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(DIS)INFODEMIC: LESSONS FROM THE COVID-19 CRISIS

(DES)INFODEMIA: LECCIONES DE LA CRISIS DE LA COVID-19

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ABSTRACT

This review of disinformation during the COVID-19 crisis provides a theoretical, conceptual, and exploratory analysis of infodemic and disinfodemic in times of public health crisis. The article attempts to clarify what infodemic and disinfodemic are, within the framework of bioinformationalism, reflects on whether we are too late to tackle them, exposes the dangers for public health, democracies, and historical truth due to the rise of viral conspiracy theories, fake news, and smear campaigns against scientific and health authorities, and analyses the communicative role of scientists and journalists in resolving this health crisis.

Keywords:

Disinfodemic, disinformation, COVID-19, conspiracy theories, bioinformationalism.

RESUMEN

En esta revisión sobre la desinformación durante la crisis de la COVID-19 se hace un análisis teórico, conceptual y exploratorio de la infodemia y desinfodemia en tiempos de crisis de salud pública. En el artículo se intenta precisar qué son la infodemia y la desinfodemia, en el marco del bioinformacionalismo, se reflexiona si hemos llegado tarde para atajarla, se exponen los peligros para la salud pública, las democracias y la vedad histórica por el auge de teorías conspirativas virales, de noticias falsas y de campañas de desprestigio contra las autoridades científico-sanitarias y se analiza el papel comunicativo de científicos y periodistas en la resolución de esta crisis sanitaria.

Palabras clave:

Desinfodemia, desinformación, COVID-19, teorías conspirativas, bioinformacionalismo.

Translation by **Paula González** (Universidad Católica Andrés Bello, Venezuela)

1. INTRODUCTION

If the COVID-19 pandemic caused by the SARS-CoV-2 coronavirus has posed the greatest challenge to the well-being of humanity, in all its dimensions, since World War II (Gautam and Hens, 2020; Gutérres, 2020; International Energy Agency, 2020; Johnson, 2020; World Bank Group, 2020; Feuer, 2021), the hoaxes, lies, and conspiracy theories infecting the Internet and spread mainly from social networks - but also by mass media - about this pathogen have boosted threats to democracies, security, and citizens' health.

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The scientific community has warned: the disinformation pandemic has been, and continues to be, potentially as dangerous to society as the viral outbreak itself (Gallotti et al., 2020; Jolley and Lamberty, 2020; Patel et al., 2020; Solomon et al., 2020; Zarocostas, 2020). As noted by Tedros Adhanom Ghebreyesus, director general of the World Health Organization (WHO), "we are not just fighting an epidemic, we are fighting an infodemic; fake news spreads faster and more easily than this virus" (The United Nations Department of Global Communications, 2020).

Given this scenario, and with the perspective of time, after the onset of the pandemic in 2020, this article makes a non-systematic review of the concepts of infodemic and disinfodemic in the framework of bioinformationalism and the context of the COVID-19 crisis and presents an exploratory and critical analysis of the responses to the (dis)informative epidemic. For this purpose, the PubMed database and the Google Scholar search engine were used, introducing and combining the word "COVID" with key concepts such as "disinformation", "misinformation", "fake news", "infodemic", or "conspiracy" in the searches, to consult the literature published from the beginning of the COVID-19 pandemic, in January 2020, until August 2022. Complementarily, and with the idea of exploring the relationship between disinformation and conspiracy theories with the field of health, similar searches were repeated, changing the word "COVID" for "health", which was combined with the same concepts, in this case, without limiting the period, to also consult literature before the COVID-19 pandemic. In this exploration of the scientific-academic literature, the controversy about the impact and role of preprints in the COVID-19 pandemic emerged, so specific searches were also made with both words ("COVID" + "preprints"). Reference lists of selected articles were used to search for additional articles. In addition, a series of news and reports used by the author for the Science Journalism course he teaches at the Universidad Carlos III de Madrid was selected.

With all the selected information, the theoretical-conceptual, historical-referential, and critical analyses were assembled and organized into the following sections: in the first, we ask whether we are too late to tackle (dis)infodemics, a phenomenon that is not new and that began to be studied in the mid-1990s; in the second, we review the mechanisms of conspiracy theories and disinformation in health crises such as that of COVID-19 and examine the threats to our well-being, to democracies, and historical truth derived from the fabrication and viralization of health-related falsehoods; the third addresses the role of bad science and bad journalism in this health crisis and the negative impacts that science denialism and sensationalist journalism can generate, and finally, some brief conclusions are drawn.

2. INFODEMICS AND DISINFODEMICS: ARE WE LATE?

Infodemics can be conceived as outbreaks of over-information in which truthful news and data circulate along with false or unreliable ones that have effects on social dynamics and can substantially increase the spread of the natural epidemic (Gallotti et al., 2020; Tangcharoensathien et al., 2020). Similar to an epidemic, infodemic (information + epidemic) spreads between humans, but in this case through physical and digital communication and information systems.

