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CERC as a growing research model: analysis of its application in health emergency communication strategies over the last decade[1]

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Abstract. In the wake of recent disease outbreaks, several researchers have pointed out that Crisis and Emergency Risk Communication (CERC) model is useful for guiding strategic communication during health emergencies. It is a priority to see what role this model plays in the international scientific literature. A systematic review of 90 articles published in eight international databases between 2011 and 2021 was conducted. The results confirm that CERC implementation, quantification and systematisation have increased considerably since the start of COVID-19. The statistical and network analysis announces the preponderance of four emerging clusters -intangibles, case studies, message content analysis and the role of social media-. The study identifies some challenges for public relations research and practice during future health emergencies like skin cancer.
Keywords: Public relations; strategic communication; health emergencies; CERC; systematic review

[es] CERC como modelo de investigación en crecimiento: análisis de su aplicación en las estrategias de comunicación de emergencias sanitarias en la última década

Resumen. A raíz de los recientes brotes de enfermedades, varios investigadores han señalado que el modelo de Comunicación de Riesgos en Crisis y Emergencias (CERC) es útil para orientar la comunicación estratégica durante emergencias sanitarias. Resulta prioritario observar qué papel tiene este modelo en la producción científica internacional. Se ha realizado una revisión sistemática de 90 artículos publicados en ocho bases de datos internacionales entre 2011 y 2021. Los resultados confirman que la aplicación del CERC, la cuantificación y la sistematización se han multiplicado considerablemente desde el inicio del COVID-19. El análisis estadístico y de redes anuncia la preponderancia de cuatro grupos temáticos emergentes, los intangibles, el estudio de casos, el análisis del contenido de los mensajes y el papel de las redes sociales. El estudio identifica algunos retos para la investigación y la práctica de las relaciones públicas en futuras emergencias sanitarias como el cáncer de piel.
Palabras clave: Relaciones públicas; comunicación estratégica; emergencias sanitarias; CERC; revisión sistemática

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1. Introduction

The current situation caused by the outbreak of health pandemics and epidemics has generated an immediate need for information management and communication by public health authorities (Drescher *et al*., 2021; Alhassan &AlDossary, 2021).

The World Health Organization (Müller, 2020) uses the term "public health emergency" to refer to an "unusual" and "unexpected" outbreak of a disease that affects more than one country, has a serious impact on public health and also requires an internationally coordinated strategy to respond. Since 2009, international organizations have listed twenty health emergencies in

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which they are actively working. The most outstanding are those caused by COVID-19, Ebola, Zika, Influenza A (H7N9)-fowl flu-, MERS-CoV and Influenza A (H1N1)-swine flu- (WHO, 2022).

Despite the fact that the progress made is demonstrable and reflected in its periodic reports, the organization states that "communicable diseases remain a major problem. Even if preventable or treatable,[...] they kill more than 4 million people a year and are an obstacle to social and economic development" (WHO, 2018, p. 49).

Other emerging health emergencies such as skin cancer are increasing in incidence internationally, with organisations and agencies already warning that they are likely to become epidemics. The International Agency for Research on Cancer (2022) states that skin cancers are the most common groups of cancers diagnosed worldwide, with more than 1.5 million new cases estimated and 57,000 people died from the disease in 2020.

In the midst of these situations, communication has become an immediately necessary aspect (Drescher *et al*., 2021). The World Health Organization (WHO, 2020) and Public Relations researchers (Burton, 2019; Paek &Hove, 2019; Castillo *et al*., 2020; Moreno *et al*., 2020; Drylie-Carey *et al*., 2020) agree in putting attention on crisis and risk communication strategies in healthcare contexts. It seems clear that strategic communication is an essential element in responding to public health emergencies (Ow Yong *et al*., 2020).

According to Ihlen (2020), although the key role of communication and its rhetorical dimension is applicable to all types of organizations: "public health authorities must understand audience perceptions to strengthen credibility, while recognizing the contingent and situational nature of this effort" (p. 164).

Since the beginning of the millennium, communication theorists have put forward various theories and models for crisis situations such as the Situational Crisis Communication Theory (Coombs, 2007). However, the Crisis and Emergency Risk Communication model (Reynolds, 2002) emerged as a concrete and unified response to crisis and risks situations, and could be widely applied in communication strategies during public health emergencies.

