

From Activism to Radicalization: The Evolution of Vaccine Disinformation in the Brazilian Social Media Ecosystem (2021–2025)

Del Activismo a la Radicalización: La Evolución de la Desinformación sobre Vacunas en el Ecosistema Brasileño de Redes Sociales (2021–2025)

Originales

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Abstract

Introduction: This article analyzes the evolution of the vaccination discourse in Brazil on the X platform, comparing the civic mobilization of 2021 with the radicalization and collapse of dialogue observed in 2025.

Objectives: To analyse “Platform Effect” as the central variable explaining the discursive shift over time.

Methodology: A comparative-longitudinal approach was used, employing semantic network analysis and co-occurrence graphs to map narratives and ecosystems across both periods. **Results:** Findings indicate that in 2021, platform architecture reduced organizing costs (Shirky), facilitating pro-vaccine activism. In contrast, 2025 shows the consolidation of radical niches where disinformation is quantifiably relevant, attributed to the reversal of *affordances*. The algorithmic prioritization of conflict and emotional intensity elevated contestation costs for scientific voices (Gillespie), creating a discursive vacuum. The anti-vaccine discourse became a “cultural war” against the PNI. **Conclusion:** The fight against disinformation is inseparable from the debate on the regulation and design of digital architecture, given the severe threat to public health and democratic integrity.

Keywords: Disinformation; Vaccination; Social Media; Immunization Programs; Public Health

Resumen

Introducción: Este artículo analiza la evolución del discurso sobre la vacunación en Brasil en la plataforma X, contrastando la movilización cívica de 2021, con la radicalización y el colapso del diálogo observados en 2025. **Objetivos:** Analizar “Efecto Plataforma” como la variable explicativa central de esta inflexión discursiva.

Metodología: Se empleó un método comparativo-longitudinal con análisis de redes semánticas para mapear las narrativas y los ecosistemas en ambos periodos. **Resultados:** Los hallazgos muestran que en 2021, la arquitectura redujo los costos de organización (Shirky), facilitando el activismo provacuna. En fuerte contraste, el escenario de 2025 revela la consolidación de nichos radicales, donde la desinformación es cuantificablemente relevante. Esta inflexión se atribuye a la reversión de las *affordances*: la prioridad algorítmica al conflicto elevó los costos de contestación para las voces científicas (Gillespie), generando un vacío discursivo. El discurso antivacuna trascendió de la crítica puntual, transformándose en una “guerra cultural” contra el PNI.

Conclusión: La lucha contra la desinformación es inseparable de un debate sobre la regulación y el diseño de la arquitectura digital, dada la amenaza a la salud pública y a la integridad democrática.

Palabras Clave: Desinformación; Vacunación; Medios Sociales; Programas de Inmunización; Salud Pública.

Introduction: From Activism to Radicalization

The visual allegory of crisis and social disintegration finds a paradigmatic representation of the limit of the human condition in Théodore Géricault's *The Raft of the Medusa* (1819). The work transcends the factual record of the shipwreck to construct a microcosm of disorder and precariousness, in which the agonizing co-existence of exhausted bodies highlights the collapse of hierarchies in the face of the struggle for survival. By capturing the moment of faint hope, sustained by a desperate collective effort, Géricault offers a compelling metaphor for the fragility of the social bond under chaotic conditions. This image, of a group adrift in search of salvation, projects itself as a mirror for contemporary crises. It is within this horizon of social fragility that the dual current crisis event is inscribed: the sanitary crisis and the communicational crisis, the latter marked by the so-called infodemic. The term designates the excess of information, some accurate, others misleading, which makes access to reliable guidance difficult (OPAS, 2020). Recent studies emphasize that the infodemic not only increases informational confusion but also undermines adherence to public health measures and complicates scientific communication processes (Fagá, Cyrino & Teixeira, 2025). In Brazil, this phenomenon reveals a paradox: the country that built a globally recognized National Immunization Program (PNI) is now facing an abrupt drop in its vaccination coverage rates. According to the 2025 VacinaBR Yearbook, between 2000 and 2023, childhood vaccination coverage showed a continuous decline, which intensified after 2020, and none of the national calendar vaccines met coverage targets in all Brazilian states in 2023. One of the main causes is disinformation, which, converted into a force of symbolic disaggregation, undermines social cohesion. Thus, the need arises to understand how it is structured and propagates in the digital ecosystem.

Although the Covid-19 pandemic intensified the denialist debate and strengthened anti-vaccination groups, the phenomenon was not restricted to Brazil. Morejón-Llamas (2023) demonstrates that vaccine misinformation became a significant challenge throughout Latin America, particularly through narratives questioning vaccine safety, efficacy, and adverse effects. In Brazil, the 2021 scenario was nevertheless marked by pro-vaccine mobilization on platforms like the former Twitter, articulated by emotion, an appeal for collectivity, and an alliance between science and influencers, as previously shown by Chinazzo Müller (2024b). In contrast, in the 2025 media ecosystem, we see the platform, now called X, consolidating itself as a channel for radicalized disinformation where false or decontextualized information and conspiracy theories circulate with the aim of discrediting all types of immunizers. The observed evolution reflects the exhaustion of a collective communicational pact that, during the pandemic, sustained the pro-vaccine discourse and trust in science. The topic stopped occupying the center of public attention and lost its affective urgency, while platforms relaxed their moderation policies and maintain an algorithmic logic that favors conflict and emotional saturation. We argue that this change is not accidental, but a symptom of what we call the "platform effect".

In light of this transformation, the present research seeks to answer the following question: to understand how discourses on vaccination in Brazil evolved, in the environment of the X platform (formerly Twitter), from a space of civic mobilization in 2021 to an ecosystem marked by radicalization and the circulation of disinformation in 2025. The central problem guiding this investigation concerns the effects of changes in the platform's *affordances* and algorithmic architecture on the configuration of the public debate about vaccines: to what extent did these technical transformations contribute to the discursive shift observed in the period? To answer this question, the general objective is to analyze the evolution of narratives and discursive ecosystems regarding vaccination on X, comparing the two temporal contexts. Specific objectives include: mapping the strategies of pro-vaccine digital activism in 2021 and the main anti-vaccine narratives circulating in 2025 based on semantic analysis and the main hashtags used in each period; quantifying the

prevalence of vaccine disinformation on X in 2025; and investigating the “platform effect” as an explanatory variable for the observed discursive transformation.

The relevance of this work is evident in both the social and academic spheres. Socially, it addresses a public health crisis that threatens historical achievements, revealing the deep erosion of trust in science and institutions. Academically, the article contributes to studies of communication, disinformation, and digital culture by demonstrating how classic theories of network activism need to be re-evaluated. In a context of platformization, where technological architecture plays a central role in modulating public debate, the fight against disinformation requires constant updating of our analytical lens. To develop this analysis, the article is organized into the following sections: theoretical foundation, which outlines the conceptual framework on digital activism and disinformation; methodology, which describes the research design and analytical procedures; results and analysis, which explore the empirical evidence; discussion, which integrates the findings with the theoretical framework; and final considerations, which present the implications and future directions of the research.

From Collective Action to Network Mobilization (Analysis of ‘Act I’ - 2021)

The intense pro-vaccine mobilization in 2021 demands a conceptual framework capable of explaining the rapid and effective organization of civil society around collective health. To this end, we resort to the logic of networks by Manuel Castells (2015), who interprets contemporary social movements based on the redefinition of their organizational dynamics. The author argues that networks replace hierarchical structures with collaborative and rhizomatic forms. This structural transformation is crucial for understanding how resistance and civic engagement manifested in a distributed manner. The substitution of order for fluidity is, therefore, the initial lens for the analysis of Act I.

