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Perceptions regarding open science appraised by editors of scholarly publications published in Spain

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Abstract: Pillars of open science are often included within the editorial policies of scholarly journals, including policies on open access publication, availability of underlying research data, preprints and open peer review. The aim of this paper is to examine and analyse perceptions and editorial practices related to open access, preprints, open research data and open peer review, from the perspective of editors of scientific journals published in Spain, to gain an insight into editorial policies related to open science. Results and data were obtained by a combined method of online interviews and an online questionnaire. The online survey was sent to editors from journals indexed in the Dulcinea directory, which at the time of the study included 1875 academic journals. A total of 420 responses (22.4%) were obtained. The results indicated that 92% of the journals were open access journals, 2% of the journals conducted open peer review, 15% of the journals had instructions to allow archiving preprints, and out of 375 responses, only 59 journals (16%) reported having a policy on underlying research data. Based on these results, there is a trend in favour of open access, but the perceived barriers to open peer review outweighed the advantages. There is also some reluctance to allow preprints to be made available. This concern might be because editors want authors and readers to read and cite the contents published in their journals, rather than their preprint versions.

Keywords: open science, science editors, Spain

INTRODUCTION

The UNESCO recommendation (UNESCO, 2021) on open science defines it as 'an inclusive construct that combines various movements and practices with the aim of making multilingual scientific knowledge available, accessible and reusable for everyone, increasing scientific collaborations and information exchange for the benefit of science and society, and opening the processes of creation, evaluation and communication of scientific knowledge to societal actors beyond the traditional scientific community'. Open science is based on the following key pillars, namely 'open scientific knowledge, open scientific infrastructures, scientific communication, open engagement of societal actors and open dialogue with other knowledge systems' (UNESCO, 2021). As scientific publishing is part of open scientific knowledge, all parties involved in it—researchers, editors, publishers, funding

agencies and institutions—play an important role in making open science a reality. In this sense, science editors can exert considerable influence by implementing the journal's editorial guidelines and policies on open access, underlying research data or new forms of peer review. For this reason, in this article the authors analyse the perceptions and editorial practices of editors of academic journals, related to open access, preprints, underlying data and open peer review (OPR), specifically in the Spanish context.

According to the Leiden University Rankings, at some European universities open access (OA) publications account for more than 90% of their open access output (CWTS Leiden Ranking, 2015). In Europe, the Curtin Open Knowledge Initiative estimates that three of the most advanced countries in open science initiatives, namely the Netherlands, Finland and the United Kingdom, have an OA share of over 70% and a green OA share of around 60% (Curtin Open Knowledge, 2019), meaning that 20 years after the Budapest Open Access Initiative, there is still a lot of work needed to achieve full open access.

Research data constitutes another pillar of open science and an important challenge for researchers and institutions, since it has a strong dependence on infrastructure. Incorporating data as supplementary material or depositing it in an open access repository facilitates research verification and reproducibility. Research data should therefore be properly cited in journal articles (Cousijn et al., 2018) and properly documented. Data citation principles stress that data should be considered legitimate and citable products of research and that citation is a tool for giving recognition and credit to its authors (Force11, 2013). The Panton Principles (Murray-Rust et al., 2010) recommend using clear terms in editorial policies related to what can be done with published data and using appropriate licences for the treatment of data, without limiting its commercial use or the creation of derivative works.

Data sharing has been of vital importance during the COVID-19 pandemic, which is why the COVID Rapid Review Initiative (OASPA, 2018), a collaborative program involving numerous publishers, issued a call in January 2021 for research data to be shared in a public repository rather than being made available only on request. The Coalition on Publishing Data in the Earth and Space Sciences (COPDESS) also recommends that data should be accessible at the time of publication, deposited in a reliable repository, and cited according to open data principles.

Taking into account the importance of defining FAIR policies, a group from the Research Data Alliance (RDA) has developed a model to assess the type of editorial policy for research data based on 14 variables. This model identifies six different policy types defined by their degree of compliance with the various items (Hrynaszkiewicz et al., 2020). Jackson (2021) offers a set of recommendations for the development of an editorial policy for research data based on the analysis of 201 Library and Information Science journals indexed in Web of Science (WOS) and/or Scopus, taking into account their formats and data repositories, among other characteristics.

Funding requirements to make research data public and compliant with FAIR funding principles are key to making findings widely and openly available (Peset et al., 2017). In addition to meeting FAIR requirements, this also poses several ethical challenges (Boté & Termens, 2019; Méndez, 2016; Wilkinson et al., 2016) related to ensuring the security and privacy of the data.

Key points

- Support for open access and open science does not always translate into actions of support due to concerns about implementation.
- Open peer review is still perceived by Spanish editors as a difficult policy to implement, and has little support.
- Whilst open access is strongly supported by Spanish journal editors, there are concerns about the business models and financial viability.
- There remain concerns about reuse of open content and the Creative Commons BY-NC-ND licence is used most commonly.
- Spanish editors worry about the emergence of preprints and how they affect and interact with journals, leading to few journals having policies for authors on preprint posting.
- Few Spanish journals provide clear guidelines on how to cite datasets and make them freely available.

As a relatively new issue regarding open science, OPR has a direct impact on scientific journals. This can mean revealing the identities of reviewers and authors in the review of a scientific article, but it can also mean open sharing of reviewer comments and even allowing the public to participate in the review process (Ross-Hellauer, 2017; Ross-Hellauer & Görögh, 2019; Teixeira da Silva, 2018; Thelwall et al., 2021). OPR raises many questions that have yet to be resolved, such as its impact on article citations, possible bias in reviews, or the perceptions researchers may have when putting their name to a review. On the question of impact, Wolfram et al. (2021) reviewed 17 journals with OPRs between 2017 and 2018 and found that increasing the number of reviews did not contribute to an article's impact. However, Zong et al. (2020) analysed 1495 articles published in the journal *PeerJ* between 2013 and 2015, and determined that articles with an open peer review history could be expected to have significantly higher citation counts than articles with a closed peer review history.

Bias and resistance can occur in open reviews; for example, Thelwall et al. (2021) studied bias in open reviews on the F1000Research platform from 2012 to 2019 with 2,553 contributions from 79 countries, finding weak evidence of bias if the reviewer was from the same country as the author. Zhang et al. (2020) identified greater resistance to signing reviews among women than men, and resistance was also found among junior researchers, who feared that signing a negative review could

have adverse implications for their future careers. Differences between disciplines also exist; for example, a study by researchers at a Greek hospital (Delikoura & Kouis, 2021) found that the medical and health science community participated very actively in open reviews. Research funding agencies have suggested that publishing the reviews of articles is a good way of better informing both readers and authors (Polka et al., 2018).

