

The Covid-19 Vaccine on TikTok: A Study of Emotional Expression in The Brazilian Contexto

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Abstract

In this article, our objective was to analyze the emotions expressed regarding the Covid-19 vaccine in content published in Brazilian Portuguese on TikTok, a video sharing platform that has recently experienced global popularity. Our data set for this investigation was comprised of posts including the hashtag #vacina (vaccine), extracted using the Python TikTokAPI library. Emotions were identified and classified using standardized descriptors from the Human-Machine Interaction Network on Emotion (HUMAINE) and the Core Affect Model. Given the diversity of content on TikTok, videos with emotional content were also separated into categories. Results revealed a prevalence of positive emotions such as contentment, enthusiasm, and interest regarding the vaccines, especially in videos of a personal and informative character. Negative emotions, such as doubt and disapproval, were associated with contextual and strategic factors, with significant expression in humorous and infotainment publications.

Keywords: Vaccine, Covid-19, Emotions, TikTok, Brazil.

INTRODUCTION

As the Covid-19 pandemic took shape, discussions and debates around the topic of vaccines as a public health resource experienced increased visibility and gained new nuances in different societal spheres, due in large part to the high number of infections and deaths caused by the disease. In Brazil, which suffered the second highest number deaths caused by Covid-19 as

ranked by country (World Health Organization 2019), the approval and regulation processes of Covid-19 vaccines were subjected to disputes resulting from disinformation tactics (Monari, Santos, and Sacramento 2020; Recuero and Soares 2022) and politicization (Monari and Sacramento 2021; Recuero et al. 2022; Soares et al. 2023).

On internet social media platforms, characterized as interactive (Primo 2007) and

sociability (Santos and Cypriano 2014) spaces that allow for the expression of interests and affects (Papacharissi 2014; Serrano-Puche 2016), these disputes and their developments reverberated through content produced and published for different audiences and on distinct platforms (Almars et al. 2022), especially with regard to the adoption, by some governments, of isolation and social distancing measures as disease containment strategies. In light of these uses and appropriations, some studies have indicated how internet platforms and social media sites represent spaces that can be observed not only as informational sources on health topics (Orr, Baram-Tsabari, and Landsman 2016), but also as sources of information on the behavior of different sections of the public with regard to public health resources such as the vaccine (see, for example, Amanatidis et al. 2021; Southwick et al. 2021; Cascini et al. 2022).

With these premises in mind, our objective in this article was to investigate the emotions expressed by the Brazilian public on social media in regard to the Covid-19 vaccine and vaccination processes. To this end, we selected content about the vaccine that was produced and published on TikTok. This platform was chosen due to its growth and popularity, specifically in the Brazilian context, during the Covid-19 pandemic itself (P. Neto, Santos, and Mota 2022; Statista 2023). In addition to this factor, TikTok was selected due to the fact that the majority of studies on the Covid-19 vaccine and its relationship with social media and emotions have been carried out using data from other platforms, especially those that are text-based (see, for example, Chou and Budenz 2020; Hu et al. 2021; Greyling and Rossouw 2022; Obeica and Martins 2022; Rodas et al. 2022).

Taken *a priori* as a network built for the sharing of short videos, TikTok, according to Schellewald (2021), is more than an entertainment platform, constituting a means through which culturally significant artifacts emerge and can be interpreted in a contemporary context.

Brazil represents the network's third largest user base by country with 82 million users, behind only the United States and Indonesia (Statista 2023), with 12% of the Brazilian public affirming their use of TikTok as a source of information (Newman et al. 2022). These data demonstrate the need for careful reflection regarding the content produced on this platform, especially with respect to publications on the Covid-19 vaccine in a context permeated by conflict and dispute around its regulation (Monari and Sacramento 2021; Recuero and Soares 2022).

In light of these considerations, our primary research questions were: (1) Which emotions were expressed with regard to the Covid-19 vaccine and vaccination processes in TikTok publications in Brazilian Portuguese?; (2) Considering the diversity of published content, what types of posts were responsible for the greatest affective mobilization with regard to vaccines?; (3) What were the most important topics, under the central theme of the vaccine, that evoked emotions?

It is worth noting that, despite often being left unexplored, emotions have been described by numerous authors as important components of the understanding of social and historical events (Ahmed 2014; Corbin, Courtine, and Vigarello 2020), having been demonstrated as a viable analytical approach in the observation of popular behavior (Rathnayake and Suthers 2023), as well as of the attitudes, motivations, beliefs, and interests of the public with regard to public health resources (Chou and Budenz 2020; Hu et al. 2021; Southwick et al. 2021; Cascini et al. 2022), as is the case of the Covid-19 vaccine. Investigation of emotions in regard to these applications can contribute to the knowledge base of content that may encourage or discourage behaviors of specific segments of the public in regard to vaccines. Such information, in a period distinguished by its anti-vaccine rhetoric (Costa and Silva 2022), may prove relevant for the promotion of public vaccination tactics and strategies.

THEORETICAL BACKGROUND

Released in 2017 as an international version of the Chinese social network Douyin, TikTok, which is a property of Byte Dance (a technology company headquartered in Beijing, China), is a platform based around video sharing that gained worldwide popularity after acquiring Musical.ly in 2018, which had a similar format and was previously popular in the USA (Abidin 2020; Anderson 2020; Southwick et al. 2021).

