Peer review: the attitudes and behaviours of Covid-19 pandemic-era early career researchers

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Abstract

Explores science and social science early career researchers' (ECRs) perceptions and experiences of peer review, seeking also to identify their views of any pandemic-associated changes that have taken place. Data are drawn from the *Harbingers-2* project, which investigated the impact of the pandemic on scholarly communications. Peer review, one of the activities covered, is singled out as it proved to be the activity of greatest concern to ECRs. Findings are obtained from interviews, which covered around 167 ECRs from China, France, Malaysia, Poland, Russia, Spain, UK and US, supplemented by an international survey that took the data out to a bigger and wider audience for confirmation and generalisation. Results obtained are enhanced by comparisons with pre-pandemic evidence yielded by *Harbingers-1*, the forerunner of the present study, and anchored in an extensive review of the literature. Main findings are: 1) most ECRs were experienced in peer review, both as reviewers and authors, but few had formal training; 2) half the ECRs had a lot or some reservations as to whether peer review vouches for the trustworthiness of research; 3) inadequate reviewers and slow processes were the main peer review associated problems; 4) there was a strong feeling that some kind of compensation, whether monetary or reputational, could help in dealing with these problems; 5) the pandemic impacted most on the speed of processing, with the majority of ECRs saying it had slowed the process; 6) nearly everyone thought that any pandemic-induced impacts would be temporary.

Keywords

Research; Scholarly communication; Scientific communication; Young researchers; ECRs; Peer review; Reliability in peer review; Pandemics; Covid-19; Harbingers Project; Impacts; Consequences of the pandemic; interviews; Peer review trustworthiness; Surveys; Resilience; Differences between countries; China; France; Malaysia; Poland; Russia; Spain; United Kingdom; USA.

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1. Introduction

We have learnt about early career researchers' (ECRs) views and experiences of peer review in the course of the just-concluded, international, six-year long, longitudinal *Harbingers* research project, which investigated the working lives and scholarly communication behavior of junior science and social science researchers. The project had as its basic premise the belief that ECRs –tomorrow's leading professors, influencers, and decision makers– hold the key to understanding where the scholarly communications is heading, indeed, will be instrumental in transforming it. After all, they are the new generation, traditionally held to be trailblazers, and, as such, disruptors of the established order of things, as well as millennials, who characteristically possess generational values of openness to change and community-mindedness (**Burstein**, 2013; **Duffy**; **Shrimpton**; **Clemence**, 2017; *FEPS*; *ThinkYoung*, 2018; *Pew Research Center*, 2010a; 2010b; **Schewe** *et al.*, 2013, **Sørensen** *et al.*, 2017).

In fact, the pandemic might have tipped the scale toward their giving precedence and acting upon their millennial tendencies, for, as **Nugin** and **Kalmus** (2022) suggest, it is particularly during profound societal changes that young people can become agents of social transformation, rather than being objects of socialization. With the pandemic creating the kind of changed and challenging societal reality that calls for and incentivizes new ways of coping (**Herman** *et al.*, 2021), the likelihood that the new generation of researchers will mobilize transformations in the scholarly system has arguably become more pronounced.

Of course, it is only to be expected that in their endeavours to bring about change, ECRs, as newcomers to academe, would focus first on the system's age-old problems, a major one of which, as the literature amply evidences (see the *Background and context* section), is peer review. Not only has it long been a much-debated aspect of the scholarly communication system, but recently it unmistakably came even more to the fore, figuring as highly as it did among the weaknesses that the pandemic exacerbated or at least shed new light on. Indeed, the evidence obtained over the years of the *Harbingers* project has proven the peer review process to be a major reason for concern among ECRs, with the scale, seriousness and centrality of its weaknesses having come top of the list among the 'cracks' they have identified in the pandemic-era scholarly system (**Nicholas** *et al.*, 2022a; 2022b; 2023).

This paper seeks to follow-up on this finding and present a comprehensive portrayal of ECRs' perceptions and practices of peer review by examining in detail the vast amount of data we have collected, inclusive of the impact that the pandemic might have had on its processes. We are well-placed to do so, as we have been investigating ECRs' attitudes to and practices of peer review in context and in the round and exploring its relationships to other scholarly activities over six-years, the whole duration of the project: in *Harbingers-1*[1]*,* the first leg of the undertaking (2016-2019), which directly preceded the pandemic, and in *Harbingers-2*[2], the *Alfred P. Sloan Foundation*[3] funded extension to the project (2020-2022), conducted during and after the pandemic. The analysis of the peer review process, as ECRs see it, thus covers ECRs' training for the role of referees, their attitudes to and experiences of the peer review process, their suggestions for its improvement as well as their views of the impact of the pandemic on peer review.

2. Aims

The overarching aim of this study is to establish ECRs' perceptions and experiences of peer review, seeking in particular to identify their views of any pandemic-associated, possibly long-term changes that have been taking place. Within this broad aim the paper shall seek to find out:

- How experienced in peer review ECRs are.
- What training for the role of reviewers ECRs obtain.
- What ECRs think of the peer review process: its strengths, weaknesses and future.
- What suggestions ECRs have (if any) for improving peer review.
- What ECRs believe to be the impact of the pandemic on peer review (if any).

3. Background and context

Peer review, the

> "social mechanism through which a discipline's 'experts' maintain quality control over new knowledge entering the field" (**Berkenkotter**, 1995, p. 245),

has been described as

> "the lynchpin about which the whole business of science is pivoted" (**Ziman**, 1968, p. 111),

indeed, as

> "the institutionalised practice… [that] glues the academy together" (**Neylon**, 2018).

Justifiably so, of course, for the procedure aims at safeguarding the quality, novelty, reliability, soundness, theoretical and empirical validity, and potential impact of new knowledge produced (**Eve** *et al.*, 2021; **Mulligan**; **Hall**; **Raphael**, 2013; **Nicholas** *et al.*, 2015b). Just what a central role peer review plays in the scholarly undertaking has never been more clearly demonstrated than in pandemic times, when the crucial need for rapid dissemination of relevant scientific knowledge shone a strong light on its direct, and very powerful bearing on the publication process (**Horbach**, 2020). Still,

whilst stakeholders in the academic enterprise agree that peer review, per se, is indispensable (**Nicholas** *et al.*, 2015b; 2019; *Publishing Research Consortium*, 2016; **Tennant**; **Ross-Hellauer**, 2020), it nevertheless seems to be the most debated and charged aspect of the scholarly communication.

