



COMUNICAÇÃO SOCIAL

The dark side of anti-vaccination: analysis of a brazilian anti-vaccine Facebook group

O lado obscuro da antivação: análise de um grupo brasileiro antivacina no Facebook

El lado oscuro de la antivaación: análisis de un grupo brasileño antivaación en Facebook

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Abstract: This paper explores disinformation in the context of vaccination on Facebook through analyzes based on the use of data mining tools. The objective is to identify, from a case study in the group "O Lado Obscuro das Vacinas", the themes related to the (mis)information circulating on the network, taking into account the theorization of post-truth. Analyzes of the entire set of publications published in the group for the period from 2015 to 2019 are presented. Computational solutions are used for data extraction and processing, with a view to identifying thematic groups and similarity graphs. The results reveal a weaving of beliefs and emotions, characteristics of a post-truth scenario, as well as a recurrent convergence of the terms "measles" and "autism", with reference to controversies motivated by misinformation that was fomented in the 1990s.

Keywords: vaccination; misinformation; Facebook; data mining.

Resumo: Este artigo explora a desinformação no contexto da vacinação no Facebook por meio da realização de análises baseadas na utilização de ferramentas de mineração de dados. O objetivo é identificar, a partir de um estudo de caso no grupo "O Lado Obscuro das Vacinas", as temáticas relacionadas às (des)informações circulantes na rede, levando em conta a teorização de pós-verdade. São apresentadas análises de todo o conjunto de publicações veiculadas no grupo para o período de 2015 a 2019. Utilizam-se soluções computacionais para a extração e processamento de dados, com vistas a identificação de grupos temáticos e grafos de similitude. Os resultados alcançados revelam um tecer de crenças e emoções, características de um cenário pós-verdade, assim como uma convergência recorrente dos termos "sarampo" e "autismo", com referência a controvérsias motivadas por desinformações fomentadas ainda na década de 1990.

Palavras-chave: vacinação; desinformação; Facebook; mineração de dados.

Resumen: Este artículo explora la desinformación en el contexto de la vacunación en Facebook mediante la realización de análisis basados en el uso de herramientas de minería de datos. El objetivo es identificar, a partir de un estudio de caso en el grupo "O Lado Obscuro das Vacinas", los temas relacionados con la (des)información que circula en la red, teniendo en cuenta la teorización de la posverdad. Se presentan análisis de todo el conjunto de publicaciones editadas en el grupo para el periodo de 2015 a 2019. Se utilizan soluciones computacionales para la extracción y procesamiento de datos, con miras a identificar grupos temáticos y gráficos de similitud. Los resultados alcanzados revelan un tejido de creencias y emociones, características de un escenario de posverdad, así como una convergencia recurrente de los términos "sarampión" y "autismo", en referencia a controversias motivadas por la desinformación que se fomentó en la década de 1990.

Palabras clave: vacunación; desinformación; Facebook; procesamiento de datos.



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Introduction

Misinformation, understood as intentionally false content, whose objective is to harm people, groups or organizations (WARDLE, 2017), has gained more and more space in the media and in academic research, due to its dissemination amplified by the wide access of individuals to virtual social networks. In the field of health, this communicational phenomenon proves to be even more harmful, considering the disastrous consequences it can have on the preservation of human life (OLIVEIRA; MARTINS; TOTH, 2020).

In this paper, the misinformation and fake news that circulate on virtual social networks about vaccination will be explored, where a Brazilian public anti-vaccination group on Facebook, the group The Dark Side of Vaccines (*O Lado Oscuro das Vacinas*, in the original) is analyzed. The group defends the freedom of choice that parents should have regarding the immunization of their children through vaccines and questions whether vaccines are really safe. Furthermore, the very name of the group asserts the existence of an undisclosed truth about the safety of these substances. The group has more than fifteen thousand members.

In Brazil, the year 2019 had one of the worst levels of vaccine immunization in the children's calendar of the 2010s, according to a statement from the National Immunization Program (PNI) of the Ministry of Health of Brazil. One of the factors that make individuals not undergo vaccination or immunize their children with vaccines are preconceived beliefs about their safety, often legitimized by the misinformation that circulates in anti-vaccine groups on virtual social networks, which can generate damage to public health, considering that, when clusters of insufficiently immunized people are formed, diseases previously considered eradicated have returned with all their resulting harm (VASCONCELLOS-SILVA; CASTIEL; GRIEP, 2015). The problem question that will guide this paper is: Considering the analyzed group and its central theme, that is, the existence of a supposed unrevealed truth about the safety of vaccines, what the most talked about sub-

-themes reveal about the controversies around vaccine immunization?

Misinformation is nothing new in contemporary society. However, nowadays, it is possible to observe the ease of its propagation in the face of easy access to virtual social networks in the context of the technological evolution of the Internet, where users produce and share content with ease (HIREMATH; KENCHAKKANAVAR, 2016).

In this scenario, a commonly used expression is fake news, which imitates the layout of a factual news source to establish themselves as true, even if they are deliberately misleading news, aiming to confuse the reader, involving an economy of emotions that stimulates its adoption, as true and induces its replication (ALLCOTT; GENTZKOW, 2017; BAKIR; MCSTAY, 2017). This concept does not include other types of false content, such as unintentional journalistic errors and satire in journalistic format when these are flagged by the author.

Fake news plays with what subjects would like to be true, contributing to the ratification of unfounded beliefs and dogmas and generating a scenario called post-truth (DE SOUZA, 2019). This expression refers to circumstances where objective facts that are reliably verifiable exert less influence on the decision-making of individuals than the emotions that these facts provoke in them (D'ANCONA, 2018).

The popularization of the use of the expression fake news is marked by some important events in the political sphere that took place in 2016, in the context of Donald Trump's election for the presidency of the United States (ROSS; RIVER, 2018; POLLETA; CALLAHAN, 2019). This process was permeated by a huge range of fake news, called "alternative facts" by its advisors, with the aim of mitigating the gravity of alleged fraudulent speeches that were disseminated.

The punctuated circumstances generate a scenario of informational insecurity (MORETZSOHN, 2017), which engenders, worryingly, a belief in conspiratorial narratives and, therefore, increases the discredit of many individuals in relation to democratic institutions and even in processes

of scientific verification (D'ANCONA, 2018). Far beyond electoral political disputes, the problem of disinformation enters the intricacies of other social spheres. Some individuals depreciate and belittle the processes of scientific validation of procedures considered safe, such as vaccination, converging on the creation of anti-vaccination groups on virtual social networks.

