Octopus

# A snapshot of the academic research culture in 2023

## And how it might be improved

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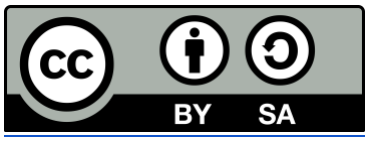



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# Executive summary

Octopus (**octopus.ac**) is a new research publishing platform with the goal of reforming how research is conducted, shared, and reviewed. It is different from other open research platforms by breaking down the reporting of research into eight distinct elements:

- Research problem
- Rationale/Hypothesis
- Methods
- Results
- Analysis
- Interpretation
- Real world application
- Peer review of any of the above

This platform encourages the publication of research in smaller increments, with a lower barrier to entry compared to the traditional journal article format. In addition to being free-of-charge for authors, Octopus is distinct from other platforms because it requires published items to be linked to one another. For example, a method proposed by one researcher could be linked to a hypothesis (or multiple hypotheses) published by another.

Ultimately, Octopus aims to reform research culture in five ways:

1. Reducing barriers and hierarchies that restrict research sharing, leading to more meritocratic recognition (especially for early career researchers and specialists)
2. Reducing pressures that can lead to questionable research practices (QRPs)
3. Addressing factors that lead to certain topics and types of research being favoured
4. Reducing bias in the assessment of publications and their quality
5. Encouraging more openly collaborative ways of thinking and working – division of labour and open critique of all parts of the research process

To understand whether Octopus is achieving these aims, and if its offering could be improved, we conducted a baseline evaluation of the academic research and publishing ecosystem. To do so, we employed three methods in order to achieve a broad understanding of research culture across different fields. Implementation details for the three approaches are described in the appendix, and summarised here:

- Literature review - To avoid duplicating past work, and incorporate previous findings into our conclusions, we conducted a literature review on published studies on research culture relevant to the five aims of Octopus. This included informal searches, and keyword-based systematic searches on major publication databases.

- Semi-structured interviews - We invited researchers across the social, natural, and applied sciences to 1-hour interviews. These comprised open-ended questions regarding how they perceive the culture in which they work, specifically with regards to division of labour, sharing practices, giving and receiving critique and credit, and views on their careers.

- Online survey - We conducted an online survey to gather input from a greater diversity and number of researchers. It contained questions regarding overall research culture, barriers to sharing, division of labour, and factors affecting research assessment.

### What is open research?

For the purposes of this report, we refer to open research as the set of practices which produce open knowledge **as defined by the Open Knowledge Foundation**:

"*Knowledge is open if anyone [has the freedoms] to access, use, modify, and share it — subject, at most, to measures that preserve provenance and openness.*"

We also recognise that open research should include considerations such as, but not limited to, if and how to make sensitive data available as guided by the Findable, Accessible, Interoperable, and Reusable (**FAIR**) principles for data.

## Summary of findings

Our evaluation revealed a wide variety of barriers to more open sharing of research. While some are related to perceived or experienced biases based on personal characteristics such as gender or inequitable access to support, most result from a research culture that primarily assesses achievement and quality through traditional, peer-reviewed papers. This focus, and the resulting competition, encourages researchers to hide their work at least until a traditional journal paper is published. In some situations, these pressures lead to questionable research practices (QRPs), such as data manipulation to achieve an "interesting" or statistically significant result more likely to appeal to a journal with higher impact metrics or perceived "impact". In general, open research practices are viewed as not beneficial, or even detrimental, to job security and career advancement. This is especially true given competing demands and the need for academics to prioritise their time on outputs that count in assessments that they are subject to.

The following summarises how our findings relate to the aims of Octopus, with more detailed results described in subsequent sections of this report.

### Barriers and hierarchies that restrict research sharing

Lack of time was one of the most prominent barriers to research sharing, as noted in the literature review, interviews, and the survey. Data from the interviews suggested that this may arise from researchers being incentivised to prioritise other activities, such as publishing papers in high impact journals or networking to gain influence and power, which directly benefit their careers.

The interviews and survey also revealed that the fear of scooping constitutes a major barrier to sharing research. This is related to a highly competitive culture which places great value on being first with "findings". And since traditional journal articles are the only recognised way for receiving credit for research, other forms of sharing such as publishing methods or data are heavily discouraged. In addition, since institutions tend to reward flashy research – such as those with a "sound-bitey" story or can claim very high and dramatic "impact" – researchers are afraid of sharing outputs which may be immature (e.g., intermediate work that is still subject to revision) or incorrect.

There is also inequitable access to resources – such as funding – to support research sharing. This can be seen through our interviews and survey, where respondents are mostly based in the Global North and typically did not express these problems. On the other hand, the literature review showed that, among other global inequities, researchers from less affluent backgrounds are being excluded from academic discourse simply because they cannot afford to publish their work in the same venues.

## Pressures that lead to questionable research practices (QRPs)

Some interviewees discussed how the untenable stresses of academia force researchers into QRPs, such as data manipulation. The literature review revealed several factors leading to this stressful environment, such as a focus on the quantity of papers rather than quality; or the pressure to obtain only positive or novel results. These factors are mirrored in our survey results, where the trendiness or novelty of research is viewed as at least as influential (and possibly more so) as methodological rigour.

## Factors that lead to certain topics and types of research being favoured

Our literature review, interviews, and survey did not reveal specific factors leading to certain research topics being favoured over others. Instead, our findings in this area showed that factors leading to QRPs are similar to those favouring the publication of certain types of research. This includes a research culture which values positive or flashy results. For example, one meta-study in our literature review found that papers with positive findings are cited twice as often as those without. Journal editors also consider the newsworthiness of an article which favours research with dramatic results.

## Bias in the assessment of publications and their quality

Our study revealed multiple causes for bias in research assessment. One is discrimination based on the personal characteristics of the researcher, which may be, but not limited to:

- Gender
- Primary language
- Geographical location
- Personal and institutional prestige

In addition, one of the largest sources of bias in assessment is a perceived over-emphasis on a researcher's publication record. Metrics tend to measure quantity over quality, to the extent that competition to put one's name on a paper matters more than its content. In this race, power and seniority often decide authorship, while leaving behind junior researchers or specialist contributors. The latter could include those in "plumbing" roles like statisticians, or those with crucial tacit knowledge such as local "fixers" in a social sciences study. And because of this bias, researchers feel pressured to expend substantial effort on networking to build up connections and prestige.

According to our interviews, institutions – such as universities, academic journals, or funders – also tend to favour research with a “good story” with “impact”, and researchers are pressured to present their work in those terms. Similarly, our literature review suggests that “novel” findings are favoured. Our interviewees lamented the need to be “sound-bitey” where "...it almost feels like [...] I'm a novel writer instead of a researcher.” They fear that this bias disadvantages the mundane but important “grunt” work in research that does not have glamorous narratives.

## More openly collaborative ways of thinking and working

Existing literature focused on the value of collaboration in research, such as increased productivity, or the development of novel ideas via contributors with different backgrounds. Currently, collaboration occurs more often for higher-level tasks such as when defining the research question, interpreting analyses, or applying results to a different context.

While those we interviewed described many problems with the research cultures they inhabit, they also suggested solutions:

- **Focus on processes instead of outputs** - Instead of measuring the number of papers that a researcher has published, focus on providing useful feedback on how their work is conducted. Interviewees consistently stressed that a key benefit to the more open sharing of research is receiving feedback, especially during its early stages to improve methodology.

- **Value null or negative results** - Research culture should value null or negative results at least as much as positive ones with a flashy story. Similarly, researchers should be rewarded for being open about mistakes and what could be learned from them.

- **Recognise diverse forms of contribution** - Authorship on traditional papers do not reflect the diverse forms and magnitude of contributions to research. There should be a more granular approach to giving credit that reflects contributions throughout the research lifecycle from ideation to execution. This can also partly alleviate concerns about scooping.

- **Provide space and recognition for specialists** - Academics are required to be generalists, taking on roles outside of research such as teaching, administration, fundraising, mentoring, among others. Rather than being good at everything, many interviewees wish for space to focus on their strengths in research and be recognised for it with a secure career.

- **Assessments should be assessed** - The way assessments for funding and career advancement are conducted should be subject to rigorous, scientific scrutiny and improvement just like any other research.

- **Provide opportunities for feedback outside traditional peer review** - There is widespread sentiment among interviewees that critique of research is crucial, especially in its early stages. Currently, however, feedback is only formally given during peer review of traditional papers. Outside of that, researchers are hesitant to give unsolicited critique, sometimes with fear of retribution.

Some of these solutions are congruent with the aims of Octopus and the problems it can solve, which we will discuss next.

## Implications for Octopus and open research

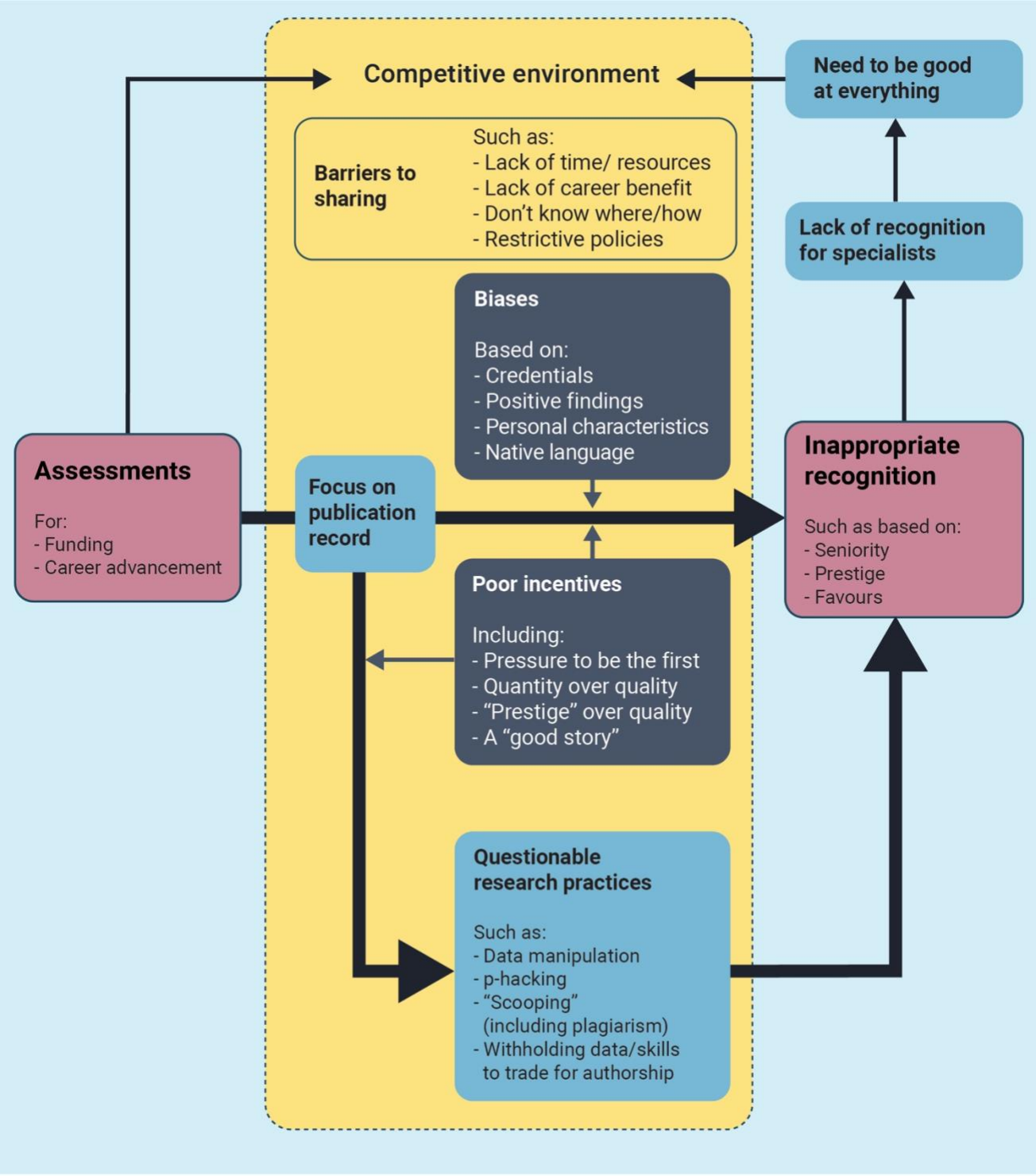


***Figure 1.*** *High level diagram of issues as identified from our evaluation. The pathway from assessment to recognition passes through the lenses of bias and incentives - the latter causing additional pressures towards questionable research practices - which tend to result in inappropriate recognition. The whole process takes place within a competitive environment, enhanced by the inappropriate recognition (especially the lack of reward for specialism) which also raises barriers to sharing and open practices.*

**Figure 1** summarises the issues that affect researchers and the research culture, as identified by researchers themselves through our interviews or survey, and from the existing literature on the topic.

Essentially, assessment (either for funding or for career advancement) drives the incentive system for research and researchers, and it is focussed heavily on what researchers publish (since this is currently the tangible, public output of research that can be assessed). Assessment, of course, creates a competitive environment - which is inevitable when funding and career opportunities are limited.

This competitive environment, then, surrounds the publishing system, as the main arena for researchers to try to gain recognition. Unfortunately, the path through the publication system to recognition is affected by the filters of biases (many unintentional but inevitable without mitigation, such as bias against non-native English speakers), and by a system of incentives that do not support best practice because they have not been designed with that in mind (such as the pressure for “novelty” or “a good story”).

The poor incentives tend, instead, to cause pressure for QRPs, and those, alongside the action of the biases, can lead to inappropriate recognition rather than recognition on true merit.

The whole system also inevitably drives a number of barriers to sharing research and its outputs, since these are not incentivised, and indeed the competitive environment sometimes actively acts to make it better not to share. Because of the lack of recognition for open sharing practices, many researchers do not have the time or financial resources to become trained in them, or carry them out.

The high prevalence of inappropriate recognition itself then feedback back into a vicious circle, as it can lead to a feeling that specialism is not rewarded and that researchers need to be “good at everything” (especially since producing a whole paper requires a lot of different skills, and collaboration is not well incentivised), which makes researchers feel an increased sense of pressure and competition as well as lack of professional satisfaction.

These findings chime well with the different aspects of the system that Octopus is designed to improve or mitigate.

Octopus is an alternative publication system specifically designed with the aim of removing many of the biases and the perverse incentives that affect the pathway from assessment to recognition.

The table below shows the main issues discovered during this evaluation and how Octopus’ design should help improve them:

| Biases | Octopus solution |
|---|---|
| Researchers with prestigious credentials get preferential publication and assessment of their work | Researchers' institutional affiliations and credentials (including geographic location) are not displayed on publications (this is stored as meta-data for reporting purposes only) |
| Research that produces "positive" findings is more likely to be published and assessed highly | All research can be published - there are no barriers to publication.<br><br>Publications are assessed (post-publication) on their intrinsic qualities, rather than their impacts (i.e. what is important is how well the work was done, not what it ended up showing) |
| Researchers with certain personal characteristics (e.g. sex, ethnicity, age) are treated differently during the publication and assessment processes | Researchers' surnames and initial only are shown on publications to reduce opportunities for unintentional bias (first names and more details are available if clicked-through to allow disambiguation and further background on a research to be available) |
| Researchers who are not native or as-native speakers of English find it harder to publish or are assessed less highly | Publications are welcomed in any language. Automatic language translation is anticipated as a feature in the near future to make the platform truly language-agnostic. |

| Incentives | Octopus solution |
|---|---|
| There is an incentive to "be first" and have "novel" findings (over doing careful and high quality research) | Publications are assessed only on intrinsic qualities (i.e. how well it was done) |
| There is an incentive to produce a lot of publications (over doing high quality research) | Publications are assessed only on intrinsic qualities (i.e. how well it was done) |
| There is an incentive to publish in "prestigious" outlets and work on "prestigious" subjects (over intrinsically high quality work) | Publications are assessed only on intrinsic qualities (i.e. how well it was done) |

| | |
|---|---|
| There is an incentive to “tell a good/impactful story” in a publication | Publications are intentionally non-narrative. Each is a small piece of work, judged entirely on its own merits.. The publications are linked together to improve discoverability, collaboration and emergent findings |

By tackling these biases and improving the incentives, Octopus aims to ensure that the pathway from assessment to recognition is no longer skewed.

The breaking down of the assessment units from a traditional, peer-reviewed journal paper into smaller, more specialised units, also tackles the perceived issue of lack of recognition for specialism. This should also remove the feedback loop identified which increases the sense of a competitive and unfulfilling professional environment (as well as improving meritocratic recognition overall).

The barriers to sharing research that have been identified also need to be addressed, in order to unlock the full potential of Octopus. These include a lack of knowledge about how and where to share, and policies that actively (unintentionally) make sharing difficult or impossible.

What we have learned about research culture, then, suggests open research publication platforms such as Octopus could be an important mechanism for achieving various reforms, but need to be supported by those who carry out assessments for funding or for career advancement.

For example:

- Outreach and education about Octopus (and other similar platforms) would alleviate a substantial barrier to sharing, as respondents to the survey and interviews often do not know how and where to publish non-paper-based research outputs.

- Funder and institutional policies need to be checked to ensure they reward and do not hinder good research sharing.

- Overtly recognising the value of good ideas and methodological innovations as much as data or results would help address concerns about “scooping”, whereby researchers feel that they only get credit for work if it involves a “finding” (and a “positive” finding at that).

- The eight Octopus publication types can both allow recognition for forms of research other than “results”, and bring recognition to specialists – such as data scientists or data collectors – especially if research assessment can recognise these contributions.

- Breaking the link between “results” and other parts of the research process can, as in registered reports as well as modular publication platforms such as Octopus, mitigate the pressure for QRPs and publication bias in order to produce “positive findings”.

- Peer review (and the proposed ratings system) within Octopus, focussed as it is on smaller publications than an entire “paper”, could help assess the intrinsic qualities of research, without such an assessment being influenced by the potential findings and implications of it, again focussing the incentives on research quality and minimising publication bias and the pressures for QRPs.

- The Octopus open peer review mechanism could satisfy the strong desire for early feedback when developing studies, particularly if the risk of retribution can be mitigated.

- The removal of first names and institutions from the top of publications within Octopus (which could potentially be extended to an entire replacement of names by **ORCID iD**s) helps remove some cues for unintentional bias (gender and institutional) by making a reader follow a link to find out more details of any individual author. This allows readers to read and assess the quality of a publication more on its own merits, rather than unintentionally noticing gender and institutional cues that might bias their assessment.

- The use of automatic language translation (with care, to avoid mistranslation incidents) could help reduce the biases faced by non-native English speakers.

During the interviews, participants struggled to break down research in their disciplines into an ordered, discrete set of steps. In addition, we received criticism during the survey that it was framed around the natural and applied sciences without consideration for other fields, such as the arts and humanities. This reflects the diversity in how research is done within and across disciplines, and where Octopus could be placed within the wider open research publishing ecosystem. For example, while Octopus presents itself as the “global primary research record”, its eight ordered publication types might not be the one size that fits all forms of research. Indeed, it is unlikely that the “research” Octopus currently claims to represent includes fields such as, but not limited to, the arts and humanities. This should be clarified on its website. In contrast, some platforms allow publishing individual components of research without an overarching structure. For instance, GitHub is commonly used to publish the code behind scientific software, though it was not originally conceived for that purpose.

Some of the issues revealed by our study – such as the culture around chasing novelty and a "good story" – might need to be tackled through using a publishing platform like Octopus (which offers itself as a venue where there is no need for a story) as places to carry out research assessment, breaking the current perceived link between "good story" and "good research". Such platforms can sit alongside outlets where a story is the driver of readership (and those story-driven articles could be commissioned by such outlets, and potentially even authored by, and with commensurate credit to, story-writing specialists such as science writers and journalists). This could be part of a broadening of what counts as a research "output" in assessments to include non-narrative publications. It could also improve recognition for specialist contributions – such as that from statisticians, methodological experts, or local "fixers" – and be part of a movement to include criteria for doing open research in assessments. These reforms should be sensitive to the fact that researchers, especially academics, are already overburdened, and for open research to be prioritised and become the norm, other dis- or mis-incentives should also be tackled so that what is being assessed is "different" and not "extra".

