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Availability of Research Articles for the Public During Pandemic — A Case Study

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Abstract

The coronavirus 2019 (COVID-19) disease has affected millions of lives, forcing most of us to stay at home and work. However, there is an immediate need to conduct research on potential drugs against COVID-19. In this article, the extent to which major publishers have provided access for the public to read research articles relevant to potential drug candidates for the COVID-19 disease are presented.

A systematic search of five electronic databases (Elsevier's ScienceDirect, Taylor & Francis, SpringerLink, Wiley, and New England Journal of Medicine (NEJM)) was conducted on April 12–17, 2020. The total number of research articles containing terms 'Ribavirin,' 'Remdesivir,' 'Hydroxychloroquine OR Chloroquine,' 'Favipiravir,' 'Lopinavir OR Ritonavir,' 'Sarilumab,' and 'Tocilizumab,' available for the public to read for free were determined. In this study, there was a lack of full access to research articles related to potential drugs of COVID-19 in commercial academic databases, except for 'Remdesivir' and 'Favipiravir' from NEJM.

Keywords: Open access; scholarly communication; COVID-19; Coronavirus; pandemic

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1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic has impacted our lives more than we could imagine forcing most of us to stay at home and work (Amla & Amla, 2020; Ciuriak, 2020; Hamzelou, 2020; Pueyo, 2020; WHO, 2020). As we find our way through the COVID-19 crisis, some scientists are adjusting to the new routine of working from home (Burke et al., 2020). For example, clinical research not requiring patient contact is conducted remotely as per Food and Drug Administration (FDA) guidelines, while balancing the rights and safety of study participants (Padala, Jendro, & Padala, 2020). Additionally, activities such as writing grants, research articles, and peer-review are continued from home to maintain productivity while keeping researchers safe and engaged (Omary et al., 2020). At this emergent time, it is essential to recognise that the lack of access to research articles for the public to read could become a barrier to implementing evidence-based practice for healthcare professionals, policy makers, and government officials (ElSabry, 2017; Look & Marsh, 2012; Willinsky, 2003).

As pivotal as it seems, the lockdown has changed the business practices of major scientific publishers (Nadeem, 2020). In response to the COVID-19 crisis, various publishers and journals have started providing free access to research articles to encourage researchers to continue their work from home (Nadeem, 2020). As a result, the number of articles published on COVID-19 is increasing, which raises concern over the quality of research published (Peyrin-Biroulet, 2020). Nevertheless, there is an immediate need to conduct research on potential drugs and vaccine against COVID-19. One of the ways to make progress on this front is to make research articles relevant to potential drugs of COVID-19 available in the internet public domain.

The World Health Organization is now conducting a megatrial of the four most promising COVID-19 treatments (Kupferschmidt & Cohen, 2020), including Remdesivir (Cao, Deng, & Dai, 2020b), Chloroquine and hydroxychloroquine (Arnold & Buckner, 2020), and Ritonavir/lopinavir drug combinations (Cao et al., 2020a). More recently, researchers are conducting studies on Ribavirin (Khalili, Zhu, Mak, Yan, & Zhu, 2020), Favipiravir (Du & Chen, 2020), Sarilumab (Lu, Chen, & Chang, 2020), and Tocilizumab (Lu et al., 2020) in patients with COVID-19 infection. A systematic analysis of proteins encoded by severe acute respiratory syndrome coronavirus (SARS-CoV) genes using target-based virtual ligand screening has identified more than 10 drug compounds that might have anti-viral properties against COVID-19 (Wu et al., 2020). As of 12–17th

April 2020, I analysed whether research articles related to potential drug candidates of COVID-19 were available on the internet for free to read.

2. Methods

As a first step, the drugs with potential anti-viral activity against COVID-19 were selected through a literature search on PubMed. The keywords from medical subject headings (MeSH) were used to conduct the search (Drug Therapy, Drug Development, Coronavirus, COVID-19) (Table 1). After removing duplicate records, a total of 486 research articles were identified from the literature search (Table 1). Next, title and abstract screening were conducted to select articles based on the inclusion criteria (1) patients with COVID-19 disease, (2) clinical studies involving treatment of COVID-19, and (3) clinical studies with specific endpoints of recovery from COVID-19, and exclusion criterion (1) studies on other coronavirus-related diseases such as Middle East Respiratory Syndrome (MERS). From a total of six studies (Arnold & Buckner, 2020; Cao et al., 2020a,b; Du & Chen, 2020; Khalili et al., 2020; Lu et al., 2020) which were chosen for full text review, seven potential drug candidates and combinations were selected to determine how many research articles were available for the public to read for free (Table 2).

