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## Chapter

# Lesson on Misinformation in the COVID-19 Era

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## Abstract

The COVID-19 pandemic has been accompanied by a massive infodemic, that was exacerbated by the global scale of the emergency. The word infodemic derives from information and epidemic, the term was first used to refer to an abundance of information on a certain topic, displayed in a very short period of time and regardless of the information's quality. During the last 2 years, scientific journals were under tremendous pressure to publish information on COVID-19 as quickly as possible, releasing articles that had not been peer-reviewed, which led to an overabundance of information that was propagated rapidly and ultimately retracted after further investigation. The consequences of this infodemic are unprecedented, they went from mistrusting treatments and intervention measures to consuming toxic substances that led to severe intoxication. Misinformation caused individuals to manifest panic attacks and other psychiatric illnesses, or even generated political crises encouraged by public discord promoted by fake news. The following work reviews the impact of misinformation so far through the COVID-19 pandemic.

**Keywords:** infodemic, COVID-19, fake news, pandemic, misinformation

## 1. Introduction

In December 2019, the mass media spoke about a new virus that caused atypical pneumonia, and on January 30, 2020, the World Health Organization (WHO) declared an international emergency state. The disease had spread throughout the world creating a need for information never seen, the COVID-19 pandemic, was the first in history where technology and social media were used to help people to stay safe, informed, productive, and connected, at the same time, this technology enables a large volume of information associated with the disease was shared very quickly. The misinformation and rumors appeared, the manipulation of information with doubtful intent [1]. The infodemic problem was so serious during the first months of the pandemic that Tedros Adhanom Ghebreyesus, WHO general director declared "We are not just fighting with a pandemic, we are fighting an infodemic".

It was estimated that prior to the pandemic approximately 4.5% of the total searches made on Google worldwide were related to health issues [2], the search for

health-related information intensified, especially in the month of March 2020, when, according to Google Trends page, searches for the term COVID alone accounted for 89% of all Internet searches in the United States [3].

We live in an information technology era, and technology allows us to collect data in unimaginable amounts. One assumption about information is that it is true. The most important difference between information, misinformation, and disinformation is the truth, misinformation, and disinformation are untrue. Misinformation denotes “wrong or misleading information” Disinformation is wrong information, and it is known falsehood. Disinformation is “the dissemination of deliberately false information”.

In 2017, only 19% of Mexicans had plenty of trust in newspapers, 18% trusted in radio news, and 17% in television news. In other words, 80% of the Mexican population distrust these sources of information. In economically developed countries, such as the United States, where trust indexes in the media reached over 70% during the 70s, there has also been a significant decrease in the last two decades. Between 1999 and 2015, notes a Gallup poll, the trust index of Americans regarding their information media has decreased from 55 to 32%. And more indicative, the same Gallup survey reveals that among the population between 18 and 40 years of age, which are daily users of electronic networks, only 26% indicate to have confidence in the information media such as newspapers, radio, or television [4]. The data are worrying, among other things, they indicate the imminent disappearance of fundamental institutions for an active and socially informed political life, as well as for a broad and well-founded public debate which is necessary for adequate public health. In an exceptional situation, such as the pandemic, this trend is even worse.

In a pandemic context where social media and networks are the main sources of information and communication among individuals and communities, the efficiency of such conversation has to be questioned. Undoubtedly, networks presuppose connectivity, but not all connectivity presupposes successful communication. With social media, the general population becomes an information disseminator. The publication of information is no longer exclusive to professional media institutions, in this context, the information available is very unequal. Exposure to different media and information sources will lead to totally different outcomes in terms of behavioral decisions. For example, in China, in information dissemination, “who says” is more important than “say what” for the Chinese public’s trust judgment [5].

## **2. Effects of media on the pandemic**

There is a correlation between media use and public health behavior during health emergencies. During the COVID-19 pandemic, the mass media (newspapers, radio, and television) have had a positive effect on public health protection behaviors (e.g., washing hands, wearing face masks, and isolating health care). Objective, accurate, and timely news reports can reduce risk perceptions. Social media, on the other hand, provided new sources of information and platforms for public expression which facilitates access to knowledge and misinformation.

### **2.1 Positive effect**

The information was shared through social media faster than during the pandemic. The health workers could quickly share data regardless of geographic location. The treatment update system was very efficient, according to the evidence that

appeared it was changed. The health workers could discuss the treatment and their results with colleagues from all over the world. Finally, thanks to social media, it was possibly better management of crises by harnessing social media tools.

