


Scientific ways to confront covid-19 fake news


Os caminhos da ciência para enfrentar fake news sobre covid-19

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Abstract

Parallel to the covid-19 pandemic, the World Health Organization warns of an infodemic of fake news related to the disease. This integrative review investigates the dimension of this phenomenon and how science found ways to confront it. A bibliographic search was conducted on the Scopus/Elsevier and Medline/PubMed databases, retrieving 23 articles. Literature analysis found that fake news provide false social support and mobilize feelings which make them more acceptable than the truth. Hence, social media and the internet emerge as platforms to spread false information. Research suggests that government and media institutions can use communication channels and monitoring and intelligence technologies as allies to alert, elucidate, and remove misleading content. We find the need of investments in scientific and digital literacy actions so people may assess the quality of the information they receive. Finally, this study proposes the adoption of creative strategies to foster reasoning skills together with scientific information translated into an accessible language, preferably approved by health and institutional authorities.

Keywords: Fake News; Pandemics; Covid-19; Social Media.

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Resumo

Paralelamente à pandemia de covid-19, a Organização Mundial da Saúde alerta para uma infodemia de fake news relacionadas à doença. Objetiva-se, neste trabalho, conhecer a dimensão do fenômeno e alguns caminhos já identificados pela ciência para enfrentá-lo. Trata-se de uma revisão integrativa da literatura, realizada nas bases Scopus/Elsevier e Medline/PubMed, que incluiu 23 artigos. Por meio de análise da literatura, identificou-se que fake news oferecem falso suporte social e mobilizam sentimentos capazes de torná-las mais aceitáveis do que notícias verdadeiras. Dessa forma, as redes sociais e a internet despontam como plataformas disseminadoras de informações falsas. As pesquisas sugerem que instituições governamentais e midiáticas podem utilizar os canais de comunicação como aliados, com tecnologias de monitoramento e infovigilância para alertar, esclarecer e remover conteúdo enganoso. Também deve haver investimentos em ações de alfabetização científica e digital, de forma que as pessoas tenham condições de avaliar a qualidade das informações recebidas. Propõe-se a adoção de estratégias criativas, que despertem a capacidade de raciocínio, aliadas a informações científicas traduzidas em linguagem acessível, de preferência com aprovação de autoridades sanitárias e institucionais.

Palavras-chave: Notícias Falsas; Pandemia; Covid-19; Mídias Sociais.

Introduction

The seas of the internet rage and fake news storms which worsened during the covid-19 pandemic. This new disease, caused by a virus science is still seeking to better assess, has precipitously increased searches for information in all societal sectors. In this scenario, individuals have widely used internet platforms and social media to try and understand the new Coronavirus, its origin, and prevention, contagion, treatment, and vaccine forms (Galhardi et al., 2020).

Moreover, social distancing constitutes one of the World Health Organization (WHO) guideline to mitigate and control the new virus, leading thousands of people to develop activities at home, including work and study. The Internet has been a fundamental tool to keep this connection remote, creating conditions for research and social interaction on this new reality in the virtual environment (Rovetta; Bhagavathula, 2020a).

This phenomenon led the Pan American Health Organization - PAHO (2020) - to warn that, along with the pandemic, society faces another global challenge which is as lethal to public health as the virus itself: a fake news infodemic. The WHO understands infodemic as the excess of information on a specific theme, driven by uncertainties in the face of extreme situations (such as a pandemic), making it difficult to identify the accuracy of content and appropriate sources (Freire et al., 2021; PAHO, 2020).

The issue of fake news is in as much evidence as the concept of post-truth. Lima et al. (2019) define post-truth as knowledge within the social pole, i.e., the horizon of beliefs, strengthened by both absolutist and relativistic views and in which balance crosses the scientific dialogue with society. Tandoc Jr., Lim, and Ling (2018), who reviewed more than 30 studies on the subject, help us understand the definition of fake news.

The authors called fake news the untrue content hidden behind a veneer of legitimacy appropriating the various formats of traditional media: texts, photos, websites, and videos. This manipulation can generate several combinations - in public health, for example, the effect is harmful since society aims to seek information which generates health

and well-being (Ferrari, 2018; Teixeira; Santos, 2020). The Lexico dictionary (2022), by Oxford University Press, defines fake news as false information transmitted or published as news for fraudulent or politically motivated purposes.

