publications in 2021 and 2022, suggesting that the COVID-19 pandemic and the 2022 elections amplified the information disorder context in Brazil.
High Levels of Political and Ideological Polarization	Political polarization intensifies the spread of disinformation (Faris et al., 2017; Jungherr & Rauchfleisch, 2024; De Zuniga et al., 2023), with conservatives being more susceptible (Guess et al., 2020).	21.4% of HRTC posts (475,830) included politically polarized terms, linking health discussions to narratives that a "communist" government was hiding treatments, such as the "miracle cure" or the "dioxide of chlorine." Peaks align with the 2022 elections.
High Levels of Affective Polarization	Emotional identification with political groups and hostility toward opponents increase susceptibility to disinformation (Jenke, 2022; Ndahinda & Mugabe, 2024).	13.2% of HRTC posts (293,522) connected health topics to conspiracy narratives such as the "new world order," linking them to the destruction of traditional values such as "family" and "children".
Populism	Populist governments encourage the spread of disinformation, and belief in conspiracy theories increases support for populism (Arceneaux & Truex, 2023; Serani, 2023).	No empirical test was conducted, but the word "elite" was found 9,817 times in HRTC), with narratives often portraying an elite that allegedly hides miraculous medicines and cures while coercing people into vaccination.
Social Tensions	Amid disputes over narratives, disinformation exploits race, gender, and identity divisions (Bjola & Papadakis, 2020; Vićić & Gartzke, 2024).	7.9% of HRTC posts evoked "moral agendas", and terms such as "minorities," and "culture war".
Historical Traumas and grievances	Disinformation narratives use past historical traumas and social tensions to spread and legitimize disinformation (Nguyen et al., 2023; Perl et al., 2018).	No empirical test conducted.
Geopolitical Tensions	Disinformation narratives can exploit geopolitical conflicts to promote agendas of conspiracy based on prejudices and stereotypes (Zhao et al., 2024; Dawson & Innes, 2019).	In geopolitical and "globalist" communities, 15.2% (104,297 posts) linked health-related disinformation to theories such as the "plandemic".
Economic Hardships	Economic crisis and unemployment are exploited to fuel disinformation narratives (Kermani, 2023; Hughes & Waismel-Manor, 2021).	No empirical test conducted.
Religion	Authoritarian religiosity and	26.4% of HRTC posts (586,786) used

	fundamentalism increase belief in conspiracy theories, reinforcing resistance to scientific evidence (Yendell & Herbert, 2022; Czech, 2022).	religious framings, e.g. “miracle cures,” often Christian or syncretic narratives.

Tab. 2 - Overview of Informational Ecosystem Enabling Factors.

Enabling Factors	Reference in the Literature	Empirical Finding
Infodemic	Volume of information makes it difficult to distinguish between reliable and misleading content, and this confusion creates more space for disinformation (Maati et al., 2023).	13% (1.36M) of full dataset posts contained health disinfo, interwoven with other conspiracies like flat earth and "New World Order" conspiracies.
Attention Economy	Algorithms—acting as gatekeepers—prioritize sensationalism and emotionally charged narratives over accuracy, systematically favoring divisive content that drives traffic (Torreblanca, 2023; Bolton, 2021; Wu, 2016).	No empirical test conducted.
New Monetization Models	Advertising-driven revenue models incentivize misleading or sensationalist content disguised as legitimate news, exploiting algorithms to attract clicks and blurring the line between fact and fiction (Wu, 2016; Torreblanca, 2023).	No empirical test conducted.
Decline of Mainstream Journalism and Disintermediation	The rise of social digital media and the loss of traditional gatekeepers have expanded the spread of unverified content (Dahlgren, 2018; Torreblanca, 2023).	53% of HRTC posts links direct users to social media platforms, versus 47% to external portals, highlighting the predominance of social media platforms in information circulation.
Media Consumption Habits	The usage patterns of both direct and indirect exposure shape users' vulnerability to disinformation, though the relationship remains contested in the literature.	Fragmented and multi-media ecosystem, dominated by Telegram and YouTube. The prominence of long-form and intra-platform sharing suggests intentional, ideologically-aligned consumption, rather than incidental exposure.
Fragmentation into Partisan Niches and Audiences	Vehicles and niche partisan portals reinforce pre-existing beliefs instead of pluralizing the debate, forming echo chambers and engaging in disinformation (Mauk & Grömping, 2024; Krafft & Donovan, 2020).	Within HRTC, 75% of top domains shared are partisan media; only 25% link to mainstream or institutional sources.
Endogenous Vulnerabilities of Digital Media	The speed, scale, and personalization of social digital media make individuals more susceptible to disinformation (Chernobrov, 2022; Torreblanca, 2023).	Most-shared links were Telegram invites; 202M shares vastly exceed reactions/comments, suggesting virality through passive transmission, and demonstrating how disinformation networks reinforce themselves endogenously.
Digital Divide and Unequal Access	Indirect exposure among digitally excluded populations increases reliance on interpersonal (dis)information flows (Gadjanova et al., 2022).	No empirical test conducted.

