Risk perception and crisis communication during the Covid-19 pandemic: Analysis based on Twitter hashtags

Percepción de riesgo y comunicación de crisis durante la pandemia de Covid-19: Análisis basado en hashtags de Twitter

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Abstract: This research evaluates response strategies to crisis communication, in terms of perceived risks, in organizations during the Covid-19 pandemic by studying the main discussion topics in social media. The data was collected from Twitter between March and April 2020. By using big data software, a total number of 3559255 tweets in different languages were extracted worldwide from Twitter API of popular hashtags on the Covid-19 pandemic. The data processing was carried out through the association of terms in order to identify patterns and relationships in the discussion topics. The results indicate that the relationships of the terms "crisis" and "risks" were statistically significant with seven important topics for businesses, users, and consumers: "business", "economic and financial", "social"," health"," work"," family" and "government"; and in turn these seven topics are related to other terms related to the impact of the crisis, the response to the crisis, aid, the watch out, and support. This research has implications for the situational crisis communication theory by showing that in situations with high perceived risk, such as the Covid-19 pandemic crisis, the use of crisis response strategies predominates in organizations. This research also has implications for managers who can use crisis response strategies to rebuild their reputation and avoid market losses, thus helping to reduce the effects of unpredictable crisis situations.

Keywords: Crisis communication. Social media. Covid-19. Twitter. Pandemic crisis.

Resumen: Esta investigación evalúa las estrategias de respuesta a la comunicación de crisis, en términos de riesgos percibidos, en las organizaciones durante la pandemia de Covid-19, mediante el estudio de los principales temas de discusión en las redes sociales. Los datos se recopilaron en Twitter entre marzo y abril de 2020. Mediante el uso de software de big data, se extrajo un número total de 3559255 tweets en diferentes idiomas en todo el mundo de la API de Twitter de hashtags populares sobre la pandemia de Covid-19. El procesamiento de datos se realizó a través de la asociación de términos con el fin de identificar patrones y relaciones en los temas de discusión. Los resultados indican que las relaciones de los términos "crisis" y "riesgos" fueron estadísticamente significativas con siete temas importantes para empresas, usuarios y consumidores: "negocio", "económico y financiero", "social", "salud"," trabajo", "familia" y "gobierno"; ya su vez estos siete temas se relacionan con otros términos relacionados con el impacto de la crisis, la respuesta a la crisis, la ayuda, la vigilancia y el apoyo. Esta investigación tiene implicaciones para la teoría de la comunicación de crisis situacional al mostrar que, en situaciones con alto riesgo percibido, como la crisis de la pandemia de Covid-19, el uso de estrategias de respuesta a crisis predomina en las organizaciones. Esta investigación también tiene implicaciones para los gerentes que pueden usar estrategias de respuesta a crisis para reconstruir su reputación y evitar pérdidas en el mercado, ayudando así a reducir los efectos de situaciones de crisis impredecibles.

Palabras clave: Comunicación de crisis. Redes sociales. Covid-19. Twitter. Crisis en pandemia.

1. Introduction

In 2020 the world is hit by the global pandemic known as COVID-19. In this sense, for Guo et al. (2020) COVID-19 has been characterized by respiratory difficulties, and community transmission has been accelerating around the world (ECDC, 2020). The COVID-19 pandemic is changing human interaction (Kye and Hwang, 2020), generating business crises (Crick and Crick 2020), economic crises (Nicola et al., 2020), crises and risks in the family (Campbell, 2020), changes and crises at work (Bartsch et al., 2020).

It should be added that crisis communication is essential to reduce uncertainty, maintain the company's reputation and avoid negative consequences. In this framework, social media has emerged as a crisis communication research area (Zeng and Gerritsen, 2014) and Twitter has been the main means of crisis communication during the COVID-19 pandemic.

This research aims to examine response strategies to crisis communication from companies and organizations during the COVID-19 pandemic regarding perceived risk and crisis, through the main topics of discussion in Twitter hashtags about the COVID-19 pandemic during the COVID-19 pandemic regarding perceived risk and crisis, through examining the main topics of discussion in Twitter hashtags about the COVID-19 pandemic and contribute to the literature gap that exists about how companies and organizations carry out their response strategies to crisis communication to avoid negative consequences.

2. Literature review

Crisis communication

A crisis is an organizational or business problem that may have natural causes or man-made disasters that threaten the operation of a company, its reputation, and its ability to do business (Weiner, 2006), crises are sudden and unexpected and pose both a financial and reputational issue that can disrupt company operations and involve a wide variety of stakeholders such as the community, employees, customers, suppliers, and shareholders (Coombs, 2007).

Specifically, COVID-19 has generated a global crisis (Maak et al., 2021) and global crises are characterized by the struggle for the survival of countries, companies, and citizens in the face of these crises, companies have adopted commercial initiatives aimed at preventing the loss of customers, the decrease in income and the erosion of market share. (Salunkhe et al., 2021). During the COVID-19 crisis, people paid more attention to messages related to COVID from companies on the social networks Facebook and Twitter than to any other type of messages and acted by commenting and sharing with other users of said networks (Kwok et al., 2021), this crisis communication on Twitter also includes government and health agencies (Watkins and Clevenger, 2021; Wang et al., 2021).