The relevance of this research is justified in the face of the alarming problem of misinformation around a summarily important topic, which is the submission of the population to immunization processes, already proven to be safe, effective and accessible, characteristics proven by based scientific evidence studies (LEAVELL; CLARK, 1953; GEOGHEGAN; CALLAGHAN; OFFIT, 2020; KRISHNA; THOMPSON, 2021). For people to take possession of their status as citizens, it is necessary to guarantee, among other things, the fundamental rights of existence in society (MARSHALL, 1950). In this context, the right to health is one of the most important, ensuring the social well-being of the population, a vital condition for citizens to exercise their role in the community.

It is essential that there is research on the communication processes involved in the problem of anti-vaccination, as well as it is important to delve into possible solutions to minimize the harmful effects of misinformation. This paper presents a contribution with a view to understanding the phenomenon of disinformation in the context of a public anti-vaccination group active on Facebook, investigating how the most discussed issues in this space refer to the issue of anti-vaccination, as well as the existing relational dynamics.

The results reveal patterns of the communicational dynamics characteristic of the analyzed group as an environment for the dissemination of anti-vaccination ideas, through the identification of the themes explored and their relationships. The study explores computational solutions that enable massive data extraction and processing, allowing the analysis of the entire set of publications for the period considered (2015 to 2019). The period was strategically chosen, so as not

to take into account, for the intended purposes, the period referring to the COVID-19 pandemic, since, in this case, there are particularities that demand specific analyzes ranging from finding issues that, in certain moments, go beyond the anti-vaccination movements.

Misinformation, bubbles and anti-vaccination

The new information and communication technologies are important instruments that promote social aggregation, communication links and a series of information recombinations (LEMOS, 2009). These communication flows refer to the concept of network, which according to Castells (2013) is a range of interconnected nodes where each of these has a greater or lesser importance in the composition of this structure.

These networks form information flows and expand communicative possibilities, bringing the idea of a network society. The network society generates changes in the forms of sociability (CASTELLS, 2005) and refers to power. Power is a relational capacity that enables the social actor to exert a certain asymmetric influence on the decisions of other social actors in order to favor the interests and values of the one who holds power (CASTELLS, 2013).

The effectiveness of power depends heavily on the construction of shared meanings. When thinking about power in the context of the network society, it is necessary to observe that the territorial notion of society is re-signified (CASTELLS, 2013). In this scenario, the power of certain discourses is observed, many of them intentionally misleading, which are called disinformation.

According to Wardle (2017), disinformation can be divided into three distinct concepts, in order to cover the varied possibilities of the information disorder phenomenon. The terms are established according to their intention: disinformation refers to information that is intentionally false, generated with the intention of harming people, groups or organizations; misinformation characterized by being inauthentic, however, created without

the deliberate intention to deceive those who consume it; and mal-information that is based on real information, however, used in a distorted and manipulated way, intending to harm people, groups or organizations. In this context, fake news is one of the types of disinformation that have an intentional deception character, whose falsity can be verified (ALLCOTT; GENTZKOW, 2017) and which involve an economy of emotions that foster them.

An important concept in this context is that of bubbles, also called echo chambers (SANTAELLA; CYPRIANO, 2018). The bubbles refer to the fact that the personalization of the user's connected life, from the moment they use Internet search engines to find their preferences, makes the algorithms offer more and more results that seem to be interesting. Insofar as it monitors its preferences, digital platforms provoke the emergence of new digital ambiances. Users with similar preferences will be segregated in a kind of bubble, formed by the customization of filters promoted by the algorithms. In this context, search engines on social media can promote a kind of ideological segregation (SANTAELLA; CYPRIANO, 2018).

This view of an alleged censorship of full freedom of information, promoted by the existence of bubbles, is questioned by some researchers. In this scenario, there would be no possibility of thinking about a post-true world, since the attempt to distort facts and information is not new. From this perspective, the novelty lies in the possibilities that the Internet brings for the viralization of content through social networks, which are experiencing exponentially explosive growth (GENESI, 2018). In our study, we considered the existence of a post-truth scenario.

The consumption of uninformative content causes, several times, the emergence of certain reactions characteristic of the post-truth scenario, where emotions direct many subjects to have a romantic view of overly complex political and social processes. It is in this scenario that public health issues come in, which, if poorly understood, can lead to risk-generating behaviors, such as the absence of vaccination.

The phenomenon of misinformation, surrounded by post-truth scenarios, incites a movement of distrust of subjects towards any and all institutions, political processes and even scientific denialism. Maia (2008) presents a Habermasian perspective of the public sphere, which is characterized as a locus of argumentation, an environment in which people deliberate on issues of common interest.

The Internet cannot be understood as a public sphere in itself (MAIA, 2008), since the dialogic possibilities promoted by it are not full. This situation occurs due to the problem of access and technological illiteracy, which consequently promotes the exclusion of certain groups from the debate. Even so, the technological support that the Internet offers can facilitate the conditions of communication, and can mitigate the harmful consequences of disinformation.

The circulating misinformation generates an enormous loss in terms of the credibility of scientific research on the safety of vaccine immunization processes. It is observed that these beliefs, often regulated by the exaltation of very personal experiences, make the people who feed them come to value a type of experiential authority (SACRAMENTO, 2018). Searches and preferences for anti-vaccine content cause users to segregate themselves into bubbles (SANTAELLA; CYPRIANO, 2018), strengthening pre-existing beliefs on the subject of immunization.

In the context of the network society, anti-vaccination groups that work on the Internet are configured as points of convergence and distribution of misinformation, where they are nodes in these networks (CASTELLS, 2013). The anti-vaccination movements, when they widely explore the possible risks of vaccines, frighten certain individuals who come to believe that not undergoing immunization is configured as a beneficial self-care. In addition, an unrestricted defense of the autonomy of decision-making processes is reinforced, even if certain decisions are deleterious at the individual and collective level. Parents defend their own autonomy as a condition of existence and argue that the subject

should be able to deliberate about their health freely, even preferring not to be vaccinated, a logic that is very much in force in anti-vaccination groups active on Facebook (SACRAMENTO, 2018).

Methodology

The development of this study is based on the use of the Knowledge Discovery in Databases (KDD) process as a methodological tool. Proposed by Fayyad, Piatetsky-Shapiro and Smyth (1996), KDD is a process that comprises five steps: selection, pre-processing, transformation, data mining and, finally, evaluation of the results obtained, which can be further understood as an interpretation and validation of the information generated against the defined objectives (DEAN, 2014).

