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0894-9115/03/8210-0790/0
American Journal of Physical Medicine & Rehabilitation
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DOI: 10.1097/01.PHM.0000087607.28091.B7

Literature Review & Analysis

Peer Review Issues in Physical Medicine and Rehabilitation

ABSTRACT

Wagner AK, Boninger ML, Levy C, Chan L, Gater D, Kirby RL: Peer review: Issues in physical medicine and rehabilitation. *Am J Phys Med Rehabil* 2003;82:790–802.

Peer review, although the standard for evaluating scientific research, is not without flaws. Peer reviewers have been shown to be inconsistent and to miss major strengths and deficiencies in studies. Both reviewer and author biases, including conflicts of interest and positive outcome publication biases, are frequent topics of study and debate. Additional concerns have been raised regarding inappropriate authorship and adequate reporting of the ethical process involving human and animal experimentation. Despite these issues, a good peer review can provide positive feedback to authors and improve the quality of research reported in medical journals. This article reviews some issues and points of concern regarding the peer-review process, and it suggests guidelines for new (and established) reviewers in the area of physical medicine and rehabilitation. It also provides suggestions for editorial considerations and improvements in the peer-review process for physical medicine and rehabilitation research journals.

Key Words: Peer Review, Physiatry, Rehabilitation, Reviewer Guidelines, Authorship, Research Ethics

Peer review of the scientific literature is the gold standard when determining the merits of research for publication, but it can be subject to errors, inconsistencies, and biases. Many individuals who submit manuscripts will also review others' work. This type of academic service is important to all disciplines, but particularly for the field of physical medicine and rehabilitation in which a tradition of rigorous research has been slow to evolve.¹ In addition to

determining if a manuscript is appropriate for publication, good reviews help authors improve their work, and ultimately, the quality of the science reported. In contrast to these altruistic reasons for volunteering to review manuscripts, participating in the peer-review process can also help reviewers. By reviewing other's work, one can gain insights on study design and manuscript writing. Reviewing manuscripts can also help keep the reviewer up to date on the latest literature. Finally, reviewing manuscripts can help generate new research ideas.

This article serves as a guide for reviewers and editors in physical medicine and rehabilitation. One focus of this article is to delineate possible issues and shortcomings with the peer-review process. We provide a brief overview of some design and methodologic issues that are pervasive within the rehabilitation literature. Within this context, we hope to better acquaint readers with the peer-reviewer and editorial portions of the peer-review process within the general medical research community and highlight issues specific to peer review in rehabilitation research. Importantly, this article also provides an informative guideline for new (and established) reviewers to use in helping them prepare high-quality manuscript reviews. Guidelines for some of the editorial aspects of the peer-review process are also suggested. Finally, this article provides suggestions for future directions our discipline might take in optimizing the peer-review process for our primary journals.

STUDY DESIGN AND RESEARCH METHODS IN REHABILITATION RESEARCH

Rehabilitation research, as in all areas of medical research, requires different study designs for different goals. As in other fields,

clinical trials in rehabilitation are critical to help justify efficacy of pharmacologic and therapeutic interventions aimed at impairments (e.g., spasticity, pain, weakness). Unlike many other fields, rehabilitation research also focuses on the improvement of abilities and participation.² For instance, assistive technology (e.g., wheelchairs) devices can improve abilities without affecting impairment. Social interventions such as caregiver training can improve participation and quality of life for our patient populations.

However, more than in most fields, double-blind randomized control trials are difficult to carry out. Sample sizes tend to be small, the number of confounding variables is higher, there is a lack of consensus on appropriate outcome measures, and postintervention improvements may not be seen for months or years. As a result, reviewers are likely to see a number of different types of research.³ What is critical is that each research design be rigorously evaluated with an understanding of the challenges surrounding the conduct of rehabilitation research.

In the "Instructions to Authors" of the *American Journal of Physical Medicine and Rehabilitation*,⁴ the editors state they are interested in "original scientific investigations that advance the field of physiatric medicine." Types of research articles include, in order of preference, (1) cohort studies, such as randomized controlled trials and longitudinal studies, (2) case-control studies, (3) historical prospective studies, (4) cross-sectional studies, and (5) radiologic diagnostic studies. Single-subject design case studies can also be published.

Pitfalls and difficulties have been reported in the rehabilitation research literature with each of these types of study designs. Authors, reviewers, and editors need to recog-

nize these pitfalls are potentially significant issues affecting the quality of rehabilitation research being published. Ottenbacher and Barrett⁵ reviewed several published clinical rehabilitation trials and showed that, in many cases, the trials were small and had not been adequately powered to detect a significant difference when one might be present. Dijkers et al.⁶ evaluated how well rehabilitation articles report information on the interventions they evaluate. The results of this study revealed that many articles published in rehabilitation journals do not report randomization procedures, the use or timing of the intervention, and the nature of the data collected.

Outcomes assessment is an important aspect of much rehabilitation research. However, studies published in rehabilitation journals are often deficient in their reporting of the validity and reliability of the outcome measures used.⁷ Definitions, operationalization, associated social values, and target population can also be difficult to address in rehabilitation outcomes research.⁸ Additionally, systematic bias may be present in studies in which there is significant loss to follow-up and subjects who cannot be followed fall into specific sociodemographic categories.^{9,10} Without appropriately reporting selection bias, interpretation of study results can be confusing and difficult. Often, busy clinicians find it difficult to be involved with large clinical studies. However, the appropriate use of single-subject research designs to test efficacy of treatments may be a practical and viable alternative that may lead to future cohort studies aimed at a more definitive and generalizable analysis of treatment effects.¹¹ Methodologic flaws present in published rehabilitation research can reflect negatively on the status and importance of research in our field but can be significantly effected and improved through quality peer review.