Available in over 150 countries and having reached the one billion active worldwide user mark (Statista 2023), TikTok is centered around the production, sharing, and consumption of videos that vary in duration from a few seconds to a few minutes, which, according to researchers, is facilitated by its accessible and interactive interface design that promotes rapid editing and posting of content (Southwick et al. 2021). With this defining characteristic, TikTok has ranked among the fastest-growing platforms over the past few years, being indicated as one of the most downloaded apps of the last decade (Schellewald 2021; Lewis and Grantham 2022). These processes only intensified during the Covid-19 pandemic, when TikTok experienced an exponential expansion of its user base (Southwick et al. 2021), particularly among the youngest demographics, which are considered its target audience (Montag, Yang, and Elhai 2021; McCashin and Murphy 2022).

In Brazil, where TikTok boasts 82 million active users (Statista 2023), 45% of its audience is between 19 and 29 years of age (Statista 2022), corroborating this trend. Given the platform's intense growth, researchers have suggested that TikTok may constitute a channel for political debate (Medina Serrano, Papakyriakopoulos, and Hegelich 2020), dissemination of official information by governments and institutions (Chen et al. 2021; Che, Zang, and Kim 2022), and the dissemination of educational content (Barin, Ellensohn, and Silva 2020; Hayes et al. 2020), as well as public health information (Basch, Hillyer, and Jaime 2020; Ostrovsky and Chen 2020).

In regard to this last point, Wang and He (2022) indicate that, despite TikTok having been one of the fastest growing platforms during the pandemic and also had most content published this context, the implications of the information published during this period are not entirely clear, which is also the case in terms of content specifically related to the Covid-19 vaccines. According to Southwick et al. (2021) and Basch, Hillyer and Jaime (2022), the careful interpretation of these data is of utmost importance, seeing as content published on TikTok can play a significant role in forming how people who use the platform receive, interpret, and adhere to circulated messages and guidelines.

With these dynamics in mind, as well as the database of studies that have already been performed on vaccine-related content on other platforms such as Twitter (Hu et al. 2021; Monselise et al. 2021), Facebook (Oliveira et al. 2023) and Instagram (Seltzer et al. 2017; Basch and MacLean 2019), researchers have also applied their efforts to the analysis of vaccine-related content on TikTok. This approach is understood as an opportunity to evaluate and comprehend the emotions expressed by the public in regard to vaccines (Chou and Budenz 2020; Cascini et al. 2022).

From this perspective, with the objective of understanding messages and interactions related to the HPV vaccine on TikTok, Boatman et al. (2021) analyzed content on this particular vaccine in the 170 most popular videos on the platform that addressed the theme. Their conclusion was that the majority of the publications were pro-vaccine. However, they also observed that anti-vaccine publications, despite being fewer in number, garnered more user interactions; this was considered to be an important factor in the promotion of more effective youth-targeted strategies on the theme of vaccines.

Southwick et al. (2021), in turn, characterized Covid-19-related TikTok content during the initial months of the pandemic (January to March, 2020). Of the 750 videos that were

analyzed, the majority were considered primarily humorous or parodical, while 15% evoked fear and 6% evoked empathy. Over the period studied, a shift was noted in the emotional content of the analyzed videos, with fear fading and empathy gaining in prevalence, especially in the month of March.

Wang and He (2022) similarly investigated the emotions expressed in TikTok videos related to the Covid-19 vaccine. Their results also indicated that the majority of publications, especially at the beginning of the pandemic, were humorous or parodical in character. With respect to the emotions identified, joy was most frequently present in videos with the hashtag #vaccine, followed by surprise regarding side effects and the attitudes expressed by certain groups regarding the vaccine. Less commonly, negative emotions such as anger, indignation, and revulsion were demonstrated, generally in sarcastic comments or in content based on disinformation.

Lewis and Grantham (2022) also found a preponderance of favorable positions towards the Covid-19 vaccine in a study investigating discourse on the topic on TikTok, analyzing the 100 most popular videos with the hashtag #CovidVaccine. The authors also found that most of the videos contained elements of humor and were produced by users who did not present themselves as professionals or specialists. This finding, as well as the authors' determination of a low level of contribution to the theme by mega-influencers—defined as users with exceedingly large numbers of followers—indicate that the production of vaccine-related content, on the whole, was performed by average people.

The bias towards humor and parody, which was pointed out in the majority of studies performed on TikTok, was also corroborated by Basch et al. (2021), who described content related to the Covid-19 vaccine on the platform. Among their results, in contrast to the other studies cited, Basch et al. (2021) noted that the majority of videos in their data set discouraged vaccination. It is important to note that this

dynamic was accentuated precisely through the use of humor and parody, which, according to the authors, were not always intended to entertain, but rather to discourage vaccination, and that this was occurring even before the vaccine was distributed to the public, demonstrating how significantly negative sentiments and emotions can be expressed through a phenomenon typically considered to be positive, as in the case of humor.

Some authors use the term sentiment in their studies. There is, however, a distinction between emotions and sentiments in the literature, though there may not be a consensus. Stets (2006), for example, defines sentiment as a subjective experience that reflects socially shared meanings. Emotion, in turn, is understood as an intense behavioral response of short duration to a determined event or object. The American Psychological Association (APA 2014) adds that sentiments are distinguished from emotions due to their internal nature, while emotions are projected out into the world. Originally, this study was designed to focus on emotions, which have been more widely explored by our research group, which initially investigated emotions expressed in science museums. However, given that studies on sentiments are somewhat convergent to our objectives, we included references to some studies in this line. In these cases, we have preserved the terms used by the authors (emotions or sentiments).

