

METHOD/OLOGY

Research Methods: How to Perform an Effective Peer Review

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ABSTRACT

Scientific peer review has existed for centuries and is a cornerstone of the scientific publication process. Because the number of scientific publications has rapidly increased over the past decades, so has the number of peer reviews and peer reviewers. In this paper, drawing on the relevant medical literature and our collective experience as peer reviewers, we provide a user guide to the peer review process, including discussion of the purpose and limitations of peer review, the qualities of a good peer reviewer, and a step-by-step process of how to conduct an effective peer review.

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Peer review has been a part of scientific publications since 1665, when the Philosophical Transactions of the Royal Society became the first publication to formalize a system of expert review.^{1,2} It became an institutionalized part of science in the latter half of the 20th century and is now the standard in scientific research publications.³ In 2012, there were more than 28 000 scholarly peer-reviewed journals and more than 3 million peer reviewed articles are now published annually.^{3,4} However, even with this volume, most peer reviewers learn to review “on the (unpaid) job” and no standard training system exists to ensure quality and consistency.⁵ Expectations and format vary between journals and most, but not all, provide basic instructions for reviewers. In this paper, we provide a general introduction to the peer review process and identify common strategies for success as well as pitfalls to avoid.

WHAT IS THE PURPOSE OF PEER REVIEW?

Modern peer review serves 2 primary purposes: (1) as “a screen before the diffusion of new knowledge”⁶ and (2) as a method to improve the quality of published work.^{1,5}

As screeners, peer reviewers evaluate the quality, validity, relevance, and significance of research before publication to maintain the credibility of the publications they serve and their fields of study.^{1,2,7} Although peer reviewers are not the final decision makers on publication (that role belongs to the editor), their recommendations affect editorial decisions and thoughtful comments influence an article’s fate.^{6,8}

As advisors and evaluators of manuscripts, reviewers have an opportunity and responsibility to give authors an outside expert’s perspective on their work.⁹ They provide feedback that can improve methodology, enhance rigor, improve clarity, and redefine the scope of articles.^{5,8,10} This often happens even if a paper is not ultimately accepted at the reviewer’s journal because peer reviewers’ comments are incorporated into revised drafts that are

submitted to another journal. In a 2019 survey of authors, reviewers, and editors, 83% said that peer review helps science communication and 90% of authors reported that peer review improved their last paper.¹¹

WHAT MAKES A GOOD PEER REVIEWER?

Many editorials, reviews, scoping reviews, surveys, and quality improvement initiatives have aimed to discern or describe the ideal qualities of a reviewer. Although the breadth of literature allows for some variation, opinions coalesce around 3 key themes.^{1,5,6,8,12}

1. *Expertise:* Peer reviewers should be up to date with current literature, practice guidelines, and methodology within their subject area. However, academic rank and seniority do not define expertise and are not actually correlated with performance in peer review.¹³
2. *Professionalism:* Reviewers should be reliable and objective, aware of their own biases, and respectful of the confidentiality of the peer review process.
3. *Critical skill:* Reviewers should be organized, thorough, and detailed in their critique with the goal of improving the manuscript under their review, regardless of disposition. They should provide constructive comments that are specific and addressable, referencing literature when possible. A peer reviewer should leave a paper better than he or she found it.

HOW DO YOU DECIDE WHETHER TO REVIEW A PAPER?

So, you’ve been asked to review a paper. Congratulations! Once you’ve determined that the invitation is from a legitimate scientific journal, the first step is to consider if you are the right person to do this review. Ask yourself these questions:

1. *Is the manuscript within your area of expertise?* Generally, if you are asked to review a paper, it is because an editor felt that you were a qualified expert. In a 2019 survey, 74% of

requested reviews were within the reviewer’s area of expertise.¹¹ This, of course, does not mean that you must be widely published in the area, only that you have enough expertise and comfort with the topic to critique and add to the paper.

2. *Do you have any biases that may affect your review?* Are there elements of the methodology, content area, or theory with which you disagree? Some disagreements between authors and reviewers are common, expected, and even helpful. However, if a reviewer fundamentally disagrees with an author’s premise such that he or she cannot be constructive, the review invitation should be declined.
3. *Do you have the time?* The average review for a clinical journal takes 5 to 6 hours, though many take longer depending on the complexity of the research and the experience of the reviewer.¹⁴ Journals vary on the requested timeline for return of reviews, though it is usually 1 to 4 weeks. Peer review is often the longest part of the publication process and delays contribute to slower dissemination of important work and decreased author satisfaction.¹⁵ Be mindful of your schedule and only accept a review invitation if you can reasonably return the review in the requested time.

