

with and without COVID-19, respectively, and the percentage of males was 66.5% and 54.9%, respectively.

Ninety-two patients with COVID-19 and ARDS were propensity score matched to 92 patients with non-COVID-19 ARDS (Table). The etiologies for ARDS among the non-COVID-19-matched cohort were bacterial pneumonia (60%), aspiration (27%), influenza (7%), respiratory syncytial virus infection (2%), and *Pneumocystis jirovecii* pneumonia (2%). Patients with COVID-19 were more likely to develop gastrointestinal complications compared with those without COVID-19 (74% vs 37%;  $P < .001$ ; incidence rate ratio, 2.33 [95% CI, 1.52-3.63]). The difference in incidence was more evident after the third day of critical illness (Figure). Specifically, patients with COVID-19 developed more transaminitis (55% vs 27%;  $P < .001$ ), severe ileus (48% vs 22%;  $P < .001$ ), and bowel ischemia (4% vs 0%;  $P = .04$ ). Three of the 4 patients with COVID-19 and bowel ischemia were taken to the operating room and had intraoperative findings consistent with COVID-19 bowel as previously described in different patients.<sup>3</sup> Pathology findings demonstrated fibrin thrombi in the microvasculature underlying areas of necrosis.

**Discussion** | This study found a higher rate of gastrointestinal complications, including mesenteric ischemia, in critically ill patients with COVID-19 compared with propensity score-matched patients without COVID-19, suggesting a distinct phenotype for COVID-19 compared with conventional ARDS. High expression of angiotensin-converting enzyme 2 receptors along the epithelial lining of the gut that act as host-cell receptors for SARS-CoV-2 could explain involvement of abdominal organs.<sup>5</sup> Higher opioid requirements and COVID-19-induced coagulopathy may also explain the disproportionately high rate of ileus and ischemic bowel disease.<sup>2</sup> Differences in duration of illness did not seem to explain the differences in gastrointestinal complications. Limitations of this study include the single center and the unavailability of inflammatory markers to use for matching. Further translational studies are warranted to examine the pathophysiology of these findings.

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## Preprint Servers' Policies, Submission Requirements, and Transparency in Reporting and Research Integrity Recommendations

Preprint servers are online platforms that enable free sharing of preprints, scholarly manuscripts that have not been peer reviewed or published in a traditional publishing venue (eg, journal, conference proceeding, book). They facilitate faster dissemination of research, soliciting of feedback or collaborations, and establishing of priority of discoveries and ideas.<sup>1</sup> However, they can also enable sharing of manuscripts that lack sufficient quality or methodological details necessary for research assessment, and can help spread unreliable and even fake information.<sup>2</sup> Since 2010, more than 30 new preprint servers have emerged, yet research on preprint servers is still scarce.<sup>3</sup> With the increase in the numbers of preprints and preprint servers, we explored servers' policies, submission requirements, and transparency in reporting and research integrity recommendations, as the latter are often perceived as mechanisms by which academic rigor and trustworthiness are fostered and preserved.<sup>4</sup>

**Methods** | We conducted a cross-sectional analysis of, to the best of our knowledge, all known preprint servers that do not limit posting of manuscripts to authors with specific institutional affiliations or study funding (eg, *Wellcome Open Research*) nor actively seek out peer reviewers (eg, *F1000*) (see the eAppendix in the Supplement for server



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Supplemental content

Table 1. Number of Records on Preprint Servers on May 29, 2020<sup>a</sup>

Server name	No. of records <sup>b</sup>
arXiv	1 708 255
Social Science Research Network (SSRN) <sup>c</sup>	802 602
EconStor (economics and business studies)	119 864
bioRxiv <sup>c</sup>	84 009
RePEc/Munich Personal RePEc Archive	49 164
PhilArchive	48 927
Hyper Articles en Ligne (HAL)	48 610
ViXra	35 827
OSF Preprints <sup>c</sup>	17 174
INA-Rxiv <sup>c</sup>	16 641
Cryptology ePrint Archive	14 817
Preprints.org <sup>c</sup>	14 052
ChinaXiv <sup>c</sup>	13 682
Research Square <sup>c,d</sup>	12 962
Mathematical Physics Preprint Archive	9601
PsyArXiv <sup>c</sup>	9475
Social Science Open Access Repository (SSOAR)	8193
JMIR Preprints <sup>c</sup>	7888
Optimization Online	7531
medRxiv <sup>c</sup>	5935
SocArXiv	5497
LingBuzz	5113