In summary, the evaluation shows us that Octopus, while not *sufficient* in itself, could be seen as a *necessary* part of realising systematic reforms in research culture, especially with regards to research sharing and assessment. The rest of this report discusses in more detail the findings from our literature review, interviews, and survey.

# Literature review

A total of 396 titles and abstracts and 381 full-text articles were processed. After duplicates were removed, we started processing articles for eligibility. After full-text assessment, 127 articles were excluded. Thus, 269 articles were considered as eligible and relevant for the literature review. Following our five research questions, we have split our findings into five sections. Every section presents information found in the literature related to these research questions, and identifies gaps.

## Research Question 1: What are the barriers and hierarchies that restrict research sharing, and therefore impede more meritocratic recognition (especially for ECRs and specialists)? (85 articles)

This area yielded the greatest number of sources in our literature search. Based on the information found, several sub-topics can be distinguished.

### Environment and external factors

In this section we will provide an overview of factors that are related to the environment and conditions where scientists are working. Researchers considered **time pressure** to be a powerful factor that impacted the publishing process, as well as research and data sharing (Chawinga and Zinn, 2019; Spanager et al., 2013; Stewart et al., 2020). According to some surveys (Al-Halabi et al., 2014; Duracinsky et al., 2017; Stewart et al., 2020) and interview studies (Yarris et al., 2014), lack of time might frustrate data sharing initiatives, cause work-life imbalance, impact research quality and demotivate publishing in general. It also affects early career researchers (ECRs), who mentioned that they had no official time for conducting research (Solaja et al., 2018) or adequately preparing manuscripts.

This factor was followed by a **lack of guidance**. Some surveys reported that scientists, especially ECRs, were not given enough training and mentorship (Turk et al., 2018). This caused difficulties during the publication process. Another survey (D'Souza et al. 2018, Editage Insights 2018) showed that early career researchers (ECRs) needed more guidance on Open Access (OA) publishing. Respondents of another survey stated that they lacked data management and publication skills, and were uncertain about organising and preparing data for sharing (Houtkoop et al., 2018). The majority of those who shared such experiences, mentioned that they would like to have more training and education in this area.

Another factor that affected research culture was **limited support, resources and funding**. Paying Open Access fees by individual researchers was considered problematic (Fuller et al., 2014; Nyamai et al., 2020; Schroter et al., 2005; Severin et al., 2018). A qualitative study by Watkinson and colleagues (2017) highlighted that the OA system creates barriers to publishing and inequity of access to funds for individual researchers; therefore, they can struggle to pay publishing fees. Some reviews (Day et al., 2020; Misra, 2016; Vervoort et al., 2021) supported this point, and also mentioned the problem of paying fees. Results of the review by Siler and colleagues (2018) show that authors from high-ranked or well-funded institutions are more likely to have the resources to allow them to choose publishing options. Therefore, "there is stratification in institutional representation between different types of publishing access, there is also inequality within access types" (Siler et al., 2018, p. 1). As a part of a larger perceived problem, some respondents believed that time and resources of grant proposals were used in inappropriate ways, making academics do more administrative work instead of focusing on research itself (Herbert et al., 2013).

The **competitive environment** was also mentioned as a barrier. Researchers pointed out that an unsupportive and competitive environment made them uncertain or unwilling to share research data (Stevens et al., 2021; Stewart et al., 2020). In publishing, there is a tendency to include the names of authors from high-income countries in the first and last positions, and not to list authors from low-income countries (Rees et al., 2017). A competitive environment also has a negative effect on ECRs. In an attempt to create a reputation and to be published, they might become victims of predatory journals (McCann and Polacsek, 2018).

A **lack of advantage or professional reward** was also mentioned as a barrier to sharing data and publishing open access (OA). A survey by Stieglitz and colleagues (2020) discovered that researchers do not want to share data due to fear that other researchers will benefit at their expense because findings are more valued than data themselves, so academics will not receive the expected recognition for their work. Some studies showed that academics do not feel valued enough when publishing OA or do not see OA publishing as beneficial for their career (Mozersky et al., 2021; Turk et al., 2018; Yarris et al., 2014). Many researchers may simply not consider the benefits of publishing OA, and instead prioritise publishing in journals with a high reputation, as they consider this important for career progression (Köster et al., 2021; Kuballa et al., 2017; Severin et al., 2018). Additionally, there is evidence that authors may perceive open access publications as being less prestigious and lower quality than closed publications (O'Hanlon et al., 2020, O'Kelly et al., 2019). The reputation of OA publishing may also be tarnished by perceived similarity to predatory journals which also use a pay-to-publish model (Lam and Langer-Gould, 2021).

Finally, another barrier was related to journal **policies,** regarding both open science (Editors and WHO November 2003 Group, 2004; Ksenija Zečević et al., 2021; Moustafa, 2022; O'Kelly et al., 2019; Singh et al., 2021; Strømme et al., 2022). Several reviews pointed out that journals have inconsistent policies for regulation of open science, preventing authors from sharing their data (Bakker et al., 2017; Gentemann et al., 2022; Hrynaszkiewicz and Cockerill, 2012). Another quantitative study has shown that publishers' policies play a crucial role in the willingness of academics to share their data, and weak journal policies or unfavourable policies may frustrate data sharing initiatives (Chawinga and Zinn, 2019).

## Inequalities between countries with different income levels

Another major theme of the barriers to sharing data and research was the inequalities faced by researchers from countries with different income levels. A problem that has emerged in the literature is related to limited resources in middle- and low-income countries (LMIC) (Brant and Rassouli, 2018) and the dominance of publications from countries with high income (HIC) (Busse and August, 2020). Among the barriers faced by researchers from LMIC were: struggling to pay publication fees (Jain et al., 2021), lack of opportunities to participate in research projects (Eduardo Cazap et al., 2020) inability to meet journals' requirements due to limited access to resources (Turk et al., 2018), lack of guidance on the research process (Editors and WHO November 2003 Group, 2004), difficulty of writing in a foreign language (Brant and Rassouli, 2018), poor access to international publications or data (Matheka et al., 2014), and lack of education which leads to poor research quality (O'Hanlon et al., 2020). Also, a barrier of inconsistent internet access was mentioned (Brant and Rassouli, 2018; Matheka et al., 2014).

Another problem that appeared in this context considered misconduct of researchers from HIC. Some studies show that scientists from HIC undervalue contributions from those from LMIC and may at times exploit them (Rees et al., 2019). Also, there is a tendency unfairly not to indicate the authorship of researchers from low-income countries, but instead to put the names of authors from high-income countries (Rees et al., 2017). For instance, according to this study, 40% of multicountry studies did not include authors from every LMIC involved. This was caused by power imbalance and "authorship parasitism" among researchers from HIC.

### Ideological barriers to sharing

Another barrier that prevented scientists from sharing their studies or data online was concerns about OS practices. One concern researchers had was about data safety, especially in qualitative research. A survey by (Mozersky et al., 2021) has shown that only 4% of qualitative researchers have ever shared qualitative data in a repository. Their main concerns were related to the sensitivity of data, getting permission from participants, and breaching trust. They also cited a lack of finances to cover repository costs, lack of guidance on ethics and a lack of assistance with data anonymisation. Another concern regarding data security was related to the fine line between predatory journals and OA journals (McCann and Polacsek, 2018). According to this study, predatory publishing has created a negative image of OA. Some scientists fear sharing their data because predatory journals aim to make a profit rather than promote scientific activity. Predatory journals may trick authors by creating false websites, hijacking journals to make them believe that they are legitimate publishers.

Although barriers to research sharing were, in general, quite widely covered in literature, some of the predetermined subtopics we posited did not appear in our literature search corpus, for example, suppression of sharing by human gatekeepers. This could be due to a variety of reasons: it may have been difficult to find using our search terms, this subtopic might be under-represented in the literature, or it may not actually be a significant issue in the research community.

## Research Question 2: Which pressures lead to questionable research practices? (48 articles)

This section focuses on pressures and factors that can motivate academics to resort to questionable research practices (QRPs). The literature revealed a range of explanatory factors which may incline academics to unethical activities.

### Quantity oriented environment and pressure to publish

One of the most common factors related to research productivity. A survey by Schoot et. al., 2021 came to the conclusion that modern research culture is quantity rather than quality oriented. This point was also supported by arguments from several reviews (Ball, 2016; Ding et al., 2020; Mads U. Werner, 2021; Nosek et al., 2012; Schoot et al., 2021; Vuong, 2019). When academics are rewarded for the number of publications, it can result in poorer research methods. Such a system creates the so-called publish-or-perish culture, which “will pressure all but the most ethical scientists, to overemphasise quantity at the expense of quality, create pressures to “cut corners” throughout the system, and select for scientists attracted to perverse incentives” (Edwards and Roy, 2017, p. 53). The pressure to publish a lot leads not only to a decrease in the quality of publications but also to the dubious practice of so-called “salami-slicing”: dividing results from one study into many fragments and using them for different purposes as separate publications.

## Pressure to get positive findings

Another factor leading to QRPs is pressure to get positive results or novel findings. Several surveys (Fong and Wilhite, 2017; Fraser et al., 2018; José Perezgonzalez et al., 2021; Moran et al., 2022; Wolff et al., 2018) have found that research culture is oriented towards 'novel' findings, thereby encouraging researchers to QRPs to obtain them. Reproducibility is valued less than novelty, and those who have "clean" data and "significant" results win the race for recognition. This conclusion has also been supported by reviews (Bergkvist, 2020; Open Science Collaboration, 2015), meta-studies (Fidler et al., 2017; Nissen et al., 2016), qualitative analysis and analysis of secondary data (Baldwin et al., 2022; Gibelman and Gelman, 2005) and other sources (Laitin et al., 2021; Verma and Detsky, 2020). It is inextricably related to pressure to publish, since "statistically significant findings that are visually and numerically clean are easier to publish" (Diong et al., 2018, p. 7). Such conditions force researchers to fight for publication and recognition and incline them towards misusing data analysis (p-hacking) and selectively publishing results.

## Dependence on funding

This kind of pressure was less mentioned than others but still has a significant influence on research culture. A systematic review and meta-analysis by Fanelli (2009, p. 9) found that 33% of respondents admitted 'changing the design, methodology or results of a study in response to pressures from a funding source".

Other studies noted pressure from grant schemes (Edwards and Roy, 2017; Fanelli et al., 2015; Huistra and Paul, 2022) and demonstrated imperfections of the science system. According to some interviews conducted with scientists, competition for money and dependence on grant funding negatively affects research integrity. The expected results of grant schemes are fundings of research programs and promoting growth, however the actual results are lack of time for gathering and thinking about data and focusing on getting the positive results. (Edwards and Roy, 2017, p. 52).

## Hierarchical pressure from superiors/competitive environment

Another factor that can affect research integrity is hierarchical or environmental pressure. Some meta-analyses (Fanelli et al., 2015) and reviews (Rupp et al., 2019; Sharma and Verma, 2018) conclude that it strongly affects young researchers, who are trying to build a reputation and might be subject to criticism from colleagues. According to a mixed-method study by Gerrits et al., (2020) and some surveys, competitiveness and hierarchical pressure had a negative impact on research integrity (Gopalakrishna et al., 2022; Metcalfe et al., 2020). Competitive environments make scientists focus on the speed and statistical significance of their research in order to build their CVs, get funding or gain promotion. This affects research integrity and the quality of findings.

### Lack of clear policies

Another factor we identified was related to lack of publishing policies or consequences for violating norms. Several reviews and commentaries (Bouter, 2015; Ding et al., 2020; Kiri et al., 2018) mentioned that scientists committed misconduct for two reasons. The first one is confusion in definitions of "good" and "bad" practices. The second one is existing gaps in policies and regulations that allow the use of QRPs with low risk of consequences.

## Research Question 3: What are the factors which lead to certain topics and types of research being favoured? (20 articles)

In the literature we reviewed, we found evidence relating to some types of research being favoured in terms of publication.

### Types of findings

According to multiple studies, 'positive' research findings are favoured in the literature. Statistically nonsignificant results are less likely to be published (Fidler et al., 2017; Fong and Wilhite, 2017; Vuong, 2019). Several studies have found that current research culture undervalues null or negative findings, which in turn causes researchers to make changes in statistics (for example, p-hacking, data dredging, selective reporting) and present statistically significant or positive results in order to get their work published (Brembs, 2018; Carbine et al., 2019; Nissen et al., 2016; Smaldino et al., 2019; Schweitzer and Schulz, 2018; Verma and Detsky, 2020: Stanley et al., 2022). A meta-research study by Bram Duyx (2017) found that papers with positive findings are cited twice as often as negative ones. Pressure to publish and the desire and incentive to be cited can lead to decrease of quality and reliability of studies.

The factors which make it difficult to publish null or negative results are the same as those that lead to QRPs. Firstly, null findings are seen to be less valuable for publishing by both journals and scientists (Nissen et al., 2016; Ioannidis et al., 2014). Under the pressure to publish, authors may "cherry pick" the information and publish only positive results (Schweitzer and Schulz, 2018). According to Nissen and colleagues (2016), publication bias is so strong nowadays that a significant part of scientific literature does not present negative results. This encourages a self-fulfilling cycle. For example, several reviews (Brembs, 2018; Vuong, 2019) indicated pressure to publish and the trend of "not to publish negative results" as motivating factors for scientists to selectively publish positive findings. This, in turn, leads to biased knowledge (Schweitzer and Schulz, 2018).

## Research in certain journals

A quantitative research study which analysed poorly and well -cited articles in orthopaedic journals (Kortlever et al., 2019) came to the conclusion that there is no difference between the proportion of poorly cited articles in subscription-based and OA journals. This study found that 36% of the total analysed articles were defined as poorly cited five years after publication. Unfortunately, this study did not provide information on factors that led to this situation, but it suggested there is more polarisation in what research receives attention. Other research has shown that the platform of publishing impacts the number of citations, with articles from better-known platforms more likely to be cited. For example, according to (Wakeling et al., 2016), scientists are more likely to cite articles from PLOS ONE and Scientific Reports than other less well-known mega-journals.

## Field of study

Quantitative bibliometric analysis by Larivière et al., (2015) has shown that there is a difference between publishing papers in natural and medical sciences (NMS) and social sciences and humanities (SSH). The results of the analysis revealed that during the transition to the digital environment, social science communities began to publish their work in giant commercial publishers (Reed-Elsevier, Wiley-Blackwell, Springer-Nature, and Taylor & Francis), while representatives of the medical sciences preferred to stay more independent and publish in smaller publishers. This happened due to the fact that the social science communities were more dispersed and were likely to have fewer resources to adapt to the digital age. Therefore, for instance, social scientists were more likely to have agreements with commercial publishers. Consequently, 70% of papers from the top five publishers belong to the social sciences field.

Another problem that appeared in literature was related to the funding of different types of research. Some studies mentioned a problem of unfair funding stratification among different types of research, for instance, education research and implementation research are underfunded (Duyx et al., 2017; Yarris et al., 2014). According to Yarris and colleagues (2014), there are a few available grants that are not enough for covering research projects' needs.

## Gaps

Our literature search yielded fewer results for this research question, compared to the first two, due to the difficulty of finding specific keywords or phrases associated with the topic at a feasible level of specificity. The original research question was designed to cover several subtopics, including the favouring of research that is attention-grabbing, lack of support for rarer research questions, and preference for certain types of outputs (i.e., traditional research articles). Our search methods did not yield results for these subtopics; therefore, they remain as gaps in our analysis.

## Research Question 4: What biases affect the assessment of publications and their quality? (59 articles)

Our literature search found evidence that multiple types of bias may influence assessment of publications and their quality. In our analysis, we grouped these biases into three categories, relating to demographics, geographical factors, and prestige. Findings for these sections include results of surveys and qualitative studies and also reviews and commentary articles.

### Demographic biases

**Gender bias** appeared in the literature quite frequently. Several surveys (Cruz-Castro and Sanz-Menendez, 2021; Fox et al., 2015; Johnson et al., 2021; Morales et al., 2021; Silberzahn et al., 2018) demonstrated that bias against female researchers exists in various disciplines. This finding also appeared in reviews and included such disciplines as medical science (Ingrid Toews et al., 2017; Upthegrove et al., 2021), economics (Rousseau, 2021), ecology (Eisen et al., 2013; Sing et al., 2017), chemical sciences (Bennie and Koka, 2021), and biology (David B. Resnik et al., 2008). The bias against women manifests in multiple ways. Firstly, an analysis of conference abstracts and whether they were eventually published in a journal found that the "last author's female gender was predictive of a lower likelihood of publication" (Johnson et al., 2021). Previous studies have mentioned that the assessment process for journal publications might be affected by subjectivity of editors. Lack of gender diversity of editorial boards leads to disparity of published papers. In journals, where editors were male, there was less proportion of female reviewers (Fox et al., 2015). Secondly, there is an imbalance in the review process which appears because of the tendency of editors to invite reviewers "like themselves". Some reviews (Detweiler et al., 2016; Eisen et al., 2013; Upthegrove et al., 2021) and a survey (Morales et al., 2021) found that women are less likely to receive invitations for peer review and also that representation of women in positions of senior author is less than that of men. A survey by Gunthe and Gettu (2022) showed that the output and quality of research publications by some academics (especially women and ECRs who moved between institutions, changed career paths or had a pause in research activities) are not fairly assessed.

### Geographical and language bias

These biases affect researchers from low-middle income countries and those whose first language is not English. Research culture prioritises English today because all high-ranking journals are in English (Baltazar et al., 2019; Naik, 2017) and publication in English increases the likelihood of citation (Vinkenburg et al., 2021). Therefore non-English speaking researchers experience problems with popularisation of their works (Lawrence, 2007). The prioritisation of the English language in the academic literature creates a disadvantage for non-native English speaking authors and forces them to spend extra time and resources getting their work published (Hagan et al., 2020).

Another factor which may result in bias against researchers is underrepresentation of reviewers from low-middle income countries. Reviewers mostly come from high-income countries, as academics from low-income countries do not have time and resources to do additional jobs. *"Having reviewers mainly from high-income countries means that the interest of these scientists and populations are perpetuated, and those in low-resource settings are marginalised"* (Cheah and Piasecki, 2022, p. 1601). Same tendency appeared in a survey by Publons (2018) that has evidence that reviewers from LMIC are not invited to review academic papers. This means that researchers from low-middle income countries are not equally included in the evaluation process .

### Bias for author and institutional prestige

Manuscripts are frequently assessed for publication based on status of authors or institutions or other subjective factors (Detweiler et al., 2016; Cazap et al., 2020; Eyre-Walker and Stoletzki, 2013), which makes reviews biassed (Nestor et al., 2020). The fact that reviewing and decision-making often does not happen openly (Bonn and Bouter, 2021; Wicherts et al., 2012; Siler et al., 2015) enables assessors, even inadvertently, to prioritise manuscripts based on their personal biases. For instance, assessors may favour articles which cite famous authors (Urlings et al., 2021; Gøtzsche, 2022), show "significant" findings (Cazap et al., 2020; Ekmekci, 2017; Jannot et al., 2013), or whose authors are based at institutions with more prestigious reputations.

## Research Question 5: How is labour divided across different parts of the research process? (21 articles)

In this section we will describe particular components of collaboration and division of labour in the research process. This part will mainly focus on preferences and perceptions of researchers and their general vision of the collaborative activities in the research. There still might be more information on this topic; however, this question was problematic for searching due to keywords specification (topic was quite broad) and time limitations.

### Division of labour

Although the research question was designed to illuminate what division of labour looks like in current research ecosystems, the literature search mostly yielded sources focused on the importance of collaboration and how scientists think the future of division of labour should look like. Some articles distinguished different types of contributions during the research process. For example, a mixed-method study evaluating a technological collaboration tool (Julpisit and Esichaikul, 2019) analysed knowledge sharing practices of research teams and concluded that collaborative activities could be categorised into four types: identifying research goals, designing tasks, performing tasks, and writing reports. "A survey of research teams across a range of scientific disciplines (Lee et al., 2015) found that while the impact of research increased with team size, the novelty of research was boosted by a variety of team members with distinct knowledge bases". In relation to kinds of activities, some studies mentioned the importance

of “collaborative supportiveness” (Liu et al., 2013; Woodzicka et al., 2015). It may increase productivity by providing a broader understanding of the research process, and improve research culture by supporting individual contributions to team activities. This encourages more collaborative ways of thinking among researchers and highlights research contributions of individual researchers. Other studies noted that it is important to value all types of contributions as this affects the productivity of research collaboration and the research culture itself. (Lariviere et al., 2021; Mauthner and Doucet, 2008; Wolfe and Alexander, 2005). Despite the fact that many studies have a similar structure (conceptualisation, operationalisation and written communication), other, more niche and narrow tasks cannot be ignored. When one type of work is perceived as more worthy than another, it leads to inequalities across disciplines and teams. Another study by Haeussler and Sauermann (2020) found that interdisciplinary teams use greater division of labour.

