

## The impact of COVID-19 on scientific publishing

Annarita Barbaro (a), Federica Napolitani Cheyne (b) and Maria Cristina Barbaro (b)

(a) Knowledge Service / Library, Italian National Institute of Health, Rome, Italy

(b) Scientific Communication Service, Italian National Institute of Health, Rome, Italy

### Abstract

*This article proposes an analysis on the impact that COVID-19 pandemic is having on the process of scientific publishing in academic journals. It will specifically describe the response of the scholarly publishing community to meet the pressing demand from authors and researchers wishing to disseminate, as rapidly as possible, information on the virus. Its aim is to provide an overview for the community of librarians and information specialists about publishing in the COVID-19 era.*

**Key words:** COVID-19; pandemics; scholarly communication; peer review, research; preprints as Topic.

### Introduction

Over the past two decades, the international scientific community engaged in a debate on the opportunity to make scientific information of public interest freely accessible among researchers worldwide in order to speed up the spread of relevant findings. The Ebola (2014-2016) and Zika (2015-2016) virus outbreaks provided an added sense of urgency to these efforts (1); the public health emergency triggered by the COVID-19 is an issue of international concern and an unexpected incentive to the debate. The collaborative efforts of practitioners and researchers to find an effective solution to the global health crisis have highlighted the urge to embrace the adoption of open data, open science and new forms of communication. From January to June 2020, the fight against the virus has produced an unprecedented flood of scientific information across the internet with the number of COVID-19 papers growing tremendously (2). Before entering formal peer review, a huge amount of new findings has been released in the form of preprints through platforms such as bioRxiv (<https://www.biorxiv.org/>) and medRxiv (<https://www.medrxiv.org/>). These preprints often receive a great deal of attention on social media: on the microblogging site Twitter, the top COVID-19 preprints have been retweeted over 10,000 times (3). At the same time, to support the public health emergency efforts to contain the spread of COVID-19, publishers have committed to accelerate the management of article review processes in order to

publish papers as quickly as possible. Several publishers have made articles on COVID-19 issued in their journals available online free of charge, taking on the great responsibility of ensuring both quality of contents and speed of information. The massive number of articles on COVID-19 submitted for publication demands skills and new strategies to find balance between accuracy, scrupulousness, flexibility and urgency of release, and journals are quickly evolving their publishing procedures in response to the COVID-19 health crisis (4).

One of the consequences of these changes in the dissemination of scientific information is that its increased speed and volume have made it harder for researchers to quickly spot the most relevant findings (5). The sharing of scientific and clinical data in a very short period of time has led to a serious concern about the quality of its contents and the need to rethink the peer-review models practiced by science journals. The World Health Organization (WHO) has defined the dissemination of an over-abundance of information – some accurate and some not – occurring during an epidemic, with the term “Infodemic” (6). Assuming that accurate information must spread at least as fast as the virus, it is imperative that those involved in communication allow public health information to spread faster and in the best possible way.

COVID-19 has made an impact on work culture in so many ways. Video conferencing and virtual training have been the new normal during the strict lockdown

*Address for correspondence:* Federica Napolitani Cheyne, Scientific Communication Service, Istituto Superiore di Sanità, Viale Regina Elena 299, 00161 Rome, Italy. E-mail: federica.napolitani@iss.it

measures imposed by governments to contain the pandemic, and the enormously increased workloads have required adaptability and very high level of competence. Indeed, with great changes come great responsibilities, but opportunities and privileges as well.

This article analyses the influence and changes of COVID-19 public health emergency on scientific publishing. The authors, editors of the science journal *Annali dell'Istituto Superiore di Sanità* (the official Journal of the Italian National Institute of Health), aim to provide a point of view for the community of librarians and information specialists about publishing in the COVID-19 era, according to their expertise on the topic.

### Science publishing in times of crisis

During the COVID-19 outbreak, science journals have experienced an unprecedented situation: they received what many called a “tsunami” of COVID-19 related submissions, which eventually lead to a “pandemic” of publications (7). Indeed, an analogy between the pandemic curve and the growth in the number of published papers has been reported by some authors (8). This huge increase in the number of new publications on this topic mainly affected the most prestigious journals. For instance, three to ten times the usual number of submissions occurred in *The Lancet* group of prominent journals (9).

