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The Peer Review Process

Peer review is a process whereby experts help judge the value of a work that they were not part of creating. Editorial peer review involves scientific or academic manuscripts submitted for publication or meeting presentation, while grant peer review involves review of funding applications. This entry focuses on editorial peer review of work submitted to scientific journals, although some of the issues discussed apply to other types of peer review as well.

The primary function of editorial peer review is gate keeping - selecting the best from a pool of submissions. In addition, peer review often involves constructive criticisms intended to improve a submitted work prior to publication. A common misunderstanding is that peer review validates the scientific integrity of a published article. This is unrealistic, however, as reviewers typically have access only to what the author or authors present in the manuscript. Important logistical and methodological decisions made along the way will be unknown to the reviewers, as will key details that the authors might omit. In essence, we must trust the authors. As Drummond Rennie notes, "Peer review makes an assumption of honesty, and, though it can assist in establishing scientific validity, it cannot guarantee it." (in Godlee & Jefferson, 2003, p. 2).

Early forms of editorial peer review go back as far as the beginning of the 18th century, most notably within the Royal Societies of London and Edinburgh. The first modern peer review system was developed in the late 19th century by Ernest Hart, editor of the British Medical Journal. Yet it was only after the Second World War, as medical research methods became more sophisticated and journals became more selective, that peer review systems became institutionalized in the scientific and academic journals of the United Kingdom, United States, and elsewhere.

In this context the term "peer" is loosely interpreted to include subject-area experts, statisticians and methodologists, journal editors, editorial boards, and sometimes others, such as graduate students or non-experts. Outside experts are usually sought because of their specialized knowledge in the submitted manuscript's content area, or their advanced statistical or methodological skills. Ideally these reviewers will have more expertise than the authors of the submitted work. But due to the proliferation of scientific journals, and the many competing demands on experts' time, this specialized ideal is not always reached. It is therefore not uncommon for less qualified reviewers to assume this role.

A variety of peer review systems are employed across the world's 10,000 or so journals. Systems vary in their relative reliance on external reviewers such as outside experts, versus in-house reviewers such as editors and editorial boards. Acceptance rates can differ widely across journals, ranging from around 2% for the most highly selective journals, to 90% and above for some electronic journals where publication space is less of an issue, and pay-per-page journals such as those that serve primarily as outlets for routine pharmaceutical studies.

Post-publication peer review is an important, if often neglected, type of review. This can include letters to the editor or full articles critiquing a published work, sometimes going so far as to involve reanalysis of the original data. As Doug Altman has cautioned: "Many readers seem to assume that articles published in peer-reviewed journals are scientifically sound, despite much evidence to the contrary. It is important, therefore, that misleading work be identified after publication." (2002, p. 2766). While the need for post-publication review is now receiving more attention, challenges remain. Authors sometimes choose to ignore a published critique, or respond minimally to peripheral issues in place of the specific criticisms made. Even when serious errors are detailed in a critique, retractions or corrections are the exception. Medline and other databases rarely link post-publication critiques to the original article, and literature reviews that cite a criticized work frequently ignore the critique.

Many criticisms of peer review have been raised by authors and reviewers as well as journal editors. A common criticism is that peer review is prone to bias. Bias can take various forms, including ad hominem bias, affiliation bias, ideological bias, and publication bias, among others. Ad hominem and affiliation bias are found when a review is influenced, either consciously or unconsciously, by knowledge of the author's identity or affiliation. Mixed evidence has been found on the presence and extent of these two biases. Some have argued that such influences are not necessarily biases, but can be valid considerations in reviewing a manuscript. Yet the prevailing opinion remains that these potential influences are inappropriate for editorial peer review. It is for this reason that the norm is blinded review, where the author's name and affiliation are not known to the reviewer. The opposite is true however in grant peer review, where authors' names and affiliations, as well as other detailed information about the authors' past experience and accomplishments, are typically an integral part of the reviewed application.

Ideological bias, where a reviewer's antecedent values-based views for or against an author's position unduly influence a review, have been demonstrated in several studies on the peer review process. Closely related is confirmation bias, the more general and well documented tendency to less critically evaluate evidence that is consistent with one's existing beliefs. Numerous experimental demonstrations of these types of biases have led some to call for use of only the introduction and methods section of a paper in publication decisions, but this strategy has not yet been widely embraced or studied. Also related is publication bias, the selective publication of manuscripts based on the direction and magnitude of their results. It is widely accepted that research reporting statistically significant positive results is more likely to be published than research with null or non-significant results, and that this can among other problems lead to serious negative consequences for meta-analyses and other types of systematic reviews. Interestingly, studies have failed to support the belief that editorial decisions are biased in this matter. Instead, publication bias appears to result primarily from authors' reduced likelihood of submitting papers with null or negative results.

