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COVID-19 and telemedicine: A netnography approach

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A B S T R A C T

The COVID-19 pandemic has consolidated some trends that already existed in our society. Perhaps one of the most visible is the transformation of society towards greater digitisation. Digitalisation has gained weight in all aspects of our lives, and from the point of view of the health system we find an example in the slow historical adoption of telemedicine, which contrasts sharply with the massive conversion to this technology as a tool for social distancing. In this sense, the homebound population is the one most affected by the pandemic and the one that could benefit the most from the use of telemedicine. Using a netnography approach and based on the stimulus-organism-response paradigm, this study proposes to analyse the evolution of perception about telemedicine using the opinions expressed on Twitter. The primary technical tasks of the study incorporate the analysis of topics and the review of emotions and positive image perception using natural language processing. Specifically, tweets about telemedicine generated by the Spanish community are analysed in this work. The findings show that the COVID-19 pandemic has affected emotions and topics of interest related to telemedicine. This has changed the image that it had and the behaviour of the Twitter community in Spain. In conclusion, the study results suggest that changes in health systems affect people's emotions and behaviours.

1. Introduction

Telemedicine consists of using information and communications technology (ICT) for the remote exchange of information to provide both assistance and medical education in the form of teleconsultation (Belvís et al., 2021). The World Health Organization has promoted the following comprehensive description "The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for the diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities" (World Health Organization, 2010). In this vein, four components apply to telemedicine: 1) It means to provide clinical support; 2) It is intended to overcome geographical barriers, connecting users who are not in the exact physical location; 3) It involves the use of several types of ICT; 4) Its objective is to enhance health results. Telemedicine is a valuable tool to reduce the costs of health organisations that build more sustainable public health systems. It has enormous potential to reduce the inconsistency of diagnoses and improve the clinical management and distribution of health care services worldwide by increasing access, quality, efficiency, and cost-effectiveness.

The COVID-19 pandemic has consolidated some trends that already existed in our society. Perhaps one of the most visible is the transformation of society towards greater digitisation. We have continued to work, interact, or enjoy… but connected throughout the hard months of confinement (Castro-Martinez et al., 2021). Digitalisation has gained weight in all aspects of our lives, also in the face of public administrations. From the point of view of the health system, we find an example in the slow historical adoption of telemedicine, which contrasts sharply with the massive conversion to this technology as a tool for social distancing. In this context, people's health and health services have become one of the main concerns, including on online social networks (Hermann and Govender, 2022). In this way, the homebound population is the one most affected by the pandemic and the one that could benefit the most from the use of telemedicine. Supporting telemedicine in primary care reduced the time to consult with the medical specialist and the number of patients on the waiting list, allowing the sickest patients to access a specialist faster (Yang et al., 2022). Moreover, telemedicine can be a useful tool for complementing and improving the monitoring of chronic patients (Ye et al., 2022) and the elderly (Cao et al., 2020). To adequately implement telemedicine in health systems, it is necessary to have a holistic vision that makes it possible to analyse the phenomenon. In this regard, the recent netnography technique provides suitable tools

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for this. Netnography is defined as a genealogical form based on virtual communities and their cultures, accessible via the Internet (Kozinets, 2002). This technique overcomes many traditional quantitative and qualitative methods when working with freely-created user-generated content. The development of online social networks has provided a forum for discussion on almost every subject of interest, and telemedicine is no exception. They bring together the knowledge, news, opinions, and experiences of the key players involved in a particular issue. In this sense, online social networks have proven to play an important role in transitory and adverse circumstances such as natural disasters, crises or catastrophes that require rapid measures to minimise the consequences (Castro-Martinez et al., 2021). COVID-19 fits perfectly with this definition of a global crisis. However, each country has managed the COVID-19 pandemic differently, with cultural, economic, social and, most importantly, health system differences (Tang et al., 2022). With this in mind, it is interesting to study the case of Spain, a country belonging to the Western economies, with a health system comparable in number of beds per 1000 inhabitants to that of the US or the UK. It also has one of the highest rates of use of masks in the world, and, due to its Mediterranean culture, which facilitates rapprochement between people, it faced a high rate of infections and deaths caused by COVID-19 (Tang et al., 2022). Considering this scenario, the question guiding our work is: What has been the impact of the COVID-19 pandemic on telemedicine among the online community members in Spain?

To answer that question, we used the Stimulus-Organism-Response (SOR) model (Mehrabian and Russell, 1974). This theory maintains that the response to a stimulus is dependent on how the organism in question handles it. For example, Teng and Bao (Teng and Bao, 2022) have applied this model to explain how interactions between people and information serve as a stimulus and are perceived by people for adopting fitness applications. In the health field, Yang et al. (Yang et al., 2021) study how online social support stimulates the patients' perception of telemedicine applications to stay in online pharmacy programmes. Similarly, Ye et al. (Ye et al., 2022) examine how online and offline doctor-patient interactions are understood and how this stimulates continued attendance at online medical consultations. The study will take the COVID-19 pandemic as a stimulus. To achieve this, we will distinguish three time periods: before lockdown, lockdown, and after lockdown. The lockdown periods were not homogenous worldwide in variables such as the start date, length, level of restrictions, etc. Specifically, the lockdown period in Spain was between March 15, 2020, and June 21, 2020, lasting 98 days and with mandatory stay-at-home orders. For our analysis, in a total three-year period incorporating the lockdown period, we consider the period before lockdown between October 1, 2018, and March 14, 2020, and the period after lockdown between June 22, 2020, and October 30, 2021. As the organism that must process these stimuli, we will use the Spanish online community related to telemedicine on Twitter. Specifically, the raw material is the posts about telemedicine published on Twitter for three years by Spanish users. We will use big data techniques that enabled us, based on 334,652 tweets, to identify 34,746 tweets from users located in Spain. Similar studies have been developed in different areas such as tourism (W. An and Alarcón, 2021), consumer behaviour (Bilro et al., 2021) and urban planning (El Hilali and Azougagh, 2021). An analysis of emotions based on (Plutchik, 2001) and topics (Mogaji et al., 2021) treated by it will be developed in this community. As the response, we will include the image (positive or negative) that this community offers about telemedicine and the interest shown at each period measured by the variation in the number of daily tweets published.

This work contributes in several ways. Most of the research on the adoption of telemedicine has been conducted centred on models such as TAM or UTAUT (Kamal et al., 2020; Shiferaw et al., 2021) using questionnaire-based methodologies. In addition, along with other theories close to the above, such as PET (Jarl and Lundqvist, 2020), TRA (Zhang et al., 2014) or TPB (Ramírez-Correa et al., 2020), it is based on the relationship between perceptions and their relationship to

behaviours. However, our work has a novel vision provided by the netnographic methods, big data techniques and accompanied by the theoretical framework provided by the SOR model. From managers' point of view, a vision is proposed on critical elements to understand the current response to this technology. We will explore the implications that different agents, subjects, and emotions may have in the future of this technology. We analyse the perceptions of these agents, and their behaviours, based on a new perspective provided by these new techniques. In this spirit, telemedicine appears as a great change and simultaneously as a challenge to provide an essential service to society.

This article is structured as follows. First, the theoretical framework is developed, in which the SOR model and its application are explained in the current context of telemedicine. Second, the netnographic methodology used is discussed. In addition, the big data techniques used for analysing emotions, subjects, and feelings are described. The results of our analysis are described below. The study ends with a discussion of the results obtained, the main conclusions, and the limitations of the research.

2. Literature review

2.1. COVID-19, ICT and the healthcare industry

At the start of 2020, emerging ICT, such as content sharing platforms, blockchain, robotics, and wearable devices, were helping pave the way for innovation. As organisations still had plenty of room to harness the full potential of digitisation, the COVID-19 pandemic significantly boosted the adoption of these technologies worldwide. These accelerated processes have occurred mainly in the health and education areas. On the one hand, society used all the benefits of bioinformatics, computational biology, and immunoinformatics to accelerate the discovery and development of vaccines against COVID-19. These results were achieved by the interdisciplinary application of data science, big data, and machine learning (Utku Kose et al., 2021). On the other hand, e-learning tools have been used worldwide, and all their pros and cons were shown, and, based on this, its bugs and drawbacks were corrected. The pandemic has led all academic structures to update their knowledge management and governments to invest in e-learning infrastructures (Alammary et al., 2021). And while it is a fact that the COVID-19 pandemic has accelerated the trend towards the adoption of digital technologies, today, the embracing of these technologies can be hindered by external interests, nostalgia, opportunism, and adverse effects on well-being (Amankwah-Amoah et al., 2021).

A solid health care system is vital to the development of a welfare state. As such, advancing technologies are a key tool in the sustainability of these systems (Alrahbi et al., 2022). Over the last few years, there has been a significant introduction of online services in a variety of ways. This has led to the development of telemedicine as a form of interaction with patients (Ye et al., 2022). One of the most significant impacts of the implementation of these technologies is the application of big data and artificial intelligence techniques with the information of patients themselves. Consequently, what has been called "P4 medicine" has been developed: predictive, preventive, personalised and participatory (Cuomo et al., 2020). As we can see, these new technologies have an impact on health care users by offering them benefits but also by forcing them to deal with certain problems. As a result, due to a significant change in the role of patients, these new technologies require a more active role on their part (Yang et al., 2022). Meanwhile, healthcare professionals are being forced to update for this new form of patient contact.

Hermann and Govender (Hermann and Govender, 2022) examined comments from 128 countries on Facebook about COVID-19 during the lockdown period. Health logically played a particularly important role in the subjects covered. Oddly enough, most of the topics discussed were related to positive feelings, except for specific topics related to COVID-19. This illustrates the difference between people's perceptions of

health services and the impact of the pandemic. Our work goes further in that regard.