As a strategy for ensuring full access and solving delays in publishing (and citing), recently a lot of attention has been devoted to preprints. Along with data, preprints have been a key element in the communication of results in the pandemic era (ASAPbio, 2020). In fact, publications on COVID-19 between January and May 2020 on the preprint servers MedRxiv and BioRxiv outnumbered articles found on the topic in PubMed (Gianola et al., 2020). Preprints can accelerate the visibility and social impact of science by cutting out the time lag between evaluation and formal publication in a journal. They can even encourage innovation and experimentation with new peer review and curriculum evaluation processes (Sever et al., 2019). Preprints also serve as confirmation of the impact of the research when they are deposited in a trusted repository (Dorrego-Rivas et al., 2021). Papers previously deposited as preprints have also been found to receive more citations (Fraser et al., 2020). In the case of editorial policies related to the acceptability of preprint deposits prior to article submission, there are differences depending on the discipline (Reichmann et al., 2019).

Regarding relevant studies related to Spain, there are articles analysing open access editorial practices (Melero et al., 2017), perceptions towards open access (Ruiz-Pérez & Delgado-López-Cózar, 2017), to open access and peer review (Segado-Boj et al., 2018), towards open science (Rodríguez-Bravo & Nicholas, 2021), and recently with a focus on philosophy (Feenstra & López-Cózar, 2022) and drivers and barriers in the transition to open science (González-Teruel et al., 2022). The aim of this paper is to examine and analyse perceptions and editorial practices related to open access, preprints, underlying data and open peer review, from the perspective of editors of scientific journals published in Spain. The purpose of this analysis is to gain an insight into editorial policies related to open science in Spain, as part of a larger project related to the implementation of open science at Spanish institutions. The following research questions (RQ) will be addressed:

RQ1: What are the perceptions of science editors regarding open access, preprints, underlying data and open peer review in the Spanish scholarly publishing landscape?

RQ2: What insights does this give us into editorial practices related to open science?

METHODOLOGY

Online interviews

Due to the pandemic, the focus groups planned with journal editors from different disciplines were converted into personal online interviews, which took place between April and May 2020. Nine individual sessions were held with editors from different disciplines: Documentation, Pharmacy, Medicine (Traumatology), Education, Biology, Botany, Economics, and Sports Medicine. The sessions with each of the editors covered the four topics that would later help to define the blocks examined in an online survey addressed to editors: open access, open peer review, preprints, and open research data. These topics are described in the following section. The sessions were recorded and later transcribed in order to extract and synthesize the topics and observations that emerged in the conversations. The editors interviewed were informed about the project of which the interviews formed a part. An informed consent form explaining the details of the project was completed and signed before the discussions took place. The findings helped to formulate some questions in the subsequent survey.

Online survey

An online questionnaire in Spanish was developed using Limesurvey. Respondents were not asked for personal data, and questions did not require a response (were not mandatory) except for the title of the journal. The survey was sent to the contacts of the 1875 journals indexed in the Dulcinea directory (Dulcinea, 2008) at the time the research was conducted. Data from Dulcinea were retrieved by exporting metadata from its database. A copy of the survey was uploaded as supplementary material on Zenodo (Melero, 2022). This directory contains the editorial policies regarding access and self-archiving of Spanish scholarly journals. The questionnaire was sent out in May 2021 and three reminders were sent in June, July and September 2021. The questionnaire consisted of five parts:

1. Demographic data about the journal and the role of the respondent
2. Information in terms of access to the journal contents;
3. Information in terms of open peer review process;
4. Information related to preprints;
5. Information related to the underlying data of published papers.

Depending on the question, responses could be single, multiple or 5-point Likert scale responses (e.g., from 'strongly disagree' to 'strongly agree'), which were translated into a numerical scale from 1 to 5 for quantitative analysis and statistical processing.

Before being sent out, the survey was tested on a group of nine editors to analyse the difficulty, length, and comprehensibility of the questions. Although participants in this test found the questions easy to answer, some questions were raised about respondent familiarity with the concepts of open access, open review, preprints or open data, and there was also some feedback related to the length of the questions. After some corrections, the form was ready for use.

A descriptive and statistical analysis of the responses to the questionnaire was conducted with SPSS v27 and Excel 2016.

For the quantitative analysis of the Likert-scale questions, Cronbach's alpha was first calculated to check the reliability of the scale used. A hierarchical cluster analysis was conducted on all the answers to the questions that used the same Likert scale in order to determine or classify potential groups of editors surveyed based on their answers. At the end of each section of the survey, a box was provided for free text comments, which were taken into account in the discussion of the results, in the form of quotes, as shown in Section 3.

Limitations of the study

There are two limitations of the study related to the population used for the qualitative and quantitative analyses, which may affect the extrapolation of the results to other communities:

1. The target population for the online survey was restricted to Spanish editors of journals that are mostly open access and published by universities or research centres. Most of the editors were also active scientists or professors of recognized prestige who were well acquainted with the discipline and the editorial practices of scholarly publications;
2. The disciplines of the journals belong mainly to the social sciences and humanities areas, according to the classification of the Dulcinea directory.

RESULTS AND DISCUSSION

Following the interviews with the editors, their comments were categorized into 'advantages/benefits' and 'challenges/barriers' for each of the topics discussed (Table 1). Benefits include the effect on the immediacy of open access, the transparency offered by open peer review, the acceleration of public communication facilitated by the publication of preprints, and the value of open data for enhancing the reliability of the results. On the other hand, challenges included the high cost of article processing charges (APCs), the emergence of predatory journals, the reliability of preprints, potential conflicts between peers arising from open peer reviews, and the fear of fraudulent appropriation of data. The comments and issues discussed have been highlighted in other studies, mostly involving surveys of researchers (Kim & Stanton, 2016; Melero & Navarro-Molina, 2020), which shows that in the case of scientific journal editors who are also teachers and/or researchers, it is difficult to separate the two roles when discussing their opinions on certain issues.

Online survey

The survey received 420 responses, representing a participation rate of 22.4%, although not all respondents answered all the questions.

Most of the survey respondents (75%) were editors or journal directors, which means that the majority of respondents held positions of importance for the decision-making process related to the development of the journal. The roles of other respondents were copy editors (4%); managing editors (10%); journal secretaries (7.4%); and editorial board members (6.4%).

In addition, the majority of respondents (more than 80%) had held some role related to scholarly communication in their careers: editor (86%); editorial board member (82%); author (84%); or reviewer (84%). The median number of years that respondents had been working for a journal was estimated at 10 years ($N = 408$, $SD = 8$).

General data on journals

Table 2 provides data on the discipline, publisher type and copyright owner of each of the journals that participated in the survey, together with data on the total number of journals indexed in the Dulcinea directory at the time the research was conducted. The proportion of commercial journals participating in the survey was considerably lower than the percentage of commercial journals present in Dulcinea. The type of content published by the journals in order of frequency was: research articles (100%); book reviews (62%); editorials (36%); literature reviews (33%); data articles (17%); opinion articles (14%); conference proceedings (14%); letters to the editor (9.5%); and clinical trials (8%).

Most print journal versions were established between 1980 and 2000, making their average age around 30 years, while most digital journal versions were launched between 2010 and 2016, with an average age of approximately 12 years.