Viruses are parasites that cannot survive on their own. Without a host, their existence is very short and their ability to spread is nil. So they look for ways to enter living organisms to feed on their cells and multiply, creating replicas of themselves. This is what happens with the SARS-CoV-2 coronavirus, the flu virus, or HIV, for example, but also with the Internet lie virus. Massive social networks such as Facebook, Twitter, Instagram, and

TikTok, or instant messaging services such as Whatsapp or Telegram are sort of meta organisms with hundreds of millions of cells (their users) susceptible to host the lie virus, replicate it, and spread it exponentially around the world, turning it into a disinfodemic (disinformation + epidemic), "more toxic and more lethal than disinformation on other subjects" (Posetti and Bontcheva, 2020a, p. 2). We are not talking, therefore, of social networks, but of infectious, or viral, networks, where disinformation finds its best hosts. In the framework of bioinformationalism (Peters et al., 2020), we should meditate on why "viral" is the word most associated with social networks, emphasized and adored by their users (especially by the so-called 'influencers', or aspirants to that viral status), as it is clear evidence of the infectious nature of these virtual spaces for online mass communication.

For Gallotti et al. (2020, p. 1286), there is a "growing consensus around the idea that the infodemic of news consumption should be analyzed through the lens of epidemiology, to gain insight into the role of online activities in the dissemination of trustworthy and untrustworthy news." An idea that, although invigorated by the COVID-19 pandemic, predates it with the proposals of Eysenbach (2002), who introduced the term "infodemiology," which he coined almost two decades before the SARS-CoV-2 pandemic to conceptualize "the epidemiology of (dis)information." Eysenbach places in 1996, almost at the dawn of the World Wide Web (launched in 1990), the first infodemiology study. That research (Davison, 1996) focused on the impact on health of the (mis)information that was already circulating on the primitive Internet about diets and healthy eating. It is a substantial fact that health, as we will explore in more detail below, is a very productive and lucrative area for viral lies creators. It is a substantial fact that health, as we will delve into later, is a very productive and lucrative area for the makers of viral lies. Eighteen years later, at the height of the SARS-CoV-2 coronavirus crisis, Eysenbach (2020), editor of the Journal of Medical Internet Research, noted that infodemiology had finally been recognized by public health organizations and the WHO as a scientific field; A delay that should also make us reflect on whether, as a whole, scientific, academic, health, and political authorities around the world, now so focused on (dis)infodemics, have been late - at least two decades late - in trying to identify and tackle epidemics of misinformation on the Web.

In Tomes (2020, p. E1311), the concept of infodemic "reflects the enormous effect that new information technologies have had on contemporary health communication". But, although digital communication and information technologies may be favoring, even more, these viral phenomena, intensifying them and making them more difficult to control, we should not forget that they already existed before the Internet era. In fact, "from the bubonic plague of the mid-14th century to the HIV-AIDS epidemic of the late 20th century, disease outbreaks have often stimulated torrents of confusing rumors, conspiracy theories, and improbable cures" (Tomes, 2020, p. E1311).

Although we have a vaccine against this virus - truthful and contrasted information - it seems to have demonstrated an insufficient rate of effectiveness when applied in the infectious networks of the Internet, where the exponential propagation capacity of lies seems to surpass the immune capacity of contrasted truth. Its speed and scale are such that we still have not found an effective way of slowing down or cutting off the contagion of lies and eradicating this global disease that affects social, political, and economic well-being. Information virologists know this: scientific studies have shown that false information reaches farther, faster, and more people than true information. For example,

in Vosoughi et al. (2018, p. 1146) we see that false information spreads "significantly farther, faster, and more deeply and widely" than true information "in all categories of information," although the impact is "more pronounced" in the case of false political news, which, after all, is the one that has the greatest ability to influence public opinion and, therefore, people's behavior. But more seriously: "Contrary to popular belief, robots accelerate the spread of true and fake news at the same rate, implying that fake news spreads more than the truth because humans, not robots, are more likely to propagate it" (Vosoughi et al., 2018, p. 1146). Lies are therefore not a technological evil, but a human disease. Without obviating that the so-called "social bots" that are designed to contribute to the viralization of lies on the Internet act according to algorithmic orders created with human biases (Ferrara et al., 2016; Baptista and Gradim, 2021; Noble, 2018; Shahid et al., 2022).

3. COVID-19, THE PERFECT PANDEMIC TO CONSPIRE AGAINST

Political lies are not the only ones that spread through the Internet. Health is a very productive and lucrative area for the manufacturers of *viral* lies, knowing that it is one of the issues that most concern citizens and that most queries and interest arouse on the Internet, where many contents are of dubious or no quality and reliability (Daraz, 2019), from Google searches, to the consumption of videos on platforms such as YouTube, to an overwhelming presence of pseudo-experts and pseudo-scientists who spread misinformation, dangerous advice, biased opinions, and false narratives in traditional media, on social networks, and other content platforms on the Internet (López-Cantos and Millán-Yeste, 2018; Naeem et al., 2020; *Fuhrer* et al., 2021), generating a state of individual and collective pseudo-knowledge (Introne et al., 2018).

In the global crisis caused by the SARS-CoV-2 coronavirus pandemic, lies have also triumphed. This is evidenced, for example, by the report *Bulos sobre coronavirus*, edited by the Institute #SaludSinBulos, an initiative of the communication agency Com Salud in collaboration with the Asociación de Investigadores en eSalud (AIES): "Hallucinated conspiracies about the origin of the epidemic and bogus remedies for COVID-19 continue to dominate Twitter conversation " (Salud sin Bulos, 2020).