2.2. Stimulus organism response (SOR)

Within the framework of environmental psychology, the SOR model has as an antecedent the Stimulus-Response (S-R) model. This S-R model describes how external factors motivate users to respond. Mehrabian and Russell (Mehrabian and Russell, 1974) revised the SOR model to include the concept of the organism in the stimulus-response relationship. The S-R model did not consider the organism's characteristics -or person- in responding. Organisms with different traits may react differently in response to the same stimulus. The SOR model is used to study the impact of the environment on human emotions, which then impact behaviour. The central idea is that environmental factors influence human cognitive and emotional responses, conscious and unconscious, and thus behaviour (Mehrabian and Russell, 1974). In other words, it mediates between the stimuli and the answer given. Overall, the SOR model has already been used to investigate the impact of environmental factors on emotional states and human behaviour (Ballester et al., 2021; Chao et al., 2021). Some studies have utilised this model for health systems (Yang et al., 2021) and telemedicine (Cao et al., 2020; Chang et al., 2019; Goyal et al., 2021). Applying the SOR model involves distinguishing three main groups of elements: stimulus, organism, and response (see Fig. 1).

In terms of the impact of the COVID-19 pandemic on various health systems around the world, there is evidence (Tang et al., 2022) that environmental factors (economic, political, social, and cultural) have had a strong influence on the response of different health systems. This compels us to try to understand what the stimulus of the COVID-19 pandemic has meant for Spain in a fundamental tool such as telemedicine.

2.3. Stimulus: COVID-19

The stimulus element is "the influence that arouses the individual" (Eroglu et al., 2001). Although these stimuli can be internal, such as the motivations of individuals, the primary stimuli come from the environment. As such, health issues are one of the most significant drivers of human behaviour (Pandita et al., 2021). COVID-19 may be considered a powerful environmental stimulus. The COVID-19 pandemic can be defined as a traumatic event, historically at the level of wars and economic depressions (Güngördü Belbağ, 2021). From the point of view of the SOR model, there are already a significant number of researchers (Chiu et al., 2021; Laato et al., 2020; Pandita et al., 2021; Song et al., 2021; Zheng et al., 2020) who have treated COVID-19 as an external stimulus that causes responses in individuals.

Our research considers COVID-19 as an external stimulus in our SOR model. To do so, we distinguish three periods. One is the time before the pandemic. Second, the months of strict COVID-19 lockdown. And as the last period, the months after a lockdown in which the pandemic is still present, although without the previous levels of freedom reductions.

2.4. Organism: topics and emotions

In the SOR model, the organism mediates between the stimulus and the response, affectively and cognitively. As we say, distinguish two large groups: cognitive and affective. The cognitive elements refer to individuals' mental processes and "everything that goes in the consumers' minds concerning the acquisition, processing, retention, and retrieval of information" (Eroglu et al., 2001). The affective elements reflect individuals' emotions caused by environmental stimuli (Islam and Rahman, 2017). Our research has taken two parts within the organism, one of an affective nature and a cognitive character.

The cognitive elements considered are the topics covered and the agents that deal with these topics. The topics covered (El Hilali and Azougagh, 2021; Mogaji et al., 2021) discussed in the tweets published on telemedicine have been analysed. These topics are the main ideas that the researched community has addressed. And it perfectly fits the definition given above (Eroglu et al., 2001). On the other hand, the affective element analysed is the emotions related to the topics covered in the published tweets. Emotions are a primary aspect of human consciousness (Abramson et al., 2020). In the SOR model, many investigations have included some emotions as an essential element of the organism (Chao et al., 2021; Chiu et al., 2021; Pandita et al., 2021). Specifically, we have included the eight basic emotions (Plutchik, 2001): anger, anticipation, disgust, fear, joy, sadness, surprise, and trust. Analyses of emotions like ours have been carried out in other contexts (Hossain and Rahman, 2022).

Based on the SOR model and the literature review, we propose the following proposition:

Proposition 1. *In the Spanish community that talks about telemedicine on Twitter, the evolution of COVID-19 affects the topics and their associated emotions.*

2.5. Response: sentiments and interactions

Finally, in the SOR model, the response refers to the consequences of the stimulus after being mediated by the organism (Kamboj et al., 2018). As the last element, we consider two types of response: an effective response and another, behavioural response.

In our research, the affective response assessed is the image, positive or negative, that is generated concerning the phenomenon of telemedicine. For this, a positive or negative analysis of sentiments is a good solution. This type of analysis was successfully applied to the branding assessment (Bilro et al., 2021; Mingione et al., 2020; Mogaji et al., 2021). On the other hand, the behavioural response collected in our research is the intensity of communication in each period. It is measured by the number of tweets published each day about telemedicine. In this sense, Luo et al. (2021) show that the increase in communications, especially on online social networks such as Twitter, can be a way of responding to the stimulus of COVID-19. The pandemic and lockdowns produce emotions in individuals that can be released through these types of interactions. Similar findings are provided by (Pandita et al., 2021). Using the SOR model, they also find an increase in the interactions of individuals in online social networks and participation in e-
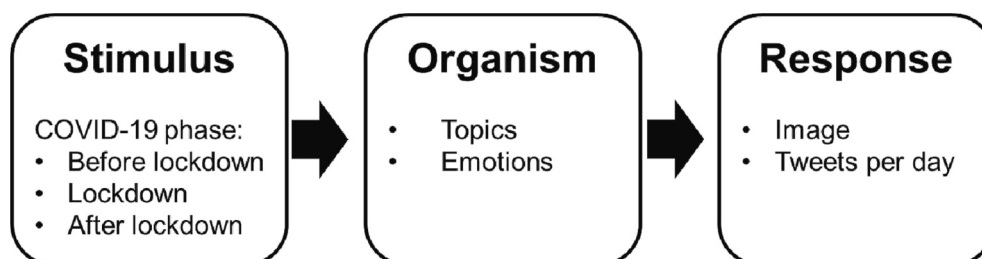

Fig. 1. SOR framework applied to the study.

learning courses in response to COVID-19.

Based on the SOR model and the literature review, we propose the following proposition:

Proposition 2. *In the Spanish community that talks about telemedicine on Twitter, the topics and their associated emotions affect the number of interactions that occur each day and the perceived image of this phenomenon.*

We will apply the netnographic methodology described below according to the SOR model described above.

2.6. Netnography

Kozinets (Kozinets, 1997, 1998) established the term Netnography in consumer behaviour research. In his words, netnography is defined as a: "new qualitative research methodology that adapts ethnographic research techniques to study the cultures and communities that are emerging through computer-mediated communications" (Kozinets, 2002). In today's Internet-driven world in which all events have a significant impact on online social networks netnography has now become one of the methodologies with the highest projection (Jeacle, 2021).

The success of Netnography is due to its pragmatic and flexible nature to understand phenomena, combining quantitative and qualitative methodologies. It differs from other methodologies through three elements (El Hilali and Azougagh, 2021):

Cultural focus: Netnography focuses on culture to understand human behaviour in response to various phenomena. In our case, understanding how Spanish perceptions and behaviours have changed in response to telemedicine caused by COVID-19.

Social media data: Netnography uses as its main data source the interactions and comments that occur on online social networks (Facebook, Instagram, Twitter, WhatsApp, …). Nowadays, everything that happens in "real" life has an impact on online social networks. Among these networks, the literature shows many reasons for choosing Twitter as a data source (Mingione et al., 2020): Firstly, it makes data available to researchers via an Application Programming Interface (API). Secondly, it can accurately identify interactions between different individuals. Third, Twitter reduces the text to 240 characters. That forces its users to work to select the most suitable words, which favours the use of an adequate lexicon for the analyses developed in our study. And finally, Twitter has played a particularly important role throughout the pandemic as an information channel that has contributed to managing the perception of risks through user interactions within this public space (Castro-Martinez et al., 2021).

Participation: Netnography supposes the free participation of users in online social networks. This fact generates a participation with the social, physical, and emotional characteristics of users within a community that facilitates their study. And as has been said, in our case, the Spanish community of Twitter users offers comments on telemedicine.

For all these reasons, we consider that Netnography is an appropriate method for developing our research.

3. Methodology

This research is intended to be descriptive with a qualitative approach. Qualitative methodologies help researchers understand phenomena in context (Recker, 2013). Within these approaches, observation is a crucial technique in data collection. This study draws on the netnography method proposed by Kozinets (Kozinets, 2002). Netnography is a modern form of observation that involves the observation of online behaviours or communities (Kozinets, 2010). According to Heinonen and Medberg (Heinonen and Medberg, 2018), netnography is a suitable method to study digital consumer behaviour, as people feel comfortable sharing personal ideas on the Internet. Additionally, we used quantitative data analysis to understand the main topics communicated by users and evaluate emotions and positive sentiments in these communications. Fig. 2 shows the process followed in this study based

on Kozinets (Kozinets, 2010).

Next, we detail the research steps.

Step 1: Definition of Research Questions. The research question defined in this study is: what has been the impact of the COVID-19 pandemic on telemedicine among the online community members in Spain?

Step 2: Community Identification and Selection. According to the research question defined, we identified the Spanish twitter community to study the phenomenon. Twitter is a popular social media platform with over 120 million active daily users, including individuals, organisations, celebrities, and political figures. The platform has made it easier for different social movements to communicate globally. Twitter features the ability to build a community and engage in online conversations. Twitter users can post their thoughts in a short post, further comment on others' posts, share others' posts by "retweeting", mention other users using an "@" character, and link their posts to an online repository of similar posts using hashtags (Kachen et al., 2021). Twitter was chosen on purpose for two main motives. First, this platform enables data access to interactions between users and organisations with few restrictions, thanks to the application programming interface (Mingione et al., 2020). And second, due to its 240-character limit on posts, the platform suits the NRC lexicon used to perform sentiment analysis (Mohammad et al., 2015).