PEER-REVIEW PROCESS

Consistency and Quality of Critiques

Peer review influences what projects get funded and where research is published.¹² However, peer review has been criticized as lacking standardization and objectivity.¹³ Variability in the performance of reviewers is widely acknowledged. In one study,¹⁴ it was found that the best reviewers tended to be <40 yr of age, from top-ranked academic institutions, were well known to the editor, and were blinded to the identity of the manuscript authors. However, Black et al.¹⁵ found that there was a suggestion that better reviewers were 40–60 yr old, spent more time preparing their reviews, were educated in North America, and were trained in epidemiology or statistics.

Inconsistency among the overall recommendations of peer reviewers is common. Rothwell and Martyn¹² studied the reproducibility of the assessments of peer reviewers for 116 manuscripts submitted to two clinical neuroscience journals. Agreement among the reviewers as to whether manuscripts should be accepted, revised, or rejected was not significantly greater than expected by chance for the first journal and was poor for the second journal. The authors speculated that (1) some reviewers may not be certain about which aspects they should be reviewing; (2) some reviewers may lack the time, knowledge, or training to properly review manuscripts; and (3) personal bias may distort some reviewer's judgments. To evaluate reviewer consistency and quality, Kumar¹³ utilized a sham article deliberately designed with deficiencies to test the ability of established reviewers. Although the reviewer response rate was small ($n = 7$, 22%) and the results should thus be interpreted with caution, the participating reviewers missed many significant flaws in the article.

Suggestions for strengthening peer review have included improved training for reviewers, use of standardized assessment forms, greater feedback to the reviewers, and financial remuneration to reviewers. MacAuley and McCrum¹⁶ reported that using a structured model for critically reviewing a research manuscript resulted in a more appropriate appraisal of the manuscript and was helpful to all reviewers, regardless of their training, background, or level of experience. This approach utilized a structured worksheet for evaluating a manuscript's relevance to medical practice, ability to alter physician behavior, and study methodology. Structured feedback and reviewer workshops, although theoretically positive interventions, have failed in some studies to demonstrably improve the quality of review.^{17,18}

Despite the acknowledged flaws, peer review helps editors decide what to publish, helps authors revise and strengthen their manuscripts, and gives the appearance that decisions regarding publication have been arrived at fairly.¹² Goodman et al.¹⁹ showed that the peer review and editing process improves the quality of medical research published. In this study, assessors rated manuscripts before and after the editorial process. Different assessors than those evaluating the original submission evaluated the revised manuscripts. Results showed significant improvement in manuscript quality, particularly in the areas of discussion and study limitations, which heavily influence the generalizability of findings and the incorporation of new treatment strategies into clinical practice. The largest gains were made with manuscripts originally scored in the bottom half of those reviewed.

Editors of rehabilitation journals should take steps to internally evaluate the consistency, objectivity, and quality of their current peer-review process. Action should then be taken in national organizations, which

could offer peer reviewer training workshops and facilitate multi-journal editorial roundtables aimed at improving weaknesses in the rehabilitation research peer-review process. A formal author feedback mechanism is not common practice with most rehabilitation journals, but it may be a form of feedback that could help identify journal-specific peer-review issues and ways to improve peer-review quality.

BLINDING/MASKING OF REVIEWERS TO AUTHORS' IDENTITIES

Sending manuscripts to reviewers with the identity of the authors obscured is done to remove bias for or against the authors. Presumably, established authors may benefit from a bias to grant them the benefit of the doubt, whereas authors who are not yet established might be judged more harshly. Fisher et al.²⁰ examined the reviews of 57 consecutive research manuscripts submitted to the *Journal of Developmental and Behavioral Pediatrics*. Each manuscript was sent to four reviewers, two of whom were blinded to authors' identities, and two of whom were not. Manuscript authors were informed of the purpose of the study and asked to provide a list of publications for each coauthor to designate a senior author. The ratings of the blinded and nonblinded reviewers were not significantly different. Blinded reviewers thought that they knew who the authors were in half of the cases. Of these, they guessed the authors' identity correctly 89% of the time. The blinded reviewers most often based their guesses on self-reference, the topic, or the authors' knowledge of the subject matter. Contrary to expectations, senior authors received significantly better scores from the blinded reviewers.

Justice et al.²¹ compared editors' and authors' evaluations of reviews delivered by blinded *vs.* nonblinded

reviewers of the same manuscript. Neither editors nor authors perceived a significant difference in the quality of masked *vs.* unmasked manuscripts. Further, masking was successful only 68% of the time, failing most often with more generally known authors. Cho²² also examined masking effectiveness, and in three medical journals that routinely masked, found the masking success rate to be only 60%; four medical journals that did not routinely mask had a similar success rate of 58%. Taken together, these results suggest that, although blinding may be ineffective, it may in some cases improve the objectivity or quality of the reviews completed. Rehabilitation medicine is a small field, and this issue makes blinding more difficult. However, through increased participation in the peer-review process by rehabilitation physicians, careful reviewer screening, and reviewer conflict-of-interest disclosure, blinding can serve a useful role in increasing the objectivity with which manuscript peer review is conducted.