Indeed, peer review has been found in study after study to be wanting, manifesting as it does a host of characteristic limitations. Thus, inter alia, it has been criticised for bias and unfair assessment (**Demarest**; **Freeman**; **Sugimoto**, 2014; **Haffar**, **Bazerbachi**; **Murad**, 2019; **Lee** *et al.*, 2013; **Silbiger**; **Stubler**, 2019), arbitrariness (**Brezis**; **Birukou**, 2020; **Roumbanis**, 2022), problematic scientific gate-keeping (**Bartneck**, 2017; **Flaherty**, 2022; **Jubb**, 2016; **Seeber**, 2022), suppression of innovation (**Siler**; **Lee**; **Bero**, 2015), ineffective detecting of error or fraud (**Brainard**; **You**, 2018; **Horbach**; **Halffman**, 2019), and delays in publishing (**Allen** *et al.*, 2022; **Christie** *et al.*, 2021). The flurry of retractions in the past decade or so (**Hesselmann** *et al.*, 2017; **Sharma**, 2021; **Steen**; **Casadevall**; **Fang**, 2013), and especially during the pandemic (**Kodvanj** *et al.*, 2022; **Shimray**, 2022), which can arguably be traced back, among other reasons, to oversight in peer review and editorial verification, certainly seems to imply that there are inadequacies in the system.

By the same token, so does the unrelenting search for achieving more equitable, fair, efficient and effective ways and means of doing peer review. Indeed, the past few years have seen numerous innovations in peer review and quality assurance in scholarly publishing (**Woods** *et al.*, 2023). These range from initiatives striving to make the process more open, in order to increase referee accountability and minimize their bias (**Ross-Hellauer**, 2017), through efforts at de-coupling the procedure from journal publishing and making it more collaborative and community-led (**Tennant** *et al.*, 2017), to recent technological advances, inclusive of AI-assisted ones, which aim at rendering it more efficient (**Barroga**, 2020; **Horbach**; **Halffman**, 2018).

Plainly then, peer review occupies the hearts and minds of the scholarly community, and with good reason, too: as **Squazzoni** and **Gandelli** (2013) suggest, summing it all up in a nutshell, it is peer review that determines, whether directly or indirectly, how the resources of the science system –including funding, positions and reputation– are allocated. Indeed, with the publication of research achievements hinging on peer review, the refereeing process assumes a pivotal role in shaping scholarly careers, for –to reiterate what by now has become a truism– research productivity is held to be a major yardstick, if not *the* major yardstick by which scholarly success is measured (**Blankstein**; **Wolff-Eisenberg,** 2019; **Herman**, 2018; **Herman**; **Nicholas**, 2019; **Nicholas** *et al.* 2015a; **Niles** *et al.*, 2020; **Van-Dalen**; **Henkens**, 2012).

This, of course, is particularly so in the case of novice researchers, yet to prove their suitability to an academic career by producing an impressive publishing record (**Jamali** *et al.*, 2020; **Nicholas** *et al.*, 2017a; 2018a; 2020a; 2020b). With the pandemic negatively impacting many aspects of their work-life (**Christian** *et al.*, 2021; **Douglas** *et al.*, 2022; **Herman** *et al.*, 2021; **Jamali** *et al.*, 2023; **Johnson** *et al.*, 2021; **Levine** *et al.*, 2021; **Morin** *et al.*, 2022), ECRs' ability to successfully navigate the turbulent waters of the publishing process, inclusive of its peer review component, seems bound to be further affected.

4. Scope

The findings reported here come from the aforementioned, *Sloan Foundation*-funded, *Harbingers-2 - Early Career Researchers and the Pandemic Research Project*, the two-year extension to the original, four-year *Harbingers-1* study (for more detail see the *Methods* section). The data are drawn from both the interview leg of the project, which was at the heart of the research, and the international survey that subsequently extended and generalised it, albeit majoring on the former. There were three rounds of interviews, but for the purposes of this paper we are only taking data from the final round, when ECRs would have had two years familiarity with peer review in pandemic times and would thus be in a good position to comment on it. The findings are enhanced, where relevant, by the pre-pandemic results obtained in *Harbingers-1*.

5. Definitions

Peer review

Peer review is definable, as **Ross-Hellauer** (2017) suggests, as the formal quality assurance mechanism whereby scholarly manuscripts (e.g., journal articles, books, grant applications and conference papers) are made subject to the scrutiny of others, whose feedback and judgements are then used to improve works and make final decisions regarding selection (for publication, grant allocation or speaking time).

ECRs

With different, conflicting and country-specific definitions of an ECR circulating (**Teixeira-Da-Silva**, 2021), a pragmatic conceptualization of the term was decided on. Our definition of an ECR focusses on the common denominators of their standing, that is, their being employed in a research position but, being relatively young and in an early phase of their career, not yet established as permanent faculty:

> "Researchers who are generally not older than 40, who either have received their doctorate and are currently in a research position or have been in research positions, but are currently doing a doctorate. In neither case are they researchers in established or tenured positions. In the case of academics, some are non-tenure line faculty research employees".

Subject/discipline

The reference to subject/disciplinary representativeness in this paper builds on **Fanelli** & **Glänzel**'s (2013) findings, which support the 'gradualist' view of scientific knowledge suggested by the *Hypothesis of the Hierarchy of Sciences* –the placing of each field of research, moving from the physical to the social sciences, along a continuum of complexity and softness. Thus, the wide disciplinary area of Social Sciences is divided here into 'hard' disciplines, such as Psychology and 'soft' disciplines, such as Sociology.

6. Methods

The *Harbingers-2* project continues the mixed methodology approach of *Harbingers-1*, as detailed in **Nicholas** *et al.* (2019; 2020a) and on the project website[1]. This provides for a high-degree of data triangulation: an ongoing literature review, semi-structured interviews and a questionnaire survey to test the results on a larger and more diverse population. The data are drawn from both the interview leg of the project, and the international survey that subsequently extended and generalised it, albeit majoring on the former. The findings are enhanced, where relevant and possible, by the pre-pandemic results obtained in *Harbingers-1*, which covered roughly the same disciplines and countries, although the number and composition of the cohort differed a little, and an extensive, analytical literature review.

6.1. Interviews

As noted, the interview stage of *Harbingers-2* consisted of three rounds of interviews, but the results presented here come from the final round, two years into the pandemic (Spring of 2022), when ECRs were best placed to report on their experiences of peer review as things unfolded on the ground.

Recruitment

Interviewees for *Harbingers-2* included both ECRs who participated in *Harbingers-1* and new ones, recruited to fill the ranks of participants who had left research or no longer qualified as ECRs. New (and old) ECRs were recruited by the eight national interviewers, utilizing their local networks and connections, with numbers supplemented by mail-outs from scholarly publisher lists. Each country was given a quota of interviewees (between 20 and 24) to achieve an element of representativeness in terms of age, gender and subject and also to ensure some consistency across countries.