### Generalist vs specialist roles

Based on the literature, researchers’ ways of working can be categorised into several types. Certain studies, both qualitative and quantitative, describe potential roles for researchers as: generalists (who are team players), specialists (who work alone) and versatiles (who do both). According to (Lu et al., 2020), which used more than 100,000 articles from PLOS and extracted author contribution statements, generalists are the majority. (Note, however, that this method cannot separate whether most authors are actually generalists, or whether contribution statements might be inflated due to pressure to appear as generalists.) Also, a qualitative study (Haeussler and Sauermann, 2020) has analysed pre-defined contribution statements from PLOS and found that roughly 22% of authors perform 20% or less of all contributions (“specialists”), while 29% perform more than 60% of all contributions (“generalists”). As for the authorship of articles, versatiles are more likely to be first authors (Lu et al., 2022), confirming past studies (e.g. Lu et al., 2020) who found that versatiles are most often senior authors and are associated with funding and supervision.

The topic of the division of labour turned out to be the least disclosed in literature. There are still gaps in questions of how scientists feel about publishing all parts of the research process, how they perceive open critique and what parts of the research process are the most valued.

## Conclusions

The aim of this literature review was to understand the state of the research environment with regard to five of Octopus’ aims. In addition, we identified some subtopics with little or no coverage in the existing literature. Such sub-topics include the culture of critique in research and the topic of division of labour and collaboration in general. The area of favoured topics might be more covered in literature, however, the complexity of its conceptualisation made it problematic for us to search. However, the topics of barriers to research sharing and publication, questionable research practices and bias in assessment have been well covered in existing studies.

# Interviews

We conducted 60-minute online interviews with 14 researchers from October to December 2022. While most are based in Europe, we also reached researchers in Africa, Asia, and North America. More than half of those interviewed were women, and they represent disciplines across the social and natural sciences, engineering, and statistics. Several work outside of academia, including government agencies, private companies, or non-profit organisations.

When asked about how they share research, all respondents indicated that the traditional peer-reviewed journal article is the most important and primary form for doing so, with events such as conferences being a secondary way. For some social scientists, events could also include workshops that gather input from stakeholders to shape their research. Sharing other aspects of research, such as data, methods, or ideas, is very rare when compared to traditional papers which present a complete "story".

Regardless of how sharing is done, almost all researchers we interviewed stressed the unmet need for more constructive feedback on research, especially in its early stages. Overwhelmingly, they considered this a key reason for sharing research because early critique can improve methods before work commences. They emphasised that the "process" of *how* research is done is more important than "output", because "...the process is something you can control".

Sharing research methods is not limited to describing them in the methods section of a traditional paper, but also refers to other formats in which they are documented. This includes protocols or software code, where the latter is seen as occasionally shared but rarely reviewed.

Some interviewees recognised other benefits of sharing research, where it:

- Reduces duplication of precious time and effort;
- Reduces friction in finding and accessing material, such as data;
- Ensures honesty, transparency, and accountability, especially (but not exclusively) if the research is publicly-funded;
- Creates new opportunities for networking; and
- Acts as a backup of a researcher's work, allowing them to find it again more easily.

The researchers agreed in principle that open research is desirable. One described an ideal situation where the entirety of their research is documented in an electronic notebook, because it would "...save so much time, people could use that data retrospectively, they wouldn't have to repeat things." Despite this ideal, the researchers spent most of their interview time describing barriers to its realisation.

## Barriers to research sharing

Some of the barriers to sharing research are technical or personal, while most are related to political pressures experienced by almost all interviewees.

### Technical barriers

Several researchers shared concerns over publishing sensitive data, of which the most common type is personally identifiable information. Other sensitive information could be safety-related, such as communication protocols for commanding spacecraft which can be misused to redirect their trajectory. The interviewees generally recognised that this is not a binary issue, but rather a difficult set of trade-offs where one should strive to be "as open as possible, as closed as necessary." One of them mentioned the usefulness of publishing representative, "synthetic" datasets rather than none at all.

Other concerns include not knowing how to avoid predatory journals and the prohibitively-high article processing charges (APCs) of some open access journals. The latter has wider political dimensions in terms of inequitable access to resources across the world. For example, one respondent suggested that high APCs have a gatekeeping role, forcing those with less funding to publish only in journals they can afford, rather than those most appropriate for the subject matter and with high visibility.

### Personal reasons

As described above, most of those we interviewed recognise the value of sharing research, especially in its early stages. However, many of them also expressed a fear of publishing intermediate, immature, or incorrect outputs. They anticipate personal embarrassment and being negatively judged by their peers. A respondent said: "I still find so many typos in my papers now" and even these relatively minor mistakes are a continuing source of unease.

### Political factors

One interviewee praised the scientific value of pre-registered replication studies, but ultimately concluded that they will not be doing this kind of open research. Like most others who were interviewed, this researcher cited lack of time as a major barrier to sharing more of their work: "I'd be drowning... If you're a successful person, you don't have the time to do that... I get no recognition for being involved in those projects at all. There's no value to me to do that." While this researcher is based in industry, the sentiment is widely shared among academics. When questioned further, most participants revealed that this barrier to sharing is due to political considerations, especially with regards to how their careers would be impacted.

> *"If you're a successful person, you don't have the time to [share more]... I get no recognition for being involved in those projects at all. There's no value to me to do that."*

Top among these concerns is the perceived risk of being "scooped". Depending on research discipline, the target of scooping could be data (such as in fields reliant on secondary data), research ideas (such as for theory-focused researchers), or methods (such as software code of hardware designs). There is very little trust among researchers that their work will not be scooped partly because, as one interviewee described it, the current system "rewards scooping".

While most did not explicitly define scooping, it is most commonly referred to as a form of plagiarism. To mitigate this behaviour, some participants noted the benefit of publishing early stages of research is to create a historical record of who first thought of and did what. For example, one physical scientist described how the GitHub version control platform maintains a detailed history of "commits", which tracks the who, when, and what of changes to software code on a fine scale. In principle, having such a paper trail allows proper attribution in cases of plagiarism. That said, even if a time stamped record of work exists, the interviewees stressed that institutions must be reformed to recognise these non-traditional forms of publishing research.

Even without plagiarism, another form of scooping stems from a research culture rewarding those who are first. For example, one researcher feared that even if they publish their research idea and put their name on it, someone else could still beat them to winning a grant based on that idea. Therefore, according to another interviewee, there is considerable incentive for everyone to keep their work a secret at least until (and not necessarily even then) a peer-reviewed, high impact paper is published or a grant is awarded.

In addition, there is substantial fear of negative career consequences from being "caught" for making honest mistakes. A biologist we interviewed recalled that, during the peer review of a submitted paper, problems with a reagent used in their experiment suggested the results were not as high-impact as originally thought. This meant that their work could not be published in a high-profile journal, and with far less benefit to their career. According to this biologist: "...if I have done something wrong, I want it to be found out... but it would be a horrible experience to go through". This quote is consistent with the widely-expressed desire for early stage feedback, and suggests the current system might be punishing those who are honest about their mistakes.

## Causes of questionable research practices (QRPs)

The pressure to publish high-profile papers while avoiding – or not revealing – mistakes could lead to questionable research practices (QRPs). Some QRPs are inappropriate randomisation and blinding in studies, or, most commonly, data manipulation and cherry picking.

One quantitative social scientist described widespread data manipulation in their field, or "trying different methods to get a significant result". This is, in part, enabled by a focus on traditional papers while not requiring the publication of data, code, or detailed and replicable methods. In fact, if asked to publish other components of research, it will "[sound] like you're killing them." This has been so normalised that when confronted about "cleaning" data, a common justification for this QRP is that "no one would know about it".

## Bias in research assessment

### Overvaluing publication records

Of those interviewed, academic researchers overwhelmingly cite traditional peer-reviewed papers as the key consideration in research assessment for funding, career progression, or national-level university evaluations. Many lament that the content of research is not important as long as it is published in a high profile journal: "...it kind of doesn't matter so much what you did because once your name [is] on the paper, that's like, you've got it. It's in the bank." Some job openings even require applicants to have published in a select list of the most “high impact” journals. The quantity of publications is just as influential, where early career researchers are taught to break down results into "minimum publishable units" to maximise the number of papers. One interviewee also lamented that in many assessments, a paper in "[an open access journal] doesn't count as a publication."

Additionally, one participant voiced concern that with some universities or research funders, only papers above a certain number of citations will be considered. This way of doing assessments only values research that is currently popular. This interviewee works in a highly specialised field where they publish their work in a journal that is topic-appropriate, and where they can receive the most useful review of their work. However, because the journal is so niche, it does not rank highly in the citation-derived metrics that assessors consider. This has hampered the development of this researcher's career and their job security, despite widespread praise by downstream practitioners on the value of their work.

Interviewees also noted that the importance of publication record in assessments gives an oversized role to those reviewing articles. Typically, only two peer reviewers are assigned to a submitted article, and their perspectives and biases could potentially derail the career of a researcher. One engineer we interviewed recalled how their manuscript on construction materials for buildings was rejected by a reviewer because it was not useful for aircraft. Another interviewee noted that it is unfair to place such a great responsibility and stress on peer reviewers, as their

critique might have long-lasting implications for others beyond the content of the paper itself.

Another respondent noted that because funding agencies or universities rank people with “impressive publication records” higher than those without, they – in effect – conduct assessments "not from judging pieces of research, but from judging researchers".

## The politics of attribution

The obsession with publication record that the interviewees perceive in assessment engenders a complicated set of politics and competition around authorship on papers.

One aspect is the very strong competition to be the first to put their name on a piece of research, which can easily "make or break" careers. Personal connections and prestige are perceived to be key in this arena. Instead of sharing, this environment promotes "castle building", where research outputs (such as software code) are kept secret, and "...if you want [me to share this] capability, you need to have me on your team". The capabilities in question could also be tacit knowledge and skills, or components of research like protocols and data. For the latter, it can be traded as a currency for paper authorship. This practice is sometimes formalised, where: "If you want to use other people's data [sets], then you might need to sign the contract saying that if you use their data set to produce any work, then their names should be on the papers as well." This is also reflected in views on the goals of networking in research, where it is defined as knowing the right people in order to obtain the data you need instead of for intellectual exchange.

When a traditional, peer-reviewed paper is being drafted, deciding authorship and its order can be complicated and stressful. A common symptom is that the division of labour is unclear and leads to misappropriation of credit. For example, the authorship of someone who provided guidance on research might be placed in a more prestigious slot, like first or last author (depending on discipline), while taking focus away from those who actually carried out the work. There is also disproportionate recognition in authorship, such as those who did 90% versus 10% of the work being placed at positions in the author list which imply equivalent contributions.

Interviewees described their struggles defining what levels of contribution merit authorship, especially when the *effort* behind that contribution seems small. For instance, one author had trouble deciding whether to include someone who provided useful but brief comments that probably did not take a lot of time. In other situations, those who are considered to be "plumbers" – such as statisticians, software programmers, or local “fixers” – are often demoted on the author list. For example, a statistician whose feedback completely changed the focus of a paper and its target journal was only mentioned in its acknowledgements section.

> *"...you would want to have the Nobel Laureate at the top, just to make sure that you get picked up by a journal"*

In addition to these legitimate challenges in deciding authorship, there are several forms of political pressure. Sometimes junior researchers are left out of authorship to make room for those with more power. In other cases, some authors are added – possibly as a favour to them – even when no one who conducted the research knows them or what their contributions were. One interviewee was forced to add an author who was "[a senior researcher] literally just [because they] gave me a [sample] on dry ice". Also, the prestige of the author list is so important that "...you would want to have the Nobel Laureate at the top, just to make sure that you get picked up by a journal." According to another: "I think it's already become a norm now that people accept the fact that you don't need to do anything. You just need to know the [right] people, then you put those people together, you'll get the credit as well."

Some interviewees acknowledge that there are existing attempts to provide more equitable attribution in paper authorship, such as the **CLEAR** or **CRediT** guidelines. However, "nobody reads it, it has no impact."

### The need for a "good story"

> *"...it almost feels like [...] I'm a novel writer instead of a researcher."*

For a piece of research to be published in a paper, there is a heavy bias towards what would most likely be considered an impactful, "flashy" story. Regarding "flashiness", one researcher described it as: "I think most research is just, you know, very small, incremental steps. But it's like you can't really get funded if you can't say that it has huge, like potentially huge, impact on something very downstream." In other words, interviewees generally agreed that assessments "...are heavily persuaded by writing quality, particularly in the idea of storytelling quality, and then making a sound-bitey type point." This is further complicated by the fact that what counts as "interesting" research is in the eye of the beholder. The flashiness of research is so important that, to the frustration of one quantitative social scientist: "...it almost feels like [...] I'm a novel writer instead of a researcher."

Another researcher was concerned that the impact of research is typically, and often solely, measured in "capitalist" (i.e. how much profit can this research generate?) or "colonialism" terms. The latter could be "parachute research" where communities studied or affected by the research have little to no say in how it is done, shared, or assessed.

Some interviewees noted that the bias towards research with "impact" neglects the nature of doing science, which is often meandering and non-linear. Research is often built on mundane, boring "grunt work" that is valuable, and might eventually build up to impact that is not initially apparent. Discoveries often happen during this grunt work, and "...it's the practical stuff, really, that churns out the interesting stuff and then that's kind of where you work from." For one social scientist, traditional papers take too long to publish and are not useful for the stakeholders they work with. Instead, there is value in spontaneous and unplanned work, such as co-developing a survey with a community partner for whom the research can have direct benefit. In any case, researchers are sometimes pressured to retroactively come up with a good story to justify their work, which can be frustrating.

## Other biases and discrimination

The interviewees raised other forms of bias and discrimination in research assessment, such as:

- "Credentialing" where, for example, if a researcher with “only” an undergraduate degree is listed in a grant application, it will be discriminated against regardless of actual merit.
- Personal characteristics such as gender or race affect assessment outcomes.
- The personal geopolitical biases of referees or journal editors can inappropriately decide the outcome of peer reviews.
- Funders sometimes define their remit too narrowly, missing out on valuable interdisciplinary research.
- Support for research, especially financial support, is narrowly aimed at academic institutions which excludes many non-institutional researchers.

## Improvements to research assessment

Despite prevalent misgivings about the current state of research assessment, those we interviewed identified several ways that the process could be reformed.

As described earlier, while there are guidelines such as **CLEAR** or **CRediT** for better attribution for authors of traditional peer-reviewed articles, that information tends to be ignored by readers and those performing assessments. Encouraging, or possibly requiring, adoption of these guidelines for incorporation into, or replace, author lists could be a useful first step.

Similarly, some interviewees wish that open research practices were valued in assessments. This could be paper trails, such as commits in a Git repository or hypotheses published on Octopus, which could be used as a source of accurate attribution. This way, "...even if I announce my hypotheses, but I never get around to testing it [...] and someone else does. That's totally fine, because you've timestamped that hypothesis... and you can be much more open."

Several of those interviewed highlighted the need to reward researchers who openly share mistakes. One also pointed out the value of recognising limitations in a study, and discussions of it should be required in papers. Such discussions should recognise that research quality is not a binary issue, but the management of trade-offs resulting from practical constraints. Another researcher believed that positionality statements – which present a researcher's experiences and perspectives relevant to a study – should be required not just in the social sciences, but for all research because we all bring our perspectives to the work we do, and should not pretend to be objective.

Most interviewees agreed that assessments are over-focused on outputs, whether that is papers in academia or patents in industry. Assessments should be based on the process of research, not its products. This could mean that in addition to reviewing methods, assessments should value the usefulness of negative or null results. Some noted this as a key difference between academia and industry where, for example, a null result could be viewed as valuable for a pharmaceutical company because it helps them avoid unproductive avenues for drug development. When assessing methods, one biologist observed that assessments are often done by senior researchers who do not perform any practical work, and can no longer effectively appraise it. Instead, "it should be grunts assessing grunts, right?"

Crucially, several researchers stressed that the method for assessment should itself be subject to critical scrutiny and research. In one large collaboration in the physical sciences, a social scientist was brought in for an ethnographic study on the collaboration itself. Insights from this study helped these researchers reflect on their collaboration, and potential ways to improve it. Another researcher noted that when assessing assessment, community stakeholders beyond the nominal, academic researchers should be involved.

## Encouraging more openly collaborative ways of thinking and working

Unfortunately, as evidenced by the pervasiveness of structural problems that the interviewees described, most of them are not hopeful of positive changes. Some described a brain drain from research, especially academic research, because "there's people now who want a change, but they're not in a position for the change to happen. And by the time they are, everyone's giving up. They're leaving." Academics are especially overworked and underpaid, and as described in one sharp comment: "...anyone with half a brain cell now realises that the academic system is just not a level playing field and they just get the hell out of the dodge as quickly as possible."

In addition to what has already been described, interviewees highlighted issues preventing open critique of research, and how the division of labour and specialist skills are not recognised and rewarded, resulting in everyone becoming overburdened.

## Open critique of the research process

Lack of time is a common barrier to not just doing open research, but also providing effective critique. One social scientist described how they are stressed by not having sufficient time to provide quality peer reviews of papers or make fair editorial decisions, yet these activities are expected of academics. Another said that offering critique is difficult, because traditional papers have a sense of finality that does not welcome further feedback.

> *"...anyone with half a brain cell now realises that the academic system is just not a level playing field and they just get the hell out of the dodge as quickly as possible."*

In the context of open research, giving critique publicly can be intimidating, not just from a lack of confidence or fear of discrimination (such as based on gender), but also the possibility of retribution from those in positions of power: "...being vocal means that I often get in trouble.... they don't invite me to meetings, for example, because they don't want someone sitting there throwing a spanner in the works or something, right? They'd rather just try and get by without anyone mentioning anything."

There is a perceived lack of social structure for feedback outside of the peer review process for papers. Some find it is hard to give unsolicited feedback, while others decry the absence of a safe way to communicate with more powerful or senior researchers.

That said, one researcher recounted feeling validated and encouraged by positive feedback, which meant that they were "on the right track".

## Division of labour

Early career researchers tend to act as generalists, and have to take on practically all of the work, end-to-end. This is especially true for students from undergraduates to those pursuing a PhD. This might be expected, as many training degrees are designed to give people a generalist overview and experience across all parts of the research lifecycle. In some circumstances, the tasks include applying for research funding which, as mentioned above, could be difficult for those with only undergraduate credentials regardless of the merit of their proposed research. In any case, these early career researchers do identify gaps in their abilities, and bring on specialists as needed. They perceive that those in more senior positions do much less of the practical steps in research, such as data collection or analyses.

Regardless of career stage, there is widespread sentiment that specialist contributions to research are often "invisible" and not appreciated. For example, one physical scientist we interviewed performed a major overhaul of the analytical source code underpinning a major research project. This contribution required expert knowledge in software engineering and the underlying science. However, other than receiving verbal appreciation, this effort was largely "thankless", and the researcher was pressured to "pivot towards publications" which is considered more productive. Similarly, work by statisticians or data scientists are often unappreciated: "Sometimes they wouldn't be put on a paper as a middle author, and maybe they would be put in the acknowledgement... the view of the statisticians is being like one of the plumbers or something like that, where '[they are] just calculating p values, right?'" A manifestation of this lack of understanding is that senior project managers, such as principal investigators, would hold unrealistic expectations regarding what junior researchers should produce with limited resources. This could, for example, take the form of a project manager setting an unrealistically short timeframe for completion of certain research tasks by a junior team member.

The diverse forms of this crucial, but unrecognised labour also include "fixers" with expert local knowledge to facilitate social science research; interview transcribers or translators with tacit contextual knowledge; or various research assistants. Several interviewees also recognised that critical specialist contributions to research extend beyond those directly related to the subject matter. They could be administrators and finance staff in large projects, or professional writers and graphic designers.