Table 1: Search history.

Step	Search Query	Items found
7	Search (((Drug Therapy[MeSH Terms]) OR Drug Development[MeSH Terms])) AND ((Coronavirus[MeSH Terms]) OR COVID-19[Supplementary Concept])	486
6	Search (Coronavirus[MeSH Terms]) OR COVID-19[Supplementary Concept]	12,819
5	Search COVID-19[Supplementary Concept]	1,545
4	Search Coronavirus[MeSH Terms]	12,598
3	Search (Drug Therapy[MeSH Terms]) OR Drug Development[MeSH Terms]	1,469,432
2	Search Drug Development[MeSH Terms]	157,950
1	Search Drug Therapy[MeSH Terms]	1,344,112

MeSH: Medical Subject Headings

Table 2: Research articles available for the public to read for free as of 12–17th April 2020.

COVID-19 candidate treatments	Elsevier's ScienceDirect	Taylor & Francis Online	SpringerLink	Wiley Online Library	NEJM
Search Query					
"Ribavirin" (Khalili et al., 2020)	Total=7,547 Open access=1,032 Open archive=420 Available in first 6,000 articles listed=1,130*	Total=2,321 Available=443	Total=7,869 Available=1,746	Total=10,818 Open access=354 Available in first 2,000 articles listed=818**	Total=93 Available=86
"Remdesivir" (Cao et al., 2020b)	Total=56 Open access=8 Open archive=0 Available=51	Total=16 Available=12	Total=38 Available=36	Total=65 Open access=13 Available=59	Total=6 Available=6
"Hydroxychloroquine" OR "Chloroquine" (Arnold & Buckner, 2020)	Total=19,099 Open access=2,372 Open archive=1,258 Available in first 6,000 articles listed=858*	Total=6,166 Available=1,213	Total=15,877 Available=5,004	Total=18,644 Open access=460 Available in first 2,000 articles listed=771**	Total=131 Available=56
"Favipiravir" (Du & Chen, 2020)	Total=169 Open access=38 Open archive=5 Available=66	Total=75 Available=32	Total=131 Available=73	Total=84 Open access=12 Available=61	Total=5 Available=5
"Lopinavir" OR "Ritonavir" (Cao et al., 2020a)	Total=4,460 Open access=594 Open archive=218 Available=948	Total=2,916 Available=216	Total=7,202 Available=1,661	Total=5,981 Open access=475 Available in first 2,000 articles listed=1,093**	Total=70 Available=69
"Sarilumab" (Lu et al., 2020)	Total=46 Open access=4 Open archive=2 Available=12	Total=100 Available=18	Total=199 Available=82	Total=92 Open access=12 Available=70	Total=0 Available=0
"Tocilizumab" (Lu et al., 2020)	Total=1,420 Open access=242 Open archive=75 Available=349	Total=1,405 Available=162	Total=4,015 Available=1,322	Total=2,049 Open access=166 Available in first 2,000 articles listed=1,222**	Total=15 Available=13

*Elsevier's ScienceDirect database provided a maximum of 6,000 research articles per search;
**Wiley Online Library database provided a maximum of 2,000 articles per search; NEJM: New England Journal of Medicine.

The availability of research articles containing search terms of seven potential COVID-19 drug candidates and combinations (Table 2) for the public to read for free from the internet as of 12–17th April 2020 were determined from online databases of four major publishers (Elsevier's ScienceDirect, Taylor & Francis, SpringerLink, and Wiley) (see Screen-capture A1.1–A4.7)[1] (Larivière, Haustein, & Mongeon, 2015; Rolnik, Binfield, & Graves, 2008). A similar search was conducted on the online database of the New England Journal of Medicine (NEJM) as several drug studies on human subjects with lower statistical errors related to the documentation, presentation, and interpretation of findings have been published in NEJM (see Screen-capture A5.1–A5.7) (Strasak, Zaman, Marinell, Pfeiffer, & Ulmer, 2007). The lack of access to research articles that were locked behind website paywalls was determined separately for all five databases (see Screen-capture B6.1).

