



Master's Thesis

**Communication Strategies During COVID-19: The EU and US
Perspective**

Volume II: *The EMA and FDA*

*X (Twitter) Communication Strategies During the First Year of the Pandemic:
A Crisis and Emergency Risk Communication (CERC) Model Perspective*

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In the words of Maya Angelou, "Nothing will work unless you do". This quote has been a source of inspiration for me throughout my life and especially during this journey.

LIST OF ABBREVIATIONS

| | |
|----------|--|
| COVID-19 | Coronavirus disease |
| WHO | World Health organization |
| FDA | Food and Drug Administration |
| EMA | European Medicines Agency |
| USA | United States of America |
| EU | European Union |
| CERC | Crisis Emergency Risk Communication |
| CDC | Centers for Disease Control and Prevention |
| ECDC | European Center for Disease Prevention |
| PHEIC | Public Health Emergency of International Concern |
| PADM | Protective Action Decision Model |
| ERC | Emergency Risk Communication |

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EXECUTIVE SUMMARY

The COVID-19 pandemic, beginning in late 2019, quickly escalated into a global health emergency that required the rapid dissemination of accurate information. As the situation intensified, the World Health Organization declared it a global pandemic in March 2020, highlighting the critical need for effective communication to manage the spread of the virus. Social media, and X (Twitter) in particular, became a crucial platform for public communication during this period. This study investigates how the Food and Drug Administration (FDA) and the European Medicines Agency (EMA) utilized X (Twitter) during the first year of the pandemic. It specifically explores their communication strategies within the framework of the Crisis and Emergency Risk Communication (CERC) model, which emphasizes six key principles: be first, be right, be credible, express empathy, promote action, and show respect.

The research aimed to answer three key questions: What type of content did the FDA and EMA share with their audience during the first year of COVID-19? To what extent did their tweets align with the six CERC principles? And finally, did their communication evolve in response to changing COVID-19 case trends in the EU and the US?

Through a comprehensive analysis of the FDA and EMA's Twitter activities, the study reveals that both agencies placed a strong emphasis on providing timely and accurate information. The FDA was notably proactive, delivering frequent updates to maintain a steady flow of information, whereas the EMA had a more conservative approach and focused on transparency and collaboration. Both agencies aligned their messaging with the "be credible" principle, a strategy crucial for countering misinformation and guiding public behaviour during health emergencies.

However, the study also found that the principles of emotional engagement, such as expressing empathy and showing respect, were less evident in their communication strategies. While both agencies prioritized delivering factual and evidence-based information, they paid less attention to fostering an emotional connection with the public. This gap suggests an area where future communication strategies could improve by integrating more empathy, potentially enhancing public trust especially during crises.

This research highlights both the strengths and limitations of their approaches, offering valuable insights into how health regulatory agencies can refine their use of social media for crisis communication. The findings emphasize the need for a balanced strategy that combines factual

accuracy with empathetic engagement, enhancing the effectiveness of public health messaging in future emergencies.

Keywords: *COVID-19 pandemic, crisis communication, risk communication, social media, twitter, Food and Drug Administration (FDA), European Medicines Agency (EMA), CERC framework, public health emergencies*

1. INTRODUCTION

The COVID-19 pandemic was the biggest global health crisis in modern history. Emerging as a novel and highly infectious respiratory disease first identified in Wuhan, China, in December 2019 it rapidly spread worldwide. By March 2020, over 700,000 cases had been reported globally, resulting in more than 40,000 deaths (World Health Organization, 2020).

The World Health Organization (WHO) declared COVID-19 a “Public Health Emergency of International Concern” (PHEIC)” on 30 January 2020, a Global Pandemic on March 11, 2020 and was concluded on May 5, 2023 (WHO, n.d.). In May 2023, almost seven million people worldwide died from COVID-19, and it had impacted nearly every country and territory around the globe (Elflein, 2024).

In the midst of this crisis, the rapid dissemination of accurate information became crucial to mitigate the transmission of the highly contagious virus, with the key challenge being to deliver information to the worst-affected areas faster than the disease itself (Lima et al., 2020). Quick and free access to reliable, high-quality information from credible sources is vital for improving the global medical response to crises like the COVID-19 pandemic, as this timely communication is essential for both healthcare workers and the general public to help reduce the spread of highly contagious infections (Chan et al., 2020).

The Protective Action Decision Model (PADM) suggests that individuals' reactions to health risks are significantly influenced by their exposure to information, including the credibility of the source, the clarity of the message and the relevance of the content to their personal circumstances (Lindell & Perry, 2012).

According to PADM, the process of deciding on a protective action is shaped not only by the information received but also by how that information is processed and interpreted within the context of perceived threat and efficacy. Effective risk communication, therefore, requires carefully crafted messages that are timely, accurate, and delivered through appropriate channels to encourage individuals to adopt protective behaviours. Moreover, PADM highlights the importance of continuous and iterative communication efforts, particularly during the pre-crisis phase, to ensure that communities are well-prepared and able to respond effectively when a health risk escalates into a crisis (Lindell & Perry, 2012).

During the pandemic, normal life was disrupted by the closure of schools and leisure centres (Heydari et al., 2021). Additionally, mandatory business restrictions, quarantines and limitations on mobility were implemented to curb the spread of the virus (Heydari et al., 2021; International Labour Organization, OECD, 2020). As a result, the general public turned to social media to obtain health information and social media became an essential tool for shaping public opinion (Malik et al., 2021).

Social media have almost four billion users worldwide, covering 60% of the world's population (Kemp, 2020). By 2021, Twitter had more than 300 million users worldwide (Jo Dixon, 2023). For the purpose of this study, the platform X will be referred to as 'Twitter,' as the study covers the period of January to December 2020, when the platform was still known by this name. Twitter was rebranded X in July 2023 (Ivanova, 2023).

As highlighted in the Wang et al. (2021) paper, Twitter is the leading microblogging platform globally and played a key role in spreading information about COVID-19. The power of Twitter is further developed in the study of Han (2024), which states that Twitter is one of the “most influential social platforms”. In his study, Han (2024) highlights the powerful role of Twitter in crisis communication, emphasizing its ability to rapidly disseminate information and shape public opinion. Twitter serves as a vital platform for instant communication during crises, allowing real-time updates and fostering public awareness. The platform's influence extends to guiding public sentiment and providing support, which helps mitigate the psychological impact of crises. However, the study also acknowledges the potential for misinformation and rumour spread, which can complicate crisis management.

As Apuke and Omar (2021) observed, social media offered connection, education, entertainment and communication but this came with the price of rising misinformation and spreading of fake news. This idea was also expressed by Dr Tedros Adhanom Ghebreyesus, the Director-General of World Health Organization (WHO) during a press release on February 20th, 2020 where he stated “*We are not just fighting an epidemic; we are fighting an infodemic*”, making it clear that we should be vigilant about the harmful impact that false and misleading information can have on individuals and communities (WHO, 2020). Henceforth, to fight the spread of false information, governments and healthcare authorities are encouraged to leverage their social media platforms as a tool for disseminating information, announcements and scientific advancements related to COVID-19 (Lima et al., 2020).

A study by Li et al. (2021) that looked at how governments and public health agencies used social media during the pandemic found that social media had become a popular way for government officials, health agencies and the general public to share and receive health information and risk updates.

Substantial research has been conducted on how governments and health authorities communicated on social media during the COVID-19 pandemic (Geurts et al., 2023; Li et al., 2021; Malik et al., 2021; Sauer et al., 2021; Wang et al., 2021). However, there is a gap in the literature regarding the specific communication strategies of health regulatory bodies on social media during this period. While some studies, such as those by Ghadarian and Schafheutle (2024), and Lythgoe and Middleton (2021) have examined the regulatory differences among health regulatory bodies in granting accelerated marketing authorizations for COVID-19 medicines and vaccines they do not address the communication nor the social media aspect. These studies mainly highlight how different regulatory approaches can influence the therapeutic value of newly approved medicines.

To fill in the gap this study aims to analyse how Twitter, was employed by the Food and Drug Administration (FDA) and European Medicines Agency (EMA), the two biggest health regulatory authorities in the northern hemisphere, during the first year of the COVID-19 pandemic. The EMA and the FDA function as regulatory bodies in Europe and the United States, respectively. Their primary mission is to safeguard public health by ensuring that medicinal products meet rigorous standards for safety, efficacy, and quality. During the pandemic, the FDA and EMA closely collaborated, drawing on their long-standing relationship and combined expertise. This partnership aimed to enhance the safety, effectiveness, and quality of medical products. Their joint efforts focused on accelerating the development and global availability of safe and effective COVID-19 vaccines and treatments, demonstrating a strong commitment to public health (Anna Abram, 2020).

While this study focuses on the crisis communication responses issued by public health authorities in the two largest democratic blocs in the northern hemisphere, we thought it would be interesting to examine the communications aspects of the pandemic from two related perspectives—political and institutional. Accordingly, the study of Allison Auld (Volume I) evaluates the communications made by their respective political leaders in the EU and US.

In addition, this study examines how their Twitter communication aligns with the Crisis and Emergency Risk Communication (CERC) framework, particularly focusing on the six CERC principles: Be first, be right, be credible, express empathy, promote action, and show respect (CDC, 2018; Reynolds & Seeger, 2014). The CERC framework was chosen due to its widespread use for strategic risk communication in numerous public health emergencies, offering best practice recommendations for each phase of a crisis (Reynolds & W. Seeger, 2005)

The effectiveness of the CERC framework lies in its ability to integrate the essential components of both crisis and risk communication, specifically tailored to the demands of emergency situations. It facilitates timely decision-making under constrained circumstances, addresses the balance between accuracy and the inherent uncertainties of crises, and effectively engages the public to encourage appropriate responses. Adherence to CERC principles ensures that organizations can disseminate critical information promptly and effectively, which is vital for minimizing harm and safeguarding lives during emergencies. Therefore, aligning risk messages with the CERC framework not only reflects best practices but also enhances the overall impact of communication efforts in crisis situations (Reynolds & Seeger, 2014).

2. RESEARCH OBJECTIVE AND QUESTIONS

The objective of this study is to examine how the FDA and EMA used their Twitter platforms during the first year of the COVID-19 pandemic, exploring the content shared and evaluating their alignment with the six CERC principles. It also aims to assess whether their communication strategies evolved with changing COVID-19 case trends.

As a result, the following research questions were developed:

1. What type of content was shared with the public to communicate about COVID-19?
2. To what extent did their tweets align with the six principles of CERC framework: be first, be right, be credible, express empathy, promote action, and show respect.
3. Did their Twitter communication evolve in alignment with the changing COVID-19 case trends in the EU and US?

3. LITERATURE REVIEW

This short literature review will examine the critical role of communication during public health emergencies, provide a clear distinction between risk and crisis communication and introduce the Crisis and Emergency Risk Communication (CERC) framework. Additionally, the review will discuss the significance of social media in public health communication, with a specific focus on how Twitter serves as a vital tool for disseminating health information.

3.1. The role of communication in public health emergencies

Public health emergencies are characterized not only by the events or factors that trigger them but also by the health impacts they produce. When these impacts are likely to exceed what the community can typically manage, the situation becomes an emergency (Nelson et al., 2007). COVID-19 was declared by the World Health Organisation (WHO) as a Public Health Emergency of International Concern (PHEIC) (WHO, n.d.). A PHEIC is a formal declaration issued by WHO in response to a significant and unforeseen health event with the potential for international spread. This designation is applied when the situation is extraordinary and presents a risk that extends beyond the borders of the affected state. The declaration of a PHEIC indicates the need for a coordinated global response and it imposes a legal obligation on all countries to act swiftly to address the threat (Wilder-Smith & Osman, 2020).

Effective communication plays a crucial role during crises or emergency situations, as the need for clear communication becomes even more important because any miscommunication or confusion can worsen the situation (Veil et al., 2008). Similarly, Dubé et al. (2022), emphasize that during a pandemic, which is a public health emergency, communication plays a vital role in encouraging the adoption of preventive behaviours and reducing the spread of disease. Furthermore, during crises, the public has a fundamental right to be informed about the situation, potential risks, authorities' plans, and possible consequences. Communication must be planned, prepared, and continually improved to ensure fast, coordinated action (Valenti et al., 2022).

In addition, the World Health Organization (2017) in their guidelines for emergency risk communication (ERC) highlights the importance of clear, accurate information through trusted sources and in languages that can be widely understood, enabling individuals to make informed

decisions, thereby protecting their own health and that of their communities. As Valenti et al. (2022) observed, evidence-based communication played a crucial role during the pandemic by generating knowledge, offering technical and scientific advice to policymakers and guiding public messaging efforts.

3.2. Defining risk and crisis communication

Risk and crisis communication are widely utilized in research related to emergencies and disasters. While the two concepts are closely connected, they have distinct characteristics. Researchers have pointed out that these terms can be used together to complement each other or separately to address specific issues. According to Seeger (2006), crisis communication is primarily focused around specific events, whereas risk communication focuses on predicting and assessing potential future risks.