One social scientist reminded us that the forms of reward and recognition for contributions can be just as diverse as specialisms. Consequently, researchers and institutions should be mindful of how contributors would like to be acknowledged and rewarded in addition to traditional paper authorship.

Importantly, several interviewees stressed that doing good open research is itself a professional skill. Sometimes, senior researchers may seem receptive to open research practices, but typically delegate the practicalities to junior team members. Like other specialisms, the "articulation work" of opening up research is not recognised. Another researcher suggested that rather than requiring yet

another skill for overburdened academics to excel at, specialists should be employed within a project to ensure it is managed according to open research best practices.

One specialism that is considered to be almost universally important is networking, and it is often for political - rather than intellectual - reasons. For example, assessments for tenure or promotion hinge not only on a "flashy" publication record, but also the personal connections of the assessed. These acquaintances are asked to provide anonymous references for the tenure-seeking researcher. Even the speed at which the references are provided can be measured during assessment, where letters received earlier are scored higher. Therefore, junior researchers are constantly stressed by the need to cultivate connections in anticipation that some might later be asked to review their performance. It was in this context that one interviewee said: "...who you work with matters, potentially more than almost anything else."

> *"Why are you asking the rocket scientists to figure out the Zoom meeting?"*

While early career scientists feel they have to be generalists, senior researchers also believe that division of labour is inefficient and it places undue burden on everyone. To quote one exasperated researcher: "Why are you asking the rocket scientists to figure out the Zoom meeting?"

In academic settings, the pressure to be good at everything is a major source of stress, including for those who do not desire to become generalists. The burdens are not limited to research, but all that is asked of an academic and what they are assessed for, such as teaching or administration. This pressure often leads to the QRPs discussed previously: "...[academics are] under so much pressure like to teach, to publish, to be at conferences, to do this, to do that... 'Do you have a [social media] account?' 'You have to engage with the students.' It's like you can't do all that stuff, and the only way that you'll meet those [assessment] criteria, like what they call metrics, is to cheat. There's no other way of doing it." One biologist we interviewed did not want to cheat, and decided to leave academia because of these untenable pressures. There is a fear that this brain drain will lead to a vicious cycle where only those with questionable ethics will remain in academic institutions.

# Survey

## Basic demographics

Respondents could choose from a list of 25 fields in the natural, social, and applied sciences that most closely match their research (**Figure 2**). While all were represented in the 406 responses we received, about a third came from researchers in “Medicine and health”, “Psychology”, or “Biology”. This skew is likely due the composition of people linked to the **UK Reproducibility Network** (UKRN) and other open research communities to which we disseminated the survey, where these fields are highly represented. In addition, some respondents chose “Other” as their field which allows a free-form response, most of which are fields in the arts and humanities.

Just over half of responses came from those with 10+ years of experience in their field; and a quarter each for less than 5 years and 5-10 years (**Figure 3**).

Location-wise, more than 80% of responses came from those who work primarily in Europe, with North America a distant second at just under 8% (**Figure 4**). Again, this is likely because of the responses we received through UKRN contacts who disseminated the survey to their institutions. Responses from outside Europe could be, in part, from authors contacted through our Web of Science search.

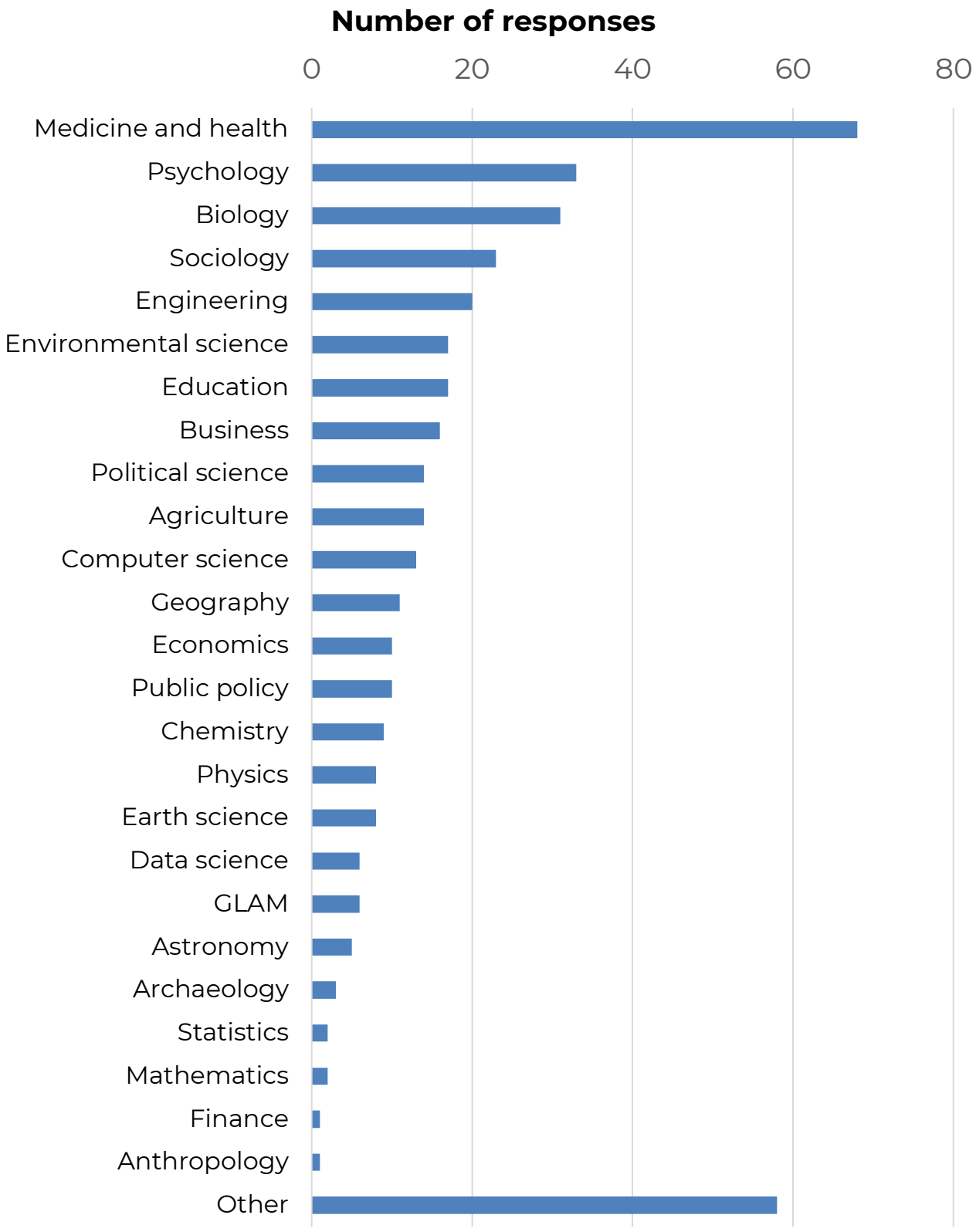


***Figure 2.*** *The 406 respondents to the survey represent a wide variety of disciplines in the natural, social, and applied sciences. Of those, about a third were "Medicine and health", "Psychology", and "Biology". Those who selected "Other" were primarily those in the arts and humanities. "GLAM" is Galleries, Libraries, Archives, and Museums.*

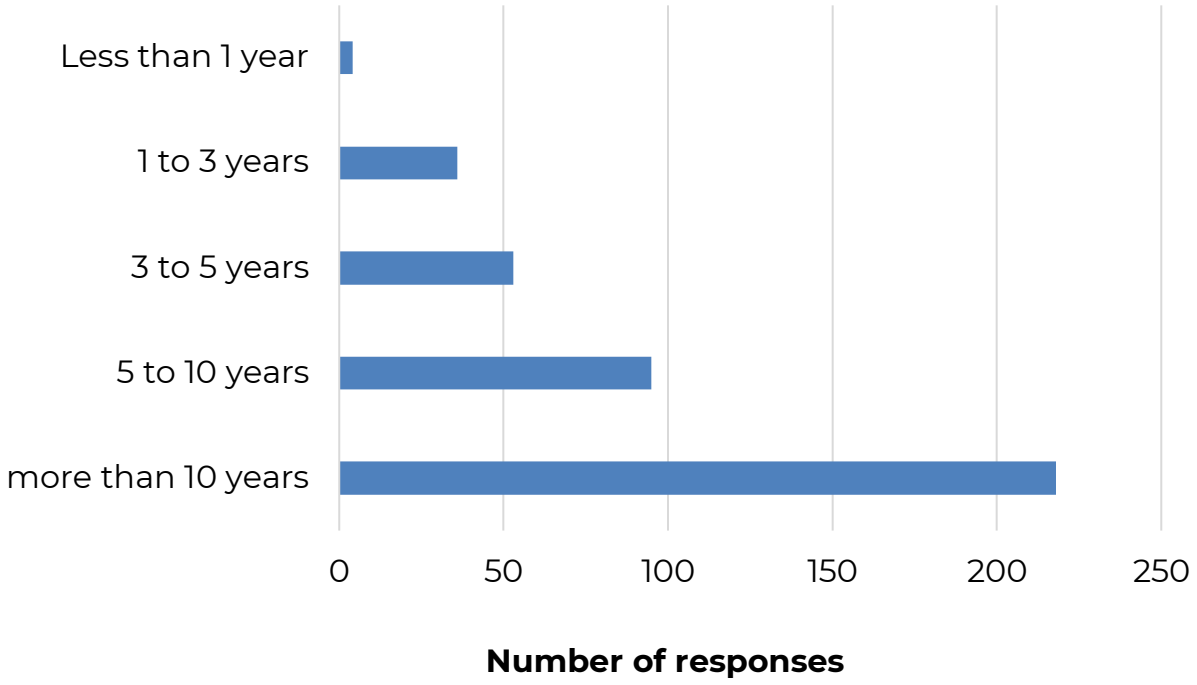


***Figure 3***. *Over half of respondents have worked in their field for more than 10 years.*

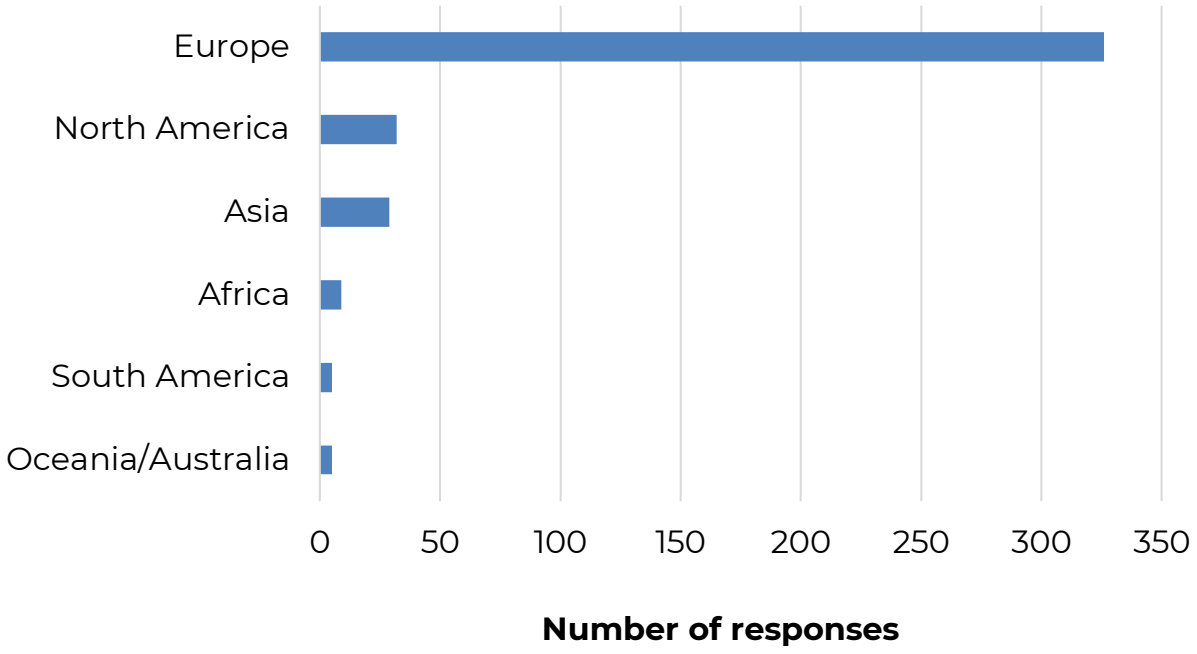


***Figure 4.*** *Responses were overwhelmingly (over 80%) from researchers based in Europe.*

## Feelings about research culture

Survey question: "*At what levels do you feel the following aspects are present in your current research job?*"

When asked about various factors regarding research culture in their fields, more than half of respondents indicated that those factors were present at a high level (**Figure 5**). These factors include, career prospects; fairness of assessment; support from colleagues; support from the community; the impact of their research; collaboration between research groups; and career satisfaction.

In contrast, a high percentage of respondents indicated "low" or "very low" career prospects and impact from their research. For the latter, over 15% chose "very low" for career prospects, substantially higher than any other factor.

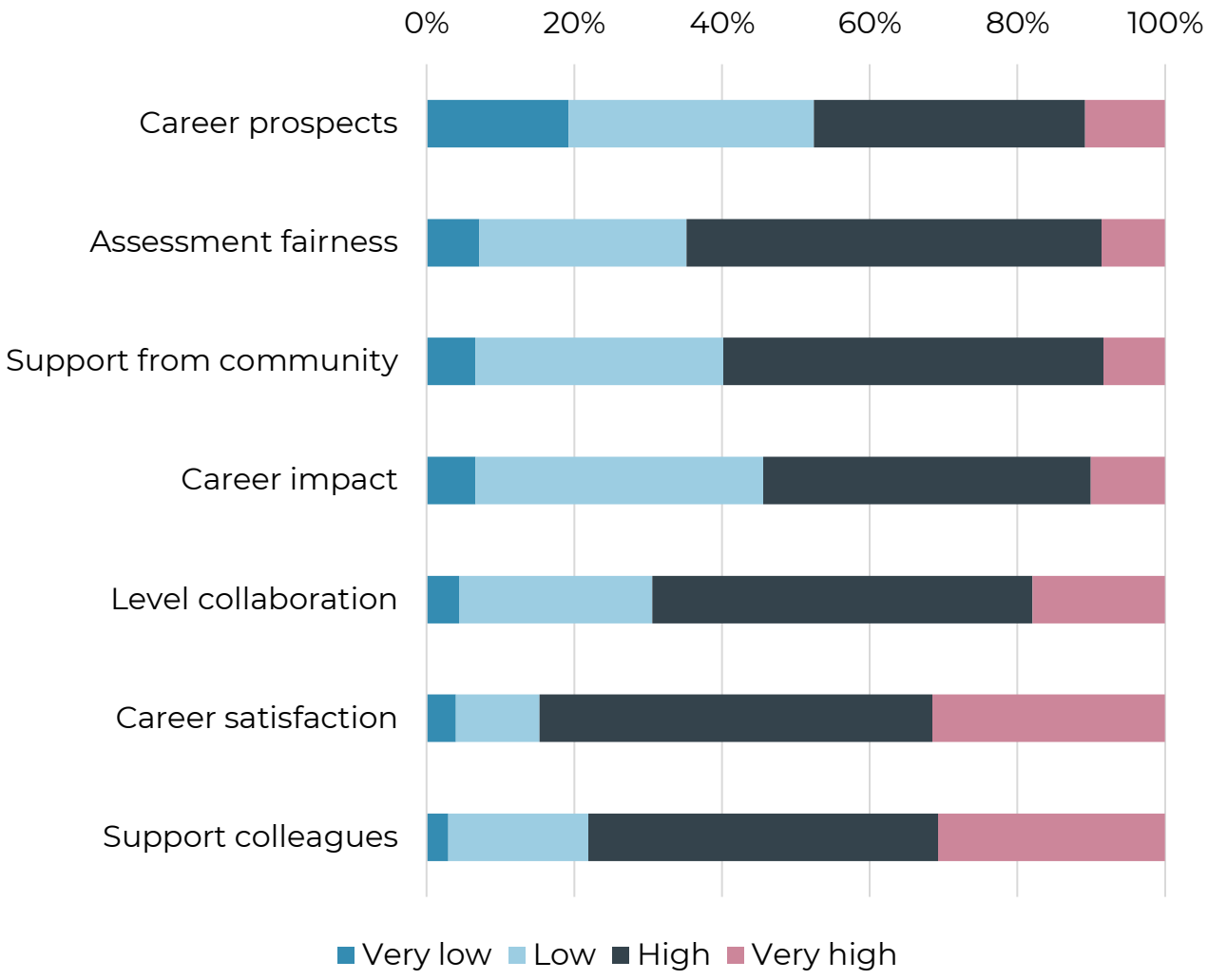


***Figure 5.*** *While most respondents indicated that various aspects of research culture - such as support, impact, or fair assessment - are present at high levels, more than half chose "low" or "very low" for their career prospects. Exact wording of each option is reported in the appendix.*

## Causes of publication bias

Survey question: "*Have you ever conducted any piece(s) of research in the past, large or small, but chose to NOT publish or share it/them publicly? [for those who answered yes] Which of the following factors prevented you from sharing or publishing this research?*"

When asked whether they have ever conducted a piece of research - large or small - that was not published, just over half of respondents said yes.

For those who answered yes, almost two thirds cited lack of time as the reason for not publishing their work (**Figure 6**). Other common causes are insufficient data, or that the research did not make a clean "story" or lacked "impact".

Just under 20% of respondents chose "It would not help my career" as the reason for not publishing something. Not conforming to "established" thinking is the least-chosen option at about 10%.

These results suggest a research culture where publishing is viewed as important to career progression, but justifying the time to do so requires the research to show an impactful narrative.

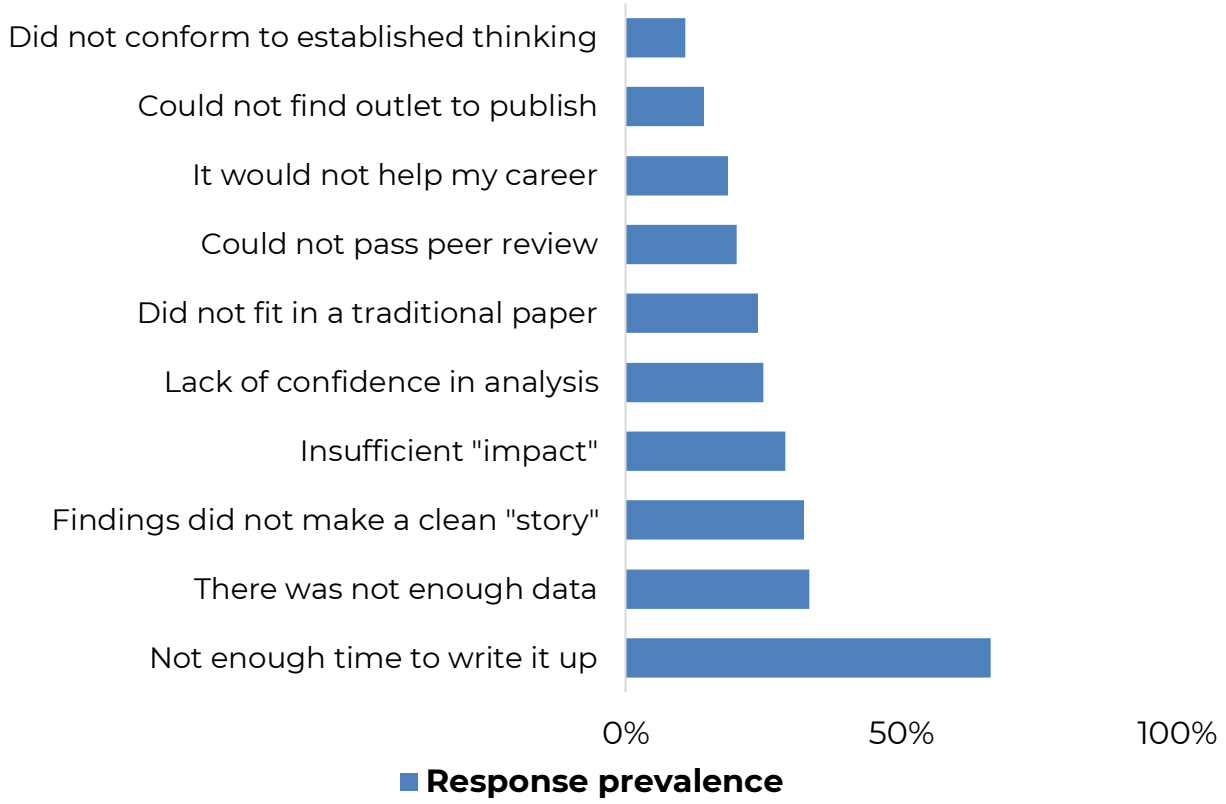


***Figure 6.*** *Of those who have left work unpublished, almost two-thirds cited lack of time as the primary reason. Exact wording of each option is reported in the appendix.*

## Causes preventing sharing research faster and earlier

Survey question: "*Imagine you have a good research question and a plan to investigate it. Which of the following factors may prevent you from publishing or otherwise sharing your research question and plan at this stage (i.e. before there is any evidence to inform it)?*"

Respondents were asked about publishing research at an early stage, such as their research question or methodology (**Figure 7**). Here, almost half selected fear of being "scooped" as the main barrier to doing so, substantially more than any other option. Lack of impact is again a common barrier at just under 30% of responses.