For the general population, it was an easy way to obtain government announcements and instructions in the management of crises. Many infographics with key points were developed and distributed via social media.

## **2.2 Negative effect**

The health workers received a big volume of information that becomes overwhelming, the information they received was associated with their beliefs, and they received a lot of misinformation and disinformation.

The general population received false information of manipulated content, a lot of propaganda, and not verified data, there was a panic transmission [6].

## **2.3 COVID-19 infodemic**

The COVID-19 pandemic was closely associated with technology and the use of social media. For a few months, many countries established quarantine periods, social life stopped, schools were closed, and employees were forced to do home office and stay connected through the use of the network. In those first months more than ever in Internet history, humanity used it not only to work, and stay in touch with their loved ones but also to stay informed, consequently, social networks have become the scenario in which social life was maintained, and was there where the infodemic has spread and remained. The use of social networks increased by between 20 and 87% worldwide during the pandemic [7].

The word infodemic derives from information and epidemic [8], the term was first used by Eysenbach to refer to an abundance of information on a certain topic, in a very short period of time and regardless of the information's quality, the information may be true or false, and just like the disease, it spreads worldwide. According to the WHO, an infodemic is an overabundance of information, online or in other formats, including deliberate attempts to spread misinformation to undermine the public health response and promote other interests of certain groups or individuals [2, 9]. The misinformation bases its credibility on the use of scientific language.

## **2.4 Infodemic contribute to misinformation**

Misinformation associated with health issues is not a phenomenon unique to COVID-19, also occurred, in the case of vaccination, where the anti-vaccine groups played a fundamental role in the resurgence of preventable diseases that were practically eradicated, like the case of measles and polio, making them a public health problem once again.

Misinformation is extremely risky as it calls to question the credibility of health institutions and programs, creating confusion and mistrust. The misinformation generated by the infodemic puts human health at risk due to: the distorted communication of facts with weak scientific evidence; and the spread of pseudoscientific theories [10]. Some media have filled their pages with unscientific recommendations and instructions, rumors, manipulated information, and conspiracy theories. The topics that have generated the most controversy is the origin of the virus, its transmission mechanisms, its clinical picture, treatment, and epidemic statistics.

Health misinformation may have effects on health-related behaviors, attitudes, and knowledge, but more importantly, misinformation coil creates the impression that no consensus exists on a topic or that official sources of information are not credible.

During the pandemic beginning there were poor sources of information but a large volume of it, conferences, webinars, and articles, making it hard to find information of quality.

Global access to cell phones with an internet connection has led to the exponential production of information, suddenly, digital health, and related concepts appeared in every conversation regarding the health system's response to the pandemic. Despite being technical concepts, the current situation has brought them to the forefront of all discussions and decisions about the pandemic response [11]. It is important to understand that Information and even more health information, has an intrinsic power to generate an influential impact on consumers. During the COVID-19 infodemic, the generation of information had increased exponentially, but the quality of the information was highly variable and, in some cases, the information presented was false, or reliable scientific data were distorted, leading to disinformation.

The main issues of low-quality information are that is promoted without restrictions, without involving peer reviews, does not require any verification by professionals, and because of the type of language it uses, it is ideal for dissemination on social networks. It is precisely on these sites where it self-amplifies, and moments of crisis such as the COVID-19 pandemic become ideal for socially spreading false ideas, including conspiracy theories. Population beliefs are greatly impacted by public culture and public figures, with reference to COVID-19, much has been said, such as the source of the infection, misleading and inaccurate statistics, infectivity and infection patterns, clinical presentation, diagnosis, preventive measures, treatment, and immunity are some of the topics which have been addressed. Political leaders had shared messages on social media platforms, creating an environment of ambiguity and concern through the influence they represent. For example, in the early stages of the pandemic, President Jair Bolsonaro of Brazil described COVID-19 as a simple cold [12]. Similarly, Donald Trump, at the time President of the USA, told the American public to "not fear Covid-19" [13]. In fact, it has been found that initial government announcements concerning the COVID-19 pandemic only briefly raised public attention [14]. In this sense, it is important to clarify that the trivializing comments of public figures and authorities have the potential to further increase the dangers caused by the infodemic.

A study analyzed the content related to COVID-19 on Tiktok, where 85.5% of the videos were uploaded by consumers and only 14.5% were from the WHO. The main topics of the videos uploaded by consumers were anxiety (14.5%), quarantine (10.3%), and less than 10% of the total content covered topics such as viral transmission and symptoms. According to the Center for Health informatics at the University of Illinois, in March 2020 around 550 million tweets included the terms coronavirus, covid19, covid-19, covid\_19, or pandemic [15].