3. Results

The maximum number of research articles accessible from the journals in Elsevier's ScienceDirect database is 6,000 per search query (from a total of 60 webpages with each containing 100 research items). The terms 'Ribavirin' and 'Hydroxychloroquine OR Chloroquine' returned more than 6,000 research articles each during the search (Table 2).The number of research articles that were available for free in the first 6,000 articles accessible from Elsevier's ScienceDirect database were counted and reported (Table 2). The total number of research articles containing search terms of potential COVID-19 drug candidates such as Ribavirin, Remdesivir, Hydroxychloroquine OR Chloroquine, Favipiravir, Lopinavir OR Ritonavir, Sarilumab, and Tocilizumab, available for the public to read for free on 17th April 2020 in Elsevier's ScienceDirect database was 1,130, 51, 858, 66, 948, 12, and 349 respectively (Table 2).

The total number of research articles containing search terms listed consecutively as above (on Table 2) available for the public to read for free on 12th April 2020 in Taylor & Francis Online database was 443, 12, 1,213, 32, 216, 18, and 162 respectively (Table 2). The total number of research articles containing search terms listed consecutively on Table 2 available for the public to read for free on 12th April 2020 in SpringerLink database was 1,746, 36, 5,004, 73, 1,661, 82, and 1,322 respectively (Table 2).

The maximum number of research articles accessible from the journals in Wiley Online Library is 2,000 per search query (from a total of 100

webpages with each containing 20 research items). The terms 'Ribavirin,' 'Hydroxychloroquine OR Chloroquine,' 'Lopinavir OR Ritonavir,' and 'Tocilizumab' returned more than 2,000 research articles each during the search (Table 2). The number of research articles that were available for free in the first 2,000 articles accessible from Wiley Online Library database were counted and reported (Table 2). The total number of research articles containing search terms listed consecutively on Table 2 available for the public to read for free on 12th April 2020 from the journals listed in Wiley Online Library was 818, 59, 771, 61, 1,093, 70, and 1,222 respectively (Table 2).

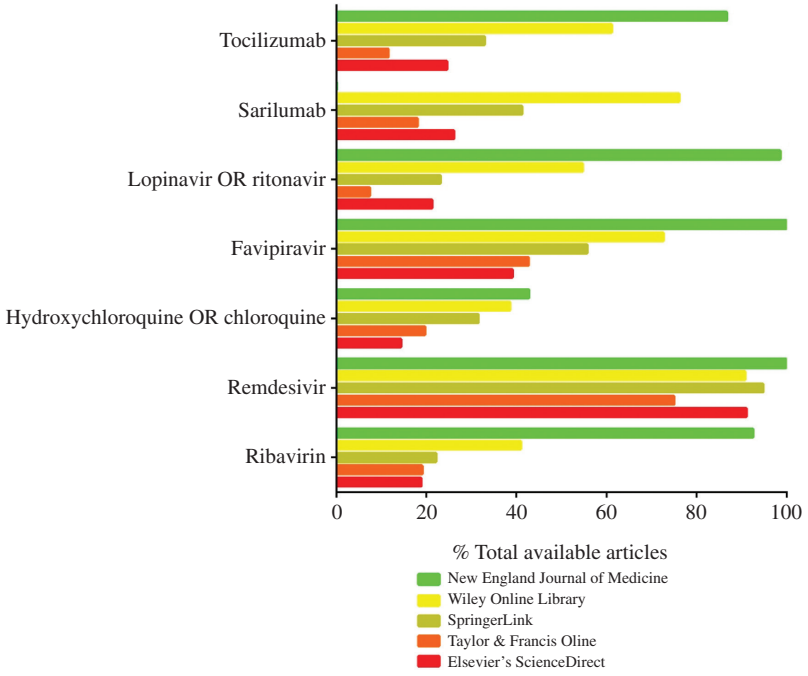
The research articles containing search terms of potential COVID-19 drug candidates such as Ribavirin, Remdesivir, Hydroxychloroquine OR Chloroquine, Favipiravir, Lopinavir OR Ritonavir, and Tocilizumab, available for the public to read for free on 12th April 2020 in NEJM database was 86, 6, 56, 5, 69, and 13 (Table 2). The term 'Sarilumab' did not return search results in the NEJM database. In this study, there was a lack of full access to research articles relevant to potential drugs of COVID-19 (Figure 1).