Notably, about a third of respondents cited the lack of career benefits as a reason for not publishing early stages of research. This is more than the proportion (less than 20%) who chose this as why they had unpublished research outputs. In other words, while publishing is generally viewed to benefit career progression, it may only be worth doing so at later stages in research and when the results demonstrate "impact" or make a good story.

Another common barrier is not knowing where to publish early stages of research. This is a technical barrier that outreach and education about platforms like Octopus could directly overcome.

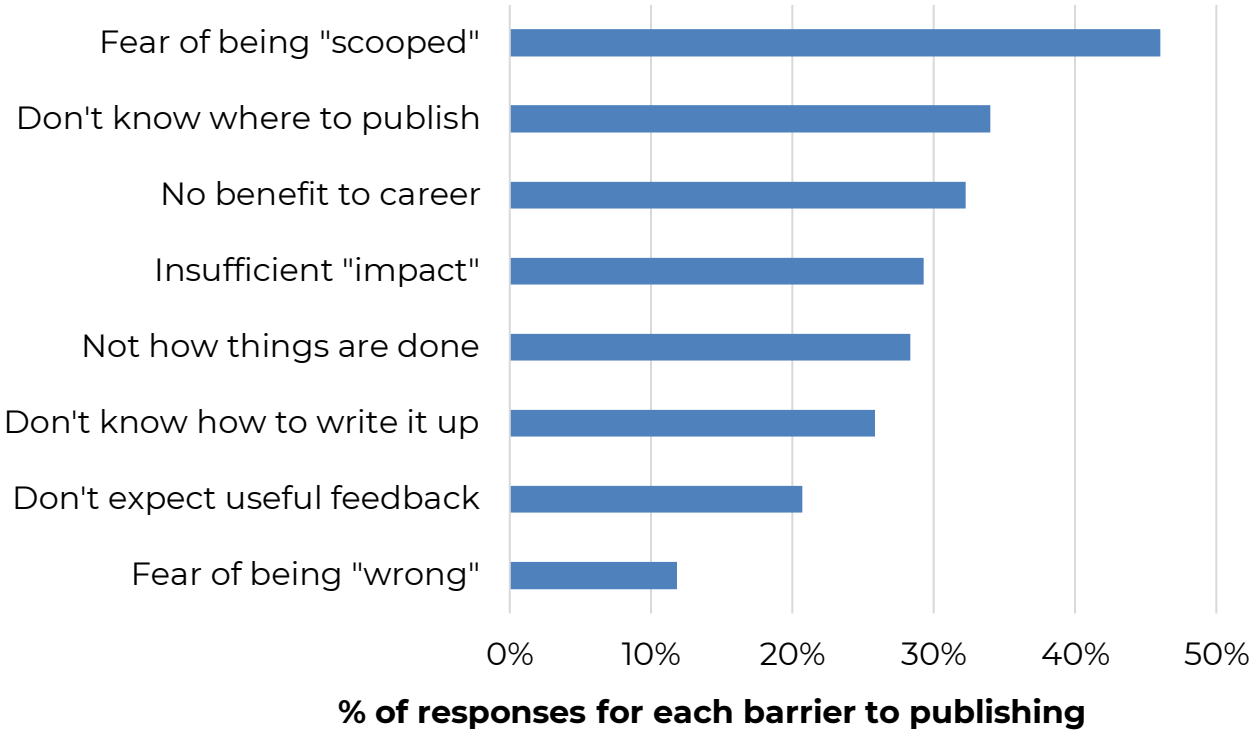


***Figure 7**. Fear of being "scooped" is the largest barrier to publishing research, especially in its early stages. Not knowing where to publish and the lack of benefit to career are other common barriers. Exact wording of each option is reported in the appendix.*

Several patterns emerge when examining the associations between barriers to sharing research at an early stage (**Figure 8**), for example:

- There is high overlap (more than 45%) between those who do not know *where* to publish early stages of research and *how* to write up such an output. This supports the observation that training and outreach for platforms such as Octopus can be useful.

- Those who fear being "wrong" likely also believe their work might lack sufficient "impact" (42%) and that there is a risk of their work being "scooped" (40%).

- High percentages (40+%) of those who chose any barrier to sharing early also chose fear of being "scooped".

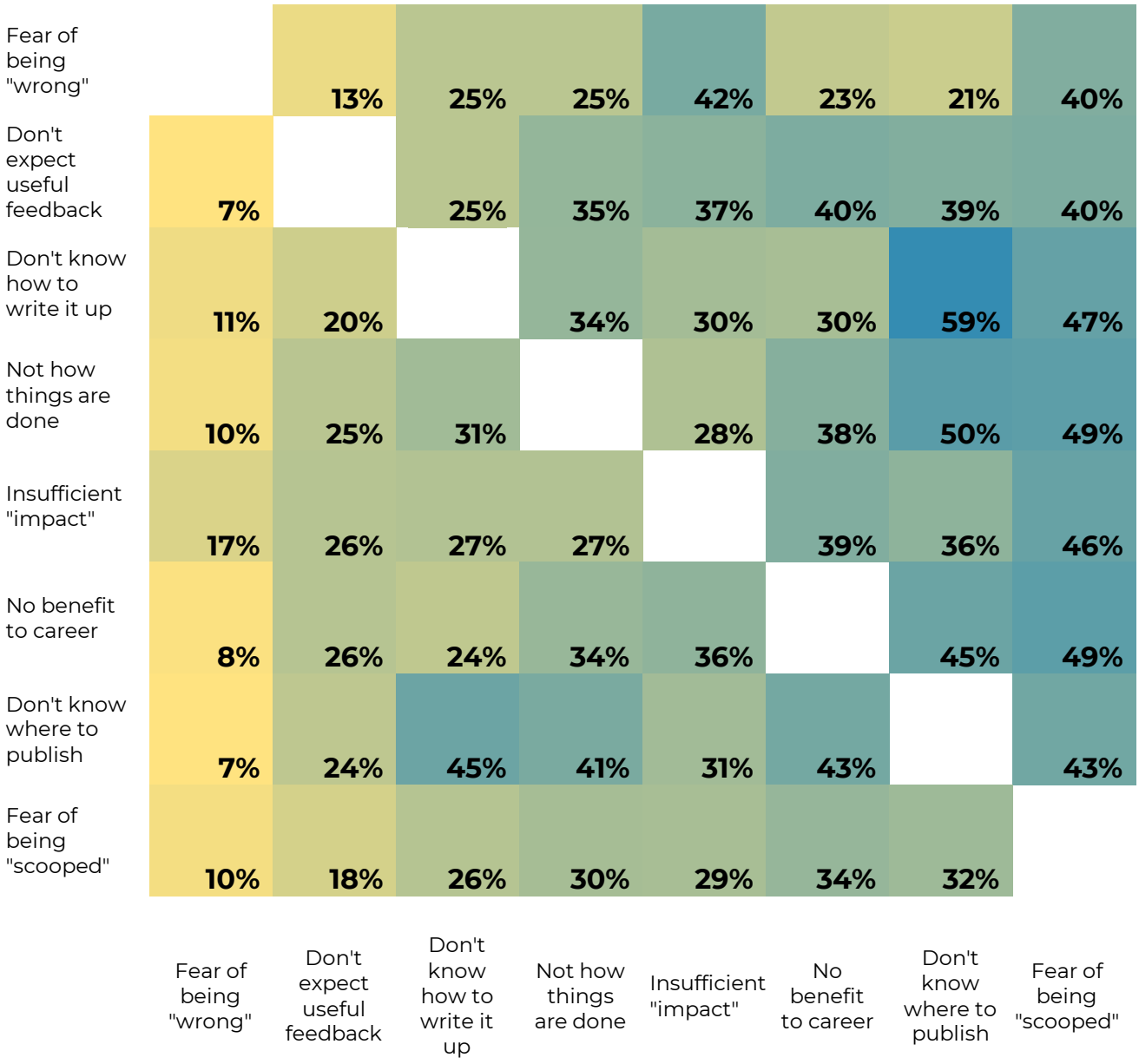


***Figure 8.*** *Associations between barriers to sharing research early. This figure is read row-wise, and deeper shades represent higher percentages. For example, of the respondents who chose "Don't know how to write it up" as a barrier, 47% of them also selected "Fear of being 'scooped'"; of those who chose "No benefit to career", 36% also chose "Insufficient impact". Exact wording of each option is reported in the appendix.*

## Research specialisation

Survey question: "*The following is a list of potential tasks involved in the research lifecycle. Think about them for a typical project you've been involved with. For each task, think about whether you typically: do it mostly on your own; do it mostly as a team; don't do it because someone else does it; or it is not applicable.*"

There is a general trend towards more group work on high level stages of research, such as developing methods, interpreting results of analyses, or applying them to a different context (**Figure 9**). In contrast, practical or routine tasks are more commonly done by individuals. This includes literature review, data collection (quantitative and qualitative), or data cleaning.

Furthermore, while most did not choose "someone else does it" in their responses about other parts of the research process, this option is most commonly selected for data collection. This could be due to the high proportion of researchers who have been in their field for 10 years or more. At that career stage, it is likely that such tasks are delegated to junior members of a research group.

One possible issue was that participants were asked to think of a "typical project" when giving their responses. This may mean that responses represent a respondent's average experience with research. And since most of them have been in the field for many years, they likely would have done most steps in the research process both individually or as a team at some point.

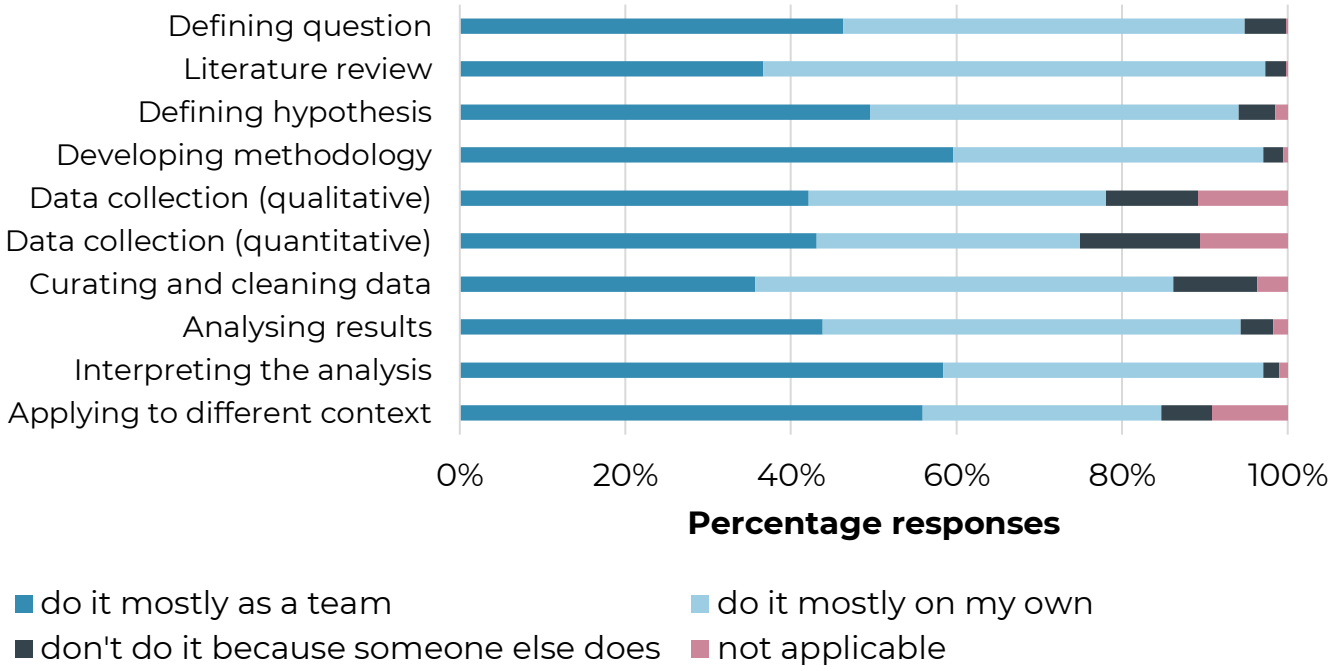


***Figure 9.*** *There is a trend towards more group work ("do it mostly as a team") during higher-level stages of research, such as when developing methodology, interpretation, or applying results to a different context. Exact wording of each option is reported in the appendix.*

## Focus of research assessments

Survey question: "*When your research outputs (i.e. your whole body of work) are being assessed as part of consideration for funding or career advancement, how much do you think the following factors influence that assessment?*"

More than 60% of respondents indicated that they believed that their publication record has a strong influence on research assessment, considerably higher than any other factor (**Figure 10**). This is consistent with our understanding of the prevailing research culture which places a premium on peer-reviewed publications. Other factors which are commonly perceived to influence assessment are the trendiness and novelty of research. This also aligns with patterns we can see from other survey questions, interviews, and the literature review. It is notable that while rigour of methods is considered important, it is equally important as research impact, and comes after the researcher's publication record. The prestige of one's institution and personal connections are also perceived to have substantial influence.

A more mixed observation is that questionable research practices (QRPs) were perceived to have less influence on assessment, such as bias towards positive results or certain personal characteristics (e.g. gender, location, etc.). However, they are still considered to play a role by more than half of respondents.

Notably, more than 40% of respondents thought that open research practices had "no influence" on assessment.

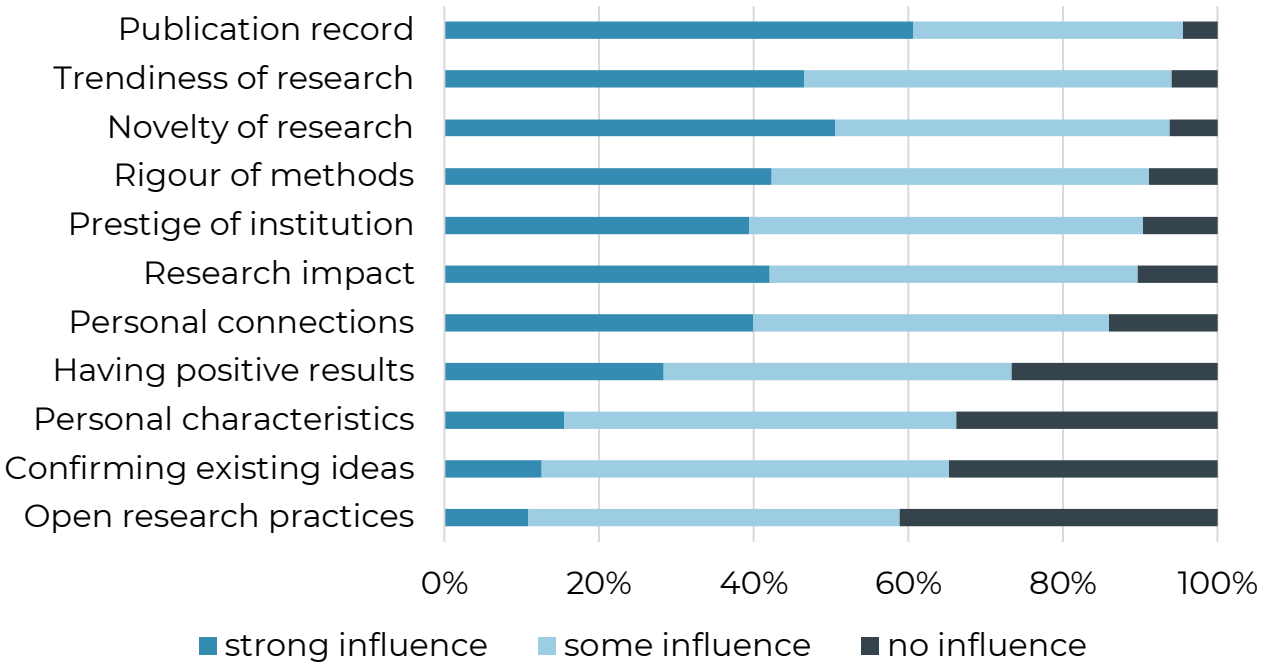


***Figure 10.*** *Most researchers perceive that their publication record has a strong influence on assessment, more than any other factor. The trendiness and novelty of their work are also influential, more so than the rigour of methodology. Employing open research practices is considered to have the least influence on assessment. Exact wording of each option is reported in the appendix.*

## Platforms for sharing research outputs

Survey question: "*Which of the following platforms are you aware of for publishing parts or all of your research?*"

When asked about venues for publishing research that they are aware of (other than academic journals), only institutional repositories and preprint servers were selected by more than half of respondents (**Figure 11**). There was also a moderate proportion who chose version control platforms (e.g. GitLab or GitHub), along with popular websites such as Wikipedia or video platforms (e.g. YouTube).

In general, with the exception of the Open Science Framework (OSF), most are unaware of publishing platforms for open research, such as Octopus. For the purposes of this survey, this suggests that participants represented a more general audience rather than those who are already open research practitioners or advocates.

