ANTICOVID VACCINES AND THROMBOSIS: FEAR IN THE SOCIAL NETWORKS

Vacunas Anticovid y Trombosis: el miedo en las redes sociales

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Abstract

Background: This article aims to analyse the existing relationship in the Spanish social network Twitter between thrombi and anticovid vaccines. Methods: Machine learning techniques and massive statistical analysis were used to determine the social networks formed their relationships, sentiment and emotion analysis and main discourses by text mining during four months. For this purpose, 915,825 messages discussing thrombosis were collected along the first four months of 2021. Results: We found a very prominent increase in messages around mid-March and a sharp rise in early April, coinciding with detected cases and temporary suspensions of certain vaccines in the United States and Europe. The main of messages came from Spain, although Mexico focuses

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the debate on Latin America. Conclusions: It was possible to determine an increase in messages with a high emotional charge, mainly negative, as well as disinformative and conspiratorial messages, especially from groups without significant referents. The disseminators of disinformation news about vaccines are sent by small nano-influencers or fake accounts using possible astroturfing techniques.

Keywords:

Thrombosis, Vaccine, COVID, Twitter, Astroturfing, Social Networks, Misinformation.

Resumen

Fundamentos: El presente artículo tiene como objetivo analizar la relación existente en la red social Twitter en español entre trombos y vacunas anticovid. Métodos: Se utilizaron técnicas de *machine learning* y análisis estadístico masivo para la determinación de redes sociales formadas, sus relaciones, análisis de sentimientos y emociones y discursos principales por minería de texto durante cuatro meses. Para ello se recogieron 915.825 mensajes que hablaran de trombosis a lo largo de los cuatro primeros meses del año 2021. Resultados: Se encontró un aumento muy destacado de mensajes alrededor desde mediados de marzo e incrementándose fuertemente a principios de abril, coincidiendo con los casos detectados y suspensiones temporales de ciertas vacunas en Estados Unidos y Europa. El principal de mensajes procede de España, aunque México centra el debate en Latinoamérica. Conclusiones: Se pudieron determinar un aumento de mensajes de alta carga emocional, principalmente negativa, así como mensajes desinformativos y conspirativos especialmente desde unos grupos sin referentes significativos. Los difusores de noticias de desinformación sobre vacunas son enviados por pequeñas cuentas *nano-influencers* o cuentas falsas utilizando posibles técnicas *astroturfing*.

Palabras clave:

Trombosis, Vacuna, COVID, Twitter, *Astroturfing*, Redes sociales, Desinformación.

1. INTRODUCTION

In December 2019, the Municipal Health and Sanitation Commission of Wuhan (China), declared an outbreak of 27 cases of pneumonia of unknown origin that had as common center a market of seafood, fish and live animals in the same city, proceeding to the closure of said market. In January 2020, a new type of virus belonging to the Coronaviridae family was identified as the causative agent of the outbreak and was named SARS-CoV-2. The World Health Organization (WHO) has named this new disease COVID-19, which has been declared a pandemic due to its worldwide involvement (Spanish Ministry of Health, 2021).

Most patients with COVID-19 have mild symptoms, including dry cough, fever, sore throat, and dyspnea. These symptoms may vary depending on the severity of the disease, the patient's age and the presence of comorbidity, such that some individuals experience complications including bilateral pneumonia, acute respiratory distress syndrome, cardiomyopathy, neurological complications and other complications inherent to prolonged hospitalization (Hernández et al*.,* 2021).

As of June 2, 2021, there have been a total of 170,426,245 cases worldwide, affecting countries all over the world, with the American and European continents being quite affected (Ministry of Health and Social Welfare, 2021). Table 1 presents information on different countries.

Table 1. *Detail of confirmed cases and deaths by country as of June 2, 2021*

Country	Confirmed Cases	Deceased	Lethality
Argentina	3.753.609	77.456	2,1%
Brasil	16.515.120	461.931	2,8%
Chile	1.384.346	29.300	2,1%
China	111.525	4.970	4,5%
Colombia	3.383.279	88.282	2,6%
Spain	3.687.762	80.049	2,2%
United States	33.093.238	591.539	1,8%
France	5.677.172	109.691	1,9%
Italy	4.220.304	126.221	3,0%
Japan	746.713	13.048	1,7%
Mexico	2.412.810	223.507	9,3%

Source: *Spanish Ministry of Health (2021).*

In December 2020, the first vaccines authorized by the European Medicines Agency (EMA) began to arrive in Spain through the European Union. These vaccines are based on two different mechanisms of action: on the one hand, there are the Pfizer-BioNTech vaccines, which was the first vaccine to reach Spain, and Moderna, based on messenger RNA. Later came the AstraZeneca-Oxford vaccine, with the Janssen-J&J vaccine being the last to be approved by the EMA, both based on adenovirus vector (Ministerio de Salud y Bienestar Social, 2021). In Latin American countries, vaccines were obtained directly from pharmaceutical companies or through the WHO Covax platform (2021).

