How can we overcome the barriers to researchers producing high quality, open research?

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Publication Type: Research Problem

Publication Date: 25th October 2023

Language: EN

License Type: CC BY 4.0

DOI: 10.57874/axc8-vs07

In addition to the known barriers to sharing research work openly (see https://doi.org/10.57874/7d3t-kv62), there is evidence for pressures that affect the *quality* of the research too, such as questionable research practices (QRPs), biases in research selection and assessment, and anti-collaborative practices.

Factors leading to QRPs

Quantity oriented environment and pressure to publish

One of the biggest underlying factors related to Questionable Research Practices is the so-called 'publish or perish' culture. A survey by Schoot et. al. (2021) emphasised that the modern research culture is quantity rather than quality oriented - a point supported by arguments from several previous reviews (Ball, 2016; Ding et al., 2020; Nosek et al., 2012; Schoot et al., 2021; Vuong, 2019; Werner, 2021). When academics are rewarded for the number of publications it "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). The pressure to publish high quantities 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 for positive findings

DOI: <u>10.57874/axc8-vs07</u>

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). 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

A systematic review and meta-analysis by Fanelli (2009) 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 have 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 the funding 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).

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

Several reviews and commentaries (Bouter, 2015; Ding et al., 2020; Kiri et al., 2018) mention that scientists committed misconduct for two reasons. The first is confusion in definitions of "good" and "bad" practices. The second is existing gaps in policies and regulations that allow the use of QRPs with low risk of consequences.

Factors leading to publication bias

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'Positive' versus 'negative' findings

Multiple studies have demonstrated that 'positive' research findings are favoured in the literature, with statistically nonsignificant results being less likely to be published (Fidler et al., 2017; Fong and Wilhite, 2017; Vuong, 2019). Several studies have also 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 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; loannidis 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 et al. (2016), publication bias is so strong in the current research climate that a significant part of scientific literature does not present negative results at all. 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) concluded that there is no difference between the proportion of poorly cited articles in subscription-based and open access (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 because 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 has been noted in literature is 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.

Factors leading to bias in the assessment of research quality

Demographic biases

Gender bias in research assessment has been identified by many studies. Cruz- Castro and Sanz-Menendez (2021), Fox et al. (2015), Johnson et al. (2021), Morales et al. (2021), and 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 (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 (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 early career researchers (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. The current research culture prioritises English 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 readership 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 under-representation of reviewers from low-middle income countries (LMIC). 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). Same tendency appeared in a survey by Publons (2018) that has evidence that reviewers from low-middle income countries 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; Siler et al., 2015; Wicherts et al., 2012) 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.

Anti-collaborative practices

Division of labour

DOI: <u>10.57874/axc8-vs07</u>

Work has been done on how best to foster collaborative research practices. Some authors distinguish different types of contributions during the research process. For example, a mixedmethod 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 mention 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 note 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), Marija Tukanova et al.

Published 25th October 2023

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 have greater division of labour.

Generalist vs specialist roles

Researchers' ways of working have been categorised into several types. 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.) A qualitative study (Haeussler and Sauermann, 2020) 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.

All of these potential barriers come together to make it difficult for researchers wanting to carry out best research practice, and make their work freely available for others to build on, feel that they can do this and succeed in an academic career.

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References

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

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

Brembs, B., 2018. Prestigious science journals struggle to reach even average reliability. Front. Hum. Neurosci. 12.

https://doi.org/10.3389/fnhum.2018.00037

DOI: <u>10.57874/axc8-vs07</u>

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 preregistered 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. and Foxall, K., 2020. New journal authorship criteria: how ecancermedical science is supporting authors and readers from underserved

settings. *ecancermedicalscience*, *14*. https://doi.org/10.3332/ecancer.2020.ed106

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

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

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

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

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

DOI: <u>10.57874/axc8-vs07</u>

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(6), 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

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

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

loannidis, J.P., Munafo, 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

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

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.000000000001843

José Perezgonzalez, 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

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

DOI: <u>10.57874/axc8-vs07</u>

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

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

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

Lariviere, 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

Lu, C., Zhang, C., Xiao, C. and Ding, Y., 2022. Contributorship in scientific collaborations: The perspective of contribution-based byline orders. Inf. Process. Manage., *59*(3), p.102944. https://doi.org/10.1016/j.ipm.2022.102944

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

DOI: <u>10.57874/axc8-vs07</u>

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

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

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/

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

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

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

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. 4179-1 https://doi.org/10.1007/s00264-018Schoot, 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

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

Sharma, H. and Verma, S., 2018. Predatory journals: the rise of worthless biomedical science. J Postgrad Med, *64*(4), p.226.

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., 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

Smaldino, P.E., Turner, M.A. and Contreras Kallens, P.A., 2019. Open science and modified funding lotteries can impede the natural selection of bad science. R Soc Open Sci, *6*(7), p.190194.

https://doi.org/10.1098/rsos.190194

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 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

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., Duyx, B., Swaen, G.M., Bouter, L.M. and Zeegers, M.P., 2021. Citation bias and other determinants of citation in biomedical research: findings from six citation networks. J Clin Epidemiol, 132, pp.71-78.

https://doi.org/10.1016/j.jclinepi.2020.11.019

Verma, A.A. and Detsky, A.S., 2020. Preprints: a timely counterbalance for big data-driven research. J Gen Intern Med, 35(7), pp.2179-2181.

https://doi.org/10.1007/s11606-020-05746-w

Vinkenburg, C.J., Ossenkop, C. and Schiffbaenker, H., 2021. Selling science: optimizing the research funding evaluation and decision process. Equality, Diversity and Inclusion, 41(9), pp.1-14

https://doi.org/10.1108/EDI-01-2021-0028

Vuong, Q. H. (2019). Breaking barriers in publishing demands a proactive attitude. Nat Hum Behav, 3(10), 1034-1034.

Wakeling, S., Willett, P., Creaser, C., Fry, J., Pinfield, S. and Spezi, V., 2016. Open-access megajournals: A bibliometric profile. *PLoS one*, 11(11), p.e0165359.

https://doi.org/10.1371/journal.pone.0165359

Werner, 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.

140 4477 1405005400 4070070

https://doi.org/10.11///10506519042/29/8

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

Funders

DOI: <u>10.57874/axc8-vs07</u>

No sources of funding have been specified for this publication.

Conflict of interest

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-prot 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. Tim Fellows has a BSc in Business Economics, with experience as a product manager on various research management platforms. He currently works for Jisc as the product manager for Octopus, and is responsible for overseeing the growth and development of the platform alongside Alex Freeman. 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.