2. Theoretical framework

Following the outbreak of the pandemic, Cernicova-Buca and Palea (2021) have observed that COVID-19 emergency risk communication is a "rich field" for understanding the interaction between public relations and health communication. In emergency situations, one of the main tasks of teams is to inform the public quickly and in a coordinated and accurate manner (Suau-Gomila *et al*., 2022). In scientific production, previous studies focused mainly on the sender, i.e. organisations, whereas in recent times there has been a shift towards the receiver, the publics (Coombs and Holladay, 2014). In relation to this, Clementson and Beatty (2021) take into account in their study the organisation's previous relationship with its publics and the history of crises.

According to Avery and Park (2016), there are dominant paradigms for crisis communication research in public relations, such as Situational Crisis Communication Theory (SCCT), (Coombs, 1995), or Image Restoration Theory (Benoit, 1995). The studies that address them tend to refer to very repetitive topics, such as response strategies or the typology of crises. The SCCT reports that public relations practitioners frequently employ strategies to diminish attributions of responsibility, which during crises are related to a basic psychological process (Coombs, 2016). This indicates that, although classical theories focus primarily on crisis typology and response strategies, they are also able to identify emotional variables in the public's reaction. For example, compassion or sympathy are emotions addressed by Kim and Liu (2012).

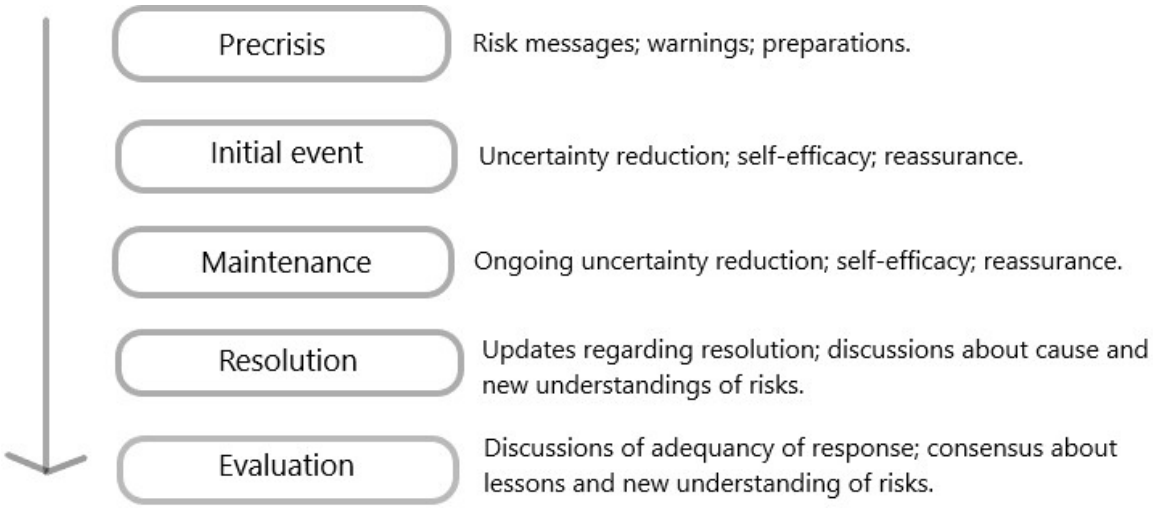
In recent years, several researchers have pointed to the Crisis and Emergency Risk Communication (CERC) model as useful for guiding authorities' strategic communication during health emergencies (Lwin *et al*., 2018; Meadows *et al*., 2019; Moreno *et al*., 2020; Gentili *et al*., 2020; Alhassan &AlDossary, 2021; Malik *et al*. 2021). CERC is defined as an integrated model that draws components from crisis communication theories, applied risk communication theories and health communication theories (Veil *et al*., 2008). Malik *et al*. (2021) state that although institutions and academics have developed models and frameworks for risk communication in crises and emergencies over the years, they are not viable and apply the CERC model. Moreno *et al*. (2020) explain that this combined form of communication highlights the communication needs and demands of the population during the different stages of the development of a health crisis episode.

As conceived, this model can be highly applicable to public health emergencies, as they are "often related to the outbreak of specific diseases or the identification of specific risks arising from environmental or lifestyle factors" (Reynolds & Seeger, 2005, p. 44).

It combines the principles of crisis communication and effective risk communication in a model composed of five stages: pre-crisis, initial event, maintenance, resolution and evaluation (Elwy *et al*., 2014). It should be noted that the communication activities to be carried out according to each stage of the episode (Alhassan & AlDossary, 2021). Actions will be aimed at risk communication, preparedness and prevention during the pre-crisis and the crisis stage; reducing uncertainty and curbing the consequences during the crisis and post-crisis stages (figure 1).