Given the growing wave of fake news on covid-19, the WHO Information Network for Epidemics (EPI-WIN) has developed a communication strategy known as “Myth busters” to increase the sharing of information from reliable sources. Its offices, supported by international agencies, develop actions around the world. Brazil belongs to its Ibero-American verification project, involving 34 organizations from 17 countries aiming to refute rumors and disseminate measures adopted by health authorities (United Nations, 2020; Zarocostas, 2020).

We also find the call for the public health community to collaborate with these platforms and media to better evaluate subjects and searches, avoiding disclosures distancing themselves from the evidence, such as the space in which research results take place. As much as health authorities recommend universal contingency tactics, scientific understanding of the virus continues to change, constituting fertile ground for the social imaginary, fostering emblematic debates, and challenging scientific recommendations (Vasconcellos-Silva; Castiel; 2020; Zarocostas, 2020).

Since the pandemic onset, many studies have emerged (still under development) analyzing content published on the Internet and social media on covid-19, the nature of searches on engines and hashtags, and the sharing of information. Several countries have conducted research in different contexts, but we still find few scientific reviews which synthesize the understanding of the dimension of this challenge and possible exits for it.

Based on this information, this study aims to find some of the paths science has already highlighted to cope with the dissemination of fake news during the covid-19 pandemic.

Method

This is an integrative literature review of national and international documents on the studied theme. The review was conducted in six stages:

(1) research theme/question definition; (2) eligibility and search criteria selection; (3) data extraction and categorization; (4) study evaluation; (5) result interpretation; and (6) knowledge synthesis (Mendes; Scott; Galvão, 2008).

Following the problem, interest, and context (Pico) strategy in Stern, Jordan, and McArthur (2014), our guiding question is: what are the paths science has found to cope with the dissemination of fake news in the context of the covid-19 pandemic?

Studies were searched via an internet protocol of the Coordination of Improvement of Higher Education Personnel (Capes) Journal Portal, accessed via Universidade Federal do Ceará (UFC), to retrieve free and paid materials. The Scopus (Elsevier) and Medline/PubMed databases were included and searched between November 2020 and April 2021. In our choice of databases, the relevance of their scientific publications on collective health and human and social sciences was considered.

To formulate our search strategy, controlled descriptors were chosen - Descriptors in Health Sciences/Medical Subject Headings (DeCS/Mesh) - and used without controls. The following controlled descriptors were included: Pandemics, Social Media, and covid-19. The keyword “Fake News” was also included as it is considered the main expression of interest for this study. Thus, the general keyword search setting was: Fake News AND (covid-19 OR Pandemics) AND Social Media.

Original quantitative or qualitative studies and literature reviews in English and/or Portuguese were included in our eligibility criteria. During pre-selection, titles, abstracts, and keywords were read to seek content relevant to the development of scientific research, assess the fake news phenomenon in the context of the covid-19 pandemic, identify which paths science has traced on the theme, and evaluate researchers' offered exits.

Considering that our focus is an integrative review of scientific articles, book chapters, dissertations, and theses were excluded from our sample. Scientific articles unavailable online and publications diverting from our research object were also excluded.

Given these assumptions, 108 publications were retrieved from the Scopus/Elsevier database, of which nine were selected. In total, 41 publications

were found on Medline/PubMed and 14, included. In all, 23 scientific articles were considered to meet our objective. Of these, 19 were published in 2020 and 2021 (nine on Scopus and 11 on PubMed) and four in previous years (one on Scopus and three on PubMed).

We should explain that we prioritized publications from 2020 and 2021 given the onset of the covid-19 pandemic. However, to initially contextualize our themes (fake news and public health), some previously published references were included.

Thus, to better assess the issue until the current scenario, two 2018 studies were included in our analysis - a literature review seeking to define fake news, published in Digital Journalism - and a quantitative study published on Science which analyzed the scope of fake news.

In total, two 2019 studies were also included, including a systematic review of how health-related misinformation spreads, published on Social Science & Medicine; and a mixed-approach study dealing with memories related to fake news in Psychological Science. To further develop the discussion, two classics were visited - Bakhtin (1992) and Habermas (2003) -, as well as “Comunicação e saúde” (Communication and health) (Araújo; Cardoso, 2015), a Brazilian reference in the area.

Given the above, 23 scientific articles were included in our final sample. Thus, publications were broadly analyzed, observing authors’ methods, results, and reflections about our guiding question to develop this theoretical essay. Charts 1 and 2 describe the chosen studies.

