

preprint version - DOI:10.5281/zenodo.3763140 manuscript No.  
(will be inserted by the editor)

---

# 1 Open Access and Altmetrics in the pandemic age: 2 Forecast analysis on COVID-19 literature

3 Daniel Torres-Salinas · Nicolas  
4 Robinson-Garcia · Pedro A.  
5 Castillo-Valdivieso

6  
7 Preprint published: 23 April 2020 / To be submitted to ...

8 **Abstract** We present an analysis on the uptake of open access on COVID-  
9 19 related literature as well as the social media attention they gather when  
10 compared with non OA papers. We use a dataset of publications curated by  
11 Dimensions and analyze articles and preprints. Our sample includes 11,686  
12 publications of which 67.5% are openly accessible. OA publications tend to re-  
13 ceive the largest share of social media attention as measured by the Altmetric  
14 Attention Score. 37.6% of OA publications are bronze, which means toll jour-  
15 nals are providing free access. MedRxiv contributes to 36.3% of documents in  
16 repositories but papers in BiorXiv exhibit on average higher AAS. We predict  
17 the growth of COVID-19 literature in the following 30 days estimating ARIMA  
18 models for the overall publications set, OA vs. non OA and by location of the  
19 document (repository vs. journal). We estimate that COVID-19 publications  
20 will double in the next 20 days, but non OA publications will grow at a higher  
21 rate than OA publications. We conclude by discussing the implications of such  
22 findings on the dissemination and communication of research findings to mit-  
23 igate the coronavirus outbreak.

24 **Keywords** altmetrics · scientometrics · coronavirus · COVID-19 · open  
25 access · repositories · science of science · open science

---

D. Torres-Salinas  
Departamento de Información y Comunicación, Medialab UGR, Unidad de Excelencia Iber-  
lab, y Ec3metrics spin off. Campus Cartuja, s/n. 18071 Granada, España  
E-mail: torressalinas@go.ugr.es

N. Robinson-Garcia (corresponding author)  
Delft Institute of Applied Mathematics, TU Delft, Delft, Netherlands  
E-mail: elrobinster@gmail.com

P.A. Castillo-Valdivieso  
Departamento de Arquitectura y Tecnología de Computadores, University of Granada,  
Granada, Spain  
E-mail: pacv@ugr.es

## 1 Introduction

On March 11, 2020, the World Health Organization (WHO) declared the COVID-19 a world pandemic (Organization et al., 2020). Since then, the spread of the disease has expanded, forcing governments to confine their population and enforce social distancing to reduce the spread of the virus. The gravity of the situation has led to an unprecedented scientific race to mitigate the effects of the pandemic (Torres-Salinas et al., 2020) which is has overflowed the scientific scholarly communication system (Larrivière et al., 2020). The normal pace of scholarly communication has proven to be too slow and inefficient, leading to a complete transformation in the way new findings are reported and consumed. Traditional bibliometric databases such as Web of Science or Scopus, which index mainly published journal literature, have become almost instantly obsolete while journals are accelerating to an unprecedented rate their publication track for any COVID-related study. This has led scientists' attention to unexpected sources such as *ad hoc* compilations of scientific literature openly accessible and curated by the scientific community. Examples of such compilations are the CORD-19 dataset<sup>1</sup>, a global community effort, the COVID-19 Database maintained by the WHO<sup>2</sup>, or some publisher curated lists. These topic-specific databases are characterized by their daily update as well as including both, peer-reviewed and non-peer reviewed literature literature.

The COVID-19 pandemic has confronted scientists to an unprecedented challenge in which time and efficiency are critical. The exponential growth of scientific literature on the coronavirus outbreak and the means by which new findings are disseminated, disregarding the traditional status of journals for the sake of speed and efficiency (Larrivière et al., 2020), confront scientists to additional obstacles. They need to keep up with new scientific literature, be more critical than ever with non-peer-reviewed literature and respond to the the expectations of society. As a consequence, scientific discussions and conflicts are more public than ever (Gulbrandsen et al., 2020), revealing an additional threat, as socially responsible attitudes are crucial to stop the spread of the outbreak (Thelwall and Thelwall, 2020). Examples such as a recent paper suggesting the virus was man-made (Delgado López-Cózar et al., 2020) reveal that responsible communication to non-scientific audiences is essential to balance between open scientific debates and public outreach. In this new context, altmetrics gain more importance than ever, as they become the quickest vehicle to monitor social perception of science in an area where citations play a secondary role as they lack on speed to keep up the production and reception of new findings.