It is important to mention that crisis communication often transfers to a great extent the risks perceived by people, and in times of pandemic it was no exception, so it is important to highlight how the literature shows various dimensions of perceived risk during the COVID-19 pandemic, there was a perception of financial risk in clients in the hotel industry (e.g. Quan,

2022), perception of health risk in tourism industry (e.g. Bae and Chang, 2021; Rather 2021), and in hospitality industry (e.g. Leung and Cai, 2021), perception of economic risks for customers and businesses due to confinement restrictions (e.g. Foroudi et al., 2021) perception of risk in families by contagion in health workers (e.g. Gorini et al., 2020), perception of social risk due to social distancing and isolation (e.g. Eddy, 2021), perception of risk in businesses due to decreased sales because the restrictions and change in consumption habits in COVID-19 pandemic, for example in restaurants, hotels and leisure industries (e.g. Parady et al., 2020), perception of risk in government intervention in actions against COVID-19 (e.g. Duan et al., 2020), perception of risk at work due to the probability of contagion and job instability (e.g Han et al., 2021).

It is worth emphasizing that crisis management has as its main axis the adequate crisis communication strategy between the interested parties and these strategies depends on the type of crisis, the crisis, and the organization's responsibility for the crisis (Coombs, 2015). The theory of situational crisis communication tries to establish crisis response strategies with positive results for the organization in the public perception of the crisis and the attitude towards the organization to protect its reputation and reduce the negative effects (Coombs, 2007; Coombs, 2014). Likewise, crisis communication is crucial to reducing perceived uncertainties during the crisis (Charoensukmongkol and Phungsoonthorn 2022), and managing reputation (Christensen and Lægreid, 2020).

On the other hand, in situational communication crisis theory there are three primary crisis response strategies: (a) deny crisis response strategies, this strategy completely reallocates blame away from the organization, crisis denial strategies should be used in victim crises when the organization is faced with rumors or accusations that are damaging, but not true, (b) diminish crisis response strategies, this strategy works to minimize the amount of responsibility placed on the organization minimizing the perceived damage caused by the crisis, diminish crisis strategies should be used more frequently in response to victim crises where the company is not to blame for the problem, and (c) rebuild crisis response strategies, this strategy aims to rebuild relationships with stakeholders, this is achieved by taking responsibility for the crisis and offering apologies or compensation to those affected by the outcome (Coombs, 2007).

The networked crisis communication theory considers that crisis communications distributed by social media can provoke different responses, which are affected or impacted by the medium used, the type of crisis, and people's emotions (Schultz et al., 2011; Utz et al., 2013). Is little known in the literature on the effect of crisis communication in social networks from the perspective of the recipient since social networks can facilitate responses from multiple voices of organizations and the public or consumers (Liu et al., 2016; Utz et al., 2013).

Understanding online dialogues would help to understand communication in crisis (Lin et al., 2016). Particularly, the literature points to how economic actors develop and carry out their constructions of reality (make sense) to maintain control over the situation and institutional changes (Schultz & Raupp, 2010) and to maintain control over the situation and institutional changes (Wu et al., 2016).

Specifically, the literature is clear that in a communication crisis, companies behave differently in a group setting compared to when they face a crisis individually (Comyns and Franklin-Johnson, 2018) being that many times there is a taxonomy of crisis messages in social

networks that interested parties can send to organizations (Roshan et al., 2016). As well as, in which public entities communicate with each other rather than with organizations about disasters and predict a wider variety of results of crisis communication (Liu et al., 2016). It seems important that government organizations emphasize providing instructive information to their primary audiences, such as guidelines on how to respond to the crisis using social networks more frequently than traditional means of responding to crisis (Kim and Liu, 2012) using the strategy of briefing information predominantly before and during a disaster, while information adjustment and reinforcement strategies are used more during post-disaster recovery (Liu et al., 2018).

Crisis communication and social media

Twitter is a social network that has allowed dialogues and reactions in communications in crises, becoming a functional information center during disasters (Schwarz, et al., 2016). Twitter is one of the first sources of information to obtain information (Barbe and Pennington-Gray, 2018). Therefore, Twitter has been more effective than Facebook and Instagram in terms of restoring a company's reputation after a crisis, as it improves behavioral intentions and triggers positive engagement (Triantafillidou and Yannas, 2020). For this, the tweets will recycle links to news sources inherited limitations that plagued media coverage in their inability for quick response, as well as defensive and offensive tactical dialogues, such as increasing organized events, outreach, and expert opinion statements (Roundtree, 2018).

I would have to say then that, in social media, the approval or disapproval of other people or the way other people are perceived are social norms that influence people's behavior (Cialdini and Goldstein, 2004). Today, social networks make people's behaviors visible and extend them through harmful behaviors or behaviors that benefit, through communications that can be extended to networks of a friend, friends of friends, and even friends of friends of friends (Christakis and Fowler, 2013).

For Roundtree (2018), tweets will recycle links to news sources inherited limitations that plagued media coverage in their inability for quick response, as well as defensive and offensive tactical dialogues, such as increasing organized events, outreach, and expert opinion statements. Adicioanllity, Lee (2021) has highlighted how emotions of various kinds have recently had a direct impact on decisions, and resource management.