The CERC model has been used in health emergency research in recent years to analyse several variables such as the influence of emotions (Meadows *et al*., 2019), types of messages (Meadows *et*

Figure 1. CERC working model



Source: own elaboration following Reynolds and Seeger (2005).

al., 2019; Wang *et al*., 2021), information-seeking and message-receiving behaviour (Moreno *et al*., 2020), audience perceptions (Gentili *et al*., 2020; Ow Yong *et al*., 2020), strategic uses of social media (Vos & Buckner, 2016; Alhassan & AlDossary, 2021; Mackay *et al*., 2021; Malik *et al*., 2021; Zahry *et al*., 2023), frames and themes (Reyes *et al*., 2021) and risk mitigation (Rickard *et al*., 2013). These different applications point to a current interest in the CERC model.

Therefore, although the use of the CERC model seems to be a trend, there is still no clear picture to determine the extent and evolution of the model's application in health emergency communication, nor of its role within the scientific production and professional practise over the last decade. This paper therefore poses the following research questions on the body of international public health research on crisis and emergency risk communication:

RQ1. How many times is the CERC model mentioned and/or directly applied in the scientific production of the last decade?
RQ2.Which health emergencies have received the most attention?
RQ3.Which topics are most observed in empirical research?
RQ4. Which research methods are most prevalent?
RQ5. What is the level of theoretical and practical progress developed during the last decade?

3. Methodology

To address the above research questions, this study has conducted a systematic literature review covering the last decade. As observed by López-Redondo (2020), the systematic review of the existing literature is a prior and necessary step to ascertain the main contributions made to a given subject.

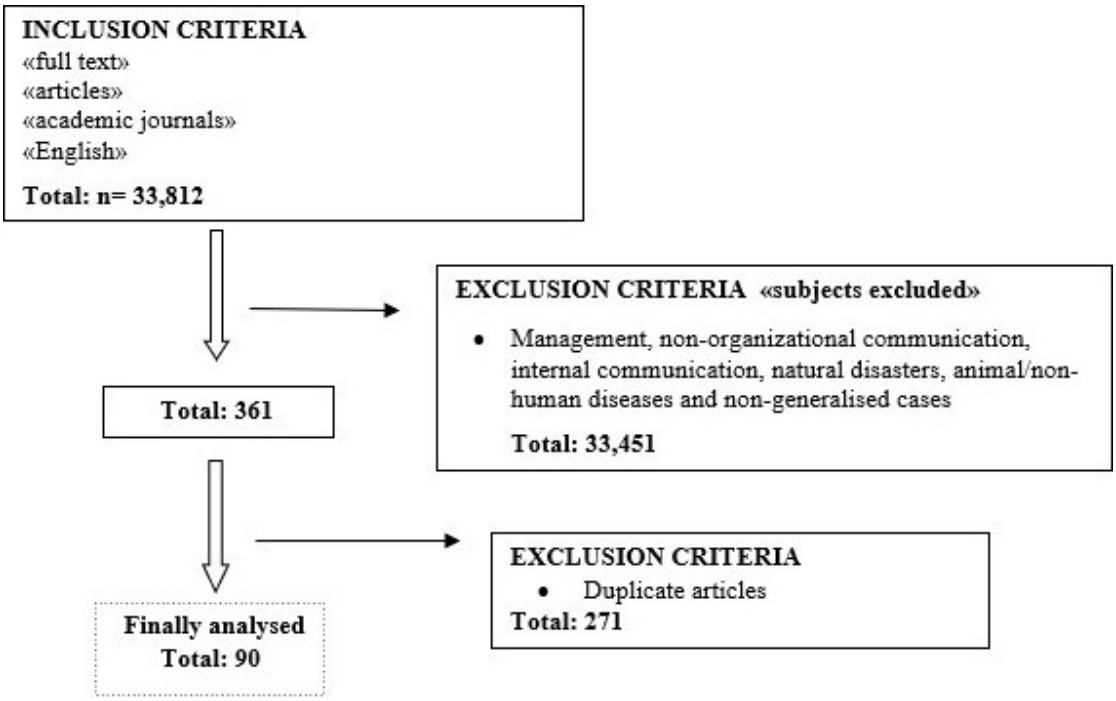
The unit of analysis for this paper is the research article on crisis communication and public health emergency risks present in at least one of the eight major scientific databases during the last decade (2011-2021). To find these units of analysis, a comprehensive bibliographic search was conducted in eight major international databases and search engines specialized in Social and Legal Sciences and Health Sciences, *Academic Search Complete, Business Source Complete, Communication & Mass Media Complete, Scopus, CINAHL Plus, Medline Complete, Web Of Science* and the *PubMed* search engine. The key terms used to retrieve the texts of interest for this study were "emergency health crisis communication" and "emergency health risk communication".