Cases of thrombi found in patients after administration of the AstraZeneca-Oxford vaccine have raised doubts among users, triggering an interesting scientific and social debate (Hernández et al., 2021; Konstantinides, 2021). Following the appearance of these complications, the AstraZeneca-Oxford vaccine was temporarily suspended in several European countries, although the EMA concluded that the benefits of such a vaccine outweighed the risk of suffering the side effects (Smadja et al., 2021).

1.1. Vaccines, social networks and public opinion

Currently, the digital world, and especially social networks, are a very important space for influencing public opinion (Campos-Domínguez, 2017), becoming new containers to which, any user can quickly access content (Casero-Ripollés et al., 2016). This whole process creates easy and

immediate access to content that feeds and reinforces the opinions, emotions and personal beliefs of each individual, through the formation of so-called "bubble filters" (Pariser, 2011). The emergence of certain opinion leaders (known in social networks commonly as influencers) have a high capacity to connect with various social groups and reach out to persuade them (Baviera, 2018). In this way, social networks create an environment conducive for them to become resonance echoes of content, often without being verified (van der Linden et al., 2017) and that can cause the appearance and dissemination of content that could be uninformative and/or polarizing public opinion (Levi, 2019).

The use of basic emotions, from those exposed by Ekman (1992), such as fear or disgust in speeches stimulates the senses, memory and other processes in the brain, although they are ephemeral, but if they are maintained over time they can reach persistent emotional states and perceptions (Williams, 2021). Their use determines a greater speed of diffusion among society (Zhu et al., 2019) and their analysis helps to know and understand public opinion.

The communication through social networks of the benefits of anticovid vaccines and the need to promote their administration is necessary and should be carried out effectively, but it can also be used to spread misinformation and unverified rumors. This fact caused that already in December 2020 large social networks tried to eliminate such false claims (Broniatowski et al., 2021), although the discrediting of these may increase the exchange of disinformative content and polarization (Moslech et al., 2021). In this line it should be emphasized that the debunking of disinformation is not enough to change people's minds about vaccines, since the truth, to be accepted, must fit into people's principles and frameworks and, that which does not fit, is bounced (Lakoff, 2007).

Twitter is a social network halfway between blog, forum and media in which at the beginning its possibilities for the promotion of democracy were exposed (Stieglitz & Dang-Xuan, 2013) but today it receives various alerts for malicious use in the face of disinformation campaigns (Persily, 2017; Badawy et al., 2018). In this network many people have sought information in the absence or difficulty in accessing the official one, even being able to have contact with denialist or disinformation groups as happened during the Zika, Ebola or COVID-19 pandemics (Bora et al., 2018; Fung et al., 2016; Herrera-Peco et al., 2021).

The academic study on the Twitter network is mainly focused on content analysis of a few users, but analysis by machine learning methods (machine learning) allows reaching deeper analyses on large amounts of messages, where techniques such as sentiment analysis, polarity or network theory can be employed. This is an incipient study, but there are already algorithmic studies on Twitter users with respect to vaccines (Cano-Garcinuño and Arce-García, 2020; Gunaratne et al., 2019), which show that it is a good tool for monitoring public opinion on health issues (Tavoshi et al., 2020), with wide dissemination in English but still scarce in Spanish.

Algorithmic studies of the social network Twitter, such as that of Zheng et al. (2021) and Doha et al. (2022), show how tweets with negative feelings and emotions during the COVID-19 pandemic were more widespread than positive ones, while studies in this same social network in English and Italian have shown a high polarization especially against the AstraZeneca-Oxford vaccine and greater sadness (Stella et al., 2022), as in India (Kumar, 2022) or Germany (Fieselmann et al., 2022), coupled with the presence of a large amount of misinformation around vaccines (Ng et al., 2022).