Chart 1 – Studies on the Elsevier-Scopus base

Journal/year	Title	Authorship	Type of study	Objectives	Conclusion
Social Network Analysis and Mining/2021	Creative social media use for covid-19 prevention in Bangladesh: a structural equation modeling approach	ISLAM, M. et al.	Structural equation modeling.	To assess the influence of the creative use of social media.	The authors found that it was important to integrate creative production in social media with education. According to this study, health agencies should track the misinformation associated with covid-19 in real time and involve local communities and government stakeholders to unmask misinformation.
Digital Journalism/2018	Defining “fake news”: a typology of scholarly definitions	TANDOC JR, E. C.; LIM, Z. W.; LING, R.	Bibliographic review of 34 academic studies.	To evaluate the concept of fake news.	Fake news hide behind a veneer of legitimacy which grows as it increasingly resembles real information.
Humanities & Social Sciences Communications/2021	Toward effective government communication strategies in the era of covid-19	HYLAND-WOOD, B. et al.	Literature review.	To analyze the efficiency of government communication in times of crisis.	The confidence transmitted in communication channels leads to society cooperating and engaging toward guidelines.

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Chart 1 – Continuation

Journal/year	Title	Authorship	Type of study	Objectives	Conclusion
Social Network Analysis Mining/2021	Use of bot and content flags to limit the spread of misinformation among social networks: a behavior and attitude survey	LANIUS, C.; WEBER, R.; MACKENZIE JR., W. I.	Quantitative experiment (N =299) with participants in the USA.	To review the use of bot flags and incorrect information on Twitter.	Results suggest that signaling tweets with alerts for fake news actually reduced participants' attitudes about them.
Social Science & Medicine/2021	Covid-19 information on social media and preventive behaviors: managing the pandemic through personal responsibility.	LIU, P. L.	Descriptive statistical analysis.	To analyze preventive behaviors regarding the new Coronavirus pandemic.	Personal responsibility leads to a greater preventive behavior stemming from the consumption of information about covid-19 on social networks.
Trends in Cognitive Sciences/2021	The psychology of fake news	PENNYCOOK, G.; RAND, D. G.	Analysis of scientific literature and news.	Evaluate psychosocial models related to fake news.	Suggest a more proactive approach, teaching people how to identify fake news in an engaging way.
Online Social Networks and Media / 2021	An exploratory study of covid-19 misinformation on Twitter.	SHAHI, G. K.; DIRKSON, A.; MAJCHRZAK, T. A.	Exploratory analysis of 1,500 tweets regarding 1,274 false statements and 226 partially false statements.	To investigate the spread of misinformation via Twitter.	Fake tweets use a more informal language and people who shared them generally seemed to worry about their family members' well-being.
Cadernos de Saúde Pública.	COVID-19, fake news, and the sleep of communicative reason producing monsters: the narrative of risks and the risks of narratives.	VASCONCELLOS-SILVA, P. R.; CASTIEL, L. D.	Assay using the Google platform.	Better assess about the phenomenon of fake news during the pandemic.	Transmitted as news, fake content validates political, commercial, or even criminal ideas which confuse and generate skepticism about factual and institutional narratives, resulting in loss of references and orientations.
Information Processing & Management/2021	Characterizing the dissemination of misinformation on social media in health emergencies: an empirical study based on covid-19.	ZHOU, C. et al.	Literature review.	To assess disinformation during searches for healthcare.	The authors found two dimensions in seeking for health information: counseling and caution and seeking help. For them, the dissemination of fake news assumes a role of false social support which could be informative or emotional.