The results were selected on the basis of established inclusion and exclusion criteria. The inclusion criteria were the type of document (scientific journal article), full text status and language (English). The researchers excluded all those articles that focused on crisis management, instead of communication; non-strategic but journalistic, interpersonal communication (media, public, doctor-patient, etc.); internal organizational communication (hospital employees, etc.); natural disasters; cases that do not affect humans and specific cases that are not generalized. In other words, they include those whose object of study is external organizational communication (whether public or private) on generalized health crises in humans (figure 2).

The final sample consisted of 90 articles, which were processed and analysed using IBM SPSS Statistics software. For the analysis of clusters, the researchers used the network analysis software used by Buhmann *et al*. (2019), VOSviewer.

The content was coded, using an internal data extraction form (table 1), following a dynamic similar to that of García-Borrego and Casero-Ripollés (2022), but including different variables:

Figure 2. Flow diagram of systematic review selection



Source: own elaboration.

Table 1. variables and main categories of the internal data extraction form

Variable	Main categories
Theory/model	SCCT, Image restoration, Extensive Parallel Processing Model, CERC model…
CERC's level of use	Applied to the study (use) / reported as a reference (mention) / not used or not mentioned
Public health emergency	COVID-19, Ebola, Zika, HIV, H1N1 flu, SARS, tuberculosis…
Main topic	Response strategies, message content and/or tone, public perceptions, social media use, intangible variables…
Type of methodology	Quantitative/ qualitative/ mix methods
Method	Content analysis, survey, experiment, in-depth interview, case study, ethnography…
Advance degree	The article introduces an innovative theoretical-empirical background (high advance degree) / The article doesn't present a novel theoretical-empirical background (low advance degree)

Source: own elaboration.

4. Results

4.1. CERC model in international scientific production

A large part of the documents do not present a specific theory (48.9%), and the theories that follow in position are the Crisis and Emergency Risk Communication -CERC- model (13.3%), the Situational Theory of Crisis Communication (7.8%) and the Extensive Parallel Processing Model (3.3%).

Because of its volume, the CERC model requires a more detailed study. Of the 90 articles published in the field, 12 texts (13.3%) explicitly use the CERC model and 39 (43.3%) mention it at least in the bibliographical references section.

The first mentions made of the Reynolds and Seeger (2005) study take place in 2013. Before that date there

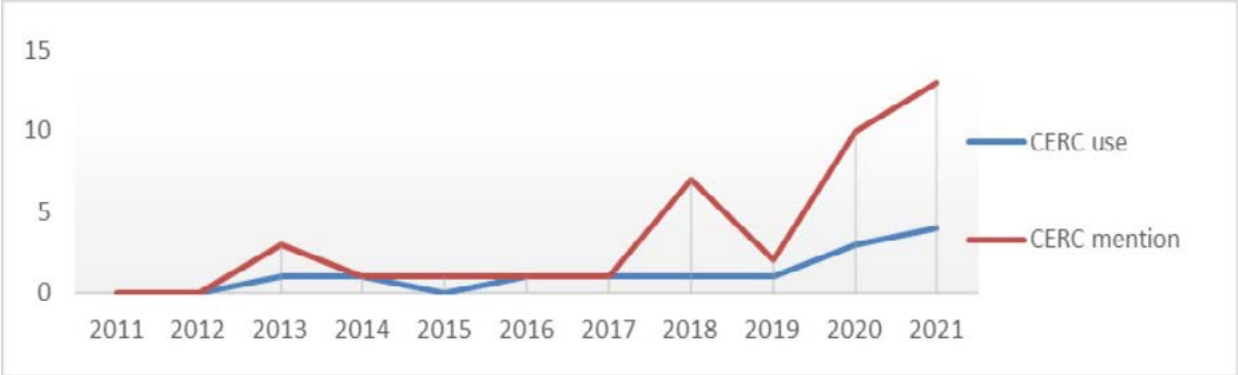
is no article in the area that mentions or employs the theoretical model. The three studies that at least mention the model in the references are Rickard *et al.* (2013), Cairns *et al.* (2013) and Louma-aho *et al.* (2013).

