

Status of and perspectives on emergency publishing for science, technology and medicine journals in China: a survey on publishing regarding the COVID-19 pandemic

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Abstract

Emergency publication provides immediate evidence to support responses to crises and scientific development of public health policy. This is an important manifestation of national governance. During the COVID-19 pandemic, scientific journals become vital disseminators and played a crucial role in emergency publishing. Establishing a scientific emergency publication system is a prerequisite for timely publishing during emergencies. We used a literature review and questionnaire survey to explore how scientific journals in China established an emergency publication system. Against the background of emergency publication during COVID-19, we analyzed the sources of manuscripts, speed of publication, dissemination routes and influence of 276 scientific journals. The emergency publication route was mainly used for research articles. The audience for these articles are scientific researchers, healthcare workers, teachers, and college students in related fields. Most scientific journals do not follow serious public health emergencies closely enough, and their response tends to lag behind. Setting up fast paths and special columns, and using preprint platforms, will improve the ability to publish more rapidly during emergencies. New media also play an important role in emergency publications. However, the influence of emergency publications in scientific journals in China still needs to be improved. China's scientific journals need to further strengthen the systematic emergency publishing system. They should promote open access to epidemic-related papers, carry out pilot demonstrations of emergency publishing and create an emergency publishing platform. They should also follow developing trends for media integration and innovate new ways to disseminate the findings of emergency publications.

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INTRODUCTION

Emergency publishing is a particular means of publishing's response to emergencies. A generally agreed definition of emergency publishing is currently lacking. Wang defined emergency publishing as a contingent and instrumental activity carried out by publishers to respond to emergencies, meet the public's demand for knowledge, and restore social order^[1]. In the practice of emergency publishing, publishers have formed a set of unique mechanisms for topic selection and planning, which are distinct from the normal publishing process. Emergency publishing provides crucial scientific guidance for policymakers during times of crisis and can be a flexible supplement of the disaster response system. The first cases of coronavirus disease-19 (COVID-19) were reported in late 2019, and a 'Public Health Emergency of International Concern (PHEIC) was declared by the World Health Organization on January 30th the following year. Shortly after the outbreak, there was a substantial increase in scientific research output and popular science writing on COVID-19. To cope with this pressure of journal publishing, science, technology, and medicine (STM) journals in China coordinated their resources to overcome publishing resistance. This ensured the timeliness and effectiveness of the

dissemination of information, which also supported the prevention and control of the epidemic^[2-4]. STM journals are more authoritative and credible than other media. The expression of scientific journals in the face of the epidemic reflects their social commitment and, more importantly, the competitiveness of the journals. It is therefore important to investigate the status of emergency publishing among STM journals and to identify any bottlenecks in the process.

Several studies have examined journal publishing during the COVID-19 pandemic^[3-20]. Some scholars have used bibliometric methods to analyze the status of journal publishing related to COVID-19. Pal mapped knowledge domains to visualize the development of knowledge from 14,588 scientific publications of the viral agent and COVID-19 that were indexed in Scopus as of May 31st, 2020^[16]. Belli et al. identified the most productive countries for coronavirus publications, showed the proportion and typology of open access (OA) publications on this topic, and analyzed international collaboration between researchers^[6]. Li & Ding compared the characteristics of scientific publications about COVID-19 indexed in the China National Knowledge Infrastructure (CNKI) and Web of Science^[3]. They also investigated CNKI's Open Access Online-First Publishing Knowledge Service Platform of Fighting against Novel

Coronavirus Pneumonia and proposed several strategies to improve emergency publishing in STM journals^[3]. Palayew et al. and Carvalho et al. studied the lag times of COVID-19-related publications over two different time spans^[7,17]. Some studies drew on publishing ethics to analyze the new challenges brought by COVID-19 to scholarly publishing. Smith et al. pointed out that in emergency publishing, it is particularly important to ensure the accuracy and validity of studies, and to pay attention to the social values, transparency, and accountability mechanisms for scholarly publishing^[21]. Other studies used the perspective of organizational management to investigate emergency publishing and management measures adopted by journals^[22–26]. Han et al. argued that the far-reaching impact of COVID-19 has changed academic communication and publishing^[23]. They recommended that publishers should establish an emergency mechanism for academic publishing to enhance service capacity and promote knowledge innovation and dissemination. Sun & Song used a case study of the Tsinghua University Press^[24]. They discussed its application of lean management to emergency publishing from three aspects: precise value, fine management, and precise placement. Other studies using a case approach have also analyzed the practice of emergency publishing among specific publishing entities^[23,27,28].

So far, however, there has been little discussion about the details of the emergency publishing process and assessment of the impact of journals after this period. Our study aimed to fill this gap. The study systematically analyzed the sources of manuscripts, speed and route of publication, communication channels, and post-publication impact of emergency publishing among STM journals in China. We designed a survey on the publishing flow among STM journals in China on the topic of COVID-19. The study aimed to answer the following questions:

- (1) Are the STM journals in China fit for emergency publishing, and did they take an initiative to respond?
- (2) How quickly did the STM journals in China organize sources of manuscripts for emergency publishing?
- (3) What about their response speed?
- (4) How did the STM journals in China attempt to shorten the lag times for publishing?
- (5) What approaches did the STM journals in China use to disseminate papers about the COVID-19 pandemic and increase the post-publication impact?