<sup>a</sup> Servers not listed above include the following 12 servers with greater than 500 and less than 5000 records: *ChemRxiv*, *Authorea Preprint Repository*, *PhilSci-Archive*, *Electronic Colloquium on Computational Complexity*, *Zenodo*, *EarthArXiv*, *LawArXiv*, *engrXiv*, *Thesis Commons*, *e-LIS*, *Earth and Space Science Open Archive (ESSOAr)*, and *Advance (SAGEpub)*. Also not listed above are the following 23 servers with less than 500 records: *EdArXiv*, *Commons Open Repository Exchange (CORE)/Humanities Commons*, *MarXiv*, *Arabixiv*, *AgriXiv*, *LIS Scholarship Archive (LISSA)*, *EcoEvoRxiv*, *SportRxiv*, *MindRxiv*, *APSA Preprints*, *PaleorXiv*, *MetaArXiv*, *AfricArXiv*, *ECSarXiv*, *IndiaRxiv*, *FrenXiv*, *MediArXiv*, *NutriXiv*, *BodoArXiv*, *OARR: Open Anthropology Research Repository*, *FocUS Archive*, *MitoFit Preprint Archives*, and *BioHackRxiv*.

<sup>b</sup> The term *records* is intentional, as not all servers have filters that clearly differentiate between preprints and published articles or account for duplicate records.

<sup>c</sup> These servers allowed health sciences discipline selection during the submission process.

<sup>d</sup> For *Research Square*, only preprints not undergoing journal peer review were included.

identification details). Between January 25 and March 31, 2020, M.M. analyzed servers' web pages that resembled instructions to authors traditionally found in scholarly journals, as well as servers' about, policy, and frequently asked questions pages. For each server, M.M. also went through the preprint submission process (without submitting a preprint) to check for additional information in the submission platforms (except for *ChinaXiv*, which required an email associated with a Chinese institution). Then, M.M. extracted data on explicit mentioning of 7 topics related to preprint policies, 6 to submission requirements, and 18 to transparency in reporting and research integrity that were deemed applicable across disciplines. The topics were informed by our previous analysis of journals' instructions to authors and topics unique to preprints (see the eAppendix in the Supplement for details).<sup>5</sup> On May 29, the number of records

Table 2. Preprint Servers' Policies, Submission Recommendations, and Transparency in Reporting and Research Integrity Topics<sup>a</sup>

	No. (%)	
	All servers (n = 57)	Health sciences servers (n = 10) <sup>b</sup>
Preprint policies		
Screening check	47 (82)	8 (80)
Before a preprint is made public	39 (68)	6 (60)
After a preprint is made public	8 (14)	2 (20)
Authors advised to check preprint policies of journals	40 (70)	9 (90)
Commenting section for preprints provided	39 (68)	9 (90)
Versioning of preprints guidance provided	30 (53)	8 (80)
Instructions to authors page provided	27 (47)	5 (50)
Direct transfer of preprints to or from journals enabled	10 (18)	6 (60)
Text mining of preprints allowed	7 (12)	3 (30)
Submission guidance		
Scope requirements	57 (100)	10 (100)
Specific (sub)discipline	41 (72)	3 (30)
All disciplines	10 (18)	5 (50)
All disciplines but for authors with region- or country-specific affiliation	6 (11)	2 (20)
Study type requirements (eg, experimental studies only)	31 (54)	6 (60)
Preprint structure recommended (eg, IMRaD)	19 (33)	7 (70)
Reference style recommended	16 (28)	5 (50)
Abstract guidance provided	12 (21)	5 (50)
(La)TeX format for submission allowed <sup>c</sup>	10 (18)	3 (30)
Transparency in reporting and research integrity		
Data sharing	22 (39)	5 (50)
Recommended	17 (30)	4 (40)
Required	4 (7)	1 (10)
Linking or uploading data allowed	1 (2)	0
Plagiarism addressed	15 (26)	4 (40)
ORCID ID recommended	14 (25)	5 (50)
Errata guidance provided	12 (21)	4 (40)
Conflicts of interest declaration required	9 (16)	4 (40)
Ethics approval declaration required	9 (16)	6 (60)
Funding declaration required	9 (16)	4 (40)
Authorship guidance provided	8 (14)	3 (30)
Null or negative results studies invited	6 (11)	0
ICMJE recommendations endorsed	5 (9)	2 (20)
Patenting addressed in relation to preprints	4 (7)	2 (20)
Replication studies invited	3 (5)	1 (10)
Reporting guidelines recommended	3 (5)	2 (20)
COPE recommendations endorsed	2 (4)	1 (10)
Image manipulation addressed	2 (4)	1 (10)
Study limitations reporting required	2 (4)	2 (20)
TOP guidelines endorsed	2 (4)	1 (10)
Statistical reporting guidance provided	0	0