It is important to mention that in the institutional part, social presence strategies were effective in generating public attention on Twitter. Also, express appreciation, provide guidance, and inform the public about the actions of governments with public attention (Mazid, 2022).

Thus, for example, Aldekhyyel et al. (2022) mention how communications from government entities on issues related to COVID-19 published by Saudi government ministries on Twitter can be classified into those related to the disease and those not related to the disease. For the authors, the integration of behavioral theories in the development of health risk communication should be taken seriously by government communication specialists who manage social network accounts, since these theories help to underline the determinants of people's behaviors and their reactions.

Carvache-Franco et al. (2022) in their study analyzed the discussion topics in the popular Twitter's tourism hashtags during the COVID-19 crisis related to coastal and marine tourism, their findings contribute to the relationship of the topics with the motivational dimensions of the tourist, and the discussed destinations on marine and coastal tourism in times of crisis due to the COVID-2019 Pandemic in Twitter tourism hashtags, and companies will also be able to improve their communication strategies and develop post-pandemic products, and in the study of Carvache-Franco et al. (2022) stand out as Twitter became a medium of communication during pandemic crises, helping to reduce negative perceptions and harmful effects of tourism crises in companies and destinations.

On the other hand, the motivations and behaviors found within each of the public in crisis ––influencers and followers– are fundamentally different from each other by nature throughout the regenerative crisis situated (AO & Mak, 2021). Likewise, the importance of the influence of third parties in crisis communication and the need to use both social and traditional networks in response to crises (Austin et al., 2012) the medium matters more than the message (Schultz et al., 2011).

We must add that confidence in crisis communication is affected by the characteristics of communication, transparency, empathy, opportunity, quality, and this communication in social media occurs with various actors including public health, media, and the public who are co-producing and responding to the message, so crisis communication should be monitored to assess the acceptance of the message (MacKay et al., 2021). During the pandemic, changes in governors' communication patterns were accompanied by changes in public perception of governors' responses (London and Matthews, 2021).

Among the characteristics of this crisis communication carried out by companies on Twitter during the COVID-19 pandemic, the main concern is that of products and services, and in which their main strategy to address this concern was the exchange of information (Chong and Momin, 2021) and the response to the crisis communication of companies is that consumer confidence has been recovered when this communication has been emotionally directed (Wang et al., 2021). The strategies used by European airlines during the COVID-19 pandemic are mainly to instruct and adjust crisis communication, deny, diminish, rebuild, bolster and Twitter replaced Facebook as the main communication channel in the crisis (Scheiwiller and Zizka, 2021).

In crisis communication, relational communication seems to be more effective than informational communication (Einwiller et al., 2021). It is very clear that social networks for companies are effective means to communicate with their customers with negative emotions in a pandemic crisis such as COVID-19, what remains unclear is how companies should respond to social networks in the face of a crisis pandemic to avoid negative consequences and it seems that the strategies that have worked best in Twitter are those that evoke positive emotions among consumers (Li et al., 2021).

In crisis communication during pandemic COVID-19, evidence has been found about diminished crisis response strategies in EU airlines with evidence that the strategy used has a different application between classic airlines and low-cost airlines (Chmielewska-Muciek, et al., 2021), other evidence that exists in airlines is the use of five different crisis response strategies as instructing and adjusting information, deny, diminish, rebuild, and bolster (Scheiwiller and

Zizka, 2021) and other airline evidence reports the use of rebuild crisis response strategies (Ou and Wong, 2021) while in universities has been reported with positive results in building reputation (Dominic et al., 2021) and evidence how corporate crisis response strategy and response using rebuild consumer trust (Wang et al., 2021).

Likewise, government agencies have promoted, for example, communication on issues associated with confinement, online learning, digital platforms, empowerment, responsibility, reports not related to the disease, local and international news, and general statements (Aldekhyyel et al. 2022).

Additionally, in Tourism offices in Spain and Italy, for example, the types of content related to the category of communication on the Covid-19 crisis on Twitter, focused on communication of tourist efforts to face the Covid-19 crisis or communications to safeguard the image of the destination as a tourist attraction (Huertas et al., 2020).

Twitter data processing allows the identification of the main topics mentioned by tourists and in many cases, the emotional expressions they have can be easily detected (Park et al., 2016), which the above leads directly to a better understanding of the attitudes and behaviors of tourist experiences, especially in the motivations of the tourist (Gilbert, 2016; Park et al., 2016). Specifically, we will mention that tourist behavior and the purpose of the trip can be inferred through Twitter data (Nozawa et al., 2016) since travelers have different reactions to social media information about travel planning (Zeng and Gerritsen, 2014).

As a result of the above, Twitter allows obtaining the consumer's perception, by identifying popular words and emotions expressed by tourists in the comments of this social network (Park et al., 2016). Consequently, by analyzing Twitter data, customer preferences can be identified, which directly generates support for companies of different services when planning the services, they offer to their customers (Sinha et al., 2018).