In this study we compare the growth on publications, citations and altmetric mentions to COVID-19 literature using the Dimensions dataset which includes publications, datasets, grants and clinical trials (Resources, 2020).

<sup>1</sup> <https://pages.semanticscholar.org/coronavirus-research>

<sup>2</sup> <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/global-research-on-novel-coronavirus-2019-ncov>

69 The general goal is to analyze the size of scientific literature is expected in re-  
70 lation to this crisis, as well as the size of the discussions as any type of analysis  
71 or tool built based on this increasing body of information will have to consider  
72 such growth rate. More specifically, in this study we aim at responding at the  
73 following research questions:

- 74 1. What are the differences in terms of access to COVID-19 related litera-  
75 ture? We establish comparisons between OA and non-OA output as well  
76 as between journal articles and preprints to study the effectiveness of the  
77 communication strategies followed by scientists working on this subject.
- 78 2. What is the expected growth of both, scientific literature, citations and  
79 social media attention? By modelling our data we establish predictions to  
80 up to 30 days which will can help on the design of infrastructure and tools  
81 which will make use of this data.

## 82 **2 Data and methods**

### 83 **2.1 Data collection**

84 We use the Dimensions dataset on COVID-19 literature version 14, which was  
85 updated for the last time in April 14, 2020 (Resources, 2020). This dataset  
86 contains information on four document types: publications, datasets, clinical  
87 trials and grants. In this study we work with the publications dataset, which  
88 includes a total of 11,686 records. This dataset is much more restrictive than  
89 COVID-19, which employs a much wider criteria of inclusion (Colavizza et al.,  
90 2020). This set is retrieved from the Dimensions database after using the  
91 following search query<sup>3</sup>:

92 Year: 2020; Data Search: "2019-nCoV" or "COVID-19" or "SARS-CoV-2"  
93 or (("coronavirus" or "corona virus") and (Wuhan or China))

94 For each record it includes publication metadata as well as information  
95 on number of citations, Altmetric Attention Score, journal or repository and  
96 open access (OA) status. Table 1 offers a brief overview of the contents of the  
97 publication dataset with regard to publication type, document type and type  
98 of access. Dimensions provided OA information retrieved from Unpaywall, but  
99 assigns documents to one OA type exclusively, overriding cases in which there  
100 might be evidence of more than one OA type for a single document (Robinson-  
101 Garcia et al., 2020).

102 In this study we restrict our analysis to two document types, that is, ar-  
103 ticles and preprints. The Dimensions dataset includes other document types  
104 such as monographs, book chapters and proceedings, but these only amount  
105 to a total of 278 records. We must also note that preprints and articles are  
106 document types unrelated to their OA status of the manuscript, as preprints  
107 (e.g., online first) can also be found in journals. After some normalization on  
108 the original dataset, we identified 67.5% of all COVID-19 related publications

<sup>3</sup> Additional information on this dataset is available at <https://covid-19.dimensions.ai/>.

**Table 1** Overview of the Dimensions dataset for COVID-19 related publications

Type of access	Journal	Repository	% preprints
Closed	3514	288	0.00
Bronze	3072	318	0.00
Green, Accepted	4	0	0.00
Green, Published	15	627	0.98
Green, Submitted	21	1538	0.99
Hybrid	458	626	0.00
Pure Gold	1205	0	0.00
<b>Total</b>	<b>8289</b>	<b>3397</b>	<b>0.23</b>

109 openly accessible, with 8.2% of closed publications deposited under embargo  
110 in repositories.

