



## Review Article

# Communication vs evidence: What hinders the outreach of science during an infodemic? A narrative review



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## ABSTRACT

**Background:** The COVID-19 pandemic is placing significant pressure on national and international health organizations and the measures taken to combat it are having many impacts beyond health. At the same time, misleading communication practices and what has been called an “infodemic” by the World Health Organization have been hampering the uptake of coronavirus-related scientific information. Moreover, public awareness about the dangers of the infodemic remains poor, and misinformation may lead to hazardous behaviours. We therefore analysed factors potentially undermining communication of scientific evidence and proposed strategies to counteract this phenomenon.

**Methods:** We sought official academic and institutional publications of any type, published in English and analyzed their approaches to communication used during the pandemic.

**Results:** The factors that might undermine appropriate communication include but are not limited to (a) the exponential increase of COVID-19-related publications, often including biases in the peer-review and editorial process; (b) the role of traditional media; (c) politicization of the virus; and (d) the impact of social media. We argue that evidence synthesis and knowledge translation are useful tools to communicate accurate scientific evidence to decision-makers.

**Conclusion:** Clear and concise messages in this form can help decision-makers to interpret data correctly, take consequent actions, and avoid being compromised by low-quality or even misleading information.

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## 1. Introduction

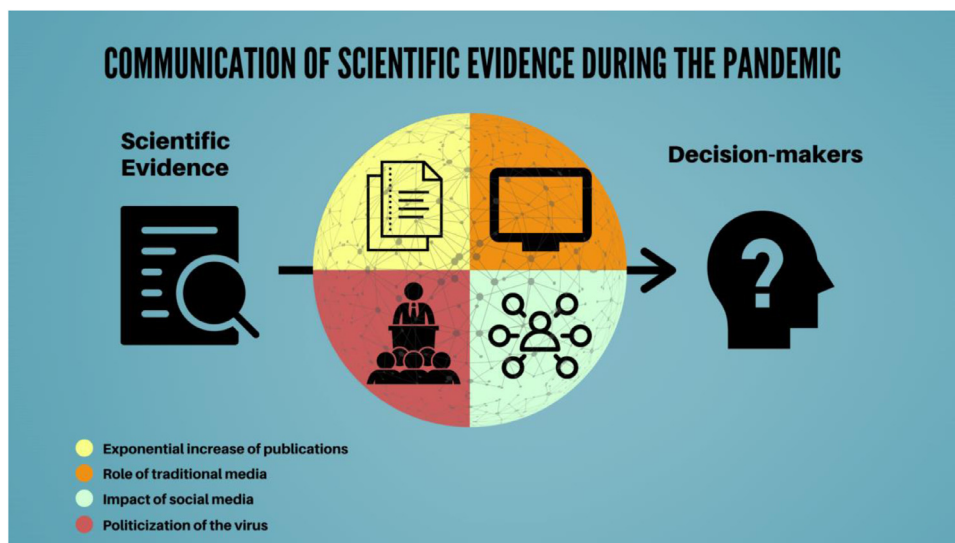
While the COVID-19 pandemic has been placing a strain on national and international health organizations and the measures taken to combat it are having many impacts beyond health, what has been called an “infodemic” by the World Health Organization is threatening scientific communication with key stakeholders involved in the management of the emergency. According to the crowdsourced WHO technical consultation “interventions and messages must be based on science and evidence and must reach citizens and enable them to make informed decisions on how to protect themselves and their communities in a health emergency”.<sup>1</sup> Infodemic goes in the opposite direction. The term “infodemic” was coined by Gunther Eysenbach.<sup>2</sup> It was adopted by the WHO

in a report on 2 February 2020 to describe “an over-abundance of information – some accurate and some not – that makes it hard for people to find trustworthy sources and reliable guidance when they need it”,<sup>3</sup> when massive misinformation and conspiracy theories relating to COVID-19 were circulating widely on the internet. The associated problems go far beyond the effectiveness of the communication strategies adopted, and also depend on external factors affecting the delivery of the message. A context assessment can determine the possible causes of the failure of communication strategies and help to identify and promote effective interventions.

Digital communication strategies have been shown to have both benefits and harms.<sup>4</sup> Engagement marketing strategies have been used to drive the public's engagement towards accurate information,<sup>5,6,7</sup> but public awareness regarding the current health emergency remains uncertain.<sup>8</sup> During emergencies, accurate scientific communication should be capable of providing clear messages to improve knowledge and achieve timely behavioural change.<sup>9</sup> However, clear messaging depends entirely on the available evidence,

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**Fig. 1.** Main factors undermining communication of accurate scientific evidence during the COVID-19 outbreak - 1. the exponential increase of COVID-19-related publications, often including biases in the peer-review and editorial process, 2. role of traditional media, 3. impact of social media, 4. politicization of the virus.

and at the beginning of the COVID-19 pandemic the evidence for many decisions and choices was incomplete or completely lacking. Messages have altered as new evidence emerged but, even now, after a year into the pandemic, there are still many gaps and uncertainties.