How did the journals react to this pressing demand from authors wishing to disseminate, as rapidly as possible, new information on the virus? Major publishers could count on strong infrastructures and on a wide network of international editors and collaborators. But still they had to quickly adapt their workflow systems to meet the new publication needs. The other scholarly journals, published at national or international level, also struggled to modify their standards and procedures to keep up with the pace. Both categories of journals were also facing the challenge of having their own editors and staff working from home during the lockdown period, in some cases with inadequate technological resources.

The urgency to publish information and data potentially useful to save as many lives as possible, during the first weeks of the pandemic, forced editors to consider breaking some traditional barriers in the publication process. It was clear from the beginning that the first

data on the virus had to be published with a fast-track priority. This in order to help researchers rapidly develop their studies, clinicians deal with their patients flocking to the emergency departments and governments to adopt restrictive measures supported by scientific evidence both at national and global level (see, for instance, 10). National health institutes rapidly produced technical, surveillance or situation reports, which often represented the only source of information and data to cope with the pandemic at national level. Such reports contained precious “raw material” later developed in journal articles.

Under the urgency of the coronavirus crisis, an unexpected small revolution occurred in science publishing and several ongoing changes and developments were further accelerated. At least two areas of the publication workflow were affected: the peer-reviewing and the dissemination of research results.

### Peer-reviewing

Peer-review has been a keystone in the publication process from the times of the *Philosophical Transactions* of the Royal Society of London, at the beginning of the nineteenth century (11). Though highly debated for decades, this independent critical assessment is still considered by the International Committee of Medical Journal Editors (ICMJE) as “an intrinsic part of all scholarly work, including scientific research, [and] an important extension of the scientific process” (12). Recently, a general tendency towards a greater openness in science is forcing the scholarly publishing community to study different – untraditional – forms of open peer-review, which are currently listed under the so called “open peer-review umbrella”. At present, however, the great majority of biomedical journals still adopts a traditional peer-review system, as shown in a study by the same authors of the present paper on the journals listed in the Public, Environmental and Occupational Health category in the Journal Citation Reports, whose results will be presented at the EAHIL Virtual Conference which will take place in November 2020 (13).

As it is well known, traditional peer-review can be a time-consuming process. When a manuscript requires more than one round of review before being accepted for publication, the process can last several months. With the pandemic outbreak, these lengthy review times had

to be reduced. Editors were rushing to identify papers, whose content was potentially useful to fight the virus, and publish them as rapidly as possible. They were sometimes forced to accelerate the peer-review process contracting it even to a few days and authors felt the urge to make their papers available in the form of preprints (see the following chapter).

Editors also struggled to find reviewers who would accept this task and complete their assignment quickly even under stressful conditions. This difficulty caused a prolongation in the acceptance of manuscripts and the frustration and anger of authors. From the point of view of reviewers, those perceived to be experts in the field were “inundated” with requests and the strict deadlines posed the risk of lowering the quality of the review and the spreading of inaccurate, potentially dangerous information (14). Some publishers addressed their reviewers with a note showing understanding of the difficulties encountered by reviewers and offering flexibility by postponing the deadlines and specific updated guidelines.

On 27 April 2020, a COVID-19 Publishers Open Letter of Intent for Rapid Review (15) was announced by a group of publishers and scholarly communications organisations to maximize the efficiency of peer-review during the pandemic. This initiative, initially comprising of eLife, Hindawi, PeerJ, PLOS, Royal Society, F1000 Research, FAIRsharing, Outbreak Science, and PRereview, supported by the Open Access Scholarly Publishers Association (OASPA), aimed at ensuring that the key works on COVID-19 were “reviewed and published as quickly and openly as possible” (16). The signatories invited researchers who were willing to conduct a rapid peer-review of COVID-19 submissions to voluntarily enter the list of potential reviewers.

As this initiative strongly underlines, the peer-review must remain rigorous and efficient, although rapid and open. A question then arises: would these new circumstances impact the quality and integrity of peer-review? During the recent EASE Virtual Conference held in June 2020 it was debated whether “it is acceptable to reduce quality assurance processes in order to fast-track important research in times of crisis” (17). This delicate matter will be further discussed in the scholarly publishing community.