Characteristics of the sample

177 ECRs were recruited for the first round of interviews, of which 167 remained for the third round, mainly because of ECRs' moving out of academe/research. Table 1 provides a country and discipline breakdown of the cohort as of the final round of interviews. The main differences between the rounds of interviews in terms of make-up is that in the final round of interviews there were: a) 3 fewer French ECRs; b) 3 fewer youngest ECRs, aged 24-28. The disciplinary and gender balance remained much the same.

Table 1. Discipline and country breakdown of ECRs (Interview 3)

	Total	CHEM	ENV	LIFE	MATH	MED	PHY	SOCH	SOCS
China	23	0	0	0	5	9	5	1	3
	14%				22%	39%	22%	4%	13%
France	17	2	0	2	3	2	5	0	3
	10%	12%		12%	18%	12%	29%		18%
Malaysia	20	1	0	3	4	2	2	5	3
	12%	5%		15%	20%	10%	10%	25%	15%
Poland	22	2	3	3	3	3	4	1	3
	13%	9%	14%	14%	14%	14%	18%	5%	14%
Russia	20	3	2	2	2	3	4	3	1
	12%	15%	10%	10%	10%	15%	20%	15%	5%
Spain	20	3	3	2	2	2	2	4	2
	12%	15%	15%	10%	10%	10%	10%	20%	10%
UK	24	1	2	5	2	6	2	4	2
	14%	4%	8%	21%	8%	25%	8%	17%	8%
US	21	2	2	3	2	5	3	2	2
	13%	10%	10%	14%	10%	24%	14%	10%	10%
Total	167	14	12	20	23	32	27	20	19
	100%	8%	7%	12%	14%	19%	16%	12%	11%

Interview procedure

Interviews were conducted remotely via *Zoom* or similar video conferencing systems, and in the national language, except Malaysia where English is widely understood. They lasted between 60-100 minutes, were recorded, transcribed and translated (if necessary) and returned to the interviewees for agreement and comment.

The interview protocol contained a mix of closed, open and hybrid questions, covering every aspect of the scholarly system: job, status, career aims/progression, assessment, research directions, working life, reputation, as well as scholarly communications practices –collaboration, searching/finding, networking, ethics, informal communication (preprints, blog posts, posters), social media, publishing, metrics, sharing, outreach and transformations. There were 9 direct questions about peer review and, in addition, a free-text search was conducted for mentions of peer review in responses to other questions. Indeed, ECRs volunteered information about peer review in the context of a further 33 questions and sub-questions, covering more than a dozen scholarly activities, undoubtedly a testimony to the ubiquity and importance of the topic. These mentions of peer review were also included in the data analysed and reported here.

Data analysis

All the interview transcripts were transferred by the national interviewers to a coding sheet, which closely matched the questions of the original interview schedule, but left room for information derived from additional enquiries or clarifications during the interview process. A mapping was maintained so that same, revised, and new questions could be matched between schedule, coding and the three rounds of interviews. The coding sheets were multi-faceted, containing both quantitative and qualitative data, and often a question generated both. For each question, the code sheet captured the interviewee's response in three ways: 1) as a code (e.g., Y/N); 2) as a quotation; 3) and as an explanatory comment from the interviewer. We refer to 2) and 3) as being free-text comments. Not all questions were encoded, as some sought a more extensive explanation, which is recoded only as quotation and commentary. Quotations and commentary were 'at will', they vary in extent and quality and, often for coded responses, were omitted by respondents. Free-text data were analysed using thematic coding, based on themes from the questions and any new themes emerging from the data.

6.2. Survey

A questionnaire, informed by the interview phase of the study, was developed, piloted and sent out towards the end of the study (Summer of 2022) in order to obtain further data on key interview findings from a bigger, more international and disciplinary population of early career researchers. There were just two questions concerning peer review, which asked ECRs whether, based on their own personal experience, the pandemic affected: a) the quality standards of peer review; b) the speed of review.

Recruitment

We did not have a sampling framework because there is no register of ECRs in any of the case study countries. Therefore, a probability sampling approach was not possible, and it was decided to distribute the survey as widely as possible through various channels. Four methods were used for distribution:

- Invitations were sent out by scholarly publishers or relevant institutions to potential ECRs (e.g., *Taylor and Francis*).
- A link to the survey was tweeted by publishers or relevant institutions to researchers (e.g., *Oxford University Press*).
- A banner image with a link to the survey was put on *Wiley Digital Library* and anyone who saw the banner while visiting a journal or article, and was interested, could click and go to the survey.
- Direct invitation emails and texts were sent to ECRs at universities in the case study countries by the national interviewers.

Survey tool

The questionnaire contained 17 questions, two of which, as noted, were on the impact of the pandemic on peer review. The questionnaire was translated by the research team into Chinese, French, Polish and Spanish and was hosted on *Qualtrics* in the third quarter of 2022. For the sake of consistency and to be able to triangulate the data, we used the same definition for ECR used in the other phases of the *Harbingers-2* project (see the *Definitions* section). The survey started with a screening question that asked respondents to self-identify whether they were an ECR based on the definition. Those who said *No* in answer to the screening question exited the survey.

Characteristics of respondents

After data cleaning, 800 responses remained for analysis. Slightly more women (440, 55%) than men (314, 39.3%) participated. The majority were 31 years or older (560, 70.1%). The disciplinary distribution of respondents was biased towards the social sciences (294, 36.8%) and was followed in rank by the life/biological sciences (158, 19.8%). Chemical sciences (21, 2.6%) and mathematical sciences (28, 3.5%) had the lowest numbers of respondents. Respondents came from 71 countries, with those based in the USA accounting for slightly more than a third of responses (285, 35.6%), followed by a large gap to China (61), Spain (48), France (40), Australia (31), Malaysia (30), India (28), UK (27) and Poland (17).

Comparing the make-up of the survey respondents with those who participated in the interview phase of the study, the survey respondents were more international, more American, on average older, and, unlike the interview cohort, some came from the arts and humanities, too. Health/medical sciences were the largest disciplinary group in interviews, whereas they were the third largest group in the survey.

Data analysis

Statistical analysis including descriptive (frequency and percentage) and some inferential (non-parametric Chi-square, Mann Whitney U, and Kruskal-Wallis H tests) were conducted using the *Statistical Package for the Social Sciences* (*SPSS*). Non-parametric tests were used because of the nature of variables (some nominal or ordinal) and lack of normality of the data. For six questions with Likert options (strongly disagree to strongly agree, or significant negative impact to significant positive impact) the mean value was also calculated using numeric values of the options (1 being 'strongly disagree' or 'significant negative impact' and 5 being 'strongly agree' or 'significant positive impact'). 'Don't know' or 'not sure' options were excluded in the mean calculation for these questions. Comparisons between countries were only made in the case of the seven countries that were included in the qualitative phase of the study (Russia was also initially part of the project but was missing due to problems resulting from the war in Ukraine), so that we could compare the survey findings with interviews.