STATISTICAL INPUT IN PEER REVIEW

Most manuscripts that are based on experimental data will include statistical analysis. Therefore, reviewers must be competent to evaluate whether the statistical methods employed were appropriate and whether it was properly performed. The chance that a particular manuscript will contain a statistical method that the assigned reviewer is unable to competently evaluate grows as the complexity of experimental design and statistical analyses increases. Some medical journals are able to supply a statistical consultant to aid the reviewer or editor. Unfortunately, this resource is expensive and not universally available. Goodman et al.²³ reported that articles published in journals in the top quartile of circulation had a much higher probability

of having a statistical review than those published in smaller journals (52% *vs.* 27%). Of journals in the top circulation quartile, 82% had statistical consultants on staff, compared with 31% in the bottom quartile. Additionally, reviewers with a statistical or epidemiologic background have been shown to produce higher-quality reviews,¹⁵ and editors have judged in one study that statistical review resulted in an important change in a manuscript in about half of the cases.²³

The use of appropriate sample size, power, and statistical techniques (including correction for multiple comparisons) has been a significant issue in published rehabilitation research.^{5,24,25} This may, in part, be the result of a suboptimal peer review in regard to the statistical methods used. Because the readerships of most journals rely on the editorial process to ensure the validity of the statistical and methodologic approaches used, a lack of statistical expertise in the peer-review process can be a significant problem. Statistical reviewers cannot always critique clinical relevance of findings; however, the validity of the findings and conclusions presented in most research articles is embedded in the methodologic design and statistical approach. Therefore, rehabilitation journals need to take steps to ensure that the statistical component of the review is competently conducted, and this may include incorporating a statistical reviewer into the review panel for submitted manuscripts.

BIASES

Sex and Minority Biases

Partiality on the basis of the sex or minority status of an author or the study participants may exist. The exclusive use of the male pronoun may create the impression of bias, even when it does not exist. Sex differences and biases in the peer-review process

may exist within different medical journals. Women reviewers have been found in one study to accept articles written by women at a 3:1 ratio over male authors, whereas male reviewers accept reviews from women and men in equal proportions.²⁶ Gilbert et al.²⁷ reported that, although sex differences existed between the two editors at JAMA, it did not seem to affect their peer-review processes or acceptances of manuscripts for publication. Rehabilitation journals should look closely and objectively at their own peer-review process to ensure that sex biases are not present with the critique and acceptance of manuscripts.

Minority status can sometimes be inferred when authors are not entirely comfortable in their use of the English language and, thus, introduce biases into the peer-review process. Link²⁸ assessed how United States and non-United States reviewers evaluated manuscripts submitted by United States and non-United States authors for one journal. Her results showed that both United States and non-United States reviewers more favorably ranked United States manuscripts for acceptance than non-United States manuscripts. United States reviewers ranked United States manuscripts much more favorably, whereas non-United States reviewers ranked United States manuscripts slightly more favorably. The authors commented, however, that the quality of manuscript submission was not evaluated in this study and should be considered when making definitive conclusions about this type of bias. Presentation quality is ultimately the responsibility of the authors and may require a consultant to help when the manuscript is being written in the authors' second language. However, high-quality manuscripts undoubtedly are submitted by both United States and non-United States authors, and care needs to be taken to ensure that studies are re-

viewed primarily on their scientific merit, not solely on writing style.

Senior vs. Junior Author Bias. As noted earlier in our discussion about the merits of blinded reviews, when the reviewer is aware of an author's earlier work, the reviewer may give a senior author "the benefit of the doubt," whereas a junior author might be asked for further clarification. Also, in research areas in which there are only a small number of qualified reviewers, the reviewer may be reluctant to criticize a manuscript if he or she is concerned that the nature of the criticism will allow the author to recognize the source of the comments and retaliate when the roles are reversed. This can lead to an incestuous relationship between the author and reviewer—"you praise my research and I'll praise yours." Rehabilitation journals that ask authors to suggest the names of potential reviewers may unintentionally encourage this culture, to the extent that authors are most likely to suggest the names of like-minded reviewers.

Content Bias. A reviewer may be less likely to recommend publication of a manuscript that deals with a topic that he or she views as uninteresting or unimportant than one that is in his or her area of interest. Similarly, a reviewer may place more weight on a study that has immediate clinical applicability than one that is considered more of a basic-science or curiosity-driven one. Journals often make an effort to minimize such bias by attempting to match the reviewers' expertise to the subject matter of the study.

Similarly, there may be a methodology bias. Although there are a variety of valid approaches that can be used to achieve research objectives, reviewers are likely to be more familiar with some approaches than others. For instance, a descriptive study that can provide the basis from which important hypotheses arise

may be considered less important than the randomized control trial that arises from it. Similarly, reviewers may be unfamiliar with or not recognize the important role of case reports, single-subject design, qualitative/naturalistic approaches, or mechanistic studies in sequentially building a focused area of rehabilitation research.