The use of KDD is associated with the large volume of data analyzed within the scope of the present study, which demands computational automation strategies. The data set to be explored are publications from the brazilian Facebook group The Dark Side of Vaccines (*O Lado Oscuro das Vacinas*), between the year 2014, when the group was first published, and December 2019. It is important to note that the publications are published on the group in a public and accessible way, enabling its access through computational solutions. It is also important to point out that the purpose of extracting the data is specifically to obtain textual, temporal, and engagement data (reactions and comments) from the publications. Data that allow the identification of users are not considered.

Data extraction was performed using a web scraping solution (MITCHELL, 2019) based on the *urllib3* and *BeautifulSoup* programming libraries of the Python programming language. Data is extracted automatically and persisted in a structured file. Textual data extracted from social networks commonly present variations in terms of writing and use of emoticons, links, hashtags and mentions to other users. This data can also share content, such as images, videos and links, without registering textual content. In the pre-processing and data transformation

steps, routines are performed to clean the textual records through regular expressions (FITZGERALD, 2019), in order to remove occurrences of the cited items. The dataset is transformed into a processable pattern according to the requirements of the Iramuteq software, used for textual analysis purposes.

Data mining refers to the use of techniques, methods and tools that seek to identify patterns and generate information through processing in data sets (AMARAL, 2016). We applied two data mining techniques: similarity analysis and Reinert's classification method (REINERT, 1990). Similarity analysis makes it possible to identify the most frequent terms in a textual corpus, semantically related through a network structure (VERGÈS; BOURICHE, 2003). Reinert's classification method aims to identify textual classes through the evaluation of similarity between textual elements (REINERT, 1990). The techniques are applied using the Iramuteq software. The software Gephi was used to render the similarity graphs.

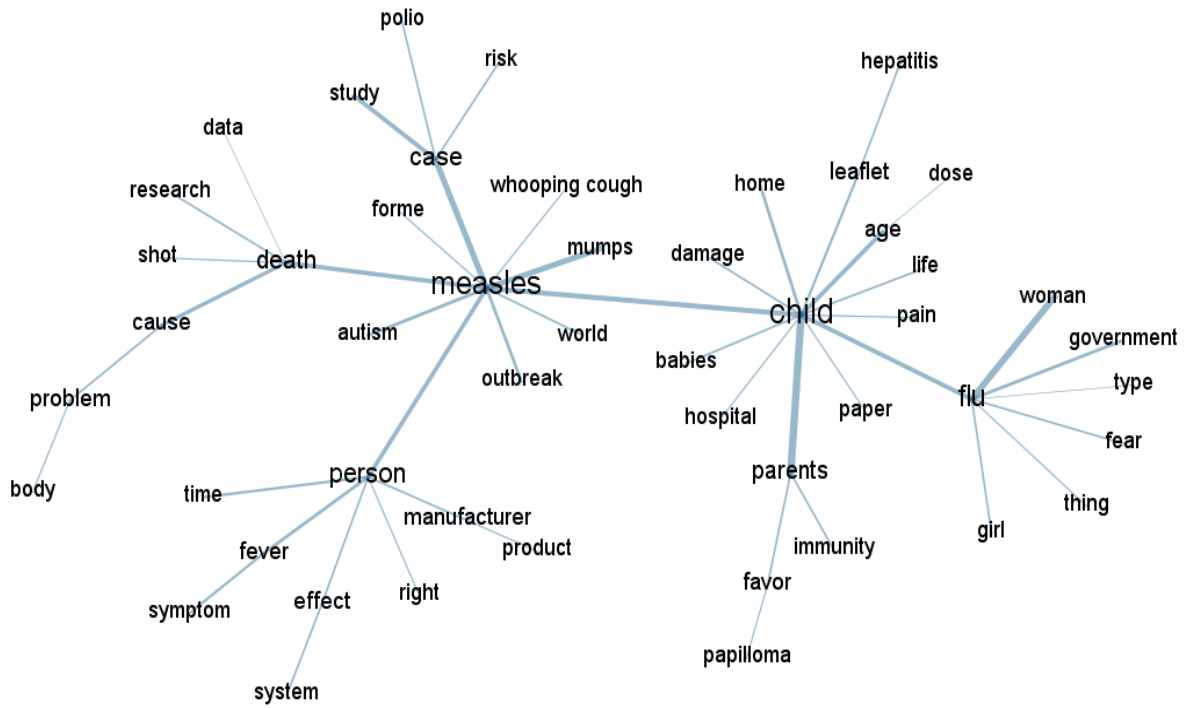
The results achieved allow the performance of interpretations and analyzes on the object of study, in order to identify the circulating (mis) information and the dynamics in the investigated group. In addition, social and political events around the topic of vaccination are correlated to the results, in order to draw connections between the themes addressed in the group concurrently with the events observed.

Results

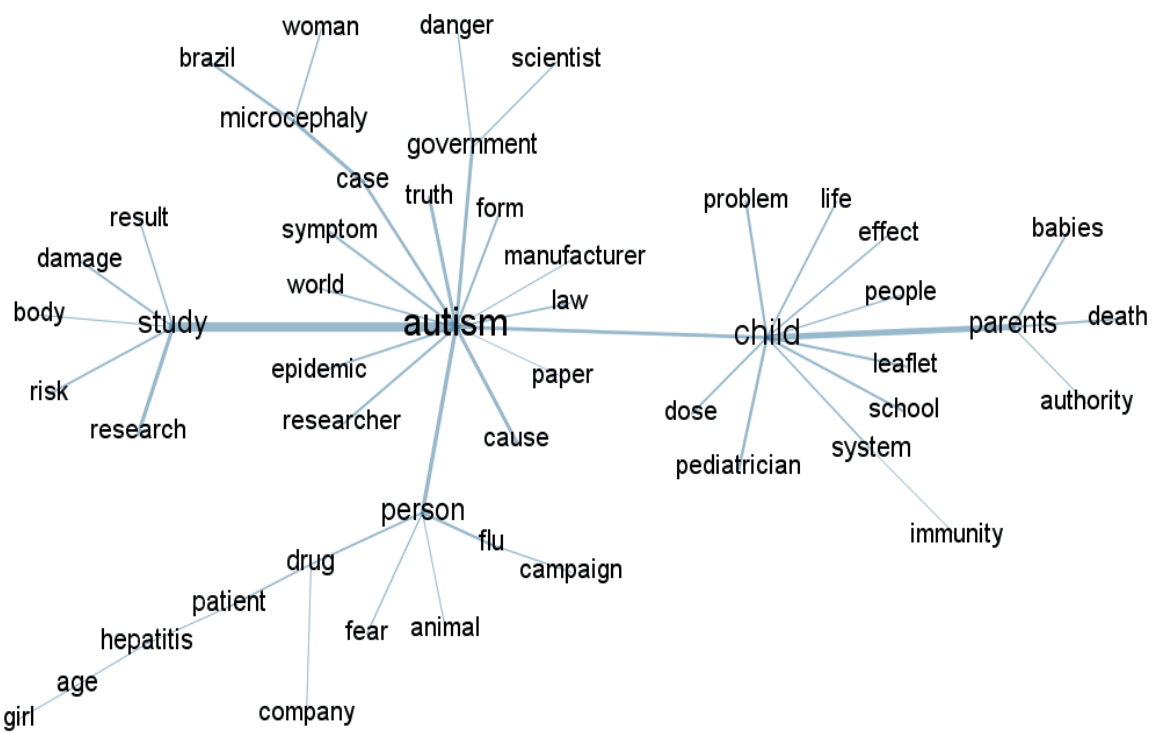
The execution of the data extraction solution returned 5,433 publications, published between 2014 and 2019. Due to the low number of textual elements found for the year 2014, the publications for this year were not considered when generating the results. In order to identify possible variations in the sharing of content and circulating information in the studied group, individual similarity graphs were generated for each year (Figures 1). Figure 2 shows the result considering the entire textual corpus for all years collected.