7. Results and discussion

7.1. ECRs' involvement in peer review

Experience

Three interview questions sought to find out how experienced ECRs were when it came to peer review, in order to enable us to weigh the depth of their understanding by establishing how informed they were about the process:

- Are they involved in responding to criticisms of their/their groups' publications?
- Have they undertaken peer review themselves?
- Have they had any formal and/or informal training for these roles?

In response to the first question as to whether they were involved in responding to criticisms/suggestions of reviewers on papers that they/their research group authored, the vast majority (89%) of ECRs answered yes (Table 2). This came as no real surprise, as the *Harbingers-1* findings have already indicated that ECRs were keen to participate in responding to reviewers commenting on their work: 85% of the 116 interviewees said so (**Rodríguez-Bravo** *et al.*, 2017).

Chinese and Malaysian ECRs were the most experienced, with all of the interviewees in both of these groups saying they had been involved in responding to referees. Russian ECRs, with half of the group answering 'no' to the question, were the least experienced.

As to ECRs' extent of experience as reviewers – belying their junior status, well-over three-quarters of the interviewees have undertaken peer reviews of other people's papers (Table 3). Again, not much of a surprise here, as we have already been told by the participants of the *Harbingers-1* interviews, 58% of whom reported having had reviewing experience, that it is quite common for ECRs to stand in for their busy seniors when it comes to performing the task (**Rodríguez-Bravo** *et al.*, 2017). US ECRs were the most experienced, with all 21 of them having reviewed, but then so had many, if not most of the interviewees in the other countries, the only outlier being France, with only a third of ECRs (5/15) reporting to have reviewed.

7.2. Training

Putting the two tables together, the Chinese, Americans, Spaniards and Malaysians have particularly high levels of experience when it comes to peer review –on both sides of the peer review fence. Is it, though, because ECRs in these coun-

Table 2. Involved in responding to reviewers?

Country	Total	No	Yes
China	23	0	23
France	15	4	11
Malaysia	20	0	20
Poland	22	2	20
Russia	20	7	13
Spain	20	1	19
UK	24	3	21
US	21	1	20
Total	165 (100%)	18 (11%)	147 (89%)

Table 3. Involved in peer reviewing?

Country	Total	No	Yes
China	23	2	21
France	15	10	5
Malaysia	20	1	19
Poland	22	7	15
Russia	20	9	11
Spain	20	1	19
UK	24	7	17
US	21	0	21
Total	165 (100%)	37 (22%)	128 (78%)

tries are better trained for the task? The next question set out therefore to find out whether, in addition to experience, ECRs had any formal and/or informal training for peer review. Only two-fifths had had some kind of training, so most must have learned on the job (Table 4), a finding that comes as no great surprise: for example, in a systematic review of all openly available online training in scholarly peer review, a comprehensive search of the literature identified only 20 openly accessible online training materials (**Willis** *et al.*, 2022a).

Table 4. Any training for peer review?

Country	Total	No	Yes
China	23	11	12
France	14	13	1
Malaysia	20	20	0
Poland	22	14	8
Russia	20	9	11
Spain	20	16	4
UK	24	12	12
US	21	5	16
Total	164 (100%)	100 (61%)	64 (39%)

According to our findings, it is the US that stands out as provider of training, with 76% of the interviewees having received training, although in China, UK and Russia there is some training given, too, with around half of the ECRs in each of these countries saying so. However, there does not seem to be a correlation between the training ECRs get and the extent to which they participate in the peer review process. It would seem reasonable to surmise that the more prevalent a task is, the more training would be given to those that do it, which, indeed, is the case in the US, where ECRs are very active in peer review. Still, in Malaysia, for example, with all that, nearly all ECRs take part in the peer review process, none have received any training whatsoever for the task. In the case of Russia, ECRs who are not reviewers do not receive training. And those who are, receive training in one form or another: either official, from the journal, or from senior colleagues or Principal Investigator.

It is certainly not for lack of need or want for training in peer review that there seems to be so little of it given, even where senior researchers are concerned. Rather the contrary, as a survey among biomedical researchers found: 84.2% of the 171 participants (assistant, associate, or full professors) said they had never received formal training in peer review, although most (75.7%) agreed that they should have (**Willis** *et al.*, 2022b). Indeed, in a roundtable discussion focusing on how publishers and editors can help early career researchers, all agreed that publishers should provide more assistance/ training/ support for ECRs with peer review (**O'Brien**; **Graf**; **McKellar**, 2019).

7.3. Peer review as ECRs see it

Moving on to ECRs' perceptions of the peer review, the next five questions concentrated on the extent to which they felt they could trust the system, whether it was in need of improvements, and if so, how.

Trustworthiness of the system

Seeking to establish the extent to which ECRs rely on the system, the interviewees were asked:

- To what extent do they feel that the peer review system vouches for the quality and trustworthiness of formally published research?

Around half of the ECRs who responded to the question (which provided an opportunity to provide free text comments, too) said 'true to a great extent', 43% as 'true to an extent', and 6% as 'not a lot' (Table 5). With 49% of ECRs thus expressing at least some reservation about the system's capability to guarantee the soundness of the scholarly endeavour, there are clearly problems here.

However, there were some very big country differences. Thus, French or Malaysian ECRs were of the opinion that peer review delivered quality/trustworthiness to an extent/to a great extent, so much so, that in fact none of either cohort thought it did not. In all likelihood in both cases the roots of the phenomenon are traceable to widely held cultural attitudes. With mutual trust and respect seen as necessary in order to establish a strong relationship, French academics have a profound respect for their peers (**Scroope**, 2017). By the same token, so do their Malaysian counterparts, guided as they are by the traditional Malay concept of 'budi', which sees politeness and respect as essential to human interaction (**Evason**, 2016).

Table 5. Peer review - how trustworthy?

Country	Total	To an extent	Great extent	Not a lot
China	23	0	22	1
France	16	3	13	0
Malaysia	18	5	13	0
Poland	21	11	7	3
Russia	20	10	10	0
Spain	20	13	6	1
UK	24	15	7	2
US	17	11	3	3
Total	159	68 (43%)	81 (51%)	10 (6%)

Even bigger supporters of peer review, at least in terms of absolute numbers, were the Chinese ECRs, with 22 out of 23 saying that peer review vouched for quality to a great extent. Indeed, Chinese researchers tend to be greatly appreciative of peer review,

considering it the very basis of scientific communication. Having said that, our Chinese interviewees, needing to navigate foreign waters in their publishing practices (**Jiang**; **Borg**; **Borg**, 2017), were in a position to point out that the peer review processes of Chinese journals and English-language journals, published by international publishers, are quite different, with peer review felt to be more trustworthy in English-language journals.