METHODOLOGY

An anonymous questionnaire was designed to target the editors of STM journals in China. It aimed to collect following data: the basic information about the journals, the sources of manuscripts, the speed and impact of emergency publication and the communication channels of publication. The questionnaire contained three types of questions: single-choice, multiple-choice and open questions, with 28 questions in total.

We carried out a pretest and revised it before the actual survey. The online questionnaire was launched from 14 September to 3 October 2021, during which a total of 318 responses were received. Overall, 276 valid questionnaires were obtained, an effective recovery rate of 86.8% after excluding invalid questionnaires with incomplete information and inconsistent logic, and any duplicates from the same journal. In general, the sample size should be five to ten times the number

of variables in the questionnaire, and thus the minimum sample size was identified using the ratio of questionnaire entries to sample size of 1:5. The number of valid questionnaires collected in this survey was therefore considered to be a suitable sample size.

The statistical analyses were performed with SPSS 26.0 software. We used the number (percentage) to describe the count data, and a one-sample t-test to analyze quantitative variables. $P < 0.05$ indicated that the difference was statistically significant.

RESULTS

Statistical characteristics of the sample

Valid samples were collected from 276 different STM journals in China, of which 91.3% were Chinese journals (252 respondents) and 8.7% English (24 respondents). In total, 44.2% were published bimonthly (122 respondents), 38.4% (106 respondents) monthly, 13.0% (36 respondents) quarterly, 4.0% (11 respondents) every ten days or semimonthly, and 0.4% (1 respondent) annually. In total, 218 of the journals (79%) were indexed by the core databases of China, such as Chinese Social Sciences Citation Index (CSSCI), Chinese Science Citation Database (CSCD) and some by Science Citation Index (SCI), Ei Compindex, Medline, PubMed, and other databases. The other 21% (58 respondents) have still not been indexed by core databases. [Table 1](#) shows that the main audience of 97.5% of journals are researchers, with 53.3% targeting college students, 18.8% government, and 15.9% business staff, with just 4.0% targeting the public.

[Figure 1](#) shows the publication status and journal subject areas in our sample. Among all the 276 valid responses, 58.7% (162 respondents) had published articles related to COVID-19. The remaining 41.3% (114 respondents) had not published any articles related to COVID-19. In terms of subject areas, 46.7% of all journals we surveyed were in the field of medicine and health (40.2% had published related articles, with the remaining 6.5% not publishing any). Almost a third (30.8%) of journals were in the field of engineering and information technology (11.6% had published related articles, 19.2% had not). Just under a quarter of journals (22.5%) were in basic science and agriculture (6.9% had published related articles, with the remaining 15.6% not having done so). In summary, our sample covered STM journals in China across different languages and subject areas, aimed at different audiences. It therefore has a high credibility and reflects the needs of the objectives of this study.

It was imperative for medicine and health journals to expedite publication on COVID-19 because the pandemic affected the whole world. Other subject areas also actively fulfilled their social responsibility to provide accurate and timely academic resources for researchers and medical workers, as well as

Table 1. Primary audience for valid sample journals.

Primary audience	Number of journals/titles	Proportion (%)
Research worker	270	97.5
College students	147	53.3
Government and related departments	53	18.8
Enterprise staff	44	15.9
General public	12	4.0

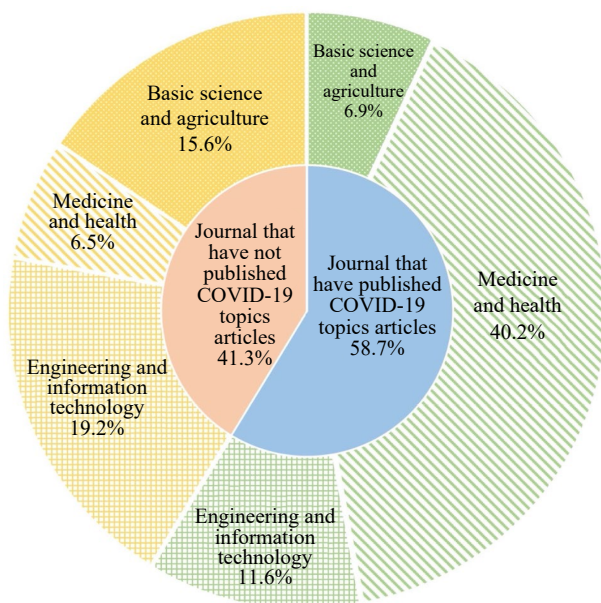


Fig. 1 Analysis of publication status and journal subject areas.

building an effective platform for academic communication, which is directly related to human life and health. For example, among the sample of journals in this study, *Engineering* (in the field of engineering sciences) published a study in March 2020 on the differences in efficacy of different antiviral drugs for the treatment of COVID-19^[29]. *National Science Review* (a multi-disciplinary science journal) published a study on the origin of SARS-CoV-2 and its evolutionary dynamics^[30].