Conflict-of-Interest Bias. Conflicts of interest on the part of both authors and reviewers are often a point of controversy for academic institutions, journals, and funding agencies. Conflict-of-interest bias can be as subtle as a reaction to any findings that reflect (positively or negatively) on a reviewer's research, clinical activities, or beliefs. This is particularly so if the reviewer's livelihood might be put in jeopardy should the study be published. For instance, a psychiatric reviewer would probably more rigorously scrutinize a study that seemed to demonstrate that electrodiagnosis adds little value to outcomes than a study that demonstrated the contrary.

Reviewers also need to be alert to the investigator's potential conflicts of interest but not to exhibit a reflexive negative reaction when one is disclosed. Financial gain is considered by many to be the primary reason for author conflict of interest. However, all investigators benefit personally by having their studies published through recognition, promotion, and freedom from clinical or administrative responsibilities. A researcher who develops a new product is in a particularly difficult position. Although research is desirable to ensure the safety and efficacy of the product, commercialization is needed to bring the product to those who might benefit from it, and such research may be viewed as tainted by the profit motive. Krinsky and Rothenberg²⁹ noted that, although those who oppose financial disclosure policies state that financial disclosure

represents only one of many potential conflicts of interest issues, others think that reporting financial interests allows readers to formulate their own opinions regarding the actual existence of a conflict of interest and its relevance to study findings.

The International Committee of Medical Journal Editors states "authors are responsible for recognizing and disclosing financial and other conflicts of interest that might bias their work."³⁰ Despite these guidelines, Wilkes and Kravitz³¹ reported that only 26% of responding editors required authors to reveal the sources of their funding, 28% required disclosure of all institutional affiliations, 13% required disclosure of consultant positions, and 10% required disclosure of stock ownership that might be perceived as a conflict of interest. Much good work can be conducted, despite conflicts of interest, but full disclosure is needed to allow reviewers and readers to recognize the potential for bias and the steps taken to minimize it. Additionally, further uniformity and more specificity on the part of journals and editors regarding what and how to disclose potential conflicts of interest is needed to improve the peer-review process and the quality and context of the medical research literature.

Positive Findings Bias. Studies that report novel, clinically significant findings are often thought to be more interesting than those that do not. Studies have shown that although there is a predilection for journals to accept meeting abstracts for studies with positive findings, there are not significant differences in the strength of design or scientific rigor with these studies than with those reporting negative findings.³² Rejection of research abstracts for presentation at national meetings is associated with a lower publication of that research in medical journals.³³ In another report evaluating clinical studies approved by a local research and ethics com-

mittee, there were significant publication biases found in work showing statistically significant results being preferentially published. In this report, studies with statistically significant results were also more likely to lead to future publications and publication in "higher-impact" journals. Observational and bench-related studies were the most vulnerable to this type of bias, and randomized clinical trials were less vulnerable.³⁴ Positive-outcome publication bias is significant and can have serious implications for treatment practices and the accuracy of literature review. If the one study with positive findings on a topic gets published and the 19 with negative findings do not, a review of the literature will result in a misleading conclusion. Reviewers and editors need to be aware of this bias and, if the studies are well done, to be equally open to the publication of negative findings as positive ones.

AUTHORSHIP REQUIREMENTS AND ETHICS

The inclusion and ordering of investigators as authors on manuscripts has long been a point of controversy. Individuals reviewing manuscripts often do not deal directly with this matter, particularly when manuscript reviews are blinded, but this issue is relevant at the editorial policy level of peer review. Authorship in a publication should establish accountability, responsibility, and credit for the work presented and, as such, remains an important topic for discussion in peer review.³⁵ The inappropriate naming of individuals on manuscripts through honorary authorships and the exclusion of others who meet criteria for authorship undermines the integrity of authorship and the peer-review process. Although many authors or investigators are reluctant to accept responsibility for integrity of the data,

reporting errors, or other problems with manuscripts, too few abstain from taking advantage of an opportunity to be named on a manuscript. There may be pressures (spoken or implied) on trainees and junior investigators to include people such as departmental chairpersons and disinterested advisors or senior level investigators on manuscripts. This is true even with individuals who are only peripherally knowledgeable of the work completed or who have research interests in the same general topic areas as the primary author. This phenomenon often leads to a perspective by trainees or junior faculty of "being the ox to which others yoke themselves for the sake of personal academic advancement." Conversely, the pressures of research success and the continual "raising of the standards bar" for academic advancement may contribute to senior investigators using poor judgment when expecting or accepting honorary authorships.

In recent years, there has been a significant increase in the numbers of authors named on manuscripts. It was reported that, for one medical journal, the increase in the numbers of authors on manuscripts was primarily due to the rise in authorship of professors and departmental chairpersons.³⁶ Flanagan et al.³⁵ confidentially surveyed corresponding authors to determine the prevalence of articles with honorary (named authors who have not met authorship criteria based on the guidelines set forth by the International Committee of Medical Journal Editors³⁰) or ghost writers (individuals not named as authors but contributed substantially to the work). Her results showed that of 809 articles, 19% had honorary authors and 11% had ghost authors.

In addition to uniform requirements for publication of manuscripts, including redundant and secondary publication, patient privacy,

reporting guidelines, reference styles, conflicts of interest, industry support, and peer review, the International Committee of Medical Journal Editors has definitive guidelines for what contributions merit authorship on a manuscript.³⁰ The authors of this document stated that:

authorship credit be based only on (1) substantial contribution to conception and design, or acquisition of data, or analysis and interpretation of data; (2) drafting the article or revising it critically for important intellectual content; and (3) final approval of the version to be published. Conditions 1, 2, and 3 must all be met. Acquisition of funding, the collection of data, or general supervision of the research group, by themselves, do not justify authorship.³⁰

These guidelines imply author responsibility for the accuracy and integrity of the results.