British and Spanish ECRs on the other hand had relatively high levels of reservation or concern in respect to the trustworthiness of the procedure, with only around a third of each cohort saying that peer review could be vouched for to a great extent. US ECRs showed even more concern, with just 3 opting for 'to a great extent' answer when asked about the trustworthiness of peer review. In fact, one of them, a Medical scientist, even raised the possibility of doing altogether without peer review:

> "Part of me just thinks that it shouldn't exist and everything should just be pre-prints and the consumer should just think critically about it themselves."

ECRs' main reservations, echoing concerns voiced in *Harbingers-1*, too, (**Jamali** *et al.*, 2020; **Nicholas** *et al.*, 2018b; **Rodríguez-Bravo** *et al.*, 2017), were:

- it took too long to get reviews completed during the pandemic;
- reviewers for the task were unsuitable, with some asking questions already answered in the paper and others wanting authors to do more experiments or analyses that were outside the scope of the paper; and
- the quality of reviews was not up to scratch, with some reviewers providing little feedback, others asking questions that suggested that they were not familiar with the field, and, here again, asking for additional work that did not make sense.

Undoubtedly then, ECRs are well-aware of the problems with the system, but, as many ECRs suggested, much along the lines of Churchill's well-known aphorism about democracy –the worst form of government except for all those other forms that have been tried from time to time– even if peer review is not perfect, it is indispensable. Bearing testimony to this are the mentions of peer review in responses to questions not directly related to the topic. Indeed, many interviewees stressed the basic necessity of having and trusting peer review accredited information in a variety of contexts. Thus, for example, a French life scientist expressed no doubts whatsoever as to the centrality of peer review:

> "Journals are still the gatekeepers and are still law. They validate ideas exposed in preprint repositories; It's the peer review process that is crucial. There has to be a check."

In the same vein, a US medical scientist explained why, despite their reservations, peer review remains at the heart of research:

> "I trust it if it's gone through the peer review process, which is contradictory to what I just said about it. You kind of have to trust the system but I don't have to like the system."

The same notions emerged from ECRs' responses when asked about numerous scholarly practices, which, of course, is yet another proof of the centrality of peer review to research. Thus, for example, a Malaysian hard social scientist, talking about what they call 'pay to publish' (i.e. OA) journals, echoing the concerns encountered in *Harbingers-1* (**Nicholas** *et al.*, 2020c), stressed the importance of peer review for being able to distinguish between acceptable and questionable publications:

> "I can say that now I join some group who do research and publish the paper to pay-to-publish journal. But it still goes through peer review process. My suspicion towards the group lessens because I understand these days your papers still need to go through peer review, it's just your chances [*to getting published*] is higher because of the additional [*money*]."

By the same token, a British medical scientist, looking at the rise of preprints during the pandemic from the reader's point of view, noted that

> "preprints have become more common practice, but still considered to be unreliable sources of evidence because of absence of peer review,"

and a US chemist, speaking mainly as an author, pointed out that with all that preprints have their welcome uses,

> "at the end of the day you are evaluated by your publications in peer reviewed journals."

Indeed, discussing whether informal communications (often interpreted as preprints) would have a greater role in scholarly communications, the consensus among interviewees was that it would not, with the barrier to greater use being the absence of peer review. As a French physicist, speaking for others who voiced the same notions, too, explained:

> "Only if the peer reviewed [sic] is guaranteed, otherwise it cannot work whatever is the innovation. Journals are deeply integral to research and the way to do research."

Thinking along the same lines, a Chinese soft social scientist, whilst acknowledging the positive role of preprints, which

> "may allow everyone to share as soon as possible and ensure the author's initial ideas, nevertheless stressed that the dissemination of academic ideas should be screened through specific procedures, such as peer review and formal publishing procedures."

7.4. Need for improvements to the system

Having learned ECRs' views as to the extent to which the peer review is trustworthy, we probed more deeply and asked whether they thought that it needed improving. This, via a question that offered Yes/No/Don't know options, but also allowed for the interviewees to comment freely on the topic:

- **Do they feel that the peer review system needs improving in any way?**

Nearly two-thirds of the ECRs (66%) opted for 'yes' in response to the question, i.e., they were of the opinion that peer review needed improving (Table 6), a percentage that is a little higher than might have expected from the answers to the previous question. With only 18% of the interviewees saying that the system was good as is, and 16% of them not sure about it, plainly few researchers thought that the system did not require change, strong evidence, perhaps, that it does not always work for them. This was not surprising, having learned from *Harbingers-1* participants of a wide range of concerns about the system (**Jamali** *et al.*, 2020; **Rodríguez-Bravo** *et al.*, 2017).

Table 6. Peer review in need of improving?

Country	Total	Don't know	No	Yes
China	22	2	2	18
France	16	7	5	4
Malaysia	18	3	4	11
Poland	22	3	6	13
Russia	20	4	9	7
Spain	20	0	1	19
UK	24	6	1	17
US	19	0	1	18
Total	161	25 (16%)	29 (18%)	107 (66%)

It was ECRs from Spain and the US who felt most strongly that the system was in need of improvement, with almost universal agreement voiced in both cohorts: 19/20 interviewees in the former and 18/19 in the latter. Arguably, though, as there were quite a few assistant professors among them, who were likely to have had more experience with peer review, they might have been simply more knowledgeable about the system and its problematic aspects. Spanish ECRs were especially critical, claiming that there were big and widespread problems with peer review, principally because the best reviewers do not review any longer (*burnt out*), so the quality of reviewing is diminishing. Besides, they said, there are more papers for declining numbers of reviewers, which slows up the whole process at a time when authors want to be reviewed faster than ever. The pace of the process, a long-standing problem (**Allen** *et al.*, 2022; **Christie** *et al.*, 2021), which had *Harbingers-1* participants complaining bitterly (**Jamali** *et al.*, 2019; **Rodríguez-Bravo** *et al.*, 2017), came even more to the fore, as we are about to see, when the pandemic dictated the quick reviews of COVID-related results and the speeding up of their publication (**Horbach**, 2021).

The free-text, optional contributions to the question, which came to nearly a hundred, demonstrating how vocal ECRs are in respect to peer review, lent further support to ECRs' awareness of multiple weaknesses in the system. Thus, complaints about the lack of speed in processing and the poor training provided re-emerged here, too, but the biggest problem of them all was thought to be the (in)appropriateness, (poor) quality and bias of reviewers, with more than a fifth of the interviewees saying so. The notion of some sort of compensation for reviewers, be it monetary or reputation-building recognition on the institutional- or the field-level, was brought up again and again by ECRs as a possible way to incentivise peer reviewers to spend as much effort as required on producing quality reports.

Thus, for example, a US Mathematical scientist, musing aloud on the topic, said:

> "I think *compensating reviewers* would probably encourage better use of time and a higher quality. You can sometimes take on too many peer reviews and you just don't have time to give it the in-depth review it needs. And compensation may make up for that, but it might not. I think it would have to be tested more."