The main force behind emergency publishing during public health emergencies are medical and health journals. Another problem that emerged was whether journals from other disciplines should be expected to take any responsibility for emergency publishing during COVID-19. We therefore used a Likert-type scale ranging from 'very relevant' (5 points), through 'relevant' (4 points), 'moderately relevant' (3 points), and 'somewhat relevant' (2 points), to 'irrelevant' (1 point) to measure the attitudes of the sample journals regarding this issue. The mean score of the survey results was 3.89, and the single sample t-test score had a significance of 0.000. The score was therefore significantly different from the neutral score of 3. These results suggest that all journals had a similar attitude to emergency publication and felt that medical journals should be the focus of emergency publications concerning public health events.

Analysis of sources of manuscripts for emergency publishing

Content analysis of emergency publishing

The 162 journals that had published articles related to COVID-19 reported that most articles were research papers, 60.5% of the total sample. The second most common type of paper were reviews (17.3%) and other (13.0%), followed by case studies (4.9%) and summary reports/newsletters (4.3%) (Table 2).

As emergencies evolve, scientific journals may need to make continuous adjustments to the content and topics for emergency publishing. Journal editors should focus on the current situation as a way to reduce the homogenization of manuscripts and improve the timeliness of the research. With regard

Table 2. Content analysis of emergency publications.

Survey items	Options	Number of samples	Percentage (%)
The main types of articles published on COVID-19	Research paper	98	60.5
	Review	28	17.3
	Other types	21	13.0
	A case study	8	4.9
	Summary Report/Newsletter	7	4.3
Whether to solicit contributions about delta and other mutated strains	Already done	4	2.5
	In planning	42	25.9
	Not yet grouped	116	71.6

to the situation of journal tracking of hot issues, we requested information on whether any journals had solicited contributions on the Delta variant and other mutant strains of the virus, which are currently causing an epidemic rebound in some regions. Only 2.5% of the journals (four respondents) had already solicited contributions on the Delta variant and other mutant strains, 25.9% (42 respondents) were planning to solicit contributions, and 71.6% (116 respondents) had not solicited contributions and had no plans to do so. This shows that only a small number of journals have therefore adjusted the content of their emergency publications to match the evolution of the pandemic. The vast majority of journals have not adjusted their topic selection. This proves to be insufficient ongoing attention of major public health emergencies by most STM journals in China and that their response speed lags behind the need.

Analysis of sources of manuscripts

The questionnaire asked participants to complete three multiple-choice questions that asked about the subjects of solicitation, the methods of solicitation and how to determine the theme of solicitation.

Figure 2 shows the subjects of solicitation of COVID-19 related articles for emergency publishing. Research institutions (70.4%) were the major subjects of solicitation, followed by hospitals (63.0%) and universities (58.6%), then government departments (10.5%), and other institutions (8.7%). It is evidently clear from the findings that the main groups targeted for emergency publication were scientific researchers, medical workers, and teachers and students in related fields in universities, which are consistent with the current audience of STM journals.

Figure 3 shows the solicitation methods adopted by the respondents. In total, 72.8% chose 'free submission', 53.1% chose 'solicited by the editorial team', 32.7% chose 'solicited by the editorial board members', and 3.1% chose 'others', such as

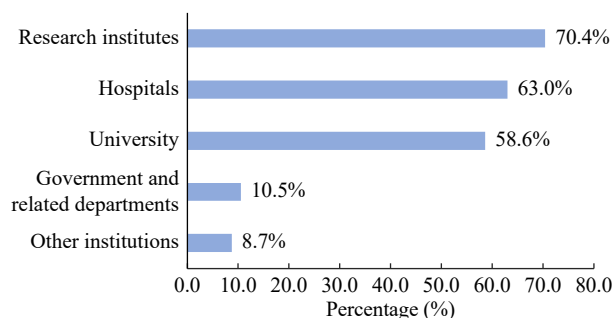


Fig. 2 Solicitation subjects of publications on COVID-19 in Chinese science and technology journals.

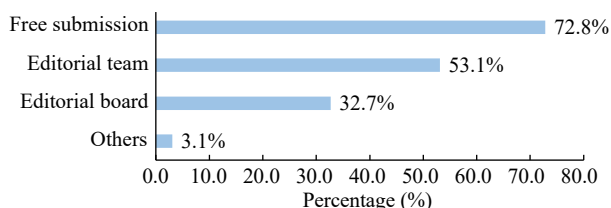


Fig. 3 Management of COVID-19 related articles in journals.

editor-in-chief appointments. These results show that the STM journals in China still waited for papers to be submitted for emergency publishing. STM journals, especially those in the field of medicine, are important media providing scientific and authoritative information. During public emergencies, journals should take the initiative to undertake social responsibility, actively plan topics and quickly collect and publish relevant information that can meet societal demands.

Figure 4 shows the pathways used by STM journals to identify topics during COVID-19. In total, 47.5% of the sample selected topics and themes based on current affairs and news, 46.3% utilized expert interviews, 24.1% used literature queries, 18.5% drew on academic conferences, and 41.4% used other methods. The largest group of journals therefore used current affairs and news to determine topics of articles, and the smallest number of journals used the academic conference route. This finding shows that the STM journals have not formed a systematic emergency publication system to respond to major public health emergencies. Instead, most rely on external information sources such as news and expert opinions, with little use of independent planning and low sensitivity in topic selection.