Chart 2 – Studies on the MedLine/PubMed base

Journal/year	Title	Authorship	Type of study	Objectives	Conclusion
Journal of Medical Internet Research/2020	Top concerns of tweeters during the covid-19 pandemic: infoveillance study.	ABD-ALRAZAQ, A. et al.	Meta-analysis with a infoveillance study.	To identify the participation of Twitter platform the covid-19 pandemic.	It is necessary to prioritize national and international systems of disease detection and infoveillance, monitoring social media.
Clinical Gastroenterology and Hepatology/2020	Increased internet search interest for GI symptoms may predict covid-19 cases in U.S. hotspots.	AHMAD, I.; FLANAGAN, R.; STALLER, K.	Meta-analysis using Google Trends.	To assess how to combine internet and public health.	They inferred that the increasing number of visits to Google about gastrointestinal symptoms may predict cases of covid-19. The platform serving as a gateway to fake news can be an ally of public health.
Journal of Medical Internet Research/2020	Covid-19 and the 5G conspiracy theory: social network analysis of Twitter data.	AHMED, W. et al.	Meta-analysis of 10,140 tweets.	To analyze conspiracy theorists' strategies about covid-19.	Rapid and targeted interventions to delegitimize sources are key to coping with fake news.
The American Journal of Tropical Medicine and Hygiene/2020	The Peru approach against the covid-19 infodemic: insights and strategies.	ALVAREZ-RISCO, A. et al.	Essay.	To analyze perceptions and strategies during the pandemic in Peru.	It is necessary to invest in health literacy for the population and, at the same time, in the use of artificial intelligence to develop tools to detect harmful content.
Telematics and Informatics/2021	Fake news and covid-19: modelling the predictors of fake news sharing among social media users.	APUKE, O. D.; OMAR, B.	Online quantitative questionnaire with 770 people.	To obtain an alternative view on sharing fake news.	Relatives and friends increase information sharing and educational attainment is directly associated with sharing fake news.
Research, Society e Development/2020	Scientific dissemination in the fight against fake news in the covid-19 times.	DANTAS, L. F. S.; DECCACHE-MAIA, E.	Literature review.	To assess how scientific literacy can better identify fake news.	The scientific community must present science in a more accessible and welcoming way.

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Chart 2 – Continuation

Journal/year	Title	Authorship	Type of study	Objectives	Conclusion
Ciência & Saúde Coletiva/2020	Fact or fake? An analysis of disinformation regarding the covid-19 pandemic in Brazil.	GALHARDI, C. P. et al.	Quantitative content analysis.	To analyze fake news on covid-19.	WhatsApp is the main channel for sharing fake news, followed by Facebook and Instagram. Thus, the ideal is to stimulate public debate to increase social awareness.
International journal of environmental research and public health/2021	Journalistic Fact-Checking of Information in Pandemic: Stakeholders, Hoaxes, and Strategies to Fight Disinformation during the covid-19 Crisis in Spain.	LÓPEZ-GARCÍA, X.; COSTA-SÁNCHEZ, C.; VIZOSO, Á.	Quali-quantitative communication comparative study.	To assess means and methods of information analysis during the pandemic.	WhatsApp, Twitter, and Instagram constitute, in this order, the main platforms disseminating fake news.
Psychological Science/2019	False memories for fake news during Ireland's abortion referendum.	MURPHY, G. et al.	Quali-quantitative study with 3,140 participants.	To analyze memories about news related to the referendum on abortion in that country	The authors concluded that people with low cognitive ability are more likely to adhere to their own knowledge rather than seeking other sources.
JMIR Public Health and Surveillance/2020	Covid-19-related web Search behaviours and infodemic attitudes in Italy: infodemiological study	ROVETTA, A.; BHAGAVATHULA, A. S.	Descriptive study using Google Trends.	To analyze the most read titles and websites to investigate infodemic monikers circulating in Italy.	The main terms found in Google Trends were: "China Coronavirus," "symptoms," and "Coronavirus vaccines." The authors also found searches with "coronavirus conspiracy" and "coronavirus laboratory," identified as the most dangerous and showing a tendency to racism and xenophobia.

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Chart 2 – Continuation

Journal/year	Title	Authorship	Type of study	Objectives	Conclusion
Journal of Medical Internet Research/2020	Global infodemiology of covid-19: analysis of Google web searches and Instagram hashtags.	ROVETTA, A.; BHAGAVATHULA, A. S.	Descriptive study using Google Trends.	To explore internet searches and behaviors related to the covid-19 pandemic.	This study showed the potential of this resource to monitor the transmission of disinformation on the Internet.
Acta Psychiatrica Scandinavica/2021	Managing the infodemic about covid-19: strategies for clinicians and researchers.	SCOTT, J.	Literature review.	To assess strategies physicians and researchers can use to manage the infodemic.	It is necessary to rebuild A mental model involving both denying information and empowering individuals to evaluate it.
Science/2018	The spread of true and false news online.	VOSOUGHI, S.; ROY, D.; ARAL, S.	Quantitative study analyzing more than three million tweets.	To assess the reach and sharing of fake news.	Each true post reaches, on average, 1,000 people, whereas fake ones, between 1,000 and 100,000 people.
Social Science & Medicine/2019	Systematic literature review on the spread of health-related misinformation on social media.	WANG, Y. et al.	Systematic literature review.	To understand information dissemination.	Misinformation about chronic diseases and even nutrition are frequent on the internet.