Despite the relevance of these studies, we observe that, in their majority, they were carried out in high-income countries (Limaye et al. 2021) and in the English language (Perez Rosas, Mihalcea, and Morency 2013; Xu, Chang, and Jayne 2022). In Brazil, some efforts have been made to investigate the relationships between vaccines, social networks, and emotions, though they are mostly still incipient. In their majority, they have been carried out on text-based platforms, such as Twitter in the case of articles published by Penteado et al. (2021), Obeica and Martins (2022) and Rodas et al. (2022), which all investigated the feelings and emotions of the

public in regard to Covid-19 vaccines during specific periods of 2022.

A predominance of positive emotions following the approval of the vaccine in Brazil was among the most noteworthy findings of these studies (Penteado et al. 2021), along with the occurrence of positive emotions and preference for the Coronavac vaccine (Obeica and Martins 2022), as well as a shift in the polarity of emotions expressed, specifically a reduction of positive emotions due to the growing numbers of Covid-19-related infections and deaths and the emergence of new viral strains (Rodas et al. 2022). Other studies, focused on other social networks, have also been performed, such as a study by Author et al. (2023) that aimed to identify the emotions expressed regarding the Covid-19 vaccine on Facebook, as well as their valences and objects, in which it was observed that positive emotions predominated. However, negative emotions were also prevalent in reference to often disregarded contextual factors, such as political figures involved in the processes of regulating the vaccines and management strategies for addressing the pandemic.

In recognition of the contributions and limitations of these studies, our current study proposes to expand reflections on the theme of the Covid-19 vaccines and the emotions expressed regarding them on a platform that, as previously described, has been little explored to date, as is the case of TikTok.

MATERIALS AND METHODS

Data Collection

In contrast with other networks, TikTok still does not make an Application Programming Interface (API) available for general use or for Brazilian researchers for the purposes of conducting studies on the platform. As such, data extraction for this article was performed using the Python TikTokAPI library (<https://github.com/davidteather/TikTok-API>),

which offers access to an unofficial TikTok programming interface for the extraction of publication metadata such as authorship, date of publication, text, video urls, and interactive video elements such as stickers and music, among others.

We created a Python script based on this code that would scrape video data for publications with the hashtag #vacina (<https://www.tiktok.com/tag/vacina>), considering each publication's ranking in terms of interactions, which is performed by the platform itself. This script was written to solicit up to 1,000 videos and returned a sample of 934 publications. This sample was later manually filtered and verified in order to select only publications that were in Brazilian Portuguese and relevant to the theme of the study. Seeing as TikTok does not have an official API for Brazilian researchers, it was not possible to specify data parameters or a temporal window. As such, the data correspond exactly to the list of most-interacted-with videos with the hashtag #vaccine that were displayed at this TikTok URL on November 9th, 2022 (the data at which publications were extracted).

As a result of this filtering process, 290 posts were discarded due to their foreign origin and 38 were excluded due to being unavailable at the time of data codification. This resulted in a final sample of 606 publications for initial analysis in terms of the emotions expressed regarding the vaccine in Brazilian TikTok content.

Data Codification Process

After the collection and filtering of the data was complete, a primary analysis was performed on the vaccine-related TikTok posts in order to identify emotional expression. In the posts that were categorized as containing identifiable emotional expression, the descriptor "emotion expressed and identified" was applied. The descriptor "no emotional expression" was applied to publications void of emotional content, and "emotion not identified" was applied to posts that, despite having observable emotional

content, lacked clarity in terms of which emotion or emotions were being expressed.

Of the total number of Brazilian Portuguese publications (n=606), which constituted the initial sample, 435 were classified as “emotion expressed and identified”, 111 as “no emotional expression”, and 60 as “emotion not identified”. In view of this study’s objective of investigating the emotions of the Brazilian public in regard to the Covid-19 vaccine on TikTok, the publications in the “no emotional expression” and “emotion not identified” categories were discarded, resulting in a final dataset of 435 posts.

Emotions were subsequently labeled via multimodal sentiment and emotion analysis (Morency, Mihalcea, and Doshi 2011; Perez Rosas, Mihalcea, and Morency 2013). Employing an approach similar to that used in analyzing sentiments and emotions in text (Liu 2010; Xu, Chang, and Jayne 2022), multimodal sentiment and emotion analysis considers not only text but also audiovisual characteristics of the objects beings analyzed, being, therefore, more appropriate for the analysis of TikTok content.

According to Perez Rosas, Mihalcea and Morency (2013), studies that use sentiment and emotion analysis as a foundational technique have been carried out primarily on textual data,

even when applied to audiovisual objects. As such, important content elements such as sound and video, as well as emotional expression not captured by text, are not considered in a number of studies, which constitutes a technical deficit for the field. Multimodal analysis proposes to integrate these elements, and has been growing in popularity and robustness through its use in the carrying out of new studies (such as Busso and Narayanan 2007; Want and Guan 2007; and Soleymani et al. 2017, among others).