Timeliness of emergency publishing

Response time lag and publication cycle analysis for emergency publishing

Public health emergencies place a high demand on the response speed of STM journals. During the COVID-19 pandemic, both Chinese and English journals have accelerated the publication of COVID-19 related articles to meet public concerns, promote academic communication and speed up the pace of managing the epidemic. However, the actual response time varies between journals. Table 3 shows the relationship between the opening of 'green paths', which can speed up publication via an accelerated peer review process, by journals and the publication cycle. Of the 162 respondents, 38.9% published COVID-19 related articles in January to March 2020, 32.1% published the first COVID-19 related articles in April to June, 13.6% in July to September, 8.6% in October to December, and 6.8% did not publish articles on COVID-19 until 2021 or later. Of the 162 respondents, 59.9% opened 'green

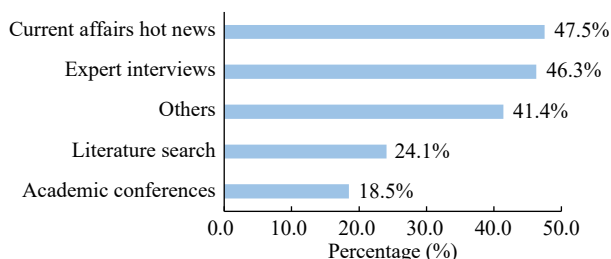


Fig. 4 How journals identified suitable topics for articles during the pandemic.

paths' to publish articles related to the outbreak as soon as possible, 9.9% have plans to open 'green paths', and 30.2% have no plans to open 'green paths' at present. Of the 34 respondents that printed articles within one month, 73.5% had opened 'green paths', 20.6% had not done so, and 5.9% were intending to do so. In summary, the journals with the shortest publication cycle (less than one month) have three times as many 'green paths' as those that do not. Among journals with actual publication cycles of two to three months, 60% opened 'green paths'. This shows that the opening of 'green paths' had a positive contribution to shortening the publication cycle of manuscripts and speeding up emergency publication.

Public emergencies are characterized by urgency, complexity, and uncertainty^[31]. These characteristics make it necessary for the publication cycle of emergency publishing to be shorter than usual. A previous study showed that the median time from receipt of manuscript to acceptance is usually approximately 100 days. However, the median time from receipt to acceptance of COVID-19 articles published between January 30, 2020, and April 23, 2020, in the PubMed database was only 6 days^[17]. We found that 21% of the 162 respondents that had published COVID-19 related articles completed the process from receipt to formal appearance in paper within 1 month, while 58.6% took 2–3 months from receipt to paper publication, 17.3% took 4–5 months, and 3.1% took more than 6 months.

It is well known that the publication of articles in STM journals requires rigorous review. However, it is also important to ensure quality while publishing quickly during major health emergencies. Of the 162 respondents, 31.5% reported an ideal publication cycle of less than 1 month, 59.3% reported an ideal publication cycle of 2–3 months, 8.0% reported an ideal publication cycle of 4–5 months, and only 1.2% reported an ideal publication cycle of more than 6 months. Table 4 further cross-tabulates the actual and ideal publication cycles of the respondents. Nearly half (41.2%) of the respondents with issues due within a month would like to see a slower pace of

Table 3. 'Green paths' and actual publication cycle of journals.

		Actual publication cycle				Total
		<1 month	2–3 months	4–5 months	≥ 6 months	
Opening of the 'green paths'	'Green path' has been opened	25	57	13	2	97
	'Green path' has not been opened, but there is a corresponding plan	2	10	3	1	16
	No plan to open a 'green path'	7	28	12	2	49
Total		34	95	28	5	162

Table 4. Cross-tabulation of actual and ideal publication cycles for COVID-19-related articles.

	Actual publication cycle	Ideal publication cycle				Total
		<1 month	2–3 months	4–5 months	≥ 6 months	
	<1 month	20	14	0	0	34
	2–3 months	31	60	3	1	95
	4–5 months	0	20	8	0	28
	≥ 6 months	0	2	2	1	5
Total		51	96	13	2	162

publication, while 58.8% of the respondents were satisfied with the current publication cycle. Of the respondents that took 2–3 months from receipt of manuscript to paper publication, 63.2% wanted to maintain the current publication speed, 32.6% wanted to streamline the process and speed up publication, and the remaining 4.2% wanted further rigorous review of manuscripts to improve their quality. Almost all the journals with a publication cycle of 4–5 months or more wanted to speed up publication.

When asked about the process issues that took the most effort and time during the publishing process, 32.1% of respondents chose post-review feedback, 30.3% chose peer review, 25.9% chose appointments, and 11.7% chose other. This shows that all aspects of the emergency publishing process have an impact on the timeliness of publication.

Journals' attempts to improve speed of emergency publishing

There are several ways that journals can speed up emergency publication. The first is opening a green path, as mentioned above. Journals can also organize a special issue/column to avoid affecting publication of articles on other topics. Of the 162 journals that had published COVID-19-related articles as emergency publishing, 64 respondents (39.5%) said that emergency publication had affected the publication of other articles in the journals. Of these 64 respondents, more than 70% of them had opened 'green paths' for COVID-19-related manuscripts. This suggests that improvements in emergency publishing timeliness are achieved by raising the priority of papers on emergency publishing-related topics within a specific timeframe. However, this affects other articles. To avoid this, a special issue/column can be used for emergency publishing to guarantee overall publication efficiency of the journal. We concluded that 46.3% of respondents had organized a special issue/column for emergency publishing, and 47.5% had not; 6.2% had plans but had not yet done so. Table 5 provides a further cross-sectional analysis of the emergency publishing response of journals, including special issue/columns. More than half of the STM journals that published articles related to the epidemic for the first time from January to June 2020 had set up a special issue(s)/column(s). Those that have not set up a special issue/column had a longer lag in publication, indicating that organizing a special issue/column has a positive effect on emergency publishing.