Scientific findings on fake news and their relationship with covid-19

Researchers at the Massachusetts Institute of Technology, United States, evinced the reach and dissemination potential of fake news. In a study published on Science, the authors showed that online fake news are 70% more likely to be shared than true news. Analysis of more than 126,000 “tweeted” news by about three million people showed that every true post reaches, on average, 1,000 people, whereas the most popular fake posts – among the 1% most replicated – from 1,000 to 100,000 people. Another curious datum is that, contrary to common sense, robots and humans accelerate the dissemination of fake news in the same proportion and that humans are the most prone to it (Vosoughi; Roy; Aral, 2018).

In addition to its greater dissemination capacity, fake news mobilize feelings which may make them

last longer than true ones. A study conducted in Ireland with 3,140 participants analyzed participants’ memories of six news stories on the local abortion referendum, two of which were false and four, true. The authors found that most participants recalled, with a wealth of details, content related to the fake news with which they identified, concluding that people with low cognitive ability are more likely to take a passive stance regarding the search for information, refusing to reconsider their opinion even after discovering that a piece of news was false (Murphy et al., 2019).

Thus, they evinced a striking characteristic of fake news: attachment to controversial themes which can stir individuals’ spirits. The uncertainties of the pandemic have disseminated false information in an unprecedented proportion. Anchored on the Internet, social media have expanded the reach of false information, confusing, frightening, and mobilizing feelings.

Analyzing more recent articles on research developed during the covid-19 pandemic (2020-2021), we found a scenario of uncertainties regarding both the virus and its consequences and the unbridled search for information on internet technologies and social media (Barcelos et al., 2021; Fachin, Fachin. Ahmad; Sousa, 2020; Freire et al., 2021; Zarocostas, 2020;).

The literature mentions WhatsApp, Twitter, Facebook, and Instagram as the main channels for sharing fake news (Galhardi et al., 2020; López-García; Costa-Sánchez; Vizoso, 2021). A survey conducted with the two main Spanish verification agencies (Newtral and Maldita) specially emphasized WhatsApp, featured as a disinformation black hole since it is a closed medium across which false information discreetly circulates in the shadows. On the other hand, the authors found that verification agencies have successfully used WhatsApp to receive, investigate, and neutralize fake news on the very channel in which they expand (López-García; Costa-Sánchez; Vizoso, 2021).

The analysis of 12,101 texts on the social media platform *Sina Weibo*, one of the most popular in China, showed that two dimensions predominate in the search for health information: “counseling and caution” and “seeking help”. In this space fake news assume a role of false social support, which can be informative or emotional, providing the adoption of strategies which give them greater scope. In addition to the use of ambiguous words, which help mask the false information conveyed, the richness of misinformation, as the authors mention, linked to the used display formats, involve individuals and lead them to share the information (Zhou et al., 2021).

To better understand covid-19 outbreak fake news trends, an Italian study analyzed Google Trends, identifying the infodemic monikers circulating in Italy by observing the titles of the most read articles and websites between January and March 2020. It defined any term, query, hashtag or phrase feeding disinformation on the Internet as an infodemic moniker. The main terms the authors found include: “China coronavirus,” “face masks,” “symptoms of the novel coronavirus,” and “vaccine

for coronavirus.” The authors also found searches with “coronavirus conspiracy” and “coronavirus laboratory,” identified as the most dangerous and showing a tendency to racism and xenophobia (Rovetta; Bhagavathula, 2020a).

Another broader study, conducted between February and May 2020, examined web searches (Google Trends) and hashtags (Instagram). The countries with the highest number of COVID-19 cases in the period led web searches. The main monikers the authors found were “coronavirus ozone,” “coronavirus lab,” “coronavirus 5G,” “coronavirus conspiracy,” and “coronavirus Bill Gates”. By analyzing Instagram hashtags, the study showed the potential of this feature to monitor the transmission of misinformation on the internet, with more than two million occurrences of infodemic hashtags, such as “corona,” “corona memes,” “coronado,” and “corona time.” On the other hand, the authors found more than 165 million prevention-related hashtags, of which “stay home/safe” and “lockdown life” were the main ones (Rovetta; Bhagavathula, 2020b).