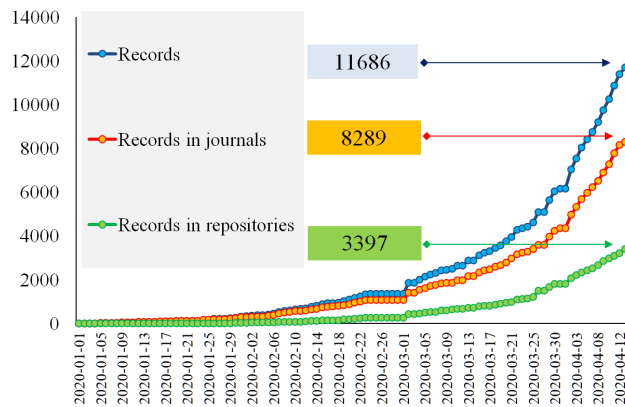
## 111 2.2 Methods

112 The focus of the paper is on the growth of publications as well as of social  
113 media attention. As a proxy for the latter we use the Altmetric Attention  
114 Score (AAS) provided in the original dataset. Altmetric scores can only be  
115 obtained for documents which include an identifier such as a DOI or a PMID.  
116 11,189 records in the Dimensions dataset include an identifier, that is 95.7%  
117 of the records. The AAS has been strongly criticized by the scientometric  
118 community (Gumpenberger et al., 2016; Mukherjee et al., 2018) as it is a  
119 composite measure difficult to interpret. In the case of altmetrics this becomes  
120 even more problematic as Altmetric.com (the altmetric platform behind the  
121 score) includes a plethora of diverse sources with little relation with each  
122 other. While these limitations are acknowledged, we used this indicator as  
123 an exploratory attempt to identify those documents with higher social media  
124 attention. In further analyses we plan to obtain additional information from  
125 Altmetric.com on the specific scores obtained by each paper in each of the  
126 platforms this database covers.

127 To establish prediction on publications, citations and altmetrics growth  
128 (with particular interest on OA) we address the problem as a one of time  
129 series prediction. To do so, we need adequate tools to analyze historical data  
130 and thus, making predictions Hassan (2014); de Oliveira and Oliveira (2018).  
131 There are several types of models that can be used for time-series forecasting  
132 Siami-Namini et al. (2018). In this study we make use of ARIMA (AutoRe-  
133 gressive Integrated Moving Average) Ho and Xie (1998), which is one of the  
134 most widely known approaches Hyndman and Athanasopoulos (2018). In this  
135 kind of models, the forecasts correspond to a linear combination of past values  
136 of the variable Hyndman and Khandakar (2008), explaining a given time series  
137 based on past values.

138 An ARIMA model is characterized by three parameters  $(p, d, q)$  where,

139 –  $p$  refers to the use of past values in the regression equation for the series



**Fig. 1** Time trend on the accumulated number of records overall, in journals and in repositories

- 140 –  $d$  indicates the order of difference for attaining stationarity
- 141 –  $q$  determines the number of terms to include in the model

142 Here we obtain ARIMA models for the total number of publications, by  
143 location of the record (journal or repository) and OA status. All the analyses  
144 are conducted on an Ubuntu 18.04.1 machine with R version 3.6.3 and RStudio  
145 version 1.1.456. Figure 1 shows the publication time trends observed in the  
146 Dimensions dataset. As reported in a previous paper (Torres-Salinas, 2020)  
147 the literature on COVID-19 is growing at an exponential rate. If we consider  
148 the total number of publications, the value of  $R^2$  is equal to 0.93. In the case  
149 of journal publications the value of  $R^2$  is 0.92. In the case of repositories, we  
150 observe a much slower growth ( $R^2 = 0.36$ ). Predictive models were obtained  
151 for each of the variables observed and subsequently estimated. These models  
152 will be referred to from here on as ARIMA(1,2,2) for the "Total" series,  
153 ARIMA(0,2,1) for the "Journal" series, and ARIMA(2,2,4) for the "repositories"  
154 series. Our 30 days predictions are based on these models.

### 155 3 Results

#### 156 3.1 Descriptive analysis

157 Table 2 provides an overview of the dataset used. A total of 11,686 papers  
158 were retrieved, out of which 7,884 (68%) are available in OA. This proportion  
159 decreases during the month of April. Despite the fact that this analysis covers  
160 three and 1/2 months, a total of 27,129 citations have already been made.  
161 This means on average 2.32 citations per paper. This average is even higher  
162 for non OA publications, which receive an average number of citations of 3.28.

163 These papers have raised an unprecedented amount of social media atten-  
164 tion according to their AAS. On average, these documents receive an AAS of

a. Number of papers in <i>Dimensions</i>			
	Totals	Open Access	Non Open Access
▪ January	313	261	52
▪ February	1039	847	192
▪ March	4815	3980	835
▪ April (until 04/13)	5519	2796	2723
	11686	7884 (68%)	3802 (32%)
b. Attention Altmetric Score & citations			
	Accumulated	Average per paper	Max Value
<i>Altmetric Attention Score- AAS</i>	1373008	117.49	27609
▪ Open Access	1200466	152.25	27609
▪ Non Open Access	172542	45.38	7680
<i>Citations</i>	27129	2.32	1238
▪ Open Access	25914	0.31	1238
▪ Non Open Access	1215	3.28	127
c. Journals, repositories and main information sources			
	Nr Papers	AAS accumulated	Citations accumulated
Journals	8288	1105043	24604
Repositories	3397	267964	2525
▪ <i>Information sources:</i>			
▪ Pubmed*	5143	998682	24008
▪ PMC*	2330	424181	13973
▪ BioRxiv	346	77411	1029
▪ MedRxiv	1232	154540	1260