In some countries, health workers were attacked as a result of misinformation distributed on social networks, such as the supposed extraction of fluid from the knees of patients with COVID-19 to sell it, neuron-killing thermometers, and fingerprint-stealing oximeters, among many other rumors, these sorts of rumors complicated the management of health and pandemic prevention programs.

A great percentage of the fake news and misinformation was generated and shared by common users. According to a study by the Center for Health Informatics at the University of Illinois, in the month of March 2020 some 550 million tweets included the

terms coronavirus, corona virus, co-vid19, covid-19, covid\_19, and pandemic. This was a worldwide phenomenon, at the beginning of the confinement period in Italy, there was an exponential increase in the volume of tweets, which peaked around the day the United States declared that the pandemic had become a national emergency. Of the total number of tweets, 35% came from the United States, 7% from the United Kingdom, 6% from Brazil, 5% from Spain, and 4% from India. The gender distribution was almost equal, although men tweeted slightly more (55%). With respect to age, 70% of all tweets were produced by people over 35 years of age; this was followed by the children and adolescents (under 17 years of age) group, with 20%. By March 2020, 361,000,000 videos were uploaded on YouTube in the categories of “covid-19” and “covid 19” [11].

## **2.5 Infodemic and science**

During the first-year scientific journals were under great pressure to publish COVID-19 information as quickly as possible, releasing articles that had not been peer-reviewed, which became a two-edged sword, since at that moment physicians and researchers were just learning about the virus in a dynamic process in which knowledge was adjusting as more information about the virus and its chameleon-like clinical manifestations was generated. The knowledge generated about the pandemic by the world's health and sciences sector had political repercussions in the decision-making process of governments, so that in the race to publish during the pandemic, results have been misinterpreted and false conclusions were reached in the studies. By accelerating the time of publication, the required quality goals in the health area were not being met. Such was the case of the studies on the therapeutic use of hydroxychloroquine, a drug that was withdrawn from the treatment protocols for COVID-19 after a group of researchers wrote to the *Lancet* pointing out several anomalies in an article previously published in the journal, in which it was concluded that patients treated with this drug had an increased risk of dying and experiencing cardiac arrhythmias. Among the irregularities reported, there was the use of data not obtained legitimately, the data was from a company called Surgisphere, which, refused to release the data requested by a group of scientists to validate the published study. The *Lancet*, which is perhaps the most prestigious medical journals, retracted the paper [16]. The authors that were not linked to the Surgisphere company wrote that they could not guarantee the veracity of the primary data sources. Surgisphere did not agree to release the requested data, arguing that it would violate the confidentiality of its clients. Days later, WHO restarted the hydroxychloroquine protocols [17].

The misinformation generated around COVID-19 had a profound impact on many areas, for example, the National Institute of Public Health in Japan published an article in which the author reviewed the features of successful information and communication technologies approaches against COVID-19 and categorized them into the patient registry, clinical decision support, telemedicine, contact tracing, and digital quarantine. They found that tracking patients and their contacts were imperative to public health in the fight against infectious diseases. Johns Hopkins University Department of Public Health, Baltimore, Maryland, USA, developed an interactive geographical information service to display the number of confirmed cases of and deaths caused by COVID-19 on a map and make it easier to visualize and act into controlling the spread.

## **2.6 The infodemiology of misinformation**

As evidence of the information excess surrounding COVID-19, we did a simple example; Google is the most widely used tool search worldwide, a search using the

terms COVID-19 was performed, as a result, Google showed more than 13.7 billion results, and when the term SARS-CoV-2 was used, 619 million results were shown. If the search was performed using Google Scholar tool, which is a search engine specialized in information from the world of education and science, and whose results come from trustworthy information sources that are selected by means of an algorithm that allows the platform to verify their quality, the term COVID-19 showed 4,850,000 results, while the term SARS-CoV-2 showed 222,000. Using PubMed, which is a search engine that allows the content of the MEDLINE database to be consulted, the most important database for medical literature in the world, associated with the National Library of Medicine of the United States, the term COVID-19 showed 126,607 results and the term SARS-CoV-2 showed 64,649. It was interesting to compare this search with another disease, also viral, which has affected the entire world for 30 years, acquired immunodeficiency syndrome (AIDS). The amount of information generated in just a few months about COVID-19 makes clear the magnitude of the infodemic we are facing, and its impact in terms of the quality of the information generated (**Table 1**) [18].