Crisis response strategies represent the words or terms and actions that organizations can take during a crisis (Coombs, 2007), and in the literature exists a gap about how companies and organizations carry out their strategies in response to crisis communication to avoid negative consequences. For the above, text analysis can be used as an exploratory analysis, but it can also be used to test hypotheses or interrelationships between constructs (Harlow & Oswald, 2016). This study asks the following research question: what response strategies from companies and organizations represent the topics discussed about risk and crisis in communication in Twitter COVID-19's hashtags?

3. Methodology

Twitter data provides a means to analyze the attitudes and behaviors of a broad spectrum of the population (Harlow and Oswald, 2016). Through the process of Twitter's big data, it is obtained data patterns and text sentiment analysis which is an important twitter data processing technique (Kirilenko et al., 2018).

Word association

The term association is a technique for finding syntagmatic relationships (syntagmatic relation) between terms or words when they appear together in a context (Correia et al., 2018). Through the analysis of the frequencies of words and hashtags, relevant topics and keywords for tourism are identified (Park et al., 2016). In the association of terms, knowledge is derived from patterns and relationships that can be used to reveal facts, trends, or constructs.

The association of terms generally uses a quantitative approach to approach the analysis of larger volumes of texts and helps to discover knowledge by increasing the volume of the text to be analyzed (Kobayashi et al., 2018). This technique when you have large volumes of data is used to classify or group and to explain using existing knowledge (Harlow and Oswald, 2016).

The term association is a technique that allows obtaining the perception of consumers and their expectations of products, services, and events through the frequency of mention of topics or words in texts or dialogues (Gámbaro et al., 2014; Pontual et al., 2017; Rojas-Rivas et al., 2018).

The term association technique has two stages, the first is to find a list of words that are more prevalent within a set of tweets than others, once these words are found, the next stage is the contextualization or interpreting of the meaning of these words in the context. context of this difference (Thelwall, 2021a, 2021).

On the other hand, it is important to refer to sentiment analysis, that is, the ability to detect positive and negative opinions from text, making key component research using big data Sentiment analysis is the ability to detect positive and negative opinions from text, making it key component research using big data (Thelwall, 2019). Text sentiment analysis is an automated process of semantic examination of relationships and meanings of tweets (Alaei et al., 2019). The sentiment analysis uses the lexicon-based method (Medhat et al., 2014), which requires a predefined group of lexicons of feelings used to determine the polarity of a text which are the emotions in the text (Saif et al., 2016).

Data collection

The use of hashtags to collect information is very helpful because it allows concentrating the opinions of a specific sector or the dialogues on a specific topic in the community (Fatanti and Suyadnya, 2015). Twitter data allows us to identify communication patterns and dissemination of community information through hashtags (Park et al., 2016). Hashtags are commonly used in crisis communication in tourism, and during the crisis, there is generally an associated hashtag that allows users to obtain relevant information (Barbe and Pennington-Gray, 2018).

The data was collected from Twitter between March and April 2020, for which a group of frequently used hashtags about COVID-19 was identified, which are shown in Table 1. The data was collected through the Twitter API using the Mozdeh big data text analysis free software from big data (http://mozdeh.wlv.ac.uk), the extraction of tweets was carried out by filtering in the software the tweets that have in the text the hashtags that appear in Table 1. The data was extracted in different languages and globally, that is, from different countries (USA, UK, Japan, France, Spain, Netherlands, Mexico, Brazil), and companies in general and non-governmental

organizations, managing to extract 3´559,255 tweets that met the condition that each tweet in its text could have one or more of the hashtags popular about COVID-19.

Table 1: Hashtags used about COVID-19 used in Twitter data collection

Hashtag	Number of tweets mentioned in the hashtag
#coronavirus	911,932
# covid19	954,425
# covid-19	1,079,753
# covid_19	359,860
#Crown	241,684

As part of the processing, the data analysis followed the following steps using the Mozdeh big data text analysis software:

First, the data was cleaned by removing duplicate tweets.

Second, the term association technique was used to obtain the words associated with the term "risk" or "crisis" in the Twitter data collected using a quantitative process with Pearson's Chi-square statistical test, derived from a 2x2 contingency table used with a value critical threshold of 3,841. To reduce the risk of falsely believing that a word is significant when examining multiple Chi-square values, the method of Benjamini and Hochberg (1995), which is a procedure that tests all words at the same time and shows all significant words or terms as results, this method controls the risk of false positives when running multiple tests. The statistical significance used is at the 0.1% level (***).

The literature shows evidence of the use of Twitter data extraction and the term association technique using the Mozdeh big data text analysis software to get the main topics of discussion in the tweets (e.g., Thelwall et al., 2019; Thelwall et al., 2021; Carvache-Franco et al., 2022a, 2022).

4. Results

Through the results of the association of terms in the tweets of the popular hashtags about COVID-19, the topics or most used words in the examined tweets were obtained. Table 2 shows the results of the association of terms with the business term, it is worth emphasizing that the contrast or relationship is made with the search term crisis/risk matched 120,298 tweets out of 3,559,255 tweets from the data collected.

Regarding the association of terms crisis and risks with business, the discussion topics that stand out are "help", "need", "support", "impact", "leader", "plan", "government" and "employees" (Table 2), this shows the crisis in business and employment with global impact and needs to help and support businesses and contribute with leadership, plans, and management.