4. Discussion and Conclusions

In this study, the availability of research articles relevant to potential drugs of COVID-19 disease for the public to read for free was determined. At the time of this study when the pandemic was increasing, many research articles containing terms 'Ribavirin,' 'Remdesivir,' 'Hydroxychloroquine OR Chloroquine,' 'Favipiravir,' 'Lopinavir OR Ritonavir,' 'Sarilumab,' and 'Tocilizumab' from online databases of Elsevier's ScienceDirect, Taylor & Francis, SpringerLink, and Wiley were not available for the public to read for free (Table 2). For search terms 'Remdesivir' (n=6) and 'Favipiravir' (n=5), the online database of NEJM provided all available articles to read for free (Table 2).

Since the start of this pandemic, many academic publishers promised to make research articles relevant to COVID-19 virus free to read from the internet. For example, Elsevier's ScienceDirect database returned 21,000+ articles free to read following the search using "COVID-19" OR Coronavirus OR "Corona virus" OR "2019-nCoV" OR "SARS-CoV" OR "MERS-CoV" OR "Severe Acute Respiratory Syndrome" OR "Middle East Respiratory Syndrome"

Fig. 1: The availability of research articles relevant to potential drugs of COVID-19 for the public to read for free. The research articles available (expressed as a percentage of the total) to read for free as of 12–17th April 2020 in Elsevier's ScienceDirect database ranged between 14.3% to 91.1%, Taylor & Francis Online database ranged between 7.4% to 75%, SpringerLink database ranged between 22.2% to 94.7%, Wiley Online Library ranged between 38.5% to 90.7%, and New England Journal of Medicine ranged between 42.7% and 100%.



terms. The NEJM has provided all journal content related to COVID-19 pandemic free to read from the internet. However, in this case study, it was found that articles relevant to potential drugs for COVID-19 infection were not entirely free to read (Figure 1). At this time of crisis, it is not only essential to provide free access to research articles related to the search terms 'COVID-19' or 'SARS-CoV' but also the allied content necessary to conduct research and develop health policies.

Since the turn of this century, there were massive changes in scholarly communication due to digitalisation and therefore, scientific material was easily

accessible from the internet (Baffy et al., 2020). As a consequence, free access to research articles through the internet has increased the scientific output from developing countries (Mueller-Langer, Scheufen, & Waelbroeck, 2020). This has raised a serious concern about the quality of research articles published through online open access journal systems (Bohannon, 2013). It is indeed necessary to have quality checking measures in place through open science initiatives to improve the standard of research output (Walther & van den Bosch, 2012). Although there are concerns over the quality of research articles published rapidly during this pandemic, we should realize that scientific progress depends on real time response to the pandemic through research conducted both in laboratory and at home (Kaplan, 2014). For example, some researchers might be more effective writing their manuscripts at home (Bažant, 1993). It is therefore necessary to make sure that researchers have free and easy access to academic databases at this emergent time. As stated by Zdenek P. Bažant (Bažant, 1993), "the only thing that matters in research is what is achieved." To overcome the COVID-19 emergency, it is essential for the publishers to provide free access to research articles, facilitate data sharing, and support the position of the World Health Organization on Open Science (Moorthy, Restrepo, Preziosi, & Swaminathand, 2020).

Availability of research data: The full video screen captures of the performed searches are available from the LIBER Quarterly Dataverse at https://doi.org/10.7910/DVN/IZ3VAU.

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Note

1 All screen-captures are available for downloading from the LIBER Quarterly Dataverse at https://doi.org/10.7910/DVN/IZ3VAU.