Castells (2015) further maintains that networked movements are primarily catalyzed by feelings of indignation and hope for social transformation, overcoming societal inertia. This perspective is essential for understanding how generalized frustration with the sanitary crisis was channelled into a collective pro-vaccine effort, based on the hope of rescue through science. In this model, communication acts as the territory of political action, where common identities and objectives are constructed. Pro-vaccine engagement thus becomes a manifestation of political optimism.

The effectiveness of this rapid organization is complemented by Clay Shirky’s (2009) view on the power of digital technologies in collective action without the need for formal institutions. Shirky focuses on the reduction of coordination costs made possible by platforms, simplifying the logistics of networked mobilization. This allows for the effective articulation of previously dispersed individuals around common causes. This dynamic explains the readiness with which diverse actors - from health professionals to influencers - were able to intervene in the public space in 2021. The result is the overcoming of bureaucratic inertia by the fluidity of civic self-organization.

Shirky’s (2009) model highlights how participation in crises can bypass centralized formal institutions to create social impact. Success lies in organic network initiatives that compensate for failures in official communication. This was evident in the Brazilian pandemic response: despite limited federal government mobilization and open anti-vaccine rhetoric from the then-President Jair Bolsonaro, social media users - including scientists, artists, and citizens -

The central argument is that this transition is explained by the «platform effect»: the architecture of X, which initially (2021) reduced the costs of organization for pro-vaccine mobilization, subsequently (2025) reversed this affordance, drastically increasing the costs of contestation for scientific voices

spontaneously organized. This capacity for fluid, self-organization became the central hallmark of Act I, overcoming state inertia and bureaucratic rigidity. To analyze these everyday discursive practices, we use Henry Jenkins's (2013) participatory culture framework, which examines content re-signification. Jenkins emphasizes users' ability to remix memes and affective posts, assigning them new meanings within network dynamics. This content fluidity is vital for cultural engagement and establishing a deeper connection with the pro-health message.

This dynamic of creation and appropriation – as theorized by Jenkins (2013) – allows institutional content, often technical, to be transformed into something popularly consumable. This process of re-signification establishes a cultural and affective bond with the general public, going beyond the mere transmission of data. The pro-vaccine discourse, by leveraging memes and other forms of humour, gains greater accessibility and capillarity in the digital environment (Chinazzo Müller, 2024a). Thus, these meme contents consolidate themselves as a powerful mobilization tool in the sphere of collective health. The pro-vaccine discourse, by appropriating memes and other forms of humour, gains greater accessibility and capillarity in digital circuits.

The 2021 mobilization should be read through the lens of Health Communication, which transcends the mere transmission of technical data to appeal to the emotional sphere. The effectiveness of the pro-vaccination campaigns was thus directly related to the capacity to articulate reason and emotion in messages. As highlighted by Schiavon and Barcellos (2021), this focus is a key element for social adherence and should not be perceived as noise. In this sense, empathy acts as a crucial mobilizing factor for establishing bonds and expanding civic engagement. By mobilizing affective repertoires, communication becomes capable of translating biomedical discourse into meaningful and shareable narratives, strengthening public trust and the effectiveness of institutional campaigns. The success of the “*Vacina Sim*” campaign and the use of emotional testimonials in 2021 demonstrated the prioritization of affect as the most effective communication strategy to disarm initial resistance and create a narrative of collective care. In this context, the PNI (National Immunization Program), a symbol of excellence in public health, was culturally re-signified in the digital environment. This networked mobilization was an organic and effective response to the crisis of trust, using the architecture of the platforms to generate social cohesion and sustain the program as a non-negotiable value.

Collective action, therefore, proved to be more flexible and resilient than traditional models, utilizing the architecture of the platforms to create discursive coherence and social belonging. This mobilization was sustained by the fluidity of affective bonds, which allowed for rapid adaptation to the crisis and the overcoming of bureaucratic inertia. This flexibility, which prospered on digital platforms like the former Twitter in 2021, will be contrasted with the rigidity and fragmentation of the radicalization niches observed in 2025.

Disinformation Ecosystems and the ‘Platform Effect’ (Analysis of ‘Act II’ - 2025)

To interpret the migration and consolidation of radical discourse on channels like X in 2025, the theoretical focus shifts to platform architecture and disinformation systems. This conceptual move is crucial because the crisis of trust demands that analysis transcends the simple evaluation of content, focusing instead on the environment that propagates it. The fragility of social dialogue in the digital ecosystem obliges us to understand the transition from narrative dispute to the entrenchment of beliefs. Therefore, it is indispensable to attempt to look at the technological variables that modulate how radical discourse gains visibility and cohesion, allowing for a more robust investigation into the collapse of the debate.

The anti-vaccine discourse in 2025 needs to be analyzed as a disinformation system (Recuero, 2024), which involves a complex intersection of technology, politics, and economy. This systemic approach is essential for going beyond simple content analysis and understanding the purpose of the radical discourse. The problem lies in the intentional creation of an ecosystem that sustains disbelief, and not merely in accidental error. Understanding its architecture is essential for developing effective public health strategies capable of dismantling this network of disbelief. As Fagá, Cyrino and Teixeira (2025) argue, contemporary health communication faces the challenge of simultaneously promoting scientific information and confronting increasingly sophisticated forms of misinformation, requiring coordinated action among researchers, institutions, communicators, and digital platforms.

Although the typology proposed by Wardle & Derakhshan (2017) - which distinguishes misinformation (unintentional error) from disinformation (deliberately misleading content) - is widely used to classify different forms of false information, this distinction proves less relevant in the current context of digital networks. Platforms like X operate through algorithms that prioritize content with a high potential for engagement, which favors the circulation of polarizing, emotional, and controversial messages - characteristics common to all categories of informational disorder, especially disinformation. Even if some users share false information believing in its veracity, the system that sustains and amplifies these messages is rooted in a logic of visibility that, ultimately, favors strategies of deception. For this reason, we adopt the concept of disinformation here to encompass this informational ecosystem in which individual intentionality is diluted in the face of a structural dynamic that incentivizes and propagates the false.

Considering this, the central thesis of this article lies in the analysis of the “platform effect,” drawing on authors such as Tarleton Gillespie (2010) and José van Dijck et al. (2018) to explain the radicalization. The argument is that the architecture of X (its *affordances* and moderation) does not constitute a neutral stage, but rather an actor that actively amplifies the radicalization of discourse. This technological architecture must be viewed as a determining variable in the polarization of the debate, directly influencing public health. The platform shapes the type of discourse that thrives, making it co-responsible for the radicalization.

The vocabulary of platform theory allows for the analysis of how the *affordances* (potentialities and constraints) of X favor the circulation of affective discourses, especially those marked by intense emotional charge, personal narratives, and polarizing positions. The platform’s algorithmic function prioritizes content that arouses emotions—such as empathy, indignation, or fear—because these reactions lead users to engage with publications through likes, shares, and comments. This occurs to the detriment of informative, explanatory, or scientific posts, which adopt a neutral and analytical tone, focusing more on rationality and, therefore, being less effective in generating immediate emotional responses. As Van Dijck et al. (2018) point out, the technical design of platforms shapes the forms of social interaction and the visibility of topics and content. In the case of X, its model contributes to the emptying of public debate, the devaluation of forms of knowledge that do not fit the dominant emotional logic, and the rise of radicalized discourses.