The first specific use of this model during the analysis period is located in the work of Rickard *et al*. (2013). The CERC model is observed to highlight best practices in crisis communication, and explore how the characteristics of the death plague incident in the Grand Canyon can mitigate plague risk.

In the following year, Elwy *et al*. (2014) again use this model, this time to identify critical aspects of disclosure processes for large-scale adverse events involving healthcare facilities. Through the application of the five stages of the CERC model, the authors generate five recommendations for improving communication during each stage.

From this point, there is a one-year pause until this model is employed again (Vos & Buckner, 2016) and until 2019 it is studied at the rate of one article per year. It is not until 2020 and 2021 that the use of the model grows significantly, a date that coincides with the outbreak of the COVID-19 pandemic. The following graph shows the evolution of the use and mention of this theoretical model during the period indicated (figure 3).

Figure 3. CERC model in current research (2011-2021)



Source: own elaboration.

Looking at the stages of the CERC, there is also an evolution of study. During 2013, the authors focus especially on the pre-crisis stage, including guidance on risk messages, warnings and preparations (e.g. Cairns *et al*., 2013). By 2016, Vos & Bucker focus on self-efficacy within the initial event of the Bird Flu (H7N9 virus). In 2020, Rao *et al*. (2020) note the shift from alarm to reassurance messages, a recommendation of the CERC model for the initial event stage.

4.2. COVID-19 as a prevalent public health emergency

There is an exponential growth in the number of papers from 2011 (0%) to 2021 (34.4%). These figures are to some extent related to periods of disease outbreaks, or times of increased attention to these events. In 2013 (5.6%) there is a spike of attention on a set of outbreaks that broke out since 2005 (H1N1 flu, SARS, HIV, tuberculosis). In this year, the papers relate the strategies employed for each event to each other, as a joint analysis. Later on, the number of articles decreases in 2014, but gradually rises again over the years until 2019 (10%), to from which it rises steeply, coinciding with the time of the outbreak of the COVID-19 pandemic.

Following the previous trend, among the observed emergencies, COVID-19 has been the most analysed. Despite its shorter period of existence (since the end of 2019), more than half of the articles found (52.2%, n= 47) deal with COVID-19. It is followed with 12.2% by the set of several diseases and Ebola with 6.7%.

On the one hand, there is a smooth evolution of articles as the phases of the pandemic progress. The first paper published from the period that includes the coronavirus pandemic, counting from its preprint publication in April, is Zeng & Li (2020). This study is already based on the CDC's crisis and health emergency risk communication through social media, in this case on China's Weibo social media. They conclude that there is a gap in the two-way interaction between the Government and the public in terms of information and prevention messages. The next articles appear in June of the same year, activating the pandemic publication (Chut *et al*., 2020; Rao *et al*., 2020; Ratzan *et al*., 2020). According to Chu *et al*. (2020), however, academic medical centres made effective use of communication tools through the Facebook social media, but see a significant rise, from January (21%) to April (56.3%). The period between the end of May and the beginning of April marks a turning point in most articles analysing the period. At this point, as mentioned above, alarm messages on Twitter begin to shift towards reassurance (Rao *et al*., 2020).

On the other hand,, during the research period analysed, only one article out of the 90 obtained studied cancer risk. Strekalova and Krieger (2017) investigated Amplification of Cancer Risk Communication

on Social Media through content analysis of Facebook posts from the US National Cancer Institute.

These results concur with the most used keywords, communication (n=79), crisis (n=38), health (n=36), COVID-19 (n=32), risks (n=30), social (n=28), public (n=28), Twitter (n=9), coronavirus (n=8) and analysis (n=8).