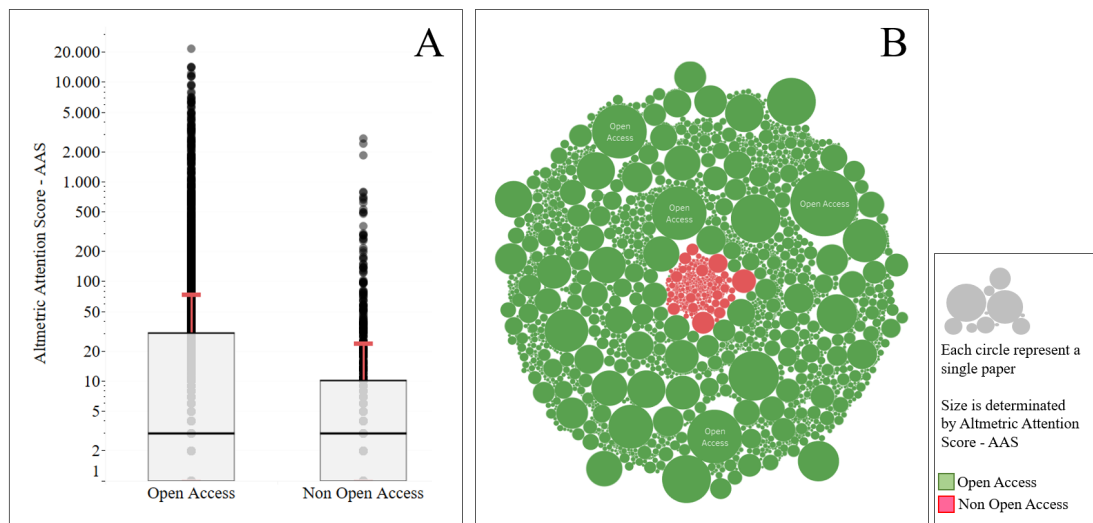
**Table 2** Description of the dataset by type of access. **A** Time trend, **B** Altmetric Attention Score and citation indicators, and **C** distribution of records, Altmetric Attention Score and citations by location (journals or repositories).

\* These two repositories include also journal literature and hence overlap with the two location types.

165 117, which is even higher in the case of OA papers (152.25). In this sense, we  
 166 observe differences depending on the location of the record. Journal articles  
 167 receive higher citations than those stored in repositories, but there are differ-  
 168 ences by repository. PubMed and PMC receive a considerably higher number  
 169 of social media attention than the rest of the repositories. Although BioRxiv  
 170 and MedRxiv provide a lower number of documents to the dataset, they still  
 171 attract a high number of citations (in the case of the former) and social media  
 172 attention (for the latter).

### 173 3.2 Open Access and social media attention

174 Figure 2 shows the distribution of AAS (A) and numberthe relation between  
 175 the number of documents and AAS each receives (B) by OA status. Most of