The aim of the study is two-fold: 1) to outline the main factors that could have undermined communication of accurate scientific evidence during the COVID-19 pandemic, and 2) to highlight communication strategies that could promote access to scientific evidence by the stakeholders involved in the decision-making process, whose reasoning is often compromised by an overwhelming amount of low-quality information.<sup>10</sup>

## 2. Methods

As a first step, we searched multiple sources to prepare a thematic overview of the issue and to outline keywords related to core communication challenges that affected the scale of the infodemic such as: news reporting of the early pandemic, political discourse and public debate concerning COVID-19, social media posts during the pandemic, the editorial process of scientific publications and their dissemination. We also consulted regulatory and governmental bodies, national and international organizations websites to trace the events and their timeline and relevant literature.

Once we determined our nexus of terms and concepts we set the following keywords: "covid infodemic", "covid communication", "covid debate", "covid news", "covid politics", "disinformation", "infodemiology", "information disorder", "evidence synthesis", "evidence decision-making", "evidence policy-making", "knowledge translation", "misinformation", "public debate covid", "science communication", "science decision-making", "science policy-making", "science debate covid", "social media covid", "social media infodemic", "social media misinformation", "traditional media covid".

We searched online databases including PubMed, Cochrane Library, Campbell Collaboration, and JSTORE. We also included related studies suggested by the databases' algorithm. Using the same keywords, we also searched Google Scholar to identify related studies. Between July and 15 October 2020, we searched official academic and institutional publications of any type, published in English with no date restrictions. We chose this timeframe to conduct our searches to identify studies which referred to the first

months of the pandemic. Pre-prints were excluded due to uncertainty of the accuracy of the reported results, at the time of the searches as were conference abstracts or equivalent. We included in the review only articles accepted for publication.

Based on the topic of the identified studies we classified the manuscripts in themes; manuscripts that discussed communication approaches used by political figures, COVID-19 news reporting, editorial process alterations and the public sentiment reported on the social media. Then, we studied how the concepts varied across disciplines and we discussed the correlation of these themes with the concept of the infodemic.

## 3. Results

We identified four main factors potentially undermining appropriate communication: 1) the exponential increase of COVID-19-related publications often including biases in the peer-review and editorial process, 2) the role of the traditional media, 3) the politicization of the virus, and 4) the impact of social media. Fig. 1 depicts the key factors that adversely affected scientific evidence communication during this pandemic, highlighting their interconnection.

### 3.1. Information coming from the scientific community

As of 4 October 2020, the COVID-19 Portfolio of the National Institute of Health (NIH), that traces publications relative to COVID-19, had counted over 70,000 studies. The incredible pace at which publications are produced and the frequent undesirable repetition of studies exacerbates the difficulties of researchers and healthcare professionals in keeping up with the literature relevant to their studies and practice.<sup>11,12</sup>

During this period of great proliferation of the scientific literature, biases and failings have been reported in the peer-review process.<sup>13</sup> One example, that drew the attention of the traditional media and generated adverse effects on public trust, was a study published online on 22 May 2020 in *The Lancet*, concerning hydroxychloroquine as a treatment for COVID-19 patients.<sup>14</sup> This study published in one of the world's most impactful scientific journals was retracted within weeks but caused a domino effect of misinformation spreading.<sup>15</sup>

### 3.2. The role of the traditional media

Information production, distribution, and consumption were undergoing crucial changes before the surge of the pandemic. Through the 21<sup>st</sup> century, “symbiosis” of traditional and social media evolved as information consumption have been moving into the digital era, affecting conventional journalistic practices and presenting new challenges for journalists.<sup>16,17,18</sup>

The involvement of journalists in debunking and fact-checking misinformation have strengthened the response against inaccurate online content.<sup>19,20</sup> This should limit the possibilities for users to encounter misinformation online, especially when it is accompanied by content removal from social media platforms. Although attempts to debunk misinformation have been associated with a backfiring effect, reinforcing the ideas of conspiracy minded people, there is still not enough supportive evidence on this matter.<sup>21,22</sup>