Kouzy et al. (2020, p. 1) determined, based on an analysis of messages posted on Twitter tagged with 14 *hashtags*, that "medical misinformation and unverified content related to the global epidemic of COVID-19 is spreading at an alarming rate on social networks". Behind such misinformation or false information are often non-health users. While Naeem et al. (2020, p. 143) highlight that "fake news is pervasive on social media, putting public health at risk".

Although many studies focus on Twitter because of the ease of downloading and analyzing massive data on this platform, the problem of health misinformation spreads across all social platforms, with video being a fertile ground for misleading content. A study on videos posted on YouTube related to COVID-19 found that "the medical content of these videos is suboptimal and needs to be improved" (Khatri et al., 2020), for which its authors call on government and health agencies to increase their online presence and consider YouTube as a popular source for the dissemination of reliable information. In the same vein, and after analyzing 69 reviewed studies, published between 2010 and 2021, on videos with false information about various diseases (including COVID-19) and vaccination on platforms such as Twitter, YouTube, and Facebook, Melchior and Oliveira

(2022) also call on health agencies and professionals to increase their online presence and improve the quality of health information on social networks to counteract the (dis)infodemic.

Jolley and Lamberty (2020) consider that the SARS-CoV-2 coronavirus crisis has been another "breeding ground for conspiracy theories", as have other diseases and health crises. In an article published in *The Conversation*, they comment:

> The belief that evil powers are hatching a secret plan is widespread in all societies, and they often refer to health. A 2019 YouGov survey found that 16% of Spanish respondents believe that HIV was created and spread around the world by a secret group. Meanwhile, 27% of French and 12% of British respondents were convinced that "the truth about the harmful effects of vaccines was being deliberately withheld from the public." (Jolley and Lamberty, 2020).

The problem has been of such magnitude, that the WHO itself created a web space to try to stop the virus of lies about SARS-CoV-2, denying the hoaxes that spread over the Internet about this coronavirus (Zarocostas, 2020).

Smith et al. (2020) decry the proliferation of messages and ads for false home and natural remedies to prevent and cure the coronavirus that are not only sterile, but in some cases "may also have counterproductive effects", and argue that, in the face of "unprecedented levels of misinformation, conspiracy theories, fake news, and rumors related to COVID-19", which jeopardize the fight against the pandemic, it is necessary to turn to reliable sources such as the WHO website:

> Social media and sensational news stories about the outbreak have generated panic and mistrust in the general public, not only diverting attention away from the outbreak response but also hampering the activities of already overburdened health professionals (Smith et al., 2020, p. 1426).

For example, Rocha et al. (2021) conducted a systematic review of studies addressing the impact of fake news on COVID-19 in patients and healthcare professionals worldwide, identifying psychological distress, panic, fear, depression, and fatigue. Sadly, "panic on social media travels faster than the spread of COVID-19" (Depoux et al., 2020).

Factories of lies have always existed, but it is in times of crisis (political, war, economic, social, health, or natural) when their production chain is at full capacity (van Prooijen and Douglas, 2017; Posetti and Matthews, 2018). And now, more than ever. Internet infection (social) networks are an extraordinary distribution channel for lies; the largest, fastest, and most effective ever created. Their (global) web-scale and immediacy make them the greatest weapon of mass destruction of truth that humanity has ever known (Fox, 2020).

But, to return to Jolley and Lamberty (2020), "conspiracy theories are not unique to our current time or culture."

> Research shows that conspiracy theories tend to emerge in situations of social crisis, such as when a terrorist attack takes place or sudden political changes or economic recessions occur. Thus, theories multiply in periods of uncertainty and threat when we seek to make sense of a world in chaos, with similar circumstances to those that occur with viral outbreaks, which explains the extent of conspiracy theories concerning the coronavirus (Jolley and Lamberty, 2020).

The links between situations of social crisis and the belief in conspiracy theories, we insist, are not something new, but have existed throughout human history (van Prooijen and Douglas, 2017).

> Evidence suggests that the aversive feelings people experience when in crisis (fear, uncertainty, and the feeling of being out of control) stimulate a motivation to make sense of the situation, increasing the likelihood of perceiving conspiracies in social situations (van Prooijen and Douglas, 2017, p. 323).

But there is a next phase that follows the process of conspiracy theory formation, when conspiracy theories "become historical narratives that can spread through cultural transmission", forming "the basis of how people subsequently remember and mentally represent a historical event" (van Prooijen and Douglas, 2017, p. 323). This is how, for example, in the context of the COVID-19 crisis, attempts have been made to construct a narrative without evidence or proof, only speculative - what populists and post-truth fabricators call "alternative facts" - about the origin of the SARS-CoV-2 coronavirus, for example, placing it in a leak from a laboratory, a conspiracy theory for some, scientific hypothesis for others, which to date has not been proven, but which has been taken as true by many citizens thanks to the impulse that has been given to conspiracy narratives (Nadesan, 2022), and which is opposed to the theory that seems to have had greater scientific consensus, that of the zoonotic origin through the "*spillover"* model (Borsetti et al. 2021; Ruiz-Medina *et al*, 2021; Frutos et al., 2022a, 2022b).