Pre-publishing platforms such as BioRxiv, medRxiv and arXiv all rapidly published COVID 19-related articles during the epidemic and played an important role in emergency publishing^[32]. This approach could greatly improve the efficiency of publishing^[23]. The pre-publication model of rapid dissemination developed rapidly during the COVID-19 pandemic. Its immediacy and openness were attractive to a large number of

scholars. In the sample of 276 journals in our study, 49.6% (137 respondents) used CNKI's OA Online-First publishing platform, 7.6% (21 respondents) used other prepublication platforms, 2.2% (six respondents) used Early Access, and 1.1% (three respondents) used preprint platforms such as BioRxiv and arXiv. However, 39.5% (109 respondents) of journals did not use pre-publishing platforms. All six journals using Early Access were English, as was one of the three journals using preprint platforms such as BioRxiv and arXiv. This data suggest that the usage rate of pre-publishing platforms by STM journals in China still needs to be improved. We optimistically predict that the popularity of pre-publishing platforms means that the speed of emergency publishing by STM journals in China will continue to improve in the future.

Dissemination channels used for emergency publications

We found that the main dissemination channels for emergency publication by STM journals in China were official websites, journal databases and journal's WeChat accounts, used for 80.86%, 75.9% and 64.8% respectively as listed in Table 6. Far fewer journals used other dissemination channels, such as microblogging, Twitter and short video platforms. Some journals were not yet using any emerging new media dissemination channels. Overall, 105 journals (64.81%) used their official WeChat account alone as a communication medium. Only 10 journals (6.17%) utilized foreign social media to disseminate emergency publications during the pandemic. Chinese emergency papers were more likely to be shared via new media (including official accounts of WeChat and microblogging). This suggests that journals are moving towards the integration of old and new media, which is undoubtedly an effective way to expand the influence of journals. In 2020, several science and technology evaluation policies were introduced, including *Measures to Break the Bad Orientation of 'Dissertation only' in Science and Technology Evaluation (Trial)* and *Some Opinions on Standardizing the Use of Related Indexes of SCI Papers in Colleges and Universities and Establishing correct Evaluation Orientation*. These are important in encouraging STM journals in China to obtain high-quality contributions and seek high-quality development. Dissemination and promotion of high-quality papers through overseas social media is a quick way for STM journals in China, especially English-language journals, to cultivate an international audience, enhance their international influence, and build their brand image. Promotion of emergency publishing should therefore not be limited to domestic social media in China, but also encompass foreign social media platforms, such as Twitter and Facebook.

We also examined views on the effectiveness of publicity for emergency publishing. We used a five-point Likert-type scale

Table 5. Cross-tabulation of emergency publication response and organizing special issue/column for journals.

		Time of first publication of COVID-19-related articles					From 2021	Total
		January–March 2020	April–June 2020	July–September 2020	October–December 2020			
Organizing a special issue/column on the COVID-19 in journals	Special issue/column has been organized	35	30	6	2	2	75	
	No special issue/column has been organized yet, but there are plans to do so	3	3	3	0	1	10	
	No plan to open a special issue/column	25	19	13	12	8	77	
Total		63	52	22	14	11	162	

Table 6. Analysis of emergency publication dissemination channels.

Survey items	Options	Number of samples	Percentage (%)
Distribution media of articles related to the theme of the COVID-19 of the journal	Official website	131	80.86
	Journal database	123	75.9
	WeChat	105	64.8
	Others	23	14.2
	Other foreign social media	21	13.0
	Foreign social media (e.g. Twitter)	10	6.2
	Microblogs	8	4.9
	Short video platforms	5	3.1
How effective is the promotion of articles related to the theme of your journal's COVID-19?	Very effective	19	11.7
	Effective	69	42.6
	Moderately effective	66	40.7
	Slightly effect	8	5.0
	Not effective at all	0	0

from 'very effective' (5 points), through 'effective' (4 points), 'moderately effective' (3 points), and 'slightly effective' (2 points), to 'not effective at all' (1 point). The mean result obtained was 3.61 points. The significance of this was 0.000 using a one-sample t-test, which indicates that this is significantly different from the neutral score of 3. We therefore concluded that the journals felt that their publicity on COVID-19-related articles was effective. The diversification of dissemination channels also means a more diverse audience. At present, the main targets of academic communication related to COVID-19 are still limited to official websites and journal databases, and journals are still mainly aimed at academics and professionals working in the field. This should broaden if journals want to look at other options for dissemination.

Impact of emergency publishing

The highest number of citations of papers shows that of the 162 journals that have published articles related to COVID-19 (Fig. 5), the most cited article in 43.2% (70 respondents) had been cited less than 10 times, 35.8% (58 respondents) reported articles cited 10–50 times, 5.56% (nine respondents) 50–100 times, 8.02% (13 respondents) 100–500 times, and 7.41% (12 respondents) more than 500 times. Most articles on COVID-19 therefore received only a low number of citations, and nearly 80% of them had received fewer than 50 citations at the time of the survey.