The “platform effect” thus explains why disinformation persists and strengthens in these environments where its algorithmic survival is guaranteed (Gillespie, 2010). The sustenance of this argument lies in the fact that X, with its potentially looser moderation policies since the acquisition by Elon Musk, has become fertile ground for narratives that continuously attack science. The platform, by prioritizing engagement over accuracy, guarantees the longevity and reach of radical discourse in specific niches. Thus, the architecture of X becomes an active agent in the consolidation of institutional distrust and vaccine hesitancy.

The radicalization of beliefs in 2025 is intensified by psychosocial and technical mechanisms, named as “echo chambers” and “filter bubbles” (Pariser, 2011). These phenomena occur when users are exposed mainly to information that confirms their pre-existing beliefs, limiting the diversity of opinions. In these niches, internal validation becomes the main driver of radicalization, independent of external facts or scientific consensus. This dynamic reinforces ideological entrenchment through the creation of communities impermeable to public health discourse.

The entrenchment of narratives resulting from these psychosocial mechanisms explains the consolidation of the anti-vaccine discourse in specific niches, according to initial mappings (Chinazzo Müller, 2024a, 2024b). This discursive rigidity allows radicalization to be sustained by the absence of confrontation and the continuous validation of internally accepted conspiratorial views. The niche thus becomes completely impermeable to rational debate, which is a crucial factor in characterizing the collapse of dialogue. This dynamic weakens the public sphere and collective health.

The architecture of X, by potentially rewarding polarized or sensational content for generating quick engagement, actively contributes to a discursive vacuum in the health debate. This means that qualified, evidence-based messages are obscured or lose algorithmic visibility in favor of the extreme. The result is that the cost of organizing the counter-discourse rises drastically for public health. The defense of science then begins to demand a much greater effort and resources to demystify disseminated error.

In this context of entrenchment, the conspiratorial narratives of 2025 become more aggressive and comprehensive, moving to attack not only the COVID-19 vaccine but the entire PNI vaccination calendar. The anti-vaccine discourse transcends the specific criticism of the virus to take on an evident character of a cultural war against science and established institutions. The essence of the public health system becomes the main target of distrust and radicalization. This doctrine aims to undermine confidence in the Brazilian immunization policy in its entirety.

The analysis of the “platform effect” (Gillespie, 2010) allows for the establishment of a fundamental contrast with the 2021 mobilization scenario. While at that time the platform reduced the costs of organization for pro-vaccine activism (Shirky, 2009), in 2025 it increases the costs of contestation for scientific voices. This inversion occurs because the algorithmic architecture privileges conflict over cohesion. The direct result of this architectural asymmetry is the collapse of dialogue and the flourishing of disinformation, consolidating the radicalized niche.

The role of the PNI (the Brazilian National Immunization Program) changes drastically, shifting from a symbol of hope and excellence in 2021 to the central target of attack in 2025. This transition from criticisms and disinformation content specifically about the COVID-19 vaccine to the radicalized doctrine against the entire vaccination calendar is the essence of our comparative study, according to initial mapping by Chinazzo Müller (2024a, 2024b). The erosion of trust thus extends to the entire public immunization policy, threatening historical achievements. This evolution proves that radicalization aims to undermine the foundations of national collective health.

Understanding these mechanisms proves crucial for collective health to develop communicational strategies capable of breaking through echo chambers and reversing the radicalization cycle. This requires that interventions actively consider the architecture and affordances of each digital platform, adapting the message to the environment in question. An effective response to radicalization necessarily involves media and technological literacy for both the general population and health professionals. Only in this way will it be possible to reestablish dialogue and trust in scientific knowledge.

Methodology

The research design adopts a mixed-method approach with a comparative-longitudinal structure, essential for capturing the evolution of the discursive ecosystem on social networks over time. The design intentionally focuses on two contrasting moments: the peak of the public debate about vaccination in Brazil and the social mobilization in favor of immunizers when the vaccination against Covid-19 began in Brazil, in January 2021 ; and the more recent scenario, marked by the consolidation of anti-vaccine discourses on X, in May, June, and July of 2025. In the 2021 period, all publications with terms related to vaccination on Twitter were collected during the week of January 13 to 21. The resulting data volume, 2,976,197 publications , is extremely expressive and highlights the intensity and centrality of the debate at that time. By 2025, the scenario is significantly distinct, as the debate about vaccines shows lower visibility and volume of interactions on X. For this reason, we chose to extend the collection interval to three months, seeking to build a more robust base for analysis, in total approximately 127,673 publications.

The selection of these two specific time points - 2021 and 2025 - is a deliberate methodological choice grounded in the most different systems design (Przeworski & Teune, 1970), widely adopted in comparative communication research. The contrast between the two periods is the analytical instrument itself: 2021 represents the peak of civic pro-vaccine mobilization under the original Twitter architecture and active moderation policies, while 2025 captures the post-acquisition environment under reversed affordances. Including intermediate years would dilute this structural contrast and expand the study scope without adding explanatory value for the central variable - the platform effect. This binary comparison allows for precise isolation of the discursive transformation attributable to architectural and moderation changes on X.

Starting from these already processed datasets, two movements were performed: 1) Visualization of hashtag graphs, with the objective of mapping the most commented topics in each period; 2) Visualization of semantic graphs, with the hundred most frequent terms and their associates, allowing the identification of narrative patterns in each period. For these movements, Social Network Analysis (SNA) was fundamental for identifying semantic and bimodal networks of actors and hashtags. The visualizations were performed using the Gephi software, whose metrics, such as in-degree and modularity, demonstrate the hierarchy of the hashtags and terms, as well as revealing the cohesion and antagonism of the vocabulary around the users' values and worldviews.

The visualizations were performed using Gephi (version 0.10), a tool internationally recognized and widely adopted in Social Network Analysis research across communication, information science, and public health (Bastian, Heymann, & Jacomy, 2009). From a mathematical and statistical standpoint, Gephi implements the same modularity detection algorithms (Blondel et al., 2008), centrality metrics (degree, betweenness, closeness), and semantic co-occurrence analysis procedures available in R packages such as *igraph* and *tidygraph*. The choice of Gephi over R was motivated by its robustness for large-scale networks (exceeding 100,000 nodes) and by the transparency of its interactive graph visualizations, which is essential for communicating discursive patterns in academic publications. The platform difference lies in the interface and visual output capabilities, not in the underlying statistical rigor.

This methodology allows us to understand which narratives were prominent, how they articulated discursively, and to what extent these narratives were shaped by the *affordances* and algorithmic architecture of the platform. This last dimension constitutes a central variable in the analysis, allowing us to empirically test the concept of the "platform effect" (Van Dijck et al., 2018) , which is the influence of the technical configurations and operational logics of the platforms on the discourses circulating within them. By observing how changes in the architecture of X in recent years

directly affect the radicalization of the anti-vaccine discourse, we seek to understand both the transformation of content and the mediating role of technology in structuring disinformation ecosystems.

Results and Analysis

This section presents and interprets the research findings, structured around two contrasting analytical acts. Act I consolidates the pro-vaccine mobilization strategies on the former Twitter in 2021, and Act II confronts that basis with the radicalization observed on X in 2025.

Act I (2021) – The Dispute over Trust: Activism and Affect on the Former Twitter

The analysis of publications about Covid-19 vaccination on X, during the week of January 13 to 21, 2021—the initial milestone of the immunization campaign in Brazil - reveals a discursive ecosystem strongly mobilized in defense of vaccination, characterized by multiple strategies of engagement and digital activism. In this context, communicative practices are observed which, while confronting disinformation, celebrate science, build narratives of hope, and mobilize affect, playing a central role in forming a public opinion favourable to immunization.