There are parallels between conspiracy narratives about the origin of SARS-CoV-2 and HIV, a virus that, despite scientific evidence that it was transmitted from monkeys to humans and the origin of the AIDS epidemic has been placed in 1920 in Kinshasa, capital of the Republic of Congo (Faria et al., 2014), not a few have maintained the falsehood that it is a laboratory-created virus, a biological weapon, or even that it does not exist (Nattrass, 2013), as some conspiracy groups have also maintained about COVID-19 (Henley and McIntyre, 2020). For example, a Pew Research Center survey conducted in March 2020, at the onset of the pandemic, found that 29% of Americans believed that SARS-CoV-2 was intentionally developed in a laboratory (Schaeffer, 2020). This claim without proof or evidence, at a time of uncertainty, was vented by US President Donald Trump himself, who gave "institutional legitimacy" to the conspiracy theory that the new coronavirus had been created in a Chinese laboratory, generating "strategic misinformation" (Jaiswal et al., 2020).

Beliefs in health-related conspiracy theories put us all at risk. One of their objectives is to cast doubt on health and scientific authorities, suggesting that they work at the service of an evil power that only seeks to cause harm to humanity (only an alienated person can think that scientists from all over the world, with different ideologies, cultures, interests, problems, life experiences, and circumstances, can secretly agree among themselves and with rulers from all over the planet to cause evil). This is what happens, for example, with the anti-vaccine movement, with stupid conspiracy theories of fanatics who put the lives of their children and others at risk (Jolley and Douglas, 2014). Conspiracy beliefs "figure prominently" in misinformation and in generating distrust of experts, and "it can be difficult to present evidence persuasively to refute these kinds of ideas, especially because experts are often seen as part of the conspiracy" (Jaiswal et al., 2020, p. 2776). Thus, perceived deception is a conspiratorial belief based on the conviction that authorities and officials engage in mass deception of society to achieve their malevolent ends (Wood et al., 2012).

Several studies have correlated belief in conspiracies with the rejection of science and endorsement of pseudoscience (Lewandowsky et al., 2013a, 2013b; Lobato et al., 2014; van der Linden, 2015; Lobato and Zimmerman, 2019) and with an attitude toward science as a field lacking credibility (Hartman et al., 2017), despite its methods of verification. A survey of 2,501 adults in England between May 4th and 11th, 2020, found that people with conspiracy beliefs were less likely to follow social distancing guidelines, wear a facemask, get tested, or accept a future COVID-19 vaccine, potentially endangering their own and other people's lives (Freeman et al., 2022). Roozenbeek et al. (2020) conducted national surveys between mid-April and early May 2020 in Ireland (n = 700), the United States (n = 700), Spain (n = 700), and Mexico (n = 700), and two separate ones in the United Kingdom (n = 1050 and n = 1150); overall, they found that there is a "clear link" between acceptance of misinformation and doubts about vaccines and a lower likelihood of compliance with health measures imposed or recommended by authorities. This rejection of scientific evidence and the generation and acceptance of misinformation and counter-empirical conspiracies pose serious health risks. In the context of the COVID-19 pandemic, an analysis of 100 million Twitter messages posted worldwide during the early stages of the spread of COVID-19, from January 22nd to March 10th, 2020, found that measurable surges of potentially unreliable information preceded the increase in COVID-19 infections, showing that "in a highly digital society, the epidemic and infodemic dimensions of COVID-19 co-evolve" (Gallotti et al., 2020, p. 1289).

The consequences of the disinfodemic have been dire, including the deaths of many people who have been "misled, leaving them unable to understand and apply science-based preventive measures" (Posetti and Bontcheva, 2020a, p. 3). For example, Islam et al. (2020) estimated that about 800 people persuaded by false claims died worldwide during the first quarter of 2020 as a result of consuming methanol as an antidote to COVID-19, more than 5,800 were hospitalized, and 60 were blinded. The victims had ignored the recommendations of scientific and health authorities.

For Jolley and Lamberty (2020), "researchers have shown that conspiracy theories related to medical emergencies have the power to increase distrust in health authorities, which can translate into difficulties for the population to take measures to protect themselves". No wonder, therefore, the furious attacks -mainly from populist and far-right movements, deniers of scientific evidence- that Fernando Simón, director of the Centre for Coordination of Alerts and Health Emergencies of the Ministry of Health, has received in Spain, collected in headlines such as the following: "Vox increases its criticism of the management of the coronavirus: "We are governed by psychopaths"[1], "Vox retweets a trick video showing Abascal throwing Simon over a cliff"[2]. Nor should we forget the statement of the then leader of the Partido Popular in Spain, Pablo Casado, accusing in March 2020 the Spanish Prime Minister, Pedro Sanchez, of "hiding behind the science"[3] in the coronavirus crisis, when there is no other solution to a viral pandemic than science and health. Something similar happened in the United States with the use of "strategic disinformation" encouraged by *Trumpism*, by "casting doubt on the evidence presented by Dr. Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases and member of the White House Coronavirus Task Force, validating and reinforcing pre-existing xenophobia and racism, and diverting attention from the White House's

[1] In Europa Press. https://bit.ly/3u4k2Oo
[2] In *El País*. https://elpais.com/politica/2020/10/05/diario_de_espana/1601892145_330683.html
[3] In eldiario.es. https://www.eldiario.es/politica/casado_1_1027440.html

inadequate and delayed response to COVID-19" (Jaiswal et al., 2020, p. 2776). Fauci, and the scientific community, came under direct attack from the nation's president himself, Donald Trump, who went so far as to declare at a rally, "People are fed up with Fauci and all those idiots"[4]. This marks a substantial difference with the case of Fernando Simón, since "in Spain, it would be unthinkable that a scientific spokesman would discredit the government as Anthony Fauci does with the president of the United States Donald Trump" (Elías, 2020, p. 20).