Results related to open access

Most of the participating journals (92%) reported being open access immediately upon publication (compared to 84% in Dulcinea), 1% used a hybrid open access model (2.2% in Dulcinea), 5% provided free access after an embargo period (6% in Dulcinea), and 1.8% had access restricted by subscription (8% in Dulcinea). These figures are lower than the directory due to the low participation of commercial journal editors in the survey. Although all the participating journals described themselves as open access (probably several of them meant 'gratis') only 82% reported allowing reuse of content, which means that some journals do not fully comply with the Budapest Declaration's definition of open access. Regarding the transfer of copyright, 60% confirmed that they required copyright transfer agreements regardless of the type of access. In relation to open access directories, 62% ($N = 420$) reported being indexed in DOAJ, while 46% were indexed in SHERPA/RoMEO.

Of the responses obtained to the question on Creative Commons licences ($N = 364$), 18% reported not using Creative Commons (CC), while the breakdown of the rest is as follows: CC BY-NC-ND (29%); CC BY (21%); CC BY-NC (14%); CC BY-NC-SA (9%); CC BY-SA (6%); and CC BY-ND (3%). The most commonly used licence is thus the most restrictive (CC BY-NC-ND), followed by the most open (CC BY). During the online interviews, before the survey was sent out, editors expressed concern that commercial use may be made both of original work and of potential derivative works of what they offer for free, so they prefer to restrict such permissions.

TABLE 1 Summary of themes that emerged during online interviews with editors.

	Advantages/benefits	Barriers/challenges
Open access	• Immediacy • Transparency in content • Transparency in business model • Openness to professionals and society as a whole • Sustainability with article processing charges (APCs) • Innovation in publishing	• Production budget • Quality is questioned, associating free OA with low quality • Lack of knowledge of OA in certain disciplines (e.g., clinical medicine) • Emergence of predatory journals • Delays in the entry of new journals into databases (*impactitis*) • Cost of APCs • Publishers not very open to innovation
Open peer review	• Transparency • Quality of the reports • Able to see previous comments and versions • Promote international common standards • Contribute to new criteria to assess communication and participation in the process	• Difficulty in finding reviewers • Rivalry between peers • Generation of conflicts between peers • Possible bias by reviewers towards more prestigious journals • Lengthening of the process • Resistance to change (slow) • Discipline matters
Preprints	• Accelerate science communication • Facilitate self-archiving before submission	• Which version to cite • Metrics (citations not counted from other websites) • Editorial policies not adapted to preprints • Fear of authors/readers (in medicine) • Confusion between preprint and online first • Following the Ingelfinger rule • Discipline matters
Open research data	• Facilitates use of open access data • Provides reliability • Visibility • Quality indicator • Allows validation of results • Innovation: can generate new publication models (e.g., data papers)	• Discipline-based acceptance • May affect privacy (reason not to share) • Affect exploitation of data • Who owns the data? • Economic interests • Reluctance to publish 'inconvenient' data (negative or unexpected) • Confidentiality • Suspicion regarding the appropriation of data (without mentioning who is the owner) • Fear of misuse • Not knowing where to place the data (repository) • Reuse of unpublished data

The criteria for choosing one licence over another have been based on the recommendations or guidelines of the publishing service, the institutional open access policy, or the model adopted by other journals in the same discipline.

In the opinions expressed on the current communication system and options for publication, peer review and open data (Fig. 1), there was a significant correlation ($p < 0.01$) among those who answered that open access journals, open peer review and open data should be common practices. However, as will be discussed in the sections on open peer review and open data, these are not common practices among the editors who responded to the survey.

We analysed the benefits (Q23) and potential barriers (Q24) (Melero, 2022) of open access for publications according to the editors surveyed. Cronbach's alpha values, which indicate the reliability of the chosen scale, were 0.825 for the questions about the benefits, and 0.705 for the questions related to the barriers. As shown in Fig. 2, the strengths identified included the visibility that open access offered publications, the immediacy of content availability and the benefit of making knowledge accessible to the public. From a publishing point of view, it was also recognized that the open access business model provides transparency. On the other hand, the sustainability of a model based on APCs does not seem to be widely accepted, possibly because most of the responses come from open access journals and/or public institutions:

- *Open access is basically a new business, where publishers get paid to publish even if nobody reads what they publish. They used to charge because people wanted to read quality articles. With open access, publishers no longer function as guarantors of quality, as their business is not in getting readers, but in getting authors*. (Publisher: Learned Society, Subject: Ecology, Life Science)

TABLE 2 Type of publisher, discipline, and copyright holder of the surveyed journals.

	Number	%	Data from Dulcinea ($N = 1875$) (%)
Publisher			
University/Research centre	253	61.9	55
Commercial publisher	24	5.9	14.8
Association/Scientific Society/Professional Association/College	114	27.9	20.3
Governmental	15	3.7	4.6
Foundation	3	0.7	0.6
Copyright holder			
The publisher	248	59.1	73
The authors	99	23.5	27
The Society/Scientific Association/Professional Association	73	17.3	15
Discipline			
Social sciences	149	35.4	47.4
Arts and Humanities	166	39.4	27.5
Health Sciences	54	12.8	16.5
Engineering	9	2.1	2.3
Life sciences	28	6.9	3.5
Experimental sciences	9	2.1	2.1
Mathematics and physical sciences	5	1.2	1.7

It was also pointed out that APCs may pose barriers for researchers without funding:

- *APCs set up a new barrier, as only researchers with purchasing power are going to be able to publish. If you do not have money, you will not be able to publish, and that means that a lot of research will never be accessible*. (Publisher: University, Subject: Animal Biodiversity, Life Science)
- *The excessive cost imposed by some publishers to publish in open access makes open access publishing as a way of sharing knowledge a lucrative business for some companies*. (Publisher: University Press; Subject: Biology, Life Sciences)

This has been also suggested in another study (Jain et al., 2021) and it is consistent with results obtained previously by others (Ruiz-Pérez & Delgado-López-Cózar, 2017).

One important factor influencing open access is the discipline, since APCs are not charged in all subject areas:

- *In general, the ecosystem of academic journals in the humanities is very different from other disciplines. Humanities open access journals do not charge authors. In our case, this is a clear policy that seeks to eliminate biases and differences between authors with access to public or private funds and authors without them*. (Publisher: University Press; Subject: Humanities)

Potential threats (Fig. 3) include the strong competitive edge that large publishing companies have over independent journals because the latter cannot compete with their management and marketing capacity, as stated by an editor in the survey (free comment section):

- *Independent journals cannot compete with the big publishers in terms of impact, so we receive fewer manuscripts and this is detrimental to our quality and reduces our impact. It's a vicious circle*. (Publisher: University Press; Subject: Economics, Social Science)

The idea that free is synonymous with low quality is a barrier, as is the emergence of 'hijacked' OA journals whose main objective is to profit from APCs while neglecting the editorial process, as well as having low levels of security on their websites (Sureda-Negre et al., 2022).