Once you have determined that you are the right person and decided to take on the review, reply to the inviting e-mail or click the associated link to accept (or decline) the invitation. Journal editors invite a limited number of reviewers at a time and wait for responses before inviting others. A common complaint among journal editors surveyed was that reviewers would often take days to weeks to respond to requests, or not respond at all, making it difficult to find appropriate reviewers and prolonging an already long process.⁵

HOW DO YOU COMPLETE A PEER REVIEW?

Now that you have decided to take on the review, it is best to have a systematic way

TABLE 1 Dos and Don'ts of Peer Review

Do	Don't
Check your biases	Agree to review a manuscript if you cannot be objective
Note glaring omissions in citations, such as foundational studies or recent advances	Request that the authors cite a paper on which you are an author (self-citation)
Critique the manuscript	Criticize the authors
Provide constructive, specific critiques	Provide general comments without evidence
Acknowledge if there are parts of the manuscript that you do not feel qualified to review	Ignore methods or statistics with which you are unfamiliar
Recommend specific, addressable changes to analysis or interpretation	Recommend extensive additional study beyond the scope of the work described
Evaluate organization, flow, and readability	Copy edit the manuscript
Use comments to the editor to note if major grammatical errors make the manuscript difficult to read	Suggest editing by a "native English speaker" or otherwise directly impugn the authors' language skill

of both evaluating the manuscript and writing the review. Various suggestions exist in the literature, but we will describe our standard procedure for review, incorporating specific do's and don'ts summarized in Table 1.

First, read the manuscript once without making notes or forming opinions to get a sense of the paper as whole. Assess the overall tone and flow and define what the authors identify as the main point of their work. Does the work overall make sense? Do the authors tell the story effectively?

Next, read the manuscript again with an eye toward review, taking notes and formulating thoughts on strengths and weaknesses. Consider the methodology and identify the specific type of research described. Refer to the corresponding reporting guideline if applicable (CONSORT for randomized control trials, STROBE for observational studies, PRISMA for systematic reviews). Reporting guidelines often include a checklist, flow diagram, or structured text giving a minimum list of information needed in a manuscript based on the type of research done.¹⁶ This allows the reviewer to formulate a more nuanced and specific assessment of the manuscript.

Next, review the main findings, the significance of the work, and what contribution it makes to the field. Examine the presentation and flow of the manuscript but do not copy edit the text. At this point, you should start to write your review. Some journals provide a format for their reviews,

but often it is up to the reviewer. In surveys of journal editors and reviewers, a review organized by manuscript section was the most favored,^{5,6} so that is what we will describe here.

As you write your review, consider starting with a brief summary of the work that identifies the main topic, explains the basic approach, and describes the findings and conclusions.^{12,17} Though not universally included in all reviews, we have found this step to be helpful in ensuring that the work is conveyed clearly enough for the reviewer to summarize it. Include brief notes on the significance of the work and what it adds to current knowledge. Critique the presentation of the work: is it clearly written? Is its length appropriate? List any major concerns with the work overall, such as major methodological flaws or inaccurate conclusions that should disqualify it from publication, though do not comment directly on disposition. Then perform your review by section:

Abstract: Is it consistent with the rest of the paper? Does it adequately describe the major points?

Introduction: This section should provide adequate background to explain the need for the study. Generally, classic or highly relevant studies should be cited, but citations do not have to be exhaustive. The research question and hypothesis should be clearly stated.

Methods: Evaluate both the methods themselves and the way in which they are

explained. Does the methodology used meet the needs of the questions proposed? Is there sufficient detail to explain what the authors did and, if not, what needs to be added? For clinical research, examine the inclusion/exclusion criteria, control populations, and possible sources of bias. Reporting guidelines can be particularly helpful in determining the appropriateness of the methods and how they are reported.

Some journals will expect an evaluation of the statistics used, whereas others will have a separate statistician evaluate, and the reviewers are generally not expected to have an exhaustive knowledge of statistical methods. Clarify expectations if needed and, if you do not feel qualified to evaluate the statistics, make this clear in your review.