Regarding the association terms crisis and risks with economic and financial, the discussion topics that stand out are "economy", "health", "global", "need", "impact", "people", "support", "government" and "help" (Table 3), this shows a risk perception of an economic and financial crisis with a global impact and being discussed the government support and help for people and need and responses to the crisis.

Table 2: Association of crisis/ risk with business terms

Word	MatchPc	NoMatch	Matches	Total	DiffPZ	Chisq	Sig (2104031 tests)
crisis	87.90%	1.90%	1606	70437	263.8	69,572.3	***
business	58.60%	0.50%	1071	17343	356.9	127400	***
help	11.10%	2.20%	202	79053	25.6	657.1	***
risk	10.20%	0.60%	187	19935	55.4	3,072.3	***
need	4.60%	2.00%	84	71591	7.9	62	***
support	3.90%	1.20%	72	43541	10.6	111.7	***
impact	3.10%	0.60%	57	21152	14	197.4	***
leader	3.00%	0.40%	54	14091	17.4	303.7	***
plan	3.00%	0.50%	54	19461	14	195.1	***
government	2.80%	0.70%	52	25805	10.7	114.3	***
employee	2.80%	0.30%	51	11618	18.5	341.4	***
webinar	2.70%	0.30%	49	8967	20.7	419.9	***
learn	2.60%	0.30%	48	11916	17	287.9	***
economic	2.60%	0.30%	47	11818	16.7	277.3	***
management	2.30%	0.10%	42	4433	26.4	677.3	***
global	2.30%	0.70%	42	24424	8.4	69.8	***
sector	2.20%	0.30%	41	9961	15.9	252.7	***
current	2.20%	0.30%	40	12003	13.7	186.6	***
resource	2.20%	0.50%	40	16402	10.9	119.1	***

Table 3: Association of crisis/ risk with economic and financial terms

Word	MatchPc	NoMatch	Matches	Total	DiffPZ	Chisq	Sig (2104031 tests)
crisis	87.00%	1.90%	2718	70437	341.4	116,565.1	***
economic	45.00%	0.30%	1404	11818	433.7	188089.3	***
financial	30.40%	0.20%	950	7353	372	138,398.1	***
economy	20.60%	0.30%	644	9937	215.5	46,457.8	***
health	12.80%	2.10%	400	74001	42	1767.4	***
risk	12.40%	0.50%	387	19935	88.6	7,856.7	***
global	8.10%	0.70%	252	24424	Fifty	2500	***
need	7.70%	2.00%	239	71591	22.5	504.7	***
help	7.00%	2.20%	218	79053	18.1	326	***
impact	6.80%	0.60%	213	21152	45.3	2,051.1	***
finance	6.50%	0.10%	202	2477	135.7	18,309.4	***
people	6.00%	3.70%	188	130751	7	48.6	***
world	5.80%	1.60%	181	57524	18.5	343.4	***
support	5.40%	1.20%	169	43541	21.3	453.7	***
government	4.60%	1.20%	143	43523	17.1	291.5	***
response	3.80%	1.00%	118	36395	15.3	234.6	***
public	3.60%	0.80%	111	29028	17	289.8	***

Regarding the association terms crisis and risks with social, the discussion topics that stand out are "social", "distancing", "society", “people”, “health”, “need”, “impact” and “worker” (Table 4), this shows a social crisis with health risk in people and help for people and support related to workers and work.

Regarding the association terms crisis and risks with health, the discussion topics that stand out are "public", "worker", "care", “people”, “need” and “global” (Table 5), this shows a global health crisis that affects workers and work.

Regarding the association terms “crisis” and “risks” with work, the discussion topics that stand out are "worker", "work", “health”, “job”, “people” “need”, “home” “support” and “care” (Table 6), this shows crisis and specific risks at work and with the workers, the work from home and the need for help, care, and support.

Regarding the association terms “crisis” and “risks” with family, the discussion topics that stand out are "home", "people", “work”, “health”, “live” “help” and “house” (Table 7), this shows a crisis at home and risk in the family, work at home and the need for care and security for a family.

Table 4:
Association of crisis/ risk and social terms

Word	MatchPc	NoMatch	Matches	Total	DiffPZ	Chisq	Sig (2104031 tests)
Social	81.40%	1.10%	1586	41206	331.1	109,658.5	***
crisis	75.40%	1.90%	1469	70437	232.7	54150	***
risk	24.10%	0.50%	470	19935	139.4	19,426.4	***
distancing	21.10%	0.50%	411	19588	122.6	15028.2	***
society	18.60%	0.10%	363	4905	220.1	48294.9	***
people	8.80%	3.70%	171	130751	12	143.3	***
health	8.60%	2.10%	167	74001	20.1	403.4	***
half	7.30%	0.50%	142	18190	42	1760.3	***
need	6.30%	2.00%	122	71591	13.4	178.6	***
sanitary	5.40%	0.30%	106	10401	42.1	1772.6	***
help	5.20%	2.20%	102	79053	9	81.5	***
care	4.60%	1.10%	89	38129	15	224.8	***
home	4.20%	2.00%	82	70145	7.1	50.5	***
economic	4.20%	0.30%	81	11818	29.4	861.7	***
worker	4.10%	1.10%	80	40070	12.5	155.5	***
support	4.10%	1.20%	79	43541	11.4	129.3	***
world	4.00%	1.60%	78	57524	8.4	69.8	***
work	3.90%	1.20%	76	42980	10.9	118.4	***
live	3.80%	1.40%	74	48525	9.3	85.9	***
vulnerable	3.50%	0.30%	68	11711	24.4	593.7	***
practice	3.10%	0.20%	60	7052	28.6	803.7	***
impact	3.00%	0.60%	59	21152	14	195.4	***
public	2.90%	0.80%	56	29028	10.1	102.1	***