One of the most recurrent strategies was the active fight against disinformation, with publications that ironize or deconstruct false or misleading content about vaccines. These messages, often marked by humour and sarcasm,

highlight the incoherence of conspiracy theories or anti-vaccine discourses. An example, shared over 40.8 thousand times, compares vaccine hesitancy with popular consumption practices: “‘Would you trust a vaccine from Russia?’ My son, I’ve eaten instant noodles and roadside snacks too many times in this life to have that kind of criteria”. This type of content combines criticism and popular identification, functioning as a form of emotional and political engagement.

Between 2021 and 2025, a significant increase in disinformation is observed. Approximately one third of the posts analyzed in 2025 presents anti-vaccine content, vaccine hesitancy, or misleading information

Another important strategy was the exaltation of science and public institutions, especially the Unified Health System (SUS), researchers, universities, and health professionals. Many messages celebrated the emergency approval of the CoronaVac

and AstraZeneca vaccines as a collective achievement and a historic milestone. Trust in science and recognition of the efforts of the professionals involved appeared prominently, promoting a narrative of gratitude and national pride.

Affective mobilization also appears strongly in discourses of hope and positive expectation, in which users express optimism about the start of vaccination and the prospect of returning to normality. Publications like “*Hurry up vaccine because in June I want to dance forró while kissing*” articulate the desire to resume everyday life with lightness and humour, mobilizing emotions to engage audiences around a common cause. Memes and popular expressions fulfill a function of symbolic approximation in this regard, making the debate accessible and shareable.

The strategy of scientific explanation and contextualization also stands out, in which users clarify doubts about the efficacy of vaccines, their mechanisms of action, and Anvisa’s regulatory criteria. These contents, often organized in “thread” formats, contrast with the superficiality of fake news, offering interpretations based on data. Although less emotional, these messages fulfill an important role in constructing an informed and reliable narrative.

Alongside these pro-vaccine strategies, there is also an expressive use of the platform to express criticism of the federal government and the handling of the pandemic by the then-President Jair Bolsonaro, as well as support for political figures such as Luiz Inácio Lula da Silva and the Workers’ Party (PT). Although these mentions are less

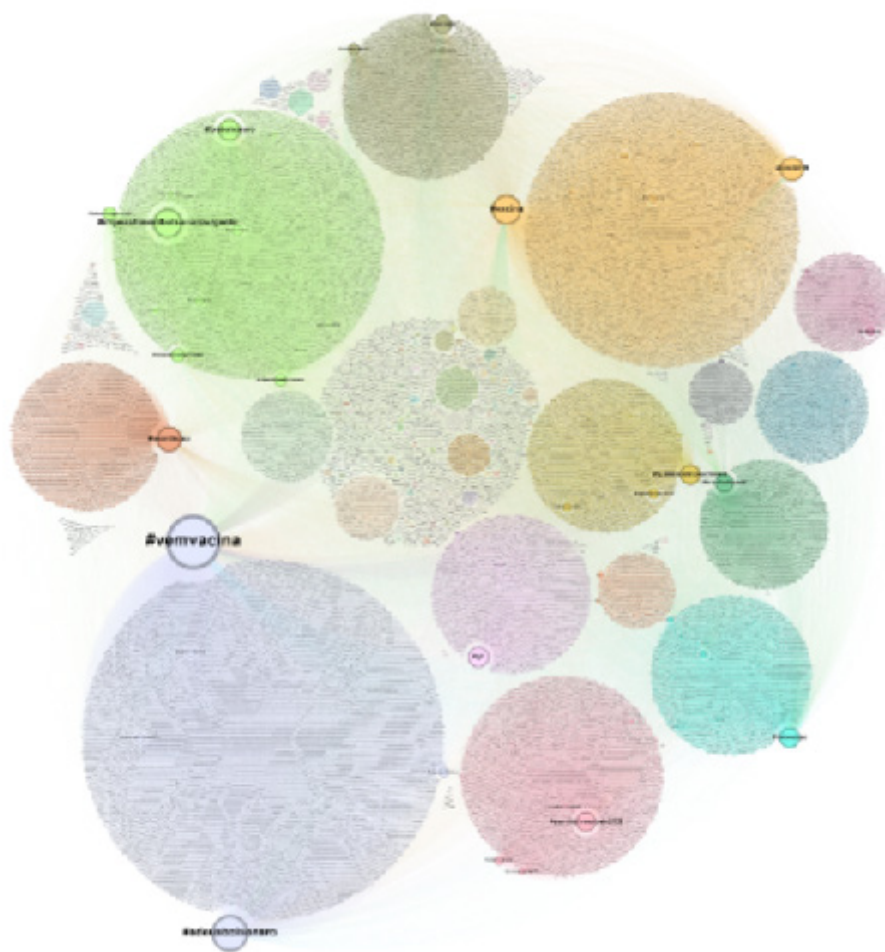
frequent than content exalting science and the SUS, they reinforce the political dimension of the debate, evidencing the overlap between the field of health and the ongoing ideological disputes. This intertwining of the vaccination theme with politics is particularly visible in the 2021 Semantic Graph (Figure 1).

Figure 1. X's Semantic Graph (2021)



Source: Own elaboration based on the public post dataset on X

Overall, the 2021 data reveal a predominantly positive atmosphere regarding Covid-19 vaccination on X. The most shared hashtags during the period—such as #vemvacina (*#comevaccine*), #vacinaparatodos (*#vaccineforall*), #vacinajá (*#vaccinenow*), #sus (*#UHS-Unified Health System*), #vamosnosimunizar (*#letsimmunize*), and #vamosnosfortalecer (*#letsgetstronger*)—express a strong sense of confidence in the immunizers and public institutions. This pro-vaccine mobilization did not occur in isolation but was strongly intertwined with the political scenario of the moment, as visually demonstrated in the 2021 Hashtag Graph (Figure 2).

Figure 2. X's Hashtag Graph (2021)

Source: Own elaboration based on the public post dataset on X

Given that the pandemic was widely politicized in Brazil, and considering the recurrent statements by the then-President Jair Bolsonaro against vaccines, the discourse favourable to immunization frequently articulated itself as a form of explicit opposition to the federal government. This overlap is evident in the use of hashtags such as *#adeusbolsonaro* (*#goodbyebolsonaro*), *#impeachmentbolsonarourgente* (*#impeachmentbolsonargonow*), *#forabolsonaro* (*#outbolsonaro*), and *#forabolsonarogenocida* (*#outbolsonarogenocidal*), which reinforce the political nature of adherence to vaccination as an act of resistance.

Although attempts at counter-narratives existed—with users defending Bolsonaro and seeking to associate the success of the vaccination with his government—this perspective proved marginal within the analyzed ecosystem. As observed in Image 1, which presents the 2021 hashtag graph, these contents appear concentrated in a small cluster, more isolated in relation to the broader network, which indicates low discursive capillarity against the predominance of messages supporting science, the SUS, and vaccination. Thus, X was configured in 2021, at that moment, as a space for symbolic resistance and digital activism, where different discursive strategies converged for the valorization of science and the encouragement of immunization.