1.2. Anticovid vaccines and thrombosis

In the face of the different brands of anticovid vaccines existing in the market at the beginning of 2021, different possible, although minimal, side effects after their application have been identified, publicly specifying minimal cases of thrombosis after the application of the AstraZeneca-Oxford vaccine (Gaus, 2021). If this is added to the initial lack of doses and the economic, productive and social inequalities between countries, it turns vaccines into an object of desire where large portions of the world population may be left out (Corvalán, 2020).

After the application of millions of vaccines worldwide, the EMA reported 222 cases of thrombosis after the application of 34 million doses of AstraZeneca-Oxford, 35 cases after applying 54 million of the Pfizer-BioNTech vaccine, five cases after four million of Moderna and six cases after seven million applications with the Janssen vaccine (Cines & Bussel, 2021). The presence of thrombi after delivery of the AstreZeneca-Oxford vaccine, in Norway, Denmark and Italy in early March 2021 jumped into the media, leading to its temporary suspension in Europe (Grady & Robbins, 2021). On April 13, the United States temporarily suspended the Janssen vaccine, due to possible cases of thrombosis after application, which led the EMA to do the same, until April 20 when permission for its use was granted again (Blázquez-Serna, 2021). Although the controversy centered on the AstraZeneca-Oxford vaccine, some media disseminated data on possible thromboses on the rest of the vaccines (Russia Today, 2021).

2. OBJETIVES

The aim of this article is to determine the public expression of the users of the social network Twitter, in Spanish, in the face of the appearance of thrombosis problems in the application of anticovid vaccines in the first months of the year 2021. With this, the aim is to know and analyze which have been the fundamental expressions that the users of this social network have commented on the COVID-19 vaccines and their possible side effects (specifically thrombosis) in order to determine whether the discourse around the COVID-19 vaccines and their effects is led by official, reliable and contrasted accounts. To this end, the secondary objectives are to determine which groups there are and what they comment on the matter, accompanied by opinion influencers and, on the other hand, to analyze the feelings and emotions associated with these discourses, so as to know the characteristics of the reactions of the users of the social network Twitter in Spanish in the first months of the arrival of the COVID-19 vaccines.

3. METHODOLOGY

The analysis through new techniques such as data mining, machine learning or sentiment analysis are valid tools for obtaining information on large volumes of data, opening new possibilities for the analysis of social sciences (Arcila-Calderón et al., 2016). As stated by Vállez and Codina "its transversality allows opening a new space of knowledge that integrates several disciplines and involves a new way of interacting with information and media dissemination" (2018). Through the use of different algorithmic techniques it is currently possible to study the main topics, as well as the emotions and polarities derived from the totality of people who participate in the networks and not just a few, thus citizen participation with respect to their public administrations (Criado and Villodre, 2018), hate speech (Busón, 2020) or politics (Arce-García et al., 2022) can be studied.

By using these tools, we intend to achieve several aspects with this research: to study the relationships that exist users who talk about the effects related to thrombosis around vaccines, to know what are the feelings and emotions, as well as the main topics that are talked about.

The sample collection was performed using R software in its virtual environment Rstudio 1.2.5033 through the Twitter API 2.0 application interface and the academictwitteR library (Barrie & Chun, 2021). Through an academic-type account, historical analysis of messages between January 1 to April 20, 2021 (day of collection) is allowed, coinciding with the moments of greatest debate on the possible thrombosis caused by certain anticovid vaccines. As a search element, the query "trombos OR trombo OR trombosis" was used for messages written in Spanish and emitted from anywhere in the world. Once all the tweets that met these filters were collected, the following analysis processes were established:

- Visual network analysis: through the network theory applied to the area of communication (Barabasi, 2016), groupings and distances are established through the graphic representation of algorithmic studies to visually express the relationships and groups formed in the social network around a theme. In this process, the Gephi software was used in its version 0.9.2, which allows establishing connections and networks between users, through the representation of nodes (user accounts) and their edges (links between nodes). The chosen algorithm, ForceAtlas2 (Jacomy et al., 2014), represents the attractions and repulsions between nodes, which in turn are expressed by circles sized according to their degree of connection (Bastian et al., 2009). The eigenvector or central vector is studied to determine the importance of a node in the network (it gives value to the impact of an account with respect to those around it, quantifying its importance over the others), as well as its betweenness or intermediation, which represents the interconnection with respect to other nodes and gives a quantified representation of those that connect and vertebrate a network, helping in the dissemination of messages between users. A cluster analysis was performed to determine the groups of users in order to identify them (by means of this technique the algorithm is able to group the different users into similar profiles and behaviors). The analysis formed was established through the retweets (RT) collected in the sample, so it is analyzed what and who is being talked about as a reference.
- Analysis of feelings or polarity and emotions: through the application of algorithms for the attribution of positive or negative feelings, as well as basic emotions, an attempt is made to determine the perception of a given public opinion in relation to certain facts as described by (Arcila-Calderón et al., 2016). On the one hand, polarity, positive or negative, is attributed through the use of the lexicon developed by the National Research Council of Canada (NRC), version 0.9.2 in its Spanish version (Mohammad & Turney, 2012). In this way such a dictionary of words is compared, focused on nouns, adverbs and adjectives, which assigns a positive or negative value between one and minus one of valence per word, and which is modified by adjectives and adverbs to increase or decrease it and have an overall value per message (Swati et al., 2015) and thus check the semantic orientation of the text. For emotions the same lexicon, through the same operation, attributes in the dictionary values to each word of the basic emotions raised by Plutchik (1980) and later developed within the theory of multiple intelligences (Sautera et al., 2010). This process is performed through the Syuzhet R library, allowing the analysis of large volumes of text and checking graphically with respect to different variables, such as time, but it has the limitation that, although very advanced in English, in Latin languages its efficiency is lower, around 70% (Mohammad, 2016). The

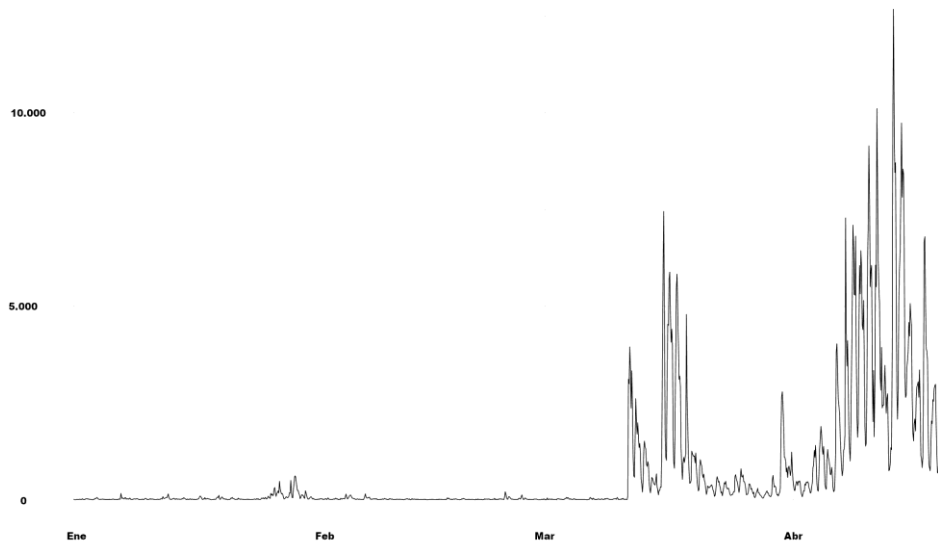statistical graphs of the relationship between these variables are represented using the R library ggplot2.

- Text mining: to determine the main frames posted on the social network Twitter without having to discard any message due to the volume treated, the use of algorithms was established to work texts in a massive way and eliminating the possible subjective perception that may be associated with them (Arce-García and Menéndez-Menéndez, 2016). The software, based on R, KH-Coder version 3.0 was used by means of the Snowball algorithm in stemming form, to search for the morphemes of the words and grouping them by cluster analysis (words with meaning that usually appear related to each other are grouped). All the messages expressed were taken as an analysis sample, discarding the retweets or retweets (RT), and the words that do not contribute meaning, called stopwords, were subsequently eliminated, following the list at https://www.ranks.nl/stopwords/spanish. Finally, a bivariate analysis was performed between the most frequently used morphemes and their relationships within each sentence, applying a cluster analysis to determine the eight main topics covered.

- Statistical analysis of Pearson's statistical correspondence between variables, using R software. The aim is to determine the dependence or not of two quantitative variables in a significant way within the statistical field. The aim is to determine whether there are emotions that are linked to each other.

4. FINDINGS

The collection of all the tweets that met the established requirements between January 1, 2021 and April 20, 2021 was 915,825, of which 151,242 (16.51%) were messages directly written by the user and 765,583 (83.59%) were forwards or retweets (RT). This corroborates that in social networks there is more of an effect of rediffusion of content from certain users than of the user's own creation. Thus, the formation of echo chambers described in the introduction would be reaffirmed. Of the 245,101 users who intervened, the great majority did not provide information on their location, but of those who did, 20% were from Spain, 3% from Argentina, 2.5% from Venezuela, 2% from Mexico, 2% from Paraguay and 1.2% from Chile.