Table 5: Association of crisis/ risk and health terms

Word	MatchPc	NoMatch	Matches	Total	DiffPZ	Chisq	Sig (2104031 tests)
health	96.60%	1.90%	5432	74001	497	247,027.2	***
crisis	68.60%	1.90%	3859	70437	359	128,898.3	***
risk	32.00%	0.50%	1802	19935	316.5	100197.3	***
public	18.70%	0.80%	1050	29028	149	22,189.8	***
worker	12.90%	1.10%	726	40070	83.8	7023.1	***
care	12.10%	1.10%	683	38129	80.7	6514.3	***
people	9.00%	3.70%	504	130751	21.1	444.8	***
need	7.20%	2.00%	403	71591	27.5	758.8	***
global	7.00%	0.70%	396	24424	57.8	3336.7	***
pandemic	7.00%	2.40%	392	85491	22.4	501.1	***
mental	6.40%	0.20%	362	7272	103.6	10,726.8	***
help	6.10%	2.20%	3. 4. 5	79053	19.9	396.9	***
world	5.80%	1.60%	324	57524	24.7	608.2	***
economic	5.00%	0.30%	279	11818	60.4	3,645.5	***
live	4.90%	1.40%	277	48525	23	531.1	***
nurse	4.30%	0.50%	244	16801	42.3	1791.7	***
system	4.30%	0.40%	242	13988	46.9	2,198.9	***
support	4.30%	1.20%	241	43541	20.9	436.8	***
work	4.20%	1.20%	238	42980	20.8	431.6	***
service	3.60%	0.70%	203	26635	24.9	620.5	***
protect	3.60%	0.50%	201	18535	31.8	1013.1	***
doctor	3.20%	0.90%	179	31598	18.4	337	***

Table 6: Association of crisis/ risk and work terms

Word	MatchPc	NoMatch	Matches	Total	DiffPZ	Chisq	Sig (2104031 tests)
crisis	63.50%	1.90%	3702	70437	337.4	113,851.3	***
worker	47.80%	1.00%	2789	40070	338.2	114,393.3	***
work	37.20%	1.10%	2172	42980	252.1	63,561.6	***
risk	37.00%	0.50%	2157	19935	373	139 113.7	***
health	17.30%	2.10%	1010	74001	81.6	6,660.5	***
job	17.10%	0.40%	995	16358	187.6	35 179.9	***
people	9.10%	3.70%	530	130751	22	483.5	***
care	8.80%	1.10%	513	38129	57.3	3,287.9	***
healthcare	7.90%	0.40%	458	15713	85.4	7298.4	***
live	7.60%	1.40%	446	48525	41.4	1714.6	***
help	7.40%	2.20%	429	79053	26.6	708.8	***
need	7.20%	2.00%	418	71591	28.1	787.4	***
home	7.00%	2.00%	408	70145	27.6	763.1	***
support	5.90%	1.20%	344	43541	32.5	1056.1	***
frontline	5.70%	0.30%	331	10476	75.9	5762	***
nurse	5.30%	0.50%	312	16801	54.4	2,957.1	***
working	5.30%	0.80%	308	28920	38	1,446.7	***
office	4.80%	0.20%	280	7641	75.7	5734	***
doctor	4.30%	0.90%	250	31598	27.7	766.6	***
essential	4.20%	0.40%	243	14253	45.6	2,076.6	***

Ultimately, the association terms crisis and risks with government, the discussion topics that stand out are "people", "health", "help", "need", "support", "state", "public", and "business" (Table 8), this shows the need for help and support from the government for the health and businesses.

In association with the terms "crisis" and "risks" with business, the discussion topic that stands out are "help", "need", "support", "impact", "leader", "plan", "government" and "employees" this shows crisis and risk perception in business and employment with global impact and need to help and support businesses and contribute with leadership, plans, and management.