The Narratives of Collectivity

The dominant narratives in 2021 were primarily founded on collectivity and affective appeal, directly contrasting with the technical and distant language of the official discourse. The key to the success of this mobilization was the translation of scientific concepts into simple slogans and shareable emotions, making the message immediately resonant with the public. The use of phrases such as “#vemvacina” and “A vacina protege quem você ama” (The vaccine protects those you love) functioned as a powerful affective repertoire, uniting individuals under a common value of social responsibility. This communication strategy, organically adapted to the digital environment, allowed initial resistance to be disarmed by transforming an individual act (vaccination) into a manifestation of mutual care (#vamosnosimunizar and #vamosnosfortalecer). The discourse was less about epidemiological data and more about the desire to return to social life, to protect family, and to participate in a collective rite of passage. Such an approach reinforces the thesis that trust is built through empathy, and not just through institutional authority.

Furthermore, the fluidity of participatory culture (Jenkins, 2013) allowed narratives to be constantly remixed by users. The meme became an important tool for intervention, transforming the seriousness of the pandemic into socially acceptable and accessible humour. In the analyzed messages, users’ humor and irreverence manifested in discursive strategies that not only extolled the benefits of vaccines but also sought to relativize perceived risks by comparing them with potentially more harmful daily habits—such as drinking questionable alcohol or consuming food under unsanitary conditions. This approach makes the pro-vaccine discourse more accessible and persuasive, even for more skeptical audiences, by appealing to common sense and shared experiences. This capacity for re-signification made the pro-vaccine message highly adaptable and viral, overcoming the rigidity of official communications and ensuring the necessary cultural engagement.

The study demonstrates that the effective fight against radicalization is, fundamentally, inseparable from a debate on the regulation and design of platforms

When we observe the 2021 narrative graph, Image 2, divided into six clusters, it is clear that the conversation about vaccination on X, in January 2021, was strongly oriented by strategies of digital activism in defense of immunization. Each semantic grouping highlights a specific dimension of this collective engagement, revealing how different forms of discourse—personal, informative, political, and affective—articulate themselves to produce a network of support for science and resistance to disinformation.

The first large nucleus, centered on the term “vacina” (vaccine) and words like *tomar* (to take), *dose*, *braço* (arm), and *vida* (life), reflects a mobilization strategy through personal testimony. Individual accounts about the act and the desire to be vaccinated, frequently marked by emotion and identification, function as micro-narratives of collective encouragement. Sharing the vaccination experience or the expectation for one’s turn in the immunization queue reinforces public trust and acts as a symbolic ritual of social belonging. These accounts contribute to the normalization of vaccination behaviour and strengthen the sense of community.

Another relevant cluster, organized around terms such as “vacinas” (vaccines), “covid,” “pandemia” (pandemic), “anvisa,” “países” (countries), and “ciência” (science), evidences a strategy of informative and contextualizing activism. In this group, posts that offer explanations about the efficacy of vaccines, the approval by the National Health Surveillance Agency (Anvisa), and international comparisons predominate. The intention of this content is to reinforce the scientific credibility of the immunizers, contextualize the importance of vaccination on a global scale, and highlight the role of public institutions. By appropriating data and evidence, these discourses act as a counterpoint to

disinformation, reinforcing a rational and fact-based narrative. Within this cluster, we also observe the political tone of the manifestations, given that the highlighted terms “bolsonaro” and “presidente” (president) are related to words like “morte” (death), “cloroquina,” “corrupção” (corruption), and “culpa” (guilt).

In a cluster focused on the political debate, structured near the term “*bolsonaro*,” with emphasis on words like “*cartão*” (vaccination card), “*direita*” (right-wing), “*golpe*” (coup), “*preso*” (arrested), “*genocida*” (genocidal), and “*inelegível*” (ineligible), we observe a strategy of confrontational activism where vaccination is used as a symbol of resistance to the federal government. This semantic group articulates direct criticisms of the pandemic management by the then-President Jair Bolsonaro, often including accusations of negligence, corruption, and political use of vaccines. The presence of the term “*dinheiro*” (money) in this cluster indicates that, besides sanitary criticisms, denunciations about the possible diversion of public funds, contract overpricing, or economic instrumentalization of the immunization process also emerge. The term “*cartão*” (vaccination card) appears linked to the requirement of proof of vaccination, frequently juxtaposed against the government’s denialist discourse, functioning as a symbol of civic responsibility. The association of Bolsonaro with expressions like “*golpe*,” “*genocida*,” and “*inelegível*” evidences the load of rejection and the use of the platform as a space for political contestation. In this context, the defense of vaccination transcends the field of public health, becoming a political and moral act, where users mobilize discourses of denunciation and demands for accountability.

Another grouping, centered on terms such as “*vacinação*” (vaccination), “*saúde*” (health), “*campanha*” (campaign), “*doses*,” and “*população*” (population), reinforces the strategy aimed at valuing public institutions and collective health. Here, the role of the Unified Health System (SUS), health professionals, and immunization campaigns is highlighted. These messages demonstrate confidence in the public system and help to position vaccination as a collective duty, supported by public policies and a sense of social responsibility.

Finally, the bottom of the semantic graph reveals two small peripheral clusters characterized by low-density narratives. The first, featuring the term “*câncer*” (cancer), presents an ambiguous semantic field: while its proximity to the HPV vaccine nucleus suggests a legitimate link to cancer prevention, the term primarily appears in a restricted subgroup with disinformative connotations, questioning the safety of RNA messenger vaccines without scientific backing. The second cluster, featuring “*febre*” (fever), reflects a thematic interference related to a parallel discourse on foot-and-mouth disease (animal health) and is not relevant to adverse reactions from the COVID-19 vaccine. Thus, the inclusion of these two groupings reflects a singular thematic interference rather than the development of relevant narratives for the coronavirus immunization discussion.

In summary, the analysis of the clusters shows that, in January 2021, the conversation about vaccination on X was largely dominated by discursive strategies of pro-vaccine activism, which operated through emotion, information, politicization, and humour. Disinformation, although present in some isolated points of the network, failed to structure a dominant narrative. On the contrary: the analyzed environment reveals expressive engagement in defense of science, public health, and vaccination as a collective pact. X, in this context, functioned as a privileged space for civic mobilization, symbolic resistance, and the production of shared meaning around immunization.

Act II (2025) – The Collapse of Dialogue: Radicalization on X

The transition of the discursive ecosystem regarding vaccination in Brazil from 2021 to 2025, within the environment of the X platform, constitutes a crucial object of analysis for understanding the contemporary sanitary and communicational

crisis. The 2025 scenario demonstrates a paradigmatic inflection compared to the previous period, characterized by the consolidation of radicalization niches and the deep erosion of the public sphere. This phenomenon is interpreted in light of what we call the “platform effect,” in which technological architecture and algorithmic logics act as determining variables in the polarization of the debate, culminating in the collapse of dialogue.