The transcription of textual elements into audio and video has shown itself to be an important strategy in the adoption and performance of multimodal analysis (Perez Rosas, Mihalcea, and Morency, 2013). This practice was employed on the TikTok publications investigated in this study. Data were then reverified in order to revise and identify their emotional expressions. Emotional classifications began with the 48 emotional descriptors in the Human-Machine Interaction Network on Emotion (HUMAINE) for Emotion Representation and Annotation Language (EARL), as indicated in the studies performed by Schröder, Pirker and Lamolle (2006) and Douglas-Cowie et al. (2007). During data revision, eight more emotional descriptors were added to this list, for a total of 56 descriptors (Table 1), as previously described in other studies (Rowe et al. 2023).

TABLE 1. List of emotional descriptors adapted from HUMAINE/EARL protocols.

Negative and forceful	20 - Shame	38 - Happiness
1 – Anger	Negative and passive	39 - Joy
2 – Annoyance	21 - Boredom	40 - Pleasure
3 – Contempt	22 - Despair	Caring
4 – Disgust	23 - Disappointment	41 - Affection
5 – Irritation	24 - Hurt	42 - Empathy
6 – Impatience	25 - Sadness	43 - Friendliness
7 – Disapproval	Agitation	44 - Love
Negative and not in control	26 - Stress	Positive thoughts
8 – Anxiety	27 - Shock	45 - Confidence

(Continues)

TABLE 1. (Continued)

9 – Embarrassment	28 - Tension	46 - Courage
10 – Fear	Quiet positive	47 - Hope
11 – Helplessness	29 - Calmness	48 - Humanity
12 – Powerlessness	30 - Contentment	49 - Satisfaction
13 – Worry	31 - Relaxation	50 - Pride
Negative thoughts	32 - Relief	51 - Trust
14 – Doubt	33 - Serenity	Reactive
15 – Perplexity	Positive and lively	52 - Interest
16 – Envy	34 - Amusement	53 - Curiosity
17 – Frustration	35 - Delight/Enchantment	54 - Politeness
18 – Guilt	36 - Elation	55 - Surprise
19 – Defensiveness	37 - Excitement	56 - Enthusiasm

Note: Rowe et al. (2023) adapted from HUMAINE and EARL.

It is important to note that the identification of either one or multiple emotions was possible for each post, due to their duration and audio-visual elements. After emotions were classified using the above-mentioned descriptors, their valences (positive or negative) and excitation levels (activation and deactivation) were assessed,

using the description of the circumplex model of Russel’s (2003) Core Affect Model as a foundation (Figure 1).

During this process, we also endeavored to identify the category of video to which the expressed emotions belonged. These categorizations were deemed necessary due to the

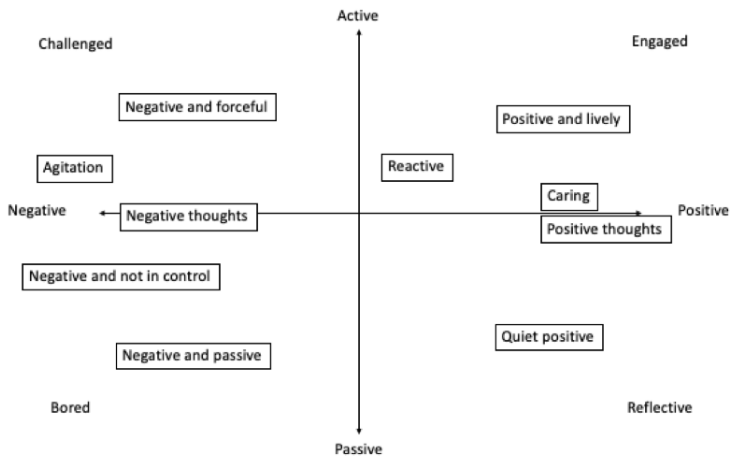


FIGURE 1. HUMAINE/EARL descriptors, as grouped by the circumplex model.

Note: Adapted from Rowe et al. (2023).

multiplicity of content types and formats that circulate on TikTok. These categories of video modality and content can be observed in Table 2.

TABLE 2. Video Categories.

Personal	Videos produced by average people, expressing their opinion, experiences, and emotions regarding the vaccine.
Informative	Videos of a predominantly objective and informative character, posted by healthcare professionals, researchers, and communicators.
Infotainment	Videos that mix data and information with entertainment.
Humorous	Videos based on humor, parody, or satire.
Marketing	Marketing-biased videos that advertise products and services.
Unidentified	Videos of unidentified authorship and a lack of clear objectives.

Source: Authors' compilation (2023).
Note: The infotainment category was defined based on discussions on the concept published in Gomes (2009) and Boukes (2019).

Finally, the objects of the emotions expressed were also codified, which was performed due to the observation that many of the emotions were not actually targeted on the vaccine itself, but rather on contextual factors, such as the pandemic in general or the actions of certain political figures. This process as a whole was performed initially by one of the authors, after which it was shared with the other author for purposes of discussion, revision, and more reliable codification.