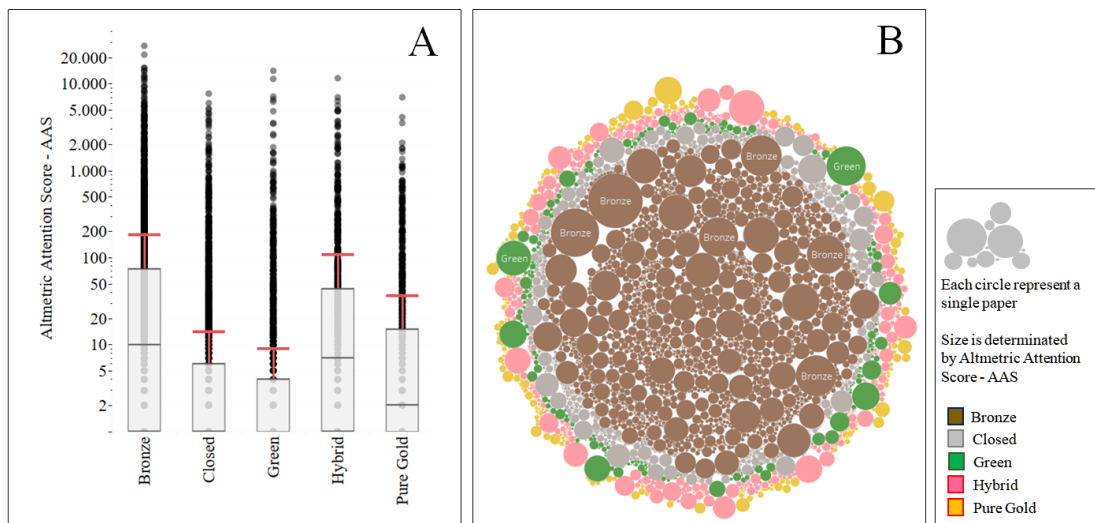


**Fig. 2** Altmetric Attention Score: Open Access and Non Open Access

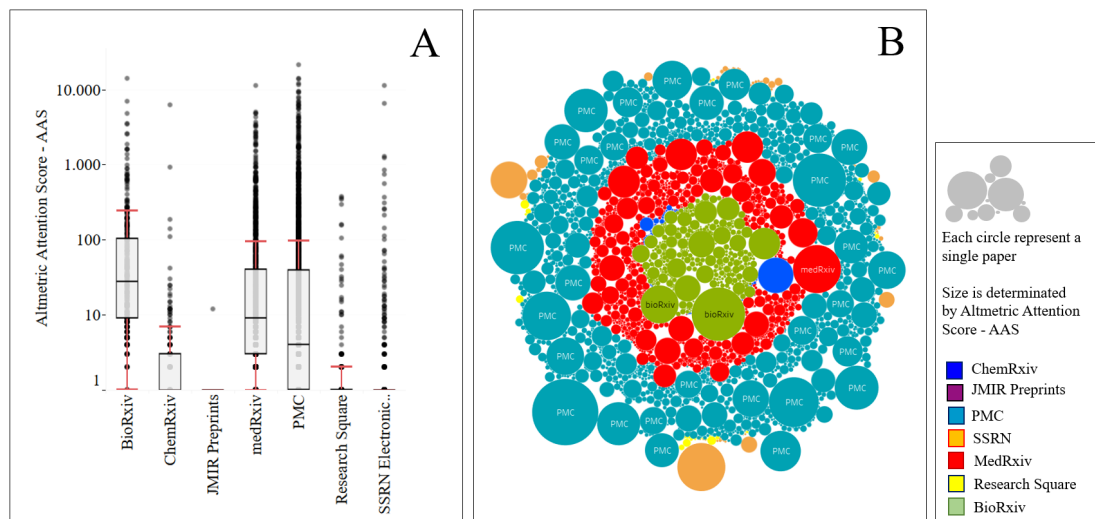
176 the papers on COVID-19 are OA and reach higher values of AAS than non-OA  
177 papers. For instance, two papers obtained AAS values of 27,609 (Nat Med 26,  
178 450-452, 2020) and 21,738 (N Engl J Med, 382, 1564-1567, 2020) respectively.  
179 Likewise 15 OA papers obtained a score of at least 10,000 AAS, accumulating  
180 a total of 215,885. These fifteen papers alone add up to more AAS than the  
181 entire set of papers published as non OA (Table 2).

182 Figure 3 shows the distribution of AAS (A) and the size of the output (B)  
183 by OA type. Bronze OA documents tend to receive a higher AAS and represent  
184 the largest share of COVID-19 related publications (3,072). Overall OA papers,  
185 either We observe that OA papers published in journals (regardless of the OA  
186 type: bronze, hybrid or pure), predominate. In relation to AAS, bronze papers  
187 have an average of 249 and papers with higher AAS are within this modality.  
188 Hybrid and gold OA papers receive less attention, 154 and 61 on average,  
189 respectively.

190 In Figure 4 we shift our focus to records deposited in repositories. The  
191 repository with the largest number of publications is PMC, with a total of 2,330  
192 papers and an average AAS of 182. Here we must note that PMC not only  
193 includes self-archived documents, but also indexes OA journals (Robinson-  
194 Garcia et al., 2020). The second largest repository is medRxiv with a total  
195 of 1,232 and an average AAS of 125 per document. Despite being the repository  
196 with the lowest number of records included (387), documents indexed in  
197 BioRxiv receive on average, the highest AAS (223). All documents in BioRxiv  
198 have receive at least an AAS of 1. The rest of the repositories analyzed (Chem-  
199 Rxiv, JMIR Preprints, Research Square and SSRN) have a peripheral role on  
200 production and visibility of COVID-19 related publications.