Although these guidelines seem definitive in nature, much regarding what contributions constitute authorship still remains gray and open for interpretation. The primary author is left to ultimately make these decisions for herself or himself. Although authors frequently take great care to discuss in the acknowledgments section the contributions of individuals who are not authors, readers and reviewers often have no idea regarding specific author contributions.³⁷ Increasingly, leading journals are requiring authors to indicate the specific contributions each author makes to a work being reviewed to increase the accountability and integrity associated with authorship.^{37,38} Authorship accountability is not currently routine within rehabilitation journals. To adequately address these issues within the rehabilitation research peer-review process, a formal authorship disclosure policy should be implemented as a publication standard. This may also need to include statements by the authors for their manuscripts attesting that all individuals

that meet criteria for authorship have been appropriately credited.

Reporting of Ethical Requirements and Guidelines with Human Subjects and Animal Research

Over the last 50–60 yr, great strides have been made to identify, ensure, and protect the rights of human subjects participating in research and to ensure the humane treatment of animals used in medical experimentation. Landmark studies, such as the Tuskegee project,³⁹ and historical regulatory milestones, including the formulation of the Nuremberg Code (<http://ohsr.od.nih.gov/nuremberg.php3>) and the Declaration of Helsinki (<http://ohsr.od.nih.gov/helsinki.php3>), have paved the way for greater protections for people participating in medical research and identifying populations with special risks. The Belmont Report of 1979 (<http://ohsr.od.nih.gov/mpa/belmont.php3>) serves as a cornerstone for the ethical principles of respect for persons, beneficence, and justice that investigators must uphold when conducting human subjects research and on which federal regulations overseeing human research conduct are based. As the complexity of modern medical research continues to grow, new ethical concerns are continually raised and include such contemporary topics as human genetics research, embryonic stem cell research, prehospital clinical trials, patient anonymity, and waived informed consent. These issues can have significant effects on how to approach rehabilitation research in patients diagnosed as having genetically linked diseases, such as muscular dystrophy and Alzheimer's dementia, patients who are cognitively impaired and considered "at risk" in the context of human subjects protection, and patients with spinal cord injury, traumatic brain injury, or stroke in whom stem cell therapy clinical trials may be feasible.

Despite these issues being well recognized, there remains a discrepancy among medical journals with the reporting of the ethical requirements and guidelines investigators followed when implementing their human subjects research. Institutional review board (IRB) approval for the vast majority of human research protocols has now become the routine at most institutions. However, in one study, approximately one half of the English-language biomedical journals studied did not publish any guidelines for authors indicating the requirements for reporting IRB approval in their manuscripts. In those journals that require IRB approval for publication, the means by which authors may meet this requirement is variable and can include a short statement in the body of the manuscript or, in some cases, a separate signed statement by the author.⁴⁰ Some journals, however, will require investigators to provide a copy of the original IRB approval letter for their research protocol. Lack of guidelines and reporting on human subjects participation and humane use of animals is not a problem solely for smaller or less prominent journals. Although higher methodologic quality is associated with both publication in higher-profile journals and with adequate human subject and animal reporting,⁴¹ even leading medical journals publish a significant number of studies that are not conducted with the approval of an IRB or equivalent committee.⁴²

Beyond the editorial obligation to ensure a written statement of IRB or other appropriate approval, reviewers have an obligation to ensure that authors explain in detail, when necessary, associated ethical issues with the conduct of their study so that readers understand how important issues like patient anonymity, waived consent, absence of standard treatment for control groups, justification for unblinded trials, guidelines for stopping a trial prematurely, and

use of biological substances for secondary analyses were handled. Reviewers evaluating animal-based research should ensure that statements are included regarding Institutional Animal Care and Use Committee or an equivalent federally accepted approval. Appropriate detail should be reported in the manuscript regarding aspects of the research protocol that minimize animal suffering such as appropriate use of anesthesia, analgesia, and euthanasia techniques.

PEER REVIEW: A GUIDELINE FOR REVIEWERS AND EDITORS

Questions to Ask Before Beginning the Review

Do I have the clinical expertise to review this article? When asked to be a reviewer for a scientific journal, each reviewer is asked to provide a list of specific areas for which they would like to review. Ideally, this reflects the reviewer's specific areas of expertise, interest, or passion. When selecting reviewers for a given manuscript, the editor will refer to this list of specialty areas and assign reviews based on the closest match to the manuscript's emphasis and identified key words. If a manuscript is assigned to a reviewer that is outside the area of his or her expertise, the reviewer should contact the editor before proceeding. Occasionally, a manuscript will address an area for which there are few "experts" available, and the editor may have selected the reviewer for his or her expertise in experimental design, statistical background, or related area of expertise. The reviewer may find it necessary to review cited references and topical reviews related to the manuscript's emphasis. Oftentimes, the greatest reward a reviewer receives is the opportunity to expand his or her knowledge base and clinical horizons.