RESULTS

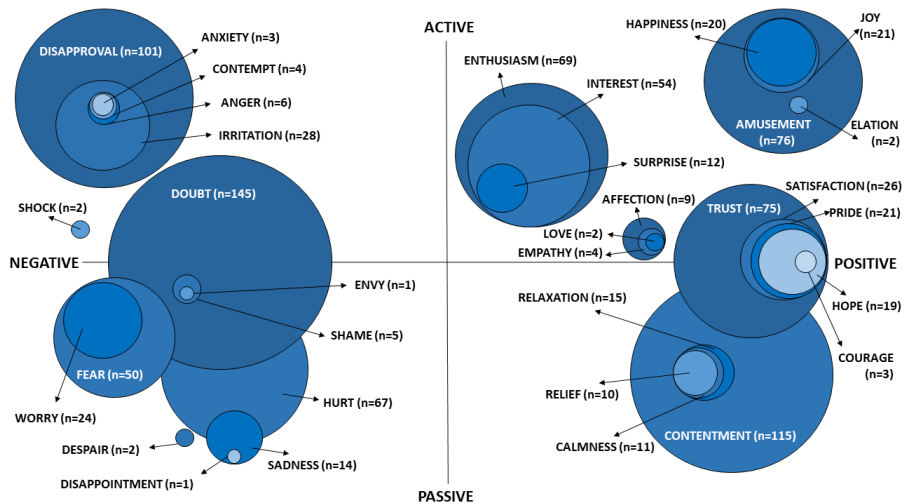
Of the 435 publications with expressed and identifiable emotions that composed this study's data set, 34 of the 56 previously discussed descriptors were applied. These emotions were expressed a total of 1,017 times. This level of expressiveness underlines TikTok's potential for

emotional expression as a platform in vaccine-related publications.

Doubt was the most commonly identified emotion (n=145), followed by contentment (n=115), disapproval (n=101), amusement (n=76), trust (n=75), enthusiasm (n=69), hurt (n=67), interest (n=54), fear (n=50), and irritation (n = 28). Other emotions were less commonly identified (Graphic 1). In terms of emotional valence, 553 (54.5%) were positive and 464 (45.6%) were negative. Grouping the occurrences of emotional expression via Russel's (2003) circumplex model, we observed 410 occurrences of high activation emotions, of which 269 had positive valence and 141 had negative valence, while 607 emotions demonstrated a degree of passivity, of which 295 had a positive valence and 312 had a negative valence, respectively.

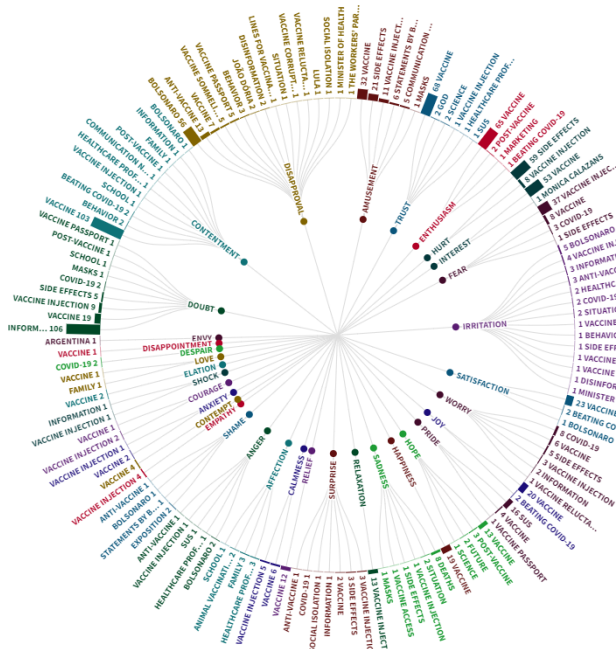
Of the total number of occurrences of emotional expression, 471 (46.3%) were directed specifically toward the vaccine, which in the vast majority of cases generated positive emotions (n=423) rather than negative ones (n=48). The remaining occurrences were directed towards topics associated with vaccination in Brazil, such as the search for information regarding the vaccine's arrival in the country, reluctance in regard to vaccine injections, vaccine side effects, and the actions and speech of former president Jair Bolsonaro in the context of the Covid-19 pandemic and other topics associated with the object of investigation (Graphic 2).

Doubt, the most frequently (n=145, 14.3%) expressed emotion, was not expressed in relation to the vaccine itself or its functionality, but rather in terms of a process of general information gathering, resulting in questioning that varied from banal inquiries regarding the day-to-day situation of users consuming content on the platform in order to promote a sense of closeness, to inquiries regarding the purchase of vaccine by the federal government, its arrival, and its administration in Brazil. Doubt was also frequently used as a personal and humorous strategy to draw attention of other users to



GRAPHIC 1. Emotions identified in the data set.

Source: Authors' compilation (2023).



GRAPHIC 2. Emotions and their respective objects.

Source: authors' compilation (2023). Note: Mônica Calazans (n=1) was the first Brazilian to be vaccinated against Covid-19 in the country. João Dória (n=2) was governor of the state of São Paulo from 2019 to 2022. SUS (n=16), in turn, is the acronym representing the Brazilian national health system (*Sistema Único de Saúde*), which provides unlimited, universal, free access to health services for the Brazilian population.

TABLE 3. Descriptive transcription of representative publications of different emotions expressed in the data set.