Overall, 11.7% (19 respondents) thought that COVID-19-themed solicitation was very effective in enhancing journal impact; 45.1% (73 respondents) thought it was effective; 37.0%

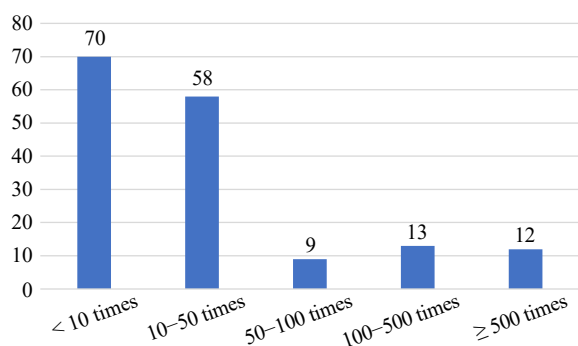


Fig. 5 The highest number of citations of papers.

(60 respondents) thought it was moderately effective; 5% (eight respondents) thought it had little effect; and 1.2% (two respondents) considered it ineffective. To clarify whether the journals believed that emergency publishing during COVID-19 had increased the impact of the journal, we compared the mean Likert-type scale score of 3.61 with the neutral value of 3 using a t-value. There was a significant difference, suggesting that the journals believe that COVID-19-themed solicitation has enhanced the journal impact. We also asked about perceptions of the attention paid to articles published on COVID-19. Equal numbers considered it higher than other articles published and that the differences were small (42.6%, 69 respondents). A further 4.9% (eight respondents) considered the focus to be lower on articles about COVID-19 than that on other articles, and another 9.9% (16 respondents) were not sure. COVID-19, is a 'hot' topic, and has gained widespread attention. However, COVID-19-related articles published by the STM journals in China have not widely gained the expected above-average attention.

OA helps to increase the reach and influence of STM journal papers^[23]. Citation, page views and social media attention are all higher for OA papers than non-OA papers, and this advantage can be maintained over a long period^[33].

In the context of the COVID-19 pandemic, journals have increased the proportion of OA publications to ensure that epidemic-related research data and results are shared quickly and widely (Fig. 6). In this study, 67.8% (187 respondents) supported OA before the pandemic, and 28.2% (78 respondents) did not. Only 4% (11 respondents) converted to support OA publication during the pandemic. The OA status and journal impact of the 162 journals that had published COVID-19 related articles were analyzed, and the results are shown in Table 7. Of the 12 journals reporting more than 500 citations, 83.3% supported OA before the epidemic. Similarly, of the 13 journals with 100–500 citations, 84.6% supported OA, as did 88.9% of the journals with 50–100 citations. However, of the journals with fewer than 10 citations, only 58.6% supported OA. A higher proportion of journals that publish highly cited articles therefore support OA, suggesting that OA affects the impact and availability of papers. During major public emergencies, more papers on the topic should be published as OA to increase access to information about the emergency.

DISCUSSION

COVID-19 is a major public health challenge worldwide. Academic journals are significant disseminators and communicators of scientific results and are important in rapid

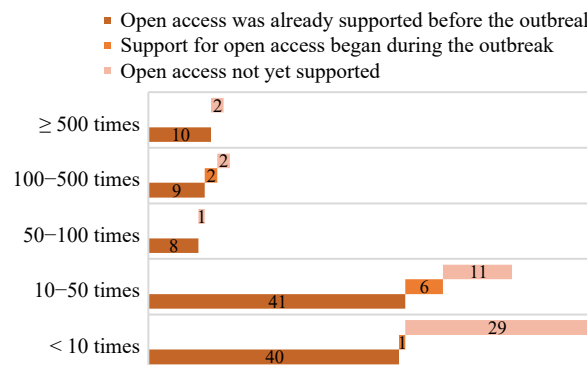


Fig. 6 Analysis of citations by OA status.

Table 7. Analysis of journal citations and OA status.

		OA status			Total
		OA was already supported before the outbreak	Support for OA started during the outbreak	OA not yet supported	
Number of citations	<10 times	40	1	29	70
	10–50 times	41	6	11	58
	50–100 times	8	0	1	9
	100–500 times	9	2	2	13
	≥ 500 times	10	0	2	12
Total		108	9	45	162

publishing and sharing of academic results during public health emergencies. Our results show that journals in several fields beyond medicine and health have also published articles related to COVID-19, including engineering and information technology, basic science and agronomy. These findings indicate that STM journals of all disciplines in China have proactive awareness of social responsibility during the epidemic. However, few journals participated in emergency publishing, and this approach was mainly spontaneous behavior by single journals. This may be connected with the fact that a mature emergency publishing system has not yet been developed among scientific journals in China. To quickly organize contribution sources, STM journals mainly targeted research institutions, hospitals and universities. The topic of manuscripts was determined by following current affairs and organizing interviews with experts. However, a large proportion of submissions were still daily submissions. Nearly 40% of the journals that published relevant articles published the first article within one to three months of the start of the pandemic. The time required to complete the process from receipt of the manuscript to the official published paper version was less than one month in approximately 20% of the journals. Some STM journals in China therefore clearly have the required capability for rapid emergency publication. To improve publication timeliness, journals used preprint platforms, set up epidemic-related 'green paths' and established specific issue(s)/column(s) to speed up publishing. The main channels for dissemination after emergency publishing were official websites, journal databases and Wechat public accounts. Notably, epidemic-related articles did not widely receive the expected above-average attention. Most articles received few citations and had little influence. A higher proportion of STM journals publishing high-cited papers supported OA than those publishing less-cited ones.