On the other hand, the possibility that editorial teams may depend on the voluntary work of editors also seems to be a threat to their sustainability, along with the lack of recognition of the role of editor:

- *There should be more widespread recognition from universities of the work carried out by the editors of their academic journals, since in addition to the teaching load, conducting our research and taking care of the management tasks we are responsible for, we do the work of editors of the publications free of charge*. (Publisher: University Press; Subject: Linguistics, Humanities)

Comparing benefits and barriers, the mean values of the responses per participant were above 3 points, indicating that those who strongly agreed that OA was beneficial also strongly agreed that potential threats to OA exist. A minority of respondents were of the opinion that the threats outweigh the strengths.

Results relating to open peer review (Q25-Q32)

Most of the journals (92%, $N = 385$) indicated that they use double-blind peer review for the review process, 6% carry out an internal evaluation, and only 2% perform the evaluation without masking the names of authors and reviewers. This demonstrates the very limited use of OPR in the Spanish academic journal ecosystem, and also suggests that open access and OPR do not go hand in hand, at least at present. Regarding satisfaction with the current evaluation system (Q26), 65% were satisfied or very satisfied, 27% were indifferent and only 7% were dissatisfied. This shows that there may be an inertia effect, as satisfaction is not widespread, but perhaps alternatives are not yet being sought.

The mean values of responses related to the openness of peer review and possible alternatives (Q27) to the double-blind

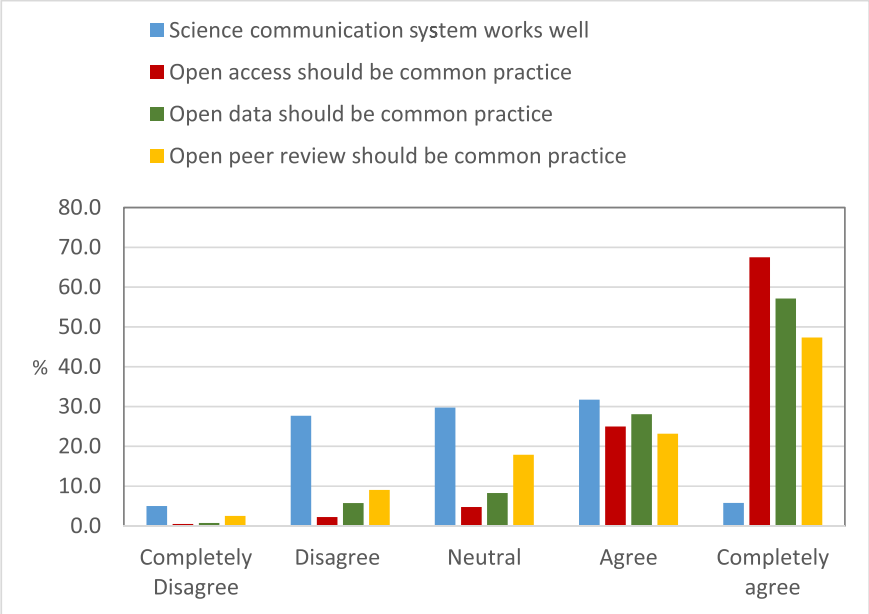

FIGURE 1 Respondents' opinion on the science communication system, open access publishing, open data, and open peer review.

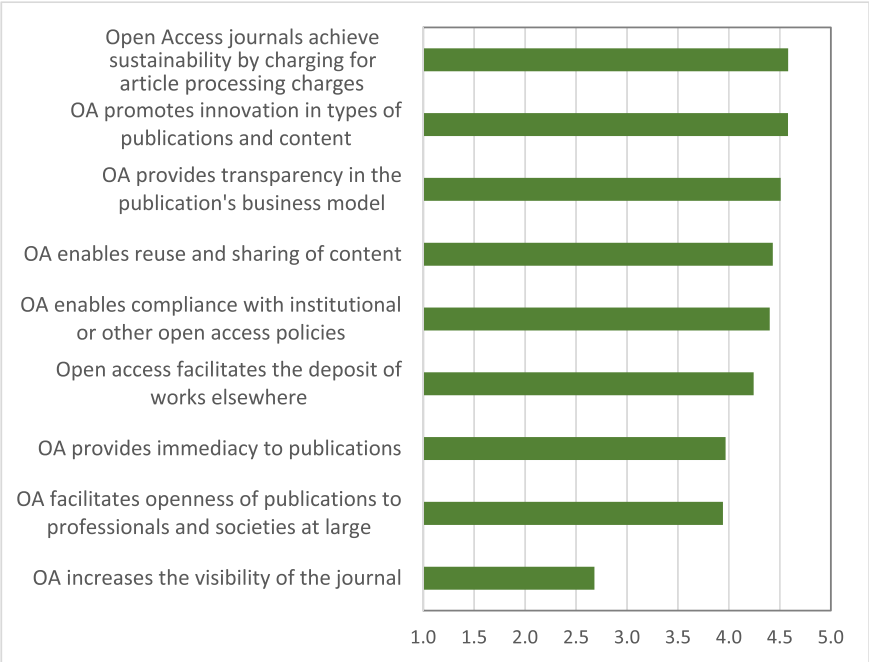

FIGURE 2 Questions related to the strengths/advantages of open access. Means ($N = 382$) of the responses of all respondents on a 5-point Likert scale from 'strongly disagree' (1) to 'strongly agree' (5). Cronbach's Alpha = 0.825.

peer review system revealed that respondents do not generally believe that the review process would be improved by providing the identities of authors and reviewers (Fig. 4).

Opinions were also not in favour of reviewer reports being openly available on the journal's web platform during the evaluation process. These opinions reflect a conservative view of the peer review process. However, participants did consider that peer review could be improved through open interaction between authors and reviewers.

The idea of review as a mechanism for interaction between members of the scientific community seemed to be viewed positively by respondents, as is also reflected in some of the individual comments, although for different reasons:

- *There are despotic reviewers who prevent the publication of good articles simply because they do not share the focus or approach of the article. OPR would give rise to peer-to-peer debate with the author.* (Publisher: University Press; Subject: Town Planning, Humanities)

Open peer review may result in 'softer' criticism if the author and reviewer are friends or acquaintances, and

FIGURE 3 Questions related to barriers/challenges of open access to scholarly journals. Means ($N = 386$) of the responses of all respondents on a 5-point Likert scale from 'I strongly disagree' (1) to 'I strongly agree' (5). Cronbach's Alpha = 0.705.