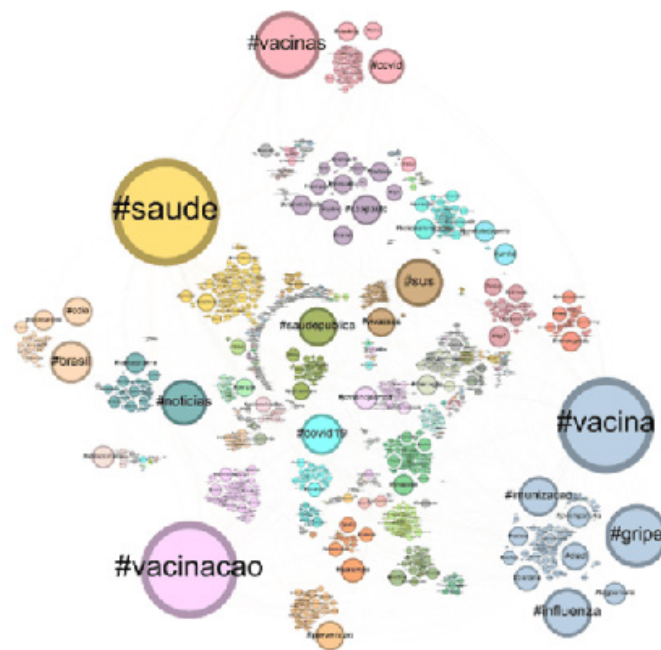
The Quantitative Prevalence of Disinformation and the Structural Focus

The data collection for 2025—covering the period from May to July - reveals a significant alteration in the composition of the vaccination debate. During this time, disinformation does not appear as peripheral noise, but as a quantitatively relevant element in the platform's environment. To measure the presence of critical and disinformative content on X (formerly Twitter) throughout the second quarter of 2025, the one thousand posts with the highest engagement each month - May, June, and July - were qualitatively analyzed by comparing them with verified sources and official information. The percentages identified were 35% in May, 28.5% in June, and 21.7% in July, all based on a universe of one thousand publications per month. From these values, the simple average was calculated by summing the percentages and dividing by the number of monthly observations. The result obtained was an average of 28.4% of problematic content circulating among the most popular posts of the period, a very expressive volume.

This data reinforces the centrality of this type of discourse in the analyzed digital ecosystem, even though a downward trend is observed over the months. The prevalence of this content suggests the ineffectiveness of the platform's moderation and containment mechanisms for disinformation. Furthermore, this finding points to the existence of a calculated and organized effort to undermine public trust, in sharp contrast to the pro-vaccine mobilization predominant in 2021.

The presence of radicalized niches on X is understood as part of a strategy to occupy an environment where algorithmic oversight and moderation policies are perceived as more permissive. This characteristic, intrinsically linked to the platform's *affordances* (Gillespie, 2010) , guarantees the survival and algorithmic reach of extremist discourses, pointing to a structural failure of the digital environment in containing the propagation of harmful narratives. In addition to favoring the proliferation of disinformation, this scenario signals the departure of progressive voices, scientists, and science communicators, who withdraw from the platform in the face of the advance of radicalization and the weakening of conditions for qualified debate. The concept of disinformation is therefore adopted here to encompass this ecosystem in which individual intentionality is diluted in the face of a structural dynamic that incentivizes, amplifies, and normalizes falsehood, transforming radicalization into a recurrent pattern of visibility.

Curiously, when we observe the most used hashtags in the 2025 publications (Figure 3), the expressive presence of critical and disinformative content identified in the qualitative analysis is not directly reflected. The predominant hashtags are mostly associated with news and institutional content, such as reports, health bulletins, vaccination campaigns, and official communications. This pattern reinforces a trend frequently observed on digital platforms and already evidenced in studies on digital behaviour in polarized environments: disinformative and denialist narratives often use artifices to circumvent algorithmic moderation systems and escape automated collection - such as the one conducted in this research. Among the most common strategies are the use of graphic substitutions (such as letters replaced by numbers, for example, v4c1n4), the intentional alteration of keywords (inoculation, for example, to refer to Covid-19 vaccines), or the diffusion of messages in visual formats to hinder textual traceability (as in the case of screenshots of supposed studies).

Figure 3. X's Semantic Graph (2025)

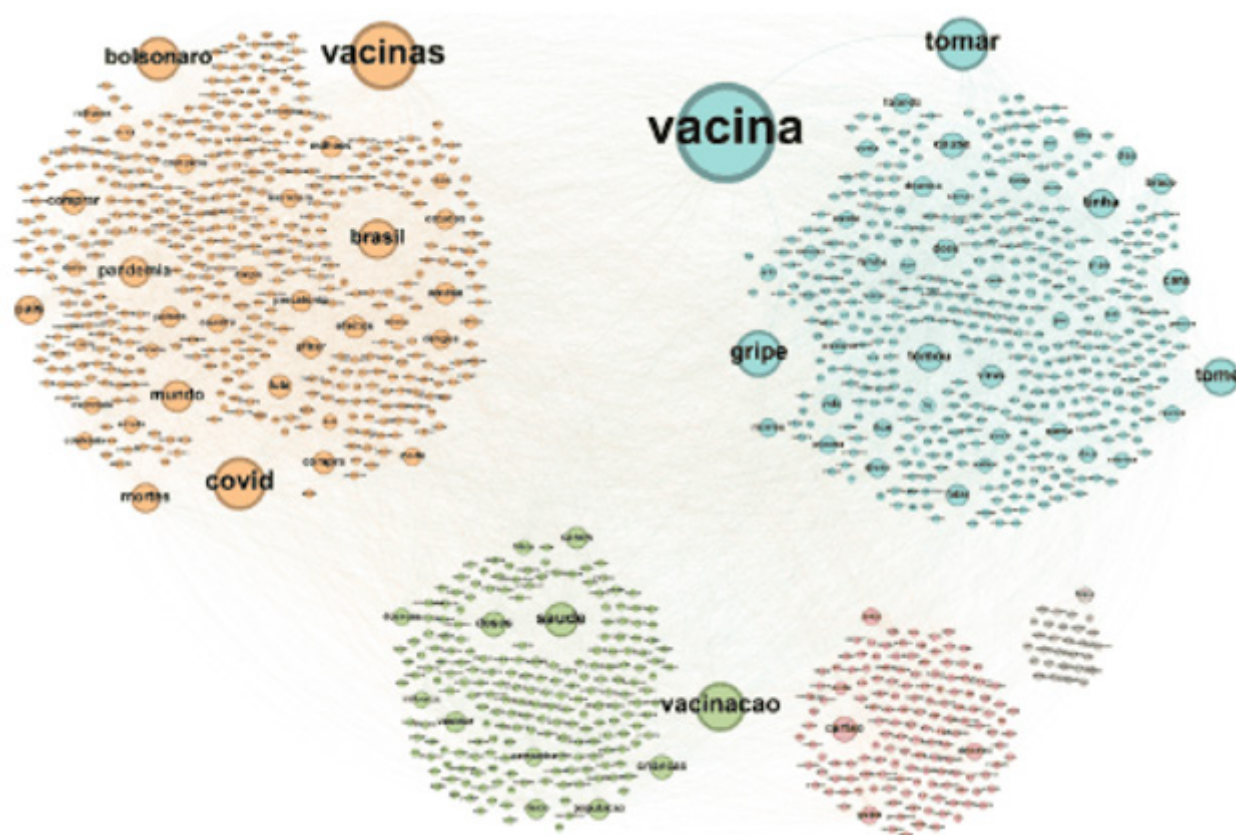
Source: Own elaboration based on the public post dataset on X

These practices align with the concept of dark participation, proposed by Quandt (2018), which describes forms of political and communicational engagement that operate at the margins of traditional civic participation, often in an opaque, manipulative, or hostile manner. In the context of vaccine disinformation, the tactical use of discursive invisibility, even in relatively permissive environments like X, represents a form of resistance to public scrutiny, allowing this content to continue being shared and replicated across the network. Thus, while hashtags function as visible markers for journalistic or institutional themes, disinformative discourses operate in subterranean layers of the digital ecosystem, making the systematic detection and confrontation of this content difficult.