Step 3: Data Collection. We collected the data using Twitter's API academictwitteR, an R package developed by Barrie and Ho (Barrie and Ho, 2021). We pulled 334,652 tweets posted in Spanish containing the word "*Telemedicina*" (Telemedicine in Spanish) from 1 October of 2018 until 30 October of 2021, from all over the world. To avoid the inclusion of tweets that could amplify specific points of view or distort public communication, we used an R script to identify and delete automated messages (bots) based on the TweetBotOrNot R package. Additionally, we reviewed accounts with more tweets to determine if they were corporate accounts. The results reveal that their influence was minimal. Before analysing, we pre-process the data in two activities: 1) Geolocation filter. We aim to limit the analysis to the content generated in Spain. Following the procedure used by Agüero-Torales et al. (Agüero-Torales et al., 2021), we filtered the tweets in Spanish using the user profile localisation field. We searched for Spanish cities with a population of over 25,000, province names, autonomous regions names, and any location identified as Spain. As a result, 34,746 tweets from users located in Spain were identified. 2) Tweets pre-treatment. We based the Tweets pre-treatment on Maier et al. (Maier et al., 2018); this procedure included: 1. Turn all characters in lowercase; 2. Remove emoticons, digits, hashtags, hyperlinks, punctuation, and special characters; 3. Eliminate stopwords; 4. Stemming; 5. Bigram tokenisation; and 6. Relative pruning, i.e., remove rare words occurring in less than 1 % of tweets.

Step 4: Data Analysis and Iterative Interpretation of Findings.

This step is composed of three sub-steps that are applied iteratively.

Step 4.1: LDA-based Topics Modeling

Natural language processing (NLP) is a challenging field in computing to allow computers to derive meaning from human language processing in textual documents (Jelodar et al., 2019). The topic analysis is an effective tool applied in NLP to extract topics from documents; this collection is known as a corpus. Latent Dirichlet Allocation (LDA) is an unsupervised statistical method to document modeling that uncovers latent semantic topics within extensive collections of text documents. LDA was proposed by Blei et al. (Blei et al., 2003), and the central insight of this approach is the notion that words contain reliable semantic information about the document. Therefore, it is reasonable to assume that documents dealing with approximately similar topics will use the same set of words. Latent topics are thus uncovered by identifying a group of words in the corpus that occur often. The learning in LDA is unsupervised since the input data is incomplete: the corpus provides only the terms in the documents, and there is no set of training with topic annotations. Thus, LDA models documents as a haphazard mixture of latent topics; each topic is described by its word distribution. LDA has
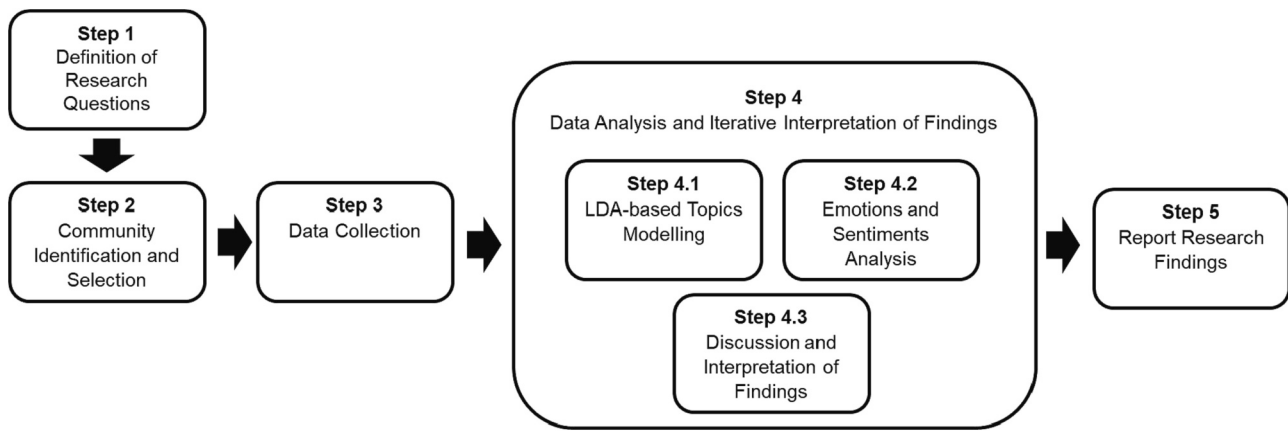
Fig. 2. Research process.

become the most popular topic analysis method in the field (Campbell et al., 2015) and has been widely used to analyse user-generated content in Twitter documents (Jelodar et al., 2019).

We used a set of R packages related to topic modeling. The topicmodels package (Hornik and Grün, 2011) provided tools to fit an LDA model based on data structures from the text mining package tm (Feinerer et al., 2008). The LDAtuning package (Nikita and Nikita, 2016) was used to obtain metrics to find the optimal number of topics for the LDA models. And finally, the LDAvis package (Sievert and Shirley, 2014) was used for the interactive display of topic models.

The topicmodels package has been used in many studies over the past decade, for instance, to derive latent brand topics and classify brand sentiments (Liu et al., 2017), or based on Twitter data for identifying relevant public health topics (Ghosh and Guha, 2013), examine the public discourse about the coronavirus pandemic (Kurten and Beullens, 2021), and determine sentiments and track perceived the service quality of healthcare services (Lee et al., 2021). Also, the Ldatuning package has been used previously in the literature, for instance, to measure shifts in public sentiment opinion about migration during the COVID-19 pandemic in some European countries and the United States (Rowe et al., 2021)and determine both the origin and direction of technology transfer research (Noh and Lee, 2019). Finally, the LDAvis package has been used recently to propose a theoretical contribution that explains how local governments define their smart city policy agenda (Clement and Crutzen, 2021), to provide research agenda about smart lighting business (Zarindast et al., 2021), and to investigate latent temporal topics from tweets during a recent disaster event (Zhou et al., 2021).

Step 4.2: Emotions and Sentiments Analysis

Sentiments analysis refers to detecting, extracting and categorising opinions, sentiments, and attitudes regarding different topics, as expressed in the textual input (Montoyo et al., 2012). On the other hand, computational emotion processing is a sentiment analysis task that has achieved acceptable precision using NLP techniques (Plaza-del-Arco et al., 2020). Emotion is a complex reaction pattern involving experiential, behavioural, and physiological elements by which individuals attempt to deal with a personally significant matter or event (APA, 2020), and the literature suggests that emotion has affective and cognitive components; the first component is related to our immediate response to stimuli, while the last component is our more controlled and conscious evaluation after the rapid response. The research proposes that positive and negative outcomes are associated with emotions (An et al., 2017).

We used Syuzhet to recognise eight emotions (Jockers, 2015). In particular, the emotions recognised by the software are based on Plutchik's proposal of basic emotions (Plutchik, 2001):

- Anger: our way of reacting to an attack, mainly if that act is done intentionally.

- Anticipation: the beliefs we generate for ourselves about a specific incident or state based on our knowledge and information.
- Disgust: we express our rejection determination or want to avoid something or someone.
- Fear: is the uncertainty we feel when we generate expectations about something we suppose will harm us.
- Joy: a state of satisfaction and comfort with ourselves and what we must live.
- Sadness: a state of misery; it requires social support.
- Surprise: the way we respond when something unanticipated happens to us.
- Trust: is the attitude we take in a particular way when considering that there is no injury or damage in a situation after an action.

In this study, we associate the emotion with something that happens in the organism before a more general reaction, such as the positive or negative sentiments towards something.

Regarding sentiment analysis, the R package applied was Syuzhet (Jockers, 2015). This package comes with four opinion dictionaries and offers a robust but computationally expensive method of opinion extraction based on the Stanford NLP Group toolkit. Among other features, Syuzhet provides the percentage of positive or negative documents. Like us in this study, recent studies assessment (Bilro et al., 2021; Mingione et al., 2020; Mogaji et al., 2021) has associated the positive or negative feelings detected through sentiment analysis with the brand image.

Step 4.3: Discussion and Interpretation of Findings

Steps 4.1. and 4.2 were done several times with different parameters. After each iteration, the researchers discussed and interpreted the findings. The procedure used was that each researcher performed their interpretation individually, then these were compared; if they were not the same, this was discussed, and a consensus was reached.

One researcher is Spanish, an expert in consumer behaviour, and has lived in Spain throughout the analysis period; the second researcher is an expert in online social networks and with professional experience in implementing ITC to support health systems.

Step 5: Report Research Findings

In this step, the study's findings are reported based on the iterations of the previous step. These findings are associated with the literature in this activity, and their implications are identified.

4. Results

Fig. 3 provides a time distribution of the number of tweets. We note that the COVID-19 pandemic significantly impacts the chosen issue.

Table 1 summarises the findings regarding the SOR framework. The first column refers to the different stimuli concerning the COVID pandemic periods in Spain: Before lockdown, Lockdown, and After

lockdown. The central columns refer to the organism, and the last two columns to the response. In the central columns, K and label indicate identity and description of the topics discovered in the period. The number of topics in each period was determined by optimising the possible LDA models. Topic labels were made using the LDAvis visualization tool. The topics are grouped in a general theme, in bold above them. The column size shows the number of terms in each case from the LDA model determined for each period. After this column is the percentages associated with the eight emotions detected in the tweets belonging to each topic using Syuzhet. The highest rate among the topics is in bold, and the lowest is underlined. Finally, regarding response, the last two columns contain, for each period, first the average number of tweets per day, and second, the rate of positive tweets.

Before lockdown, four topics were identified, three associated with publicity and advertising (Advertisements of telemedicine platforms and programmes, Benefits of teleconsultation, and Telemedicine news) and one associated with news (The collapse of primary care).

In the lockdown, eight topics were identified, five associated with opinions (Telemedicine as a tool for social isolation in medical consultations, Covid as a turning point for the use of telemedicine, Telemedicine as a suitable solution for consultations, Telemedicine is here to stay, and Covid accelerates telemedicine in primary care), two associated with advertising (Insurance company campaigns and Telemedicine campaigns to face Covid), and two associated with training (Telemedicine as a new service, help with the configuration and Ethical considerations for the application of telemedicine).