The problem has been of such gravity that a survey conducted by *Nature* of 321 scientists from various countries who participated in media and social networks to report and comment on the COVID-19 pandemic concludes that 81% of respondents experienced personal attacks or trolling at some time, 59% received some kind of attack on their credibility in social networks, 22% suffered threats of physical or sexual violence, 15% claimed to have received death threats, and six of the respondents said they had suffered physical attacks (Nogrady, 2021). Another *Science* survey of 510 researchers who have published work on COVID-19 found that 38.2% experienced some form of harassment or abuse, ranging from insults to death threats, whether on social media, by email or phone, and sometimes even in person (O'Grady, 2022).

We are, therefore, in a global scenario in which fake news, disinformation, and conspiracy theories combine with denialist and populist strategies to discredit health science authorities and "undermine trust in health institutions and programs" (The Lancet Infectious Diseases, 2020).

Science deniers, populists, and conspiracists put us all at risk. All it takes is for a few to listen to them, give credence to their fallacies, and ignore health regulations and advice to expose us all to a lethal virus. And not only this, but they also place us on the brink of hatred and social chaos:

> Just as false information about the 2019 Ebola outbreak in the Democratic Republic of Congo led to violence, mistrust, social unrest, and attacks on health workers, the evolving infodemic surrounding the COVID-19 pandemic is having real-life consequences around the world. Rumors, stigma (in particular, accusations that a specific population group is spreading the virus, leading to racist attacks), and conspiracy theories about COVID-19 can affect people's health and safety. They can also have wider social consequences, even for the health system, as well as for trust in democracies, authorities, governments, and institutions, ultimately exacerbating the likelihood of unrest. (Bentzen, 2020, p. 3).

This has been the case in many countries, where there have been protests, in some cases violent ones (Gómez and Ferrer, 2021), by COVID-19 pandemic and vaccine denialists and anti-health restrictionists. But there has also been stigmatization and hate attacks against specific groups, mainly against the Asian population living in the West (Bentzen, 2020; Giuffrida and Willsher, 2020; Inskeep, 2020).

> The spread of medical conspiracy theories can also have serious consequences for other social sectors. [...] the coronavirus outbreak has led to a worldwide increase in racist attacks on people with physical features typical of Far Eastern countries. (Jolley and Lamberty, 2020).

[4] In *El País.* https://bit.ly/3VMSBEL

Smith et al. (2020, p. 1426) also denounce the wave of hatred and racism against Far Eastern citizens, which has hit even health professionals: "The BBC reported[5] that a Filipino cardiology nurse in England was asked to "stop spreading the virus" when he was using public transport".

According to a Pew Research Center survey in the United States, conducted in June 2020, "about four in ten U.S. adults said it had become more common for people to express racist views toward Asians since the pandemic began" (Ruiz et al., 2020). That world leaders such as Donald Trump and even some media have dubbed SARS-CoV-2 as "the Chinese virus" is a further symptom of the racist and xenophobic disease spreading across the globe, driven by demagogues and populists who have occupied places of power and social relevance (Ren et al., 2020; Dhanani and Franz, 2021; Hswen et al. 2021; Holt *et al.*, 2022).

> Fear and disease stigma often go hand in hand and fearful minds can generate hatred or stigmatize a subgroup of the population. This stigma may be related to a particular race, region, ancestry, and country where the disease began, but may extend to continents and beyond. (Patel et al., 2020, p. 189).

These outbreaks have also occurred in Spain with expressions of hatred towards the population of Madrid[6], the main focus of the epidemic in this country. And many Spanish citizens have suffered episodes of xenophobia abroad as a result of this pandemic[7].

The *pandemic* of false information is not the only problem. Related to the infodemic and disinfodemic, Leung and Leung (2020, p. e156) identify the "geodemic of geopolitical considerations and nationalist populism that seems to be putting itself ahead of science in controlling the viral epidemic". The viral epidemic, the (dis)infodemic, and the geodemic close a triangle where millions of lives, knowledge and the economic well-being of a very large part of the world's population could be extinguished.

4. BAD SCIENCE AND BAD JOURNALISM

Ioannidis (2020, p. 1) warns of the existence of an "epidemic of false claims and potentially harmful actions" concerning the SARS-CoV-2 crisis and points to the urgent non-peer-reviewed scientific output that has been released on the web as *preprints* as one focal point of misinformation. Although an unprecedented global emergency such as the COVID-19 pandemic indeed requires a more agile and effective science -more attached to current events, something it is not used to due to its complex but necessary processes of production, evaluation, and publication-, the mass publication of research that has not passed the filter of peer review significantly increases the chances that other scientists and journalists will use erroneous, biased, unverified, or even false information and data, increasing the snowball of disinformation. This, of course, should not call into question the enormous and invaluable work that, as a whole, has been done by the international scientific community to understand this new virus and provide solutions (Ghebreyesus and Swaminathan, 2020). But it must be taken into account in the obligatory exercise for any scientist and journalist of knowing how to differentiate between good and bad science.