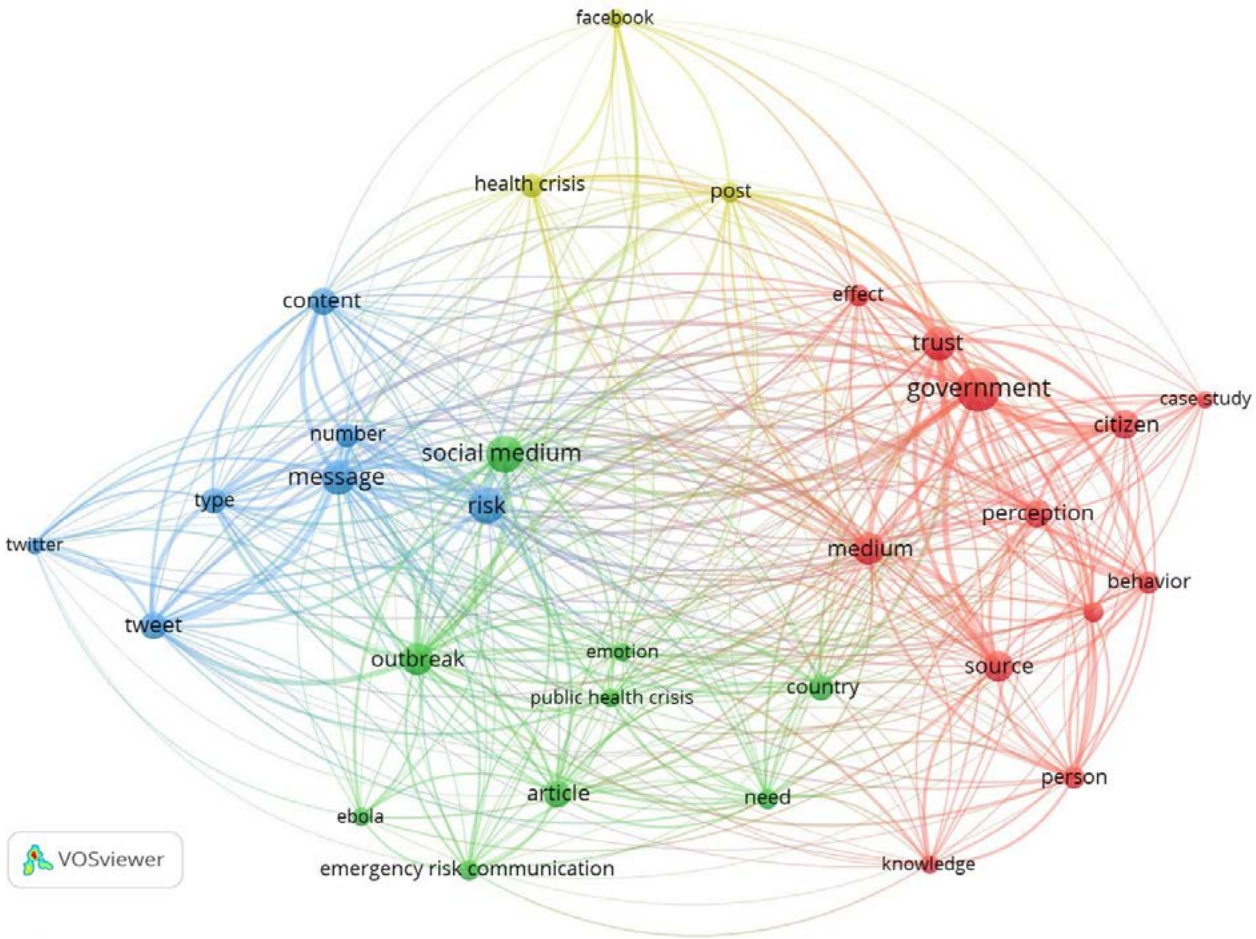
4.3. The four main clusters in public health emergency communication

The most present topical research clusters are response strategies (13.3%), audience perceptions (6.7%), social media use (6.7%), message content and/or tone (6.7%) and intangible variables (5.6%).

Only strategies would be included within the category of classic topics (13.3%). Most of the topics can be considered as emergent (66.7%), meaning they do not correspond to those provided by the classical theorists. The sum of the emergent topics is greater than those coming from these classical theories, such as the SCCT. These topics outperform the classical ones since 2013, even though the greater distance has occurred progressively from 2016 onwards.

The network analysis has distinguished four main clusters (figure 4). Cluster 1 items (in red, on the right) focus on 12 items such as perception, trust, knowledge, governance, effect or behaviour. They relate to attention to intangible values and how this influences the response of audiences. The second cluster (in green, below) is made up of 9 items, on outbreak, public health crisis, emergency risk communication, need, emotion or Ebola. These documents have their main focus on the study of concrete cases of public health emergencies.

Figure 4. Network analysis from VOSviewer



Source: own elaboration with VOSviewer software.