After lockdown, eleven topics were identified, four associated with opinions (Benefits of telemedicine, The role of consultation in telemedicine, Communication with the patient: telemedicine versus face-to-face, and Covid has changed the way of practising medicine), five associated with training (Conferences on telemedicine for health professionals, Courses and master on telemedicine, Webinar for professionals on digital transformation, Telemedicine and pain, and Course on physical examination and telemedicine), one associated with advertising (Technology and insurance companies offer telemedicine services), and one associated with news (Problems in primary care due to lack of doctors).

In the final row of each period, the percentages associated with the emotions of the total tweets of the period are presented. At the end of the table, the results of an ANOVA test are presented. This indicates that there are statistically significant differences in the means of emotions per period. There are also statistically significant differences in the means per period of both the tweets per day and the scores of positive sentiments. Finally, in the last row, the table shows that the Pearson correlations between the emotions and the positive sentiment scores of all the tweets are in all the cases statistically significant. A list of examples of tweets by topic in each period can be found in Appendix A.

To test the causality between the emotions and the positive sentiment score, and if these relationships change significantly according to the three different stimuli, we perform a multigroup analysis with partial least squares (PLS-MGA). Table 2 shows the results of this analysis. It can be noted that emotions explain the variance of the positive sentiment score, and the effect of most of these emotions changes significantly according to the stimulus.

5. Discussion

The results obtained allow us to successfully answer the question and propositions posed in our research: What has been the impact of the COVID-19 pandemic on telemedicine among the online community members in Spain? The findings show that the COVID-19 pandemic has affected emotions and topics of interest related to telemedicine. This has affected the image it had and the behaviour of the Twitter community in Spain. We wish to delve deeper into the results.

First, from a theoretical point of view, the SOR model (Mehrabian and Russell, 1974) is a valuable theory for analysing and understanding the phenomenon of telemedicine application. In the same way, the SOR model has provided an adequate framework for applying netnographic techniques (Kozinets, 2002) to study this phenomenon. The results show how the pandemic caused by COVID-19 has generated new concerns and debate topics in the community and related to them, significant variations in the associated emotions. And in response to this, the image projected concerning telemedicine in society has evolved, as well as the level of interaction of individuals in the face of this phenomenon. It has gone from a positive image before the lockdown to a worse image during the lockdown. And that image has been maintained during the current post-lockdown period.

Regarding Preposition 1 (*in the Spanish community that talks about telemedicine on Twitter, the evolution of COVID-19 affects the topics and their associated emotions*), the three periods analysed (before lockdown, during lockdown, and after lockdown) affect the topics and their associated emotions that users offer on Twitter about telemedicine in Spain, and we find significant differences in the relationships (Tables 1 and 2) between topics, emotions and the affective response, and the image of telemedicine. Also, concerning the organism, we find remarkable differences between the three periods regarding topics covered and emotions generated. The ANOVA analysis indicates significant differences in the means of all emotions between the three periods. Before the pandemic, most of the topics covered were advertising and informative. Telemedicine was probably perceived more as a tool for the future and not so much for immediate implementation. Proof of this is the high values offered by the emotions of anticipation and trust. In this period appears the topic with the highest peaks, positive and negative, in the associated emotions. This topic is, logically, the news of the appearance of the COVID-19 pandemic. The second period, characterised by the lockdown, meant a meaningful change. The themes multiplied, and the
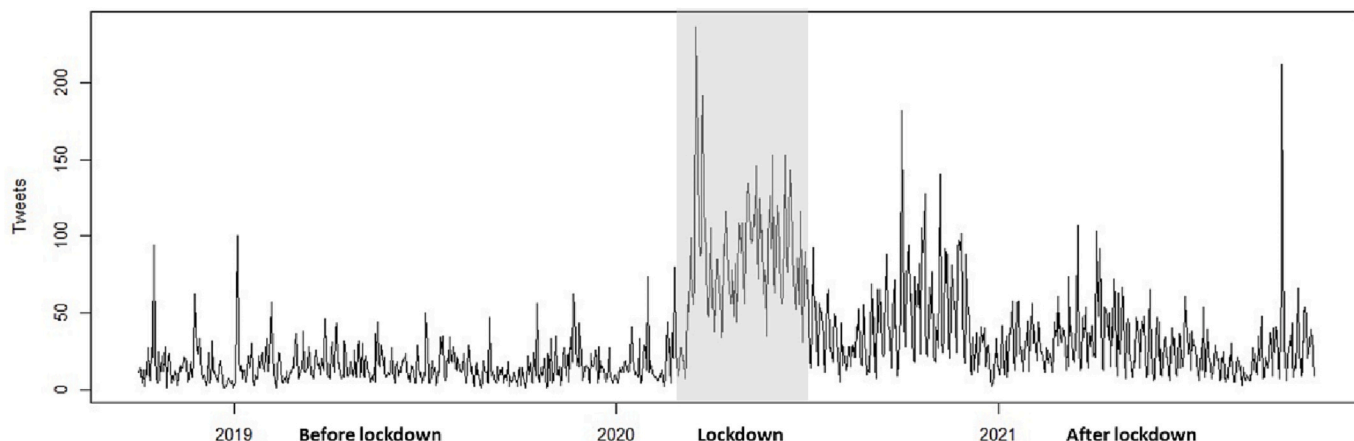

Fig. 3. The timing of tweets from 2018-10-01 to 2021-10-30.

Table 1
Analysis using SOR framework.

STIMULUS	ORGANISM											RESPONSE	
COVID	K	Label	Size	Anger	Anticipation	Disgust	Fear	Joy	Sadness	Surprise	Trust	Tweets per day	Positive Sentiment
Before lockdown October 1, 2018, to March 14, 2020.		**Publicity and Advertising**											
	1	Advertisements of telemedicine platforms and programmes	84.364	0.053	0.174	0.061	0.132	0.097	0.125	<u>0.048</u>	**0.310**		
	2	Benefits of teleconsultation	77.665	0.059	0.170	0.063	0.133	0.099	0.150	0.055	0.271		
	3	Telemedicine news	41.221	<u>0.017</u>	**0.174**	<u>0.009</u>	<u>0.078</u>	**0.113**	<u>0.122</u>	0.070	0.417		
		News											
	4	The collapse of primary care	14.749	**0.152**	<u>0.124</u>	**0.142**	**0.250**	<u>0.000</u>	**0.207**	**0.104**	<u>0.021</u>		
		All tweets of the period		0.065	0.181	0.073	0.153	0.101	0.144	0.060	0.283	16.081	0.686
Lockdown March 15, 2020, to June 21, 2020.		**Opinions**											
	1	Telemedicine as a tool for social isolation in medical consultations	30.228	0.058	0.176	<u>0.055</u>	0.168	0.071	0.202	**0.056**	0.214		
	2	Covid as a turning point for the use of telemedicine	29.716	0.057	0.154	0.061	0.165	0.070	0.235	0.048	0.210		
	3	Telemedicine as a suitable solution for consultations	29.285	0.067	0.147	0.057	0.146	**0.099**	0.161	0.049	0.274		
	5	Telemedicine is here to stay	27.069	0.056	**0.189**	0.056	0.165	0.077	0.159	0.051	0.246		
	6	Covid accelerates telemedicine in primary care	25.480	**0.077**	0.113	0.063	**0.243**	0.055	0.234	0.039	<u>0.176</u>		
		Advertising											
	7	Insurance company campaigns	22.466	0.058	0.111	**0.131**	0.190	0.053	<u>0.157</u>	0.013	0.287		
	9	Telemedicine campaigns to face Covid	16.062	0.063	<u>0.000</u>	0.125	0.063	<u>0.000</u>	**0.438**	<u>0.000</u>	0.312		
		Training											
	4	Telemedicine as a new service, help with the configuration	28.265	0.063	0.154	0.061	0.172	0.071	0.189	0.044	0.246		
	8	Ethical considerations for the application of telemedicine	22.429	<u>0.055</u>	0.161	0.084	<u>0.044</u>	0.028	0.183	0.013	**0.432**		
		All tweets of the period		0.066	0.169	0.065	0.180	0.078	0.184	0.051	0.258	91.818	0.603
After lockdown June 22, 2020, to October 30, 2021.		**Opinions**											
	1	Benefits of telemedicine	22.463	0.050	0.178	0.039	0.158	0.096	0.141	0.044	0.294		
	3	The role of consultation in telemedicine	21.507	0.056	0.190	0.047	0.173	0.082	0.169	0.060	0.223		
	6	Communication with the patient: telemedicine versus face-to-face	20.733	0.044	**0.199**	0.052	0.123	0.096	0.140	0.037	0.309		
	8	Covid has changed the way of practising medicine	18.818	0.037	0.158	<u>0.044</u>	0.221	0.080	0.240	0.044	0.177		
		Training											
	2	Conferences on telemedicine for health professionals	22.131	0.032	0.186	0.052	<u>0.106</u>	0.089	0.125	0.064	**0.345**		
	4	Courses and master on telemedicine	21.504	0.043	0.172	0.064	0.130	0.090	0.163	0.071	0.265		
	5	Webinar for professionals on digital transformation	20.962	0.043	0.171	0.071	0.104	0.083	0.144	0.062	0.323		
	9	Telemedicine and pain	18.810	0.032	0.141	0.103	0.207	0.029	0.351	0.049	<u>0.087</u>		
	10	Course on physical examination and telemedicine	16.908	<u>0.029</u>	0.046	0.123	0.215	0.031	**0.428**	0.033	0.095		
		Advertising											
	7	Technology and insurance companies offer telemedicine services	19.050	0.080	0.189	0.055	0.123	**0.105**	<u>0.102</u>	**0.073**	0.273		
		News											
	11	Problems in primary care due to lack of doctors	15.114	**0.168**	<u>0.012</u>	**0.159**	**0.318**	<u>0.006</u>	0.161	<u>0.016</u>	0.161		
		All tweets of the period		0.056	0.166	0.073	0.167	0.082	0.198	0.055	0.257	34.575	0.601
		ANOVA F-Test Statistics for period means		262.6***	714.5***	188.5***	423.2***	433.5***	222.2***	248.4***	909.7***	521.6***	1460.2***
		Pearson Correlation with Positive Sentiment Score		0.141**	0.561**	0.077**	0.126**	0.580**	0.071**	0.298**	0.664**		

The highest values for each emotion in each time period considered are shown in bold. The underlined values refer to the lowest values for each emotion in each time period.