Do I have the research knowledge to review this article? Clinical expertise

may not directly translate into research expertise in the selected area. As stated earlier, the astute reviewer must be able to discern appropriate research design, methodology, and statistical analyses pertinent to the manuscript being reviewed. If the reviewer is unfamiliar with current methodologies for this particular area of expertise, and lacks the time or resources to gain insight necessary for critical review, the editor should be notified before proceeding. Reviewers should not be afraid to ask for specific assistance in reviewing an article or to declare their lack of expertise in evaluating a particular aspect of a manuscript (e.g., the methodology or statistical analysis used). As a whole, this type of approach to scientific review will enhance, not hinder, the end product. The manuscript's citations should include specific reference to new or unusual techniques, and reviewers should take time to browse these citations. Each reviewer should know how to critically review a medical journal manuscript and how to apply and utilize basic biostatistical analyses. In addition to materials on the Association of American Physiatrists Website (<http://www.physiatry.org/research/index.html>), excellent reviews for these topics are available.⁴³⁻⁴⁹

Are there any conflicts of interest with myself as the reviewer? This may require some soul searching on the reviewer's part. In the strictest sense, conflict of interest exists when a reviewer "has financial or personal relationships with other persons or organizations that inappropriately influence (bias) his or her actions."⁵⁰ This relationship may be in the form of employment, consultancies, honoraria, paid expert testimony, patents, and stock ownership. Conflicts may also encompass more personal reasons such as personal/family relationships, academic competition, or intellectual passion. The potential for bias may exist regardless of the reviewer's belief that the relationship will not affect his or her scientific judgment and may subsequently un-

dermine the credibility of the reviewer, editor, and journal. If the possibility for conflict of interest exists, the editor should be alerted before proceeding with the review. Because the field of physical medicine and rehabilitation is relatively small, many authors and research groups will be known to each other, and the editor will ultimately make the decision of whether the reviewer should proceed. At the very least, the editor will have been notified that a conflict of interest may exist and will have the opportunity to remove bias from the subsequent review.

Do I have the time to review this article? Most journals request that reviews be completed within 2 wk of reviewer receipt to ensure reasonable turn-around time to the authors. Yet more time spent on the review has been shown to increase the quality of the review.¹⁵ Often, the reviewer will be contacted in advance to ensure his or her schedule will accommodate such a request. Once returned by the reviewer, the editor may need to incorporate the comments of the two or three reviewers into a concise and cohesive document that will be of benefit to the author or authors. As such, the thoughtful reviewer should allow adequate time in his or her schedule to read through the manuscript thoroughly, with additional time allotted for citation review and time to construct an appropriate commentary. Ideally, the review will be completed before it is due to allow a final inspection of the commentary before forwarding to the editor.

Questions to Ask When Reviewing the Manuscript

These questions and concepts are adapted from Bordage et al., "Review Criteria for Research Manuscripts."⁵¹ Reviewing a manuscript is not necessarily a linear process. For instance, one cannot accurately assess the appropriateness of the abstract until the entire manuscript has been reviewed. Therefore, a reviewer will often go

through the manuscript more than once. Although there are many valid ways in which to review a manuscript, one ought to keep several general questions in mind when reading. These questions are summarized as a checklist in Appendix A.

Is this an manuscript of interest to the journal's readership? Obviously, this requires knowledge of who reads the journal for which you are reviewing. *JAMA* and the *New England Journal of Medicine* have a much broader audience than specialty journals such as the *American Journal of Physical Medicine and Rehabilitation*. Therefore, the articles they publish may have some sort of broad significance. In addition, some journals, such as *Lancet*, have an international audience with many studies performed outside the United States. When in doubt about the importance of an article to a journal, reviewers should review the instructions for authors and the mission statement of the journal to ensure their objectivity regarding the importance of the topic matter.

Will the article add to the knowledge base about a particular topic? Although reproducing the results of other studies is important, good articles extend the work of others, expanding what is known about a subject.

Will the article change practice, alter research directions, or influence a health policy debate? This is the famous "so what?" criterion. An important article will have implications either for clinical practice, health policy, or how or what researchers study.

Have the researchers utilized new or interesting methods that deserve exposure? Occasionally, a manuscript will describe a novel research methodology that will be of interest to other researchers. New methods that are state-of-the-art or improve the manner in which research is conducted should be given

appropriate consideration during peer review.

Is the writing clear, logical, and organized? Writing manuscripts in a scientific style is not easy and takes a lot of practice. This difficulty can be exacerbated by the strict word limits journals have on the size of articles and language difficulties for foreign authors. Some suggestions or examples of how to improve grammar and writing style within the manuscript may be warranted. It is also appropriate for a reviewer to suggest that the authors consult a copy editor, or at least a native English speaker, before resubmitting an article.

Beyond these general questions, there are many specific questions that should be raised about various sections of the manuscript:

Abstract. Abstracts can be poor if it is difficult to determine the population studied and major findings reported. This makes the utility of abstracts in screening and retrieval of articles more difficult.⁵² A high-quality abstract should be able to stand alone and convey the essence of the text in a clear, standardized fashion. It should not contain anything that is not also in the text. Questions to consider: Is it written in a structured format? Are the text and the abstract consistent? Is there information in the abstract that is not in the text? Are there conclusions in the abstract that are not in the text?