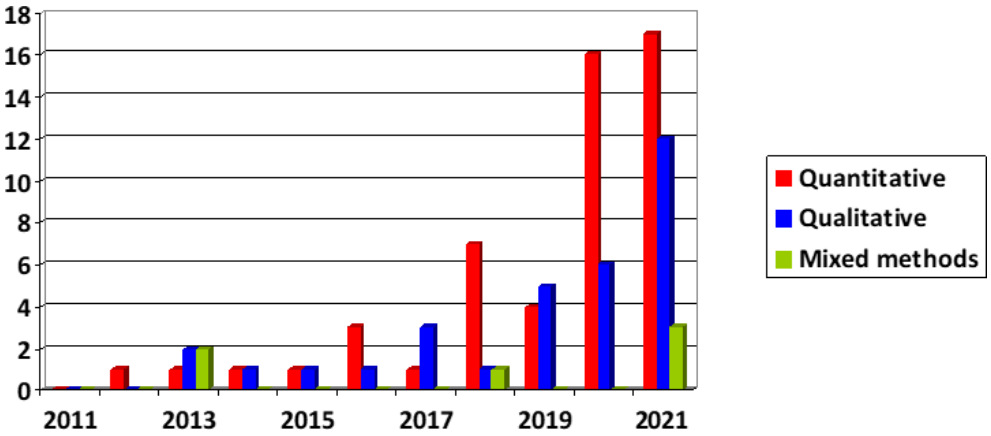
The third cluster (in blue, on the left) contains 7 items, such as content, message, or Twitter. The main content of these documents is the analysis of the speeches, content and tone of the messages issued by the authorities. Finally, the fourth cluster (in yellow, above) presents only 3 items, Facebook, health crisis and post. These focus specifically on the role of social media in health crises and emergencies.

4.4. Quantification and systematization

Regarding the methodological section, the quantitative method is in the majority (57.8%), compared to qualitative (35.6%) and methodological triangulation (6.7%). Until 2018, the methods used in the articles on health emergency communication have been varied. However, as of 2018, the quantitative method

has significantly outperformed the qualitative and mixed methods (figure 5).

Figure 5. Number of articles by method



Source: own elaboration.

The technique most commonly employed is content analysis (33.3%, n=30), followed by a set of other specific individual techniques - ethnography, latent Dirichlet assignment technique, dynamic network analysis - (27.8%). In third place is a quantitative methodology, the survey (14.4%).

4.5. Advances of the decade

There is a low level of progress on the scientific production of public health emergency communication in the last decade. 66.7% of the texts have a low degree of progress, i.e., they are replicas of studies in different contexts, or contributions that do not have a novel theoretical-empirical background. The remaining 33.3% are articles that plan an innovative model, methodology or technique. Examples of new contributions are Adekola *et al*. (2019), who present a new model, the Risk Evaluation and Policy Evaluation and Risk Communication (PERC) framework; and Jang and Park (2018), who propose the concept of Repetitive Information Communication through Multiple Channels (RICMIC), on risk prevention behaviour.

Articles with a high degree of advancement, i.e., those that propose a new theoretical model or innovative methodology suffer ups and downs in recent years. On the contrary, from 2019 onwards texts with a low degree of advancement grow rapidly. This trend peaks in 2021, when the coronavirus crisis is being studied more from different angles and contexts, but following classical models and methodologies.

Further evolution should be reviewed in the next decade, but it is unpredictable for the time being and with the data collected for this study. COVID-19 pandemic brough an increasing attention to the use of the CERC model that could be a tendency for future emergencies and, in the middle time, could also arose the interest for further and innovative development of the model with slower pace.

5. Conclusions

The Crisis and Emergency Risk Communication (CERC) model has proved to be a useful guide for many researchers and practitioners of the decade. The growth of this attention was already an internal hypothesis from the outset, which was developed during the first literature search. Even so, the systematic analysis has not only validated this internal hypothesis, but has also contributed to answering the five research questions posed. The results have pointed to the beginning of the application of the model, as well as its evolution over the last decade.

The beginning of the use of the CERC model in the field during the analysis has been dated to 2013, when research by Rickard *et al*. (2013), Cairns *et al*. (2013) and Louma-aho *et al*. (2013) was published. This year coincides with the acceptance and publication of previous work on pests and epidemic disease outbreaks, such as the 2007 pneumonia plague in Arizona, USA, or the influenza A (H1N1) outbreak in Finland.