Focusing on the content of the main shared news, Abd-Alrazaq et al. (2020) studied 167,073 public tweets with the hashtags “corona,” “COVID-19,” and “2019-nCov,” published between February 2 and March 15, 2020. The authors took interest in four main themes: the origin of covid-19; the source of the new virus; its impact on people and countries; and methods to mitigate the risk of infection. In total, two topics negatively stood out: deaths caused by covid-19 and increased racism. China was the most common topic, followed by the outbreak origin. The authors also found tweets relating the origin of the virus to meat consumption and the development of biological weapons.

Incorporated into the fake news group discussing the cause of covid-19, we found a conspiracy theory referring to the 5G technology as the origin and main means of spreading the disease. The search for the hashtag #5GCoronavirus on Twitter between March 27 and April 4, 2020, retrieved 10,140 tweets. The study found two large user groups: isolates (who “tweet” without mentioning each other) and transmitters (who form a strong network of

transmission of this content). The algorithm showed tweets against and in favor of this conspiracy theory. However, of 233 tweets, most users (65.2%) were skeptic about the conspiracy and only 34.8% genuinely defended the thesis (Ahmed et al., 2020).

Another study investigated the spread of misinformation on Twitter via 1,565 tweets from verification agency samples and 163,095 random tweets between January and July 2020. The period of greatest dissemination of disinformation coincided with the peak of the first covid-19 wave, from March 16 to April 23, 2020. According to the authors, fake tweets use a more informal language, mention health-related government agencies more often, and people who shared them seemed to worry about their family members' well-being. Its authors also warned of the risk of partially false information as it is more difficult to detect, including by verification agencies and the press (Shahi; Dirkson; Majchrzak, 2021).

Likewise, Alvarez-Risco et al. (2020), by analyzing perceptions and strategies of the pandemic in Peru, highlighted that fake news became sophisticated, mixing true and false information and evolving into deep fake (a term derived from the deep web), referring to the depths of the internet ocean, out of reach of trackers.

In this scenario, renowned and reliable institutions, such as the Oswaldo Cruz Foundation (Fiocruz), are used to circumvent algorithms, lending credibility to false content. By evaluating 154 news stories on covid-19 (collected as fake news), the Brazilian "Eu Fiscalizo" - which enables users to evaluate and notify content they deem inappropriate - showed that, of the total false messages circulating on WhatsApp, 71.4% cited Fiocruz as their source; on Facebook, this totaled 26.6%. For the authors, this both contributes to mistaken orientations and promotes disbelief in science and institutions. They pointed out that WhatsApp was the main channel for sharing fake news, with 73.7% of the published news, followed by Facebook (15.8%) and Instagram (10.5%) (Galhardi et al., 2020).

Given the above, note that the observed trends show the diversity of subthemes related to covid-19 circulating on the Internet and the prominent role

social media platforms played in investigations. Moreover, the possibility of using the Internet in favor of science also appears in the search for solutions to the experienced public health crisis, a topic which we will further develop below.

Ways to address the spread of fake news

Amid the skeptical climate of an ocean of information polluted by fake news, research points to the attempt to use technologies as tools in favor of knowledge. Ahmad, Flanagan, and Staller (2020) reinforce this idea, showing that it is possible to use the internet as an ally of public health. They analyzed Google Trends searches and inferred that recurring themes in the first places of the platform may point to epidemic or even pandemic outbreaks.

Flags may also aid recognizing and combating fake news. Lanius, Weber, and MacKenzie Jr. (2021) analyzed the use of bot flags and incorrect information on Twitter and concluded that, in fact, using flags to signal untrue information reduced participants' attitudes toward them, leading some to change their minds and affecting less those who used social media more often or consumed more news. The authors suggest that social media platforms take the signaling of suspicious content as a way to combat misinformation.

However, researchers warn that regulating content flirts with censorship and that stimulating public debate would be ideal, increasing social awareness about the consequences of sharing false messages (Galhardi et al., 2020). In addition to the aforementioned risk of unjustified censorship via artificial intelligence approaches, fact-checking and information classifiers face another challenge: its slow verification, opposed to the speed of false content dissemination (Pennycook; Rand, 2021).