Risk communication is a developed discipline that significantly influences the design and execution of public health initiatives. It involves identifying threats and sharing information about health risks and environmental dangers. By assuming the public's right to know, risk communication empowers informed decision-making and shared responsibility in managing these risks. Additionally, effective risk communication is shaped by basic principles such as message simplicity and credibility, which are crucial for ensuring that the public finds the information both believable and actionable (Reynolds & W. Seeger, 2005).

The primary focus of risk communication is to identify public health risks, encourage the adoption of healthier and safer behaviours and foster lasting changes in both individual actions and the environment (Freimuth et al., 2000). Campaigns highlighting the dangers of cigarette smoking are a prime example of risk communication. Similar initiatives have targeted issues like HIV/AIDS and safe sex, drunk driving, binge drinking, vaccines, substance abuse, infectious diseases, exercise and various health screenings. The goal of these campaigns is to inform the public about potential risks and encourage changes in behaviour (Reynolds & W. Seeger, 2005).

The European Centre for Disease Prevention and Control (2013), defines risk communication in public health as the process of sharing information about health risks or threats to health, social, or economic well-being among individuals, groups and institutions. This communication typically takes place between experts and those who are at risk. The primary

goal of risk communication is to provide the public with relevant, accurate, and timely information about potential exposures. In other words, risk communication involves discussing potential negative outcomes to help individuals avoid them by adjusting their behaviour. Its focus is on what could happen in the future rather than immediate events.

According to Hampel (2006), the key issue in risk communication is the differing views of "risk" between the public and experts. Experts focus on evidence and probabilities, while the public considers broader uncertainties. Effective risk communication must go beyond presenting facts, addressing how risks are defined and assessed, and building trust. Modern approaches promote two-way communication, fostering dialogue to create a shared understanding of risks.

The goal of risk communication is to help people understand the likelihood of harm and how they can reduce that risk. It aims to persuade people to take actions that lower the risk by making the technical information understandable and relevant to their lives. Since there is usually time to plan, risk communication is focused on carefully crafting the message. This includes testing different ways to present the information and choosing the best media channels to reach the right audience (Reynolds & W. Seeger, 2005).

On the other hand, Seeger (2006) explains that crisis communication is focused on specific events, emphasizing the need for immediate response during an urgent situation. Because crises are often unexpected, crisis communication is less predictable and more time-sensitive than regular or risk communication. The focus is on providing immediate information to the public during an emergency such as an outbreak, when people need quick guidance on how to protect themselves and others, so it tends to be less polished and more spontaneous. Crisis communication is more about reacting to the event as it unfolds, sharing what is known and what is still uncertain and updating people on efforts to gather more information or prevent further harm (Seeger et al., 1998; Sellnow et al., 2009). This type of communication often includes news conferences or announcements and uses whatever channels are available at the time, such as radio, which is widely accessible and flexible during a crisis. The goal is to share this information honestly, quickly and accurately, so that those affected can make informed decisions to protect themselves and stay safe (Reynolds & W. Seeger, 2005).

In their research Su et al (2022), have pointed out the critical role of crisis communication in managing public health emergencies. They emphasize that health officials must communicate clearly, effectively, and compassionately with stakeholders to control crises and protect public

health. Effective strategies include developing fact-based, transparent messaging, ensuring consistency and clarity, and acknowledging the limitations of current knowledge. This approach not only prevents mixed messages but also builds public trust and rapport, making it more likely that people will follow important health recommendations.

Both risk and crisis communication are designed to influence public behaviour through well crafted messages that are usually delivered through mass media and build public trust. While they both rely on credibility to persuade the public, they apply it in different contexts and ways. The key difference lies in the timing and approach: risk communication is proactive and methodical, while crisis communication is reactive and immediate (European Centre for Disease Prevention and Control., 2013; Reynolds & W. Seeger, 2005).

3.3. Crisis and Emergency Risk Communication (CERC) theoretical framework

Effective communication is the cornerstone of managing public health emergencies. Recognizing that misinformation and unclear messaging can intensify crises, the Centers for Disease Control and Prevention (CDC) developed the Crisis and Emergency Risk Communication (CERC) model. Launched in the United States in September 2002 and primarily authored by Barbara Reynolds, M.A., with contributions from CDC professionals and external collaborators, CERC was created to equip public health professionals with the tools necessary to navigate the complexities of emergency communication. By integrating principles from classical rhetoric, crisis management, risk communication and psychology, CERC ensures clear, consistent and trustworthy information is delivered during every phase of a crisis. This helps communities make the best possible decisions under pressure (Reynolds et al., 2002; Reynolds & W. Seeger, 2005)

As Veil et al. (2008) reported, the creation of the CERC framework was not just a theoretical exercise; it was a direct response to the expanding role of public health officials in managing real-world crises. Events like the anthrax episode in 2001, the H5N1 outbreak in 1997, 9/11, and Hurricane Katrina underscored the need for public health to evolve from simply educating the public about health risks to actively managing and communicating during crises. These significant incidents revealed gaps in public health communication and highlighted the necessity for a structured approach like CERC. In response, the CDC developed CERC to integrate key principles from risk and crisis communication, providing public health

professionals with a robust framework to effectively manage communication throughout all stages of a crisis

The CERC model is based on six key principles used to disseminate information during a crisis: be first, be right, be credible, express empathy, promote action, show respect. Being first emphasizes the critical importance of timely communication, as the first source often becomes the most trusted; being right involves delivering accurate and reliable information; being credible requires honesty and transparency in all communications; expressing empathy entails addressing the emotional challenges faced by the public, acknowledging emotions, suffering, and uncertainty; promoting action provides individuals with clear steps they can take and encourages positive behaviours; and showing respect involves fostering cooperation, particularly when communicating with vulnerable populations, while addressing their concerns, questions, and feelings. These principles are integral throughout all communications of a crisis lifecycle (CDC, 2018; Reynolds & Seeger, 2014).

Although CERC was originally designed for more traditional forms of media such as press releases, public announcements, radio and media briefings, the incorporation of social media into the CERC framework has become essential (Lwin et al., 2018). Social media now plays a critical role in crisis and risk communication, offering speed and immediacy, enabling real-time interaction with the public, and facilitating the rapid dissemination of information. The rise of social media necessitated the adaptation of CERC principles to ensure that crisis communicators can effectively engage with diverse audiences, correct misinformation and manage communication across multiple platforms (Lachlan et al., 2016).

There has been research demonstrating the application of CERC on social media for public health emergencies such as Hurricane Maria in Puerto Rico (Andrade et al., 2020), the Zika outbreak in Singapore (Lwin et al., 2018) and in the 2009 H1N1 pandemic (Reynolds & Quinn, 2008). These studies show that health emergencies and public crises require effective communication strategies. Social media platforms are essential for rapidly disseminating accurate information, engaging with the public, addressing misinformation, and providing real-time updates. They play a crucial role in reaching diverse populations, facilitating two-way communication and supporting coordinated responses during such crises.

This study will contribute to the existing literature by analysing how the Food and Drug Administration (FDA) and the European Medicines Agency (EMA) used their Twitter accounts

to communicate with the public during the COVID-19 pandemic. The tweets will be examined through the lens of the Crisis and Emergency Risk Communication (CERC) framework.

3.4. The role of social media in public health

As previously discussed, the global presence of nearly four billion social media users underscores its significance as a powerful communication tool (Kemp, 2020).

The CDC highlights that social media can be effectively utilized in health communication activities, which has been increasingly evident in recent years. Platforms like Facebook, YouTube and Twitter have seen significant growth in their use for disseminating health messages, becoming crucial in expanding reach, fostering engagement and ensuring access to credible, science-based information. Social media enables timely dissemination of health and safety information, facilitates information sharing and empowers individuals to make healthier decisions. By integrating social media into health communication campaigns, public health organizations can leverage social dynamics to enhance participation, trust and the overall impact of their messages (Centers for Disease Control and Prevention (U.S.). Office for the Associate Director of Communication, 2011).

In their study, Kanchan and Gaidhane (2023) observed that social media plays a significant and multifaceted role in public health, offering both opportunities and challenges. It is instrumental in disease surveillance, enabling quicker detection of outbreaks through real-time analysis of user-generated content on platforms like Twitter. Health researchers leverage social media for participant recruitment, data collection, and dissemination of research findings, significantly broadening their reach. In health promotion, social media campaigns have successfully influenced behaviours, such as risky drinking, cannabis use, and promoting women's health and oral hygiene. Additionally, social media provides healthcare professionals with platforms for professional development and policy influence, allowing them to reach wide audiences, including policymakers. It also serves as a tool to combat misinformation by providing accurate information and supporting fact-checking initiatives. In the same study it was found that despite its benefits, the use of social media in public health comes with challenges, including the spread of misinformation, privacy concerns and potential negative impacts on mental health.

Breland et al. (2017) reported that while social media is not yet widely adopted by public health researchers, its widespread use among the general public presents a significant opportunity for effective science communication. By interacting with experts through these platforms, the spread of false claims could be minimized.

Considering social media's broad impact on how people receive and act on health information, Terry et al. (2023) argue that it is crucial for public health strategies to fully utilize these platforms. They emphasize that social media should not be seen as an optional tool but as a central component in efforts to effectively communicate health messages and address current public health emergencies such as the COVID-19 pandemic.

3.5. Twitter as a health communication tool

Among social media platforms, Twitter is recognized as the leading global microblogging platform, and it has been highlighted for its key role in disseminating COVID-19 information, as noted by (Wang et al., 2021).

According to Choo et al. (2015) Twitter is a popular platform for healthcare communication, allowing users to post short public messages up to 280 characters long. The study found that hashtags (words or phrases with a "#" symbol) help categorize topics or join specific discussions. Users can "retweet" others' messages, sharing them with their own followers to spread information quickly. They can also "like" tweets to show approval. What sets Twitter apart from other social media platforms like Facebook or LinkedIn is its open design. Instead of just connecting people who already know each other, Twitter allows users to reach a much wider audience, including strangers. This feature enables everyday people to directly engage with experts and leaders in their fields, making it easier to share knowledge, information and help fight against misinformation.

In their 2015 study, Park et al. explore the use of Twitter as a health communication tool by examining how major health organizations leverage the platform to disseminate information, promote health-related actions and engage with the public. The study analyses the Twitter activity of the American Heart Association, American Cancer Society, and American Diabetes Association, revealing differences in their engagement strategies. Hashtags and hyperlinks are the most commonly used features, enhancing audience engagement and information sharing. The study also finds that, although most tweets are organization-focused, personal health

action-based messages, which encourage behaviour changes or provide health tips, tend to generate more user interaction. Overall, Park et al. (2016) conclude that Twitter is an effective platform for health communication and they suggest a more strategic use of interactive features to foster two-way communication and community building.

During the COVID-19 pandemic, the World Health Organization (WHO) and other health stakeholders such as the Centers of Disease Control and Prevention (CDC) also used their Twitter platform to share virus-related information, report updates and introduce the novel virus to the public through this platform (Wang et al., 2021).

When using Twitter as a health communication tool, it is crucial to focus on clear, consistent, and well-coordinated messaging. Wang et al. (2021) emphasize that these elements are essential to ensure the public responds appropriately and to minimize the risks associated with misinformation. Their study provides valuable insights that help public health agencies and emergency responders better understand their roles in utilizing social media during health crises, ultimately improving communication strategies and preventing harmful behaviours.

Ultimately, health organizations can establish themselves as credible sources by sharing timely and accurate health information with key audiences through their social media platforms (Park et al., 2016).

4. METHODOLOGY

This study employs a content analysis of the tweets published by the FDA (@US_FDA) and EMA (@EMA_News) to examine how both health regulatory bodies utilized their Twitter platforms to communicate during the pandemic's first year. All tweets analyzed in this research were publicly available and no interaction or direct communication with the account holders was attempted. In the following sub-chapters, the methodology will cover the data collection process, the development of the coding frame, the approach to content analysis and elements of qualitative and quantitative research and finally, the analysis of the main data. Each section will provide a clear explanation of the techniques used to compare and evaluate the FDA and EMA's crisis communication strategies, determining how closely these align with the principles of the Crisis and Emergency Risk Communication (CERC) framework.

4.1. Data source and collection process

The main source of data for this study consisted of publicly available messages, commonly referred to as 'tweets,' from the official verified Twitter accounts of both organizations. Both accounts display a blue checkmark badge, indicating that they are verified (X Help Center, n.d.).

Although Twitter data is fundamentally different from conventional data collection methods such as surveys, they can still offer valuable insights for research (Chen et al., 2022). Twitter data is well-suited for addressing a wide range of research questions and has become an increasingly popular resource for examining topics at the intersection of science, politics, and policy. Scholars have utilized Twitter data to investigate various issues, particularly focusing on public discourse around contentious scientific topics, such as genetic modification technology and the Zika virus (Chen et al., 2022).