Two retracted papers published in *The Lancet* (18) and in *The New England Journal of Medicine* (19), reporting studies on hydroxychloroquine based on the same

datasets which proved to be unreliable, clearly show the danger of a publishing system working under pressure. In its retraction note *The Lancet* apologised recalling its good faith: “We all entered this collaboration to contribute in good faith and at a time of great need during the COVID-19 pandemic”.

Good faith and trust are particularly needed in times of crisis when the normal standard processes to ensure quality and integrity might necessarily be altered. Retraction Watch (<https://retractionwatch.com/>), a website tracking all retracted papers from scholarly journals, already lists, from February 2020 as to 26 July 2020, twenty-six retracted papers with COVID-19 related content; three temporarily retracted and one expression of concern.

On 10 June 2020, the Canadian Health Libraries Association (CHLA/ABSC), the European Association for Health Information and Libraries (EAHIL), the Australian Library and Information Association/Health Libraries Australia (ALIA-HLA) and the US Medical Library Association (MLA) addressed a letter to the ICMJE with the aim “to encourage journal editors to actively seek information specialists as peer-reviewers for knowledge synthesis publications and to advocate for the recognition of their methodological expertise”. The Letter, introduced by C. Lefebvre, was also published in *JEAHIL* (20).

### **Dissemination of research results**

On 13 March 2020, the National Science and Technology Advisors from 12 countries published an open access COVID-19 Letter addressed to all Members of the Scholarly Publishing Community stating “Given the urgency of the situation, it is particularly important that scientists and the public can access research outcomes as soon as possible. The countries listed below urge publishers to voluntarily agree to make their COVID-19 and coronavirus related publications, and the available data supporting them, immediately accessible in PubMed Central and other appropriate public repositories, such as the World Health Organization’s COVID data base, to support the ongoing public health emergency response efforts” (21). The response was impressive. After a few days, more than 30 leading publishers worldwide committed to making all of their COVID-19 and coronavirus-related publications, and the available data supporting them, immediately accessible in PubMed Central (PMC) and

in other public repositories and to review and publish as quickly as possible all the research contributions related to this new virus (22). In June 2020 more than 50 publishers were adhering to this Public Health Emergency COVID-19 Initiative, as reported by the NLM ([www.ncbi.nlm.nih.gov/pmc/about/covid-19/](http://www.ncbi.nlm.nih.gov/pmc/about/covid-19/)). Already during the Ebola and Zika virus outbreaks, a statement on data sharing in public health emergencies was issued (23). At that time, the journal signatories accepted to make content, related to the viruses, free to access and to publish in their journals including any data or preprint deposited for unrestricted dissemination before submission. As stated: "We've joined other global health bodies to call for all research data gathered during the Zika virus outbreak, and future public health emergencies, to be made available as rapidly and openly as possible". However, it is with the COVID-19 emergency that all the potential benefits of the open access became evident because an unprecedented global research effort was on its way and an unrestricted and immediate dissemination of search results was needed (24). Many of the publishers are making their COVID related contents only temporarily available for free on their platforms, during the course of the pandemic crisis.

### The role of preprints during the COVID-19 pandemic

It is now a widespread assumption that the most noticeable change that this world health emergency brought to the scientific publication field is the rise of so-called preprints. Preprints are drafts of research papers, archived on specific platforms, that are open for public viewing without having undergone a peer review and being published. Due to their capacity of spreading research findings almost immediately, preprints have been, since the beginning of the pandemic, one of the main forms of up-to-date information (25).

Already a consolidated practice in physics and mathematics through the arXiv (<https://arxiv.org/>)

preprint server, this approach to fast dissemination of research through preprints has come to the biomedical sciences mainly through the servers bioRxiv and medRxiv. These are only the two most prominent of at least 44 different archives currently hosting biology preprints; most are non-profit, community-based repositories, although traditional publishers, such as Elsevier (owner of the preprint server SSRN, <https://www.ssrn.com/index.cfm/en/>), are also joining the preprint sector (26).