The New Conspiratorial Narratives: The Transition from Specific Criticism to Cultural War

Just like the quantitative analysis, the inspection of the 2025 semantic graph (Figure 4) reveals the increase and radicalization of the anti-vaccine discourse on X. The disinformation narratives transcended the specific criticism of the Covid-19 vaccine, configuring themselves as a cultural war against the Brazilian immunization policy in its entirety. The main target of attack is no longer just a specific immunizer, but the very integrity of the calendar proposed by the National Immunization Program (PNI).

Figure 4. Comunicación resultados



Source: Own elaboration based on the public post dataset on X

The semantic graph (Figure 4) exhibits a low cohesion network and fragmented clusters, signaling the phenomenon of ideological entrenchment. The largest grouping (in orange) articulates the vaccination debate with the political sphere and the pandemic, highlighting terms like “*bolsonaro*,” “*vacinas*” (vaccines), “*covid*,” “*pandemia*” (pandemic), “*brasil*” (Brazil), and “*mundo*” (world). The association of these terms with words such as “*mortes*” (deaths), “*efeitos*” (effects/adverse), and “*culpa*” (blame) demonstrates the centrality of the political polarization of the health crisis, which persists in the public debate years after the pandemic began. Polarization exists between those who attack the former president for neglecting the pandemic and those who argue he was correct and that the COVID-19 vaccine is related to health problems.

Located to the right of the graph and centered on the terms “*vacina*” (vaccine), “*tome*” (take), “*tomou*” (took), “*tinha*” (had), “*vida*” (life), “*semana*” (week), and “*gripe*” (flu), the blue cluster represents the nucleus of personal narratives about vaccination. The language is informal, with many verbs in the first or third person, and refers to direct experience accounts, such as the act of taking the vaccine, sharing symptoms, or expressing personal opinions. Positioned in the lower center part of the graph, the green cluster is organized around terms like “*vacinação*” (vaccination), “*saúde*” (health), “*doses*” (doses), “*campanha*” (campaign), “*crianças*” (children), and “*população*” (population). It represents an institutional and informative narrative, focused on vaccination as a public policy and collective action. A smaller group, in pink, on the lower right of the graph, centered on the word “*cartão*” (vaccination card), brings together terms related to access, documentation, proof of vaccination, and the demand for records. This narrative relates to discussions about vaccine mandates and the requirement of vaccine passports.

In this environment, the vaccination debate proves highly polarized, divided between pro- and anti-vaccine groups. The former relies on journalistic content, institutional campaigns, and testimonials encouraging immunization, while the latter resorts to disinformative content, often false or misleading, to sustain rejection of the immunizers. Among the main disinformative narratives, conspiracy theories and allegations about vaccine risks stand out. The Covid-19 vaccine is frequently labeled as “experimental,” associated with alleged adverse effects such as myocarditis, autism, cancer, and death. Rumours also circulate about the “AeroVax,” an alleged inhalable immunization used to spray harmful substances, and theories involving Bill Gates in vaccination programs or airborne virus dispersion. Furthermore, there are criticisms of mandatory vaccination, especially for children, pregnant women, and the elderly, and distorted interpretations of official data, such as a thread falsely linking the increase in stroke deaths to vaccine administration. Such narratives are consistent with broader patterns identified across Latin America, where vaccine misinformation frequently relies on claims about hidden risks, alleged adverse effects, and conspiratorial interpretations of public health policies (Morejón-Llamas, 2023). The Brazilian case therefore reflects not an isolated phenomenon but a regional dynamic of distrust toward vaccination.

The disinformation campaigns observed on the platform are not restricted to the Covid-19 vaccine. Various immunizers are targets of discredit and conspiracy theories, revealing a broader pattern of contestation to immunization policies. Criticism is directed at the flu vaccine, especially the strategy of double vaccination (Covid-19 and Influenza). Negative discourses also appear regarding the HPV vaccine, associated with alleged severe adverse effects and the defense of non-vaccination for children, and even about traditional vaccines, such as the triple viral. This expansion of the scope of criticism indicates that vaccine denialism transcends the pandemic context, transforming into a structural movement of generalized distrust toward science, public institutions, and the very idea of collective immunization. This ends up reconfiguring the PNI - formerly a symbol of excellence in public health - into a “global domination instrument” within the radicalized doctrine. The conspiratorial theories evolved into more sophisticated and totalizing narratives, including DNA alteration and attacks on fertility.

The most viral anti-vaccine content reinforces these narratives. One example is the case of a judge from Paraná who classified the childhood Covid-19 vaccine as experimental, generating posts with over 15 thousand likes and expressions of support for the magistrate. Another case involves videos by foreign doctors—without scientific proof—claiming that mRNA vaccines were responsible for mass deaths. There are also posts propagating disinformation about ivermectin, presented as an “anti-cancer” alternative and a protector against the spike protein, and publications criticizing the double vaccination against Covid and flu, interpreted as a “biological weapon” against the population.

These narratives resonate in political and ideological debates, inherited from the controversies of the previous federal administration. The anti-vaccine discourse intertwines with partisan disputes and institutional distrust, sustaining a disinformation network that combines distorted scientific rhetoric, conspiracy theories, and political resentment. The aggressiveness of the discourse is intrinsically linked to the dynamic of “echo chambers” and “filter bubbles” (Pariser, 2011), in which the internal validation of the niche is the driver of engagement. In these environments, social recognition is obtained by reinforcing polarization and attacking institutions, transforming adherence to the anti-vaccine discourse into a mark of political identity based on mutual distrust and aversion to the establishment.

The narratives that stand out are strongly marked by a logic of personal and emotional expression, with a predominance of first-person accounts and opinionated discourses. Users tend to share individual experiences and subjective perceptions, reinforcing the dynamic of affective bubbles and peer identification. Both favourable vaccination accounts,

such as celebrations for the release of a certain immunizer for specific age groups or descriptions of visiting the health post, and critical or alarmist accounts are observed, often based on personal or third-party experiences who supposedly suffered severe adverse effects or even death after vaccination. This confessional character, amplified by the platform's algorithmic logic, causes personal posts, criticisms, and outbursts to achieve high levels of engagement, while institutional content, such as that published by the Ministry of Health, gains less visibility. Thus, the centrality of subjective experience transforms the debate around vaccines into a highly emotionalized field, where scientific authority disputes space with individual experience.

The discursive ecosystem of X in 2025 presents a profound structural change compared to the early years of the pandemic. With the platform's acquisition by Elon Musk in 2022, there was a loosening of moderation policies and a drastic reduction in fact-checking mechanisms, which created space for the re-emergence of suspended accounts and disinformative profiles. This reconfiguration, coupled with a more aggressive and decentralized engagement logic, favored the proliferation of false and misleading content. Musk's permissive stance culminated, including, in the temporary suspension of the network in Brazil in 2024, following successive warnings about violations related to the spread of disinformation. The departure of users critical of denialism and science communicators altered the discursive balance, resulting in a less plural environment more conducive to radicalization.

Between 2021 and 2025, a significant increase in disinformation is observed. Approximately one third of the posts analyzed in 2025 presents anti-vaccine content, vaccine hesitancy, or misleading information. Pro-vaccine voices became less visible: there was a sharp drop in explanatory posts about how vaccines work, a reduction in fact-checking, and a symbolic emptying of the valorization of vaccination.

Discussion

In this section, we interpret the empirical findings, connecting the evolution of the discursive ecosystem regarding vaccination in Brazil from 2021 to 2025 to the theoretical frameworks outlined and to the broader implications for collective health and the democratic debate

The Platform Effect" in Comparative Perspective

The core of our theoretical contribution lies in the analysis of the "platform effect" (Gillespie, 2010; Van Dijck et al., 2018) in a comparative perspective. The results from 2021 and 2025 demonstrate that the X platform (formerly Twitter) is not a neutral stage but an active agent that modulates polarization and discourse visibility. The platform's *affordances* (potentialities and restrictions) act as decisive variables for the observed discursive inflection.