Media messages about the pandemic came from different actors and may have affected, in part, the scale and the outcomes of the infodemic. Overall, media messages have varied across countries and altered over time as the pandemic and its impact have evolved. Journalists have encountered different barriers, including lack of training on fact-checking and science reporting,<sup>23</sup> and poor access to accurate sources.<sup>24</sup> And, even though misinformation spreaders are now being identified and traced, the need to train information consumers to evaluate their sources remains critical.<sup>25</sup>

### 3.3. The politicization of a virus

Declarations and attitudes of politicians that are addressed to politically polarized populations have strong infodemiological effects.<sup>26,27</sup> Some political figures, responsible for complex social decisions, side-lined scientific evidence with their claims and actions, prioritizing their political agenda over the need to provide people with reliable information. This enhanced mis- and dis-information through different channels and undermined the voice of science.

The adverse effects of such communication on public sentiment have been exacerbated on social media platforms. Examples of inadequate political communication and management such as the use of the metaphor “war” (commonly used for different diseases),<sup>28</sup> the spread of conspiracy theories,<sup>29</sup> and the violation of security measures by representatives of the political class,<sup>30</sup> among many other examples, diverted public attention from the public health emergency, enhancing social polarization and spreading more confusion.

When politicians have too much in common with social media influencers, the potential risks of the politicization of COVID-19 on public health are high. However, the pre-pandemic political *status quo* cannot be altered quickly enough to cope with an emergency on the scale of the COVID-19 pandemic. Assuming that evidence also serves to shape decision-making, the role of evidence should not be underestimated. The need to invest in relevant scientific evidence to counter the infodemic and strengthen the pandemic response is urgent.<sup>31</sup>

### 3.4. The role of social media in the COVID-19 infodemic

In his commentary, following the crowdsourced WHO technical consultation, Gunther Eyesenbach introduced the information “cake” model, suggesting that the vast majority of information during the pandemic had been generated within social media.<sup>32</sup>

The amount of misinformation varies between social media platforms as social media responses varied between the organizations concerned.<sup>33</sup> Although social media organizations have provided free campaigns to institutions, promoted independent fact-

**Table 1**

Social media strategies to increase users' engagement associated with adverse effects regarding the content's accuracy.

Social media strategies to increase users' engagement	Adverse effects on the content's accuracy
Prioritization of the information shown in the content feed based on user's data	<ul style="list-style-type: none"> <li>• Filter bubbles – restrain information presented to users</li> <li>• Echo chambers – reinforce cognitive bias.</li> <li>• Accuracy of information encountered is not certain.</li> </ul>
Reactions and comments on the shared content	<ul style="list-style-type: none"> <li>• Users share content considering the impact it will generate – seeking gratification.</li> </ul>
Increased time of exposure (e.g. infinite scrolling, notifications)	<ul style="list-style-type: none"> <li>• Increases possibilities to encounter misleading messages.</li> </ul>

checking, and enhanced collaboration with the traditional media, they still struggle to counter misinformation. In Table 1, we summarize different factors involved in the spread of low-quality information associated with the main marketing strategies used by social media to enhance their users' engagement in these platforms.

Social media companies have been criticized by news media and scientists many times in the past and during the COVID-19 pandemic. Use of social media has been associated with eating disorders and higher levels of anxiety and depression in young users.<sup>34,35,36</sup> The role of social media in political computational propaganda has also raised alarm.<sup>37</sup> Concerns are mounting about how information is targeted to platform users availing algorithms that process users' data and behavior within the platform, political and religious orientation, and interests.<sup>38</sup> Such data-driven marketing strategies reduce the possibilities to tackle the infodemic within the platforms.<sup>39</sup> Filter bubbles – generated by social media algorithms – have been criticized for constraining users' cognition to what is assumed to be more likely to interest them. Similarly, echo chambers enable the rapid spread of low-quality information exploiting users' confirmation biases, and reinforcing users' misinterpretations.<sup>40,41,42</sup>

Since the early stages of COVID-19 pandemic, social media platforms have become a major hub of information and debate. People seeking social interactions while isolated, due to lockdown measures, have spent more time using these platforms.<sup>43</sup> The longer that users spend on these platforms, the higher the risks that they will be exposed to low-quality information.<sup>44,45</sup> Also, it is known that people's behaviors on social media are subject to different biases and user-generated content is not necessarily accurate.<sup>46,47,48</sup> Users' content expresses their emotional state and interpretations on the pandemic<sup>49,50</sup>; at the same time, users seek gratification from the likes and shares they may obtain.<sup>51,52</sup> With billions of active social media users sharing all kinds of information filtered by their own perspectives and algorithms choosing what should be relevant, accurate information becomes hard to recognize.<sup>53</sup>

## 4. Discussion

At the time of writing, the COVID-19 pandemic is ongoing, and emergency communication continues to evolve in response to it. As this phenomenon persists, new insights emerge and will enlighten future work. This study has encountered the following limitations: 1) The context assessment presented here was applied to the first months after the WHO announcement concerning the surge of the infodemic. Consequently, it describes the issues that emerged dur-

ing the early stages of the pandemic. 2) The searches included only articles written in English. 3) When searching, the sources concerning the infodemic were still limited and no other review interrogated the same topic.