Category	Transcription of publication
Personal	<p>[[On video, a woman and child dancing while shouting]]. A1: Out Bolsonaro, Out Bolsonaro, Out Bolsonaro! [DISAPPROVAL]. Come vaccine, come vaccine, come vaccine! [laughter] [INTEREST] [ENTHUSIASM]</p> <p>[Video subtitle: “2 hours post-vaccine 🥰😁🤗😁👤”]. [[On video, smiling [CONTENTMENT], a woman shows her vaccination card, while fragments of the song “Where we’ve got” (Aonde nós chegou), by MC MR and MC Dede, containing the lyrics “Look, where we’ve got. It was worth the wait”, play [CONTENTMENT]]]. [cut]. [Video subtitle: “Puuure joy [JOY] 🧑”]. [The woman continues showing off her filled-in vaccine card, satisfied [SATISFACTION]]. [cut]. [Video subtitle: “5h later 🤔😞😞😞😞😞😞😞”]. [[On video, the same woman with a facial expression demonstrating a lack of energy, followed by images of a thermometer and a box of paracetamol, while the song “I’m feeling bad” (Tô passando mal) by the Bonde das Atrevidas, plays in the background, including the lyrics “I’m feeling bad, I’m feeling bad, I’m feeling, I’m feeling, I’m feeling bad. I’m feeling bad, I’m feeling bad, I’m feeling, I’m feeling, I’m feeling bad”]]. [Video subtitle: “I died” [HURT]].</p>
Humorous	<p>VOICEOVER: The girls that saw me seemed really bored, I decided to make them laugh a little [[On video, a young man [A1] is vaccinated by a healthcare professional [A2]]. VOICEOVER: I felt nothing, how wonderful [SATISFACTION]. A1: After this will I be able to play guitar? [DOUBT]. A2: Sure you can! A1: Woah, that’s awesome, I’ve never played a guitar before [laughter] [AMUSEMENT]. Voiceover: ahahahaha, they’re so cute [AFFECTION].</p> <p>[[On video, imitating female characters, two men walk down a street]]. A1: Aw, Mona, I’m nervous about the vaccine [WORRY]. A2: Mona, I’m not afraid of the vaccine, I’m afraid of the reaction [FEAR]. A1: Oh man, I’m so nervous about this vaccine [WORRY]. A2: And I’m even more [WORRY]. [[The characters walk into a place simulating a vaccination station are are received by another character- a healthcare professional [A3]]. [cut]. A3: Next! [cut]. [[On video, A1 and A2 enter the vaccination room]]. A1: Come on, friend. [cut]. [[Video shows A3 simulating injecting the vaccine into A1]]. A1: O:O:OOOWW:W [HURT]. A4: What happened? [DOUBT]. A2: What happened girl? [DOUBT]. A1: No, s* [inaudible] [on video, at the moment of her response, A1 begins to speak in a deep, masculine voice, as if it were a side effect of the vaccine, at which the other characters waiting to be vaccinated become afraid and run out [FEAR]]. A2 and A4: OO:OW:W. A3 [laughter] [AMUSEMENT].</p>
Informative	<p>[[On video, a man responds to a follower’s comments]]. [Video subtitle “Reply to xxx comment Dr. I’m 3 months pregnant and I’m afraid to take the third dose of the covid vaccine” [FEAR]]. A1: The Covid vaccine, there are so many questions about whether it can be taken all during pregnancy or even in a woman trying to get pregnant. The American Reproductive Society publishes a message every 15 days on the vaccine and the disease. The vaccine, any one of them, there’s no problem if it’s taken outside of pregnancy or during pregnancy at any stage. The recommendations of health agencies is to take the vaccine. It’s more dangerous for a pregnant woman to go to the hospital because she wasn’t vaccinated than any possible damage that the vaccine could cause [TRUST]. So, get vaccinated everybody.</p> <p>[Video subtitle: “Vaccination in Brazil will begin for the elderly 75 and older, healthcare workers and the indigenous”]. [[Replay, on video, of content from CNN Brazil]]. A1: The new Coronavirus vaccine is going to be administered to the elderly 75 and older, to the healthcare team and to indigenous peoples. What do you guys think? [DOUBT].</p>

(Continues)

TABLE 3. (Continued)

Category	Transcription of publication
Infotainment	[[On video, two men simulate injecting the vaccine]]. [Video subtitle: VACCINE ACTING CHALLENGE"]. A1: Vaccine acting challenge. You're going to vaccinate me. A2: If you don't want to get injected in the butt, follow us and leave us a like. [Video subtitle: "Next!"]. A2: Next. A1: Hi, is this where you get vaccinated? [DOUBT] [Video subtitle: "(irony) No, this is where you get milkshakes!"]. A2: No, this is where you get milkshakes, I look like an ice cream guy. [Video subtitle: "Of course it's here!"]. A2: Of course it's here, you know. A1: Wait, wait. Before you stab me let me ask you some questions. [Video subtitle: "Get on with it!"]. A2: Get on with it. A1: Is the vaccine safe? [DOUBT] [Video subtitle: "If it weren't, we wouldn't be giving it"]. A2: Of course it's safe, dude. If it weren't safe, we wouldn't be giving it, right? [TRUST]. A1: Ok, but what if I turn into an alligator? [DOUBT] [Video subtitle: Are you kidding?"]. A2: You're kidding with me, aren't you? A1: Last question. Is it going to hurt? [DOUBT] [Video subtitle: I already injected it]. A2: I already injected it. A1: What... [Video subtitle: "I injected it while you were talking"]. A2: Yea, while you stood there blabbing I injected you with it. A1: Seriously, but I didn't feel anything [video subtitle: "That's because it doesn't hurt."]. A2: That's because it doesn't hurt, right. A2: [laughter] I thought it was going to hurt, woah. [Video subtitle: You know what hurts? Losing someone to this virus without being able to say goodbye!"]. A2: Do you know what hurts? Losing someone to this virus without being able to say goodbye [SADNESS]. [Video subtitle: "If you liked this, leave me a like and follow me 🙏🏻"]. A1: That's true, yea... when's the second dose going to be? [DOUBT].
Marketing	[[On video, with an instrumental soundtrack and subtitles, a woman discusses the vaccines]]. [Video subtitle: Which COVID vaccine is best? [DOUBT] "Coronavac Efficacy 50% mild 78% moderate 100% severe" "Astrazeneca 70% efficacy" "Pfizer 95% efficacy" "Moderna 94% efficacy "Sputnik ?? " If you've lost sleep thinking about this.." "It's not worth worrying about what we can't control" "Take whatever's available" "Sleeping well increases the efficacy of any vaccine!" "Sleep tips: @xxx"].
Unidentified	[Video subtitle: ""What do you think about the vaccine passport?"" [DOUBT].

