Q41 How should research quality be prioritised and supported most effectively over the next decade?

Research quality cannot be measured in bulk. Many current assessments of research quality rely on simplistic metrics, such as the journal's prestige and citation counts. These bulk systems create large amounts of data that give the veneer of certainty. But they can never hope to measure quality, and they also cause harm by encouraging researchers to produce positive results that are more publishable and citable.

The quality of a research paper is complex and cannot be boiled down to simplistic metrics, such as journal impact factor or the number of times and article was cited. As an example, consider a well-conducted trial of a new therapy that conclusively showed the new therapy was not effective. Such "negative" studies are often hard to publish and may end up in less prestigious journals. They are also likely to receive fewer citations than "positive" studies. However, our example study may re-direct future work to an effective therapy, and hence be an important step in the road to a scientific breakthrough.

Citation counts are a poor measure of a paper's value [1] and they are prone to measurement error [2] and gaming [3]. Using citations to measure national research quality is highly questionable. Australia should abandon university league tables (which rely on citations and publication journal prestige) and other simplistic measures of "quality".

There are many components and dimensions of research quality, with many being discipline and topic-specific (for example, consider the ethical and practical difference between a cancer study on patients and a field study on plant distribution). However, there are overarching principles of research robustness (using best research methods), collaboration (working together), and transparency (openly and fully reporting all research details). Such principles form a solid basis of research quality, but are not incentivised by the current research system, nor are the part of research training.

Thus, research quality should be supported by national training in research methods and integrity. This training must be engaging and relevant. Such training is particularly important for higher-degree research students. Published papers show that many researchers lack basic skills in the fundamentals of research, including blinding, randomisation, and basic statistical analysis. Many published studies are currently losing their value because of simple and avoidable mistakes in the study design and analysis [4].

Q42 What settings are needed to ensure academic integrity, and how can new technologies and innovative assessment practices be leveraged to improve academic integrity?

There have been serious breaches of research integrity in Australia [5,6], with some researchers likely fabricating data and/or results to boost their CV and win funding. Such fraud cases in Australia and internationally have received extensive media coverage, causing reputational damage to research and harms to patients and the public. Large-scale fraud is being facilitated by paper mills, which have an estimated annual revenue of over 1 billion Euros [7]. Commercial interests of legitimate journals charging author fees often obstruct their investigations of suspected fraud. In general, correcting the scientific record is not incentivised neither by journals nor other institutions, including research funders.

Automated screening of research papers could be used to improve research quality and integrity [8]. Automated programs "read" papers using algorithms that flag potential errors or omissions in the

paper. Automation is already being used on preprint servers and by the American Association for Cancer Research. Automated screening could be used to detect potential fraud, such as flagging suspicious data from randomised trials [9]. Automated screening is already widely applied to detect written plagiarism, and it could be extended to detect numerical plagiarism, where researchers copy results from previous papers, sometimes changing only a few numbers [10].

Changing the publication model of publicly-funded research to s non-commercial open access model would potentially decouple the commercial interest of journals and of the science users. Incentivising record checking and correction, and enforcing research transparency, would create opportunities for reducing research waste, accelerating scientific discovery, improving quality of scientific evidence, and upholding academic integrity of individuals and institutions.

References

1. Aroeira, R.I. and A.R.B. Castanho, M. (2020), Can citation metrics predict the true impact of scientific papers?. FEBS J, 287: 2440-2448. https://doi.org/10.1111/febs.15255
2. Vedrana Pavlovic, et al; How accurate are citations of frequently cited papers in biomedical literature?. Clin Sci (Lond) 12 March 2021; 135 (5): 671–681. doi: https://doi.org/10.1042/CS20201573
3. Crous, Casparus J.. (2019). The darker side of quantitative academic performance metrics. South African Journal of Science, 115(7-8), 1-3. https://dx.doi.org/10.17159/sajs.2019/5785
4. Paul Glasziou and Iain Chalmers: Is 85% of health research really "wasted"? BMJ Opinion. https://tinyurl.com/bdebty4s
5. "Exclusive: Australia space scientist made up data, probe finds" https://retractionwatch.com/2023/03/26/exclusive-australia-space-scientist-made-up-data-probe-finds/
6. Miles, J. Leading Queensland cancer researcher Mark Smyth fabricated scientific data, review finds. https://www.abc.net.au/news/2022-01-11/qld-cancer-researcher-mark-smyth-fabricated-data-review-finds/100750208
7. Holst, F. Increasing confidence and trust in research: cracking down on misconduct. IOP Publishing News (2022).
8. Schulz, R., Barnett, A., Bernard, R. et al. Is the future of peer review automated?. BMC Res Notes 15, 203 (2022). https://doi.org/10.1186/s13104-022-06080-6
9. Barnett A. Automated detection of over- and under-dispersion in baseline tables in randomised controlled trials [version 1; peer review: 1 approved with reservations]. F1000Research 2022, 11:783
10. Bordewijk, E. M. et al. Data integrity of 35 randomised controlled trials in women's health. European Journal of Obstetrics & Gynecology and Reproductive Biology 249, 72–83 (2020).