Another interviewee, a Malaysian Life scientist, was a proponent of reputation-building, rather than financial incentives:

> "Peer-reviewing activities are not emphasised in our KPI. If journals publish reviewers' name alongside the published article, reviewers would be more committed to provide quality review. And Universities should support this by including this activity in research assessment. University will also have data on how many of their academics contribute to science through peer-review."

That ECRs should think along these lines certainly came as no surprise, given the proposals in this vein that have been circulating for quite some time now (**Bonaccorsi**, 2023; **García**; **Rodríguez-Sánchez**; **Fernández-Valdivia**, 2022).

7.5. Possible remedies for peer review ills

Admittedly representing an extremist view of the state of peer review, several ECRs across all countries and disciplines thought the system so bad it was beyond repair, *on the verge of collapse*, as one Spanish environmental scientist put it, indeed, needing *a complete tear-down and rebuild*, as a US medical scientist stated. However, most interviewees held a more positive outlook as to the future of the peer review system, certainly not seeing it as irredeemable, as evidenced by their views on a number of possible solutions or scenarios that were proffered to those among them who thought the

system needed improving or were unsure whether it did or not. Two questions asked about specific solutions and a third asked for their suggestions, with all also allowing for the interviewees to comment freely on the topic:

- Would double blind peer review, defined as author blind to reviewer, and reviewer blind to author, improve things?
- Would the use of Open Reports, where the full content of the reviewer report is published along with the name of the reviewer (Open Identities), improve things?
- Are there any other ways that would improve quality of peer review?

Endorsing the prevalent view in academe, which sees anonymity as the key to fair peer reviewing (**Lee** *et al.*, 2013; **Mulligan** *et al.*, 2017; **Tomkins**; **Zhang**; **Heavlin**, 2017), indeed, lending support to the findings of *Harbingers-1* which indicated that ECRs felt very strongly about double-blind reviewing (**Jamali** *et al.*, 2020; **Nicholas** *et al.*, 2017b; **Rodríguez-Bravo** *et al.*, 2017), around two thirds of interviewees said 'yes' when asked whether it would improve things, and just a fifth said 'no' (Table 7). The greatest support for double-blind came from Poland and the greatest resistance and uncertainty from the UK. The reason for many ECRs' preference for double-blind reviewing was succinctly put by a British chemist:

Table 7. Does double blind reviewing improve things?

Country	Total	Don't know	No	Yes
China	21	1	5	15
France	4	1	2	1
Malaysia	7	0	5	2
Poland	22	0	5	17
Russia	11	4	0	7
Spain	20	2	2	16
UK	24	9	4	11
US	20	3	4	13
Total	129	20 (15%)	27 (21%)	82 (64%)

> "The system is very broken based on gentleman's club approach…"

The second solution posed was the Open Reports peer review model (**Ross-Hellauer**, 2017), where the full reviewer report is published along with the name of the reviewers (Open Identities). Just under half of those that answered the question thought the model would be an improvement over the traditional way of reviewing (Table 8), with the greatest endorsement coming from the UK, with 17 ECRs in support, whereas at the other end of the scale just one French ECR opting for the possibility. Not an overwhelming support then of this type of peer review, especially as nearly a quarter of the interviewees chose 'Don't know' when asked whether the model could improve the peer review system, which suggests that even now it is not so well known.

This is all understandable given the risks faced by junior researchers, yet to prove that themselves, as a French ECR put it:

> "Open Peer Review is tricky because you engage your own reputation as a reviewer".

Nevertheless, Open Reports is no longer as unpopular as it was not so long ago –*Harbingers-1* interviewees generally exhibited a suspicious attitude to the model, using terms such as 'dangerous', 'risky' and 'unwanted effects' when referring to it (**Rodríguez-Bravo** *et al.*, 2017). Indeed, in the *Harbingers-1* survey that followed only around 10% of the participants named Open Report/Open Identities as the peer review model of their choice (**Jamali** *et al.*, 2019).

ECRs were also asked whether there were any other ways they could think of which could improve peer review, with 75 ECRs making a relevant suggestion. Unsurprisingly, the most frequent suggestion (27), by some margin, focussed on the aforementioned possibility of financial remuneration for reviewers. Relatedly, another 5 mentioned financial incentives other than direct payments, such as certificates or publishing discounts. The second biggest group of comments, made by 12 interviewees, concerned again the quality and appropriateness of reviewers. Stronger editorial control/intervention, raised by 6 ECRs, was another suggestion, as were the need for reputational recognition, raised by 5, the provision of more time for the process, raised by 4, and more detailed reviewing criteria, raised by 3.

Another improvement that was suggested, if only by 3 interviewees, was the right to appeal the reviewers' 'verdict', which is not very surprising, coming as it does from our cohort of millennials, primed by their generational belief that traditional ways of doing things can and should be scrutinised. This is what a Chinese physicist had to say on the topic:

> "Authors should be given the right to appeal when a paper is rejected. Because from a historical point of view, many grand theories were not recognized by their peers at the beginning, but they were finally confirmed. Therefore, even if all the comments given by the peer reviewers are rejections, the authors should be given channels and rights to appeal."

Table 8. Does the Open Reports model improve things?

Country	Total	Don't know	No	Yes
China	21	3	5	13
France	10	5	4	1
Malaysia	10	8	1	1
Poland	22	1	11	10
Russia	12	4	4	4
Spain	20	3	8	9
UK	21	3	1	17
US	20	5	6	9
Total	136	31 (23%)	40 (32%)	64 (47%)

Finally, a US life scientist introduced a novel approach to improving the current system –a do-it-yourself one:

> "At our [*government institution*] we have a system where, if a paper hasn't been peer reviewed, we peer review it. We have two peer reviewers and an editor. The article will be scored, and we can judge if it's useful or not."

8. Impact of the pandemic on the peer review

Two inter-related interview questions sought to discover ECRs' views as to the impact of the pandemic on the peer review, probing for both quantitative and qualitative data:

- Do they think the pandemic is changing the peer review process?
- If so, in what ways and for what reasons?

8.1. Has the pandemic been changing the peer review process?

A third of ECRs thought the pandemic was changing peer review (Table 9), which, although a sizeable proportion, seems to amount to a lesser agreement with the notion than expected at a time when, as a US physicist pointed out, even the general public were much more aware of validation processes because

> "everyone was talking about COVID research peer review process even in the general public space."

Indeed, there was palpable concern at the beginning of the pandemic about the time-consuming nature of the peer review procedure, and the resulting long turnaround times in publishing novel results, as a British ECR, a hard social scientist, put it:

> "I think the pandemic has made people think about how quick or slow the peer review process is. Whether some instances require a "quicker" process, e.g., with COVID research."