Source: Authors' compilation. Note: Despite published content containing some public characteristics, for ethical reasons, it was decided that the creators of the posts would not be identified.

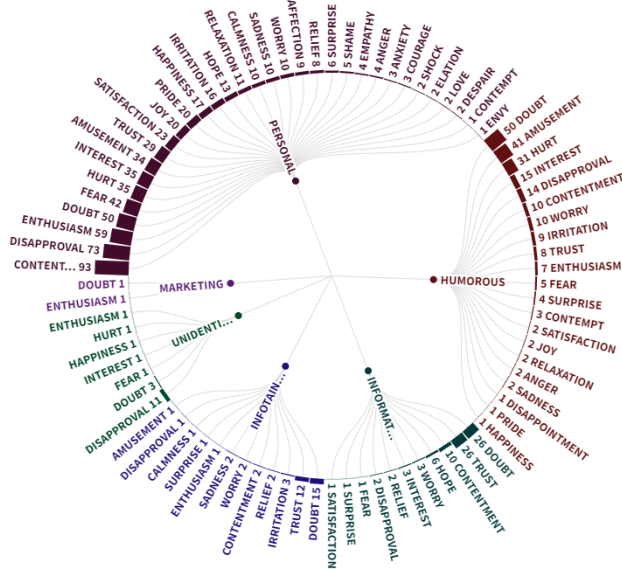
content published on TikTok (Graphic 3). The vaccine was the object of doubt only 18 times. Similarly, other emotions such as disapproval ($n = 101$, 9.9%), hurt ($n = 67$, 6.6%), and fear ($n = 50$, 5.3%) appeared mostly directed towards ancillary objects and topics, with former president Jair Bolsonaro and his actions being especially noteworthy in this category, as well as the injection and side effects of the vaccine. These topics were present in some videos in which users demonstrated both their fears due to the possibility of pain during the injection, as well as moments post-vaccination, during which they showed pain in their arms, chills, and the use of medication.

Expressions of contentment, the second most frequently observed emotion ($n=115$, 11.3%),

was observed specifically associated with the vaccine 103 times, appearing in videos in which people recorded and shared the moments in which they were vaccinated. The same dynamic applied for the emotions of trust, enthusiasm, and interest, which were also mostly expressed in relation to the vaccines themselves.

In numerical terms, emotions were identified most in content with a predominantly personal character ($n=652$, 64.3%), followed by those of a humorous character ($n=220$, 21.6%), and then the informative ($n=81$, 8%), infotainment ($n=43$, 4.2%), unidentified ($n=19$, 1.9%) and marketing categories ($n=2$, 0.2%) (Graphic 3).

Publications categorized as personal in character evoked the most positive emotions ($n=392$). In the informative category, the



GRAPHIC 3. Video categories and corresponding emotions.
Source: Authors' compilation (2023).

majority of the publications were also positive (n=48). Negative bias predominated in videos in the humorous (n=131), infotainment (n=23), and unidentified (n=16) categories, while the marketing category had one video containing positive emotional expression and one containing negative emotional expression.

DISCUSSION

The publications produced on TikTok and collected for this study on the topic of the Covid-19 vaccine evoked an expressive quantity of emotions. This demonstrates the fact that TikTok cannot be considered a space that offers only entertainment, and rather should be considered as a dynamic structure that, through its content that is produced by diverse users, reflects and projects interests, perspectives (Schellewald 2021), beliefs, and emotions on topical themes in society, as occurred with respect to the Covid-19 vaccine and vaccination processes.

In our analyses, we observed a predominance of positive emotions in regard to the vaccine,

especially the emotions of contentment, amusement, trust, enthusiasm, and interest. This result reinforced findings of other studies on the topic of discussion of the vaccines on TikTok and other platforms (Hu et al. 2021; Greyling and Rossouw 2022; Lewis and Grantham 2022; Wang and He 2022; Oliveira et al. 2023). However, generally speaking, the occurrence of one negative emotion, doubt, was highlighted as the most frequent emotion of all ($n=145$, 14.3%), even though it was not primarily or even frequently directed towards the vaccine itself.