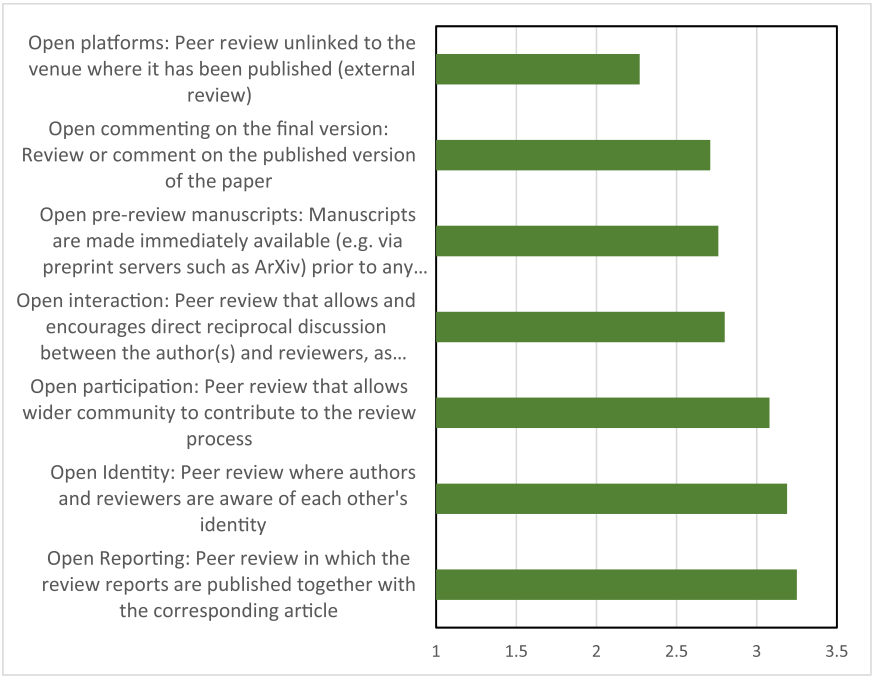

FIGURE 4 Questions related to the potential improvements of peer review process. Likert scale 1–5: Much worse (1). Worse (2). Neither better nor worse (3). Better (4). Much better (5). Mean values ($N = 383$) of all responses. Cronbach's alpha = 0.790.

> harsher criticism if they are rivals. Direct interaction between reviewers and authors, however, could be constructive. (Publisher: Research Institution, Subject: Information Science, Social Science)

As Fig. 4 shows, even considering the potential problems of the current peer review model, there was no consensus on which of the proposals might be better. This may be due to the lack of experience with alternative models, since only 12% of respondents had experience with open peer review as reviewers and 9% as authors, despite the fact that these practices have been under study for years (Björk & Hedlund, 2015; Hernandez, 2017). When asked about the use of Publons as a platform for the recognition of reviewer activity, only 20% of 380 respondents reported using it.

Figure 5 shows responses to questions about the opportunities offered by OPR (Q31). From the mean values obtained, it can be concluded that the respondents did not strongly agree with identifying reviewers unless such identification is optional, as they considered that revealing a reviewer's identity could result in a less strict evaluation. However, there was moderate agreement with the suggestion that interaction between work teams and reviewers could be beneficial.

Among the potential threats posed by open peer review (Q32) was a concern expressed by editors that it may give rise to conflicts of interest between authors and reviewers (Fig. 6). This would make it difficult to find new reviewers, which would lengthen the review process.

In any case, it seems significant that OPR could improve not just the content but also the form of the review, resulting in an

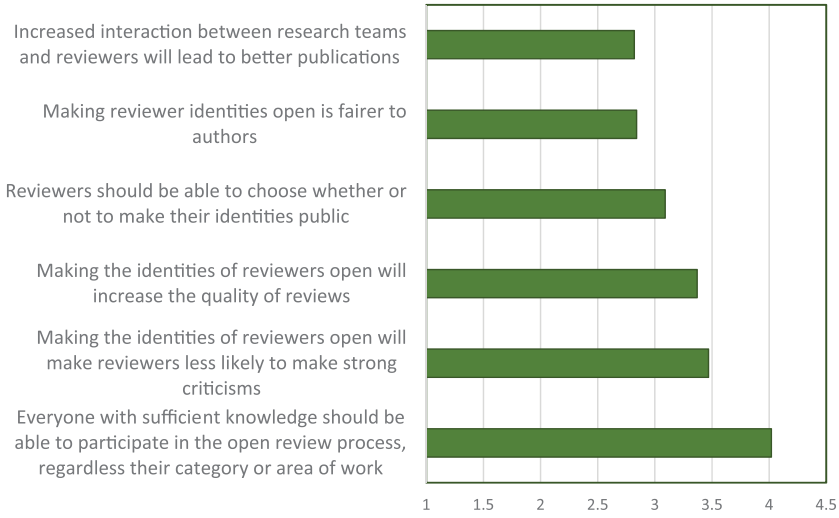

FIGURE 5 Responses to the question 'to what extent, as editor, do you agree with the following statements?' related to positive aspects of peer review process. Mean values ($N = 377$) of all responses using a Likert scale 1–5: Do not agree at all (1). Disagree (2). Neither agree nor disagree (3). Agree (4). Strongly agree (5). Cronbach's alpha = 0.705.

exchange of views that is more efficient and better appreciated (Worlfram et al 2020). It is also worth remembering that the services described here are generally provided voluntarily by the reviewers. In this respect, the editors themselves are aware of the effort made by reviewers and believe that mechanisms that ensure greater recognition of the added value provided by reviews would be better:

- *One problem with peer review, in addition to the one raised here about its transparency, is the recognition of the review work itself. Recognition with academic value*. (Publisher: Science Museum; Subject: Zoology, Life Sciences)

> Reviewers sometimes 'help' authors to improve manuscripts by pointing out weaknesses in the manuscript and adding external criticism. Reviewers are not sufficiently recognised in the traditional refereeing system. (Publisher: Learned Society; Subject: Medicine, Health Science)

The results presented in Figs. 5 and 6 reveal that opposition to OPR is stronger among respondents than recognition of the advantages of changing to this model. In this sense, although the biases occurring in peer review processes have been known for years (Lee et al., 2013), there is a reluctance to change, as can be seen in some of the comments made by respondents. For example:

- *Open peer review only further increases influence peddling and pressure, limiting the critical freedom of the reviewers*. (Publisher: Private Foundation, Subject: Nutrition, Health Science)

As can be seen, many respondents felt that OPR would intensify existing problems rather than solve them, as it would add potential new biases in relation to the identity and hierarchy of reviewers and authors, and could exacerbate the subjectivity of the review process. Comments expressing this view included the following:

- *In an open review, young authors would not dare to contradict prestige authors, for fear of damaging their careers*. (Publisher: Learned Society; Subject: Ecology, Life Sciences)

> The prestige of the journal could condition whether or not reviewers accept open peer review. Reviewing for good journals is recognised in accreditations and reviewing for others is not. (Publisher: Academic Association; Subject: Information Science, Social Science)

Comparison of perceptions of the advantages and potential threats of OPR reveals two symmetrical profiles of opinions (one side with mean scores less than 3, and the other with mean values over 3 in the Likert scale) and in both cases the scores for the threats are mostly above the neutral value of 3. There was no consensus on possible solutions to be considered. This lack of consensus explains some of the feedback offered in the survey:

- *If the identity of the reviewers is known, they will also be subject to criticism, and potential reviewers will be much more likely to decline requests to participate in reviews*. (Publisher: University Press; Subject: Medicine)

These findings are similar to those of Segado-Boj et al. (2018) in relation to the difficulty of implementing an OPR due to reviewers being openly exposed to criticism.

Results related to preprints (Q33-Q39)

This section of the survey began with a definition of preprints in order to eliminate any doubts or ambiguities: 'Preprints are versions of articles submitted to journals for publication that have not yet gone through the peer review process'.