Table 2

PLS-MGA results.

Antecedent of positive sentiment	Beta coefficients			Path coefficients' differences and significance levels		
	Before	Lockdown	After	Before versus Lockdown	Before versus After	Lockdown versus After
Anger	0.095***	−0.015ns	0.051***	0.110***	0.044***	−0.066***
Anticipation	0.325***	0.284***	0.321***	0.041**	0.004ns	−0.037**
Disgust	0.036***	−0.020*	−0.037***	0.056***	0.073***	0.017ns
Fear	−0.071***	−0.088***	−0.122***	0.017ns	0.051***	0.034**
Joy	0.213***	0.202***	0.205***	0.011ns	0.008ns	−0.003ns
Sadness	−0.020***	0.056***	0.061***	−0.076***	−0.081***	−0.005ns
Surprise	−0.094***	0.007ns	−0.059***	−0.101***	−0.035**	0.066***
Trust	0.446***	0.442***	0.455***	0.004ns	−0.009ns	−0.013ns
R²	**0.568**	**0.556**	**0.555**			

ns: not significant.

* p<0.05
** p<0.01
*** p<0.001

associated emotions changed drastically. During this period, there is an important nucleus of conversations around issues related to the implementation of telemedicine in this new context. One of the main ideas is that telemedicine has come to the health system to stay. This implies the need to have the right tools for its application. A validation of this is the crucial role that training has among the topics dealt with. In this period, it is observed how extreme emotions are more recorded in the topics related to opinions than in other topics where communication has an informative nature. Finally, the number of topics increased in the post-lockdown period, although with a very different distribution between the groups. Opinion debates have been reduced, and training has gained more weight. This is in line with the previous idea that the community understands telemedicine to be a tool that will remain within the Spanish health system. During this period, fear probably decreases because telemedicine is now perceived as a complementary tool rather than the main medical consultation form. Our findings are in line with previous studies in other online communities of users. In general, and as our analysis shows, emotional perceptions changed as the pandemic unfolded. Chandrasekaran et al. (Chandrasekaran et al., 2020) reviewed the topics of the tweets related to COVID-19, and the sentiments associated with them changed over a period before and after the illness was declared a pandemic. Sentiment scores were negative throughout the review period on topics such as case growth, symptoms, and the policy impact of COVID-19. On the other hand, the authors reported a shift in sentiment from negative to positive for topics such as the prevention, economic impact, government response, and impact on the healthcare industry. Furthermore, as our findings show, the emotion of fear diminishes over time. Xue et al. (Xue et al., 2020) studied tweets related to COVID-19 from January to March 2020 and discovered several topics; among them, fear was the most prominent emotion. Nevertheless, and based on tweets across 12 countries from January 2020 to April 2021, Oliveira et al. (Oliveira et al., 2022) reported that over the period of the study anger was steadily the most prevalent emotion, followed by sadness, optimism, and joy. In relation to online opinions on telemedicine, the previous literature, as well as our findings, details changes in the topics that are discussed at different periods of the pandemic. Massaad and Cherfan (Massaad and Cherfan, 2020) inquired about tweets related to telemedicine in a short period at the beginning of the pandemic, from March 30, 2020, to April 6, 2020. Mental health and health insurance were the most common health-related topics found by these authors, which reflects a high need for mental health care during the pandemic, and accelerated access to telemedicine with a change in coverage policies. Also, Anderson et al. (Anderson et al., 2022) reviewed tweets about telemedicine early in the COVID-19 pandemic (March/April 2020) and a year later (March/April 2021). Their findings indicate differences among the periods regarding the topics. Specifically, at the beginning of the pandemic, in line with Massaad and Cherfan (Massaad

and Cherfan, 2020), topics included the use of telemedicine in general, telemedicine for mental health applications, and health insurance for telemedicine services. More recently, the topics have focused on telemedicine-related events and the growing importance of telemedicine services. As in our results, different topics are associated with different emotions in the communities associated with telemedicine. Krittanawong et al. (Krittanawong et al., 2022) explored more than one million tweets from non-telemedicine healthcare professionals from July 1, 2020, to August 1, 2020. They divided the tweets into two groups, positive sentiments with 71.4 % and negative sentiments with 28.6 %. Positive tweets are linked to four topics: very safe and convenient; beneficial in psychotherapy; avoiding excessive transport; and environmental benefits. Negative tweets are related to five topics: lack of insurance coverage; poor broadband Internet access; cybersecurity and data security; interface or software problems; and correspondence with the doctor's office. Analogous to the effect in online communities by the pandemic, in communities associated with telemedicine, some results indicate that activity levels and emotions have changed throughout the pandemic. Champagne-Langabeer et al. (Champagne-Langabeer et al., 2021) studied tweets containing telemedicine between November 2019 and April 2020. Their results show that the COVID-19 pandemic caused an increase in tweets related to telemedicine and COVID-19 and that, in general, most people feel positive or neutral emotions towards telemedicine. Nitiema (Nitiema, 2022) reviewed the opinions of health professionals about telemedicine services from 2013 to 2020. The analysis revealed that comments about the quality of care delivered through telemedicine are associated with an overall negative rating. However, the average rating was less harmful during the pandemic than in the pre-pandemic. Additionally, there were positive views about the perceived benefits of telemedicine, but the thoughts about these benefits were less favourable during the pandemic compared to the pre-pandemic period. This last result for health professionals is in line with the results of our analysis.

As we can see, our research findings are consistent with other research in the area of health and telemedicine in online social networks. These works indicate that there is an evolution, both in topics and in emotions, associated with the progress of COVID-19.

Finally, in relation to Proposition 2 (*in the Spanish community that talks about telemedicine on Twitter, the topics and their associated emotions affect the number of interactions that occur each day and the perceived image of this phenomenon*), we have found statistically significant relationships between the organism, topics and emotions, and the affective response, in the form of a positive image level of the telemedicine phenomenon. These results are associated with qualitative reports that recognise challenges for telemedicine due to the biases of patients and health personnel (Chitungo et al., 2021; Mbunge et al., 2022). In general, all emotions affect the image, although not all to the same extent. And its

weight has varied from one period to another. In any case, the analysis of the structural equations tells that anticipation, trust, and joy are the emotions that most contribute to creating a positive image. Possibly, in this case, joy should be understood, more than as fun, as an idea related to the ease of use of this platform. As the topics with a higher level in this emotion point out. On the contrary, fear is the emotion that most hinders the positive image of telemedicine. The latter issue is consistent with reported concern about the security of personal health information when considering telemedicine (Kichloo et al., 2020). From a behavioural point of view, we also found significant differences in the number of tweets published each day in each of the periods. These findings are in line with other research with different methodologies, where the impact of perceptions on attitudes and behaviours in relation to health services was analysed. For example, Alrahbi et al. (Alrahbi et al., 2022) found that perceptions of the health system in the United Arab Emirates had an impact on the implementation of telemedicine in that country. For their part, Cao et al. (Cao et al., 2020) found that the perceptions of users of mobile health applications about the excess of information and functions of these applications, their fatigue and technological stress affected their behaviours related with resistance to the adoption of this technology. Using a methodology similar to ours, Boursier and colleagues (Boursier et al., 2021) found that for parents of children with Down syndrome who shared information through online communities, their perceptions affected their attitudes and behaviours through group learning. Similarly, Eriksson and Salzmann-Erikson (Eriksson and Salzmann-Erikson, 2018) found that perceptions of the use of robots for geriatric care services affected attitudes towards this type of technology. In short, the perceptions expressed by individuals are the basis for subsequent attitudes and behaviours related to technologies in the health sector.

6. Academic, managerial and social contributions

Our work makes various academic contributions, but mainly social and for managers. From a scholarly point of view, most of the research on the adoption of telemedicine has been conducted using models such as TAM or UTAUT (Kamal et al., 2020; Shiferaw et al., 2021) using questionnaire-based methodologies. However, our work has a novel vision provided by the netnographic methods and big data techniques (W. An and Alarcón, 2021; Hossain and Rahman, 2022). On the other hand, many works carried out from netnography have a strong descriptive character (El Hilali and Azougagh, 2021; Kachen et al., 2021); however, our research is guided by the theoretical framework provided by the SOR model (Mehrabian and Russell, 1974). Recently, Cambra-Fierro et al. (Cambra-Fierro et al., 2022), based on a systematic literature review and a focus group, have revealed a trend associated with COVID-19 of the application of technological advances in the service industry, such as telemedicine, and suggest the SOR model as a theoretical base, and SEM and text mining as quantitative methods for its future study. Like other studies (Amin et al., 2022; Goyal et al., 2021), our work used the SOR model to analyse telemedicine. Also, we used quantitative methods such as PLS-SEM and text analysis, which are consistent with the previous suggestion. But in addition, we add the netnography approach as a method of analysing the evolution of perception of the online community. This addition allows a pragmatic and flexible understanding of phenomena in the service industry, combining quantitative and qualitative methodologies.

From the point of view of managers, our work also makes contributions. Since the appearance of COVID-19, telemedicine has been the first line of defence for doctors, maintaining social distancing and providing personal care services only in the most urgent cases (Vidal-Alaball et al., 2020). There are yet significant barriers in its implementation today. In this way, although the challenge of having a communication instrument to inform and educate the population on the recommended use of telemedicine has been identified since the beginning of the pandemic (Ohannessian et al., 2020), there are still populations in the world with little knowledge of it (Omboni et al., 2022).