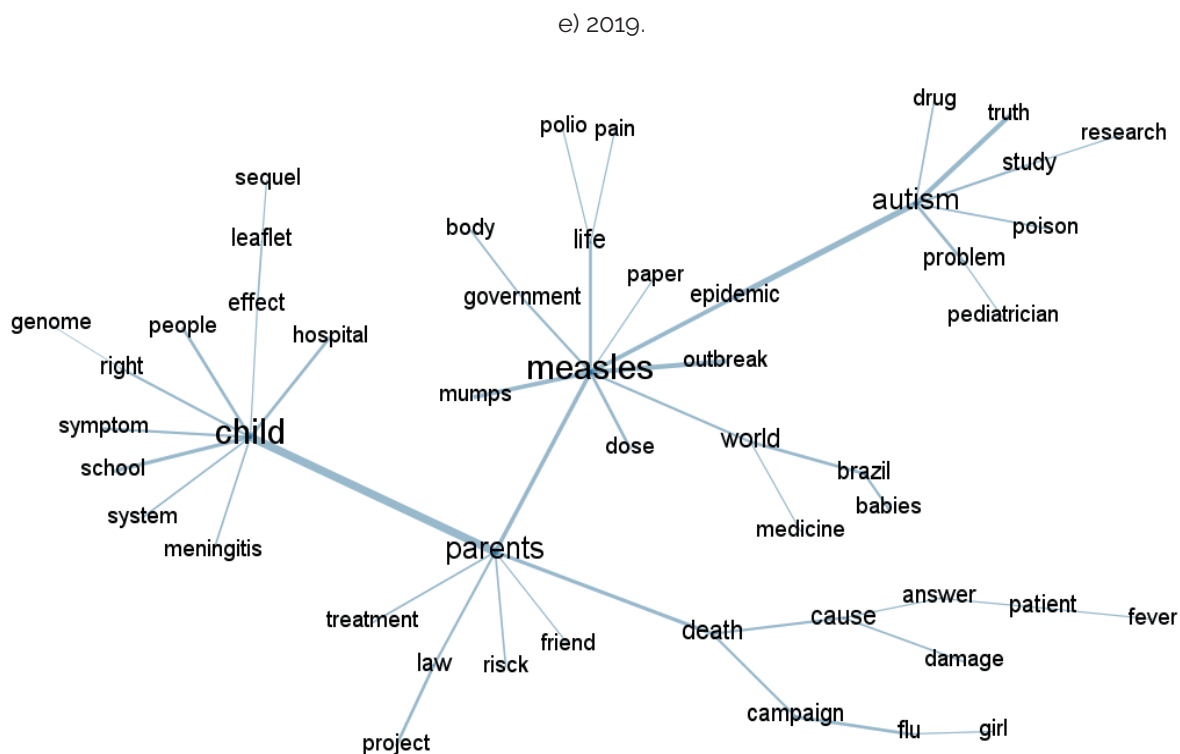
Figure 1 – Similarity graph segmented by year

a) 2015.



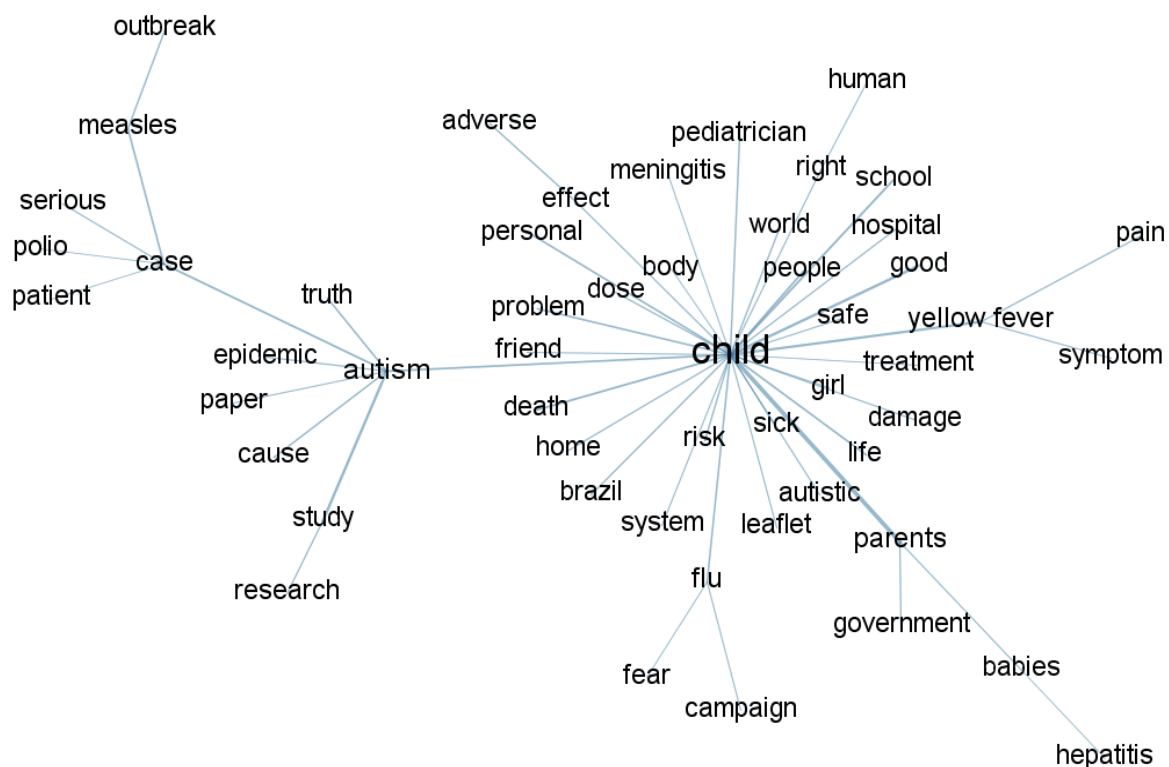
b) 2016.