**Fig. 3** Overview of social media attention on open access. **A** Altmetric Attention Score distribution by OA type and **B** Number of records and AAS received by paper by OA type

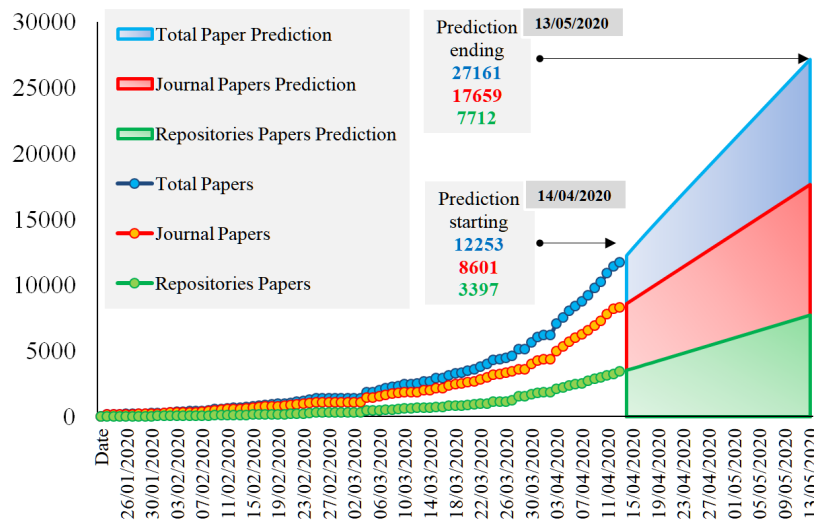


**Fig. 4** Overview of social media attention for documents deposited in repositories. **A** Altmetric Attention Score distribution by repository and **B** Number of records and AAS received by paper by repository

201 3.3 Predictive analysis: ARIMA models

202 Figure 5 shows the accumulated time trend on number of publications and  
203 by journal and repository, as well as the predicted trends according to the  
204 obtained ARIMA model.





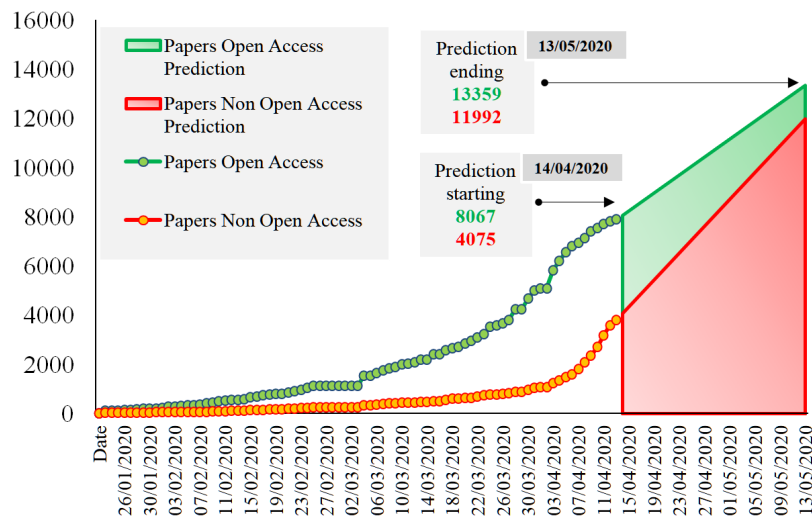
**Fig. 5** Growth evolution and predicted trend on COVID-19 related literature and by location (journals and repositories)

205 Paying attention to Figure 5, it can be seen that the estimate made by the  
206 predictive models at 30 days is of a growing trend in the number of publica-  
207 tions. The ARIMA model forecast for total publications starts on 14/04/200  
208 with 12254 publications and ends on 13/05/2020 with 27162 publications. In  
209 the case of journals it starts with 8601 publications and ends with 17660. The  
210 repositories will grow at a slower rate, the forecast starts with 3538 publi-  
211 cations and ends with 7712. The data indicate that total publications will  
212 double in about 20 days, journal publications will double in about 24 days,  
213 and repository publications will double in about 24 days

214 Figure 6 shows the accumulated time trend as well as the predicted trend  
215 differentiating between OA and non OA publications. The ARIMA model fore-  
216 cast for OA papers starts on April 14, 2020 with 8,067 publications and ends  
217 on May 13, 2020 with 13,359 publications. According to these predictions, non  
218 OA publications will grow at faster rate than OA publications. The forecast  
219 starts with 4,075 publications and ends with 11,992. It can be said that OA  
220 publications will double every 30 days and non OA publications will double  
221 every 14 days. The differences between the number of OA and non OA pub-  
222 lications appears to be narrowing as the prediction progresses. By the end of  
223 the forecast, the central role of open access will not be as clear as it was in  
224 early February and March.