The term was already familiar to more than 80% of the 381 editors who responded, although only 25% reported having experience as an author either in depositing or downloading

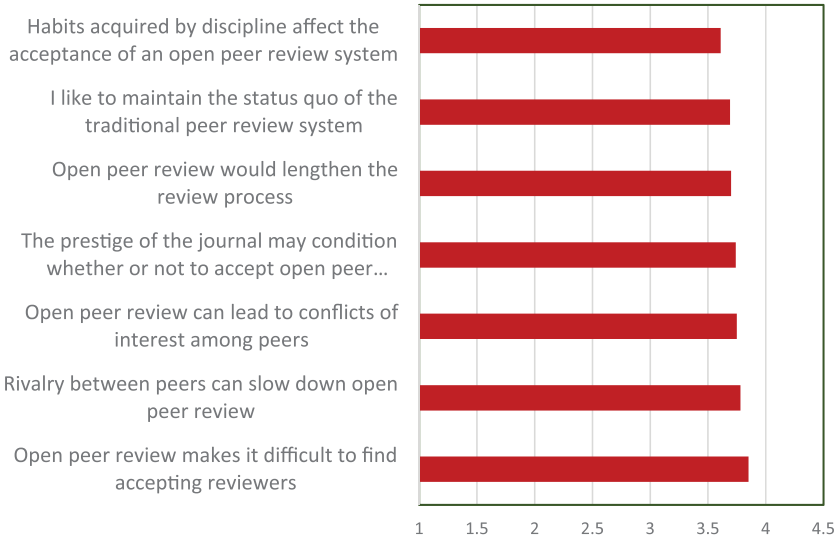

FIGURE 6 Responses to the question 'to what extent, as editor, do you agree with the following statements?' related to negative impacts of open peer review. Mean values ($N = 379$) of all responses using a Likert scale 1–5: Do not agree at all (1). Disagree (2). Neither agree nor disagree (3). Agree (4). Strongly agree (5). Cronbach's alpha = 0.729.

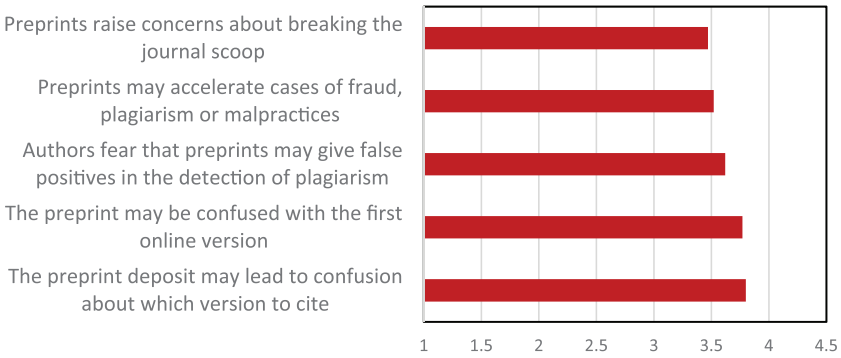

FIGURE 7 Responses to the question 'to what extent, as editor, do you agree with the following statements?' related to negative impacts of preprints. Mean values ($N = 373$) of all responses using a Likert scale 1–5: Do not agree at all (1). Disagree (2) neither agree nor disagree (3). Agree (4). Strongly agree (5). Cronbach's alpha = 0.828.

preprints. Only 17% of respondents reported that their journals had an editorial policy for preprints; 6% included a recommendation as to where they could be deposited and 15% mentioned how to cite them in their 'instructions to authors'. Responses to the question Q38 of whether preprints can be a threat to publications by causing confusion about article versions or publication impact had mean scores above the neutral value of 3 (Fig. 7).

The responses indicated that preprints may indeed offer more disadvantages than advantages from an editorial point of view and as unreviewed versions they could have a particularly damaging effect in the health sciences, especially in the context of the COVID-19 pandemic:

- *In health sciences, the current pandemic has shown us how dangerous preprints are, and how useless they are. The preprint has not taken into account their effect on evidence-based medicine, and the risks they pose*. (Publisher: Commercial; Subject: Pharmacy, Health Sciences)

This view is contradicted by other statements in favour of preprints as a means of speeding up the dissemination of results (Gianola et al., 2020) and even facilitating open review prior to their formal evaluation (Reichmann et al., 2019). There are concerns that the preprint may be confused with the accepted 'online first' version published by the journal, raising doubts about which version to cite. The risks of false positives in plagiarism detection and of fraudulent use were also areas of concern for the respondents.

In terms of the potential benefits of preprints (Fig. 8), respondents did not seem to favour them as a way to speed up the prior evaluation process, as already mentioned in the section on open peer review. However, there is more acceptance of the idea that they can accelerate scientific communication and serve as an endorsement of the impact of the research results:

- *The main purpose of a preprint is for authors to be 'protected' as first authors of a research result in fields where several groups are expected to converge on similar results. From this point of view, it seems to me an appropriate measure as long as the preprints that are ultimately rejected after the review rounds are withdrawn*. (Publisher: University Press; Subject: Biodiversity, Ecology)

Author habits vary depending on discipline: in the social sciences and humanities, for example, preprints are not so common, as one of the respondents pointed out:

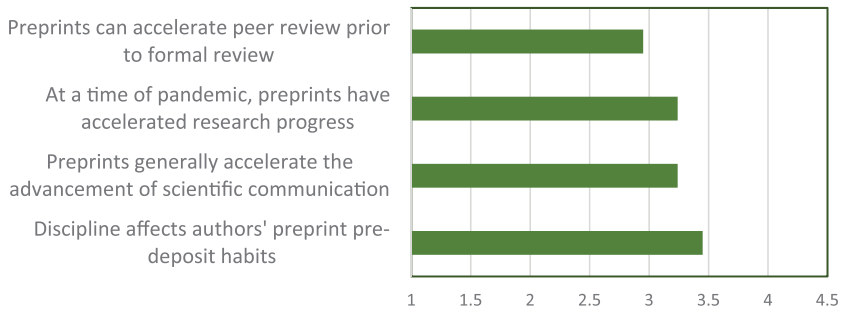

FIGURE 8 Responses to the question 'to what extent, as an editor, do you agree with the following statements?' related to positive impacts of preprints. Mean values ($N = 369$) of all responses using a Likert scale 1–5: Do not agree at all (1). Disagree (2). Neither agree nor disagree (3). Agree (4). Strongly agree (5). Cronbach's alpha = 0.760.