[5] On BBC: https://www.bbc.com/news/uk-england-norfolk-51465604
[6] In La Vanguardia: htmlhttps://bit.ly/3EK04gE
[7] In Euronews: https://bit.ly/3OC3IOl

Solomon et al. (2020) note that "the review of the science has an orthodoxy that at first glance seems unfit for a pandemic".

> The rush to publish in the COVID era has had some unfortunate consequences. While retractions will always be a part of scientific publishing, some high-profile retractions of COVID-19 articles have left the public unsure of what to believe, reducing their trust in the medical profession. Disputes between authors of COVID-19 articles have spilled over into the lay press, allowing the public to see that human frailties affect us all. (Solomon et al., 2020, p. 1807).

Precisely, one of how denialists feed their conspiracy theories is with the errors of science. And, obviously, the multiplication of preprints multiplies the published scientific errors. Before the COVID-19 pandemic, Abdill and Blekhman (2019) found that about two-thirds of preprints published in bioRxiv ended up being published in peer-reviewed scientific journals. Although the rate is considerable, it also suggests that this other third of unapproved papers that remain in open repositories can become a huge reservoir of scientific errors as their number increases, potentially confusing inexperienced journalists who risk publishing misinformation by turning to these preprints as sources of information, as they remain available online. For epidemiologist Gowri Gopalakrishna of the Amsterdam University Medical Center, "it is very difficult to look at the impact of preprints alone without considering how they have been used in the media" (Watson, 2022, pp. 4-5). And Bauchner (2017) warns that the use of preprints as references, in some cases, can "be devastating for some patients if the results that are made public before peer review are incorrect or misinterpreted".

The rise of these publications and their use as sources of journalistic information has led the Science Media Centre to urge researchers and press office managers to refrain from disseminating *preprints* until the findings are published in a peer-reviewed journal (Fox, 2020).

In the first ten months of the pandemic, when uncertainties about SARS-CoV-2 and COVID-19 were greatest, the scientific community published more than 125,000 articles related to the coronavirus and the disease it generates, of which nearly a quarter, 30,260, was hosted on *preprint* servers. In the first four months alone, up to the end of April 2020, more than 19,000 scientific publications had appeared, published both in scientific journals (12,679; approximately 65%) and on *preprint* servers (6,710; approximately 35%) (Fraser et al., 2021).

It is, therefore, a double-edged sword. The rise of *preprints* has been "both a blessing and a curse during the pandemic" of COVID-19, as they have allowed scientists "faster data sharing in a crisis" and "improve their work with feedback to researchers", but "they also open the door to attractive results from sloppy science that may find a public audience before critical review" (Watson, 2022, pp. 3-4) and which can have dire consequences: "The immediate and widespread sharing of medical and scientific information outside expert circles before it has been thoroughly vetted (e.g., *preprints*) can be dangerous, especially in a pandemic" (The Lancet Infectious Diseases, 2020). In this sense, Dinis-Oliveira (2020, p. 182), warns that some "overly speculative" *preprints* were shared "widely on social networks", provoking "fear and wrong decisions" among citizens.

But it is also fair to acknowledge that many *preprints* have been very useful, accelerating the dissemination and understanding of scientific findings on infectious disease outbreaks (Johansson et al., 2018), and in the case of COVID-19, in a way not seen in

previous epidemics (Watson, 2022). In an evaluation of bioRxiv and medRxiv *preprints* that were subsequently published in peer-reviewed journals up to April 30th, 2020, in the early phase of the pandemic, Brierley et al. (2022), found that most *preprints* did not differ substantially, in their abstracts, figures, or conclusions, from the final peer-reviewed versions.

Another question that arises is whether the accelerated pace of production of *papers* on COVID-19 in scientific journals may have relaxed quality controls, given the urgency of the pandemic. Although peer review is the main filter of scientific quality, it does not guarantee 100% reliability of all studies published in scientific journals. For example, the Retraction Watch database has recorded 35,000 retractions of published articles, with a current retraction rate of 0.1% (Oransky, 2022). This rate may have increased significantly during the SARS-CoV-2 crisis. In a qualitative analysis of peer review of manuscripts in medical journals, it was found that although COVID-19-related content was reviewed much faster than in pre-pandemic review processes, review reports do not appear to be less thorough, although different criteria were identified for COVID-19 articles that appear to be somewhat softer, "accepting of deficiencies that would not normally pass an editorial assessment or the journal's selection mechanism," in the face of needs due to the pandemic for "agility and adaptability of a system that is generally typecast as conservative, traditional, or even 'obsolete'" (Horbach, 2021, p. 237)

The truth is that the number of retractions of articles on COVID-19 has been considerable (Yeo-Teh and Tang, 2021) due to the 'paperdemic' (Dinis-Oliveira, 2020), the result of the urgencies of the COVID-19 pandemic, but also of the pressure under which scientists work in a system in which the quantity rather than the quality of papers published in journals is rewarded for academic promotion (Watson, 2022). Bauchner (2017) warns of an increase in retractions in scientific journals.

As a solution to minimize the consequences of permanent public access to retracted papers, Rzymski (2022) proposes a "hard retraction", i.e., the complete removal of the text of the retracted article, the replacement of the original abstract with a detailed retraction notice, the removal of the article from citation databases, and the deposit of the retracted article, together with the retraction notice, in a repository of retracted papers accessible only to registered users.