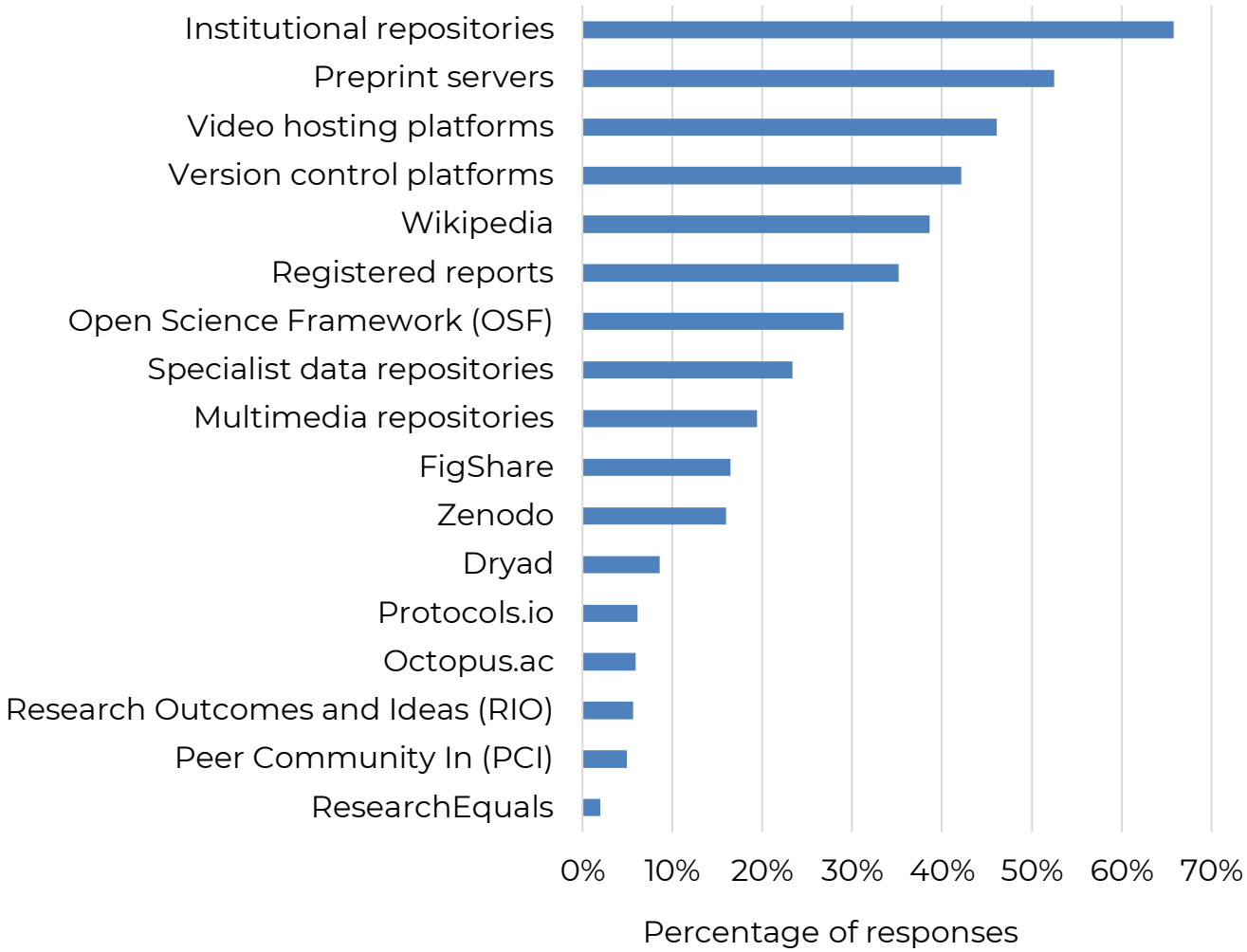


***Figure 11.*** *More than half of respondents were aware of institutional repositories and preprint servers for publishing research, but most are not aware of platforms such as Octopus. This suggests that we have reached a more general audience instead of only open research practitioners.*

## Does career length affect responses?

We split respondents into early and late career stages, delineated by having worked for less or more than five years in their field. While there are substantially more responses from late career researchers (n = 313) than early (n = 93), some patterns emerged:

- Lack of career prospects are the most common sentiment in both groups regarding research culture, but with slightly more for early career researchers.
- Early career researchers perceive more impact from their research, but substantially less fairness in how it is assessed.
- Lack of time remains the primary reason for some research to remain unpublished, and is particularly true for late career researchers.
- Lack of confidence in analysis for those earlier in their careers.
- Fear of being “scooped” remains the biggest barrier to publishing early stages of research. Substantially more early career researchers cited not knowing where to publish their work.
- Fewer early career researchers chose “someone else does it” for data collection steps in research, suggesting that these tasks are indeed delegated to them by senior researchers.

# Appendix

## Literature review

### Methodology

According to Arksey and O'Malley (2005), a scoping review, among other things, contributes to identifying gaps in the existing literature. This was the main purpose of our work. We have conducted a literature review aggregating research and opinion pieces relevant to five related research questions surrounding the production and sharing of research. We synthesised key findings from existing sources and summarised what evidence does already exist. After analysing all the topics covered, we identified gaps in the literature. This procedure allowed us to focus our efforts on illuminating gaps in the existing literature when undertaking our companion studies (qualitative interviews and survey) that formed the rest of this project.

### Search strategy

A literature search was conducted from September to December 2022.

The main database Web of Science was systematically searched using combinations of keywords associated with five separate but related research questions. If search results totalled less than 100 then they all were screened. If there were more than 100 results then the first 20-30 articles were screened depending on their relevance.

Moreover, we used a snowballing search strategy to find additional relevant literature. For instance, we screened reference lists of articles that we considered relevant. In this way we found further sources relevant to our research questions and included them to our database. Also, we directly added sources that various contributors were already aware of.

### Study selection

We searched for studies relevant to our research questions, focusing on studies that provided explanations, reasons and background of research culture, rather than on consequences or assumptions. We included studies representing different disciplines and fields of study. Types of extracted evidence were also diverse and included quantitative and qualitative findings, as well as reviews and opinion pieces. We only included articles written in English. Several studies were problematic to access, but if abstracts contained relevant information we also included it to our database.

### Charting the data

During the search bibliometric information about articles was registered to the Zotero library. After search was completed the articles were cleared of duplicates and were re-checked for relevance and compliance with the inclusion criteria. Problematic or questionable studies were discussed with colleagues and were either removed or kept in our database depending on their relevance.

### Synthesising data

The extracted findings were recorded in a Google Spreadsheet. All articles were sorted by topics or aims related to our research questions. We also extracted the following information from articles: name, author, year of publication, type of evidence, subject area, area of focus (subtopics) and key findings. Some results related to several topics at the same time, so they were distributed into multiple subtopics. This visual distribution of findings made it easier to understand which areas of research culture are already covered and where the gaps are.

## Interviews

### Methodology

We conducted a series of semi-structured qualitative interviews about various aspects of research culture. It was done with researchers in various research disciplines and institutions across the natural and social sciences.

Participant recruitment was done through the global, professional connections of the authors of this report and the wider Octopus team. Interviewees were offered a small incentive for their participation worth GBP 25. We aimed to secure interviews with researchers across:

- Career stages
- Academic and non-academic contexts, such as industry or non-profit organisations
- Locations, including outside of the Global North
- Natural and social sciences
- Qualitative and quantitative research

As this study includes no inferential statistics, our sample sizes for the interviews were based on reaching enough representatives of various criteria (demographics, research disciplines, etc.) and on logistical considerations of time.

We scheduled 60-minute online calls with the participants, which were recorded and transcribed. The recordings were deleted once the transcriptions were complete with personally-identifying information removed. These transcripts were analysed by coding them around the topics covered in the interviews.

The interviews were structured with questions on the following topics on research culture:

- Division of labour
- Credit/attribution
- Critique
- Assessments
- Attitudes on open research practices (without referring to Octopus)

We interviewed 14 researchers across the criteria outlined above. While more than half of those interviewed were women, one limitation of our methodology was a lack of specific ways to achieve representation across diverse demographics, and should be improved upon for future work.

## Interview protocol

The following is the protocol and questions used during the semi-structured interviews:

| **Introduction** | |
|---|---|
| *Question* | *Prompts* |
| Housekeeping | Welcome participant and thank for their time.<br><br>Sound check (no need to do explicitly)<br><br>Explain how long interview will take and that they can stop/take a break at any time.<br><br>Establish procedure in case of connectivity issues (i.e. try to rejoin ASAP and resume interview when ready).<br><br>Any questions? |
| Ask consent to record | |
| ***start recording*** | |
| Introduce the aims of the study | to find out more about participant's views and experiences of:<br>a. research environment and culture - esp related to publishing/sharing<br>b. contributions to research projects – who does what, how are different parts valued and credited<br>c. how publication formats affect or interact with various aspects of research process |

| **Part 1: Distribution of labour** | |
|---|---|
| To start off with, could you tell me a bit about the nature of your work? | What is your field, and your specific research focus?<br><br>Other demographics - field, career stage, and geography:<br>“what kinds of data do you work with?”<br>“modalities of your work, lab based, field based, existing datasets, etc.?”<br><br>Try to keep it under 2 minutes - don’t let them get carried away! |
| Think about a typical project in your field. I’m interested to know about the division of labour.<br><br>Let’s start by first thinking about the different components, tasks, and skills involved in a project? Who does these? | |
| What does the distribution of tasks or contributions look like for a research project in your field (your lab) in terms of who does what, and how responsibilities are shared? | How many people might work on a project? How would they split the roles?<br><br>What parts (if any) of the research process tend to be done by a specialist?<br>1. Problem<br>2. Hypothesis / theoretical rationale<br>3. Protocol / method<br>4. Data / results<br>5. Analysis<br>6. Interpretation<br>7. Applications / impact<br><br>(if needed) How does your experience compare to others in your field? |
| For the next question I want you to consider this picture you’ve sketched out for me in terms of the division of labour - what parts of the research tend to be done by specialists or generalists. With that in mind, how do you feel about this division of labour? | Does it work well or poorly? In what ways?<br><br>What, if anything, would you change about it? |

| | |
|---|---|
| What parts of the research process do you think are most valued, in your field? | By 'valued', I mean considered by other people, organisations and systems to be important and worthy of time, effort, attention, prestige.<br><br>How can you tell these parts are valued?<br><br>How are the different parts perceived by outside systems? Open-ended first, allow ppt to come up with outside systems - then prompt for below if needed:<br>1. Research assessment systems (REF, promotion, funder-specific)<br>2. The current publishing system |
| We're also interested to hear what YOU value within the research process. What parts do you think are most (or least) important to get right (in order to create 'good' research)? | |

| **Part 2: Sharing** | |
|---|---|
| Thinking about the various parts of the research process -- I'm interested to know more about how, and when, and whether information about these various parts of the research process are shared, beyond the individual person or team working on it. I'm thinking of the term sharing very broadly, it doesn't have to be something formal.<br><br>What parts of the research process do researchers tend to share beyond their own research team? | Recap the parts ppt mentioned, or Octopus list if needed<br><br>Careful with phrasing - don't want to sound judgemental that people SHOULD be sharing.<br><br>Are papers the main way people share various aspects of the research process? |
| How are these parts each shared? | |
| With whom? (How widely?) | |

| | |
|---|---|
| Why do you think people in your field share those things? | (what's "right" vs "norm/required")<br>1. Dissemination - share knowledge<br>2. Credit - give creators credit/attribution<br>3. Transparency - gain credibility, show you have nothing to hide<br>4. Feedback - get input or insight from others<br>5. Storage |
| When? (and why then?) | |
| Which parts are most valuable to get feedback (constructive critique, input, scrutiny) on? | |
| How well do you think this current process of sharing works? | |

| **Part 3: Critique** | |
|---|---|
| I'd like to talk about the culture surrounding critique of others' work. In your experience, what are situations where you feel you could or couldn't critique others' work? What is this like for other researchers? | This could be, but is not limited to, peer review of papers. |
| Are there aspects of research work that you think are acceptable or not acceptable to critique? Why is this? | e.g. the method versus the data collection versus the research problem versus the analysis or interpretation versus the writing style versus the detail shared?<br><br>(Does it feel more constructive to critique a proposed method than a 'finished paper', for example? Or to review and comment on a dataset, knowing that the authors can act constructively on that review?) |

| **Part 4: Open research (Octopus) model** | |
|---|---|
| Imagine working in a very open way - making each part of your research work open/shared - to anyone in the world, at any point in the future. How do you feel about this? | What parts of that might you object to?<br><br>How do you think other researchers would feel about doing this? |

| **Part 5: Credit** | |
|---|---|
| In terms of giving people credit for the various contributions to the project, how does that tend to go? | |
| How do you feel about the current state of it? | Probe how much people care about giving credit for work |
| Why? | Encourage them to be honest - how do you FEEL about it? |

| **Part 6: Research Assessment** | |
|---|---|
| I would like to ask a bit about research assessment now - both formally, as in hiring and promotion, prizes/honours, the REF, assessment by funders, etc., but also informally (others judging quality of research in their own opinions).<br><br>In an ideal world, if someone is trying to assess the quality of a piece of research in your field, how would they go about doing that? What aspects would they need to consider/need to know? | Try to get them to think NOT in terms of a paper/narrative.<br><br>In an ideal world, how would one assess the quality of research? What aspects about the research are most important to consider? I.e., How could someone tell whether the work you did in your day job, on these various parts of the research, is 'good'? |
| Now, could I have you think about the current state of how research actually is assessed? | |

| | |
|---|---|
| What have your experiences with research assessment been like? | As in, when your own research has been assessed, or when you've assessed others.<br><br>Both formally and informally - and not just in terms of papers! |
| What are your views on the current state of assessing research quality? What is good or bad about it? | Do any parts of the research process get more focus than others during assessments? Which ones? Why is that? (Is that good?) |
| Have you encountered (or seen) any biases in assessing research quality? What kinds, if so? | Does anyone get more or less recognition than they deserve?<br><br>Prompt demographics, roles, fields, location, etc. if needed.<br><br>Remember this is about THEIR experiences/views, not generalities. |

| **Part 7: Participant's role** | |
|---|---|
| What are the things you feel are necessary for career progression (in terms of research)?<br>How do they match up with the things you feel are your strengths, or the things you want to be doing, as a researcher? | Focusing on the disparity between what you feel you COULD be bringing to science with your skills etc., and what you feel you have to do to progress.<br>Sometimes other things come up like teaching, etc., if so and if running out of time, could refocus them on research aspects. |

| **Closing** | |
|---|---|
| Is there anything that we haven't discussed that you'd like to talk about before the end of the interview? | |
| ***stop recording*** | |
| | Thank the participant for their time. Explain next steps (debrief, final consent etc)<br><br>Explain data management procedures (i.e. when will interview recordings be deleted, how will transcripts be anonymised etc)<br><br>Any questions?<br><br>Contact details for questions/concerns |

## Survey

We recruited participants mainly through our professional connections and professional organisations such as the **UK Reproducibility Network** (UKRN), via adverts sent by email to UKRN institutional leads to distribute within their institutions, and to representatives of funders or other stakeholders that are part of the UKRN stakeholder engagement group and cover the disciplines we seek to sample.

In addition, we sampled the first 2000 articles each from the Web of Science Social Science Citation Index (SSCI) and Science Citation Index Expanded (SCI-EXPANDED) during the six-month period between 23 July 2022 and 23 January 2023 (total 4000 articles). We then circulated this survey via email to the corresponding authors of those articles (approximately 3600 authors). The aim is to reach researchers outside of Europe across the natural and social sciences. This excludes, as we heard from respondents, many other research disciplines such as, but not limited to, the arts and humanities. Similar studies in the future should aim to achieve better representation across research fields.

By default, this survey did not collect any personally identifiable information. Participants could optionally provide their names and email addresses to be formally acknowledged in this report or a chance to win a prize worth GBP 25. This information was disassociated from the responses.

The survey was open from 17 January to 5 February 2023.

## Survey design

The finalised survey was implemented on **EUSurvey.** It is a fully open source online survey platform developed and administered by the European Commission, adhering to relevant privacy regulations (e.g. the **General Data Protection Regulation** (GDPR)).

Below is the structure and content of this survey, with numbered titles for each page, the questions they contain, and items for multiple choice questions. For multiple choice questions (except the one about research tasks), the order of answers are randomised for each respondent.

- Participant information and consent
- Information about you
    - In which field do you **primarily** conduct your research?
        - Agriculture
        - Anthropology
        - Archaeology
        - Astronomy
        - Biology
        - Business
        - Chemistry
        - Computer science
        - Data science
        - Earth science
        - Economics
        - Education
        - Engineering
        - Environmental science
        - Finance
        - Galleries, libraries, archives, and museums (GLAM)
        - Geography
        - Mathematics
        - Medicine and health
        - Physics
        - Political science
        - Psychology
        - Public policy
        - Sociology
        - Statistics
        - Other (please specify)

- **How long** would you say you have been conducting research in this field?
  - Less than 1 year
  - 1-3 years
  - 3-5 years
  - 5-10 years
  - More than 10 years
- **Where** in the world are you **primarily** based?
  - Africa
  - Antarctica
  - Asia
  - Australia
  - Europe
  - North America
  - Oceania
  - South America

- Feelings about research culture
  - **At what levels** do you feel the following aspects are present in your current research job?
    - Support from colleagues you work closely with
    - Support from the wider research community in your field
    - The worry about securing your next job or career advancement
    - Professional satisfaction you get from your research
    - Impact that your individual work has on your research field as a whole
    - Collaboration (e.g. between different groups) to tackle research challenges in your field
    - Confidence that you and your research are being judged fairly on the true quality of what you produce
- Causes of publication bias
  - Have you ever **conducted** any piece(s) of research in the past, large or small, but chose to **NOT** publish or share it/them publicly?
    - Yes
    - No

- (for those who answered yes) Which of the following factors prevented you from sharing or publishing this research?

  - It did not conform to established thinking (e.g. a "desired" result, etc.)
  - The findings did not make a clean “story”
  - I did not have confidence in the analysis/interpretation
  - It did not fit in a traditional peer-reviewed paper
  - There was not enough data
  - It did not have sufficient "impact"
  - It was not a "positive" or “desired” result
  - It would not help my career
  - It was rejected by peer reviewers and I did not/could not do the requested revisions
  - I did not have time/resources to write it up
  - I could not find an outlet that would publish work on this topic
  - I cannot think of an instance where I’ve done something I did not share publicly
  - Other (please specify)

- Causes preventing sharing research faster and earlier

  - **Imagine** you have a good research question and a plan to investigate it. Which of the following factors may prevent you from publishing or otherwise sharing your research question and plan at this stage (i.e. before there is any evidence to inform it)?

    - I wouldn't know where to publish or share this type of output
    - Fear of being "scooped" or plagiarised because I would want to collect the evidence myself and someone else might do so and then claim credit for the idea
    - There is no benefit to me and my career to publish something like this
    - This is not the way things are done in my field
    - I wouldn't expect useful feedback from readers or reviewers at this stage
    - It would not have enough "impact", so is not worth sharing
    - When evidence is collected it might not support the theory/hypothesis and I would have been shown to be ‘wrong’
    - I wouldn’t know to write up a publication like this
    - Other (please specify)

- Research specialisation
    - The following is a list of potential tasks involved in the research lifecycle. Think about them for a typical project you've been involved with. For each task, think about whether you typically: do it mostly on your own; do it mostly as a team; don't do it because someone else does it; or it is not applicable.
        - Defining the research problem or question
        - Finding out what is already known about the problem (e.g. reviewing literature)
        - Developing the theoretical rationale or hypothesis that would help address the research problem
        - Developing the methodology
        - Collecting data (qualitative)
        - Collecting data (quantitative)
        - Curating and cleaning data
        - Analysing results/data
        - Interpreting the analysis
        - Applying the results in a different context/implementing the findings
- Focus of research assessments
    - When your research outputs (i.e. your whole body of work) are being assessed as part of consideration for funding or career advancement, how much do you think the following factors influence that assessment?
        - Having "positive" instead of "negative" or "null" results
        - The "impact" of your research on the real world
        - The prestige of your institution
        - Your publication record (e.g. number of publications, citation metrics, etc.)
        - Personal connections that you have (e.g. knowing and collaborating with highly-regarded researchers)
        - Your personal characteristics (e.g. gender, ethnicity, language fluency, location, etc.)
        - The trendiness of your research topic(s)
        - The rigour of your research method(s)
        - How much you share your data, code, or other work publicly (i.e. open research practices)
        - Having research that confirms existing ideas rather than going against them or proposing new ones
- Platforms for sharing research outputs
    - Which of the following platforms are you aware of for publishing parts or all of your research?
        - Octopus.ac
        - FigShare

  - Video hosting platforms (e.g. YouTube, PeerTube, Vimeo, etc.)
  - Wikipedia
  - Institutional repositories
  - Specialist data repositories (e.g. ProteomeXchange, OpenNeuro, PubChem, PANGAEA, Qualitative Data Repository, etc.)
  - Peer Community In (PCI)
  - Multimedia repositories (e.g. Flickr, Internet Archive, Wikimedia Commons, etc.)
  - Zenodo
  - Registered reports (i.e. journal articles with pre-study peer review)
  - ResearchEquals
  - Github, Gitlab, Wikifactory, or similar service
  - Dryad
  - Protocols.io
  - Open Science Framework (OSF)
  - Research Ideas and Outcomes (RIO)

- Opt-in to acknowledgements and prize draw
  - Please indicate if you would like to be acknowledged by name in our report. This is strictly optional and your name will not be associated with your answers to this survey in any published outputs from our study. The name you provide here will be listed in the acknowledgements section under survey respondents.
    - Yes, I would like to be acknowledged by name
    - No, I do not want to be acknowledged by name
  - If you answered yes, please provide the name with which you want to be acknowledged
    - [text box for respondent's name]
  - Please let us know if you would like to enter a drawing for a prize worth GBP 25 as a token of our deep appreciation for your valuable time. This is strictly optional and your information will not be associated with your answers to this survey in any published outputs from our study.
    - Yes, I would like to enter the prize draw
    - No, I do not want to enter the prize draw
  - If you answered yes, please provide a reliable email address for contact
    - [text box for email]

## Concept map

The **Executive Summary** includes a high-level visualisation of the key issues (**Figure 1**), which is based on the following concept map of topics uncovered during the literature review, interviews, and survey (**Figure 12**).