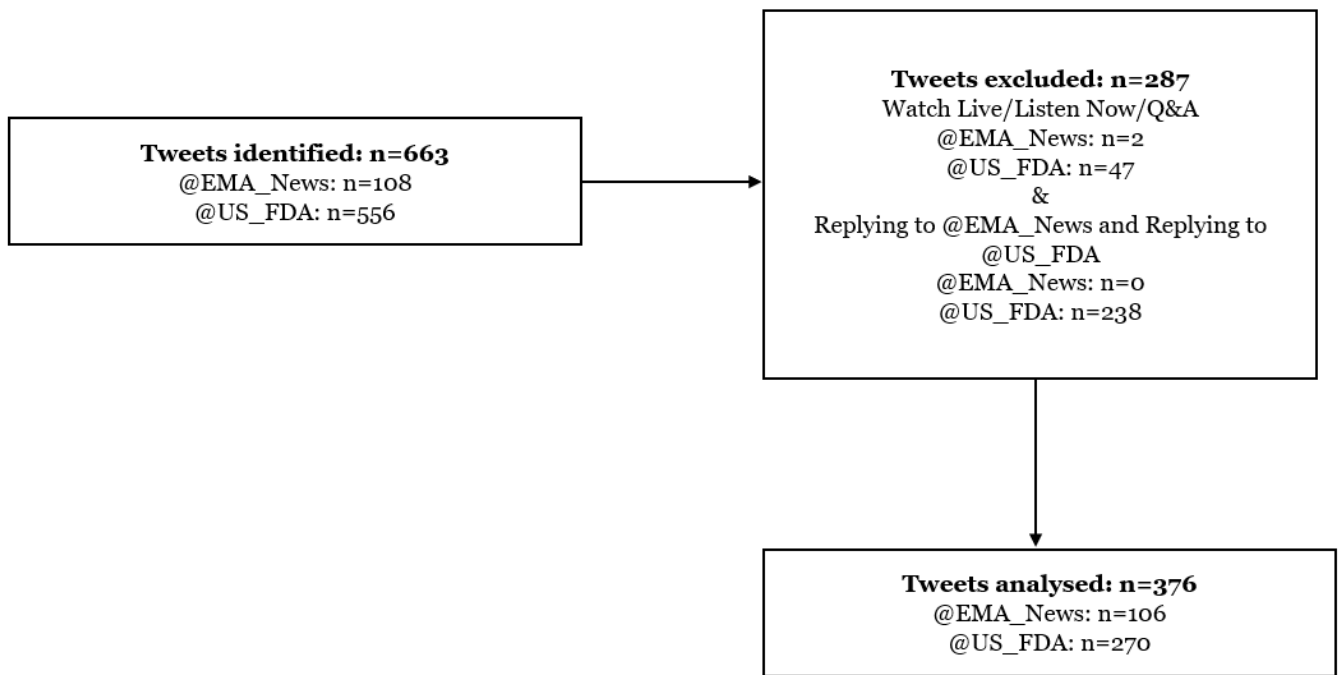
For this study, the researcher collected and analyzed only the Twitter data produced by the FDA (@US_FDA) and EMA (@EMA_News) to ensure the information came directly from the official sources. Tweets published between January 1, 2020, and December 31, 2020, were considered relevant and included in the analysis, as they reflect the evolving situation of the virus and the global response during the first year of the pandemic.

The data were retrieved manually from the official accounts of the two regulatory bodies using Twitter's advanced search tool, which is freely accessible to all Twitter users. The researcher used the web version, as the advanced search feature is not available in the Twitter app on Android or iOS device (Sendible, 2024).

When utilising the advance search tool to conduct research, it is possible to retrieve data by the use of hashtags and/or keywords. For this study, the Tweets were filtered using the following COVID-19 relevant keywords: “covid”, “coronavirus”, “covid-19”, “covid19” , “Covid19vaccines” “pandemic”, “epidemic” and “outbreak”. The Boolean operator "OR" was used to link the keywords, allowing the search to capture tweets containing any of the terms. This helped expand the search results, increasing the number of tweets retrieved during data collection. Once the keywords were determined, the researcher used the date range feature in the advanced search to conduct monthly searches for both organizations, covering the period from January 1, 2020, to December 30, 2020. This process was performed twice for both the FDA and EMA accounts to ensure that all relevant data were collected accurately and that the tweet counts were recorded correctly.

A total of 663 tweets were identified in the sourcing process, with 108 from EMA (@EMA_News) and 555 from FDA (@US_FDA). Of these, 376 tweets were selected for analysis—106 from EMA and 270 from FDA. Tweets excluded from the analysis included those with limited or no content, such as “Watch LIVE,” “Listen Now,” or “Q&A,” as well as self-reply tweets like “Replying to @EMA_News” or “Replying to @US_FDA,” to avoid redundancy. The focus was placed on impactful, externally directed communications. Figure 1 provides a detailed demonstration of the process described above.

Figure 1: Data collection and elimination process



All tweets from the FDA and EMA were collected and stored in separate folders for each organization. Within each folder, Microsoft Word (Microsoft 365) documents were created for each month, where the tweets were organized according to the month they were posted. Table 1, shows an overview of the selected from the EMA and FDA tweets per month.

Public engagement metrics (likes, comments, and shares) were not considered, as the main objective of this thesis was to analyse the content of the tweets, rather than focusing on public interactions or conducting a sentiment analysis.

Table 1: EMA and FDA tweets per month

| @EMA_News | | @US_FDA | |
|------------------|-------------------|----------------|-------------------|
| Months | Tweets EMA | Months | Tweets FDA |
| Jan-20 | 0 | Jan-20 | 0 |
| Feb-20 | 1 | Feb-20 | 7 |
| Mar-20 | 14 | Mar-20 | 27 |
| Apr-20 | 17 | Apr-20 | 28 |
| May-20 | 14 | May-20 | 28 |
| Jun-20 | 11 | Jun-20 | 27 |
| Jul-20 | 7 | Jul-20 | 30 |
| Aug-20 | 0 | Aug-20 | 21 |
| Sep-20 | 3 | Sep-20 | 28 |
| Oct-20 | 9 | Oct-20 | 20 |
| Nov-20 | 8 | Nov-20 | 22 |
| Dec-20 | 22 | Dec-20 | 32 |
| TOTAL | 106 | TOTAL | 270 |

4.2. Content analysis and elements of qualitative & quantitative research

Content analysis is a research method used to examine and interpret written, verbal, or visual communication messages (Cole, 1988, as cited in Elo & Kyngäs, 2008).

Neuendorf and Kumar (2016) explain that content analysis encompasses the study of both textual content, such as written text or transcribed speech and nontextual content, such as images, videos, nonverbal behaviours, music and sounds. Although traditionally seen as a quantitative method, emphasizing counting and statistical techniques to measure message

features, qualitative approaches also play an important role. Qualitative content analysis, in particular, focuses on interpreting the deeper meanings within messages. The choice between quantitative and qualitative approaches depends on the research aims and objectives.

Historically, content analysis has been applied to various materials, such as news media, advertisements, and political speeches, and more recently, to platforms like social media and blogs (Neuendorf & Kumar, 2016). Today, with the rise of social media as a key communication platform for governments and organizations, content analysis has expanded to include social media posts (Lai & To, 2005). Content analysis is increasingly being used to examine social media content, including impressions, opinions and behaviours, through systematic approaches to extract insights. Analysing social media content is essential for converting it into valuable information, concepts, and themes that can help generate knowledge and guide decision-making strategies (Lai & To, 2005).

Moreover, Fu et al. (2023) highlight that content analysis remains the primary method for analysing social media content, given its flexibility in examining diverse forms of communication and uncovering meaningful patterns.

Content analysis involves coding raw data, such as text or images, according to a developed or predefined (deductive approach) classification scheme, known as a coding manual. A deductive approach in content analysis is used when the goal of the study is to test or extend an existing theory or prior research. In this method, the categories or codes are established before the data analysis begins, often based on previous literature, theory, or models. Both qualitative and quantitative approaches can be applied to analyse the targeted material (Elo & Kyngäs, 2008; Hamad et al., 2016).

Given the objectives of this study, a deductive content analysis approach was selected because it enables the analysis of data using predefined categories derived from existing theories. By applying the Crisis and Emergency Risk Communication (CERC) framework to examine the FDA and EMA tweets, this deductive content analysis ensures that the data is coded in alignment with the framework's established principles. To meet the research objectives, a mixed-method approach combining both qualitative and quantitative techniques was used to analyse the Twitter posts from the FDA and EMA.

The data (tweets) were first collected as described earlier, and through careful reading and highlighting, relevant categories were formed. The coding process was performed to identify patterns and themes within the data. These categories were then grouped into broader sub-

themes, which were combined into overarching themes using the CERC framework, representing the qualitative part of the research.

In the second part, a quantitative analysis was conducted by counting the frequency of tweet messages, as well as the visual content of each tweet, such as whether it included a video, URL, or photo. This combined approach helped the researcher analyse how the tweet content aligned with the six CERC principles.

The detailed steps of this analysis will be discussed in the following sub-chapters.

4.3. Development of coding system and analysis

To create the coding system, the researcher selected at least 5 random tweets from each month of the EMA and FDA tweets to ensure diversity in the data. However, for some months, such as February, August, and September, it was not possible to gather 5 tweets from EMA; only 1 tweet was available in February, none in August and 3 in September. In contrast, this limitation did not apply to the FDA tweets, as more than 5 tweets were available for each month. In total, 99 tweets were used to develop the coding system, with 44 from EMA and 55 from FDA.

After collecting the selected tweets, the next step was coding the data. The researcher thoroughly read and highlighted the content to identify relevant categories. Sub-themes were developed from the data and broader themes were organized in alignment with the CERC framework. The entire coding process was conducted manually using Microsoft Word and Excel. For each selected tweet, an initial code was assigned using Word's "Insert Comment" function. These codes were then transferred to Excel, where they were color-coded and added into initial sub-themes. Each subtheme was highlighted in a different colour using Excel's conditional formatting, making it easier to identify and organize them later on into themes.

The COUNTIF function in Excel was then used to identify subthemes, group them into broader themes, and to count the frequency of each theme.

Once the coding system was established, the researcher applied the codes to the remaining tweets. In total 376 tweets were analysed, with 106 from the European Medicines Agency (EMA) and 270 from the Food and Drug Administration (FDA).

This combination of qualitative and quantitative methods provided a structured analysis of the data and the frequencies of themes will be presented in the following sections.

The following table (Table 2) provides a summary of the main themes and sub-themes, illustrating their connection to the CERC principles, along with a brief description of the findings.

Table 2: Presentation of the coding system

| # | Themes | Sub - themes | CERC Principles or Emerging Theme | Description of theme |
|---|--|---|--|---|
| 1 | EMA or FDA continuous actions in the fight against COVID-19 | N/A | Be first ; communicating information quickly, the first source often becomes the most trusted Be right ; being right involves delivering accurate information to maintain credibility | Updates, ongoing measures and approvals aimed at addressing and managing the COVID-19 pandemic. |
| 2 | Promoting action | Virtual meetings - social distance Hand hygiene & wearing mask Personal protective equipment Mindful grocery shopping practices Blood and plasma donation | Promote action ; encourage positive behaviors | Encouraging proactive behaviors like hygiene, social distancing through virtual meetings, minimizing grocery trips, and supporting blood and plasma donations to help those in need. |
| 3 | Combating unauthorized and fraudulent medicines | N/A | Be credible ; build trust with transparency and honesty in all communications | Preventing the distribution of unapproved or fraudulent COVID-19 treatments, ensuring public access to safe and authorized products. |
| 4 | Expression of empathy | Appreciation and thank you messages Acknowledging the suffering United against the virus | Express empathy ; addressing the emotional challenges faced by the public and show your empathy | Messages of gratitude, acknowledgment of the pain and appreciation for collective efforts, while highlighting global unity in combating the virus. |
| 5 | Providing reassurance during times of crisis | Medicine and medical equipment availability beyond COVID-19 Food supply remains safe during COVID-19 | Express empathy ; addressing the emotional challenges faced by the public and show your empathy | Communicating the continued availability of medicines, medical equipment, and ensuring the safety of the food supply during COVID-19, to reassure the public and build trust in critical resources. |

| | | | | |
|----|--|--|---|--|
| 6 | Transparency and Accountability | N/A | Be credible; build trust with transparency and honesty in all communications | Providing clear updates on the performance, removal, or authorization of COVID-19 tests and clinical trials, fostering transparency and informed decision-making. |
| 7 | Updates on new treatments and approvals | New approvals or conditional authorizations Updates on COVID-19 Treatments | Be first; communicating information quickly, the first source often becomes the most trusted Be right; being right involves delivering accurate information to maintain credibility | Providing timely updates on new COVID-19 treatment approvals or authorizations to keep the public informed on the latest advancements and regulatory milestones. |
| 8 | Public health education and awareness | Informing the public and answering questions Information on pet safety during COVID-19 Vaccine safety | Promote action; encourage positive behaviors Show respect; respect the audience's concerns, questions, and feelings by fostering cooperation, especially when communicating with vulnerable populations. | Educating the public on various aspects of COVID-19, such as prevention, treatments, safety of medicines, and critical tests, to promote informed and responsible actions during the pandemic. |
| 9 | Inclusion | Meetings including general public participation Translations of key documents Racial and ethnic minorities | Show respect; respect the audience's concerns, questions, and feelings by fostering cooperation, especially when communicating with vulnerable populations. | Inclusion of public participation through meetings and providing access to information via translated documents, with a focus on racial and ethnic minorities. |
| 10 | Global and local collaboration | N/A | Emerging theme; extends beyond CERC the principles by emphasizing joint efforts and partnerships, focusing on collective action | Joint efforts, alongside other key stakeholders, in working together on local and global levels to combat COVID-19 through shared knowledge, resources, and strategies. |

5. RESULTS

This chapter presents the key findings from the analysis of 376 tweets posted by the European Medicines Agency (EMA) and the Food and Drug Administration (FDA). A detailed discussion of the similarities and differences between the two organizations will be provided in the discussion chapter of this paper.