To demonstrate the problem to which we are exposed, Ioannidis (2020) describes the case of the work signed by several researchers from the Indian Institute of Technology and the University of Delhi, a *preprint* published on January 31st, 2020[8] -when we were just beginning to know the existence of the epidemic-, in bioRxiv, the web platform promoted by the Cold Spring Harbor Laboratory -an American reference institute in the world in biomedical research-, where scientific articles that have not yet been subjected to peer review are published quickly.

The authors of that paper claimed to have found an "incredible similarity" between the genetic sequence of the SARS-CoV-2 virus and that of HIV-1 (which causes AIDS), and suggested that these coincidences were not "fortuitous in nature". Their claims encouraged conspiracists and foolish journalists who advocate the nonsensical idea that viruses of zoonotic origin are laboratory creations of evil and malignant scientists intent on annihilating all or part of humanity. Their claims were very appealing to any

[8] Since this was fraudulent and retracted research, it is excluded from the References list of this article. Accessible at: https://www.biorxiv.org/content/10.1101/2020.01.30.927871v1

Hollywood movie producer, but the methodology of their study and their results were too flimsy for science. The article was retracted by its own authors within 72 hours of publication, after a barrage of criticism, but the damage was done. It became "the most shared scientific paper in the entire history of social media as of March 19th, 2020"[9] (López-Cózar and Martín-Martín, 2020, p. 6), "fuelling conspiracy theories about scientists manufacturing dangerous viruses and offered ammunition to vaccine denialists" (Ioannidis, 2020, p. 1). But not only to them. That work was also disseminated by the press:

> With more than 20,000 tweets and 56 news items published in different media, some of them as far-reaching as *The Los Angeles Times*, *The Guardian*, *The Scientist*, *Foreign Affair*, *Newsweek*... the *preprint* and the information derived from it went viral (López-Cózar and Martín-Martín, 2020, p. 7).

But the vast majority of scientists did not fall into the trap. Not only did the scientific community itself warn of the research's flaws, but it also ignored it. As of mid-March, the article had received "only two citations according to Google Scholar, one from an article that explores the media impact of *preprints* in the coronavirus crisis, and another from a paper that directly refutes the results of the study", which translates into a "negligible" scientific impact (López-Cózar and Martín-Martín, 2020, p. 7).

Although the scientific community has various control mechanisms that, sooner or later, detect and correct defects or errors, including retraction, the same does not happen with the impulsive and irrational communication of the masses in the infectious networks of the Internet, where, as we have already said, lies spread faster and more widely than the truth:

> While the scientific community has been able to remain immune to biased and tendentious information, obtaining the immediate withdrawal of the article and punishing the work with oblivion in the scientific literature, other sectors of the population have been very vulnerable to being infected by scandalously suggestive information that, dressed up with scientific credentials and expressed through new channels of scientific communication, is ambiguous, inaccurate, biased, and unsubstantiated (López-Cózar and Martín-Martín, 2020, p. 9).

Although the article has been retracted, the conspiracy theory "is more difficult to eliminate", says Gonçalves-Sá (2020), for whom a factor that may explain the phenomenon of the exponential spread of false information on social networks could be the fact that "people who share this misinformation overestimate their ability to understand very complex problems and experience a form of the Dunning-Kruger effect", that is, thinking that one knows more about a subject or topic than one really does, believing oneself to be smarter than the experts on a subject. "This can be exacerbated by a lack of trust in institutions, be they governments, the pharmaceutical industry, or the traditional media" (Gonçalves-Sá, 2020).

Unfortunately, this is not a problem exclusive to social media. We have seen on television sets, heard on the radio, and read in the press political journalists lecturing audiences on

[9] See: https://dimensions.altmetric.com/details/74957328#score

the new SARS-CoV-2 coronavirus and its epidemiology[10], artists[11], bullfighters[12], or businessmen[13] giving advice and giving their opinion on the measures needed to combat the pandemic, economists acting as epidemiologists[14], or denialist doctors invited to spread conspiracy theories[15]. Journalistic irresponsibility has been enormous[16].

> In this coronavirus crisis, the role of singers -celebrities- such as Miguel Bosé and his support for conspiracy theories should be analyzed. It is not his freedom of expression and erroneous beliefs that are in question - to which he has the right - but the disproportionate coverage that the media gave to what a singer claims about viruses. (Elías, 2020, p. 22).

In a citizen survey conducted in Spain between March 17th and 24th, 2020, at the beginning of the rigid confinement due to the pandemic, Bernal-Triviño (2020) found that respondents doubted the expertise of the talk show hosts invited to television programs to talk about COVID-19. And "how they have made it clearly sensationalist has in many cases followed in the wake of the worst crime-focused crime journalism programs" (Francés-Lecumberri, 2020, p. 105).

But the problem has not only been the overexposure of inexperienced or pseudo-experts. Another study showed that it has been common in the media not to identify COVID-19 *preprints* as such when they are used as a source of information, identifying them simply as "research", thus ignoring the fact that they had not passed peer review (Fleerackers et al., 2021). For their part, Fraser et al. (2021), in their analysis of *preprints* during the first ten months of the pandemic, found that 28.7% of those dealing with COVID-19 appeared in news stories, compared to only 1.0% of *preprints* dealing with other non-pandemic subjects, and were used overall in news articles at a rate nearly 100 times that of non-COVID-19 preprints.