Source: Authors.

Figure 2 – Similarity graph for all years (2015-2019).



Source: Authors.

An important starting point is the fact that terms such as “child”, “parents” and “person” are frequently observed, which leads to a natural understanding that, in this group, many users when approaching the issue of non-vaccination, refer to beliefs cultivated in the family context or in other interpersonal relationships. In addition, the recurrence of the terms “measles” and “autism” for all the years evaluated is also highlighted, which will be analyzed in more detail.

For 2015 (Figure 1-a) the terms “child”, “parents”, “person”, “flu”, “measles” and “case” stand out. For the term “flu”, its recurrence in 2015 refers to vaccination campaigns against influenza (H1N1).

The years 2014 and 2015 were recorded as the years with the lowest rate of vaccination against influenza in Brazil, which may have caused an outbreak of the disease in 2016 (ALVES, 2016). 2015 also marked the 60th anniversary of the development of the polio vaccine, the result of the then largest vaccine clinical trial in history, coordinated by epidemiologist Thomas Francis Jr. in 1955 (TAVARES, 2015). The results indicate the occurrence of the term “case” in semantic connection with “polio”, which in the posts is revealed through statements that range from questions about the effectiveness of the vaccine to unfounded claims about it (Table 1).

Table 1 – Clipping of posts containing the term “polio” (translated texts)

Date	Post
02/03/2015	More than 98 million Americans received one or more doses of the polio vaccine from 1955-1963 when the proportion of vaccine was contaminated with SV40.
05/07/2015	Polio eradication is a total sham, an example of misplaced trust, of power and control running wild. It is indicative of all aspects of the vaccination paradigm, propelled by an unfounded, industry-built fear of infectious diseases, statistical manipulation and critical information retention, and underpinned, ironically, by the very and insidious nature of vaccine injury, most of the which exhibits temporally well divorced from the act of vaccination, obfuscating causal relationship.
23/08/2015	The polio vaccines developed in the 1950's by Jonas Salk and Albert Sabin allegedly eradicated it, and one of the most feared diseases of the 20th century. The media was hailed the success of these vaccines as a modern-day miracle. However, the history of polio has a much darker side that has been mostly kept under wraps.

Source: Facebook.

2015 proved to be emblematic in the context of fighting diseases through vaccination, with the eradication of diseases such as rubella and measles in Brazil and congenital rubella syndrome in the Americas. One of the biggest targets of the anti-vaccine movements is the MMR (Measles Mumps Rubella), which is considered by such groups as a potentiator for the development of autism in children (CHANG, 2018), with such terms being identified as relevant in the generated similarity graph. Given the importance of the topic, it will be detailed in a specific subsection.

The year 2016, shown in Figure 1-b, has the following highlighted terms: “person”, “child”, “parents”, “autism”, “influenza” and “study”. The term “flu” refers to the outbreak previously described, having been a consequence of low vaccination in

previous years. In addition, there is a strong relationship between the terms “study” and “autism”, which represents the sharing of uninformative posts associated with supposed effects resulting from the MMR vaccine.

For 2017 (Figure 1-c), the most prominent terms are “person”, “child”, “fever”, “flu”, “autism”, “case”, “brazil”, “government”, “law” and “school”. A fact of considerable relevance in 2017 was the anticipation of the flu vaccination campaign in Brazil, due to the outbreak that occurred in 2016. This fact ends up enhancing the circulation of publications on this theme. On the other hand, the terms “government”, “right” and “school” are related to government campaigns in favor of vaccination, and go back to the banner of the anti-vaccination movements that defend the vaccination of chil-

dren as a right and not a legislated duty.

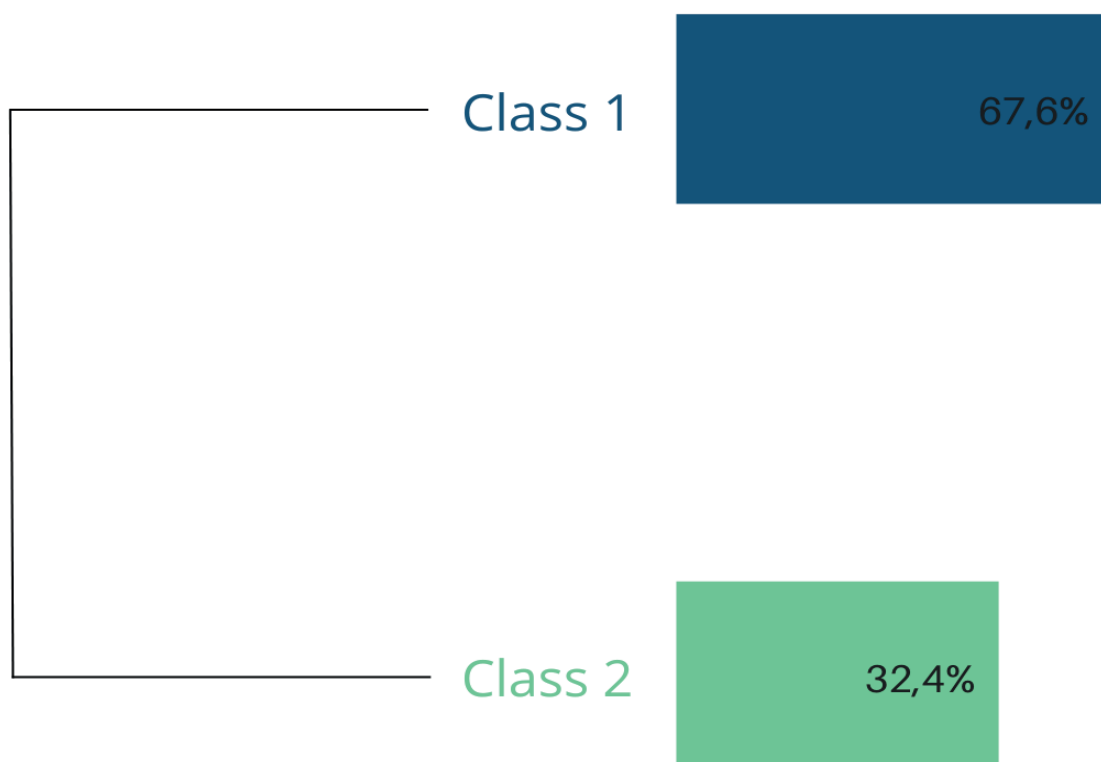
The main terms for 2018 (Figure 1-d) are "person", "child", "autism", "measles", "fever" and "case", being quite similar to what is observed for the year 2017. However, it is important to point out that in 2018 there were two measles outbreaks, which occurred in the Brazilian states of Roraima and Amazonas, both for the same genotype circulating in Venezuela (D8), which is possibly related to the entry of Venezuelans into Brazil due to the economic and social crises of the country (PACHECO *et al.*, 2019). At the time, the Brazilian Ministry of Health intensified measles vaccination coverage across the country. Along with this, there was an increase in the number of shared publications containing the terms "measles" and "outbreak", which are strongly related in the 2018 graph.