Introduction. The introduction should set the stage for the rest of the text. It should contain a study hypothesis or research question and reasons why this hypothesis or question is important. It may also contain a literature review, although this may also be found in the discussion section. The literature review should be current and complete, but the text should only touch on relevant articles. In some cases, a brief historical perspective about a topic may be relevant. In general, a comprehensive

review of early studies in an area is not usually warranted. Study variables can also be defined in this section or the methods section.

Methods. Evaluation points unique to each submission are commonly related to study design. For instance the question “was blinding effective?” is important to interventional trials but often not relevant to case series. Adequate work-up of conditions may be critical to a case report and not important to the description of a new technology device. For single-subject studies, the review must evaluate if an appropriate A-B-A design was used and should ensure that appropriate caution is used when generalizing the results to a larger population.

Other pertinent questions to think about include: Are the methods documented well enough that others could replicate the study? Do the authors adequately report on the ethical participation/use of subjects (human/animal) in their study? Is the study design appropriate for the research question? Does the study include an appropriate, clearly defined population of participants? Do the authors discuss loss to follow-up and how it was addressed? Does the study provide a multivariate analysis or other type of secondary analysis that attempts to account for confounding factors and bias? Are the instruments used well validated? Was any randomization or blinding done in an appropriate fashion? Were the statistical tests used appropriate? Was there an appropriate sample size to detect the treatment effect? Were statistical adjustments made for multiple comparisons? Was missing data handled appropriately?

Results. This section should display the study results in the clearest and most organized way possible. In this section, authors should refrain from drawing inferences about the data or repeating what can be already be found in the figures and tables. Rel-

evant questions to consider: Are all of the relevant data displayed? Is there good use of figures and tables? Does the text highlight or just reiterate these data? Do the tables agree with the text?

Discussion and Conclusions. The first part of this section should repeat the main findings of the study and put them in the context of the study objectives and the published literature. This should be followed by an interpretation of the study findings, including implications for clinical care, healthcare policy, or future research directions. The section must include paragraphs on study limitations or alternative interpretations of the data. Specific questions that should be addressed: Are the conclusions well supported by the data? Do the authors provide suggestions for future considerations and directions for their work?

After Reviewing the Manuscript

After the analysis is complete, reviewers make separate recommendations to the editor and to the author regarding the manuscript. Reviewers are asked to give the editor an overall impression about what should be done with the manuscript. Most journals group manuscripts into four categories: reject, reject with an invitation to resubmit, accept pending modifications, and accept. Very few articles are accepted outright, so most of the manuscripts end up in the first three categories. Articles on topics that are of little interest to the readership or have fatal methodologic flaws (or multiple nonfatal flaws) are usually rejected. The final decision on whether to publish is usually made by the editor. However, a recommendation that is well justified by reviewer comments is extremely valuable to the editor and improves the quality and appropriateness of articles published.

Reviewers are also asked to provide comments to the authors re-

garding their manuscript. As noted previously, reviewers should concentrate on helping the authors improve their manuscript. This means that the tone of the comments should not be unduly harsh but should be supportive and constructive. This is particularly important for young authors who are just starting out and perhaps considering an academic career.

Helping the Author

The reviewer and editor can be a tremendous help to the author, regardless of whether a study is accepted with revisions or rejected.¹⁵ However, criticism needs to be constructive to be useful. Van Rooyen et al.⁵³ showed that when reviewers were asked to consent to having their name identified to authors during the peer-review process, it significantly increased the likelihood that reviewers would decline to review. Although reasons for declining review were likely many, reviewers should ask themselves at the beginning and on completing their review if they would be comfortable having their name given to the author in association with the review they have written. In short, reviewers should be willing to stand by the quality, accuracy, non-partisanship, and constructive quality of their reviews.

Reviews should start a review by saying what is positive about the study, even if only that "it's an interesting and important topic." Remember that even poorly completed and conceived studies entailed a significant amount of work on the part of the investigators. In addition, there may be an important grain of truth that is worthy of publication within a poor study. Indeed, some methodologic errors actually enhance the validity of the conclusions (e.g., if there were problems that would only have served to make it more difficult for the findings to have been identified). The reviewer with a positive attitude will look for "the needle in the haystack" and "the wheat among the

chaff." However, the reviewer should avoid stepping over the line from being helpful to being meddlesome—"whose study is it, anyway?" Also, the reviewer should resist the temptation to suggest that the study might have been conducted differently, especially if there are merits to the method used by the authors—do not expect the authors to "unscramble scrambled eggs."

EDITORIAL ISSUES AND RESPONSIBILITIES WITH PEER REVIEW

Communication with Authors and Reviewers

The review process can be a lengthy one. In one study, time to editorial decision and communications with the editorial office were some areas of the peer-review process with which contributors were most dissatisfied.⁵⁴ If the author has not received a reply by 3 mo after the date of the initial letter acknowledging receipt of the manuscript, it is reasonable for him or her to contact the editorial office to politely inquire about the status of the review. Likewise, editors have a responsibility to ensure that reviewers complete timely reviews, and if this is not possible, employ additional reviewers to complete the peer-review process.

Editorial Appeals. Authors are not entirely at the mercy of the peer-review process. If a rejection letter is received, it is generally best for authors to let some time pass until sufficient objectivity can be recovered to determine if the manuscript still has merit. If so, authors should take the reviewers' comments into consideration, revise the manuscript, and resubmit it to a different journal. However, if an author believes that he or she has been treated unfairly, journals should have an appeals process whereby a disinterested party (e.g., the editor-in-chief) will expeditiously review the manuscript and correspondence.