Hardly surprisingly, of course: it was, after all, a time when rapid dissemination of scientific knowledge, aimed at battling the virus, was of paramount importance, so much so, that publishers of traditional medical journals, rising up to the challenge, adopted new policies to enable quicker responses, centring upon efforts to fast-track peer review of COVID-19 manuscripts (**Horbach**, 2020; 2021).

UK researchers most felt that the pandemic was changing peer review, with three-fifths of them thinking so, with, by contrast, no French ECRs thinking this. In pure numbers, perhaps surprisingly, given the alleged big impact that the pandemic had there, China stood out with 15/22 ECRs asserting that the pandemic had made no difference.

Table 9. Pandemic changing peer review?

Country	Total	Don't know	No	Yes
China	22	2	15	5
France	13	4	9	0
Malaysia	19	6	6	7
Poland	21	8	9	4
Russia	19	1	11	7
Spain	19	4	9	6
UK	22	3	6	13
US	20	0	11	9
Total	155	28 (18%)	76 (49%)	51 (33%)

8.2. Peer review during the pandemic

The free-text responses to the specific question on peer review, as well as to the final question of the interview, which asked ECRs to reflect over the last two pandemic years, rendered the picture of the COVID-wrought change to the peer review system more nuanced. With all that most of the interviewees, who thought that there was a change, did mention speed as the big change/impact, many of them said it had actually slowed down the review, as a Russian soft social scientist put it:

> "Fewer people available to do the work because of COVID (falling ill) so slowed down."

A few did argue the opposite, but they spoke of the fast-tracking of COVID-related papers that was taking place. Indeed, coronavirus-related (vs. non-related) articles were considerably more expeditiously processed and published in peer-reviewed journals, largely due to quicker peer review processes (**Helliwell** *et al.*, 2020; **Horbach**, 2020; 2021; **Jung** *et al.*, 2021; **Kodvanj** *et al.*, 2022). However, according to ECRs, too, on the whole the process became slower, as this US life scientist explained:

> "I think it [i.e. *the pandemic*] has made it slower. As a reviewer, I have accepted fewer reviews and I take longer to do them. As an author, it takes me longer to respond to them so everything is slower."

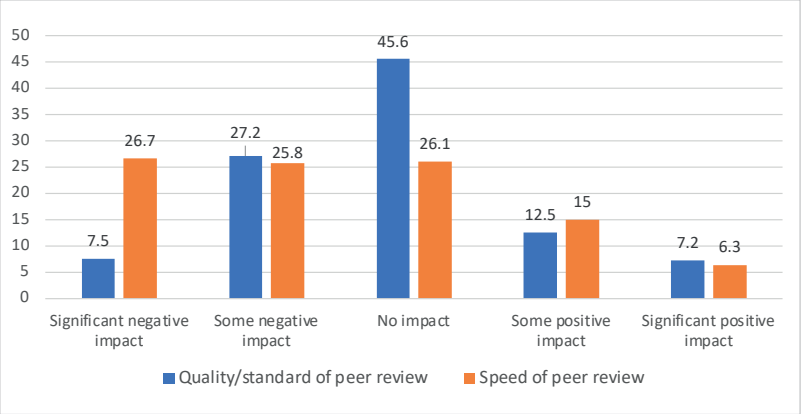
Lending further support to the picture emerging from the qualitative data, three quarters of the 800 ECRs participating in the survey felt that the pandemic had an impact on the speed of the peer review process (Graph 1). The majority found the impact to be negative, that is, they were of the opinion that the pandemic had been slowing down the process, with over a quarter even saying that the impact was significantly negative, i.e. slower. Regarding the impact on quality a majority thought there was no impact, but there were more ECRs thinking it had a negative rather than positive impact.

Nevertheless, as Graph 2 indicates, there were considerable country differences: Malaysian ECRs registered the highest impact, with most (60%) saying there had been a positive impact on peer review during the pandemic, with their US

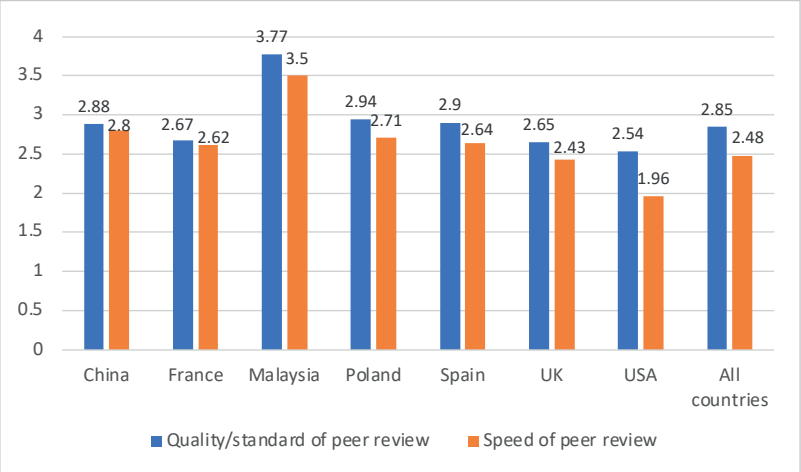
counterparts reporting the lowest level of impact, although the US also had the highest percentage of significant negative impact (46%).

Indeed, some of the interviewees thought that the accelerated speed of the process meant lower quality of reviews and reviewers, echoing a widespread concern characteristic at the time of the scholarly community. Certainly, the possibility that speed may come at the expense of the quality of rushed COVID research has been raised again and again in the literature, along with prognostications of a horror scenario of an infodemic –an epidemic of low-quality information on COVID-19 (**De-Araújo-Grisi** *et al.*, 2022; **Jung** *et al.*, 2021). Thus, for example, a British medical scientist, worried about the possibility that the state of the peer review system would only get worse in general, noted the dire effect of the pandemic, too:

> "It is going to get bigger and bigger as a problem as more material gets published –it's linear with quantity of work being done and being published. The pandemic has produced accelerated publishing processes, which translate to 'light touch' peer review, also contributing."



Graph 1. Level of impact on peer review (%)



Graph 2. Country differences for impact on peer review (mean values)

These concerns were not divorced from reality, as the rise in the number of retractions amply proves (**Kodvanj** *et al.*, 2022), for retractions have found to be traceable back to either unreliable data or to oversight/greater lenience in peer review and editorial verification that have taken place even in journals with an IF and/or high-ranking biomedical journals (**Anderson**; **Nugent**; **Peterson**, 2021; **Horbach**, 2021; **Jung** *et al.*, 2021; **Teixeira-Da-Silva**; **Bornemann-Cimenti**; **Tsigaris**, 2021; **Shimray**, 2022). As a British medical scientist's comments testify, the possibility that during the pandemic quality was sacrificed for the sake of rapid peer review did not escape ECRs' attention:

> "Traditional journals have been 'shaken' in a way through the pandemic, they first saw a great increase in submissions with COVID-related research, which decreased the quality of peer review. However, once some of the big scandals occurred with falsified COVID data and the big Lancet retraction, there was new focus on the peer-review process, which I believe it helps refining the system itself."