5.1. Presentation of key findings: European Medicines Agency @EMA News

The analysis of 106 tweets published by the European Medicines Agency (EMA) between January and December 2020 highlights two dominant themes in their communication strategy: “transparency and accountability” found in 31 tweets (29,2%) and “global and local collaboration” found in 20 tweets (18,9%). Table 3 provides a summary of the frequency counts for the key themes and sub-themes identified in the analysis.

Table 3: EMA frequency of themes and sub-themes

| @EMA_News | | | |
|---|--|--------------------|------------|
| Theme | Sub-theme | Frequency in Total | |
| | | No. | Percentage |
| Transparency and Accountability | | 31 | 29,2% |
| Global and local collaboration | | 20 | 18,9% |
| EMA continuous actions in the fight against COVID-19 | | 14 | 13,2% |
| Public health education and awareness | Informing the public and answering questions | 14 | |
| | Information on pet safety during COVID-19 | 0 | |
| | Vaccine safety | 0 | |
| Updates on new treatments and approvals | New approvals or conditional authorizations on COVID-19 treatments | 8 | |
| | Updates on COVID-19 Treatments | 4 | |
| Providing reassurance during times of crisis | | 5 | 4,7% |
| | Medicine and medical equipment availability beyond COVID-19 | 5 | |
| | Food supply remains safe during COVID-19 | 0 | |
| Inclusion | | 4 | |
| | Meetings including general public participation | 4 | 3,8% |
| | Translations of key documents | 0 | |
| | Racial and ethnic minorities | 0 | |
| Combating unauthorized and fraudulent medicines | | 2 | 1,9% |
| Promoting action | | 2 | 1,9% |
| | Virtual meetings - social distance | 2 | |
| | Hand hygiene & wearing mask | 0 | |
| | Personal protective equipment | 0 | |
| | Mindful grocery shopping practices | 0 | |
| | Blood and plasma donation | 0 | |
| Expression of empathy | | 2 | 1,9% |
| | Appreciation and thank you messages | 2 | |
| | Acknowledging the suffering | 0 | |
| | United against the virus | 0 | |
| TOTAL of posts | | 106 | |

Throughout the first year of the COVID-19 pandemic, the EMA consistently provided updates on its regulatory actions, maintaining clear and open communication regarding decisions, developments in research, and clinical trials. The theme of “global and local collaboration” further underscored the EMA's role in partnering with both international and regional stakeholders to address the crisis. Even though “collaboration” is not one of the six CERC

principles we observe that it's an emerging theme from the EMA's data analysis. This collaborative approach is evidenced by their work with global regulators to define data requirements for trials and their support for international coordination in large, decision-relevant studies, further enhancing transparency through these collaborative efforts. Below are some example tweets that support these findings:

- *“For observational studies of #RealWorldData in #COVID19, EMA calls 🚩 for transparency for protocols and results, and collaboration between researchers, to ensure high-quality, powerful studies. 🖱️ <https://ema.europa.eu/en/news/ema-calls-high-quality-observational-research-context-covid-19>” - @EMA_News 26/05/2020*
- *“EMA’s Executive Director sent an open letter to researchers from @iqwig and @cochranecollab in response to their call for EMA to make the #clinicaldata submitted as part of #COVID19 related evaluation procedures publicly available rapidly: ➡️ https://ema.europa.eu/en/documents/other/european-medicines-agency-response-iqwig-transparency-covid-19-related-activities_en.pdf” - @EMA_News 29/05/2020*
- *“EMA will provide an unprecedented level of transparency and data access for all #COVID19 medicines . Find out more about EMA’s communication and increased transparency measures in this presentation: https://ema.europa.eu/en/documents/presentation/presentation-transparency-engagement-communication-melanie-carr_en.pdf #EMAPublicMeeting” - @EMA_News 11/12/2020*
- *“What are EMA and its EU partners doing to address the potential impact of the COVID-19 outbreak on pharmaceutical supply chains into the EU? #COVID19 #SARSCoV2 <https://ema.europa.eu/en/news/addressing-potential-impact-novel-coronavirus-disease-covid-19-medicines-supply-eu>” - @EMA_News 10/03/2020*
- *“EMA & FDA co-chaired the first regulatory workshop on COVID-19, held under the umbrella of #ICMRA. It brought together medicines regulators & experts from WHO & the EU Commission to facilitate global collaboration on vaccine development against #COVID19. 🖱️ <http://ema.europa.eu/en/news/first-regulatory-workshop-covid-19-facilitates-global-collaboration-vaccine-development>” - @EMA_News 19/03/2020*
- *“EMA and Health Canada co-chaired the latest #ICMRA regulatory workshop on COVID-19. Medicines regulators & experts from @WHO & the @EU_Commission*

discussed observational studies of #RealWorldData for #COVID19 medicines:

👉 <https://ema.europa.eu/en/news/global-regulators-discuss-observational-studies-real-world-data-covid-19-medicines>” - @EMA_News 27/04/2020

- *“EMA, together with the pharmaceutical industry and the EU Member States , has launched an enhanced monitoring system for availability of medicines 💊 used for treating #COVID19: 👉 <https://ema.europa.eu/en/news/launch-enhanced-monitoring-system-availability-medicines-used-treating-covid-19>” - @EMA_News 21/04/2020*







The next most frequent themes identified were “EMA's continuous actions in the fight against COVID-19,” found in 14 tweets (13.2%), and “Public health education and awareness,” which also appeared in 14 tweets (13.2%). The theme of “Public health education and awareness” was further divided into sub-themes; however, only the sub-theme related to informing the public and answering questions was reflected in the tweets, with no mention of other sub-themes such as pet safety during COVID-19 and vaccine safety. Additionally, the theme of “Updates on new treatments and approvals,” which includes two sub-themes, was found in 12 tweets (11.3%). Both sub-themes were present in tweets that provided updates on new treatment approvals or conditional authorizations.

These tweets offered updates on ongoing actions and approvals to manage the pandemic, educational content on COVID-19 prevention, treatments, medication safety, and critical tests, and timely information on treatment approvals to keep the public informed of key advancements and regulatory developments. Below are some example tweets that support these findings:

- *“To contribute to the global response to the outbreak of the novel #coronavirus infections, EMA is taking concrete actions to accelerate the development and availability of medicinal products for the treatment and prevention of the new coronavirus: <https://ema.europa.eu/en/news/ema-su>” - @EMA_News 04/02/2020*
- *“How does EMA support the accelerated development and approval of safe, effective & high-quality 💊💊 and vaccines against #COVID19? Learn more about the fast-track procedures EMA has put in place so that marketing authorisations can be granted asap: ➡ https://ema.europa.eu/en/documents/leaflet/infographic-fast-track-procedures-treatments-vaccines-covid-19_en.pdf” - @EMA_News 09/06/2020*



- “ 🚩 EMA plays an important role in the development, scientific evaluation, approval and monitoring of #COVID19vaccines in the EU Consult our webpage to see how: 🖱️ <https://ema.europa.eu/en/human-regulatory/overview/public-health-threats/coronavirus-disease-covid-19/treatments-vaccines/covid-19-vaccines-development-evaluation-approval-monitoring>” - @EMA_News 16/12/2020
- “For #COVID19vaccines, speed of development and approval is much faster due to the #publichealthemergency, while the highest standards of quality, safety & efficacy are ensured. Find out how: 🖱️ <https://ema.europa.eu/en/human-regulatory/overview/public-health-threats/coronavirus-disease-covid-19/treatments-vaccines/covid-19-vaccines-development-evaluation-approval-monitoring>” - @EMA_News 16/12/2020
- “Do you have questions about #COVID19vaccines? EMA’s key facts webpage may have some of the answers: 🖱️ <https://ema.europa.eu/en/human-regulatory/overview/public-health-threats/coronavirus-disease-covid-19/covid-19-vaccines-key-facts>” - @EMA_News 10/11/2020
- “!! EMA receives an application for conditional authorisation of #remdesivir, 1st #COVID19 treatment in the EU. Conditional marketing authorisation is an EU early access route for a 🚑 that fulfils an unmet medical need. 🖱️ <https://ema.europa.eu/en/news/ema-receives-application-conditional-authorisation-first-covid-19-treatment-eu>” - @EMA_News 08/06/2020
- “EMA starts a review of #dexamethasone for treating adults with #COVID19 requiring respiratory support: <https://ema.europa.eu/en/news/ema-starts-review-dexamethasone-treating-adults-covid-19-requiring-respiratory-support> #CHMP” - @EMA_News 24/07/2020

The theme of “providing reassurance during times of crisis,” including its sub-theme on the availability of medicines and medical equipment beyond COVID-19, was identified in 5 tweets (4.7%). However, the sub-theme of food supply availability was not mentioned in any of the tweets. These communications focused on reassuring the public by emphasizing the continued availability of essential medicines and medical equipment for both humans and pets, helping to build trust in the stability of critical resources during the pandemic. Examples of this theme are given below:

- “How the authorisation, maintenance and supervision of human & veterinary  will be safeguarded during #COVID19: read more in a plan published today by EMA, EU Member States and the @EU_Commission  <https://ema.europa.eu/en/news/european-medicines-regulatory-network-fully-mobilised-fight-against-covid-19>” - @EMA_News 28/05/2020
- “@EU_Commission, EMA & national competent authorities have issued guidance on regulatory flexibility to ensure availability of #veterinary medicines  during #COVID19:  <https://ema.europa.eu/en/news/regulatory-flexibility-ensure-availability-veterinary-medicines-during-covid-19-pandemic>” - @EMA_News 06/07/2020
- “Emer Cooke: EMA & the  Network have built a solid foundation that protects public and animal health in Europe. Citizens in the EU can trust that the  they take are safe, effective and of high quality, which is especially relevant in moments of crisis like #COVID19 #EMA25Years” - @EMA_News 06/07/2020

The theme of “inclusion”, with it’s sub-theme on including the general public to participate into meetings and have their voices heard was found in 4 posts (3.8%). For example

“Have your voice heard !! Register to make an intervention during the EMA public meeting on 11 Dec that will inform citizens about our role in the #COVID19 pandemic and regulatory procedures in EU https://ec.europa.eu/eusurvey/runner/SpeakerApplicationForm_EMAPublicStakeholderMeetingCOVID-19” - @EMA_News 25/11/2020

“ EMA will organise a second public meeting on 8 January 2021 to inform EU citizens about new #COVID19vaccines  Registration is open until 31 December: <https://ema.europa.eu/en/news/ema-organises-second-public-meeting-about-new-covid-19-vaccines> #EMAPublicMeeting2” - @EMA_News 28/12/2020

The least emphasized themes in the EMA tweets were “combating unauthorized and fraudulent medicines,” “promoting action,” and “expression of empathy,” each found in just 2 posts (1.9%). The only sub-theme identified under “promoting action” was “virtual meetings – social

distancing” and for “expression of empathy,” the sub-theme was “appreciation and thank you messages.” Examples of each are provided below:

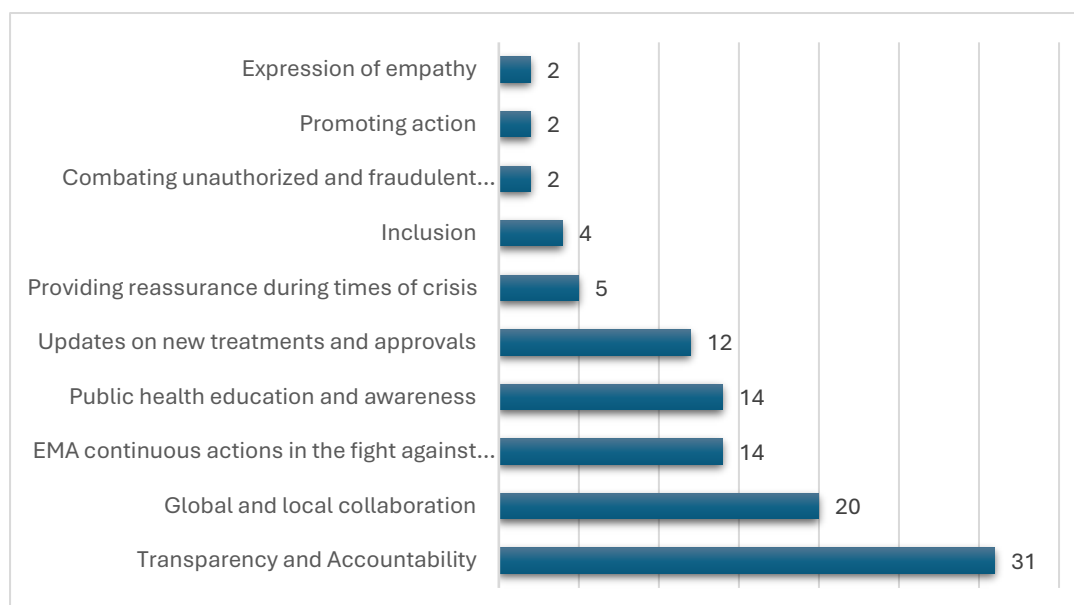
“After authorisation, EMA is urging citizens not to get #COVID19 vaccines from unauthorised websites & vendors aiming to exploit fears during #COVID19. Citizens should follow official vaccination programmes rather than seeking out alternative sources of vaccines. #EMAPublicMeeting”- @EMA_News 11/12/2020

“EMA’s first Management Board meeting of 2020 was shortened and held virtually in view of the rapidly changing situation in the context of the #COVID19 pandemic. Read the highlights of the meeting: <http://ema.europa.eu/en/news/ema-management-board-highlights-march-2020-meeting>” - @EMA_News 20/03/2020

“A big thank you 🙏 to our network of #HealthcareProfessional organisations for their support to EMA during these challenging times of pandemic. The doctors, nurses and pharmacists they represent are putting their health on the line to help #COVID19 patients.#HealthWorkers”- @EMA_News 29/04/2020

Figure 2, provides a visual representation of the frequency of the themes identified within the EMA Twitter communications.

Figure 2: @EMA_News - Frequency of tweet themes

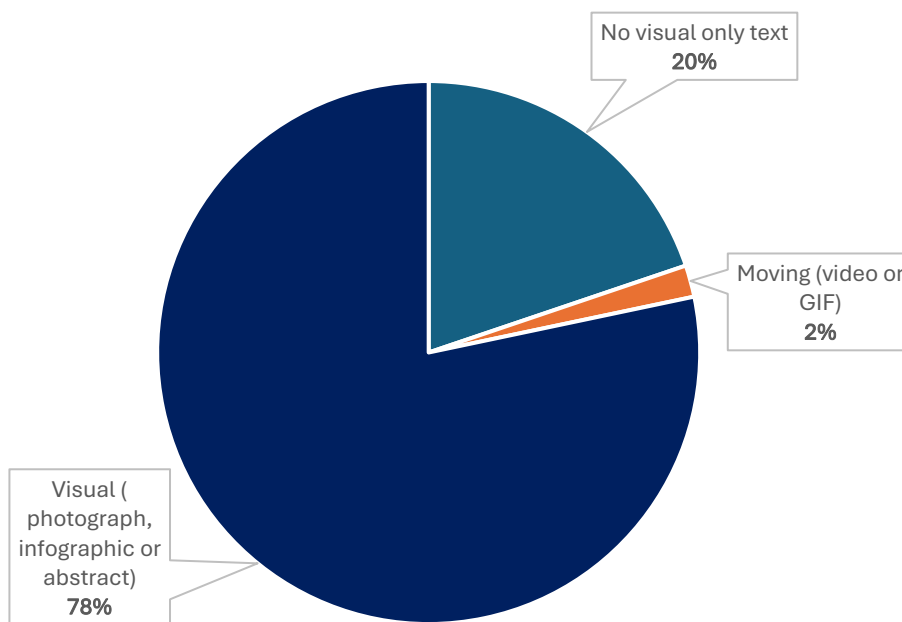


5.1.1. EMA's usage of visualizations and linking

Of the 106 tweets analyzed, 86 (80%) included some form of visual content, such as photos, infographics, short videos, or GIFs, to enhance and reinforce their messaging, while 21 tweets (20%) relied solely on text, without incorporating any visual elements. Figure 3, illustrates the presence or absence of various types of visual aids used in EMA's tweets.

Additionally, a significant portion of the posts, 94 tweets (88.7%), contained a URL link directing the audience to specific pages on the EMA website, allowing users to access more detailed information on the topics briefly mentioned in the tweets. We believe that these elements helped the EMA engage the public more effectively by combining visual aids with easy access to further resources.

Figure 3: Distribution of visual content in EMA tweet



5.1.2. EMA tweets frequency in response to COVID-19

To better understand how the EMA utilized their Twitter platform and whether their communication evolved in response to the changing COVID-19 case trends, the researcher compared their Twitter activity with the number of new confirmed cases, which were retrieved from the "Our World in Data" COVID-19 database. Figure 4 presents the number of cases

identified in the EU from January to December 2020, while Figure 5 illustrates the frequency of EMA tweets during the same period.

As demonstrated by Swain et al.(2024), Europe experienced two major waves of COVID-19 in 2020, while the third wave varied significantly across countries. The first wave spanned from February 24 to April 12, 2020, the second wave from July 24 to November 8, 2020, and the third wave appeared at different times in different countries. By June 30, 2021, most European nations had experienced three waves.

During the first wave, which began in late February 2020, COVID-19 cases peaked in early April before sharply declining by mid-April. EMA's Twitter activity closely mirrored this pattern, with a sharp increase in tweets in March, peaking in April. As cases declined, the frequency of tweets also gradually decreased, showing a strong correlation between case numbers and EMA's communication during the first wave.

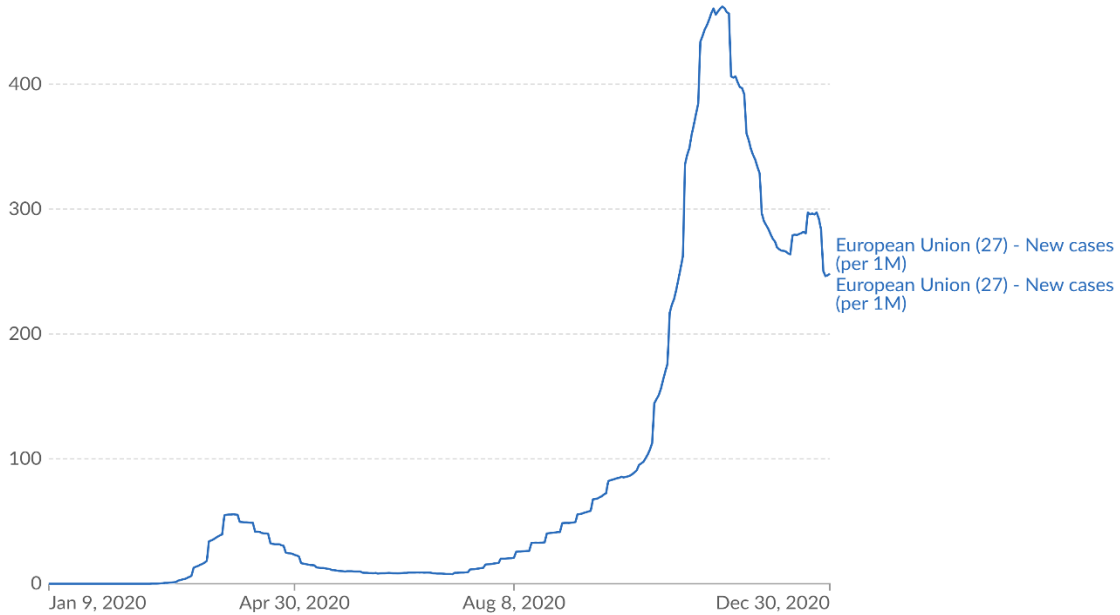
However, during the second wave, which began in late July 2020 and peaked in late October before declining by early November, EMA's tweet frequency did not align as closely with the rise in cases. While cases began to increase steadily from July, EMA's Twitter activity only started to rise significantly in October, with the peak in tweet frequency occurring in December, after the second wave of cases had already begun to decline. This shows a delay in EMA's communication response during the second wave, as their increased activity came after the peak in cases, not fully reflecting the real-time progression of the wave.

Figure 4: COVID-19 cases in the EU, January to December 2020 (Mathieu et al., 2020)

Daily new confirmed COVID-19 cases per million people, European Union (27)



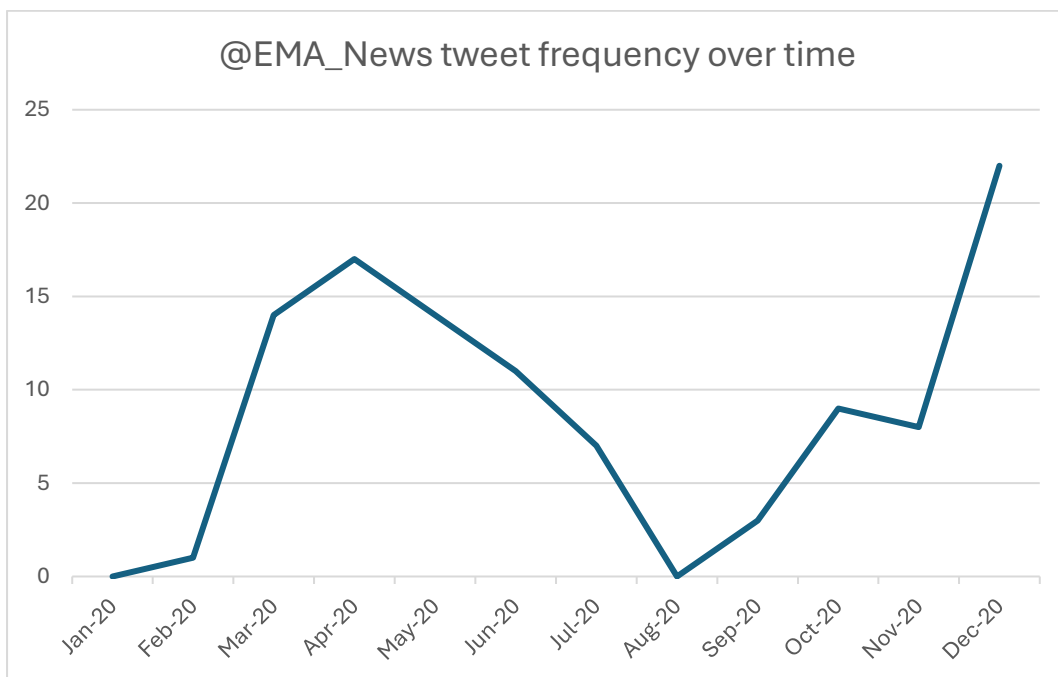
7-day rolling average. Due to limited testing, the number of confirmed cases is lower than the true number of infections.



Data source: World Health Organization (2024); Population based on various sources (2024)

CC BY

Figure 5: EMA tweets frequency from January to December 2020



5.2. Presentation of key findings: U.S Food and Drug Administration @US FDA

Out of the 270 tweets published by the Food and Drug Administration (FDA) during the first year of the COVID-19 pandemic, 110 (40.7%) were related to updates on the FDA's ongoing actions in combating the pandemic. This made the theme of "FDA continuous actions in the fight against COVID-19" the most prominent. Table 4 provides a detailed breakdown of the main themes and subthemes, organized by frequency. Throughout the first year, the FDA consistently shared updates almost daily, highlighting its ongoing efforts to protect public health and contribute to the fight against the pandemic. Below are some examples of tweets that support these findings:

- *“FDA is committed to working around the clock to help expedite the availability of #COVID19 tests. Learn about our latest actions to address and expand testing availability: <https://go.usa.gov/xdFMu>” - @US_FDA 13/03/2020*
- *“FDA works every day to tackle #COVID19. Here’s a look at our latest activities . <https://fda.gov/news-events/press-announcements/coronavirus-covid-19-update-daily-roundup-july-14-2020>”- @US_FDA 08/07/2020*
- *“The FDA continues to combat #COVID19. Read about our latest activities in today’s Daily Roundup . <https://fda.gov/news-events/press-announcements/coronavirus-covid-19-update-daily-roundup-june-23-2020>”- @US_FDA 24/06/2020*
- *“FDA works tirelessly to protect public health and support health care providers during the #COVID19 pandemic . Here’s a look at what we did over the weekend and today. <https://fda.gov/news-events/press-announcements/coronavirus-covid-19-update-daily-roundup-june-8-2020>” - @US_FDA 09/06/2020*

