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## Commentary

## COVID-19 infodemics: the role of mainstream and social media

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In a modern, interconnected world, every pandemic affects social communication, especially mainstream media and social media. Both could serve to collect data (e.g. public opinion, mental health and detection/prediction) or actively broadcast extremely useful recommendations for disease control (e.g. how to properly use personal protective equipment, respect social distancing, and updates on lockdowns and government responses), but, overall, their main aim is sensationalism, which in most cases is the opposite of the scientific method. Most users of mainstream media and the web are unable to critically assess technical contents; this has led to or facilitated the occurrence of infodemics. During the pandemic, many scientists have commonly been labelled, by themselves or by the media, as 'virologists', albeit with generally unrelated degrees and/or expertise. The aim of this commentary is to distance ourselves (and possibly other colleagues) from such an approach and to propose some simple strategies that could mitigate the trend. We will offer some examples of poor technical communications during the ongoing pandemic to which many scientists, more or less involved in the management of COVID-19 patients, also contributed.

## Emergence of SARS-CoV-2 variants

Genome mutations and deletions are a natural evolution of any virus during replication in a defined host. Variability is thus a direct consequence of replication: the faster the replication, the greater the variability. This process leads to the emergence of new variants, which are naturally associated with better long-term virus–host interaction (e.g. lower pathogenicity). Members of the Coronaviridae family, which have a very large genome, are the only RNA viruses with a proofreading exonuclease [1]; the more than 800 SARS-CoV-2 variants that have been reported to date are more the consequence of massive spreading than of a basal high mutation rate [2]. Although the scientific community has correctly classified variants of concern (VOC, characterized by immune escape) versus variants of interest (VOI, lacking features of immune escape), both mainstream and social media, sometimes following a small team of scientists, have depicted each variant as a high threat, completely denying the concept of viral adaptation to host and forgetting that SARS-CoV-2 has much lower mutation rates than, for example, the hepatitis C virus or influenza. Scientists should thus communicate that mutations leading to new variants are an expected phenomenon and a long-term means of adaptation to the human species and to lower pathogenicity.

## SARS-CoV-2 diagnostics

Limitations of antibody tests for diagnosis of an acute infection, the low sensitivity of most antigen tests, in particular in asymptomatic patients, and the difference between detecting viral RNA fragments and detecting a replication-competent virus were also poorly explained. People were not interested in the differential accuracies and settings for the use of diagnostic tests, and great confusion was generated. In addition, there was poor communication regarding the difference between analytical vs clinical meaning [3]. Scientists should instead have clarified that not all tests are created for the same purpose, validation before marketing

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is relevant, and more expensive assays, such as genotyping, are not always more meaningful from a diagnostic point of view.

### COVID19 convalescent plasma safety and efficacy

At the beginning of the pandemic, many uncontrolled or historically controlled phase 2 studies reported Lazarus-like effects in mechanically ventilated COVID19 patients in intensive care units. Many media stories overplayed successful cases only while neglecting failures, and this assumption polarized the scientific community into pro-COVID19 convalescent plasma (CCP) versus anti-CCP supporters, as happens in any entertainment context. Social appeals led to a massive number of voluntary donations, with new donors subconsciously forced to donate. Unfortunately, most of the donated plasma ended up in compassionate, late usages despite CCP being an investigational drug. Randomized controlled trials in these late settings later showed that CCP was unable to provide clinical benefit, leading to a dramatic drop in donations and usage of CCP at any stage, including early stages, where evidence of benefits had meanwhile been collected [4]; this drop in CCP usage soon translated into higher mortality in several countries [5]. Scientists should instead have explained that neutralizing antibodies work as antivirals, and hence their efficacy in early (but not in late) stages was widely expected. The same has also been generally true for therapeutic monoclonal antibodies, whose premises are nowadays widely resized.

### Vaccine hesitancy

Delay in obtaining a vaccine, despite availability, a well-known problem with all vaccines administered to children, represents a significant obstacle to management of the COVID-19 pandemic and is often a consequence of narratives and rhetorical styles common to anti-vaccine and COVID-denialist media. The most frequent narratives centre on “corrupt elites” and rhetoric appealing to the vulnerability of children [6]. In this regard, an unprecedented number of headlines have focused on immune thrombotic thrombocytopenia after vaccination with Oxford/AstraZeneca COVID-19 vaccine [7] (a vaccine whose development has been publicly funded for >97% [8]): such an adverse event remains far below the serious complications and deaths caused by SARS-CoV-2 itself. Because this adverse event is more common in younger individuals where serious morbidity and mortality due to SARS-CoV-2 is not as frequent, many countries ended up reversing the manufacturer's original indications (which reserved Vaxzeria® to patients younger than 60), by recommending it to patients older than 60 years. This led to further confusion among lay people, given the increased number of vaccines available on the market, so that many people demanded to choose which vaccine brand was administered to them. Scientists should instead explain that high-level regulatory authorities (such as EMA and ECDC) tend to be overprotective and to investigate “signals” that might ultimately not translate into real “black box” warnings.

Mainstream media have an enormous impact on public opinion, and their use should be carefully evaluated by both editors and scientists. Individual experts have often covered the information vacuum left by slowly reacting institutional authorities, less prone to using social media, with detrimental effects. While some countries reliably used the same official spokesperson, many more countries relied on freelance scientists, who sometimes received an

economic return for their opinions. Such a vacuum should be covered, and national institutions should regularly expose the same spokespersons on a daily basis to provide an official communication flow to citizens. Supranational authorities (such as EMA and ECDC) should also be more proactively and preferentially cited as a reference source by national media.

The COVID-19 pandemic was a unique opportunity to show the power of science and basic research, but this opportunity was missed. Public opinion, which has a right to continuous updates on such a critical topic, was trapped in (legitimate) dialectics and conflicts among narcissistic characters [9]. Media owners invariably seek profits, and many conflicts with institutional decisions have been artificially created for the sole purpose of increasing audience share. It is unlikely that knowledge in biomedicine is obtainable from TV, but it must be stressed that the intrinsic rules of TV shows (from sensationalism to haste) are incompatible with science.

In conclusion, scientists should tend to avoid accepting invitations to indiscriminate social media coverage and debates and increase their engagement on official communication channels; of course, journalists should steer clear of any sensationalism. A calm and informative tone should be employed during face-to-face interviews with journalists, while avoiding crowded and noisy talk shows, especially in the presence of conflict of interest. Even an uneducated audience can be informed when a topic is of critical interest, so this complex situation should be explained without undue complication or narcissism.

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### Author contributions

D.F. and G.A. wrote the first draft; E.R. F.M. and D.N. revised the draft and approved the final version.

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