Consequently, there is a call for these elements of communication; this study provides specific ideas on these elements. We provide a collection of the topics covered in each period and the evolution in related emotions. Together with this, we offer a quantitative view of the image of telemedicine as a tool. The managers of companies related to the health system, both public and private, should consider this information when making decisions about the role of telemedicine within their range of services. Similarly, our results have shown that to achieve a positive image of telemedicine it is necessary to foster, especially, the emotions of anticipation and trust, and at the same time combat the emotion of fear. The communication policy of these companies must collect these emotions to be successful, both when generating new topics for debate that improve the image of the phenomenon and when managing the communication of existing topics. For example, after lockdown some of the most critical topics are related with training, and within them, we can highlight "Course on physical examination and telemedicine". If we analyse the emotions related to this topic, we see that they are mainly negative: fear, sadness, and anger. On the other hand, positive emotions such as trust and anticipation are relatively low. In this situation, we understand that the agents, public or private, in charge of carrying out these courses should take this data into account to manage future training programmes. The new training programmes must offer and make visible greater security and trust, and demonstrate their effective responsiveness. At the same time, these must combat the most negative emotions. An idea could be to mention success stories with online patients using physical exams in different contexts.

Finally, our research has exciting contributions to society, especially technological changes. First, telemedicine is a necessary tool for the long-term sustainability of health systems. Our results show that telemedicine should be understood as a complementary tool, not a substitute for face-to-face medical consultation. However, the pandemic has accelerated its implementation, which has generated image problems for this tool. In this sense, we want to highlight how one of the main contributions of our work is the demonstration that technological changes, especially in sensitive areas such as health, affect people's emotions and behaviour. The significant differences in the ANOVA test of emotions between the different periods analysed demonstrate this.

7. Conclusions

In conclusion, COVID-19 has affected the adoption of telemedicine as a tool in the healthcare system. This impact is certainly positive for the health system to ensure long-term sustainability. However, it also demands a more active involvement of the agents involved - professionals, organisations, companies and particularly patients - which generates feelings and emotions that are not always positive. The results of our study indicate that in the Spanish community that talks about telemedicine on Twitter, the evolution of COVID-19 affects the topics and their associated emotions, and this, in turn, explains the image and number of tweets published. In short, these are technological improvements that promote change related to sensitive elements of society, such as medicine and health. The future of medicine is seen with a greater weight of technology and the involvement of patients themselves in adopting these technologies. The emergence of wearables, such as watches to measure the pulse, or new devices aimed at online monitoring of chronic patients, for example, diabetes, are good examples of the current implementation of health-related technologies. Our work suggests that changes in health systems affect people's emotions and behaviours.

8. Limitations and future lines of research

Finally, our work suffers from limitations that serve as a stimulus for future research. First, natural language recognition by computers has its limits. For example, sarcasm, or metaphors, may not be well understood. In this sense, we must recognise that Twitter is an excellent tool to capture the opinions of a community due to the need to communicate

through concise messages, which means that the ideas that are to be conveyed must be very well defined. We hope that improvements in natural language recognition algorithms through computers will solve these problems in the future. Secondly, in our data cleaning, there may be Spanish tweets that have not been considered due to the lack of information offered by Twitter. Our approach to georeferencing messages was indirect. One solution could be to analyse more specific communities, such as telemedicine by chronic patients in a particular geographical area. Lastly, the statistical techniques used to search for causality between the elements of the SOR model use linear relationships. In this sense, we believe that it would be interesting to address non-linear cause-effect relationships, especially in human emotions.

In addition, further research needs to apply and compare the findings of our study in other countries to ensure the robustness of the results. Specifically, we believe that the netnography-based method's usefulness in other virtual communities to study the effects of the COVID-19 pandemic and the consequences associated with telemedicine should be explored to improve the strength of our findings. Related to the first idea, for example, netnographic research to understand scholarly communities impacted by the COVID-19 pandemic is an area that should be revisited. The effect of the pandemic on the explosive use of ICT for education is a remarkable fact that requires a detailed exploration of the emotions and feelings of its users to understand its future development. Associated with the second idea, studies in countries with cultures other than the Mediterranean, such as Asians and Anglo-Saxons, are good options to explore their online communities about telemedicine. Cultural differences are relevant to explain the acceptance of technologies, and it is possible that, in the case of telemedicine, such effects exist or do not exist. Despite the academic relevance of the studies suggested above, given the importance of the use of telemedicine to reduce health gaps in Latin American countries, the cultural and language proximity to Spain indicate that the replication of this study in those regions can provide relevant inputs for public policies for national governments and international organisations.

CRediT authorship contribution statement

Jorge Arenas Gaitán: Term, Conceptualization, Validation, Formal analysis, Investigation, Resources, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision and Project administration.

Patricio E. Ramírez-Correa: Term, Conceptualization, Validation, Software, Formal analysis, Investigation, Resources, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision and Project administration.

Data availability

Data will be made available on request.

Acknowledgments

Appendix A

Table A1
Examples of tweets by topic.

Period/Topic	Gamma	Tweet	Date	User
BEFORE LOCKDOWN				
Topic #1				
	0.997	Si estás interesado en saber cómo disponer de un servicio de Telemedicina en tu empresa, pincha aquí: https://t.co/yTH49ZZ3xI #Telemedicina #ServicioMedico #EverHealth 6#Telemedicina #Salud #Serviciomedico #Medicina #empresas #trabajadores	06-17-2019	everhealth
	0.995	Rincón de Salud, el servicio de Telemedicina que permite poner en contacto al paciente con su médico. ¡Un servicio de calidad para el sector sanitario! https://t.co/nJDD1krEPi #salud #telemedicina	06-26-2019	Laberit_tech
	0.995	¿Sabías que la OMS afirma que la #telemedicina puede ayudar con la asistencia a crónicos? @BiodataDevices ofrece un sistema de monitorización profesional que evita que el paciente crónico reingrese en el hospital de manera recurrente #EmprendeinHealth @UnLtdSpain https://t.co/TO1ooqu66Y	02-20-2020	LillyES
Topic #2				
	0.996	La atención telemática en el ámbito de la #salud aumenta en el entorno doméstico pero también en centros escolares y residencias de mayores, donde permite ahorrar tiempos de espera a la #sanidad https://t.co/70k7SOOJ1E vía @LaVanguardia #telemedicina #eHealth #eSalud #tecnología https://t.co/1Wfl5RYhCC Las #tecnologías aplicadas a la salud son una potente herramienta.	11-28-2018	campussanofi
	0.995	Enhorabuena por la #Investigacion #innovación #telemedicina #eHealth	01-12-2020	c_jodar

Period/Topic	Gamma	Tweet	Date	User
		telemedicina. https://t.co/ummMBUEf27		
	0.986	Con la telemedicina se resuelven cuestiones en menos tiempo y contribuye a evitar el colapso, pero no en todo los pacientes ✕	10-20-2020	faprimaria
		☑Hace falta formarse en consultas médicas no presenciales y evaluar bien cada caso. #telemedicina #econsulta #AtencioPrimaria		
	0.987	https://t.co/PKNBNH8luJ En los casos en que el paciente debe trasladarse grandes distancias para acudir a la visita o bien cuando la situación del paciente no permite realizar traslados frecuentes, la consulta no presencial de #Cardiología puede ser una herramienta muy útil https://t.co/86XZInb7FF https://t.co/hAYqdEDFLb	08-29-2021	QS_Barcelona
Topic #4	0.985	Curso #MobileHealth | Descubre cómo la #SaludDigital está transformando la relación Médico-Paciente. ✓Relación entre apps y #telemedicina ✓Seguimiento clínico ✓Liderazgo digital de los #profesionalessanitarios ✓Casos prácticos 🔗 Accede gratis: https://t.co/KyIOSINA5m https://t.co/WfGT6wvD73	11-15-2020	jlumbreras13
	0.986	📖El mejor curso sobre #teleconsulta para #profesionalsanitario de #atenciónprimaria: ◈Herramientas de comunicación en remoto. ◈Cómo realizar una comunicación exitosa en remoto.	03-20-2021	campussanofi

Period/Topic	Gamma	Tweet	Date	User
		➕Conoce más sobre este curso aquí: https://t.co/cGTFTYWpEk #CampusSanofi #SaludDigital		
	0.986	📢5 motivos para estudiar un #máster #SaludDigital 1️⃣Atención sanitaria y telemedicina 2️⃣¿Cómo interpreto datos médicos a distancia? 3️⃣Salud digital y empoderamiento paciente 4️⃣¿Cómo elijo herramientas? 5️⃣Transformación digital de la salud Infórmate👉https://t.co/VjW6kYefM4 https://t.co/uJFJQM4FqS	09-27-2021	eHealthUOC
Topic #5	0.984	Todos los debates que ahora se superponen sobre el reforzamiento en España de la #sanidad van a tener en cuenta el reto de cómo hacer realidad el concepto de salud digital en cualquier necesidad y para cualquier edad. Más rapidez,…https://t.co/FUe5hyh4C6 https://t.co/6i1vgqMhgb	06-29-2020	Jesus_G_Bonilla
	0.985	"No hablamos solo de una herramienta eficaz, hablamos de una forma de hacer medicina, abocada a su desaparición tal y como la conocemos hoy en día, para formar parte de la medicina ordinaria e integrada totalmente en nuestras vidas" @rafaelrgrs	11-05-2020	everhealth
	0.985	https://t.co/zGkivaLU9x 📊Big Data y Telemedicina. Retos para la transformación digital en Sanidad @ActaSanitaria se hace eco del XXVI Encuentro del Sector de la Tecnología Sanitaria 'La transformación digital de la Sanidad' con @MarioL259, dir. de @ESADE Madrid 👉 https://t.co/g5CNuuQmrh	05-20-2021	EsadeCreapolis