Table 7: Association of crisis/ risk and family terms

Word	MatchPc	NoMatch	Matches	Total	DiffPZ	Chisq	Sig (2104031 tests)
crisis	60.80%	1.90%	2403	70437	265.7	70,578.5	***
home	54.20%	1.90%	2143	70145	236.5	55,919.2	***
risk	38.90%	0.50%	1537	19935	323.1	104,374.8	***
are	20.00%	1.00%	790	34615	121.9	14,857.2	***
Familia	18.00%	0.50%	710	20071	146.2	21,366.2	***
people	11.90%	3.70%	470	130751	27.5	755.3	***
house	8.40%	0.40%	333	13322	82.9	6878.7	***
work	7.10%	1.20%	282	42980	34.1	1,165.5	***
health	6.60%	2.10%	261	74001	19.9	397.9	***
help	6.50%	2.20%	257	79053	18.3	334	***
working	6.30%	0.80%	249	28920	38.5	1,478.6	***
need	5.60%	2.00%	220	71591	15.9	253.7	***
live	5.00%	1.40%	199	48525	19.9	396.7	***
safety	4.90%	0.80%	192	29796	27.8	770.6	***
care	4.50%	1.10%	179	38129	21.1	446.4	***
friend	3.90%	0.50%	155	17964	30.3	920.1	***

Table 8: Association of crisis/ risk and government terms

Word	MatchPc	NoMatch	Matches	Total	DiffPZ	Chisq	Sig (2104031 tests)
government	96.60%	1.20%	2119	43523	406.6	165,353.1	***
crisis	79.30%	1.90%	1740	70437	260.2	67,706.1	***
risk	21.10%	0.50%	462	19935	128.7	16,568.8	***
people	9.70%	3.70%	213	130751	Fifteen	226.2	***
health	8.00%	2.10%	175	74001	19.4	375.3	***
help	7.90%	2.20%	173	79053	18	324.6	***
need	7.40%	2.00%	163	71591	18.1	327.2	***
support	7.20%	1.20%	158	43541	25.5	649.7	***
response	6.60%	1.00%	144	36395	25.8	666.4	***
state	5.10%	1.30%	112	47364	15.4	238.3	***
public	5.10%	0.80%	111	29028	22.1	489.1	***
federal	5.00%	0.30%	110	9967	42	1762.5	***
business	3.80%	0.40%	83	13018	26.5	703.9	***
live	3.60%	1.40%	80	48525	9.2	85.2	***

In association terms “crisis” and “risks” with economic and financial, the discussion topics that stand out are “economy”, “health”, “global”, “need”, “impact”, “people”, “support”, “government” and “help”, this shows a risk perception of an economic and financial crisis with a global impact and being discussed the government support and help for people and need and responses to the crisis.

In association terms “crisis” and “risks” with health, the discussion topics that stand out are "public", "worker", “work", "care", “people”, “need” and “global”, this shows a global health crisis that affects workers and work and need and help. In association terms “crisis” and “risks” with social, the discussion topics that stand out are "social", "distancing", "society", “people”, “health”, "need", "impact", and "worker", this shows a social crisis with health risk in people and help for people and support related to workers and work.

In association terms “crisis” and “risks” with work, the discussion topics that stand out are "worker", "work", “health”, “job”, “people” “need”, “home” “support” and “care”, this shows crisis and specific risks at work and with the workers, the work from home and the need for help, care, and support. In association terms "crisis" and "risks" with family, the discussion topics that stand out are "home", "people", “work”, “health”, “live” “help” and "house", this shows a crisis at home and risk in the family, work at home and the need for care and security for a family. In association terms "crisis" and "risks" with government, the discussion topics that stand out are "people", "health", "help", "need", "support", "state", "public" and "business", this shows the need for help and support from the government for the health and businesses.

The results of data processing through the association of terms indicate that the relationships of the terms "crisis" and "risks" were statistically significant with seven important topics on Twitter: "business", "economic and financial", "social"," health", "work", "family" and "government", this shows that the perception of crisis and risk during the pandemic was associated with a global economic, financial and social crisis that involves business, health, family, work, and government, that threatens the survival of businesses. The characteristic of this crisis communication examined is the interaction through Twitter of companies, organizations, customers, suppliers, shareholders, and the public, they share information and comments through tweets in which they impregnate their own emotions and perceptions of the crisis. crises and various risks they perceive.

5. Discussion and Conclusions

This research aims to examine response strategies to communication crises from companies and organizations during the COVID-19 pandemic regarding perceived risk and crisis, by examining the main discussion topics in Twitter hashtags about the COVID-19 pandemic and contribute to the literature gap that exists about how companies carry out their response to crisis communication to avoid negative consequences.

Crisis, response strategies represent the words or terms and actions that organizations can take during the crisis (Coombs, 2007) and for the proposed objective were processed 120,298 tweets out of 3,559,255 tweets from the data collected matched the terms "crisis" and "risk" in popular hashtags about COVID-19, to obtain the main topics of discussion to examine response strategies to communication crisis from companies and organizations.

Previous literature has identified several perceived risk during the COVID-19 pandemic, as perception of financial risk in clients and business in the hotel industry (e.g. Quan, 2022), perception of health risk for tourist in tourism industry (e.g. Bae and Chang, 2021; Rather, 2021), and similar in hospitality industry (e.g. Leung and Cai, 2021), perception of economic risks for customers and businesses due to confinement restrictions (e.g. Foroudi et al., 2021) perception of risk in families by contagion in health workers (e.g. Gorini et al., 2020), perception of social risk due to social distancing and isolation (e.g. Eddy, 2021), perception of risk in businesses due to decreased sales because restrictions and change in consumption habits in COVID-19 pandemic, as restaurants, hotels and leisure industries (e.g. Parady et al., 2020), perception of risk in government intervention in actions against COVID-19 (e.g. Duan et al., 2020), perception of risk at work due to the probability of contagion and job instability (e.g Han et al., 2021).