Table 4: FDA Frequency of themes and sub-themes

| @US_FDA | | | |
|---|--|--------------------|--------------|
| Theme | Sub-theme | Frequency in Total | |
| | | No. | Percentage |
| FDA continuous actions in the fight against COVID-19 | | 110 | 40,7% |
| Public health education and awareness | Informing the public and answering questions | 31 | |
| | Information on pet safety during COVID-19 | 3 | |
| | Vaccine safety | 3 | |
| | | 30 | 11,1% |
| Updates on new treatments and approvals | New approvals or conditional authorizations on COVID-19 treatments | 29 | |
| | Updates on COVID-19 Treatments | 1 | |
| | | | |
| Combating unauthorized and fraudulent medicines | | 27 | 10,0% |
| Promoting action | Virtual meetings - social distance | 0 | |
| | Hand hygiene & wearing mask | 6 | |
| | Personal protective equipment | 1 | |
| | Mindful grocery shopping practices | 3 | |
| | Blood and plasma donation | 10 | |
| | | | |
| Transparency and Accountability | | 18 | 6,7% |
| Providing reassurance during times of crisis | Medicine and medical equipment availability beyond COVID-19 | 6 | |
| | Food supply remains safe during COVID-19 | 4 | |
| | | | |
| Global and local collaboration | | 7 | 2,6% |
| Expression of empathy | Appreciation and thank you messages | 4 | |
| | Acknowledging the suffering | 2 | |
| | United against the virus | 1 | |
| | | | |
| Inclusion | Meetings including general public participation | 2 | |
| | Translations of key documents | 1 | |
| | Racial and ethnic minorities | 1 | |
| | | | |
| TOTAL of posts | | 270 | |

The next most frequently appearing themes were focused on "public health education and awareness," including its sub-themes, which were identified in 37 tweets (13.7%). These tweets aimed to educate the public on various aspects of COVID-19 and directed individuals to the FDA's website for accurate information on their most common questions. Closely related, the theme of "updates on new treatments and approvals," along with its sub-themes, appeared in

30 tweets (11.1%). These tweets highlighted the FDA's role in providing timely information on newly approved or authorized COVID-19 treatments, ensuring the public stayed informed about the latest medical advancements and regulatory milestones. In addition, the theme “combating unauthorized and fraudulent medicines” appeared 27 times (10%) highlighting the importance of raising public awareness about unapproved or fraudulent COVID-19 treatments and ensuring access to safe, authorized products. Examples of each theme and sub-theme will be shown below:

- *“What is a novel #coronavirus?”*
- *What is COVID-19?*
- *How can I prevent COVID-19?*
- *What treatments are available for COVID-19?*

Get answers to these questions and more on our #COVID19 FAQ page: <https://fda.gov/emergency-preparedness-and-response/mcm-issues/coronavirus-disease-2019-covid-19-frequently-asked-questions>” - @US_FDA 15/03/2020

- *“If your pet needs medical attention during the #COVID19 pandemic, & you are social distancing, FDA intends to temporarily suspend certain regulations that may make it easier for a vet to help you from the comfort of your own home . <https://fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-helps-facilitate-veterinary-telemedicine-during-pandemi>”- @US_FDA 24/03/2020*
- *“Why are vaccines so important to helping end the #COVID19 pandemic? Here’s the answer from FDA Commissioner @SteveFDA... #AskDrHahn #FDAVaccineFacts” - @US_FDA 04/011/2020*
- *“Today, FDA issued an emergency use authorization (EUA) for the second vaccine for the prevention of #COVID19 caused by SARS- CoV-2. The emergency use authorization allows the vaccine to be distributed in the U.S for use in individuals 18 years and older. <https://fda.gov/news-events/press-announcements/fda-takes-additional-action-fight-against-covid-19-issuing-emergency-use-authorization-second-covid>”- @US_FDA 19/12/2020*
- *“FDA issued an EUA today for a combination diagnostic test that can test for the viruses that cause flu & #COVID19. This move can help health care providers during the COVID-19 pandemic prepare for the flu season with faster & more comprehensive results. <http://fda.gov/news-events/press-announcements/coronavirus-covid-19->*

[update-fda-authorizes-additional-covid-19-combination-diagnostic-test-ahead-flu](#)” - @US_FDA 03/07/2020

- “FDA has a task force dedicated to closely monitoring for fraudulent products as part of our #COVID19 response. Be wary of anyone claiming their product can prevent or cure this virus and report sellers you suspect of making misleading claims here: <https://fda.gov/safety/report-problem-fda/reporting-unlawful-sales-medical-products-internet>” - @US_FDA 22/07/2020
- “Yesterday, FDA issued 5 warning letters to companies making false or misleading claims that the products they sell can mitigate, prevent, treat, diagnose, or cure #COVID19 in people. <https://fda.gov/consumers/health-fraud-scams/fraudulent-coronavirus-disease-2019-covid-19-products>” - @US_FDA 07/04/2020

The next most commonly occurring themes were "promoting action" and its sub-themes, appearing in 20 tweets (7.4%). These tweets encouraged proactive behaviours such as practicing hand hygiene, wearing masks, minimizing unnecessary trips for groceries, and donating blood and plasma to support those in need. The theme of "transparency and accountability" appeared in 18 posts (6.7%), highlighting the FDA's commitment to providing clear updates on regulatory actions and maintaining transparency. For example:

- “The best way to prevent the spread of #COVID19 is by washing your hands with plain soap and water for at least 20 seconds. If soap and water are not available, use hand sanitizer containing at least 60% alcohol: <https://go.usa.gov/xGB2m>” - @US_FDA 18/09/2020
- “Wearing facemasks and cloth face coverings in public can help slow the spread of COVID-19. Looking for information on the proper use of these? Check out this infographic : <http://go.usa.gov/xwsuk>” - @US_FDA 29/06/2020
- “When grocery shopping, buying just 1 to 2 weeks’ worth of groceries at a time can help to prevent unnecessary demand & temporary food shortages during the #COVID19 pandemic . Find more tips on how to safely grocery shop from FDA’s website. <https://fda.gov/food/food-safety-during-emergencies/shopping-food-during-covid-19-pandemic-information-consumers>” - @US_FDA 27/04/2020
- If you have fully recovered from #COVID19, you may be able to help patients currently fighting the infection by donating your plasma. Learn more: <https://fda.gov/emergency->

[preparedness-and-response/coronavirus-disease-2019-covid-19/donate-covid-19-plasma](#) - @US_FDA 16/04/2020

- *“In the spirit of transparency, FDA has posted a list of #COVID19 antibody tests that are being removed from the “notification list” of tests being offered under the Policy for Diagnostic Tests for Coronavirus Disease-2019 Tests . <https://fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-provides-promised-transparency-antibody-tests>” - @US_FDA 21/05/2020*
- *“The FDA is aware that some vials of the Pfizer-BioNTech #COVID19 Vaccine have contained extra product after five doses are obtained. The agency is working with Pfizer to determine the best path forward, and will share additional updates as we have them. <https://go.usa.gov/xAYge>”- @US_FDA 20/11/2020*

Additionally, the theme of "providing reassurance during times of crisis" and its sub-themes, "medicine and medical equipment availability beyond COVID-19" and "food supply remains safe during COVID-19," was found in 10 tweets (3.7%). These tweets focused on communicating the continued availability of essential medicines, medical equipment, and the safety of the food supply, helping to reassure the public and build trust in critical resources during the pandemic. For example:

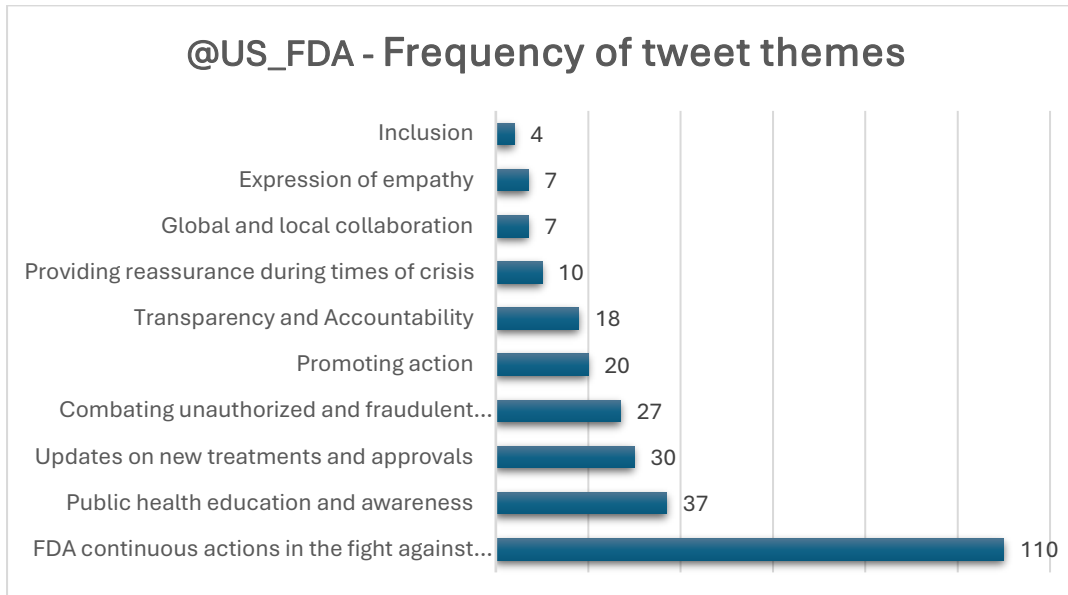
- *“FDA is facilitating efforts to diagnose, treat & prevent #coronavirus; monitoring medical product supply chains for shortages or disruptions; ensuring the safety & quality of FDA-regulated products; working to quickly facilitate access to investigational medical countermeasures” - @US_FDA 24/02/2020*
- *“During the #COVID19 pandemic, FDA is working around the clock to make sure Americans have access to safe food & medical products. Here’s an update on steps we’ve taken to mitigate supply interruptions: <https://fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-takes-further-steps-help-mitigate-supply-interruptions-food-and>”- @US_FDA 27/03/2020.*

The themes of “global and local collaboration” and “expression of empathy,” each appearing in 7 tweets (2.6%), along with “inclusion,” which was identified in only 4 tweets (1.5%), were the least frequently observed. Examples of each can be found below.

- *“Discover how FDA and the European Commission and its European Medicines Agency are collaborating on many scientific and regulatory fronts as part of our #COVID19 response. Read our latest #FDAVoices ! <https://go.usa.gov/xwADm>”- @US_FDA 25/06/2020*
- *“FDA is working with U.S. government partners, including @CDCgov, and international partners to address the #coronavirus disease 2019 (#COVID19) outbreak. For the latest updates, visit our website: <https://fda.gov/emergency-preparedness-and-response/mcm-issues/coronavirus-disease-2019-covid-19> – “@US_FDA 15/03/2020*
- *“On #WorldHealthDay, we give thanks to the hardworking health care workers in the United States and across the globe 🌍 especially during this difficult time as we seek to mitigate and combat #COVID19. Show your support & help #SlowtheSpread https://whitehouse.gov/wp-content/uploads/2020/03/03.16.20_coronavirus-guidance_8.5x11_315PM.pdf” - @US_FDA 07/04/2020*
- *“FDA staff members are like your family – we are a diverse organization reflective of this country – including mothers, fathers, daughters, sons, sisters, brothers & more. We know the pain that this country has gone through during the past year of the pandemic.” – Dr. Peter Marks - @US_FDA 12/12/2020*
- *“ FDA posted translations of the Pfizer-BioNTech #COVID19 Vaccine fact sheet for recipients & caregivers in languages including Burmese, Cherokee, Chinese (Simplified & Traditional), German, Haitian Creole, Hindi, Korean, Polish, Portuguese, Russian, Spanish, Vietnamese & Yiddish.” - @US_FDA 18/12/2020*
- *“Today, we announced that a public meeting of the Vaccines and Related Biological Products Advisory Committee will be held on Oct. 22, 2020, to discuss the development, authorization, and/or licensure of vaccines indicated to prevent #COVID19. <https://fda.gov/advisory-committees/advisory-committee-calendar/vaccines-and-related-biological-products-advisory-committee-october-22-2020-meeting-announcement>”- @US_FDA 27/08/2020*
- *“Friday, @FDAHealthEquity met with racial and ethnic minority leaders to help rapidly address concerns about some of America’s most vulnerable populations during the #COVID19 pandemic.” - @US_FDA 09/05/2020*

A visual representation of the frequency of the themes identified within the FDA Twitter communications can be found below:

Figure 6: @US_FDA- Frequency of tweet themes

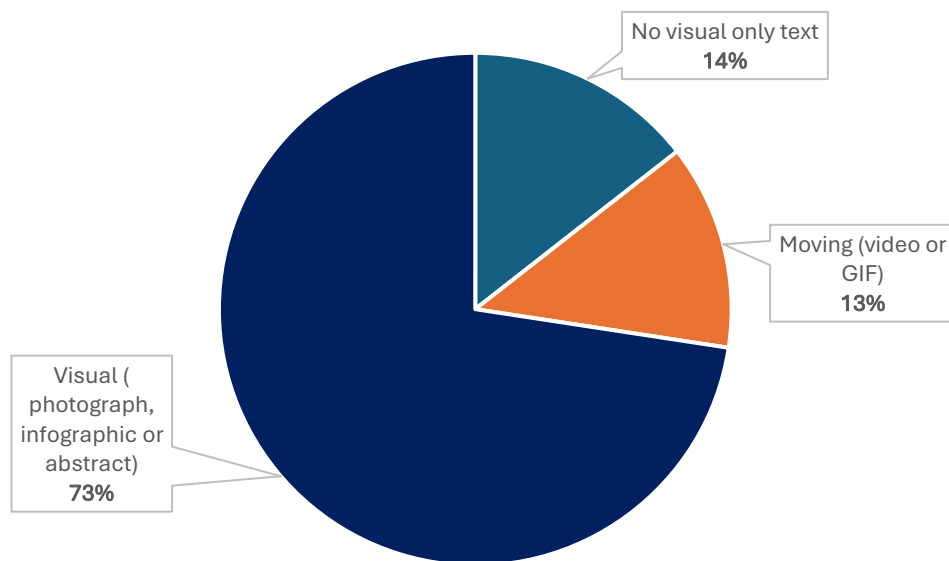


5.2.1. FDA's usage of visualizations and linking

The FDA incorporated visual elements like infographics and videos in 86% (231) of its tweets to strengthen and support their messaging and had 39 tweets (14%) with only text without any visual elements. Figure 5, shows the inclusion or absence of different types of visual aids in the FDA's tweets.