Period/Topic	Gamma	Tweet	Date	User
		#HealthForum		
Topic #6				
	0.986	Creo que seguiremos ampliando el uso de la telemedicina, de acuerdo al sistema de salud tendremos más apropiación, conviviremos con un uso híbrido, necesitamos más profesionales sensibilizados y con habilidades desarrolladas para hacerla más segura #ehealth https://t.co/bbYdm36vO5	06-02-2021	BonillaSM
	0.984	¿Cómo combinar exitosamente la #telemedicina con el cuidado presencial de sus pacientes? El siguiente artículo presenta lo que un #hospital en Seattle ha hecho para continuar atendiendo a sus pacientes: https://t.co/nOQDV4VB4v #salud #sanidad #sanitario #profesionalesdelasalud	08-03-2020	ITL_Spain
	0.984	¿Cómo nos afecta la tecnología en la comunicación no presencial? El XPatient Barcelona Congress ha tratado el tema de cómo ha afectado la tecnología en la comunicación no presencial entre pacientes y profesionales. #comunicacion #telemedicina https://t.co/6gZBglBUgI	09-28-2021	bartolsara
Topic #7				
	0.982	Increible! Movistar Salud, servicio de telemedicina para particulares y empresas https://t.co/4LHH9dpOUt "Los servicios disponibles se adaptarán a las tipologías del hogar, ofreciendo soluciones individuales y familiares. Todo a través de APP y web.Anem tard @ticsalut @salutcat?	10-08-2020	MireiaSansC
	0.982	Tu #seguro de #salud 😊🔝con todo lo que necesitas es de #Aegon: ♀Con segunda opinión Médica ♀Con asistencia en viajes ♀Con asistencia médica 24h ♀Con servicio de Telemedicina Más información: https://t.co/fFbqGy02ny	10-11-2020	aegonseguros

Period/Topic	Gamma	Tweet	Date	User
		https://t.co/xkhDeLUSZB		
	0.982	Yoigo lanza "DoctorGO", un servicio de telemedicina con atención presencial, de calidad y sin esperas, por solo 6 euros al mes para toda la familia https://t.co/MtEvNVr3Gs via @AlbertCuesta	03-17-2021	ImmaFolch
Topic #8				
	0.985	La pandemia #Covid19 ha obligado a una aceleración de la #telemedicina, lo que supone un cambio en la relación médico-paciente; pero la consulta presencial no desaparecerá nunca puesto que "la humanización en #Medicina no hay que perderla" @redaccionmedica https://t.co/i7gbdY4FUf	09-13-2020	SEMG_ES
	0.982	Un problema de estos tiempos de consultas médicas telefónicas es la enseñanza de la Medicina. Sufro teniendo alumnos a mi lado sin poder enseñarles todo lo q da de sí un paciente presencial. Reflexión para los q abogan por potenciar al máximo la telemedicina.	11-21-2020	antonioantela
	0.985	La pandemia ha cambiado la medicina. En España, antes del covid 9 de cada 10 visitas al médico eran presenciales. Este año se producirán más de 400 millones de consultas virtuales al médico en todo el mundo. https://t.co/hMgLuiBlWV con @mgcmutua	07-06-2021	LaVanguardia
Topic #9				
	0.985	Durante el #VideoForoDolor2020, organizado por @AndaluciaDOLOR, se celebró la mesa sobre #telemedicina con el apoyo de @Grunenthal_es. Los especialistas han situado la telemedicina como "un nuevo modelo asistencial y una gran oportunidad". https://t.co/f6cdeyuc9a	09-22-2020	PedroMGallardo2
	0.982	Nuevo vídeo sobre telemedicina y #dolor! esta semana, la Dra. @RamirezOrtegaM nos presenta "Pautas para realizar una adecuada	10-08-2020	YolandaVzquez17

Period/Topic	Gamma	Tweet	Date	User
		exploración #lumbar mediante consulta telemática".		
	0.987	Haz clic aquí para verlo: https://t.co/pvdCsRtZHG "Microlearning en telemedicina y dolor" es un proyecto organizado por @Grunenthal_es y @DolorPuntoCom, con el aval de @SocMadDolor	10-22-2020	EsmeraldaMorei5
Topic #10		Haga clic aquí para ver 6 vídeos sobre el uso de la telemedicina en el seguimiento del paciente con #DolorCrónico. https://t.co/msjMCxBsha		
	0.980	Curso "Exploración física en #telemedicina" Fecha de inicio: 30 de septiembre de 2020 Fecha de fin: 27 de septiembre de 2021 Acreditación pendiente ¡Regístrese en @DolorPuntoCom y acceda al curso! https://t.co/Q8G9QNsEFC	09-30-2020	CobrerosCris
	0.985	¡Nuevos vídeos sobre la exploración física en #telemedicina! Proyecto organizado por @Grunenthal_es y @DolorPuntoCom con el aval de la @Sedolor https://t.co/OZ42BQ49bC #Dolor	08-11-2020	VicentePuertoB
	0.990	@Sedolor, @Grunenthal_es y @DolorPuntoCom presentan la iniciativa llamada "Exploración física en #telemedicina". En esta plataforma, los profesionales sanitarios encontrarán #vídeos los cuales abordarán la exploración física de los pacientes. https://t.co/JT0xG9PsKS	06-25-2020	suslacasa
Topic #11				
	0.989	La atención primaria 'arde' en Andalucía: el problema no es la telemedicina, falta personal !!! Lo conseguisteis, lo que queríais beneficiar a vuestros amigos de la privada y hundir la pública, la excusa	09-30-2021	sergio_tomate

Period/Topic	Gamma	Tweet	Date	User
		del virus os ha venido de perla. #fuerapoliticos https://t.co/AYG9JUaI0x		
	0.987	La atención primaria 'arde' en Andalucía: el problema no es la telemedicina, falta personal. https://t.co/HxqvcGYudA	09-29-2021	___Jeronimo___
	0.987	🗨️🗨️🗨️ La atención primaria 'arde' en Andalucía: el problema no es la telemedicina, falta personal. 🗨️🗨️ #FALTANMÉDICOS 😡😡😡😡 https://t.co/RTNZrva8fA	09-29-2021	smandaluz

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Period/Topic	Gamma	Tweet	Date	User
		Virginia Meca: "Las tecnologías aplicadas a la salud avanzan rápido" | Madrid | EL PAÍS https://t.co/M7nEjAJcCP		
	0.995	Tus pacientes no tienen que sacrificar un día de trabajo para acudir a tu consulta. Con #DoctorUp puedes dar asistencia médica a través de videollamada. #telemedicina #esalud #ehealth https://t.co/BLZXzAwmhE	08-21-2019	bhd_Consulting
Topic #3				
	0.996	🔔 Telemedicina, el recurso tecnológico que te permite recibir consultas médicas por internet #Salud https://t.co/sOTCzi5y2d	03-04-2019	GrandesMedios
	0.985	Científicos de la @La_UPM han usado tecnología que permite una clasificación automática del glaucoma a través de imágenes de fondo de ojo. Telemedicina e inteligencia artificial para la detección precoz del glaucoma.	10-15-2019	otri_upm
	0.981	#VIDEOMED Certamen internacional de #cine médico #salud y #telemedicina 19-24 noviembre @Videomed_es en @ICOMBADAJOZ http://anisalud.com/actualidad/premios-becas/3440-videomed El ex delegado territorial de ANIS en Aragón @FRANNUAR1 participa como miembro del jurado #sociosANIS http://videomed.es	11-19-2018	Videomed_es
Topic #4				
	0.997	La atención primaria a punto de colapsar: - 2 semanas con 4 festivos seguidos: se concentran las citas de 5 días en 3 días - Al menos la mitad de la plantilla de vacaciones que no se cubre con refuerzos - Inicio de la epidemia de gripe Luego que si humanizar, que si telemedicina	01-03-2019	JBarceloMtnez
	0.997	A punto de empezar la epidemia de bronquilitis por Virus Respiratorio	11-24-2018	RedondoAnita

Period/Topic	Gamma	Tweet	Date	User
		Sincitial que saturará todos los hospitales pediátricos, la mayoría de los Centros de Salud no tienen un mísero pulsioxímetro apropiado para lactantes. Y los políticos hablando de humanización, telemedicina...		
	0.971	El Hospital Universitario de La Princesa y el Hospital Universitario del Henares , ejemplos de coordinación del teleictus. Se suma a otros proyectos de telemedicina que se han implantado en nuestro Hospital en los últimos años.	03-01-2020	Jeffcalderonch
LOCKDOWN				
Topic #1				
	0.989	@pacovr53 Consecuencias del VOVID (6) Con herramientas validadas de tecnología se pueden hacer muchas más cosas de las que hacemos hoy en día, y sin necesidad de consulta presencial, más telemedicina y teleconsulta es el futuro ya presente	04-25-2020	RafaRcrespo
	0.989	@FisicosMuertos Los medicos rurales de atención primaria o enfermeros mayores de 60 años serán los primeros en caer por una cuestión de probabilidad: son los q ven primero a los posibles infectados por el coronavirus Hay q sacarlos de primera línea y ponerlos en telemedicina o morirán https://t.co/o24WDgS5Hk	04-11-2020	_aLFRe_
	0.988	Como van a garantizar q esos médicos y enfermeras de 65-70 años no se infecten? Son personas de riesgo! Si les sacan de sus casas se debe garantizar su salud. Telemedicina o atención a pacientes no COVID! Si se infectan podrán ser atendidos en una UCI? 2/2	03-21-2020	ZorbaBlazquez
Topic #2				
	0.989	"La pandemia del COVID19 es un punto de inflexión histórico para la implementación de las nuevas tecnologías, redes sociales,...para lograr	05-14-2020	SEMERGENap