The speed at which information was being generated is unprecedented, but the quality of the information is worrying. When using a non-specialized tool such as Google, the term COVID-19 shows 30 times more results than the term AIDS; Google Scholar shows a similar number of links for COVID-19 and AIDS, and using a very specialized search engine such as PubMed, the number of links for the term AIDS is 3.5 times greater than the term COVID-19; this is associated to the people who perform the search and their level of knowledge and, therefore, to the information quality [18].

Disinformation in terms of science, technology, and health is not unique to COVID-19, what is characteristically unique to the COVID-19 pandemic is the role that social networks played in transmitting disinformation on an unprecedented social scale. Far from being beneficial, the volume and type of information that circulated around this virus generated pernicious social responses and attitudes. As the population was kept in quarantine or isolation with the latent risk of contracting COVID-19, individuals began to experience psychosocial stress and various health effects, thus generating interest in knowing and learning about the disease, however, general population is not educated to perform quality searches on the Internet, as a consequence, they search for information using basic tools such as Google or Yahoo, which exposed them to false news, rumors, etc.

Vosoughi et al. analyzed the differential diffusion of all of the verified true and false news stories distributed on Twitter from 2006 to 2017, 126,000 stories were tweeted by 3 million people more than 4.5 million times. They observed that falsehood diffused significantly farther, faster, deeper, and more broadly than the truth in all categories of information, interestingly the effects were more pronounced for false political news than for false news about terrorism, natural disasters, science, urban

	COVID-19	SARS-CoV-2	AIDS	HIV
Google	13,740,000,000	619,000,000	1,650,000,000	1,420,000,000
Google Scholar	4,850,000	222,000	4,540,000	3,220,000
PubMed	126,607	64,649	11,742	17,321

**Table 1.** *Number of links displayed by search tools using the terms COVID-19, SARS-CoV-2, AIDS, and HIV. (Search conducted on October 20, 2022.)*

legends, or financial information, the fake news diffused significantly faster and deeper than trustworthy information [19].

Disinformation can be classified into three main groups, the most common being misleading content, which represents 29% of the total information, which contains some true information, but in which the details have been rephrased and recontextualized in such a way that they become false or misleading. The second form of misinformation is the use of videos or images of events that are labeled as something new or different. Finally, there is disinformation where the content is totally invented. Public figures play an enormous role in disinformation dissemination; therefore, some platforms have vetoed them for this reason. Especially when these public figures are politicians, there is the risk of disinformation spreading through other media such as television or radio [20].

To understand the individual characteristics of those who share and consume fake news, many studies have been carried out, in demographic terms, age seems to be important, in the case of COVID-19 it was found that the adult group shared and believed less in fake news compared to young people, except in Mexico, where the adult group is more likely to share false information, either for political gain or social consensus [21–23]. Another factor was education level, those individuals who have developed analytical thinking, numerical ability, or reflexive versus intuitive thinking, detect fake news better and shared them in a lower proportion [24–26]. People who believe in COVID-19 conspiracy theories generally rejected information coming from scientists, and thus do not respect the health guidelines established to contain the pandemic [27]. Several authors agree with this and found as a common denominator that people or groups that disseminate disinformation have less trust in science, scientists, journalists, and governments, and are generally linked to a socially conservative tendency [28].

## **2.7 Misinformation and its outcomes**

It has been shown that disinformation causes significant abnormal behaviors, for example, in India, a father decided to commit suicide after being diagnosed with COVID-19 in order not to infect his children [29]. The rumors of a national shutdown in the US caused people panic, crowding stores and supermarkets, and viciously buying huge quantities of toilet paper. The images on the news created a heightened sense of insecurity. In Mexico, people began to receive via WhatsApp messages about government support in cards granted by the welfare Secretary and the treasury secretary, in these messages the recipient was asked to send personal information with the supposed purpose of opening a bank account that would be used to deposit the resources. In this way, many people were swindled by obtaining loans in their names. Messages were also sent about the total closure of supermarkets, causing people to take to the streets, desperate to buy food, generating panic, and anxiety in those who were in quarantine.