A significant portion of the posts, 260 tweets (96.3%), featured a URL link that directed users to specific pages on the FDA's website, providing more comprehensive information on the topics discussed in the tweets. We believe this method allowed the FDA to enhance public engagement by integrating visual content with easy access to additional resources.

Figure 7: Distribution of visual content in FDA tweet



5.2.2. FDA tweets frequency in response to COVID-19

According to Ngo and Dang (2023), the US faced three major COVID-19 waves in 2020: the first wave spanned from January to May, the second wave from June to September and the third wave extended from September 2020 to March 2021. This analysis aims to identify whether there is a correlation between the FDA's Twitter communication and the reported COVID-19 cases in the US. Figure 7 illustrates the number of COVID-19 cases from January to December 2020, while Figure 8 shows the frequency of FDA tweets during the same period.

We can observe that during the first wave, which peaked in April, the FDA's Twitter activity closely mirrored the rise in COVID-19 cases. There was a sharp increase in tweets from January, with tweet frequency peaking in April. Even as cases declined by late May, FDA tweet activity remained steady, indicating a strong correlation between case numbers and FDA communication during the first wave.

However, during the second wave, which peaked in late July, the frequency of tweets from the FDA did not closely match the with the increased cases. Even though there was an increase in cases from June tweet activity decreased in August before picking up again in September. This brief decrease in tweet volume during the peak of the second wave suggests a slight mismatch, between the FDAs communication and the actual progression of cases.

The third wave starting in September and peaking in December 2020, had the biggest rise in cases. FDA tweet activity matched this, hitting its highest level in December. This shows that the FDA increased its communication during the most critical time of the pandemic, especially as it shared information about vaccine approvals and distribution plans.

Figure 8: COVID-19 cases in the US, January to December 2020 (Mathieu et al., 2020)

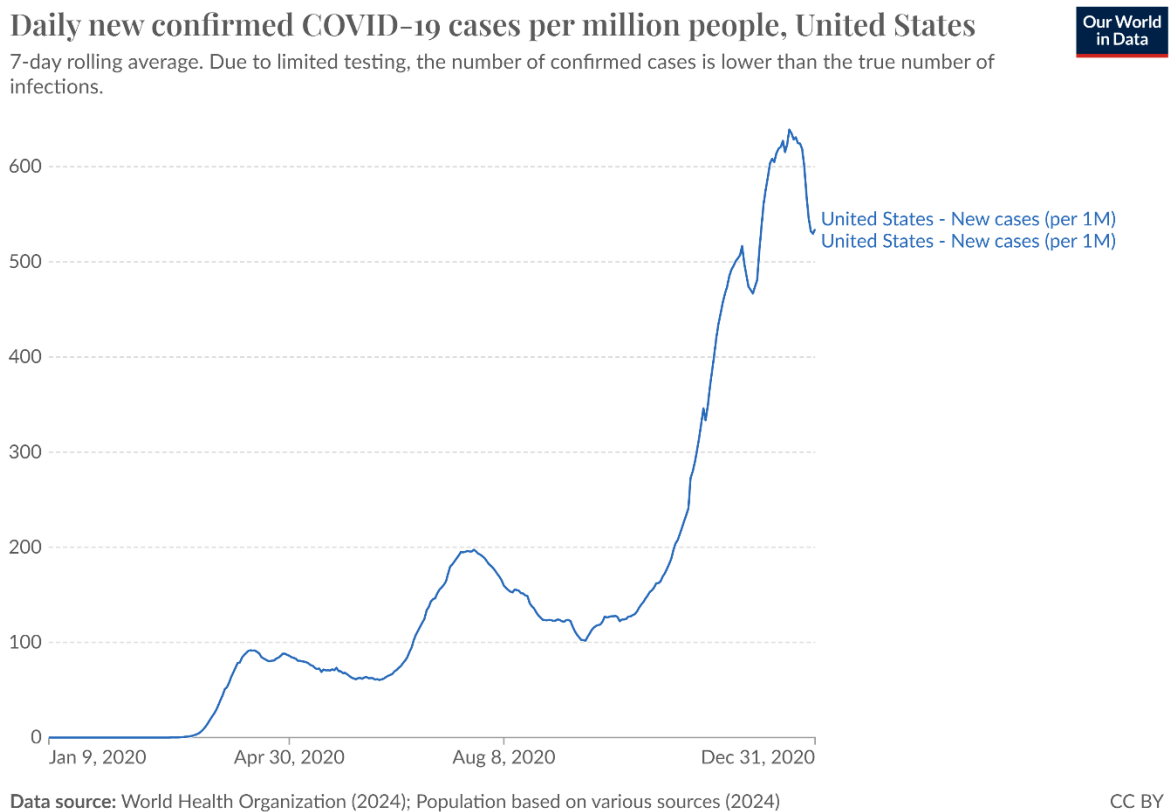
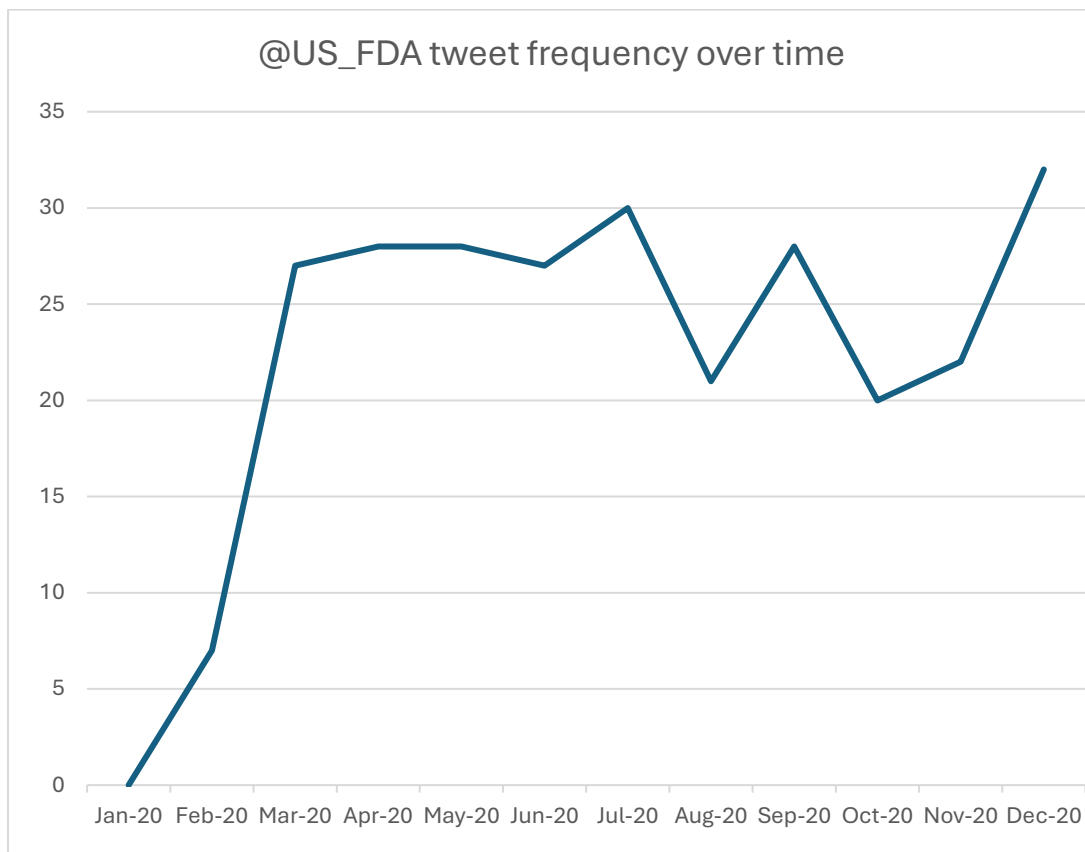


Figure 9: FDA tweets frequency from January to December 2020



6. DISCUSSION

This section will highlight and discuss the key findings of the study while addressing the efforts made to answer the proposed research question.

6.1. RQ1. What type of content was shared with the public to communicate about COVID-19?

The analysis of Twitter communications shows that both the FDA and EMA effectively and consistently used the platform to engage with their audiences during the first year of the COVID-19 pandemic. This aligns with findings by Neiger et al. (2013) and Choo et al. (2015), who demonstrated that Twitter is becoming an increasingly popular tool for sharing information and communicating with the public in healthcare settings.

As shown in Table 1, both organizations posted tweets on a regular basis each month, with the exception of January, when neither the FDA nor the EMA made any COVID-19-related posts. We believe this is likely because the virus initially emerged in China in late December and it didn't reach the EU and US until some time after that. Additionally, August saw no pandemic-related posts from the EMA, which could be attributed to August being a common vacation month in European Institutions. Notably, there is a significant difference in the number of tweets shared by the FDA compared to the EMA. The FDA made more extensive use of the platform, posting 164 more tweets, approximately 154.72% more than the EMA. While the reason for this is unclear, it presents an interesting topic for further research.

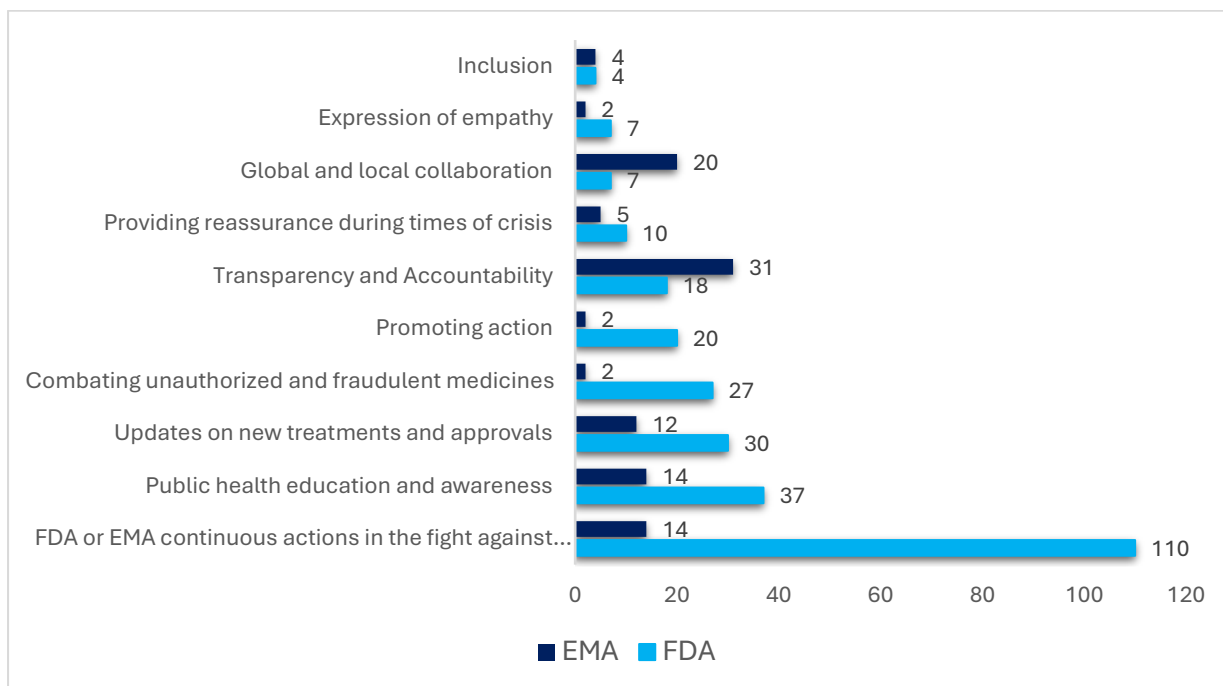
According to Figure 10 below, the FDA and EMA both covered all the key themes, but they each placed different levels of emphasis on certain themes. The details of their posting content were presented and discussed in depth in the results section of this study.