Researchers on both sides of the Atlantic noted that the model proposed by Reynolds and Seeger (2005) is useful for responding to health emergencies such as epidemics. According to Reynolds and Seeger (2005), public health diseases - such as COVID-19 - are linked to the outbreak of specific diseases or the identification of specific environmental or lifestyle risks. This repeated pattern makes it more easily analysable from the perspective of the event stages proposed by the CERC model. Rickard *et al*. (2013) explored through the model what characteristics may have influenced the public's reactions to the Arizona pneumonia incident, and how these characteristics may have thus mitigated the risk of plague. By looking at the five stages applied in the case, pre-crisis, initial event, maintenance, resolution and evaluation, they were able to confirm that certain organisational characteristics and experience in previous crises may

influence the subsequent occurrence of similar events during the pre-crisis stage. In the crisis phase, they analysed how the "information flow" influences public interpretations and behaviours, and finally, in post-crisis stage, they looked at how organisational reputation can be repaired (mesolevel).

The rapid rise in the use of CERC in the health emergency communication literature following that date highlights the broad consensus among authors on its usefulness. The results of this research showed that studies mentioning and/or applying the model have multiplied significantly since 2019, the year of the start of the unprecedented pandemic caused by COVID-19. Significantly, despite its "young age", more than half of the articles (52.2%) are dedicated to this emergency. The explanation behind this phenomenon may lie in the lack of knowledge of the event itself and the "satisfactory" results of the application of the CERC model and others similar to it during these situations.

The pursuit of replicability does not only appear in data on theories and models. Quantification and systematisation have been growing since 2018 and, more evidently, since the start of the last pandemic, which confirms the academic efforts to look at events through the prism of regularity. In other words, similarities between emergencies are sought, and if a particular model and method proves adequate for observing one event, it is highly likely that it can be used to study another similar event. Quantitative methods and techniques often seek to find commonalities across contexts. This can be very useful in the midst of public health events, to generate schemas and models applicable to different countries or institutions. While the use of quantification and systematisation is not particularly new, the development of new technologies and the learning processes of the Digital Age benefit the monitoring of these trends. Software packages such as SPSS or R allow the statistical study of large amounts of data.

Other results of this study are aligned with the characteristics of the Digital Age, such as the existence of social media and the concern for observing the content of messages and the veracity of information. Both statistical and network analysis confirm the preponderance of emerging themes. In particular, four clusters have been found within the period, namely the focus on intangible values, the case studies of public health diseases, the message content analysis and the role of social media. The observation of these new themes has become more evident since 2016.

In conclusion, the CERC model has been part of period research since 2013 and its presence is growing rapidly, especially since the outbreak of the coronavirus pandemic. The data suggest that this rise may be due to the novelty of COVID-19 and the model's capacity to study the rest of the previous emergencies. The quantification and systematisation brought about by the tools present in the Digital Era grew, also allowing the study of CERC from a replication point of view.

Looking to the future, the systematic review has highlighted the remaining weaknesses in the international scientific output and therefore presents some challenges for further studies in this field.

Firstly, it has been observed that quantification is prominent. However, studies such as Macnamara's (2021) show the benefits of implementing qualitative methods and techniques to observe emergencies through the CERC model. Subsequent papers should delve more deeply into the problem from a qualitative or mixed methods perspective, in order to identify the deeper nature of the different contextual realities.

Secondly, the results show few theoretical-empirical contributions, such as the introduction of the PERC model or the RICMIC concept. At the same time, the research gaps are oriented towards the scarcity of new practical and applicable contributions. Gregory *et al*. (2021) point out that the current literature describes and theorises organisational crisis communication, but focuses little on providing effective practical tools for specific health crisis and risk situations. The demand for such input has increased since the onset of the COVID-19 pandemic. From 2019 onwards, there has been an upturn in almost all the variables analysed, starting with the number of articles published. It is worth reflecting on the reasons why this rapid development has not been accompanied by a significant increase in innovative models and methodologies of contributions. Future studies should focus on making new contributions of specific theoretical models to be applied to health emergency situations.

Thirdly, the pandemic stands out from other events, the effects of which have not yet come to an end. The question remains whether the knowledge gained so far will also be applicable to the post-pandemic era, taking into account the specific characteristics of emergence and the rapidly changing contexts of the 21st century. Marcnamara (2021) added that a future challenge is to update the literature to cover "the increasing range of technologies available to create and support owned media" (p.256), especially for organisations communicating during a health emergency.

Finally, it was noted that in the period analysed there was no more than one research study on cancer risk in relation to health emergency communication. This exemplifies the large research gap at the international level on the study of cancer in this field. Furthermore, this paper by Strekalova and Krieger (2017) did not focus on skin cancer specifically, but on cancer risk generally. The results of a quick search of skin cancer-specific literature were then evaluated, warning of the scarce results present in international databases. This is a major challenge for international scientific research to bridge this gap and provide deeper insights into the influence of communication management on the prevention of this emerging disease.

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