#### 225 4 Discussion and further research

226 This paper reports on the growth of scientific literature, citations and social  
227 media attention revolving around COVID-19 literature. For this, it uses the



**Fig. 6** Growth evolution and predicted trend on COVID-19 related literature by OA and non OA.

228 Dimensions dataset (Resources, 2020) which is openly accessible and has been  
229 updated daily until its last update on April 14, 2020. While the dataset itself  
230 is not free of limitations, and other COVID-19 datasets are being used alter-  
231 natively, it is the one coming from the largest scientific database as compared  
232 with Web of Science and Scopus (Torres-Salinas et al., 2020). Furthermore,  
233 the search query used seems to be much more restrictive than other used else-  
234 where, which can introduce some noise when identifying the scientific corpus  
235 specifically dealing with this virus (Colavizza et al., 2020).

236 The findings reported here shows that many journals (e.g., New England  
237 Journal of Medicine, The Lancet, JAMA, Nature) are doing an important  
238 effort to prioritize the urgency of the current situation over their monetary  
239 benefits by providing COVID-19 related literature in OA. This is an unprece-  
240 dented event which should not go unnoticed, and explains to a large extent the  
241 large shares of OA literature identified related with the coronavirus outbreak.  
242 The interest on scientific development on this front go beyond the scientific  
243 realm as the high social media attention revolving these documents shows.  
244 Scientific advancements are reported daily in the news media, discussed on  
245 Twitter and used for decision-making by politicians. Indeed, scientific efforts  
246 have not only focused on mitigating the pandemic, but have also responded  
247 to social concerns, such as those derived from the rise of fake news (Andersen  
248 et al., 2020).

249 The amount of literature produced since the coronavirus outbreak suggests  
250 an exponential growth on the number of publications produced, citations and  
251 social media mentions. If we want to be able to keep up with such growth  
252 and produce tools and analyses on such increasing corpus, some preparation  
253 is needed. Our estimates indicate that this number of records will duplicate

254 every 14 days if the current rhythm of production continues. First reactions  
255 praised OA efforts from the scientific community and how these confronted  
256 the "normal" speed of science (Larrivière et al., 2020). However, our analysis  
257 shows a great dependency on journal literature and specifically on the role  
258 of major toll journals which have made openly accessible COVID-19 related  
259 literature as an exceptional measure. This reflects a great dependency on the  
260 traditional journal publishing system. Furthermore, our predictions estimate a  
261 higher growth for non OA literature in the near future. This trend, if confirmed,  
262 can become a great obstacle on the advancement of a cure for COVID-19 as  
263 well as on mitigating collateral damages from the pandemic.

264 Social media attention revolves mainly around OA publications, but again,  
265 here the role of toll journals opening their contents through bronze OA is  
266 crucial, followed by hybrid OA and gold OA, again reflecting that, despite the  
267 urgency, the traditional and mechanisms of scholarly publishing are still in  
268 place, along with all their deficiencies (Gadd, 2020).

269 That said, any conclusions on the predictions reported must be taken with  
270 caution as we live in a constantly changing situation, closely linked to the  
271 mitigation of the pandemic and political actions derived from it. Still, analyses  
272 such as the present can help us contextualize the phenomenon and provide  
273 alternative views from which scientometricians can contribute.

## 274 5 Summary of key findings

275 In this section we provide a brief summary of the main findings reported in  
276 this study.

- 277 1. 11,686 publications on COVID-19 were retrieved. 68% are OA. 27,129 ci-  
278 tations have already been made. This means on average 2.32 citations per  
279 publication
- 280 2. On average publications receive an Altmetric Attention Score of 117, which  
281 is even higher in the case of Open Access papers (152.25)
- 282 3. Most of the publications on COVID-19 are OA and receive higher social  
283 media attention than non OA papers.
- 284 4. Most of the OA publications are bronze OA. These are receiving the highest  
285 social media.
- 286 5. OA papers published in scientific journals predominate. This fact empha-  
287 sizes the central role of journals and peer review versus early access to  
288 preprints.
- 289 6. Pubmed is the repository with the largest number of publications, followed  
290 by medRxiv. Documents indexed in BioRxiv receive on average, the highest  
291 social media attention.
- 292 7. We expect that the total number of COVID-19 related publications will  
293 double in 20 days. Journal articles will double in 24 days, while papers in  
294 repositories will grow at a slower rate.
- 295 8. We expect non OA papers to grow at a faster rate than OA publications.  
296 By mid-May the number of non OA papers will have almost tripled.