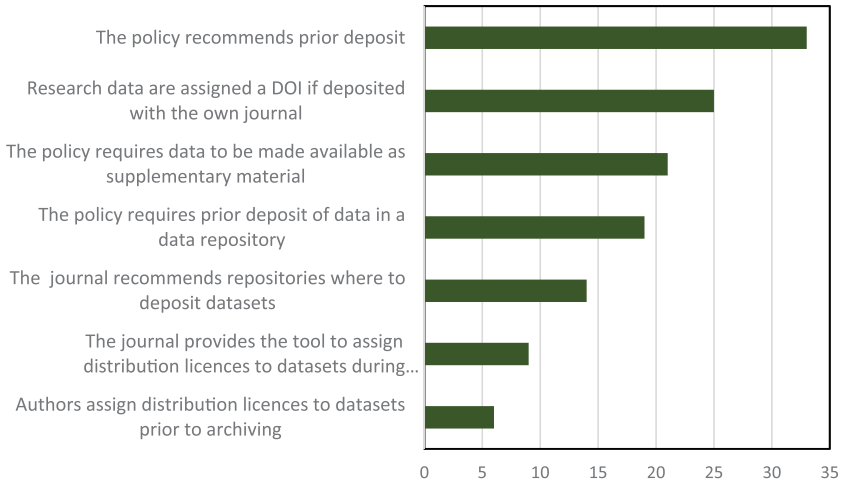

FIGURE 9 Number of positive responses from journals with a data policy ($N = 59$).

- *In the Humanities it is not very common to use preprints. In the case of our journal, we don't use them, but of course, authors can do whatever they like with their articles, so it's not a problem either. But it is rare, to be honest*. (Publisher: University Press; Subject: Humanities)

These views reflect a more conservative view of communication channels. Comparing the mean scores of responses to questions on barriers and opportunities, barriers were rated more often above the neutral value of 3, while those who rated the benefits of preprints positively also rated threats more highly.

Results related to underlying data (Q40-Q52)

Out of 375 responses, only 59 journals (16%) reported having a policy on underlying research data. Of these, 21 were in the social sciences, 19 in the humanities, 11 in the health sciences, one in engineering, five in the life sciences, one in experimental sciences, and one in mathematics and physical sciences. On the question of whether and how the research data policy required or recommended sharing of data (Fig. 9), the most frequent option was to recommend depositing the data in the journal itself, which can be interpreted as making the data available as supplementary material, as the responding journals do not have their own repository. This material can be understood as files with different content, figures, tables, small texts or datasets (Greenbaum et al., 2017).

The practice of recommending a repository where data can be deposited is not a widespread practice either, as this was identified as an option by only 14 of the 59 who responded to this question; this also agreed with the results of Castro et al. (2017) when analysing a sample of journals indexed in DOAJ. Resnik et al. (2019) similarly found that only a small percentage of 447 journals analysed mentioned a specific repository for the deposit of datasets. The recommendation to use licences and how to assign them was also uncommon, with only 1.6% ($N = 364$) responding that they recommended this, and 2.5% reporting that they provided information on how to do it. These results are in line with those obtained by Vasilevsky et al. (2017) in a survey of editors of 318 biomedical journals, which found that only a minority mentioned who the copyright holder was or gave details about licensing.

Only 7% ($N = 364$) of journals reported assigning a DOI to datasets when they are deposited with the journal itself, and only 2.5% ($N = 367$) indicated that their journal provides a tool to assign distribution licences to datasets during submission.

Only 31 journals (8.4%, $N = 368$) reported including information on how to cite datasets in their instructions to authors, suggesting that datasets are still rarely incorporated in author guidelines as a type of document in the bibliography. In this sense, journals can play an important role in creating the habit of

citing datasets like any other resource, and especially linking articles to datasets previously deposited in a repository. It has been shown that papers that cite and link their datasets receive more citations than those that do not (Colavizza et al., 2020). The use of badges to certify a journal's adoption of open science practices, such as editorial policies that require or recommend sharing underlying research data, has also contributed to increasing the proportion of shared data in publications (Kidwell et al., 2016).

Datasets are more commonly provided as supplementary material for use during peer review, according to 25% of 366 respondents, and they are evaluated as if they were a part of the papers (22% of 366). This percentage was significantly higher than that obtained by Resnik et al. (2019) when analysing 447 journals indexed in WOS, of which only 5.6% indicated that data would be evaluated during peer review.

In the responses to questions (Q51 and Q52) about the advantages (Fig. 10) and threats/barriers (Fig. 11) represented by underlying research data and their open publication, all mean scores were above the neutral value of 3 points, suggesting general agreement with the statements.

These results are reflected clearly in some of the comments received, where on the one hand the value of open data is recognized, but at the same time concerns are expressed about potential fraudulent use of open data:

- *Publishing data openly can give greater transparency to research and allow for more advances (such as through the use of techniques like meta-analysis) but it can also attract predatory researchers*. (Publisher: Scientific Association; Subject: Ecology, Life Sciences)

- *The data on which articles are based involve a lot of work that goes unrecognised. This can lead to people leeching off the work of others, simply exploiting data produced by others without offering their own data in return*. (Publisher: University Press; Subject: History, Humanities)

The mean scores per respondent for the questions about the advantages and challenges of open access to underlying data can be grouped into three categories: The first group disagrees with the idea of open data sharing, as reflected in comments like the following:

- *I think data that has been used for specific research are of little or no interest for other research. Furthermore, even if they have good metadata and can be reused, it is difficult to interpret them without making a mistake. It seems to me that most editors feel the same way and that is why they have not bothered about this. You also have to take into account the usual context of lack of resources and time. The data just add one more worry*. (Publisher: Commercial; Subject: Information Science, Social Sciences)

The second group is very close to 'neither agree nor disagree', while the third and largest group supports open data but also rates the threats posed by the practice highly.

Despite these views, data sharing contributes to transparency in data collection and reproducibility, and therefore the sooner data are available, locatable and reusable, the greater their value (Lortie, 2021), especially for example, during the COVID-19 pandemic.

The free comments in this block highlighted certain issues related to the interpretation of data, and the need for data to be well documented and supported by quality metadata in order to be able to analyse them accurately:

- *Data handled for interpretation by third parties must contain metadata and be clearly expressed to avoid misunderstandings, which requires the investment of additional work*. (Publisher: University Press; Subject: Geography, Humanities)

This issue has been raised repeatedly in surveys of researchers (Fecher et al., 2017; Schmidt et al., 2015; Tenopir

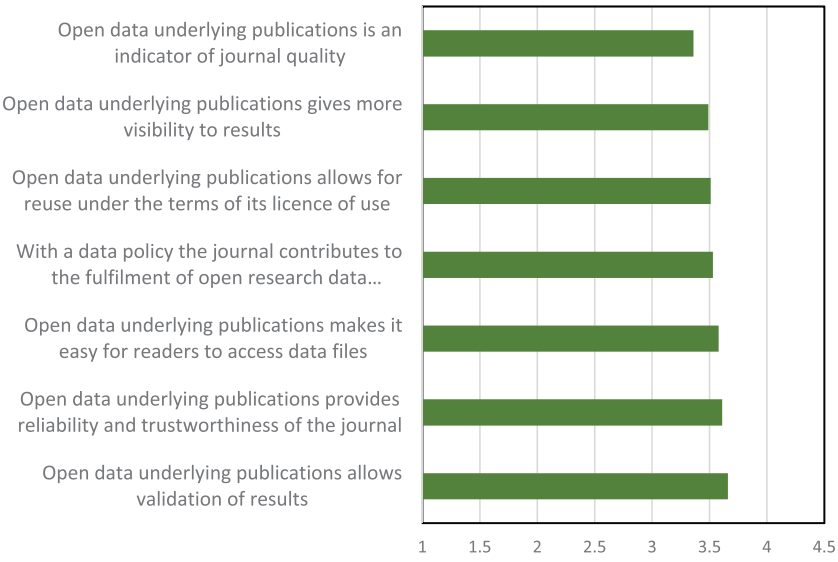

FIGURE 10 Responses to the question 'to what extent, as an editor, do you agree with the following statements?' related to positive impacts of open data. Mean values ($N = 351$) of all responses using a Likert scale 1–5: Do not agree at all (1). Disagree (2). Neither agree nor disagree (3). Agree (4). Strongly agree (5). Cronbach's alpha = 0.931.