The most striking difference was in the FDA's focus on continuous actions against COVID-19, which made up a substantial 40.7% of its total communications compared to just 13.2% for the EMA. This highlights the FDA's highly proactive approach, emphasizing frequent updates and actions taken in response to the pandemic. The FDA also placed more emphasis on public health education and combating unauthorized and fraudulent medicines, reflecting its commitment to keeping the public informed and tackling misinformation.

On the other hand, the EMA placed greater importance on transparency and collaboration, which accounted for a larger share of its communications (29.2% and 18.9%, respectively). This suggests that the EMA adopted a more measured, trust-building approach, focusing on sharing information and fostering partnerships rather than emphasizing continuous action.

In summary, while both agencies addressed all key themes, the FDA prioritized ongoing actions and public education, whereas the EMA concentrated more on building trust and fostering collaboration, marking a significant difference in their communication strategies during the pandemic.

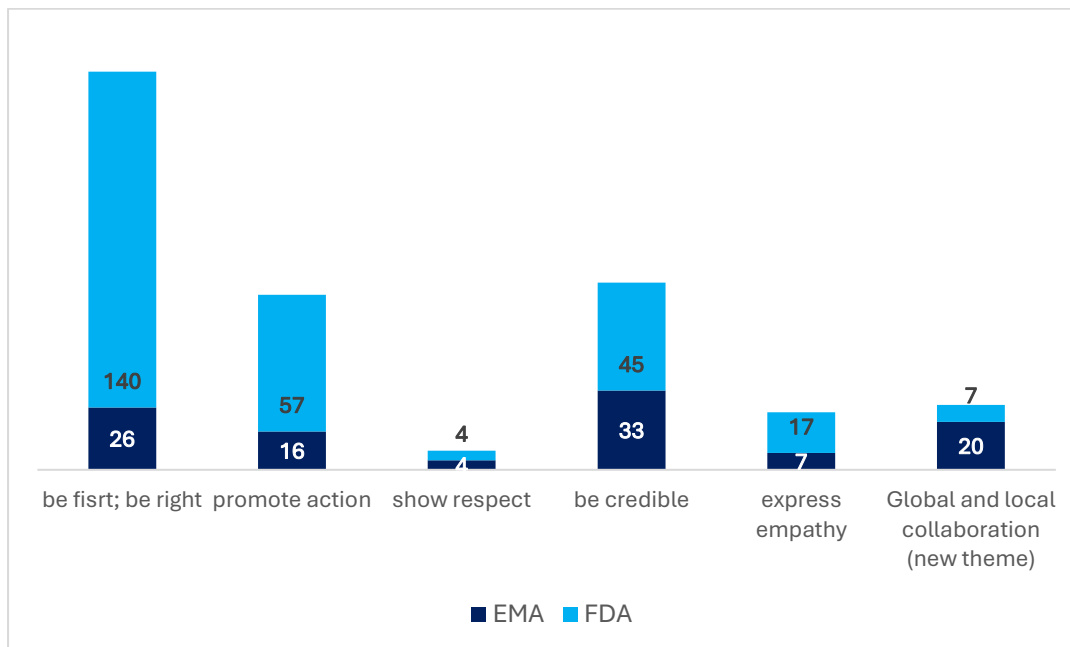
Figure 10: Twitter communication themes comparison FDA vs EMA



6.2. RQ2. To what extent did their tweets align with the six principles of CERC framework: be first, be right, be credible, express empathy, promote action, and show respect.

The findings discussed above highlight that both the FDA and EMA incorporated all six principles of CERC in their tweets. The link between the identified themes and CERC framework is explained in Table 2 and Figure 11 illustrates how often the CERC principles appeared in the Twitter messages from both parties, revealing that the principles did not appear equally often.

Figure 11: Frequency of CERC principles identified in FDA and EMA tweets



The data showed that the "be credible" principle is the CERC principle that aligns strongly between both organizations and is the most prominent one in the EMA communications. This principle was consistently highlighted in Twitter messages, focusing on preventing the distribution of unapproved or fraudulent COVID-19 treatments by ensuring the public was informed about these products and had access to safe, authorized alternatives. Both organizations demonstrated transparency by providing clear updates on the performance, removal, or authorization of COVID-19 tests and clinical trials, promoting informed decision-making. Accountability and transparency are essential to the CERC principle of "Be Credible" and were demonstrated by the FDA and EMA through their commitment to honest communication.

Additionally, both organizations included URL links in their messages, directing readers to further information. Most of these links led the public to their official websites, reinforcing credibility and ensuring access to reliable sources. This also aligns with the roles of the EMA and FDA, which are to ensure the safety, efficacy, and monitoring of medicines and medical products, facilitate access to them, and provide accurate, science-based information to the public (*European Medicines Agency (EMA)*, n.d.; *Food and Drug Administration (FDA)*, n.d.)

While this analyses showed a strong emphasis on the 'be credible' principle, with frequent efforts to prevent the spread of misinformation and promote transparency, this stands in contrast to the findings of (Li et al., 2021). Their study demonstrated that, overall, governments and public health agencies utilized Twitter less frequently to combat misinformation during the COVID-19 pandemic. This suggests that while some organizations were proactive in addressing misinformation, most did not use social media as effectively for this purpose.

The most striking difference in communication was the prominence of the “be first” and “be right” principles in the FDA's messaging, which appeared in 51.85% of tweets (140 tweets) compared to 24.53% (26 tweets) for the EMA. This highlights the FDA's proactive approach, focusing on frequent updates and decisive actions in response to the pandemic. Additionally, the FDA emphasized the principle of “promote action,” showing its dedication to keeping the public informed and addressing misinformation and encouraging proactive behaviours.

On the other hand, the EMA placed greater importance on collaboration which is not a direct principle of the CERC framework but emerged as a key theme from the data analyzed. This suggests the EMA took a more measured, trust-building approach, emphasizing collective responsibility and partnerships over continuous action. This theme also appeared in some of the FDA's tweets but on a smaller scale.

Furthermore, according to the Reynolds and Seeger (2014) the principles of “expression of empathy” and “showing respect” are key for managing public anxiety in uncertain situations and for promoting cooperation and rapport. However, these two principles were the least used by both organizations in their communications. It is the researcher’s assumption that, because these principles relate to emotional engagement, they were likely underemphasized by these organizations, which are both science-driven and typically rely on more fact-based, objective communication strategies.

Further research on this topic could be potentially interesting, as it might provide deeper insights into how science-focused organizations, such as the FDA and EMA, balance emotional engagement with fact-based communication. Understanding the reasons behind their limited use of empathy and respect in public messaging could reveal important considerations for improving communication strategies during public health crises.

6.3. RQ3. Did their Twitter communication evolve in alignment with the changing COVID-19 case trends in the EU and US?

In response to RQ3, the evidence from Figures 4, 5, 7, and 8 reveals a nuanced pattern in the alignment between FDA and EMA Twitter activity and COVID-19 case trends. Both agencies showed strong correlation during the first and third waves of the pandemic but exhibited misalignment during the second wave.

During the first wave (January-May 2020 in the US and February-April 2020 in the EU), the FDA and EMA increased their tweet frequency in line with rising cases, indicating a responsive communication strategy aimed at informing the public during the most critical periods.

However, in the second wave (June-September 2020 in the US and July-November 2020 in the EU), both agencies showed a lag in communication. The FDA reduced its tweet volume during the peak, while the EMA's activity increased only after the wave had passed. This misalignment suggests that both organizations under-prioritized timely updates, potentially reducing the effectiveness of their public health messaging.

During the third wave (September 2020-March 2021 in the US and varying times in the EU), both agencies realigned their communication efforts with case trends. The FDA's tweet frequency peaked in December, coinciding with the vaccine rollout, while the EMA also increased communication in late 2020, emphasizing vaccine-related information.

This realignment suggests that both the FDA and EMA adapted to the public's and health professionals' needs during the vaccine distribution phase. The EMA granted conditional marketing authorization (CMA) for the BioNTech and Pfizer vaccine on December 21, 2020 (EMA, 2021), while the FDA made the vaccine available under emergency use authorization (EUA) on December 11, 2020 (FDA, 2021). It is likely that both agencies increased their communication efforts during this period to educate the public and encourage vaccination. By enhancing their communication at this critical time, both agencies likely aimed to raise awareness and promote vaccine uptake in line with the broader vaccination efforts.

7. LIMITATIONS

This study has several limitations. It examined only the Twitter communications of both regulatory agencies, even though they also used other social media platforms like Instagram, YouTube, and Facebook. Additionally, significant portions of their key messages were disseminated through press releases on their official websites. Without a comprehensive analysis of all their communication channels, it is difficult to determine to which extent the CERC framework was applied. Additionally, the study did not evaluate how effective their communication strategies were, so it's hard to determine how successful their efforts were.

However, this study provides valuable insights into how the CERC framework was used in the Twitter communications of the FDA and EMA. Further research is needed to evaluate how similar health authorities can refine the application of CERC in their communication strategies during future public health emergencies.

8. CONCLUSION

This study is one of the few that shows how health regulatory agencies, like the FDA and EMA, can use Twitter strategically during a crisis. It's not clear if these agencies were intentionally following the Crisis and Emergency Risk Communication (CERC) framework, but their tweets align with its six principles in some ways. However, the study found a few gaps in their crisis communication from a CERC perspective. Additionally, the FDA and EMA had different communication strategies, highlighting their unique priorities and approaches to managing the COVID-19 pandemic.

The findings reveal that the FDA adopted a notably more proactive approach than the EMA, with 40.7% of its communications focused on providing frequent updates throughout all phases of the COVID-19 pandemic, compared to just 13.2% for the EMA. This higher volume of tweets reflects the FDA's emphasis on keeping the public informed, combating misinformation, and promoting public health measures. In contrast, the EMA's less frequent posts suggest a more measured strategy, concentrating on delivering transparent and credible messages which made 29.2% of its posts while emphasizing collaboration with key stakeholders in the fight against COVID-19 which made 18.9% of its posts.

A key difference between the EMA and the FDA is that they operate within different regulatory environments and as discussed by Ghadianian and Schafheutle (2024) both authorities have their own authorization procedures requirements which we believe significantly shapes their communication approaches.

The EMA operates independently within the EU to ensure the safety and effectiveness of medicines and medical devices for humans and animals. It assesses new products, monitors those already on the market and offers guidance to healthcare professionals and the public to uphold high standards of quality and safety. While the EMA can recommend the authorization of medicines, it does not have the authority to grant marketing approval in individual EU countries; this responsibility lies solely with the European Commission (European Medicines Agency & Authorisation of Medicines, n.d.; European medicines regulatory network & European Medicines Agency, n.d.).

Given its role in coordinating and supporting over fifty national authorities across the EU, the EMA works closely with various national competent authorities in its member states. This collaboration means that national laws and regulations may also apply, adding complexity to the EMA's operations. This responsibility requires the EMA to communicate in a cautious and carefully crafted manner to ensure consistency and accuracy across different regulatory environments (European Medicines Agency & Authorisation of Medicines, n.d.; European medicines regulatory network & European Medicines Agency, n.d.).

By doing so, we believe the EMA helps maintain public trust and clarity about medicine safety and regulations throughout the EU, emphasizing unity and collaboration in line with the EU's principles. This approach may also explain their more conservative Twitter strategy, with posts focused on collaboration and credibility.

In contrast, the FDA serves as the centralized and authoritative regulatory body in the United States, overseeing a wide range of products, including medicines, foods, cosmetics, biologics, and medical devices. It centrally manages the drug development process within a single country, allowing for uniform enforcement of regulations and maintaining consistent standards for safety, efficacy, and quality. As the sole federal authority for drug approvals, the FDA has a direct and significant impact on public health policy (BIOMAPAS, n.d.; FDA, n.d.).

Given its prominent role, the FDA is expected to be the primary source of reliable information on health matters. This expectation drives its proactive communication approach, where the agency frequently provides timely updates to the public. We believe that by providing these

constant updates, the FDA aims to build and reinforce public trust in its efforts, demonstrating transparency and responsiveness. This strategy is crucial in combating misinformation and promoting public health measures, ensuring that the public remains well-informed and confident in the FDA's role, especially during health crises like the COVID-19 pandemic.

Despite these differences, both organizations strongly emphasized the "be credible" principle from the CERC framework. Both aimed to provide timely information and updates while preventing misinformation, which aligns with Lima et al. (2020), who highlighted the importance of governments and health authorities using social media to share accurate information during public health crises like COVID-19.

Lastly, it's important to note that the principles of "expression of empathy" and "showing respect" were underutilized by both organizations which highlights the importance of investigating how science-driven organizations, such as the FDA and EMA, manage the balance between emotional engagement especially during a crisis and factual communication.

Gaining insight into why these agencies limited the use of empathy in their public messaging could offer valuable guidance for improving communication strategies in future public health crises.

This presents a potential area for future research, which may further enhance the communication strategies of health regulatory bodies.

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