Measures adopted, such as independent fact-checking, have proven a valuable resource to counteract the infodemic,<sup>54</sup> but fundamental issues remain unsolved. Institutional campaigns aiming to increase users' engagement have had positive results but, still, accurate evidence-based information does not reach all various stakeholders.<sup>55,56</sup> Instead, misleading messages find their way to their recipients, often facilitated by filter bubbles and echo chambers.<sup>57,50</sup> Put differently, evidence becomes hard to find when information is prioritized according to trends and visualizations. To counteract infodemic practices and contribute to a clear and evidence-based information for decision makers and the public, we recommend the use of knowledge translation of evidence synthesis findings.

In a statement of principles to support an evidence synthesis approach, *The Royal Society*, in association with *The Academy of Medical Sciences*, points out the fundamental values of this research methodology: adding to transparency, the rigorous evaluation of the extracted data to limit reported biases, the participation of external actors to help prioritize the information and accessibility to facilitate the implementation of evidence.<sup>58</sup>

Various organizations worldwide involved in different research disciplines promote evidence synthesis findings with concomitant knowledge translation strategies. Among others, *Cochrane* (<https://cochrane.org>) encourages and supports high-quality and up-to-date evidence synthesis to inform the decision-making of practitioners and patients. The *Campbell Collaboration* (<https://campbellcollaboration.org>) promotes evidence synthesis in the social sciences, whereas *Conservation Evidence* (<https://conservationevidence.com>) provides summarized evidence to inform decision-making on how to restore and conserve biodiversity. Furthermore, *Evidence Aid* (<https://evidenceaid.org>) collects, summarizes, translates, and indexes relevant research findings aiming to inform decision-makers before, during and after humanitarian and health emergencies or disasters caused by natural hazards.

Although evidence synthesis provides high-quality information to guide decision-making on health and social issues, decision-makers tend to neglect it,<sup>59</sup> or even completely ignore it despite needs assessment surveys that suggest an appetite for it.<sup>60,27,61,62</sup> Different types of barriers can obstruct the use of evidence in the decision-making process, such as power relationships or professional interests.<sup>63</sup> Policy changes are more likely to be effective when existing evidence is assessed and political interests are compliant.<sup>64</sup> Such barriers, in association with increased time pressure,<sup>65</sup> can make it difficult for decision-makers to make informed decisions during emergencies.

Public health emergencies rely on effective communication of scientific evidence. However, evidence-based communications still struggle to deliver messages in the current informational ecosystem. Future studies concentrating on the effects of the infodemic in the use of scientific evidence might shed light on this issue. For the time being, it is critical to study and implement interventions to promote evidence-based communications and to amplify the outreach of the messages.

## 5. Recommendations

### 5.1. "Evidence synthesis generated content"

As the corpus of the scientific literature is constantly growing, keeping up with the up-to-date evidence of different disciplines has become a complex issue and this has become much more chal-

lenging with the massive surge of literature on COVID-19. Coping with this challenge requires prioritization and synthesis of relevant and accurate scientific evidence.

Evidence synthesis allows for the combination of data from different studies on a specific subject to determine what is known and what remains uncertain.<sup>66</sup> It can be used to inform decision-making, map the existing literature, or identify possible knowledge gaps to influence and coordinate future research.<sup>67</sup> Syntheses such as systematic and rapid reviews can provide information on the effects of interventions, and scoping reviews examine the volume and the nature of available evidence.<sup>68,69,70</sup>

To provide accurate findings and minimize biases when selecting, extracting and reporting data, a protocol of any evidence synthesis should be reported and published in advance by the authors.<sup>71</sup> Such protocols should describe the research methods (e.g. information sources, search strategy, eligibility criteria, study records, etc.) as well as the rationale of the evidence synthesis. This ensures reported results are transparent, replicable and reliable. In addition, the review process should ensure that evidence can be traced back to the original studies and the reviewers should assess the quality of these studies using a defined tool.<sup>72,73</sup>

### 5.2. Knowledge translation strategies to design evidence-based communications

There are many definitions for the term "knowledge translation" (KT).<sup>74,75,76,77</sup> We used as a point of reference that from the *Canadian Institutes of Health Research*: "Knowledge Translation is defined as a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system".<sup>78</sup> We chose this definition because it spotlights the role of communication in the application of scientific knowledge.