Our findings have exposed some problems in the emergency publishing system related to COVID-19 among STM journals in China. Emergency publishing was basically carried out by each journal using their established publication models. There were little joint or shared resources. In other words, there is no shared emergency publishing system. Comprehensive academic communication platforms such as the COVID-19 research academic results platform built by the Chinese Medical Association, and the OA Online-First Publishing Knowledge Service Platform of Fighting against Novel Coronavirus Pneumonia set up by CNKI, have emerged during the pandemic. Though there is an enormous amount of information on these platforms from various sources, the data classification is mainly focused on the content of articles, without considering the target audience. The integration of information lacks focused headlines or uniform bibliometric standards. In addition, some journals do not support OA, which leads to few effective means

of dissemination after emergency publishing.

We suggest two main ways to enhance the emergency publishing capacity of STM journals in China. The first is at a policy level and requires overall planning through government or administrative management for matters that may have a long-term impact. The second is at an operational level. Each publishing unit should use its professional knowledge to respond quickly and provide timely and relevant services. We recommend establishing an all-field emergency publishing system to respond to public health events at the strategic level, carry out pilot demonstrations of emergency publishing, and create an emergency publishing platform. The system should also promote the OA process of single-issue emergency publishing at the operational level and develop an integrated approach to emerging and established media to innovate dissemination forms and means of emergency publishing. These elements are discussed in more detail in the sections below.

Emergency publication in all fields

Emergency publication during the pandemic has mainly focused on journals in the field of medicine and health. *Engineering*, an engineering journal, and *National Science Review*, a journal in the field of basic science, have also both published articles, as have a few journals in the fields of information technology and agriculture. The epidemic has threatened the lives and health of people all over the world and has also had an immeasurable impact on the world economy, diplomacy, and politics. Our survey shows that journal editors consider medical journals as the most appropriate avenue for emergency publication on the pandemic. The absence of non-medical journals reporting on COVID-19 suggests that journals may need to increase their sense of social responsibility and initiative. Journal editors as academic practitioners should prompt proactive actions during emergencies. The ability of editors of STM journals to track social hot topics in real time and plan emergency publications also needs to be improved. STM journals have certain barriers to expertise, there are inevitable differences between disciplines. Therefore, as previously mentioned, the establishment of a collaborative emergency publishing system will serve to compensate for the lack of knowledge of the editors. Collaboration between journals would also help with this issue.

Carry out pilot demonstrations of emergency publishing and create a professional platform

We suggest that journals should establish a system for immediate response and precise coverage. Information needs to be released rapidly, including article impact. Emergency publishing is mainly used to respond to public health emergencies. Under these circumstances, papers must be

published on a shorter time cycle than usual. However, the publication of papers in STM journals is subject to strict review. To enhance the speed of response during an emergency, efforts can be made to establish 'green paths', set up a special issues/columns, and use preprint platforms. 'Green paths' can speed up publication to some extent. Special issues/columns can help to improve timeliness while guaranteeing the quality of emergency publications. Enhancing the use of preprint platforms in China will further improve the speed of emergency publication. We also recommend that journals create a structured platform for emergency publishing, to support information sharing among journals, publication service providers, and publication supervisors. This can help to bring together information, realize resource sharing, reduce the cost of single-issue emergency publishing, and improve the efficiency of emergency publishing management. This will allow emergency publishing to ensure real-time responses, accurate coverage of relevant fields, rapid publication, and quality assurance.

Promoting OA and preprints in emergency publishing

Open Science has achieved widespread attention due to its efficiency and transparency. The spread of the virus causes heavy stress on academia to disseminate the progress of scientific research and initiate scholarly exchanges. After the outbreak of COVID-19, people's ways of working were inevitably affected, offline activities were limited. There is a global consensus to disseminate and share the latest relevant scientific findings and clinical information online. As a gateway for review and publication of scientific research, 75 international organizations, including Springer Nature, arXiv, CDC, and Elsevier, have signed the 'Sharing of Research Data and Results Related to the Novel Coronavirus (2019-nCoV) Outbreak' and pledged that research results related to the outbreak will be made available at the earliest opportunity access to assist in the global fight against the outbreak. The development of an open access platform will greatly facilitate scholarly communication during an outbreak. Judging from our findings and the practice of publishing OA carried out by numerous platforms such as CNKI, STM journals in China are gradually increasing their ability to respond to and awareness of reporting on major emergencies. Open access lowers the threshold for researchers to access academic information and promotes the immediate sharing of research results worldwide. The sharing of high-quality research results will also enhance the influence of science and technology journals, which is an effective driving force in improving the international status of China's STM journals.