For the year 2019 (Figure 1-e) the terms "parents", "child", "autism", "measles" and "world" are highlighted. The year 2019 had the worst vaccination coverage in the children's calendar

for the second half of the 2010s, as presented by the National Immunization Program (PNI) of the Ministry of Health. In this context, one of the main focuses of government actions was measles, and the Ministry of Health even oriented the application of a booster dose to children between six months and one year (JÁ..., [2019]), which is again linked to the remarkable number of publications on the subject in the studied group.

Figure 2 shows the results obtained considering the entire textual corpus, where the terms "parents", "child", "fever", "flu", "autism", "case", "study" and "measles" are evident. It is possible to notice that terms that refer to family and interpersonal relationships and the terms "autism" and "measles" are the most recurrent. In order to understand these relationships in more detail, a class dendrogram was generated, which makes it possible to identify the clusters that present semantic predominance in the publications (Figure 3).

Figure 3 – Class dendrogram



Source: Authors.

The main Class 1 terms are "child", "vaccine", "fever", "baby", "person", "hospital", "people", "school", "friend", "bulletin", "pediatrician", "age", "husband", "homeopath", "sequel", "vitamin", "question", "love", "consultation", "nursery", being present in 62.1% of the publications carried out for the years collected. This characteristic reveals that there is a predominance of reports and questions concerning children, consultations with health professionals (especially pediatricians) and doubts about vaccination (evidenced by the word "question"). Attention is drawn to the occurrence of the term "homeopath" in Class 1, which refers to a clinical modality that aims to stimulate the body to react against diseases based on the use of homeopathic medicines, which seeks to establish a relationship with the patient aimed at stimulating the understanding of illness and in the use of low-cost therapy (ERNST, 2005).

It is worth noting that specialists in this area share opinions regarding the indication or not of compliance with the Brazilian childhood vaccina-

tion schedule. Some of these doctors advocate against vaccines, arguing their supposed harm and indicating homeopathic medicines that would replace vaccines, a recommendation that is contested by the other part of homeopaths, who claim that there is sufficient scientific evidence proving the safety of vaccine immunization (TEIXEIRA, 2010).

42 posts were identified with the term "homeopath" and 19 with the term "homeopathy". It was identified that homeopathic treatments are sought by some parents as alternatives to vaccines, and some of these parents are already looking for homeopaths to reinforce an anti-vaccine position, others seek to resolve doubts about vaccines and others report consultations they had with homeopaths and the what they indicated about vaccines (Table 2). Homeopathy was mentioned as an alternative to vaccines, even though homeopathic medicines are not recognized as effective substitutes in disease prevention processes by vaccine immunization (TEIXEIRA, 2010).

Table 2 – Clipping of posts containing the term "homeopath" or "homeopathy" (translated texts)

Date	Post
24/05/2017	Hi!! Does anyone recommend a doctor inbox for me? A homeopath who speaks clearly that he is against vaccines, please. In SP and region or in Vale do Paraiba
15/03/2018	What a joy! Today I went to the homeopath and he advised us not to take the vaccine. He didn't want to give me the role, but at least I have a backup at home. We passed a "homeopathic vaccine".
26/09/2018	There were so many... He acquired Asma and CMPA. Can you tell me which vaccines caused these diseases? With orthomolecular medicine and homeopathy he is improving a lot! Because with conventional medicine, in 5 years they never cured him.
26/01/2019	Good morning group! My daughter is 1.9 months old, she started school a week ago.. I don't vaccinate her. Can anyone tell me if any special care is needed since she now attends school and has contact with other children... Any homeopathic doctors around here?? Thanks!!!!

Source: Facebook.

Class 2 contains the following terms, which were found in 37.9% of posts and comments: "autism", "company", "manufacturer", "research", "medicine", "researcher", "director", "agreement", "court", "process", "president", "program", "product", "drug", "project", "authority", "fraud", "scientist", "profit", referring to that go against scientific research, the pharmaceutical industry and government incentives for vaccination, which are also

explored in the studied group.

The terms "autism" and "measles"

The terms "autism" and "measles" proved to be of considerable frequency in the four years that make up the data sample obtained. These terms have an analogy with each other, which refers to an investigation that questions the safety of

the MMR vaccine, a fact that has had repercussions on the anti-vaccine movements. In 1998, a study was published in *The Lancet*, one of the most renowned journals in the health area, that indicated a probable relationship between the triple vaccine (which prevents measles, mumps and rubella) and the development of autism in children who were submitted to this immunization (WAKEFIELD *et al.*, 1998).

The episode generated a series of negative repercussions in the scientific community, which questioned the quality of the methods used in the research. The main author of the work, doctor Andrew Wakefield, maintained his stance against the mass use of the triple vaccine, which ended up strengthening the discourses of the existing anti-vaccine movements, in addition to contributing to the emergence of many others (BARBOZA; MARTORANO, 2017).

A long investigation showed, twelve years after the article was published, that the research presented by Wakefield *et al.* (1998) contained a series of forged data, as well as conflicts of interest between the authors, resulting in the withdrawal of the article from the research base of *The Lancet*, which presented a retraction signed by ten of the thirteen authors of the original article.

Following the judgment of the UK General Medical Council's Fitness to Practise Panel on Jan 28, 2010, it has become clear that several elements of the 1998 paper by Wakefield *et al.* are incorrect, contrary to the findings of an earlier investigation. In particular, the claims in the original paper that children were "consecutively referred" and that investigations were "approved" by the local ethics committee have been proven to be false. Therefore we fully retract this paper from the published record (THE EDITORS OF THE LANCET, 2010, p. 445).