The number of messages about thrombosis can be seen in Figure 1, where a very important increase in the number of tweets about this process can be seen in the middle of the month of March, then falling and rising again very strongly during the middle of the month of April, and finally falling sharply at the end of the month. These periods coincide fully with the controversy surrounding the anticovid vaccines and the appearance of cases of thrombi linked to their application. This fact is corroborated by the mention in 565,217 (61.62%) tweets of the word vaccine, 333,702 (36.44%) to AstraZeneca-Oxford, 28,015 (3.06%) to Janssen, 21,711 (2.37%) to Pfizer-BioNTech, 12,532 (1.37%) to Sputnik V and 8,532 (0.93%) to Moderna.

Figure 1. *Number of tweets over the study period*

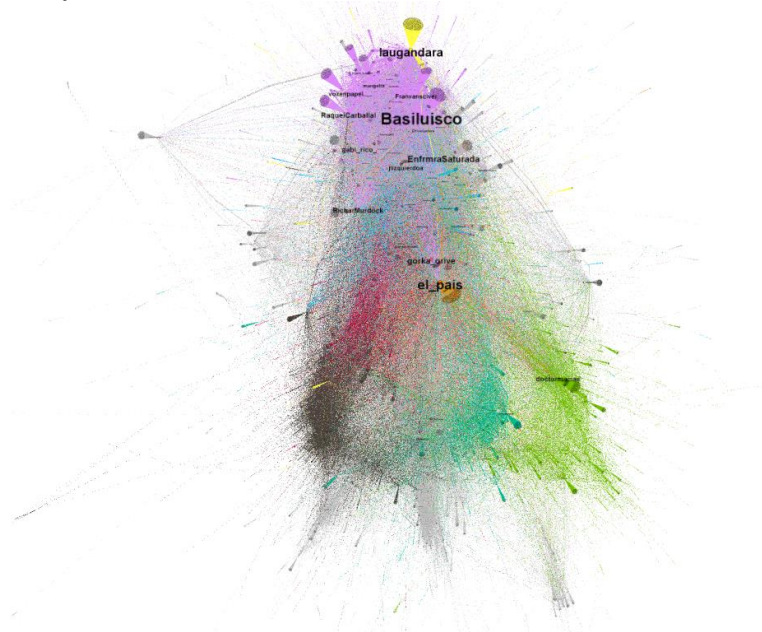**Source:** *Own elaboration.*

An analysis from network theory allows us to determine the relationships and formation of opinion groups, through different clusters, which can be represented graphically as shown in Figure 2. The average degree or average number of connections of a user with others in the network is 1.779. This network formation has a modularity of 0.686, so the assignment of each user to clusters is quite high and good for social sciences. A total of 1,889 different communities were detected, but where the top ten already account for 66.57% of the overall message traffic. Among the groups formed we can establish:

● The main group, in pink, above in Figure 2, represents 18.01% and corresponds mainly to influencers especially from Spain, from the area of biology, medicine and nursing, where @Basiluisco, a biologist, stands out as a central vector (value 1), which defines him as the most important element in the network. It also presents a very extensive connection with and between users due to its very high intermediation value. This group supports vaccination and gives reasons for doing so, in addition to saying that cases of thrombosis are very rare. Other references can also be found such as @Gorka_uribe, professor of pharmacy at the University of the Basque Country or @DrMiguelmarcos, professor and physician at the University of Salamanca. Also from Spain are groups such as the third (6.47% in light blue) of physicians (@Noapanden) and scientific disseminators (@pmarsurpia), or the eighth (4.83% in orange pink) around nursing dissemination (@EnfrmraSaturada).

● The second group in message traffic, in light green on the lower right, with 7.54%, is centered mainly on Latin American medical personnel and media, mainly Mexico, which also promotes vaccination as the previous group. The main referents are the media @proceso and the physician @DrPacoMoreno1.

● In the center of the network graph is the group around a Spanish media outlet but with a reach throughout Latin America: El País (@el_pais), which has one of the main central vector values

(0.822) and a large intermediation. This group, expressed in orange, moves 5.74% of the traffic of retweeted messages.