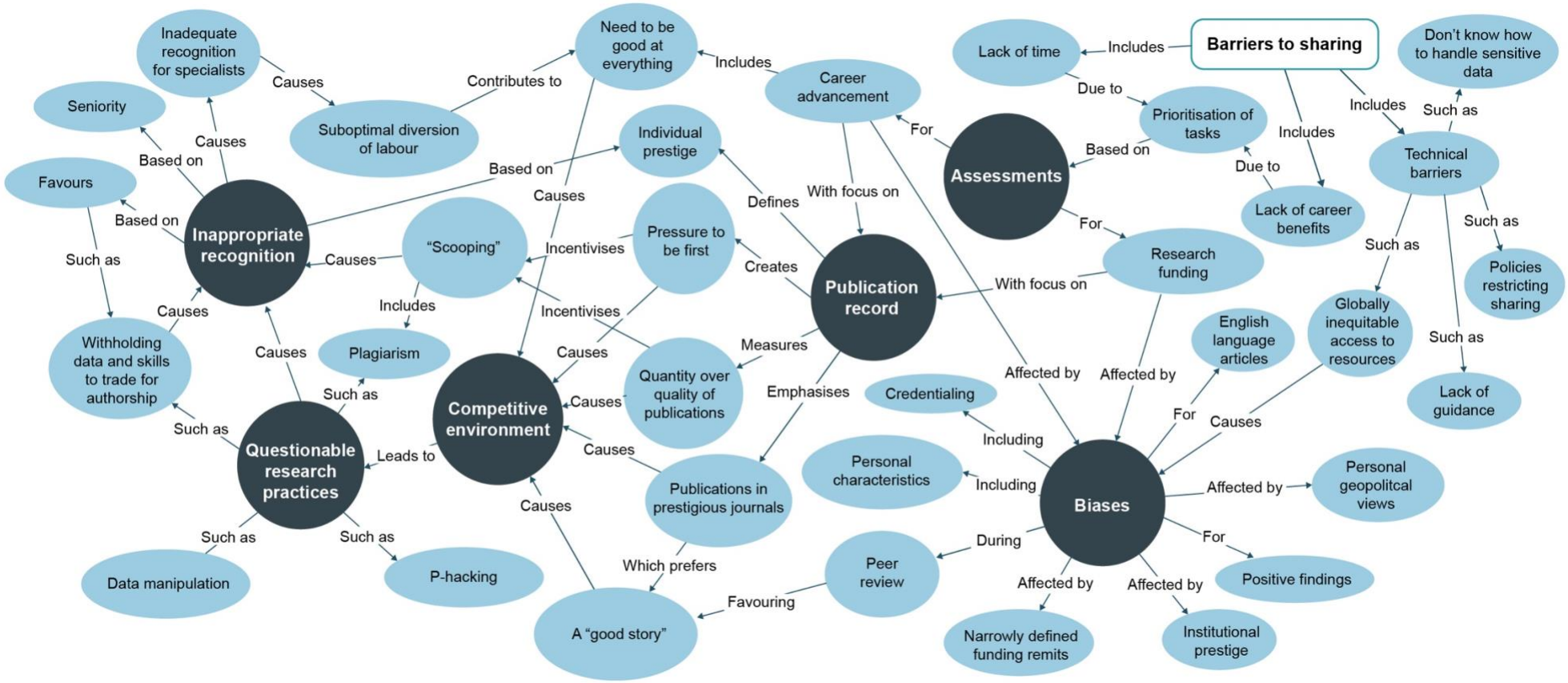


***Figure 12***. *Concept map of key topics uncovered through our literature review, interviews, and survey.*

## Positionality statements

**Pen-Yuan Hsing** has a PhD in biology, with highly multidisciplinary experience ranging from ecology and conservation, engineering, citizen science, to meta-research on open research best practices. Having developed and published relevant training material, online courses, books, and policy documents on the international level, Pen is a strong advocate for the idea that good research is open research. As someone who belongs to an ethnic minority group during their research career, Pen is particularly sensitive to issues of diversity related to geographical origin and language.

**Mariia Tukanova** has a BSc in sociology and social policy with experience in research on social policy and participating in international student exchange programs. Mariia brings a perspective to this evaluation from an earlier stage in their research career than the other authors.

**Alex Freeman** has a DPhil in biology, which she followed with a career in factual television and the media. She has spent the last 6.5 years working in an interdisciplinary group in academia on evidence communication (funded by the David & Claudia Harding Foundation) and here came up with the concept of Octopus. She is the sole Director of Octopus CIC which is a UK-registered not-for-profit company, from which she derives no salary. She does unpaid work advocating for and developing Octopus in collaboration with Jisc, and is also a strong believer in Open Science practices and research transparency. Octopus is currently funded by Research England, and has previously had awards from Mozilla, the Royal Society and an anonymous philanthropist.

**Marcus Munafò** has a PhD in health psychology, and has worked across a range of disciplines in the biomedical sciences (public health, primary care, clinical pharmacology, psychiatry, epidemiology). He is a proponent of open research and scholarship, and co-founded the UK Reproducibility Network, which receives funding from several major funders, including a Research England Development Fund award to promote open research practices. He is also co-director of the Tobacco and Alcohol Research Group (TARG), which is based within the School of Psychological Science at the University of Bristol, and a Programme Lead within the MRC Integrative Epidemiology Unit at the University of Bristol.

**Jackie Thompson** has a PhD in experimental psychology, followed by several years postdoctoral research experience in various sub-disciplines of psychology and meta-research. She has spent several years as an advocate for open research practices within psychology and academia more broadly, including working with the UK Reproducibility Network on several initiatives, mainly due to training researchers in open research practices.

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## References


Al-Halabi, B., Marwan, Y., Hasan, M., Alkhadhari, S., 2014. Extracurricular research activities among senior medical students in Kuwait: experiences, attitudes, and barriers. Adv. Med. Educ. Pract. 5, 95–101. **https://doi.org/10.2147/AMEP.S61413**

Bakker, C., Stephenson, C., Stephenson, E., Chaves, D., 2017. Public Funding and Open Access to Research: A Review of Canadian Multiple Sclerosis Research. J. Med. Internet Res. 19, e52. **https://doi.org/10.2196/jmir.6250**

Baldwin, J.R., Pingault, J.-B., Schoeler, T., Sallis, H.M., Munafò, M.R., 2022. Protecting against researcher bias in secondary data analysis: challenges and potential solutions. Eur. J. Epidemiol. 37, 1–10. **https://doi.org/10.1007/s10654-021-00839-0**

Ball, P., 2016. The mathematics of science's broken reward system. Nature. **https://doi.org/10.1038/nature.2016.20987**

Baltazar, C.S., Wheatley, C., Nsubuga, P., 2019. The challenges of getting the research published when English is not the first language: the example of Mozambique Field Epidemiology Training Program. Pan Afr. Med. J. 33, 208. **https://doi.org/10.11604/pamj.2019.33.208.18766**

Bennie, K.R., Koka, S., 2021. Leadership diversity in science: Women editors of dental journals are underrepresented compared to women editors of medical journals. J. Dent. 115, 103853. **https://doi.org/10.1016/j.jdent.2021.103853**

Bergkvist, L., 2020. Preregistration as a way to limit questionable research practice in advertising research. Int. J. Advert. 39, 1172–1180. **https://doi.org/10.1080/02650487.2020.1753441**

Bobby Lee Houtkoop, Chris Chambers, Malcolm Macleod, Dorothy V. M. Bishop, Thomas E. Nichols, Eric-Jan Wagenmakers, 2018. Data Sharing in Psychology: A Survey on Barriers and Preconditions. Adv. Methods Pract. Psychol. Sci. 1, **70–85. https://doi.org/10.1177/2515245917751886**

Bonn, N.A., Bouter, L., 2021. Research assessments should recognize responsible research practices — Narrative review of a lively debate and promising developments (preprint). MetaArXiv. **https://doi.org/10.31222/osf.io/82rmj**

Bouter, L.M., 2015. Commentary: Perverse incentives or rotten apples? Account. Res. 22, 148–161. **https://doi.org/10.1080/08989621.2014.950253**

Brant, J.M., Rassouli, M., 2018. A Global Perspective on Publishing in Oncology. Semin. Oncol. Nurs. 34, 402–408. **https://doi.org/10.1016/j.soncn.2018.09.009**

Brembs, B., 2018. Prestigious science journals struggle to reach even average reliability. Front. Hum. Neurosci. 12. **https://doi.org/10.3389/fnhum.2018.00037**

Busse, C., August, E., 2020. Addressing power imbalances in global health: Pre-Publication Support Services (PREPSS) for authors in low-income and middle-income countries. BMJ Glob. Health 5, e002323. **https://doi.org/10.1136/bmjgh-2020-002323**

Carbine, K.A., Lindsey, H.M., Rodeback, R.E., Larson, M.J., 2019. Quantifying evidential value and selective reporting in recent and 10-year past psychophysiological literature: A pre-registered P-curve analysis. Int. J. Psychophysiol. Off. J. Int. Organ. Psychophysiol. 142, 33–49. **https://doi.org/10.1016/j.ijpsycho.2019.06.004**

Cazap, E., Sullivan, R., Foxall, K., 2020. New journal authorship criteria: how ecancermedicalscience is supporting authors and readers from underserved settings. Ecancermedicalscience 14, ed106. **https://doi.org/10.3332/ecancer.2020.ed106**

Chawinga, W.D., Zinn, S., 2019. Global perspectives of research data sharing: A systematic literature review. Libr. Inf. Sci. Res. 41, 109–122. **https://doi.org/10.1016/j.lisr.2019.04.004**

Cheah, P.Y., Piasecki, J., 2022. Should peer reviewers be paid to review academic papers? The Lancet 399, 1601. **https://doi.org/10.1016/S0140-6736(21)02804-X**

Claartje J. Vinkenburg, Ossenkop, C., Schiffbaenker, H., 2021. Selling science: optimizing the research funding evaluation and decision process. Equal. Divers. Incl. Int. J. 41, 1–14. **https://doi.org/10.1108/EDI-01-2021-0028**

Cruz-Castro, L., Sanz-Menendez, L., 2021. What should be rewarded? Gender and evaluation criteria for tenure and promotion. J. Informetr. 15, 101196. **https://doi.org/10.1016/j.joi.2021.101196**

David B. Resnik, Christina Gutierrez-Ford, Shyamal Peddada, 2008. Perceptions of Ethical Problems with Scientific Journal Peer Review: An Exploratory Study. Sci. Eng. Ethics 14, 305–310. https://doi.org/10.1007/s11948-008-9059-4

Day, S., Rennie, S., Luo, D., Tucker, J.D., 2020. Open to the public: paywalls and the public rationale for open access medical research publishing. Res. Involv. Engagem. 6, 8. **https://doi.org/10.1186/s40900-020-0182-y**

Detweiler, B., Kollmorgen, L., Umberham, B., Hedin, R., Vassar, B., 2016. Risk of bias and methodological appraisal practices in systematic reviews published in anaesthetic journals: a meta-epidemiological study. Anaesthesia 71, 955–968. **https://doi.org/10.1111/anae.13520**

Ding, D., Nguyen, B., Gebel, K., Bauman, A., Bero, L., 2020. Duplicate and salami publication: a prevalence study of journal policies. Int. J. Epidemiol. 49, 281–288. **https://doi.org/10.1093/ije/dyz187**

Diong, J., Butler, A.A., Gandevia, S.C., Héroux, M.E., 2018. Poor statistical reporting, inadequate data presentation and spin persist despite editorial advice. PLOS ONE 13, e0202121. **https://doi.org/10.1371/journal.pone.0202121**

D'Souza, B., Kulkarni, S., Cerejo, C., 2018. Authors' perspectives on academic publishing: initial observations from a largescale global survey. Sci. Ed. 5, 39–43. **https://doi.org/10.6087/kcse.116**

Duracinsky, M., Lalanne, C., Rous, L., Dara, A.F., Baudoin, L., Pellet, C., Descamps, A., Péretz, F., Chassany, O., 2017. Barriers to publishing in biomedical journals perceived by a sample of French researchers: results of the DIAzePAM study. BMC Med. Res. Methodol. 17, 96. **https://doi.org/10.1186/s12874-017-0371-z**

Duyx, B., Urlings, M.J.E., Swaen, G.M.H., Bouter, L.M., Zeegers, M.P., 2017. Scientific citations favor positive results: a systematic review and meta-analysis. J. Clin. Epidemiol. 88, 92–101. **https://doi.org/10.1016/j.jclinepi.2017.06.002**

Editage Insights. 2018. Author Perspectives on Academic Publishing: Global Survey Report 2018. Cactus Communications. **https://www.editage.com/assets/files/english/guidelinks/editage-global-author-survey.pdf**

Editors and WHO November 2003 Group, 2004. Galvanising mental health research in low- and middle-income countries: Role of scientific journals | SpringerLink. Ann. Gen. Hosp. Psychiatry 3. **https://doi.org/10.1186/1475-2832-3-5**

Edwards, M.A., Roy, S., 2017. Academic research in the 21st century: Maintaining scientific integrity in a climate of perverse incentives and hypercompetition. Environ. Eng. Sci. 34, 51–61. **https://doi.org/10.1089/ees.2016.0223**

Eisen, J.A., MacCallum, C.J., Neylon, C., 2013. Expert failure: Re-evaluating research assessment. PLOS Biol. 11, e1001677. **https://doi.org/10.1371/journal.pbio.1001677**

Ekmekci, P.E., 2017. An increasing problem in publication ethics: Publication bias and editors' role in avoiding it. Med. Health Care Philos. 20, 171–178. **https://doi.org/10.1007/s11019-017-9767-0**

Eyre-Walker, A., Stoletzki, N., 2013. The assessment of science: The relative merits of post-publication review, the impact factor, and the number of citations. PLOS Biol. 11, e1001675. **https://doi.org/10.1371/journal.pbio.1001675**

Fanelli, D., 2009. How Many Scientists Fabricate and Falsify Research? A Systematic Review and Meta-Analysis of Survey Data. PLOS ONE 4, e5738. **https://doi.org/10.1371/journal.pone.0005738**

Fanelli, D., Costas, R., Larivière, V., 2015. Misconduct Policies, Academic Culture and Career Stage, Not Gender or Pressures to Publish, Affect Scientific Integrity. PLOS ONE 10, e0127556. **https://doi.org/10.1371/journal.pone.0127556**

Fidler, F., Chee, Y.E., Wintle, B.C., Burgman, M.A., McCarthy, M.A., Gordon, A., 2017. Metaresearch for Evaluating Reproducibility in Ecology and Evolution. Bioscience 67, 282–289. **https://doi.org/10.1093/biosci/biw159**

Fong, E.A., Wilhite, A.W., 2017. Authorship and citation manipulation in academic research. PLOS ONE 12, e0187394. **https://doi.org/10.1371/journal.pone.0187394**

Fox, C.W., Burns, C.S., Meyer, J.A., 2015. Editor and reviewer gender influence the peer review process but not peer review outcomes at an ecology journal. Funct. Ecol. **https://doi.org/10.1111/1365-2435.12529**

Fraser, H., Parker, T., Nakagawa, S., Barnett, A., Fidler, F., 2018. Questionable research practices in ecology and evolution. PLOS ONE 13, e0200303. **https://doi.org/10.1371/journal.pone.0200303**

Fuller, R.A., Lee, J.R., Watson, J.E.M., 2014. Achieving open access to conservation science: Open access to conservation science. Conserv. Biol. 28, 1550–1557. **https://doi.org/10.1111/cobi.12346**

Gentemann, C., Erdmann, C., Kroeger, C., 2022. Opening up to open science. Issues Sci. Technol. 38, 57–59.

Gerrits, R.G., Mulyanto, J., Wammes, J.D., van den Berg, M.J., Klazinga, N.S. and Kringos, D.S., 2020. Individual, institutional, and scientific environment factors associated with questionable research practices in the reporting of messages and conclusions in scientific health services research publications. BMC Health Serv Res, *20*, pp.1-11. **https://doi.org/10.1186/s12913-020-05624-5**

Gibelman, M., Gelman, S., 2005. Scientific Misconduct in Social Welfare Research: Preventive Lessons from Other Fields. Soc. WORK Educ. 24, 275–295. **https://doi.org/10.1080/02615470500050461**

Gøtzsche, P.C., 2022. Citation bias: questionable research practice or scientific misconduct?. J. of the Roy. Soc. of Med., *115*(1), pp.31-35 **https://doi.org/10.1177/01410768221075881**

Gopalakrishna, G., Ter Riet, G., Vink, G., Stoop, I., Wicherts, J.M., Bouter, L.M., 2022. Prevalence of questionable research practices, research misconduct and their potential explanatory factors: A survey among academic researchers in The Netherlands. PloS One 17, e0263023. **https://doi.org/10.1371/journal.pone.0263023**

Gunthe, S.S., Gettu, R., 2022. A new index for assessing faculty research performance in higher educational institutions of emerging economies such as India. Scientometrics 127, 4959–4976. **https://doi.org/10.1007/s11192-022-04460-0**

Haeussler, C., Sauermann, H., 2020. Division of labor in collaborative knowledge production: The role of team size and interdisciplinarity. Res. Policy 49, 103987. **https://doi.org/10.1016/j.respol.2020.103987**

Hagan, A.K., Topçuoğlu, B.D., Gregory, M.E., Barton, H.A., Schloss, P.D., 2020. Women Are Underrepresented and Receive Differential Outcomes at ASM Journals: a Six-Year Retrospective Analysis. mBio 11, e01680-20. **https://doi.org/10.1128/mBio.01680-20**

Herbert, D.L., Barnett, A.G., Clarke, P. and Graves, N., 2013. On the time spent preparing grant proposals: an observational study of Australian researchers. *BMJ open*, *3*(5), p.e002800. **https://doi.org/10.1136/bmjopen-2013-002800**

Houtkoop, B.L., Chambers, C., Macleod, M., Bishop, D.V., Nichols, T.E. and Wagenmakers, E.J., 2018. Data sharing in psychology: A survey on barriers and preconditions. *Advances in methods and practices in psychological science*, *1*(1), pp.70-85. **https://doi.org/10.1177/2515245917751886**

Hrynaszkiewicz, I., Cockerill, M.J., 2012. Open by default: a proposed copyright license and waiver agreement for open access research and data in peer-reviewed journals. BMC Res. Notes 5, 494. **https://doi.org/10.1186/1756-0500-5-494**

Huistra, P., Paul, H., 2022. Systemic explanations of scientific misconduct: Provoked by spectacular cases of norm violation? J. Acad. Ethics 20, 51–65. **https://doi.org/10.1007/s10805-020-09389-8**

Ioannidis, J.P., Munafò, M.R., Fusar-Poli, P., Nosek, B.A. and David, S.P., 2014. Publication and other reporting biases in cognitive sciences: detection, prevalence, and prevention. *Trends in cognitive sciences*, *18*(5), pp.235-241. **https://doi.org/10.1016/j.tics.2014.02.010**

Jain, V.K., Iyengar, K.P., Vaishya, R., 2021. Article processing charge may be a barrier to publishing. J. Clin. Orthop. Trauma 14, 14–16. **https://doi.org/10.1016/j.jcot.2020.10.039**

Jannot, A.-S., Agoritsas, T., Gayet-Ageron, A., Perneger, T.V., 2013. Citation bias favoring statistically significant studies was present in medical research. J. Clin. Epidemiol. 66, 296–301. **https://doi.org/10.1016/j.jclinepi.2012.09.015**

Jelte M. Wicherts, Kievit, R.A., Bakker, M., Borsboom, D., 2012. Letting the daylight in: Reviewing the reviewers and other ways to maximize transparency in science. Front. Comput. Neurosci. 6, 20. **https://doi.org/10.3389/fncom.2012.00020**

Johnson, M.A., Mulvey, H., Parambath, A., Anari, J.B., Wall, L.B., Shah, A.S., 2021. A Gender Gap in Publishing? Understanding the Glass Ceiling in Pediatric Orthopaedic Surgery. J. Pediatr. Orthop. **https://doi.org/10.1097/BPO.0000000000001843**

Julpisit, A., Esichaikul, V., 2019. A collaborative system to improve knowledge sharing in scientific research projects. Inf. Dev. 35, 624–638. **https://doi.org/10.1177/0266666918779240**

Kiri, B., Lacetera, N., Zirulia, L., 2018. Above a swamp: A theory of high-quality scientific production. Res. Policy 47, 827–839. **https://doi.org/10.1016/j.respol.2018.01.011**

Kortlever, J.T., Tran, T.T., Ring, D. and Menendez, M.E., 2019. The growth of poorly cited articles in peer-reviewed orthopaedic journals. Clin Orthop Relat Res, *477*(7), p.1727. **https://doi.org/10.1097/CORR.0000000000000727**

Köster, M., Moors, A., De Houwer, J., Ross-Hellauer, T., Van Nieuwerburgh, I., Verbruggen, F., 2021. Behavioral Reluctance in Adopting Open Access Publishing: Insights From a Goal-Directed Perspective. Front. Psychol. 12, 649915. **https://doi.org/10.3389/fpsyg.2021.649915**

Ksenija Zečević, Catherine Houghton, Chris Noone, Hopin Lee, Karen Matvienko-Sikar, Elaine Toomey, 2021. Exploring factors that influence the practice of Open Science by early career health researchers: a mixed methods study. HRB Open Res. **https://doi.org/10.12688%2Fhrbopenres.13119.2**

Kuballa, S., Schulze, M., Mielke, C., Gefeller, O., Haux, R., 2017. On Incentives for Open Access Publishing: A Survey at IMIA's Annual General Assembly During HEC2016. Stud. Health Technol. Inform. 245, 901–904.