Here again, the qualitative findings are borne out by the survey data: over half of ECRs (54.6%) thought that the pandemic had an impact of some kind on the quality of peer review, with most (34.7%) finding it a negative impact, although only 7.5% said this was significant. Once more, there were significant differences between the case study countries. Again, Malaysians were most likely to say there was an impact (two-thirds though it was positive) and the Americans least likely to say that, although more likely to say it had a negative impact (nearly a half thought this).

8.3. The impact of the pandemic on the future of peer review

Still, with all that the impact of the pandemic on peer review was thus deemed to be rather more negative than positive, virtually all of the comments made by ECRs suggested that it would be temporary. Their prognostications seem to be on the right track: as the pandemic evolved, consistently longer publication delays for COVID-19 manuscripts were found (**Fraser** *et al.*, 2021; **Sevryugina**; **Dicks**, 2021). Thus, as **Sevryugina** & **Dicks** (2022) contend, the much shorter submission-to-acceptance times at the beginning of the pandemic might have been simply a manifestation of the early bird effect, associated with any new and 'hot' topic. Also, as **Homolak**, **Kodvanj** and **Virag** (2020) argue, the lower quality seen in the case of COVID-19 articles might have been associated with circumstances peculiar to the circumstances at the time: the true experts that could review COVID-19 research must have been far too busy, involved with first-hand fighting with the pandemic, to devote their time to keeping up to date with new developments and/or assessing new contributions.

All this is not to say, though, that the interviewees were not aware of the very real need for accelerated peer reviewing practices; rather the contrary. Thus, for example, a Spanish chemist argued for

> "more speed in peer review for the need of generating science faster,"

with another Spaniard, a mathematician, highlighting the role played by the pandemic in bringing the problem to the fore:

> "The pandemic has agitated the debate about the speed of science. We are aware that we cannot wait months for the peer review process and that publishing not validated results can be necessary because society asks for them."

Indeed, a US hard social scientist singled out peer review among the pandemic-induced changes in their practices:

> "I think the main one was the change in my peer reviewer approach. That was what happened during the pandemic when I realized just what this kind of bottleneck situation was doing to the publication times for a lot of people where their papers were having these incredibly long publication times."

Going one step further, another American ECR, a life scientist, was hoping that the pandemic, having drawn attention to the problems with the current publishing system, would bring about change to its peer review component, too:

> "The pandemic will be seen as the inflection point of pre-prints. Before, the minority did pre-prints, and soon, the majority will do pre-prints. I hope the pandemic will lead to improvements in peer review, because it has exposed how broken the system is. The problem with pre-prints is we are not yet ready to get rid of peer review. The great thing about pre-prints is [that] they accelerate science. We need something. We're still waiting for what that is."

9. Conclusions

Having established that despite their junior status most of our ECRs were experienced in being reviewed and reviewing others, we could be confident that they knew what they were talking about when we asked them about peer review. True, only a minority had received formal training for participating in the peer review process, but with many of them being part of research teams and working with senior researchers, they were mentored and learnt on the job.

A significant proportion of the interviewees –nearly half of them, had a lot or at least some reservations as to the capability of the peer review system to vouch for the trustworthiness of formally published research. However, there were big differences between countries: whilst French or Malaysian ECRs were of the opinion that peer review delivered quality/trustworthiness to an extent and even to a great extent, with none of either cohort thinking it did not, and the Chinese ECRs, bar one, believing that the system was wholly trustworthy, British, Spanish and American researchers were more subdued in their views. Indeed, only around a third of the first two cohorts and only a sixth of the last one said that peer review could be vouched for to a great extent, with the majority in each opting for 'to an extent'.

In terms of discipline, medical scientists proved to be the greatest believers in peer review, with two-thirds of them saying the system vouched for trustworthiness to a great extent. This is perhaps why the Chinese ECRs were found to be so supportive of the capability of the system to safeguard the trustworthiness of peer review, as the most medical scientists were in their cohort. In answering the trustworthiness question ECRs' raised three main criticisms of the system: (1) it took too long to obtain reviews; (2) there were too many unsuitable reviewers; (3) partly as a consequence of (2), the quality of reviews was not up to scratch. These criticisms echoed those of pre-pandemic ECRs.

A large majority (two-thirds) of the ECRs felt that peer review needed improving, indeed, in US and Spain nearly all ECRs thought so. In the case of Spain, the short times for reviewing that some journals give, such as those of *MDPI*, may have played a role in the mistrust of the system. ECRs may perceive that reviews are too short and superficial. It was hard social scientists who were less likely to believe the system needed changing. Poor reviewers and slow processes were thought to be the main problems identified. There was a strong feeling that some form of reward (monetary or reputational-building recognition) could help solve these problems. As to the two possible remedies for the ills of the system that the participants were posed –double blind and open reports– the anonymity that double blind afforded was clearly welcomed by ECRs, lending further support to the findings of *Harbingers-1*, with two thirds thinking so. Open reports were thought to be attractive by around a half of all ECRs, with the model, approached with far less apprehension than in *Harbingers-1*, gaining most support in the UK and among environmental scientists. When asked for other remedies, again compensation was mentioned most, adding strength to what we have heard earlier. Financial rewarding of reviewers was also high among recommendations in *Harbingers-1*, indeed, it is a recurrent theme in the literature, too, but it seems the notion is largely falling upon deaf ears.

As to the pandemic impact on peer review, a third of ECRs interviewed felt there was an impact, although no French ECRs thought so, and this is partly explained by the fact that no French ECR was involved in COVID research. The most support of the possibility came from life scientists, with two-thirds of them voicing the opinion, which is perhaps not very surprising, as they were at the forefront of the efforts to combat the virus and witnessed closely how peer review affected research. Speed was thought to be the big impact, a finding that emerged quite clearly from the interviews and from the survey (three quarters of survey respondents thought so), with most saying it has slowed the process down.

However, most ECRs thought that the pandemic impacts would be transitional. But what the pandemic has done without doubt is raised the question of why most peer review is so slow. Of course, ECRs are always in two minds: as reviewers they need more time, but as authors they want more speed.

Comparing pre and post pandemic peer review data is made difficult because the questions were not exactly the same, but there is a sense that ECRs have become more independent and less influenced by their seniors and, also, more critical about the process and the latter is the reason why they are now –especially Spanish ECRs, pressing for some kind of payment, which they believe would lead to better reviews and greater trust in the system.

10. Notes

1. *Harbingers-1*
http://ciber-research.com/harbingers.html

2. *Harbingers-2*
http://ciber-research.com/harbingers-2

3. *Alfred P. Sloan Foundation*
https://sloan.org

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