Despite this, over the twelve years in which the article was in vogue, it was used by anti-vaccine groups as a basis for their speeches, promoting

the dissemination of a probable relationship between the triple vaccine and the development of autism in the imagination of many people (BARBOZA; MARTORANO, 2017). This fact is related to the consumption of misinformation and its cognitive effects, which are consolidated in the memory of the subjects who adopt these contents, as true when they ratify their pre-existing beliefs (LEWANDOWSKY *et al.*, 2012), which can be observed as a feature of a post-truth scenario (D'ANCONA, 2018). This process can influence individuals in their decision-making, such as choosing not to be vaccinated, acting in accordance with the so-called confirmation bias (KAHNEMAN, 2011), which seeks to reduce uncertainties around a given decision, especially when living together with individuals who share the same thought, case of the investigated Facebook group.

In the dataset collected for this research, there are 284 posts that contain the term "autism", 179 posts with the term "measles" and 21 posts with the word "Wakefield", the name of the main doctor involved in the triple vaccine controversy, one of whom did not sign the retraction made by *The Lancet* twelve years after the original article was published. Given that there are more posts about autism than measles, it is evident that group members are generally more concerned about the first health condition than measles.

The post with the most interaction by the participants containing the name of the mentioned doctor was made by the group administrator, on May 27, 2019. The post had a total of 159 likes, 41 comments and 39 shares. The text is accompanied by a photo of the group's administrator with Andrew Wakefield, at what appears to be a health congress (Table 3).

Table 3 - Publication in reference to Andrew Wakefield (translated texts)

Date	Post
27/05/2019	<p>I had the opportunity to say how Noble and Faithful this Man was to raise the flag of truth, about the vaccine and autism. He suffered persecution. But he didn't give up the truth. The Autism Epidemic is at hand. And it's not a contagious disease! Dr. Wakefield, once again my thanks. Our thanks.</p> <p>Today several other researchers confirm to the truth that he was the first to reveal about vaccines relationship with autism.</p> <p>Know what? We need more men like that!</p> <p>"The greatest need in the world is for men - men who cannot be bought or sold; men who in the depths of their soul are true and honest; men who are not afraid to call error by its name; men, whose conscience is as true to duty as the compass is to the pole; men who stand for what is right, even when everything goes wrong."</p> <p>Ellen G. White</p> <p>#DrWakefield Thank You! ❤️</p>

Source: Facebook.

Although the aforementioned doctor lost his professional license due to the article published in 1998, as well as the fact that his speech is at odds with the best evidence about the safety of the MMR, his statements and positions are positively received by the group administrator. The research, although refuted in 2010, is mentioned and remembered, where it is possible to notice the appropriation of uninformative scientific content in opposition to the most current and true evidence, culminating in what is called fake science.

Similar to what happens with fake news, fake sciences can present a high rate of dissemination, even if there is correction of the information disclosed. It is common for fake science to remain within an unverified set of common knowledge and to derive from a complex network that in-

volves conflicts of interest and a decline in the credibility of institutions that produce knowledge and truth, with the media being for fake news and science for fake science (OLIVEIRA; MARTINS; TOTH, 2020).

The circulation of a probable correlation between the MMR vaccine and the development of autism in children ended up generating a scenario where children were not immunized by this vaccine, configuring itself as a factor that may have contributed to the emergence of new measles outbreaks, even after its eradication was decreed in 2015. Table 4 presents a clipping of publications that refer to the doctor Andrew Wakefield, which go against the consideration of his image as a medical authority in the context of scientific support for anti-vaccination.

Table 4 – Clipping of posts mentioning Andrew Wakefield (translated texts)

Date	Post
30/04/2016	<p>Dr Wakefield breaks silence on Vaxxer, the banned documentary that exposes the effects of vaccines. Andrew Wakefield has been criticized by the system for telling the truth about the MMR vaccine that causes autism.</p>
15/03/2018	<p>VACCINES → THE BIGGEST FRAUD IN MEDICINE Dr. Andrew Wakefield, at EXPO CONSCIOUS LIFE.</p>
26/05/2019	<p>Attention: Dr. Andrew Wakefield: "Vaccines have made measles a more dangerous disease."</p>

Source: Facebook.

It should be noted that the establishment of a direct relationship between the drop in immunizations by vaccines exclusively or in the first instance in the face of anti-vaccination discourses

requires a more in-depth investigation between the performance of the anti-vaccination movement, the temporal variations of immunization and the positioning and parents choice of vaccines

along with anti-vaccination speeches.

Misinformation and the triple viral

The results presented in the similarity graphs make it possible to identify the most frequent terms and the semantic relationships between them. Despite this, the analysis of the graphs itself does not generate subsidies that support the classification of misinformative posts, given that the terms can occur in any type of content.

Therefore, in order to identify the presence of the so-called fake science in relation to the MMR, a search was carried out on publications containing the term "measles". In addition, we highlight posts for each of the years investigated, published specifically by the group administrator. The filtering of posts aims to identify a possible fomentation of controversies around the MMR vaccine. The five selected posts are shown in Table 5.

Table 5 – Clipping from publications made by the group administrator (translated texts)

Date	Post
09/05/2015	<p>Bullet gives Trimovax vaccine that is used against measles, caxumba and rubella! And we want our country to vaccinate our healthy children to develop symptoms and neurological disorders because we say that vaccination is safe with these exceptions?!</p> <p>Comment of the Bull: Seek immediate medical attention if any of the following manifestations occur: difficulty in breathing or swallowing; skin rash and cooking; vermelhidão na pele; swelling in the eyes, on the face or on the inside of the nose; sudden and very intense tiredness or weakness (hypotension). Also see your doctor immediately if your child has seizures; mental confusion; high fever (above 39.4°C); intense and continuous headache; irritability or incomum sleepiness; threw up; Stiff neck; pain, increased sensitivity or swelling of the testicles and scrotal sac. Other less serious symptoms that normally do not require medical attention may arise, such as: low or moderate fever (between 37.7°C and 39.4°C); mild headache; skin rash resembling measles or rubella; swollen two lymph nodes; swelling of the salivary glands, mainly the parotid glands; rhinopharyngitis symptoms; nausea; general malaise and joint reactions.</p>
14/11/2016	<p>Trump: Vaccines Cause Autism and Will Be Investigated Hillary: The world is round, the sky is blue, and vaccines work... Thousands of deaths and people affected say otherwise!</p>
02/07/2017	<p>See how the media confirms the elimination of measles in the country, even with outbreaks caused by vaccines! And see how the media exposes existing measles cases! Note the dates of the prints of the reports! Measles never disappeared! Does the government record that there are no measles cases for the WHO, and does the media expose outbreaks? 😊</p>
11/05/2018	<p>Have you ever stopped to think that autism can be the result of encephalopathies also caused by vaccination?</p>
27/10/2019	<p>Another young woman who dies where she has heart complications. Remember the boy from Belo Horizonte with the purple fingers, and the post by the senator with a troubled heart, posted recently? Did they get the measles vaccine?</p>

Source: Facebook.