Assurance of Adequate Reporting and Accountability. Editorial offices need to provide explicit policies for authors regarding the accountability and reporting of author contribution, conflicts of interest, research ethics, and appropriate approvals for human subjects and animal based research. Beyond this, editorial offices should provide specific guidelines for reviewers on how to evaluate these issues.

Assurance of Review Quality. Editors have an obligation to appropriately screen reviewers for appropriate qualifications and expertise. As previously noted, not all reviewers will have the expertise to adequately evaluate all aspects of the manuscript. Rehabilitation journals and editorial offices need to ensure appropriate statistical support is available to reviewers. A statistical reviewer for each manuscript submitted should be a standard practice or, in cases where this does not exist, a goal to actively pursue. Additionally, editors should consider routinely utilizing a "peer reviewer team," in which the group of reviewers, together, has the expertise to evaluate all aspects of a manuscript. To increase reviewer quality and objectivity, journals and editorial offices should consider developing journal-specific reviewer training materials and implementing detailed structured review formats for manuscript reviews. Journals and editors also should consider the need to evaluate authors' satisfaction with their peer-review experiences and use that feedback to help improve their peer-review process. Finally, editors have a specific responsibility to the medical community to encourage appropriate interest and fair acceptance of negative data articles.

CONCLUSIONS

Despite the widespread utilization of peer review for manuscript appraisal and its vital importance to the quality of the scientific literature

published, the issues discussed here highlight the difficulties that remain with quality, consistency, and objectivity of reviews. As persons with a vested interest in the quality and integrity of published rehabilitation literature, we are interested in the promotion of physical medicine and rehabilitation as an important area of medicine and a leader in the conduct of medical research. As such, we should strive to continue to improve and build on the foundations of our discipline's current peer-review process. Both academicians and private practitioners should take an active and positive role as peer reviewers to ensure that work published in rehabilitation journals is of high quality and that investigators in rehabilitation medicine receive positive and meaningful feedback to improve their work before publication. Participating in peer review should be considered a service obligation for all academicians in physiatry. Increasing the number of reviewers available to journal editors will improve the quality and objectivity of peer reviews. The development of sound approaches to manuscript critique is necessary for trainees who will eventually become reviewers and for current or established reviewers to improve on the peer-review process and improve the quality of literature published in rehabilitation journals. The material presented here is meant to serve as one resource to help achieve this goal.

Steps should be taken within our discipline and at the editorial level of our primary journals to evaluate the current state of peer review and ensure that issues such as appropriate disclosures, authorship designations and responsibilities, and verification of human subjects ethics and humane use of animals in research are consistently and completely addressed for all manuscripts to be published. Regular statistical review for manuscripts, statistical support for reviewers, and complementary peer

reviewer teams are necessary to improve the over-all quality of the peer-review process and to effectively address important methodologic issues often present in published rehabilitation research. Open communications by editorial offices with authors and reviewers along with timely review and publication of contemporary work will improve the quality of manuscripts submitted and author satisfaction with the peer-review process. Finally, peer-reviewer workshops or detailed, structured reviewer worksheets should be considered and may be helpful for higher-quality manuscript review.

ACKNOWLEDGMENTS

We thank Drs. Anthony Kline, Eugene Wagner, and Anthony Fabio for their helpful comments and critical reading of the manuscript.

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Appendix A: Peer Review Checklist

Before Beginning the Review

- Do I have the clinical expertise to review this article?
- Do I have the research knowledge to review this article?
- Are there any conflicts of interest with myself as the reviewer?
- Do I have the time to review this article?

When Reviewing the Manuscript

General

- Is this an article of interest to the journal's readership?
- Will the paper add to the knowledge base about a particular topic?
- Will the paper change practice, alter research direction, or influence health policy?
- Did the researchers utilize new methods that deserve exposure?
- Was the writing clear, logical, and organized?

Abstract

- Did the abstract stand alone and report the essential findings of the study?
- Was the abstract written in a clear and standardized fashion?
- Were the abstract and the text consistent?

Introduction

- Did the introduction set the stage for the study?
- Did the authors provide enough background to justify the study?
- Was the literature review current and relevant?

Methods

- Was there enough methodological detail given so that others could repeat the study?
- Were study variables defined?
- Did the authors adequately report on the ethical participation/use of subjects (human/animal) in their study?
- Was the study design appropriate for the research question?
- Did the study include an appropriate, clearly defined population of participants?
- Do the authors discuss loss to follow-up and how it was addressed?
- Did the study provide a multivariate analysis or other secondary analysis that took account for confounding factors and bias?
- Were the instruments used well validated?
- Was any randomization or blinding done in an appropriate fashion?
- Were the statistical tests used appropriate?
- Was there an appropriate sample size to detect the treatment effect?
- Were statistical adjustments made for multiple comparisons?
- Was missing data handled appropriately?
- If applicable, was an appropriate single-subject design implemented?

Results

- Were the results present in a clear and organized manner?
- Were all of the relevant data displayed?
- Did the text highlight or simply reiterate the data?
- Did the tables and figures agree with the text?

Discussion

- Did the discussion repeat the main findings and put them in context with the literature?
- Did the conclusions support the data presented?
- Did the discussion include a limitations section?
- Did the authors provide suggestions for future directions?