Results: Evaluate the presentation of the results. Is information given in sufficient detail to assess credibility? Are the results consistent with the methodology reported? Are the figures and tables consistent with the text, easy to interpret, and relevant to the work? Make note of data that could be better detailed in figures or tables, rather than included in the text. Make note of inappropriate interpretation in the results section (this should be in discussion) or rehashing of methods.

Discussion: Evaluate the authors' interpretation of their results, how they address limitations, and the implications of their work. How does the work contribute to the field, and do the authors adequately describe those contributions?

TABLE 2 Take-home Points

- Peer review should serve as a screen before publication and improve the submitted work
- Good peer reviewers should have expertise, professionalism, and critical skill
- To perform a peer review:
 - o First determine if you are the right person for the review
 - o Read the article once without making notes
 - o Read the article again with notation
 - Evaluate significance, clarity, approach, and presentation
 - Refer to reporting guidelines where applicable
 - o Write a structured review
 - Assemble a brief summary of the work
 - Review by section, with particular attention to methodology and appropriateness of the conclusions
 - Note major and minor critiques, including references to the text when possible
 - o Give your recommendation on disposition as well as any ethical concerns in the confidential comments to the editor
- Peer review cannot detect all errors or outright fraud, but it can improve the published literature

Make note of overinterpretation or conclusions not supported by the data.

The length of your review often correlates with your opinion of the quality of the work. If an article has major flaws that you think preclude publication, write a brief review that focuses on the big picture. Articles that may not be accepted but still represent quality work merit longer reviews aimed at helping the author improve the work for resubmission elsewhere.

Generally, do not include your recommendation on disposition in the body of the review itself. Acceptance or rejection is ultimately determined by the editor and including your recommendation in your comments to the authors can be confusing. A journal editor's decision on acceptance or rejection may depend on more factors than just the quality of the work, including the subject area, journal priorities, other contemporaneous submissions, and page constraints.

Many submission sites include a separate question asking whether to accept, accept with major revision, or reject. If this specific format is not included, then add your recommendation in the "confidential notes to the editor." Your recommendation should be consistent with the content of your review: don't give a glowing review but recommend rejection or harshly criticize a manuscript but recommend publication. Last, regardless of your ultimate recommendation on disposition, it is imperative to use respectful and

professional language and tone in your written review.

LIMITATIONS OF PEER REVIEW

Although peer review is often described as the "gatekeeper" of science and characterized as a quality control measure, peer review is not ideally designed to detect fundamental errors, plagiarism, or fraud. In multiple studies, peer reviewers detected only 20% to 33% of intentionally inserted errors in scientific manuscripts.^{18,19} Plagiarism similarly is not detected in peer review, largely because of the huge volume of literature available to plagiarize. Most journals now use computer software to identify plagiarism before a manuscript goes to peer review. Finally, outright fraud often goes undetected in peer review. Reviewers start from a position of respect for the authors and trust the data they are given barring obvious inconsistencies. Ultimately, reviewers are "gatekeepers, not detectives."⁷

Peer review is also limited by bias. Even with the best of intentions, reviewers bring biases including but not limited to prestige bias, affiliation bias, nationality bias, language bias, gender bias, content bias, confirmation bias, bias against interdisciplinary research, publication bias, conservatism, and bias of conflict of interest.^{3,4,6} For example, peer reviewers score methodology higher and are more likely to recommend publication when prestigious author names or institutions

are visible.²⁰ Although bias can be mitigated both by the reviewer and by the journal, it cannot be eliminated. Reviewers should be mindful of their own biases while performing reviews and work to actively mitigate them. For example, if English language editing is necessary, state this with specific examples rather than suggesting the authors seek editing by a "native English speaker."

Conclusions

Peer review is an essential, though imperfect, part of the forward movement of science. Peer review can function as both a gatekeeper to protect the published record of science and a mechanism to improve research at the level of individual manuscripts. Here, we have described our strategy, summarized in Table 2, for performing a thorough peer review, with a focus on organization, objectivity, and constructiveness. By using a systematized strategy to evaluate manuscripts and an organized format for writing reviews, you can provide a relatively objective perspective in editorial decision-making. By providing specific and constructive feedback to authors, you contribute to the quality of the published literature.

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