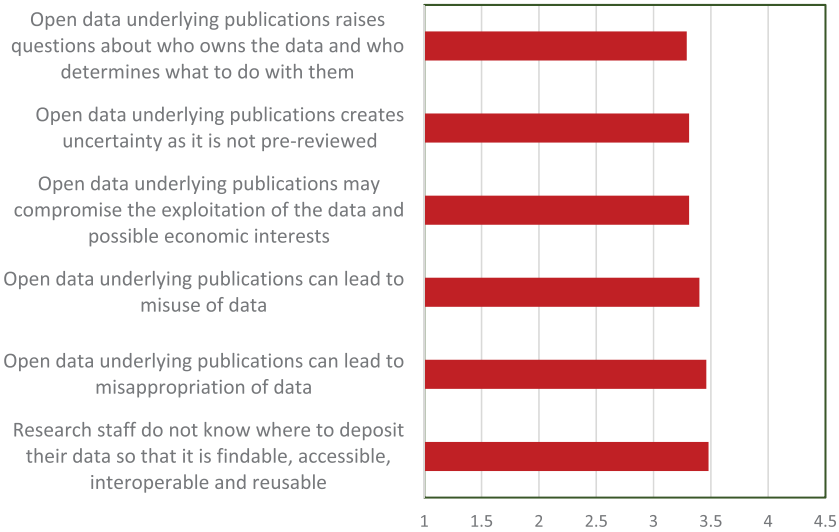

FIGURE 11 Responses to the question 'to what extent, as editor, do you agree with the following statements?' related to the negative impacts of open data. Mean values ($N = 360$) of all responses using a Likert scale 1–5: Do not agree at all (1). Disagree (2). Neither agree nor disagree (3). Agree (4). Strongly agree (5). Cronbach's alpha = 0.850.

et al., 2011). Another point raised was that peer reviews involving evaluation of data would require more time and reviewers might decline to do the evaluation:

- *But this requires more time, and for each reviewer to be an expert on each of the techniques used. I think requiring reviewers to study the underlying data would make a lot of reviewers turn the job down*. (Publisher: University Press; Subject: Medicine)

Another risk factor identified in the survey was the danger that insufficient safeguarding of personal data may pose:

- *The publication of raw data may also create a personal data protection problem*. (Publisher: University Press; Subject: Education, Social Sciences)

However, this should not be a barrier, as data should be as open as possible and as closed as necessary, especially for confidentiality, privacy or security reasons.

The discipline concerned is also a factor in data sharing, as while in experimental and life sciences the practice is widespread, this is not the case in social sciences and humanities:

- *Little or no relevance to law journals*. (Publisher: Academic Association; Subject: Law, Humanities)

- *Our data are ancient texts, which we publish in the articles, or as annexes to the articles. We don't leave the data out of the publication, so these issues are not applicable to us*. (Publisher: University Press; Subject: Linguistics, Humanities)

In the case of engineering, a survey of 28 journals (Wiley, 2018) identified very few journals with a clear policy on research data. Rousi and Laakso (2020) also detected differences between research fields regarding policy existence, strength, and specificity of data policies of highly-cited journals in the fields of neuroscience, physics, and operations research.

Respondent profiles based on views expressed

With all the responses to questions related to open access, open peer review, preprints and open data, a hierarchical cluster analysis was performed to identify potential respondent profiles. Four clusters were obtained, consisting of 50 (cluster 1), 97 (cluster 2), 92 (cluster 3) and 84 (cluster 4) participants. Respondents in clusters 1 and 4 display similar trends, as do subjects in clusters 2 and 3, although with different mean values. In all four clusters, the OA and OA data variables receive the most favourable scores, while responses supportive of aspects of OPR and preprints are much lower. Cluster 1 is made up of individuals who tend to favour open access and open data, but are inclined to disagree with new OPR initiatives or sharing of preprints. Clusters 2 and 3 are composed of respondents who rated OA and OA data positively (mean values of 4.2 and 3.6, respectively), while scoring lower mean values for questions supportive of OPR and preprints, although these mean scores are above the neutral value of 3 (3.3 and 3.2, respectively). Finally, the subjects in Cluster 4 score mean values between approximately 3 and 3.6 for all variables, that is, quite conservative values that border on neutral.

All four groups generally agree that OA has advantages related to the immediacy of the content, that it promotes visibility and universal access, that open access is not synonymous with low quality, and that the appearance of predatory journals could compromise its reputation. On the question of open peer review, the four groups agree that the option to identify participants should be optional and that OPR could slow down the evaluation process due to potential conflicts of interest. On the subject of preprints, respondents do not seem to agree on their use and implementation due to concerns of possible fraud, loss of impact or detection by plagiarism programmes. Finally, the group that sees the most advantages in open data are the editors in cluster

2, although they do agree that open data also poses potential threats. This concern may be due to the fact that most editors are also researchers and perhaps this reluctance has more to do with their experience as researchers than as editors.

CONCLUSIONS

Open access is widely known and accepted by Spanish editors and publishers. The ecosystem of journals published in Spain makes a big difference, and provides a mature market for moving towards open science, preferably in terms of data rather than OPR. Regarding the permission to re-use contents, there is some concern about the type of open licence granted to an article. The fact that information provided free of charge can be commercialized is one of them. OPR is an emerging issue among journals, but some aspects are still unclear, such as the evaluation itself or the possible drawbacks between reviewers and authors. Although preprints are widely known in some disciplines, there is still a conservative conception of preprints, and there are still limitations in their use. In an environment with such a strong presence of diamond OA, it is understandable that the preprint is not seen as an advantage but as a problem of control of content and copies. Thus, preprints, in the opinion of the editors, do not need to be a quick fix. Research data are primarily used as supplementary material for scientific articles. Furthermore, there are still no clear guidelines from journals on how to cite datasets and deposit them. Editors are a key stakeholder for the adoption of full open science practices, given that although they are often also researchers, they shape journal policies (especially in terms of open data), which can help to improve their implementation. Finally, we note that there are still many aspects that need to be covered by clear journal guidelines concerning open peer-review, preprints, and research data. Given that a conservative situation is observed in Spanish journals, adopting all these elements will require a large consensus from academic publishers.

AUTHOR CONTRIBUTIONS

RM conceived the project, RM, J-JBV and ALB developed the methodology, RM analysed the results, RM, J-JBV and ALB wrote the article.

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