The groups where we can find messages that spread more fear and adverse reaction to the possible thrombi caused by vaccines, are in the fourth group (6.13% in brown on the lower left) and ninth (3.38% in red, just above the brown). There are no major influencers who are creating content (they do not present important values of own vector or intermediation), but there is a wide interrelation of numerous accounts with low profiles, called nano-influencers (less than 10,000 followers), but who redisseminate in the first group their fears by providing news from the Spanish media @el_mundo and @abc_es, and about the account @Froillannister (which is defined as an account of "Froilán I of Spain", accompanied by several national flags). The second group has as its main referent @navedelmisterio, a TV program that deals with mysteries and conspiracy theories.

Figure 2. *Network of webs that talk about thrombi or thrombosis.*
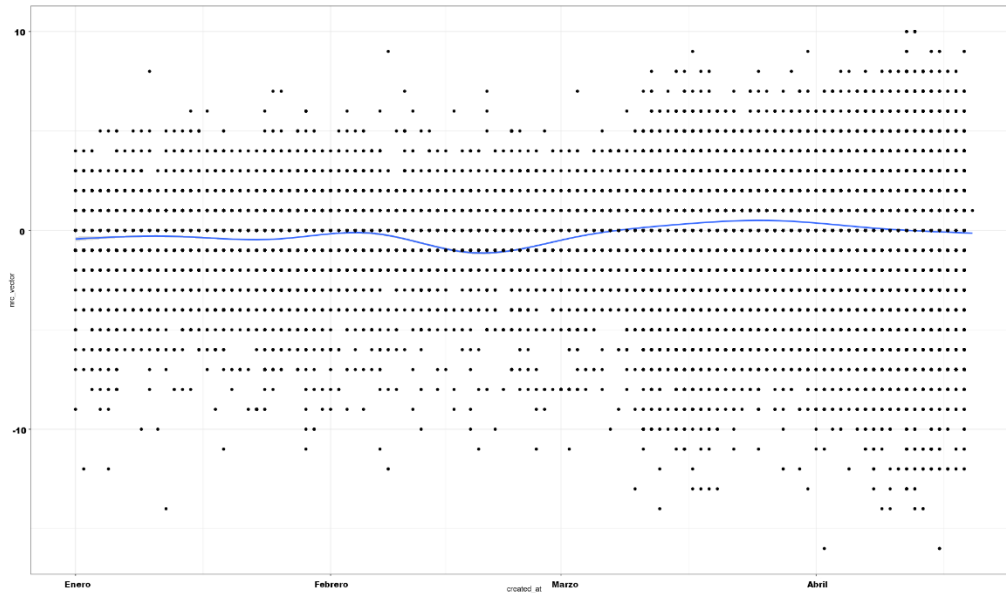

Source: *Own elaboration*

4.1. Emotional and valence study

A study of the polarity or sentiments, in the positive and negative sense, of the discourse of the messages and represented in Figure 3, clearly exposes two fundamental aspects:

● The average general sentiment is mainly negative, only remaining positive at the end of March and only very slightly so. The rest of the time the average value is in negative values.

● Values above or below valence three for a Twitter message can be considered highly polarized. Although the mean value of positive and negative polarity have similar levels, as shown in Table 1 (0.9292 and 0.8260 respectively), it can be seen in Figure 3 how there are many messages (represented by dots) very polarized that are increasing throughout the period

analyzed in both directions. Thus, although there are 24.81% of positive messages and 22.06% of negative ones, these are very intense, especially in a negative way.