During the epidemic publication process, the preprint publication model, being rapid and open, has also increasingly developed. This has become an important and immediate academic communication venue. Preprints have the advantage of reducing public lag time and promoting academic exchange. It also lessens unnecessary duplication of research in emergencies^[34]. A study based on the publication pathways of early COVID-19 research papers found that, out of total 46 articles published between 19 January and 3 February 2020, there are 33 articles published on the preprint platform bioRxiv and medRxiv. A further 13 articles were published in top journals such as *Nature*, *Lancet* and *The New England Journal of Medicine*. Between January and May 2020, bioRxiv and medRxiv, two biomedical preprint platforms alone, publish more than 3,000 research papers on COVID-19^[35]. It is thus

evident that the preprint's contribution to scholarly communication in the early and mid-epidemic period cannot be overlooked^[36]. During the epidemic, the public demand for scientific information, not only from academics, increased rapidly. However, the lack of rigorous peer review in preprints has led to scientific information that lacks scientific basis or is inherently bogus entering the public view. The preprint uncanny similarity of unique inserts in the 2019-nCoV spike protein to HIV-1 gp120 and Gag, published by a team of researchers from IIT Delhi on bioRxiv with obvious professional errors, was discussed within the research staff and reached the public via Twitter. As professional scientific information has a threshold for the general public, the misinterpretation of the preprint by some media and self-published media further spread the panic and had a negative impact on the prevention and control of the epidemic. Once again, the quality and reliability of preprints is being questioned. In response, preprint platforms have been proposing improvements. In March 2020, ChinaXiv, China's preprint platform, specifically mandated that articles publishing the results of studies such as COVID-19 drugs and their vaccines must follow relevant requirements^[37]. On 14 May 2020, bioRxiv launched a new service that integrates all open comments and transparent reviews and author responses for each paper and presents them to readers, improving the reliability of preprint content by making the open review process fully accessible^[38]. The F1000 Research platform combines a preprint platform with an open peer review process to ensure the transparency and quality of research coupled with rapid dissemination of academic results.

As the coronavirus continues to mutate and humanity faces new challenges in the fight against the epidemic, the race against time in the dissemination of scientific research is also an important process for researchers fighting for the health of human lives around the world. Despite the shortcomings, many scientists are willing to use preprints for scholarly communication and timely information sharing at a time when offline communication is being hampered by the epidemic^[39]. Preprint platforms are not widely used by STM journals in China. However, they are a feasible means for journals to shorten the publication time. Overseas preprint platforms provide a way to support international academic exchanges and help the global response to health emergencies. The prevention and control of COVID-19 cannot be achieved without the research of researchers and journals should play their role as 'guideposts' to guide researchers on their academic journey. Scientific journals are composed of elites with professional scientific authors and a dedicated team of reviewers, so their grasp of the epidemic is much more precise than that of the general media. This is when STM journals have an obligation to take on the responsibility of quickly and accurately disseminating knowledge to society and strengthening people's confidence in the fight against emergencies. Journals can develop strategies to strengthen collaboration with preprint platforms in reviewing manuscripts to achieve a win-win situation in terms of speed and quality of dissemination of research.

Develop and integrate new and traditional media to innovate the form of emergency publication and dissemination

It may be helpful to develop a new media communication system for emergency publication. This could enhance both the

influence and timeliness of the communication of emergency publications. It might also expand the audience for emergency publications. New media is often internet-based, which greatly reduces the communication cost of emergency publication and improves its speed. With new spread way developed by internet, several different internet-based dissemination channels were used by journals during the pandemic, including official websites, and new media such as journals' WeChat accounts. Most of the audience of traditional media such as official websites or journal databases are experts or scholars. However, the emergence of new media communication channels has further expanded this audience. The integration of the Internet into people's lives is causing people's reading habits to become fragmented, as well as emerging forms of communication dissemination are becoming increasingly diverse and social. Emerging media provide low cost, fast dissemination, diversified content, and more opportunities for interaction. In China, the user group of WeChat official accounts and short-form video platforms is growing. During the COVID-19 pandemic, China's WeChat accounts and short-form video platforms, with their advantages of instant information and wide distribution, effectively disseminated health knowledge, fought false rumors and eased public anxiety. Thus, it can be seen that new media has the potential to become a form of academic communication in the future, emergency publishing should follow the trend of media convergence to innovate the means of emergency publishing. The development of science and technology has made it possible to present information in more forms. Multimedia formats including text, image, audio and video can be organically integrated colliding the authority and seriousness of academia with the interactivity and accessibility of new media. Journals can expand the influence of emergency publishing by innovating the presentation of knowledge, such as producing short videos that are both scientific and artistic, and tweeting them on the journal's Twitter and Facebook social media pages to stimulate readers' interest and deepen their impressions, thereby strengthening the role of emergency publishing as a guide in public health emergencies. This should enable emergency publication to guide action in public health emergencies and increase both its influence and timeliness. Overall, this will improve the national governance of emergencies.

CONCLUSIONS

COVID-19 has brought great changes to the academic environment, and has been a major test of the resilience, organizational planning and risk prevention and control capabilities of STM journals. The academic publishing industry is an important part of information communication and exchange, with the advantages of professionalism, and scientific authority. The industry should actively respond to the pandemic and take initiative. The communication problems of STM journals in China that have been exposed in the move to emergency publishing should not be ignored in the future. Instead, journals should learn from this experience, and work together during any future emergencies.

Conflict of interest

The authors declare that they have no conflict of interest.

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