In the economic part, communication through Twitter and the interventions analyzed coincide with the line of how economic actors develop and carry out their constructions of reality (give meaning) to maintain control over the situation and institutional changes (Schultz & Raupp, 2010) and to maintain control over the situation and institutional changes (Wu et al., 2016) it makes us suppose that terms such as "crisis", "economic", "financial", "economy", "health" and "risk" prevail.

In the social part, the terms "social crisis", "risk" and “distancing” prevail in times of pandemic as one can consider that the motivations and behaviors found within each of the public in crisis –– influencers and followers– are fundamentally different from each other by nature throughout the crisis regenerative situated (AO & Mak, 2021). Likewise, the importance of the influence of third parties in crisis communication and the need to use both social and traditional networks in response to crises (Austin et al., 2012).

About the terms associated with the health part, in the tweets, terms such as "health", "crisis", "risk", "public", "worker" and "care" prevail. Being coincident with Roundtree (2018), a study in which tweets recycled links to news sources inherited limitations that plagued media coverage in their inability for rapid response, as well as defensive and offensive tactical dialogues, such as increasing organized events, outreach, and statements of expert opinions.

Regarding work and its relationships, the most predominant terms are "crisis", "worker", "work" and "risk", this can lead to many aspects, however, it is important to emphasize that recent studies such as that of Lee (2021) have highlighted how emotions of various kinds have recently had a direct impact on decisions, resource management. Regarding the relationships that are presented in the association of the term’s crisis/risk and family, being that the prevailing terms are: "crisis", "home", "risk", "son", "family" and "people". The important concerning different mentions in the literature is that people's behavior is influenced by social norms: what they perceive others to be doing or what they think others approve or disapprove (Cialdini & Goldstein, 2004).

Concerning communication in a business crisis, the most predominant terms were "crisis", "business", "help" and "risk", with the terminology found coinciding with the element that has been highlighted in the literature because it is common that companies to behave differently in a group setting compared to when faced with a crisis individually (Comyns & Franklin-Johnson, 2018) being that many times there is a taxonomy of crisis messages in social networks that interested parties can send to organizations (Roshan et al., 2016).

Associated with crisis and the term government, it seems very important that crisis communication theory focuses more on how the public communicates with each other rather than with organizations

about disasters and predicts a wider variety of outcomes of the disaster. Crisis communication (Liu et al., 2016), is that the most prominent terms have been "government" and "crisis". It seems important that government organizations emphasize providing instructive information to their primary audiences, such as guidelines on how to respond to the crisis using social networks more frequently than traditional means to respond to crisis (Kim & Liu, 2012). Reinforcing what they have already been mentioned by Liu et al. (2018) which government should use the strategy of briefing information predominantly before and during a disaster, while information adjustment and reinforcement strategies are used more during post-disaster recovery.

According to the situational crisis communication theory, rebuild crisis response strategies aims to rebuild relationships with stakeholders, this is achieved by taking responsibility for the crisis and offering apologies or compensation to those affected by the outcome (Coombs, 2007), and examining the discussion topics these show the direction of the discussion driven by the communication strategy of companies and organizations and the comments of users and customers impregnated by their emotions and risk perceptions, and examining tweets that contain the terms "risk" and "crisis" during the pandemic, it is observed that companies and organizations use predominantly the strategy of rebuilding their reputation and trust of the public and clients, by taking responsibility and giving compensation to those affected in the crisis in aids, plans, actions, alternatives in products and services, etc. This strategy is intended to avoid the negative consequences of the pandemic crisis. Our study contributes to this regard as it highlights the relevance of analyzing the use of online data during times of crisis.

Other research has found similar results during the Covid-19 pandemic. In airlines, evidence reports the use of rebuild crisis response strategies (Ou and Wong, 2021) while in universities has been reported with positive results in building reputation (Dominic et al., 2021) and evidence how corporate crisis response strategy and response using rebuild consumer trust (Wang et al., 2021).

This research contributes to the literature because examining tweets that specifically have the terms "risk" and "crisis" during the COVID-19 pandemic which denotes perceived risk in different areas such as business, economy, finance, health, work, family, government actions, and through the terms, association methodology identifies the communication topics that show the direction of the discussion driven by the communication strategy of companies and organizations and the comments of users and customers impregnated by their emotions and risk perceptions and analyzing the tweets and theses discussion topics it is identified that rebuilding their reputation and trust of the public and clients is the dominant strategy in the tweets examined.

This research has theoretical implications for the situational crisis communication theory by showing evidence that in situations with perceived risk such as the pandemic crisis, the use of rebuild crisis response strategies predominates in companies and organizations.

This research has practical implications for managers and administrators who in crisis with situations of perceived risk can use rebuild crisis response strategies to rebuild their reputation and avoid market losses and to avoid negative consequences of the pandemic crisis.

The study is limited by the temporality of the data carried out during March and April 2020. As a future line of research, it would be interesting to analyze Twitter data to examine changes in the perception of risk and crisis in the post-health emergency stage. Also, to find relations in the data, in case time to do it is not enough.

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