Figure 3. *Valencia thrombus or thrombosis*

Source: *Own elaboration*

The emotional analysis can also be seen in Table 2, where fear is the main emotion that appears in 13.22% of the messages and with the highest intensity of all (0.495). The second most displayed emotion in quantity and level is anticipation or rational thinking, followed by sadness. Confidence only appears in fourth place, at almost half the level of fear.
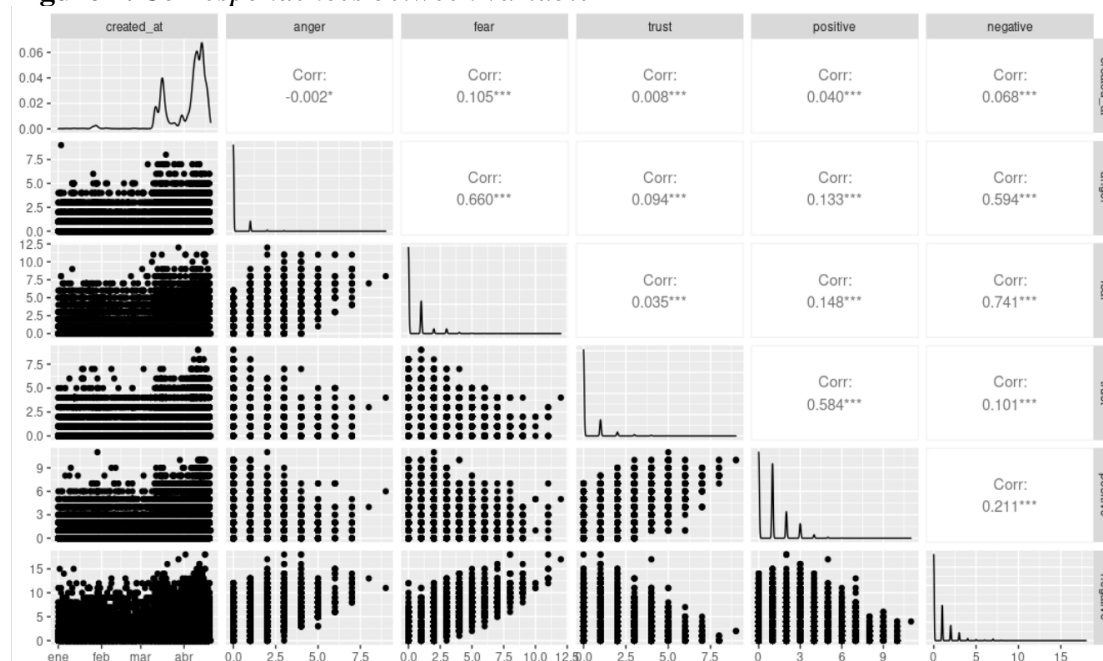
Table 2. *Presence and intensity of basic emotions*

	Disgust	Anticipation	Dislike	Fear	Joy	Sadness	Surprise	Confidence	Positive	Negative
Percentage	3,98	10,37	3,33	13,22	2,35	8,06	4,34	7,47	24,81	22,06
Average	0,149	0,388	0,125	0,495	0,088	0,302	0,163	0,280	0,929	0,826
Maximum	9	8	9	12	8	14	5	9	11	18

Source: *Own elaboration*

A cross statistical study of the feelings and main emotions of interest detected (disgust, fear and confidence) in the messages, both graphically and in terms of Pearson correlation, is shown in Figure 4. In the left column, the representation of each variable versus time can be seen, and how messages with a greater emotional charge are detected as March and April are reached. In the graphic correlations between variables, values above 0.5 can be seen between fear and disgust, disgust and negative, fear and negative (0.741, the highest correspondence), and positive and confidence. The correlation between the tendency for fear to increase over time is very slight, but the highest of all (0.105). It can therefore be said that there is an association between fearful speech accompanied by disgust and negative feelings. Establishing associations between fear and disgust makes people's thinking not reflective and intensifies, causing it to last much longer in time than if it is only accompanied by fear (Wylie, 2020).

Figure 4. *Correspondences between variable*

Source: *Own elaboration*

4.2. Text mining

The text mining analysis shows the eight main themes detected in the messages with the most used morphemes and their relationships with each other, in cluster order from most important or weighted to least:

- Cluster 1: thrombosis, vaccine, cases, astrazeneca, dead, million, causes, dose, major, much, effects, risks, people, years, country.
- Cluster 2: fear, have, can, people, put, me, pass, do, give.
- Cluster 3: suspend, against, Janssen, Spain, serious, various, apply, Europe, Denmark.
- Cluster 4: brain, study, relationship, report, medically, clotting, possible, rare, EMA.
- Cluster 5: days, AstraZeneca, female, safe, are, secondary, now, must, say.
- Cluster 6: probability, contraceptives, produce, cause, also, Pfizer, believe, want, suffer.
- Cluster 7: coronavirus, receives, research, European, Agency, links, Johnson, use.
- Cluster 8: doctor, talk, seems, nothing, problem, when, little.

These results reflect how the debate is centered on the use and possible consequences of vaccines. In the first place are those that determine the percentage of cases per million population, expressing the existence of cases and risks in people of certain ages. Cluster 7 relates the endorsement of the use of vaccines by the European Medicines Agency (EMA). But on the other hand, fear of what might happen and the temporary suspension in Europe of the Janssen vaccine for possible serious reasons, or the study of coagulations in the brain after the vaccine, also appear in other clusters.