297 **Acknowledgements** This work is supported by the Ministerio español de Economía y  
298 Competitividad under project TIN2017-85727-C4-2-P (UGR-DeepBio). Nicolas Robinson-  
299 Garcia has received funding from the European Union’s Horizon 2020 research and inno-  
300 vation programme under the Marie Skłodowska-Curie grant agreement No 707404. Daniel  
301 Torres-Salinas has received funding from the University of Granada’ Plan Propio de Inves-  
302 tigación y Transferencia under the Reincorporación de Jóvenes Doctores grant.

## 303 References

- 304 Andersen KG, Rambaut A, Lipkin WI, Holmes EC, Garry RF (2020) The  
305 proximal origin of sars-cov-2. *Nature medicine* 26(4):450–452
- 306 Colavizza G, Costas R, Traag VA, Eck NJv, Leeuwen Tv, Waltman L (2020)  
307 A scientometric overview of COVID-19. *bioRxiv* p 2020.04.20.046144, DOI  
308 10/ggsmvz
- 309 Delgado López-Cózar E, Martín-Martín A, et al. (2020) La viralidad de la  
310 ciencia defectuosa: el contagioso impacto mediático de un preprint en biorxiv  
311 sobre el coronavirus y sus efectos en la comunicación científica. DIGIBUG-  
312 UGR <https://digibugugres/handle/10481/60872>
- 313 Gadd E (2020) The purpose of publications in a pandemic and beyond
- 314 Gulbrandsen M, Tellman SM, Karaulova M (2020) Coronavirus and the impact  
315 of science
- 316 Gumpenberger C, Glänzel W, Gorraiz J (2016) The ecstasy and the agony of  
317 the altmetric score. *Scientometrics* 108(2):977–982
- 318 Hassan J (2014) Arima and regression models for prediction of daily and  
319 monthly clearness index. *Renewable Energy* 68:421–427, DOI 10.1016/j.  
320 renene.2014.02.016
- 321 Ho S, Xie M (1998) The use of arima models for reliability forecasting and  
322 analysis. *Computers and Industrial Engineering* 35(1–2):213–216, DOI 10.  
323 1016/S0360-8352(98)00066-7
- 324 Hyndman R, Athanasopoulos G (2018) *Forecasting: principles and practice*,  
325 2nd edition. OTexts: Melbourne, Australia
- 326 Hyndman R, Khandakar Y (2008) Automatic time series forecasting: The fore-  
327 cast package for r. *Journal of Statistical Software, Articles* 27(3):1–22, DOI  
328 10.18637/jss.v027.i03
- 329 Larrivière V, Shu F, Sugimoto C (2020) The coronavirus (covid-19) outbreak  
330 highlights serious deficiencies in scholarly communication. *Ise impact blog*,  
331 5 de marzo de 2020
- 332 Mukherjee B, Subotić S, Chaubey AK (2018) And now for something com-  
333 pletely different: the congruence of the altmetric attention score’s structure  
334 between different article groups. *Scientometrics* 114(1):253–275
- 335 de Oliveira EM, Oliveira FLC (2018) Forecasting mid-long term electric energy  
336 consumption through bagging arima and exponential smoothing methods.  
337 *Energy* 144:776–788, DOI 10.1016/j.energy.2017.12.049
- 338 Organization WH, et al. (2020) Who director-general’s opening remarks at the  
339 media briefing on covid-19-11 march 2020. Geneva, Switzerland

- 340 Resources D (2020) Dimensions covid-19 publications, datasets and clinical  
341 trials. figshare. DOI 10.6084/m9.figshare.11961063.v14
- 342 Robinson-Garcia N, Costas R, van Leeuwen TN (2020) State of open access  
343 penetration in universities worldwide. arXiv preprint arXiv:200312273
- 344 Siami-Namini S, Tavakoli N, Namin AS (2018) A comparison of arima and lstm  
345 in forecasting time series. 17th IEEE International Conference on Machine  
346 Learning and Applications (ICMLA), pp 1394-1401, Orlando, FL
- 347 Thelwall M, Thelwall S (2020) Retweeting for covid-19: Consensus build-  
348 ing, information sharing, dissent, and lockdown life. arXiv preprint  
349 arXiv:200402793
- 350 Torres-Salinas D, et al. (2020) Ritmo de crecimiento diario de la producción  
351 científica sobre covid-19. análisis en bases de datos y repositorios en acceso  
352 abierto. El Profesional de la Información