Historically the use of preprints in many fields (especially life sciences) was limited by policies adopted by many publishers of refusing to consider manuscripts which had been previously posted as preprints for publication, but in the last few years this barrier was torn down as many of the most prestigious journals have abandoned this practice (as an example of the acceptance of preprints also in traditional publishing, medRxiv was launched last year thanks to a collaboration between Yale University and the publishers BMJ and Cold Spring Harbor Laboratory Press) and so far, 173 journals allow submissions of preprints directly transferred from bioRxiv, and over 30 journals offer opt-in posting of preprints on bioRxiv after submission (27).

bioRxiv and medRxiv were already relatively established (bioRxiv was launched in 2013 and medRxiv in mid-2019) but have experienced an unprecedented level of use in the last few months with the emergence of the pandemic: as of today (July 27) they, respectively, count 1,440 and 5,521 preprints on this topic. Over the same period 35,154 COVID-19 related papers appeared in PubMed. It is interesting to underline that the number of COVID-19 preprints (6,961) as a proportion of peer-reviewed papers (35,154) published since the beginning of the year is high (19.8%) in historical context (Table 1). Although peer-review is crucial for the validation of science, the ongoing outbreak has shown that the speed with which preprints can disseminate information

	<b>Ebola</b>	<b>Zika</b>	<b>COVID-19</b>
Preprints	74	174	6,961
PubMed	1,641	2,187	35,154
Percentage	4.5%	7.9%	19.8%

**Table 1.** Percentage of preprints among scientific publications indexed in PubMed, in relation to three recent disease outbreaks. Ebola and Zika data from Johansson MD et al. (1); COVID-19 data from PubMed, bioRxiv and meRxiv July 27, 2020.

during emergencies is an added value in a peculiar situation where the immediacy of information has become essential for decision making (28).

The lack of peer-review revision for preprints can bring issues of credibility and misinformation, in many cases unintentional. This particular drawback has been highlighted during the ongoing pandemic, especially after the famous withdrawal, from the preprint server bioRxiv, of a study (29) claiming that COVID-19 contained HIV “insertions”. The withdrawal appears to have been prompted by a number of reports from scientists from around the world who had access to the study because it was placed on a preprint server and who signalled this on Twitter and on various science blogs (30).

Reflecting the changing perception of the status of preprints compared to traditional articles, PubMed has recently launched the NIH Preprint Pilot (<https://www.ncbi.nlm.nih.gov/pmc/about/nihpreprints/>) during which the National Library of Medicine (NLM) will make preprints resulting from research funded by the National Institutes of Health (NIH), and posted to eligible preprint servers (the preprint servers with the highest volume of papers relating to COVID-19: medRxiv, bioRxiv, chemRxiv, arXiv, Research Square, and SSRN), available via PubMed Central (PMC) and, by extension, PubMed. In this first phase, the NIH Preprint Pilot aims to focus on increasing the discoverability of preprints with NIH support relating to the SARS-CoV-2 virus and COVID-19.

Another interesting example of the interconnection between the traditional publishing system and the “innovative” publishing system related to preprints is the new MIT Press open-access journal intended to review COVID-19 preprints on a fast-tracked timeline, in an effort to stop the spread of misinformation. This new publication, *Rapid Reviews: COVID-19 (RR:C19)*, (<https://rapidreviewscovid19.mitpress.mit.edu/>) will use artificial intelligence to identify the preprints that are of most relevance to health officials, clinicians, and the public. After being screened by a group of volunteers, manuscripts will be evaluated by up to three reviewers in a matter of days, and the resulting review will be made publicly available (31). Preprints which are positively reviewed will then be given the option of being included in a so-called “overlay journal” (32), which assigns them a DOI and other “publication data”

allowing them to be cited on the same footing as conventionally published articles.

What seems to emerge from all the new publishing initiatives linked to the COVID-19 crisis is the emergence of a “fluid” publishing ecosystem where preprints are bidirectionally linked to peer-reviewed papers, which in turn are bidirectionally linked to post publication comments, updates and amendments (33); preprints will thus continue to complement published papers, rather than competing with them (34). Like other trends associated with the current pandemic (such as the increase in remote work, virtual meetings, and telemedicine) this is a development that has been underway for some time but has been dramatically accelerated, quickly moving from a marginal position to a central one.

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