- 2021 (Activism and Cohesion): The *affordances* of the former Twitter (speed, virality, low coordination cost) were instrumentalized by pro-vaccine activism to mobilize an affective and civic repertoire. The technological architecture reduced organization costs for civil society (Shirky, 2009), allowing communicational fluidity to overcome bureaucratic inertia and state discoordination. Visibility was guaranteed for social adherence and pro-science discourse.
- 2025 (Radicalization and Fragmentation): The change in X's architecture and the flexibilization of moderation policies reversed this dynamic. The *affordances* began to favor polarizing and emotionally intense discourse (Van Dijck et al., 2018), which aligns with disinformation narratives. Consequently, the platform increased the costs of contestation for scientific and institutional voices. X, by prioritizing engagement over accuracy, became co-responsible for the radicalization of the discourse.

The difference between the two acts demonstrates that technology is not merely a medium but an agent that actively shapes the debate, with the “platform effect” being the explanatory variable for the consolidation of disinformation in 2025.

Dialoguing with Theory

The contrast between the acts of 2021 and 2025 establishes a critical dialogue with the theoretical frameworks on network activism and digital communication. The pro-vaccine mobilization of 2021 corroborates the initial optimism of authors like Castells (2015) and Shirky (2009), demonstrating the capacity of fluid networks to reduce coordination costs for collective action and catalyze civic hope. The phenomenon of cultural re-signification, where scientific discourse was transformed into accessible narratives and memes, aligns with the participatory culture described by Jenkins (2013). However, the 2025 scenario acts as a crucial counter-argument to this optimism. The consolidation of radicalization and the ineffectiveness of containment mechanisms demonstrate that the platform’s architecture, as discussed by Gillespie (2010), can reverse the gains in organization, imposing the high cost of contestation on qualified voices. Our data, therefore, support Recuero’s (2024) thesis, which treats disinformation not as error, but as a complex system in which algorithmic logic and the ideological rigidity of niches reinforce each other, escalating the threat to the public sphere.

Social participation has been a structuring principle of Brazilian public health since the Sanitary Reform movement, which conceived the SUS as a system built on community engagement, social control, and democratic co-management (Paim, 2018; Campos, 2007). The pro-vaccine mobilization of 2021 can thus be read as a reactivation of this participatory tradition in the digital environment: civil society — scientists, communicators, influencers, and ordinary citizens, occupied platforms as spaces of cohesion, co-constructing narratives that translated scientific knowledge into shared meaning. Risk communication in public health cannot be conceived as a top-down institutional process; it requires the active participation of communities and trusted intermediaries. Future strategies to counter vaccine disinformation must therefore prioritize the mobilization of community networks, investing in media literacy and in the capacity of civil society organizations to contest algorithmic toxicity from within the digital ecosystem.

Implications for Collective Health and Public Debate

The findings of this research extrapolate beyond the field of communication, projecting critical implications for collective health and democratic integrity. The transition from specific criticism of the Covid-19 vaccine to a radicalized doctrine against the National Immunization Program (PNI) represents a direct threat to Brazil’s historical achievements in immunization, serving as a symptom of the profound erosion of trust in health institutions. This scenario reflects broader challenges identified in studies on infodemics and scientific communication, which highlight how misinformation compromises public adherence to health measures and weakens trust in expert knowledge (Fagá, Cyrino & Teixeira, 2025). The discursive vacuum generated by the retraction of scientific voices in 2025—a strategic response to algorithmic toxicity—demonstrates that platforms can become environments where the defense of science is structurally unviable. Consequently, the architecture of X drastically elevates the organizational and financial cost for public health in the attempt to organize the counter-discourse and demystify disseminated error, demanding disproportionate effort to penetrate “echo chambers”. The study concludes that the fight against disinformation is inseparable from a debate on platform regulation and design, making it essential for the future of health communication and for the health of democracy itself.

Conclusion

The analysis of the evolution of the debate on vaccination in the Brazilian social media ecosystem between 2021 and 2025, specifically on the X platform, allows not only for documenting a discursive inflection but also for providing a theoretical contribution regarding the active role of digital platforms in public health and the democratic sphere. In summary, the present study demonstrated that the communicational dynamic of vaccination evolved from a moment of civic activism and social cohesion in 2021 to a scenario of entrenched radicalization and collapse of dialogue in 2025. The central argument is that this transition is explained by the “*platform effect*”: the architecture of X, which initially (2021) reduced the costs of organization for pro-vaccine mobilization, subsequently (2025) reversed this *affordance*, drastically increasing the costs of contestation for scientific voices. By prioritizing emotionally intense engagement over factual accuracy, the algorithm guaranteed the survival and visibility of intentionally misleading narratives, which consolidated into a cultural war against the integrity of the National Immunization Program (PNI).

Beyond regulatory and technical responses, the defense of public health in digital environments fundamentally depends on the active participation of civil society. As Paim (2018) argues, social participation is not peripheral to Brazilian public health - it is structurally constitutive of the SUS and of the democratic project of the Sanitary Reform. Campos (2007) reinforces this perspective by demonstrating that co-management and participatory spaces are essential mechanisms for building collective health governance. In the digital context, this means that effective strategies against vaccine disinformation cannot rely solely on fact-checking or institutional communication: they must invest in building the communicational capacity of communities themselves, fostering the kind of distributed, affective, and inclusive activism that characterized the 2021 pro-vaccine movement. Only through a combination of platform regulation, institutional communication reform, and active civil society engagement will it be possible to reverse the erosion of trust in the PNI and safeguard the achievements of Brazilian public immunization policy.

Despite the relevance of the findings, we recognize the limitations imposed by the methodological scope, which focused on the analysis of co-occurrence graphs of terms and hashtags and discourse analysis on the X platform. Notably, the study did not cover communication on private messaging platforms, such as WhatsApp and Telegram, which are known to play a crucial role in disseminating disinformation in closed niches within the Brazilian context. This limitation, however, points to a crucial future research agenda. We propose developing investigations into the dynamic of disinformation transversality, mapping the flow of radical narratives from X to WhatsApp, and analyzing the specific impact of regulatory and algorithmic design changes on X regarding the visibility of scientific content, aiming to develop predictive models on the algorithmic exclusion of institutional voices in the health debate.

Ultimately, the collapse of dialogue on the X platform in 2025 cannot be treated as a mere sociological accident, but as the predictable result of a business model that transforms conflict into algorithmic currency. The threat to collective health, materialized in the weakening of confidence in the PNI, demands a response that transcends simple fact-checking. The study demonstrates that the effective fight against radicalization is, fundamentally, inseparable from a debate on the regulation and design of platforms. The health of the population and the health of democracy itself depend on an urgent rebalance between the logics of *software* engagement and the needs of public sphere cohesion. It is imperative that society demands the reduction of contestation costs and the organization of the counter-discourse, ensuring that scientific knowledge and qualified information can thrive in a digital environment more aligned with the public interest.

Contribuciones de los autores

Los autores participaron igualmente en la elaboración del manuscrito y aprobaron la versión final presentada.

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Declaración de disponibilidad de datos

Los datos presentados en este estudio pueden ser solicitados al autor de correspondencia.

Conflicto de interés

Los autores declaran que no existe conflicto de interés.

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