The position of the group administrator in relation to the MMR vaccine is evident. There is a fomentation to the controversy related to this vaccine, and of the five posts presented, three have the term "autism". In addition, one can obser-

ve the occurrence of statements and questions that explain his opinion about the relationship between measles and autism and, consequently, his anti-vaccine position.

Conclusions

In a reality of hyperconnectivity, the link between people and technological devices is something remarkable, which converges to an organic dependence (MCLUHAN, 1998). In this scenario, where the ease and accessibility in searching and sharing information is characteristic, virtual groups become means for establishing bonds between individuals, especially with reference to the alignment of pre-existing ideas, ideals and beliefs, which are reinforced. In addition, such groups are also means for sharing opinions and lived experiences, converging on a deeper understanding of topics of interest.

There are numerous and diverse thematic and informational needs that motivate individuals to seek information in virtual environments, although there is no guarantee of reliability of the contents that circulate on the networks, as is what happens with vaccines. Once people are present in a virtual community (LÉVY, 1996), and taking into account

the re-signification of spatio-temporal notions resulting from the consolidation of a network society (CASTELLS, 2013), people interested in the topic of vaccination can meet with the purpose of clarifying doubts, to seek information about health, or to strengthen their own concepts and ideas, following the so-called confirmation bias of opinions (KAHNEMAN, 2011; KAPPES *et al.*, 2020) and promoting new ways of being a citizen and socialization through virtual social networks (CANCLINI, 2008).

The ideological segregation that the group presents, revealed in the belief of a dark aspect about vaccines, characterizes this virtual environment as a bubble (SANTAELLA; CYPRIANO, 2018). This segregation of ideas results in a restriction of the possibility of open discussions regarding the benefits of vaccines, as this goes against the proposal presented by the space, which is observed in evidence in the group description (Table 6).

Table 6 – Group description (translated text)

About

OPEN GROUP! READ THIS POST!

OBS: 1. Posts in English, without translation will not be released! Please use google translator. The demand is very big. We need you to help with the translation.

2. Not all posts will be released for some special reasons, where usually admin and moderators discuss risk and benefit.

3. A tip: Be patient, and don't attack someone who attacked you first, let me know, I have a peaceful solution!

4. This group is mainly intended to disseminate information about all possible vaccines and their contents that can harm our body. The decision to vaccinate should be up to the parents, not the government's obligation.

5. If you are not convinced that vaccines are harmful, there is certainly another group that could serve you better: Vaccination discussions we are against. Peace! ♥

Source: Facebook.

With reference to the group description, there is a relationship with the Habermasian conception of the public sphere explored by Maia (2008), as there are no equal conditions for participation and insertion in the possible debates of the group and, with that, the construction of meanings supported for a plural dialogue. This characteristic is evident in item 2 of the group description, which establishes a moderation of the content to be broadcast, based on the convenience and interpretation of the administrator and modera-

tors. In addition, item 5 states that the group is not a space for pro-vaccine discussions.

In a comparative way, considering the asymmetry of possibilities of actions and interactions between the administrator of the group and the other participants, it is possible to notice that the administrator exercises power over the community, in a scenario marked by the absence of physical limits, as discussed by Castells (2013), since it has the power to moderate messages, as well as the exclusion of users who do not fit

the group's norms.

The conjectures and statements observed in the group with reference to adverse events resulting from vaccination, and the sharing of news and supposed scientific studies of a dubious nature that support an anti-vaccination discourse, flows inciting emotions characteristic of a post-truth scenario. Such characteristics are based on the persuasion observed with individuals who seek answers regarding the safety of vaccines, and who, from the consumption of the contents broadcast in the group, assume a position of fear about possible damages caused by substances described as harmful and, at the same time, of belief in anti-vaccination.

Sacramento (2018) highlights that beliefs based on misinformation are strengthened through personal experiences. When such beliefs are shared repeatedly in a given group, they can influence its members to value an authority that does not have relevant scientific support, being supported by subjective individual experiences. In this, there is a promotion of the perception that the supposed truth about the harm resulting from vaccines is something hidden by society, with the virtual space considered a place of revelation, intertwined with the unveiling of alleged conspiracy theories.

Based on this, through the results achieved by this research, the topics most commonly addressed in the group were identified and, through this, a relationship with certain social and political events was delimited, such as the establishment of public policies to strengthen vaccination campaigns and the fight against diseases. In addition, the analysis carried out pointed to themes that demanded greater exploratory detail, in which the relationship between the terms "measles" and "autism" stands out, which refer to the controversy surrounding the MMR vaccine, supported by fake science foundations in circulation over the last two decades (OLIVEIRA; MARTINS; TOTH, 2020).

Although there may be adverse events or side effects after vaccination, vaccines that are part of the Brazilian basic vaccine schedule, proven to be safe, do not have harmful effects such as those reported by anti-vaccine movements, such

as the development of autism. However, many parents end up resorting to alternatives, such as homeopathy, for not vaccinating their children, a fact that is not supported by the most recent scientific evidence on the issue (TEIXEIRA, 2010; MITTRING-JUNGHANS *et al.*, 2021).

Such results are revealed through emotions of a post-true scenario, which are corroborated by fake science in relation to the MMR, ratified in the group. In this context, even though the supposed scientific foundations have been refuted, it is possible to observe an impregnation in the imagination of enthusiasts of the anti-vaccine movements, who promote a discourse contrary to the evidence of vaccine safety.

It is important to highlight that the interpretations outlined in this study are far from exhausting the problems inherent to the complex phenomenon of misinformation in the field of vaccination, being configured, mainly, as an analytical prism, based on an exploratory view of large volumes of data extracted from social networks, in addition to the research that has been carried out under the theme of anti-vaccination. In addition to this study, it should be noted that certain gaps need to be explored, such as the need for a deeper understanding of the cognitive processes that consolidate beliefs based on fake science, the investigation of models aimed at combating disinformation and the development of strategies to confronting the circulation of fraudulent content on virtual social networks within the context of the so-called infodemic (ZARACOSTAS, 2020), taking into account aspects that consider issues related to vaccination against COVID-19.

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