Social media have proved to be valuable resources for KT and the education of physicians and trainees.<sup>79</sup> Equally, digital content strategies might follow similar patterns to the ones described in the action circle of KT,<sup>63</sup> which highlights the key steps to make evidence accessible to practitioners: 1. identification of the problem and selection of knowledge; 2. adaptation of knowledge to the local context; 3. assessment of barriers to knowledge use; 4. selection, tailoring and implementation of interventions; 5. monitoring the knowledge use; 6. evaluation of outcomes; and 7. strengthening the knowledge use.

Defining evidence synthesis as the methodology of collecting and presenting relevant scientific evidence, we argue that KT tools and strategies are essential, to convey evidence to policy makers, as well as the public. We assessed the communicational benefits of this process with particular focus on the communication strategies involved in the dissemination of high-quality evidence. We considered the following communication strategies: a) prioritization of information; b) presentation of findings; and c) multi-language translations.

- a) The prioritization of evidence occurs at different levels. Evidence relative to emergency interventions needs to be contextualized, with social and economic implications being considered.<sup>80</sup> Decision-makers can provide useful insights to prioritize information that is urgently required.<sup>81</sup> Involvement of different stakeholders shapes the choice of the messages to communicate and helps to identify barriers and facilitators encountered in the delivery of the message.<sup>82</sup> As new evidence is gathered, the information should be updated, giving priority to new erupting challenges associated with the emergency response.

- b) A common format for communicating evidence findings is the so-called “evidence summary” (or plain language summary (PLS)).<sup>83</sup> Strengths of this format are a straightforward layout that shortens read time and enables rapid information reach, and the use of plain language to render the content accessible.<sup>84,85</sup> Evidence summaries can be divided into sections to facilitate the delivery of key messages. Explicit titles at the beginning of each section, such as “what is known” or “what is uncertain” captivate the reader’s attention and enhance the readability of the message.<sup>71</sup> Evidence summaries can also be presented through infographics or podcasts. While messages presented in an infographic form have not significantly increased the reach of the summaries’ key messages,<sup>86</sup> podcasts have shown greater effectiveness.<sup>87</sup>
- c) Considering that research findings, particularly those published in peer-reviewed journals are usually published in English, many people from non-English speaking countries cannot access this information. Also, linguistic and cultural barriers obstruct adequate communication of evidence, as terminology and concepts differ across countries.<sup>88</sup> Evidence translated in different languages is crucial to communicate accurate messages in a local context.<sup>76</sup> Using community engagement strategies, language translation increases message delivery in non-English speaking populations and raises public awareness and responsiveness.<sup>89</sup> Evidence messages when translated into different languages enhance possibilities of decisions being informed.

## 6. Conclusions

In essence, factors that compromised accurate scientific communication of evidence during the early stages of the emergency can be summarized as follows: 1) Social media has a pivotal role in the current infodemic, being a hub of misleading content. Distribution within platforms has shown negative effects on the message delivery. 2) Traditional media aid fact-checking and debunking of misleading content. Messages coming from traditional media varied as to content and evolved over time. Different media messages might have affected to a certain degree the scale and the outcomes of the infodemic. 3) Politicization of the virus has adversely affected public health response, increasing misleading content and polarization. 4) Biases in the peer-review process for journal articles can fuel misleading information and damage public trust in science.

Evidence synthesis combined with knowledge translation communication strategies facilitate the use of scientific evidence to inform decision-making. Clear and concise messages translated in different languages could permit relevant scientific evidence distinguish itself in the current informational ecosystem. Social media monitoring is useful to measure the impact of information on public sentiment and obtaining feedback to improve message delivery. While the COVID-19 pandemic is still threatening lives and its socio-economical consequences are becoming ever more noticeable, the infodemic is endangering accurate scientific communication. Further research is necessary to determine why the application of evidence-based communications is still limited and how this could be addressed to counteract present and future infodemics.

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## Author contributions

**Epaminondas La Bella:** Conceptualization, Formal Analysis, Writing – Original Draft, Writing – Review & Editing. **Claire Allen:** Conceptualization, Formal Analysis, Writing – Review & Editing. **Flavio Lirussi:** Conceptualization, Formal Analysis, Writing – Review & Editing.

## Conflict of interest

The authors declare that they have no conflicts of interest.

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## Ethical statement

No ethical approval was required as this study did not involve human participants or laboratory animals.

## Data availability

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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