Other commonly voiced criticisms are that peer review is conservative and stifles innovation, is secretive and without accountability of reviewers to authors, suffers from low inter-rater reliability (typically found to be .30 or less), produces low-quality reviews and too many flawed papers are allowed to slip thorough the system, frequently omits adequate (if any) statistical and methodological review, is slow and expensive and delays publication, and is unscientific with

little or no evidence of its effectiveness. It is sometimes said that, like democracy, the peer review system is deeply flawed, yet better than all the alternatives. While no serious candidates for replacement of peer review have emerged, the many challenges to the current system have been increasingly publicized and many suggestions for improvements in current practice have attracted attention.

One proposal to increase reviewer accountability and to generate more constructive reviews is to employ a signed rather than anonymous review process, where reviewers' names are provided to the reviewed author. Several major journals, including the BMJ, now use signed review systems, while other journals encourage but do not require signed reviews. Yet most journals – and reviewers – do not yet support such a process, primarily due to reviewers' concerns about retribution, especially younger researchers fearful of criticizing senior colleagues. With reviewer recruitment already a difficult and time consuming task, additional disincentives to accept review invitations would not be ideal.

Other suggestions for improving overall review and editorial decision quality include providing more training and support to reviewers, and employing statistical and methodological review of all manuscripts. Reviewer training can take the form of workshops, tutorials, guides, apprentice models, and other strategies, and should be targeted not only to existing reviewers but to graduate students as future reviewers. Statistical and methodological review can be done concurrently with review by subject area experts, or subsequent to initial reviews by these experts. It can involve either in-house or external methodologists. Some journals, such as the BMJ and Lancet, already institutionalize separate methodological reviews, yet the majority of medical journals do not. In spite of the challenges in recruiting sufficient numbers of methodologists, this strategy has tremendous potential power, given that it has been found across several different fields that most published articles do contain non-trivial methodological flaws.

It is said that if peer review weren't already widely in use and someone were to propose it today, the evidence of its effectiveness would be so lacking that it would not be given serious consideration. But evidence is accumulating as research on the peer review process becomes more widespread and sophisticated. An International Congress on Peer Review in Biomedical Publication has been held every four years since 1989. These meetings are an attempt to encourage systematic research on the peer review process. And a large-scale collaborative mixed-methods study is currently underway to investigate the peer review processes at three prestigious medial journals – The Lancet, Annals of Internal Medicine, and the BMJ.

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See also Publication Bias

Further Readings

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Publication Bias

Publication bias can result from the selective publication of manuscripts based on the direction and magnitude of results. In particular, research with statistically significant positive results is more likely to be submitted for publication, to be published, and to be published more quickly than research with negative or nonsignificant results. Consequently, published studies on a particular topic might not be representative of all valid studies conducted on the topic, leading to distortion of the scientific record. Other sources of publication bias include multiple publication of results, and selective reporting of results within a published study.

Publication bias tends to be greater in clinical research than in public health research, and in observational studies as opposed to randomized studies. Nevertheless, publication bias has been demonstrated across all of these types of research. One area where a variety of publication biases has been documented is pharmaceutical industry studies of new drug applications.

The primary causes of publication bias are commonly assumed to be editorial decision making, together with authors' reluctance to submit research with null or negative results—sometimes referred to as the file drawer problem. While research has supported the latter explanation, studies of publication bias in editorial decision making have yielded mixed findings. Another common source of publication bias is within-study selective reporting among multiple outcomes, exposures, subgroup analyses, and other multiplicities. Although this cause has until recently been largely ignored, it is likely to cause even greater bias in the literature than does selective publication.

Publication bias presents a serious threat to the validity of systematic reviews and meta-analyses. Undetected publication bias not only can lead to misleading conclusions, but at the same time can give the impression of unfounded precision of results. A screening method for publication bias in meta-analysis involves correlating observed effect sizes with study design features that are potential risk factors for selective-publication, such as sample size. A funnel plot provides an informal graphical method where effect sizes are plotted against sample sizes, while the null hypothesis of no publication bias can be tested using rank correlation approaches such as Kendall's tau or Spearman's rho. Detecting within-study selective reporting presents a greater challenge, unless access is available to a study's original protocol and complete results of all analyses performed.

Several imperfect strategies exist for reducing or adjusting for publication bias. *Sampling methods* involve tracking down unpublished manuscripts, sometimes referred to as the grey literature, as well as broader systemic solutions such as requiring prospective registration and public release of complete trial protocols. *Analytic methods,* applicable primarily to selective publication situations, include the file drawer adjustment strategy. This involves estimating the number of zero-effect studies needed to eliminate significant findings in a meta-analysis. More

complex analytic approaches employing weighted distribution theory also are available. All analytic methods require important assumptions, which in many situations can be questionable. Analytic methods are less applicable for within-study selective reporting situations, where the solution must be found in authors' complete reporting and straightforward interpretation of results. Perhaps most importantly, consumers of research reports, meta-analyses, and systematic reviews are cautioned to be constructively skeptical in appraising results and conclusions.

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See also Evidence-Based Medicine; Meta-analysis; Peer Review Process

Further Readings

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