Abbreviations: COPE, Committee on Publication Ethics; ICMJE, International Committee of Medical Journal Editors; IMRaD, Introduction, Methods, Results, and Discussion; ORCID ID, Open Researcher and Contributor ID; TOP, Transparency and Openness Promotion Guidelines.

<sup>a</sup> Topics are listed in order of frequency mentioned on websites.

<sup>b</sup> Ten servers allowed health sciences discipline selection during the submission process and hosted more than 500 such preprints on May 29, 2020: *bioRxiv*, *ChinaXiv*, *INA-Rxiv*, *JMIR Preprints*, *medRxiv*, *OSF Preprints*, *Preprints.org*, *PsyArXiv*, *Research Square*, and *Social Science Research Network*.

<sup>c</sup> (La)TeX is a text markup system often used in academia as an alternative to direct formatting systems (eg, Word or Pages).

that servers hosted was documented, and on July 6, it was documented whether servers allowed health sciences discipline selection during the submission process and whether they hosted more than 500 such preprints (servers' health sciences categories are listed in the data repository site).

**Results** | We analyzed 57 preprint servers that hosted approximately 3 million preprints in total. Of those, 10 servers hosted more than 500 health sciences preprints (Table 1). Of the 7 analyzed policies, the most commonly addressed across all servers was screening of preprints before or after they are made public (n = 47 [82%]) (Table 2). Two servers, *Preprints.org* and *Research Square*, used a screening checklist (the latter also provided a "badge" of passed checks). The most commonly addressed submission requirements were specifying the scholarly scope of preprints (n = 57 [100%]) and the study type allowed for deposit (n = 31 [54%]). Of the 18 analyzed recommendations on transparency in reporting and research integrity, preprint servers addressed a median of 1 recommendation (range, 0-11), most commonly data sharing (n = 22 [39%]). These recommendations were more prevalent (median, 5; range, 0-11) for the 10 servers with more than 500 health sciences preprints.

**Discussion** | Although most preprint servers used screening checks for preprints, they provided little explicit guidance on issues that are important for transparency in reporting and research integrity. Disciplinary differences observed for such recommendations in journals<sup>5</sup> were also present for preprint servers, with more recommendations addressed by servers hosting more than 500 health sciences preprints. The study limitations include data extraction by 1 author, that analyzed topics were not comprehensive, and that many topics were more prominently discussed and therefore may be more commonly addressed in the biomedical literature. Also, servers may follow policies and scholarly standards that are not explicitly mentioned on their websites. Nevertheless, there is an opportunity for servers to encourage and require transparent reporting of research, adherence to research integrity standards, and detailed statements of policies and submission requirements. In doing so, they could improve quality and trust in scholarly information exchange.

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**Acquisition, analysis, or interpretation of data:** Malički, Jerončić, ter Riet, Goodman, Aalbersberg.

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## Submissions and Downloads of Preprints in the First Year of *medRxiv*

Preprint servers offer a means to disseminate research reports before they undergo peer review and are relatively new to clinical research.<sup>1-4</sup> *medRxiv* is an independent, not-for-profit preprint server for clinical and health science researchers that was introduced in June 2019.<sup>4</sup> A central question was whether there would be adoption of a new approach to dissemination of pre-peer-review science. Now, a year after its establishment, we report *medRxiv*'s submissions, posts, and downloads.

**Methods** | We used data from the *medRxiv* website,<sup>5</sup> internal data, and Altmetric.com from launch on June 11, 2019, through June 30, 2020. We assessed submissions, postings, abstract views, downloads, comments, and withdrawals. We also looked at submissions and postings before coronavirus disease 2019 (COVID-19) (July 1 through December 31, 2019)



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