Scott (2021) adds that it is insufficient to label information as false, a mental model involving both denying information and empowering individuals to evaluate it must be rebuilt. The author highlights healthcare providers' role in managing the infodemic, assuming the required

pedagogical role. Likewise, Pennycook and Rand (2021) suggest a lighter proactive approach to teach people to identify fake news by, e.g., a list of tips to combat misinformation.

Moreover, we highlight the need to intensify media surveillance, i.e., monitor posts to respond and neutralize misleading news. Macro measures are also encouraged, such as changing social contexts to facilitate behavior pattern adherence by, for example, requiring vaccination passports since strategies need to be systemically conducted to be effective, as opposed to individual and isolated actions (Scott, 2021).

Abd-Alrazaq et al. (2020) claim it is necessary to prioritize national and international systems of disease detection and intelligence to monitor social media. Thus, they argue that health authorities and official institutions should maintain a constant presence on social media, proactively acting and rapidly combating the dissemination of fake news.

Likewise, Ahmed et al. (2020) find the absence of an authoritative figure to actively combat disinformation. They recommend legislation which isolates opinions based on fake news and technological measures to enable this practice. For them, rapid and targeted interventions to delegitimize sources are key to coping with fake news.

Specific guidelines, such as tip lists and intelligence, help discern true and false news but the basis for change lies in raising awareness on the importance of analyzing how appropriate content is. Thus, investing in educational actions constitutes one of the main tools to cope with covid-19, as Silva et al. point out. (2020). According to their study, health education develops an interface between education and health promotion which is relevant to develop critical thinking and transform reality by stimulating autonomy and historical-social emancipation.

In this process, effective government communication makes a difference as it directs society in the face of a crisis as wide as a pandemic. Hyland-Wood et al. (2021) suggest that this posture be bidirectional, involving clear messages which are appropriate for each platform by spokespersons

who generate confidence, considering how different layers of the population understand healthcare and gather conditions to apply it in their daily lives. The authors believe that the credibility transmitted by official communication channels leads to societal cooperation and engagement.

However, Apuke and Omar (2021) stressed poor knowledge as a decisive factor for the sharing of fake news in their study with 770 people in Nigeria. They concluded that relatives and friends increase information sharing and educational attainment is directly associated with sharing fake news. i.e., the higher individuals' formal education, the more skeptical and critical they were toward fake news dissemination since knowledge leads to social responsibility and the adoption of preventive behaviors.

A survey which interviewed 511 participants by an online questionnaire showed that people with less knowledge are also less likely to act in the public interest. Thus, the study suggests using information technologies to disseminate information in a more instructive and personalized way and reinforce personal responsibility focused on the collective interest (Liu, 2021).

Dantas and Deccache-Maia (2020) find that scientific literacy can strengthen social cooperation and facilitate the identification of fake news. In their view, who conducted a bibliographic review on the subject, scientific literacy aims to enhance a reading of the world by re-elaborating the scientific language, enabling its minimal understanding so people evaluate the advances of science and its social implications.

Digital literacy, a strand of scientific literacy, should also be encouraged. The sharing of incorrect information across the Internet is much more due to inattention and the lack of careful reasoning (which would enable discernment) than to intentional motivations. Thus, they proposed adopting simple instructions which would raise individuals' attention on news access, analysis, and sharing, raising digital users' cognitive skills (Pennycook; Rand, 2021).

Authors argue that the creative use of social media positively influences the prevention of covid-19 and can be an important tool of action.

A study developed with 265 people in Bangladesh via an online questionnaire concluded that it is important to integrate creative production in social media with the education system via training, workshops, and insertion of social media education in the academic curriculum at all levels of education (Islam et al., 2021).

Thus, they suggested that the scientific community be concerned with producing content in podcasts, videos, lives etc. in an accessible language and circulating it in the same media as fake news, showing science in a more welcoming way (Dantas; Deccache-Maia, 2020). Pennycook and Rand (2021) claim that platforms can harness the power of human reasoning and the wisdom of crowds to improve algorithm performance.

Alvarez-Risco et al. (2020) reinforce that it is necessary to invest in health literacy for the population and, at the same time, in the use of artificial intelligence to develop tools to detect harmful content. Another study agrees on the rapid removal of fake news and government accountability (as is the case today in Peru, which has implemented imprisonment for those who create and disseminate fake news) but without leaving aside the discussion of the clash between freedom of expression and censorship (Galhardi et al., 2020).