Period/Topic	Gamma	Tweet	Date	User
		la transformación digital en salud, centrada en paciente y profesional".		
	0.988	Dr. @luisotobajas #COVID19SEMERGEN #COVID19 #NNTT #Telemedicina Buen trabajo! Gracias @CENSChile @CamiloErazoL La telemedicina es clave no solo en el marco del #COVID. Pero también puede servir para gestionar lista de espera GES, o priorizar atenciones, o incluso en la coordinación de AP. Una gran herramienta. https://t.co/2BDX5YCERr	04-15-2020	BonillaSM
	0.987	Sabemos que el #coronavirus ha llegado para cambiarlo todo. Y puede ser el empuje que la telemedicina necesitaba. "No podemos volver a tener las salas de espera llenas cuando podemos tener una agenda virtual". @magelesmedina @AAledo @carloscomsalud https://t.co/d6MyPn1Bm5	04-16-2020	monicarund
Topic #3				
	0.992	La nuevas tecnologías van a marcar la nueva forma de concebir el trabajo sabemos que muchas empresas pueden trabajar desde casa, que muchas consultas médicas las podemos hacer por telemedicina.. cosas que nos deja este #Covid_19	04-26-2020	Josetxo_Cuesta
	0.989	Creo llega el momento de planificar la atención de patologías crónicas que estamos posponiendo por el covid. ¿Como vamos a manejar las salas de espera y las consultas para evitar contagios de pacientes vulnerables? A lo mejor debemos intensificar la telemedicina inicialmente.	04-05-2020	DrRomero_neuro
	0.987	La videoconsulta con pacientes, la telemedicina, la e-consulta, nos pueden	04-12-2020	lpz_gmz

Period/Topic	Gamma	Tweet	Date	User
		permitir ser mucho más eficientes. Tecnológicamente son posibles. Económicamente son viables. ¿Podemos empezar a desarrollar la videoconsulta?		
Topic #4				
	0.989	Accede a tus consultas médicas a través de los servicios de telemedicina de tu propio centro. Escoge tu centro y pregunta si dispone de este servicio. #Telemedicina #AxaGiraldes https://t.co/l91elu8HsH	05-29-2020	GiraldesAxa
	0.989	Teniendo en cuenta que el 70% de las consultas médicas no requiere que el médico toque físicamente al paciente, la #videoconsulta es la solución idónea y, en especial, cuando no queremos esperar para ir al médico o no queremos o debemos desplazarnos 👇👇 https://t.co/MKJtRqdRqn	04-21-2020	homedoctor_es
	0.989	Accede a tus consultas médicas a través de los servicios de telemedicina de tu propio centro. Escoge tu centro médico y pregunta si dispone de este servicio. https://t.co/Rsl0biBTRv https://t.co/q8fAuKpww9	05-27-2020	Mediasegur_axa
Topic #5				
	0.991	#UNISALUD una plataforma digital de #telemedicina para el profesional sanitario. Como #pediatra, Unisalud te permitirá hacer diagnósticos y seguimiento a niños con un cuadro clínico común. 👉Prueba 3 meses gratis. 👉Haz clic en el enlace para conocer más https://t.co/UL8EiIBOod https://t.co/VLXZHJ4Nfp	04-29-2020	UnitecoPro
	0.988	La telemedicina avanza en seis semanas de pandemia más que en 15 años https://t.co/PD4335aoWh #telemedicina #avanza #tecnico #Tecnologia @TeleMedicina_	05-01-2020	eliteradiosvq

Period/Topic	Gamma	Tweet	Date	User
		@Telemed_BUAP @latelemedicina @latelemedicina #asistencia #sanitaria #usuario #servicioandaluz @servicioandaluzdesalud @medicina https://t.co/TFoGmAuZEU		
	0.987	La #telemedicina formará parte de la asistencia sanitaria pediátrica en la "nueva normalidad" https://t.co/xWR01lDZjr vía @isanidad #saluddigital	05-07-2020	CuraeSalud
Topic #6				
	0.989	El coronavirus acelera la telemedicina: así será la sanidad en el futuro. https://t.co/N1ALr6rnLH La pandemia del coronavirus marcará un punto de inflexión en la adopción en España de la telemedicina, que permite un uso más eficiente de los recursos y…https://t.co/CMJBhgaood	04-28-2020	SergioTaguaP
	0.986	#Telemedicina en tiempo de #Covid19: un antes y un después en el modelo de atención primaria del Sistema público de Salud en Cataluña https://t.co/wG4wM9LIOK via @ticsalut	05-05-2020	josemiguelcacho
	0.983	Los médicos de Atención Primaria aseguran que la pandemia por Covid-19 está beneficiando a la práctica de la telemedicina https://t.co/e2MQRGJUpE	04-10-2020	noticiascyl
Topic #7				
	0.993	¿ Conoces #MédicosfrentealCOVID? @DKVSeguros ofrece su plataforma de telemedicina de forma gratuita a todas las personas para que consulten sus dudas médicas, gratis, con médicos voluntarios. ¡Ayudemos entre todos a descongestionar nuestros hospitales! #quédateencasa	03-25-2020	GAMARRAIKER
	0.991	🔊 de 700 médicos voluntarios atienden consultas(chat o tfno) a través de la app #QuieroCuidarme 🔊Telemedicina GRATUITA para	03-24-2020	agathosa

Period/Topic	Gamma	Tweet	Date	User
		atender a todas las personas que estamos en casa, mayores, etc #MédicosFrenteAlCovid @DKVSeguros @AlejandroSanz 👉https://t.co/WKIAViD1zF @LFdCesmas https://t.co/4v0UUXfXKT		
	0.992	🌍💚@DKVSeguros ofrece su plataforma de telemedicina de forma gratuita. Si tienes dudas sobre algún síntoma,descarga la app 'Quiero cuidarme Más' y realiza una consulta con cualquiera de los médicos voluntarios.¡Ayudemos a descongestionar nuestros hospitales! #QuédateenCasa https://t.co/8JGKVqO7xQ	04-01-2020	UDGTenerife
Topic #8				
	0.992	📄Consideraciones éticas respecto a la consulta médica no presencial, #econsulta o consulta online *Informe de la Comisión Central de Deontología @OMC_Espana en relación a la #telemedicina en el acto médico* 📖Accede a su contenido vía @Icomem_Oficial: https://t.co/okqUP5Ir93 https://t.co/gA04baPRGH	06-14-2020	SEMG_ES
	0.990	Ética y #telemedicina: Consideraciones éticas respecto a la consulta médica no presencial, e-consulta o consulta on-line #eticamedica #consultaonline #econsulta Informe de la Comisión Central de Deontología del CGCOM @OMC_Espana https://t.co/xTOJVeXMwA	06-11-2020	MedenaColegio
	0.989	La Comisión Central de #Deontología del Consejo General de Colegios	06-11-2020	Icomem_Oficial

Period/Topic	Gamma	Tweet	Date	User
		Oficiales de Médicos (CGCOM) @OMC_Espana ha realizado un informe⊠ https://t.co/tZ8qAE9okJ en el que recoge consideraciones éticas y deontológicas en relación a la #telemedicina en el acto #medico. https://t.co/plzkGwwXaG		
Topic #9				
	0.991	RT @DKVSeguros: .@DKVSeguros abre de manera gratuita una plataforma de telemedicina para frenar la expansión del #COVID19. #Médicosfrenteal…	03-17-2020	FNSiete
	0.983	Docline, primera plataforma de telemedicina en ofrecer la receta electrónica privada de forma gratuita https://t.co/Q7ZGIKSlMl #salud	05-25-2020	murcia_com
	0.736	#ciencia_y_tecnología Una plataforma de telemedicina andaluza, primera en ofrecer la receta electrónica .. https://t.co/bTGGABgQkb	05-30-2020	ndp_ciencia_tec

AFTER LOCKDOWN

Period/Topic	Gamma	Tweet	Date	User
Topic #1				
	0.987	¿Cómo puede ayudar la tecnología al #sistemasanitario? Carlos Nueno @TeladocHealth #ForoSociedadDigital 🖥Vemos que puede ayudar en 3 niveles: ◈Mejorar la accesibilidad del paciente al sistema ◈Ayudar al ecosistema sanitario (#telemedicina,..) ◈Colaboración público-privada https://t.co/mK0uWUYkLK	10-13-2020	TE_GranEmpresa
	0.987	Julio Mayol: "La telemedicina puede ser una herramienta muy valiosa para generar valor si se utiliza de manera correcta. Además es clave generar confianza en los pacientes y ofrecer asistencia de calidad ahora asistencia remota. " #webinarAMA @juliomayol	11-11-2020	amaseguroses
	0.988	La telemedicina busca la salud de un	03-31-2021	at4digitalway

Period/Topic	Gamma	Tweet	Date	User
		paciente permitiendo la comunicación interactiva en tiempo real entre el paciente y el profesional sanitario a distancia. Esta comunicación conlleva el uso de equipos de telecomunicaciones que incluyen equipamiento de audio y vídeo. https://t.co/59wulWFmPu		
Topic #2				
	0.986	Actualmente, la telemedicina tiene un papel todavía más importante en el ámbito de la salud. Queda mucho por hacer, pero queremos poner nuestro granito de arena con #COMETA. Si eres profesional sanitario, te invitamos a que accedas a la web del proyecto: https://t.co/Qqw5uO3lBp https://t.co/R59ucWN64q	11-16-2020	GSK_ES
	0.986	La Dra. @ytodo5 modera hoy la mesa redonda "Gestionando Pacientes Crónicos tras la Pandemia" en las jornadas nacionales organizadas por Reumatología y Dermatología del @hvirgendelrocio donde compartirá nuestra experiencia en telemedicina y circuitos para pacientes crónicos. https://t.co/OtQq5awWUA	10-08-2021	HSJD_Aljarafe
	0.987	Esta semana en https://t.co/TFTnPa9PLU mejoramos nuestro apartado de Historia Clínica Electrónica. Para que los profesionales sanitarios puedan guardar, de forma segura, gratuita y digital, la información de sus pacientes. #saluddigital #telemedicina #ehealth #madridemprende https://t.co/8vuMnJWmCa	06-07-2021	care_ti
Topic #3				
	0.988	¿Quién decide cuantas visitas presenciales puede hacer un médico? Antes de culpar al médico, debería contestarse esta pregunta. Si se hacen telemáticas es porque es mejor eso que no hacer ninguna visita, los médicos asistenciales no hemos elegido hacer	10-04-2020	BoschBarrera

Note: Gamma is unnormalized topic distribution for each tweet.

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