Disinformation was also used to sell toxic products, such as chlorine dioxide, which was already sold to “treat” illnesses such as malaria, diabetes, asthma, autism, or cancer, and during the pandemic, it was marketed as a substance capable of preventing infection by the virus, despite the fact that no health institution in the world recognized it as a treatment. Chlorine dioxide is a disinfectant used to clean medical equipment and treat wastewater [30], however, at high concentrations and non-physiological pH, it inhibits microbial and viral activity [31]. Studies have shown that exposure to high doses of chlorine dioxide causes thyroid suppression,



DNA damage, and neurotoxicity in several animal models [32–35]. It is therefore understood that chlorine dioxide is not safe for human consumption. In fact, the Food and Drug Administration (FDA) issued a paper on the adverse health effects due to the ingestion of this substance; however, without considering the lack of scientifically based information on its use in cases of COVID-19, the government of La Paz, Bolivia, authorized in September the treatment of people infected with COVID-19 with chlorine dioxide. In Mexico, this substance is freely offered and sold on social networks and there is no data on the number of people who use it [4]. Other conspiracy theory that stand out where that the 5G network was the means of transmission of COVID-19, which led to the burning of signal antennas in the UK, or that the virus was created by Bill Gates to introduce a microchip in the vaccine and obtain control over the population. On the other hand, there were those who propose that it was a virus conceived as a biological weapon in a laboratory. According to a group of American experts who evaluate trends on the Internet, about 30% of Americans supported this theory, while others preferred to hold on to the theory that the whole pandemic was a lie of the government to rob citizens of their freedom, and that in the best of cases it was a common flu [36]. These types of phenomena had an impact on health, nutrition, and, obviously, on the psychosocial aspect of populations. All these rumors, reduce the legitimacy of scientific findings by creating a social stigma around COVID-19, which compromises quarantine and isolation measures, risks, and jeopardizes the worldwide vaccination campaign.

To understand the success of misinformation it is necessary to understand that individual needs coherence between his beliefs and the information he receives, if a new idea fits properly with the previous ones, it tends to be accepted; but if not, it is likely to be rejected [37]. It is also important to consider emotions since they influence the acceptance or rejection of beliefs.

## **2.8 Infodemic management**

Eysenbach should be considered the first infodemiologist in the world since he began to study this field two decades ago, he proposed a graphical wedding cake model, to describe how the information is generated during the pandemic, the cake had 4 different actors that he represented in cake layers as follows: (1) Science, (2) policy and practice, (3) news media, and (4) social media. The layer size is proportional to the amount of information generated by each actor.

Science is the smallest layer and it contains rigorous and selective information, during the pandemic some articles were retracted as we have mentioned before, but these do not represent more than 0.1% of the published articles during the first pandemic year. Social media is the largest cake layer, due to the large quantity of unfiltered and uncontrolled information generated or amplified (**Figure 1**) [2, 38, 39].

Eysenbach proposes that misinformation must be handled based on the following pillars:

1. Information monitoring (invigilance) and data analysis and information patterns on the internet (infodemiology) [38, 39].
2. Building eHealth literacy and science literacy capacity of all stakeholders.
3. Encouraging knowledge refinement and quality improvement processes such as fact-checking and peer-review [40].



**Figure 1.**  
Each layer represents the proportion of information that is generated and the number of users that use it.

4. Facilitate, accurate and timely knowledge translation, minimizing distorting factors such as political or commercial influences [41].

## 2.9 Where do we go from here?

By October 2022, the pandemic has been somewhat controlled, but definitely not eradicated, the death number by the third week of October exceeds 6.5 million. Health misinformation on social media, requires greater action from those working in public health research and practice.

Internet users tend to look for information closer to their views, ignoring that which is discordant with their ideology, and from polarized groups. Social media companies and governments put on a great effort to remove false information about COVID-19, but the measures taken in this regard are only reactions that occur when the information is already circulating. Sources of disinformation should be identified and, if not blocked, they should be marked as false or dubious without being censored since, it is clear that guaranteeing freedom of expression is very complicated when disinformation is disclosed.

The WHO has made agreements with social media companies such as Facebook, Google, LinkedIn, Microsoft, Reddit, Twitter, and YouTube in order to detect misinformation and present updates from official agencies, to this end, some companies have already implemented algorithms to detect disinformation and quickly remove it from their platforms [42].

Due to a large amount of misinformation during the COVID-19 pandemic, the WHO proposes seven measures to flatten the curve of the infodemic.

1. Evaluate the source, and check the veracity of the information. It even proposes some reverse search engine tools to corroborate that the source is trustworthy.