Laitin, D.D., Miguel, E., Alrababa'h, A., Bogdanoski, A., Grant, S., Hoeberling, K., Hyunjung Mo, C., Moore, D.A., Vazire, S., Weinstein, J., Williamson, S., 2021. Reporting all results efficiently: A RARE proposal to open up the file drawer. Proc. Natl. Acad. Sci. U. S. A. 118, e2106178118. **https://doi.org/10.1073/pnas.2106178118**

Lam, K., Langer-Gould, A., 2021. Open Access Fees: A Barrier to Scholarly Activity Among Neurology Trainees. Perm. J. 25. **https://doi.org/10.7812/TPP/21.041**

Larivière, V., Haustein, S., Mongeon, P., 2015. The oligopoly of academic publishers in the digital era. PLOS ONE 10, e0127502. **https://doi.org/10.1371/journal.pone.0127502**

Larivière, V., Pontille, D., Sugimoto, C.R., 2021. Investigating the division of scientific labor using the Contributor Roles Taxonomy (CRediT). Quant. Sci. Stud. 2, 111–128. **https://doi.org/10.1162/qss_a_00097**

Lawrence, P.A., 2007. The mismeasurement of science. Curr. Biol. 17, R583–R585. **https://doi.org/10.1016/j.cub.2007.06.014**

Lee, Y.-N., Walsh, J.P., Wang, J., 2015. Creativity in scientific teams: Unpacking novelty and impact. Res. Policy 44, 684–697. **https://doi.org/10.1016/j.respol.2014.10.007**

Liu, X., Guo, Z., Lin, Z., Ma, J., 2013. A local social network approach for research management. Decis. Support Syst. 56, 427–438.

Lu, C., Zhang, Y., Ahn, Y.Y., Ding, Y., Zhang, C. and Ma, D., 2020. Co-contributorship network and division of labor in individual scientific collaborations. *Journal of the Association for Information Science and Technology*, *71*(10), 1162-1178. **https://doi.org/10.1002/asi.24321**

Mark S. Nestor, Fischer, D.L., Arnold, D., Berman, B., Del Rosso, J.Q., 2020. Rethinking the Journal Impact Factor and Publishing in the Digital Age. J. Clin. Aesthetic Dermatol. 13, 12–17.

Matheka, D.M., Nderitu, J., Mutonga, D., Otiti, M.I., Siegel, K., Demaio, A.R., 2014. Open access: academic publishing and its implications for knowledge equity in Kenya. Glob. Health 10, 26. **https://doi.org/10.1186/1744-8603-10-26**

Mauthner, N.S., Doucet, A., 2008. Knowledge Once Divided Can Be Hard to Put Together Again' An Epistemological Critique of Collaborative and Team-Based Research Practices. Sociology 42, 971–985. **https://doi.org/10.1177/0038038508094574**

McCann, T.V., Polacsek, M., 2018. False gold: Safely navigating open access publishing to avoid predatory publishers and journals. J. Adv. Nurs. 74, 809–817. **https://doi.org/10.1111/jan.13483**

Metcalfe, J., Wheat, K., Munafò, M., Parry, J., 2020. Research integrity: a landscape study. Annex B - Quantitative Data Summary.

Misra, B., 2016. Ten 'Personal' Reasons why I am skeptical about Open Access (OA): Thoughts of an Individual Researcher. The Winnower. **https://doi.org/10.15200/winn.145789.92186**

Morales, E., McKiernan, E.C., Niles, M.T., Schimanski, L., Alperin, J.P., 2021. How faculty define quality, prestige, and impact of academic journals. PLOS ONE 16, e0257340. **https://doi.org/10.1371/journal.pone.0257340**

Moran, C., Richard, A., Wilson, K., Twomey, R., Coroiu, A., 2022. I know it's bad, but I have been pressured into it: Questionable research practices among psychology students in Canada. Can. Psychol. Can. **https://doi.org/10.1037/cap0000326**

Moustafa, K., 2022. No to paid peer review. The Lancet 400, 160. **https://doi.org/10.1016/S0140-6736(22)01057-1**

Mozersky, J., McIntosh, T., Walsh, H.A., Parsons, M.V., Goodman, M., DuBois, J.M., 2021. Barriers and facilitators to qualitative data sharing in the United States: A survey of qualitative researchers. PloS One 16, e0261719. **https://doi.org/10.1371/journal.pone.0261719**

Naik, G., 2017. Peer-review activists push psychology journals towards open data. Nature. **https://doi.org/10.1038/nature.2017.21549**

Nestor, M.S, Fischer, D.L., Arnold, D., Berman, B., Del Rosso, J.Q.. 2020. Rethinking the journal impact factor and publishing in the digital age. J Clin Aesthet Dermatol 13(1), 12–17. **http://www.ncbi.nlm.nih.gov/pmc/articles/pmc7028381/**

Nicholas, D., Watkinson, A., Boukacem-Zeghmouri, C., Rodríguez-Bravo, B., Xu, J., Abrizah, A., Świgoń, M., Herman, E., 2017. Early career researchers: Scholarly behaviour and the prospect of change. Learn. Publ. 30, 157–166. **https://doi.org/10.1002/leap.1098**

Nissen, S.B., Magidson, T., Gross, K., Bergstrom, C.T., 2016. Publication bias and the canonization of false facts. eLife 5, e21451. **https://doi.org/10.7554/eLife.21451**

Nosek, B.A., Spies, J.R., Motyl, M., 2012. Scientific utopia II. Restructuring incentives and practices to promote truth over publishability. Perspect. Psychol. Sci. 7, 615–631. **https://doi.org/10.1177/1745691612459058**

Nyamai, L.A., Jin, Y.-P., Mathew, D.J., Dharia, R.S., Trope, G.E., Buys, Y.M., 2020. The cost of publishing in an indexed ophthalmology journal in 2019. Can. J. Ophthalmol. J. Can. Ophtalmol. 55, 518–523. **https://doi.org/10.1016/j.jcjo.2020.06.023**

O'Hanlon, R., McSweeney, J., Stabler, S., 2020. Publishing habits and perceptions of open access publishing and public access amongst clinical and research fellows. J. Med. Libr. Assoc. JMLA 108, 47–58. **https://doi.org/10.5195/jmla.2020.751**

O'Kelly, F., Fernandez, N., Koyle, M.A., 2019. Predatory publishing or a lack of peer review transparency?-a contemporary analysis of indexed open and non-open access articles in paediatric urology. J. Pediatr. Urol. 15, 159.e1-159.e7. **https://doi.org/10.1016/j.jpurol.2018.08.019**

Open Science Collaboration, 2015. PSYCHOLOGY. Estimating the reproducibility of psychological science. Science 349, aac4716. **https://doi.org/10.1126/science.aac4716**

Perezgonzalez, J., Frias-Navarro, D., Monterde-i-Bort, H., Pascual-Llobell, J., 2021. Spanish Scientists' Opinion about Science and Researcher Behavior. Span. J. Psychol. 24. **https://doi.org/10.1017/SJP.2020.59**

Publons, 2018. 2018 global state of peer review. **https://doi.org/10.14322/publons.GSPR2018**

Rees, C.A., Lukolyo, H., Keating, E.M., Dearden, K.A., Luboga, S.A., Schutze, G.E., Kazembe, P.N., 2017. Authorship in paediatric research conducted in low- and middle-income countries: parity or parasitism? Trop. Med. Int. Health TM IH 22, 1362–1370. **https://doi.org/10.1111/tmi.12966**

Rees, C.A., Keating, E.M., Dearden, K.A., Haq, H., Robison, J.A., Kazembe, P.N., Bourgeois, F.T., Niescierenko, M., 2019. Importance of authorship and inappropriate authorship assignment in paediatric research in low- and middle-income countries. Trop. Med. Int. Health TM IH 24, 1229–1242. **https://doi.org/10.1111/tmi.13295**

Reinie G Gerrits, Mulyanto, J., Wammes, J.D., van den Berg, M.J., Klazinga, N.S., Kringos, D.S., 2020. Individual, institutional, and scientific environment factors associated with questionable research practices in the reporting of messages and conclusions in scientific health services research publications. BMC Health Serv. Res. 20, 1–11. **https://doi.org/10.1186/s12913-020-05624-5**

Resnik, D.B., Gutierrez-Ford, C., SPeddada, S., 2008. Perceptions of Ethical Problems with Scientific Journal Peer Review: An Exploratory Study. Sci. Eng. Ethics 14, 305–310 **https://doi.org/10.1007/s11948-008-9059-4**

Rousseau, S., Rousseau, R., 2021. Bibliometric techniques and their use in business and economics research. J. Econ. Surv. 35, 1428–1451. **https://doi.org/10.1111/joes.12415**

Rupp, M., Anastasopoulou, L., Wintermeyer, E., Malhaan, D., El Khassawna, T., Heiss, C., 2019. Predatory journals: a major threat in orthopaedic research. Int. Orthop. 43, 509–517. **https://doi.org/10.1007/s00264-018-4179-1**

Schoot, R.V.D., Winter, S.D., Griffioen, E., Grimmelikhuijsen, S., Arts, I., Veen, D., Grandfield, E.M., Tummers, L.G., 2021. The use of questionable research practices to survive in academia examined with expert elicitation, prior-data conflicts, Bayes factors for replication effects, and the Bayes truth serum. Front. Psychol. 12. **https://doi.org/10.3389/fpsyg.2021.621547**

Schroter, S., Tite, L., Smith, R., 2005. Perceptions of open access publishing: interviews with journal authors. BMJ 330, 756. **https://doi.org/10.1136/bmj.38359.695220.82**

Schweitzer, B., Schulz, J.B., 2018. Open Science Badges in the Journal of Neurochemistry. J. Neurochem. 147, 132–136. **https://doi.org/10.1111/jnc.14536**

Severin, A., Egger, M., Eve, M.P., Hürlimann, D., 2018. Discipline-specific open access publishing practices and barriers to change: an evidence-based review. F1000Research 7, 1925. **https://doi.org/10.12688/f1000research.17328.2**

Sharma, H., Verma, S., 2018. Predatory journals: The rise of worthless biomedical science. J. Postgrad. Med. 64, 226–231. **https://doi.org/10.4103/jpgm.JPGM_347_18**

Silberzahn, R., Uhlmann, E.L., Martin, D.P., Anselmi, P., Aust, F., Awtrey, E., Bahník, Š., Bai, F., Bannard, C., Bonnier, E., Carlsson, R., Cheung, F., Christensen, G., Clay, R., Craig, M.A., Dalla Rosa, A., Dam, L., Evans, M.H., Flores Cervantes, I., Fong, N., Gamez-Djokic, M., Glenz, A., Gordon-McKeon, S., Heaton, T.J., Hederos, K., Heene, M., Hofelich Mohr, A.J., Högden, F., Hui, K., Johannesson, M., Kalodimos, J., Kaszubowski, E., Kennedy, D.M., Lei, R., Lindsay, T.A., Liverani, S., Madan, C.R., Molden, D., Molleman, E., Morey, R.D., Mulder, L.B., Nijstad, B.R., Pope, N.G., Pope, B., Prenoveau, J.M., Rink, F., Robusto, E., Roderique, H., Sandberg, A., Schlüter, E., Schönbrodt, F.D., Sherman, M.F., Sommer, S.A., Sotak, K., Spain, S., Spörlein, C., Stafford, T., Stefanutti, L., Tauber, S., Ullrich, J., Vianello, M., Wagenmakers, E.-J., Witkowiak, M., Yoon, S., Nosek, B.A., 2018. Many analysts, one data set: Making transparent how variations in analytic choices affect results. Adv. Methods Pract. Psychol. Sci. 1, 337–356. **https://doi.org/10.1177/2515245917747646**

Siler, K., Haustein, S., Smith, E., Larivière, V., Alperin, J.P., 2018. Authorial and institutional stratification in open access publishing: the case of global health research. PeerJ 6, e4269. **https://doi.org/10.7717/peerj.4269**

Siler, K., Lee, K., Bero, L., 2015. Measuring the effectiveness of scientific gatekeeping. Proc. Natl. Acad. Sci. 112, 360–365. **https://doi.org/10.1073/pnas.1418218112**

Sing, D.C., Jain, D., Ouyang, D., 2017. Gender trends in authorship of spine-related academic literature-a 39-year perspective. Spine J. Off. J. North Am. Spine Soc. 17, 1749–1754. **https://doi.org/10.1016/j.spinee.2017.06.041**

Singh, M., Prasad, C.P., Shankar, A., 2021. Publication Charges Associated with Quality Open Access (OA) Publishing and Its Impact on Low Middle Income Countries (LMICs), Time to Reframe Research Policies. Asian Pac. J. Cancer Prev. APJCP 22, 2743–2747. **https://doi.org/10.31557/APJCP.2021.22.9.2743**

Smaldino, P.A., Turner, M.A., Contreras Kallens, P.A., 2019. Open science and modified funding lotteries can impede the natural selection of bad science. R. Soc. Open Sci. 6, 190194. **https://doi.org/10.1098/rsos.190194**

Solaja, O., Skinner, T.A.A., Mcgregor, T.B., Siemens, D.R., 2018. CanMEDS scholars: A national survey on urology residents' attitudes towards research during training. Can. Urol. Assoc. J. J. Assoc. Urol. Can. 12, E191–E196. **https://doi.org/10.5489/cuaj.4927**

Spanager, L., Danielsen, A.K., Pommergaard, H.-C., Burcharth, J., Rosenberg, J., 2013. A feeling of flow: exploring junior scientists' experiences with dictation of scientific articles. BMC Med. Educ. 13, 106. **https://doi.org/10.1186/1472-6920-13-106**

Stanley, T.D., Doucouliagos, H., Ioannidis, J.P.A., 2022. Retrospective median power, false positive meta-analysis and large-scale replication. Res. Synth. Methods 13, 88–108. **https://doi.org/10.1002/jrsm.1529**

Stevens, E.R., Shelley, D., Boden-Albala, B., 2021. Barriers to engagement in implementation science research: a national survey. Transl. Behav. Med. 11, 408–418. **https://doi.org/10.1093/tbm/ibz193**

Stewart, D., Paudyal, V., Cadogan, C., Hazen, A., Okuyan, B., Lutters, M., Henman, M., Fialová, D., 2020. A survey of the European Society of Clinical Pharmacy members' research involvement, and associated enablers and barriers. Int. J. Clin. Pharm. 42, 1073–1087. **https://doi.org/10.1007/s11096-020-01054-9**

Stieglitz, S., Wilms, K., Mirbabaie, M., Hofeditz, L., Brenger, B., López, A., Rehwald, S., 2020. When are researchers willing to share their data? - Impacts of values and uncertainty on open data in academia. PloS One 15, e0234172. **https://doi.org/10.1371/journal.pone.0234172**

Strømme, C.B., Lane, A.K., Halbritter, A.H., Law, E., Nater, C.R., Nilsen, E.B., Boutouli, G.D., Egelkraut, D.D., Telford, R.J., Vandvik, V., Cotner, S.H., 2022. Close to open—Factors that hinder and promote open science in ecology research and education. **https://doi.org/10.1371/journal.pone.0278339**

Toews, I., Booth, A., Berg, R.C., Lewin, S., Glenton, C., Munthe-Kaas, H.M., Noyes, J., Schroter, S., Meerpohl, J.J., 2017. Further exploration of dissemination bias in qualitative research required to facilitate assessment within qualitative evidence syntheses. J. Clin. Epidemiol. 88, 133–139. **https://doi.org/10.1016/j.jclinepi.2017.04.010**

Turk, T., Al Saadi, T., Alkhatib, M., Hanafi, I., Alahdab, F., Firwana, B., Koudsi, M., Al-Moujahed, A., 2018. Attitudes, barriers, and practices toward research and publication among medical students at the University of Damascus, Syria. Avicenna J. Med. 8, 24–33. **https://doi.org/10.4103/ajm.AJM_116_17**

Upthegrove, R., de Cates, A., Shuttleworth, A., Tracy, D.K., Broome, M.R., Lingford-Hughes, A., 2021. Gender equality in academic publishing: action from the BJPsych. Br. J. Psychiatry J. Ment. Sci. 218, 128–130. **https://doi.org/10.1192/bjp.2020.192**

Urlings, M.J.E., Duyx, B., Swaen, G.M.H., Bouter, L.M., Zeegers, M.P., 2021. Citation bias and other determinants of citation in biomedical research: findings from six citation networks. J. Clin. Epidemiol. 132, 71–78. **https://doi.org/10.1016/j.jclinepi.2020.11.019**

Vervoort, D., Ma, X. and Bookholane, H., 2021. Equitable open access publishing: changing the financial power dynamics in academia. Glob. Health Sci. Pract., 9(4), pp.733-736. **https://doi.org/10.9745/GHSP-D-21-00145**

Watkinson, C., Welzenbach, R., Hellman, E., Gatti, R. and Sonnenberg, K., 2017. Mapping the free ebook supply chain: Final report to the Andrew W. Mellon Foundation. **https://hdl.handle.net/2027.42/137638**

Werner, M.U. 2021. Salami-slicing and duplicate publication: gatekeepers challenges. Scand. J. Pain 21, 209–211. **https://doi.org/10.1515/sjpain-2020-0181**

Wicherts, J.M., Kievit, R.A., Bakker, M. and Borsboom, D., 2012. Letting the daylight in: reviewing the reviewers and other ways to maximize transparency in science. Front Comput Neurosci, *6*, p.20. **https://doi.org/10.3389/fncom.2012.00020**

Wolfe, J. and Alexander, K.P., 2005. The computer expert in mixed-gendered collaborative writing groups. J. Bus. Tech. Commun., *19*(2), pp.135-170. **https://doi.org/10.1177/1050651904272978**

Wolff, W., Baumann, L. and Englert, C., 2018. Self-reports from behind the scenes: Questionable research practices and rates of replication in ego depletion research. PLoS One, *13*(6), p.e0199554. **https://doi.org/10.1371/journal.pone.0199554**

Woodzicka, J.A., Ford, T.E., Caudill, A. and Ohanmamooreni, A., 2015. A successful model of collaborative undergraduate research: A multi-faculty, multi-project, multi-institution team approach. Teaching of Psych., *42*(1), pp.60-63. **https://doi.org/10.1177/0098628314549711**

Yarris, L.M., Juve, A.M., Artino Jr, A.R., Sullivan, G.M., Rougas, S., Joyce, B. and Eva, K., 2014. Expertise, time, money, mentoring, and reward: systemic barriers that limit education researcher productivity—proceedings from the AAMC GEA workshop. J Grad Med Educ, *6*(3), pp.430-436. **https://doi.org/10.4300/JGME-D-14-00340.1**

Zečević, K., Houghton, C., Noone, C., Lee, H., Matvienko-Sikar, K., Toomey, E., 2021. Exploring factors that influence the practice of Open Science by early career health researchers: a mixed methods study. HRB Open Res. **https://doi.org/10.12688%2Fhrbopenres.13119.2**

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