In the analyzed data set, doubt resulted from questions regarding general day-to-day issues with the intention of increasing contact and closeness between the producers and consumers of content on the platform, demonstrating its capacity to serve as a strategically mobilized resource to attract public attention, especially in humorous videos (Graphic 3). Disapproval, another negative emotion, was in turn primarily associated with the actions and speech of former president Jair Bolsonaro (Graphic 2), who on

numerous occasions voiced his opposition to vaccines, propagated disinformation about them (Recuero et al. 2022; Recuero and Soares 2022), and promoted the use of medications lacking proven efficacy (Monari, Santos, and Sacramento, 2020).

The expression of these emotions in regard to objects other than the vaccine itself demonstrates how discussions on the topic of vaccines involve not just topics such as healthcare and scientific development, but also politics (Sun et al. 2022) and the functionality of the platform itself, based on the attention economy (Davenport and Beck 2001). For Hu et al. (2021), in some cases these articulations can be problematic, especially when they result in anti-vaccination process positions, as they reverberate into public debates and the ways in which the vaccines are understood.

Publications in the personal category were the most numerous, and contained mostly positive valence emotions such as contentment, enthusiasm, and interest, indicating the use of TikTok to discuss the personal experiences, perspectives, and expectations of users regarding vaccines. Lewis and Grantham (2022) commented on this same bias towards the personal in their study, observing that, in most of the videos they analyzed, the creator presented a personal narrative in the first person, often in the form of a monologue based on personal experiences.

In contrast to the personal category, the second most common category, humorous videos, demonstrated a preponderance of negative emotions. The recurrence of negative valence emotions in this seemingly positive category is due to the high frequency of doubt, which, associated with humor, parody, or satire, was utilized, as previously stated, as a strategy to draw attention and produce engagement. According to Schellewald (2021), humor and comedy are forms of communication constituent to the process of content production and consumption on TikTok, as well as serving as a technique to attract interest and raise visibility. However,

according to Basch et al. (2021), in humorous content, this strategy can be employed in the evocation of anti-vaccine emotions, for example in parody or satire videos, in which disinformation about vaccines can be explored and perhaps further disseminated since it is associated with a sense of fun.

The configuration observed by Basch et al. (2021) was also observed in this study's data set through occurrences of the "hurt" emotion, a negative valence emotion that was often expressed in the humorous category in situations in which videos depicted users satirizing or simulating suffering during their injections or experiencing side effects of the vaccine, which, in the context of disinformation, can be considered as a communication risk in regard to vaccines, increasing anti-vaccine sentiment.

In the informative category, positive emotions outweighed negative ones, which was not the case in the infotainment and unidentified categories. Informative publications contained an equal number of expressions of trust and doubt. Trust was expressed in relation to the vaccines through the communication of informative statements by healthcare professionals, researchers, and communicators, whereas doubt was utilized as a resource to generate interactions with followers (see Table 3). Doubt was also the most frequent emotion in the infotainment category, in which it was expressed similarly to its expression in the humorous category, reinforcing the necessity of reflection on published content on vaccines that at first seem to be positive (Basch et al. 2021), but upon deeper analysis may not have positive effects. In the unidentified category, doubt and disapproval were prevalent, and the publicity category had only one positive and one negative occurrence of emotional expression.

In general, considering the diverse array of emotions that were expressed and identified, as well as their objects and categories, our analysis of this data set indicates that the vaccine, isolated from its context, was treated positively in the personal and informative categories, in contrast

to the humorous, infotainment, and unidentified categories.

FINAL CONSIDERATIONS

In this study, our objective was to analyze emotions expressed in relation to the Covid-19 vaccine and vaccination processes on TikTok. Our findings revealed a diverse array of emotions identified in publications of distinct categories, as well as the principal topics that were associated with the vaccine and that garnered attention.

Specifically regarding the vaccine, positive valence emotions such as contentment, trust, and enthusiasm were the most frequent, while negative emotions were evoked in regard to issues involving public debate about the vaccines, as in the case of expressions of doubt (the most frequently expressed emotion in the data set as a whole), which was used primarily as an engagement strategy; disapproval, related to the speech and actions of former president Jair Bolsonaro; and hurt, related to reluctance to take the vaccine as well as its side effects. Positive valence emotions were mostly expressed in the personal and informative categories, which was revealed by the categorization process adopted in our analysis. The humorous category, often initially perceived as positive, was responsible for a large number of expressions of negative valence emotions, which was also the case for the infotainment and unidentified categories. This result highlights how much negative content about vaccines can gain visibility through strategies based on humor and infotainment, constituting risks to effective communication about vaccines.

After video categorization, the identified emotions and their objects constituted a panorama of interpretations of the vaccine by the Brazilian public on TikTok, providing important information as to how this public health resource was received and debated on a platform that as of yet has been little explored

academically, despite being extensively used by younger demographics. This knowledge may prove valuable in understanding factors that may encourage or discourage certain segments of the public in terms of vaccination. Moreover, this study also served as a contribution to the field of sentiment and emotion analysis, which in its majority has been carried out on textual data from English-speaking countries.

Considering these results and their implications, as well as the limitations of this study, we emphasize the relevance of this approach for further research on vaccines. This is especially due to the necessity of investigation of how this important resource was received and interpreted on other platforms and content types, such as in humorous and infotainment, which are widely circulated and consumed, and, as seen in this article, can do more than inform, contributing to the scenario of disinformation surrounding vaccines.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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