5. Conclusion and Limitations

This study examined which socio-political and informational ecosystem vulnerabilities contribute to information

disorder and how they manifest in anti-vaccine Telegram communities in Brazil. Using a mixed-methods approach that combines a systematic literature review with large-scale empirical analysis, we identified 18 enabling factors and found empirical evidence of 11 of them in over 10 million Telegram posts. The results demonstrate that socio-political enabling factors—such as institutional distrust, high levels of polarization, and social tensions—and ecosystem information factors are strategically exploited within anti-vaccine discourse. Certain vulnerabilities are not only structural but cyclical: for example, loss of trust in institutions facilitates the spread of disinformation, which in turn further erodes trust. The study also finds that crises and periods of uncertainty, specially the COVID-19 pandemic and election cycles, serve as catalysts for the infodemic, accelerating the circulation of false and misleading content. From the perspective of the informational ecosystem, the study confirms that platforms like Telegram enable the amplification of disinformation due in particular to endogenous digital vulnerabilities and disintermediation. This is exacerbated by the declining trust in mainstream journalism and increasing fragmentation into partisan niches and audiences.

Importantly, this work contributes to a growing body of scholarship that reframes disinformation not simply as a problem of "truth" or technological advancements, but as a structural phenomenon embedded in broader socio-political and media systems. Addressing information disorder requires acknowledging the contextual vulnerabilities present in a given setting, understanding how they intersect, and identifying the full range of stakeholders needed to develop sustainable, multi-level responses. Our findings suggest that effective responses must go beyond fact-checking and digital literacy. Sustainable interventions must address the structural conditions—both socio-political and informational—that allow disinformation to take root and flourish. This may include rebuilding institutional trust and developing platform governance strategies that recognize contextual vulnerabilities that enable disinformation, but further research is needed.

Certain limitations must be acknowledged. First, by focusing exclusively on Telegram, the findings reflect the dynamics of a single platform characterized by minimal moderation and high user anonymity. While this choice enables in-depth analysis of a key disinformation hub in Brazil, it limits generalizability to other platforms. Second, the study does not include psychological or individual-level variables—such as cognitive bias or conspiratorial thinking—which may further influence user susceptibility. While this aligns with our focus on systemic vulnerabilities, future research could integrate micro-level analyses to better understand how personal factors interact with broader socio-technical enabling factors. Third, this article does not evaluate nor propose policy solutions. Instead, our findings lay the groundwork for future studies to propose policy interventions addressing the identified enabling factors –beyond the prominent measures such as media literacy– that could address information disorder from a more systematic perspective. Future research should explore how information disorder operates across multiple platforms, how it intersects with offline behaviors, and how structural and individual-level vulnerabilities interact.

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Data/Software Access Statement

TelegramScrap, an open-source tool developed by one of the authors, was used for Telegram data collection and analysis. The tool is publicly available with documentation for replication: https://github.com/ergoncugler/web-scraping-telegram.

Contributor Statement

Julie Ricard: Conceptualisation, Methodology, Literature Review, Writing-Original Draft, Writing – Review & Editing, Supervision. Ergon Cugler: Methodology, Software, Visualisation, Writing-Original Draft, Ivette Yañez and Leticia Hora: Literature Review, Writing-Original Draft, Writing – Review & Editing.

Use of AI

During the preparation of this work, the author(s) used Google Translate in order to translate content from Portuguese to English. Authors also used GPT 4.o to summarize findings for systematization tables. After using these, the authors reviewed, edited, made the content their own and validated the outcome as needed, and take full responsibility for the content of the publication.

Conflict Of Interest (COI)

There is no conflict of interest.

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