2. Go beyond the headlines, as these can be misleading to get large amounts of views.
3. Identify the author.
4. Check the date.
5. Examining the evidence, since reliable sources support the information with citations, statistics, studies, etc.
6. Evaluate our own trends, that is, identify the reasons that make us feel attracted to an article, and what is our interpretation.
7. Verify that the information is true [21].

Very few authors have dared to recommend legal measures against the publication of false or manipulated health information, for several jurists, the criminalization of intentionally sharing health misinformation acknowledges the wrongful violation of the right to life and liberty. On the other hand, for anti-criminalization supporters, creating policies controlling health misinformation and disinformation goes against freedom of speech and a free flow of information. Countermeasures that would suit both points of view can be awareness campaigns for patients and health-care professionals, the creation and dissemination of easy-to-navigate platforms with evidence-based data, the improvement of health-related content in the mass media by using high-quality scientific evidence, the increase of high-quality online health information and improved of media literacy [43].

There is an increase in information consumption and communicative virality, so the verification of information is elementary in all areas, the “fast checking,” which is defined as “an operation that applies techniques of data journalism to unmask mistakes, ambiguities, lies, lack of rigor or inaccuracies of some content published in the media” [44]. This term has gained importance due to the large amount of false information disseminated, which is promoted in the context of digitization, so there has been a need to develop specialized platforms to clarify and expose inappropriate or false information. The International Fact-Checking Network, is a non-profit organization dedicated to the fight against misinformation [26], and during the pandemic appear the #CoronaVirusFacts Alliance, work is looking for reliable primary sources, to analyze published information, and confirm or deny its veracity and quality, about the covid-19 pandemic. On his website users can access a database that detects false information published about covid-19, filters the results by country, classifies articles as “False,” “MISLEADING,” “MISSING CONTEXT,” “No evidence,” and “Partly false,” and the organization that published it.

### **3. Conclusions**

We summarize the most significant downsides of misinformation in the COVID-19 era in **Table 2**.

As it has been repeatedly shown, social networks have become a problem in the midst of the pandemic, since individuals seek information on these platforms to make sense of their situation. Unfortunately, this is where users find miracle prescriptions against COVID-19, the sale of diagnostic tests, and fake vaccines. It is through these

1. Increased mistrust of treatments such as vaccines
2. Promoted discord among the population generating political crisis
3. Generated collective hysteria
4. Generated panic, stress, and mental disorders in individuals
5. Association with poor distribution of resources
6. Increased of the creation of poor-quality content
7. Government intervention measures not accepted by society

**Table 2.**  
*Negative effects generated by misinformation on health decisions during a pandemic.*

networks that, for political purposes, epidemiological data are modified or misinterpreted creating a feeling of unease among citizens. Also, these rumors generate pressure on governments to make decisions on, for example, when to remove obligatory mask usage or whether to privilege economics over health.

Ironically, information and communication technologies have also helped to counter COVID-19-related misinformation, the WHO and other health organizations of many countries have ensured that accurate information is published. They have also blocked misinformation shared on social media and guided public information. Social media platforms also banned many accounts that propagated conspiracies related to COVID-19.

On that note, it is of the utmost importance that the population is educated on how to make quality searches for scientific information. As well as developing superior judgment on the information that they are receiving from different platforms. It is imperative that there is clear communication of the public health risks associated with disinformation. It is important to work on disinformation because of the consequences that affect health management and what that can mean in times of crisis, especially in countries such as Mexico, which is the second largest consumer of false news after Turkey, according to analyses of information made on social networks, and where the influence that disinformation can have on the behavior and decision making of individuals can be very significant.

Promoting and disseminating trustworthy health information is crucial for governments, health authorities, researchers, and clinicians to outweigh false or misleading health information disseminated in social media. Citizens, government, scientists, and physicians all need to be involved in the discussion about how information-heavy platforms should be monitored in order to be able, to counteract false promises and other forms of information alteration and abuse. Managing the COVID-19 pandemic and related infodemic requires efficient, regulated, and coordinated action from multiple sectors of society and government. Knowledge and pertinent information that people can use, adapted to their context, will continue to be crucial to fighting misinformation and saving lives as the pandemic evolves. Partnerships between social media companies and other agencies can offer opportunities to counter misinformation, for example, Facebook created a partnership with WHO and health ministries to promote links to verified content in their news sections [16], Facebook has also partnered with third-party fact-checkers to refute misinformation about the virus. These collaborations and initiatives have been promoted by the UN Special Rapporteur on freedom of expression and access to information, regional rapporteurs, and others [45].

## **Conflict of interest**

The authors declare no conflict of interest.

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