In certain groups, the introduction of misinformation regarding supposed contraceptive phenomena associated with the Pfizer-BioNTech vaccine and suffering can be detected (Cluster 6).

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5. CONCLUSIONS

The study of the messages posted on the social network Twitter about thromboses or thrombosis from the beginning of the year until April 20, 2021, offers a strong causal relationship between them and the consequences of applying anticovid vaccines, since their number shoots up with the appearance in the media of problems with people who take the vaccines. In this way, the two great moments are centered in mid-March and, especially, in the first days of April, and then decrease. Thus, more than 60% of the messages relate thrombi and vaccines, and more than 36% do so with the AstraZeneca-Oxford vaccine, which received the most media attention due to cases derived from thrombi after its administration. The rest of the other vaccines have much lower percentages of mention (equal to or less than 3%).

The assignment of clusters for the detection of groups allows, firstly, to find groups that defend and promote the use of vaccines, on the one hand from Spain, which moves most users and influencers in the health and scientific fields, and from Latin America, which has mainly in Mexico its influencers in the health field. There are two groups with conspiratorial tendencies or tendencies to spread fear of vaccines and their consequences, without having clear references that champion a discourse in this sense, finding only fake accounts or accounts of programs about mysterious and conspiratorial phenomena.

Thus, the stated objectives are met, where the greater interest and polarization of the discourse of users can be seen, as stated by various authors (Zheng et al., 2021; Doha et al., 2022). All this, taken together, indicates that the communicative message comes from certain influencers in the scientific and health fields, differentiated on the one hand in Spain and on the other hand in Latin America, centered in Mexico in its dissemination. It can be seen how discourses of fear are disseminated, and the particular case is brought in front of the scientific fact, in which antiviral vaccines, the origin of the beginning of the end of the world pandemic, are the source of doubt, fear and lack of confidence. The appearance of a quarter of a million direct messages of disinformation reflects how anti-vaccine hoaxes could be spread without the lack of outstanding accounts through numerous accounts of little relevance. It would be, therefore, a crossroads of defense of the vaccine mainly by recognizable disinterested people, against a discourse without clear referents, which pours a very large emotional charge, especially negative. This would suggest the possibility of the existence of negationist and/or anti-vaccine groups organized through small anonymous accounts that seek to sow doubt and polarization, taking advantage mainly of the cases that have appeared in the media with the AstraZeneca-Oxford vaccine and that are trying to extend to other vaccines, such as those of Pfizer-BioNTech or Janssen. This attack on vaccines, especially that of AstraZeneca-Oxford, has also been corroborated in other countries (Stella et al., 2022). This would be the technique of the so-called astroturfing effect, campaigns where "the dissemination of misleading opinions by impostors [human or not] posing as autonomous individuals on the Internet with the intention of pushing a specific agenda" (Zhang et al., 2013) and which is linked to the spread of misinformation around vaccination as exposed by Ng et al. (2022).

All this reflects two fundamental aspects: vaccines have generated a debate in public opinion and the possible existence of certain side effects has led to a strong increase in the debate surrounding these aspects and an increase in fear. The struggle in the face of this lack of information is being made up for by numerous health professionals in a personal capacity who are on the networks, but who are not, for the most part, official media that reliably support confidence in vaccines. The other aspect comes from the amount of polarized discourse (emotions and feelings too intense for a normal conversation are found) in addition to main topics, as detected in text mining, linked to

misinformation. All this causes a great breeding ground around something essential such as pandemic vaccines and what exists in social networks in a large part does not help, as has also been detected in other languages. The existence of groups and messages that could be interested in introducing fear and disgust (so that it lasts longer in the collective) and mistrust among the population towards vaccines, by disinformative groups throughout Latin America in Spanish, as has been detected in other countries. It is therefore necessary to find good sources, which are the main sources of confidence in vaccines and which are lacking in the Spanish-speaking world. Not only does the negative have greater reach, but it even reaches a greater diffusion structure, fed by the bubble filters formed, where users only see what reaffirms their convictions as established by Pariser (2011). Therefore, official sources should be clear leaders in social networks and use techniques to disseminate their contents that mitigate the disinformative effort based on fear and disgust (which prevents rational thinking and that lasts over time), which almost only finds particular voices of some health workers.

This research has among its virtues its own limitations, since while it allows the analysis of almost a million messages over time, its algorithmic application on the Spanish language is still in the process of improvement.

6. REFERENCES

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