Another more specific path highlighted to cope with this phenomenon is infodemiology, a communication science branch analyzing ordinary users' public health content to improve the provision of public health services. By monitoring and analyzing information, infodemiology stimulates health literacy, translating scientific knowledge, checking news, and reviewing content to minimize distortion and misinformation factors (Freire et al., 2021).

Likewise, Shahi, Dirkson, and Majchrzak (2021) stress that scientists and professionals have been sounding the alarm on the risks of fake news. However, technology platforms can do much more in this battle and the warning should configure an incentive to continue to improve actions. Billions of dollars are invested in algorithms which virally propagate content which grows uncontrollably and generates unimaginable results. However, the same

economic proportion is not invested in the development of mechanisms to protect and ensure the reliability of information circulating in media and on the Internet (Costa; Romanini, 2019; Pariser, 2011).

Another issue to be considered is that the dissemination of fake news can be part of political projects. During the covid-19 pandemic peak in Brazil, some managers deemed scientific recommendations as innocuous since political actors occupying the federal executive deliberately disseminate fake news to stay in power and feed denialists' sympathy.

Therefore, the ideal world, with complete information based on the discourse of reliable authorities, loses space for the fluidity of changing truths, feeding communicative vehicles with the speed and superficiality of real time, leaving to citizens, experts in themselves, to choose the more acceptable or unbearable sources (Vasconcellos-Silva; Castiel, 2020).

The key point of this discussion is that traditional institutional and media communication focus on producing and circulating information, but communication actually occurs in content appropriation. From there, interlocutors recognized by the public, who may not necessarily be specialists in the subject, but rather holders of cultural and social capital, occupy speech places determined by the context and influence the appropriation of content by society (Araújo; Cardoso, 2015).

Basing this reflection, Bakhtin (1992) states that the game of interests in communicative production is expressed in multiple voices, according to individuals' position in the social structure and context, which can worsen differences or pave the way for negotiations. Habermas (2003) argues that rational motivation, which finds that achieving common goals takes place via dialogue, can base actions. Thus, we should observe that democratizing information not only means producing and circulating content on the Internet and social media but must also consider which voices echo this information and how messages are received and resignified.

Scientific studies indicate that avoiding manipulation and misrepresenting content

involves investing in health education policies and activities via creative and engaging training and fostering human reasoning to check facts as a powerful vaccine against seductive and accessible misinformation (Dantas; Deccache-Maia, 2020; Pennycook; Rand, 2021).

It is necessary to break the vicious circle of fake news production, driven, on the internet and social media, by algorithms consciously manipulated or which only emerge automatically in the sea of information. In any case, more assertive and targeted actions can successfully cope with this phenomenon which threatens public health on a global scale, provided that health, governmental, scientific, traditional media, alternative and digital influencers cooperate, preferably synchronized toward common purposes.

Final considerations

We found, in the investigated scientific studies, fundamental questions to understand the dissemination of fake news on the covid-19 pandemic. We highlighted the factors with the greatest potential to disseminate false information given their true persuasive capacity and false social support, involving individuals in groups and/or bubbles fostering their beliefs and opinions. The assessed studies showed the high probability of people simply inattentively sharing information, even if they worry about their family members' well-being at the same time. Factors related to news varnished of legitimacy, in which misinformation can become almost imperceptible, also influenced them.

We claim that developing infoveillance systems and implementing technologies which monitor information, especially by timely checking, finding, alerting, and neutralizing fake news via proactive communication from scientific and sanitary authorities with accessible language and approval from reliable institutions constitute alternatives to cope with the studied phenomenon. The vaccine to contain this infodemic thus consists of investing in health education actions and fostering digital literacy in an engaging and creative

way so individuals can evaluate the information they access via individual and collective responsibilities.

Government institutions and media outlets should consider replacing merely persuasive communication with strategies which ensure scientific content and provide the necessary means for society to appropriate this knowledge. Thus, education will always be the best trail.

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Authors' contribution

Raquel and Alencar designed the project and its manuscript - introduction, methodology, data analysis, results, and final draft. Raquel and Souza organized tables and the draft and translated the abstract. Ribeiro, Barreto, and Andrade analyzed data and critically reviewed the content of this article. Barreto and Andrade approved this final draft.

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