The desire for media impact and notoriety of some researchers can be a problem, coupled with the lack of skill and scientific knowledge of many journalists. Nelissen and Bollen (2020) advise authors of *preprints* not to send such publications to journalists to draw attention to their work, as *preprints* are intended to be read and discussed by other scientists before peer review, and journalists and the public may not understand the difference between an unreviewed *preprint* and a paper published in a scientific journal; furthermore, premature press coverage may contribute to misinformation.

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[10] On Cuatro: 'Todo es mentira' (04/03/2020), completo y en HD. 23'22"-25'58". https://www.cuatro.com/todoesmentira/programa-completo-hd-290_18_2909295361.html

[11] On laSexta: Miguel Bosé vuelve a opinar sobre las vacunas contra el coronavirus: "Nos van a matar a todos". https://bit.ly/3ig6pJk
On El País: "Victoria Abril: «Somos cobayas, metiéndonos vacunas que son unos experimentos sin probar»". https://bit.ly/3OCPyMX

[12] On *Público*: 'Espejo Público' lleva a Fran Rivera para hablar del coronavirus y le llueven las críticas. https://bit.ly/3VyaPtt

[13] On *El País*: Los empresarios acusan a Trabajo de generar "alerta y confusión" con la guía del coronavirus. https://bit.ly/3F5XYt5
On *ABC*: "Bill Gates alerta del riesgo de una nueva pandemia tras el coronavirus: «Podría ser el fin de la sociedad»". https://bit.ly/3F4Mvd6

[14] On *El País*: Miguel Sebastián: "Fernando Simón should ask for forgiveness". https://elpais.com/sociedad/2020-07-11/miguel-sebastian-fernando-simon-deberia-pedir-perdon.html

[15] On laSexta: "Un médico negacionista del coronavirus: «Con la pistola que mide la temperatura inciden en el cerebro y provocan que la gente se suicide»". https://bit.ly/3AO2iKJ

[16] On *El Mundo*: El enfrentamiento en redes entre Iker Jiménez y Antonio Maestre. https://www.elmundo.es/f5/descubre/2021/08/10/6112642be4d4d8af678b458a.html

> [...] such rapid widespread public dissemination versus sharing within a community of specialists more likely to understand the complexities of the science and public health concerns or without rigorous editorial assessment and peer review before publication is not without potential consequences and harms (Flanagin et al., 2020, p. 1843).

The public's perception of the media's informative work during the COVID-19 pandemic should concern us, but also that of the scientific community itself. In a survey of 818 scientists in Spain, de Sola-Pueyo (2021, p. 12) found that "the scientific community considers that, in general terms, there has been a lack of rigor and realism in the media and that there has been an excess of sensationalism". In another survey in Spain conducted in April 2020 of 1,122 people during the total confinement phase, Masip et al. (2020, p. 8) found that "the majority of citizens affirm that the media are treating the pandemic in a sensationalist way and generating social alarm unnecessarily". And Bernal-Triviño (2020, p. 169), in another consultation with a population of 530 subjects in Spain, at the beginning of the confinement, found "criticism of disinformation, fake news, sensationalism, lack of ethics in certain media, and constant doubt about the ideological intention of the information". At the same time, Costa-Sánchez and López-García (2020) found examples of alarmism and sensationalism in the treatment of information about the pandemic in the first months of the pandemic.

Therefore, there have been perceived problems, not only in Spain, in the way COVID-19 has been reported in the media, which "are often guilty of favoring quick, sensationalist reporting rather than carefully worded scientific messages with balanced interpretation" (The Lancet Infectious Diseases, 2020).

5. CONCLUSIONS

The scientific and health community agree on the need to have contrasted, transparent, and open information, accessible to everyone, "to reduce fear and discrimination" (Ren et al., 2020, p. 655) and stop the pandemic of lies, besides the viral one. And in this, the involvement of the scientific-health and governmental authorities of all countries is fundamental, as well as the collaboration of rigorous journalists specialized in scientific and health information. But it has also proved essential to "understand the etiologies of misinformation and mistrust of medical information" (Jaiswal et al., 2020, p. 2776) to respond to a public health crisis such as that of COVID-19.

Perhaps today, more than ever, truth and access to verified, reliable, and accurate information have become a "matter of life and death" (Posetti and Bontcheva, 2020a; Pennycook et al., 2020). This is why it is vital to flatten the disinfodemic curve (Posetti and Bontcheva, 2020b).

This article aims to provide a critical and referential framework for this purpose, not only in the context of the COVID-19 pandemic but also to address other similar public health crises and threats. For example, the global crisis of antibiotic resistance could become another case of a disinfodemic and worsen soon if the criteria and measures suggested by experts are not applied, with even more negative consequences for public health; the same could happen with new viral epidemics and other possible new diseases, which could be the subject of disinformation campaigns and motivate new conspiracy theories if we do not anticipate them with effective measures to prevent and protect citizens from them. To this end, a bioinformationalist approach to understanding the epidemiology of disinformation seems vital. Because everything seems to indicate that, indeed, we have

arrived late to stop the current disinfodemics, but we still have time to prevent other future health disinformation pandemics.

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