

Health Policy Review


Medical Journal Peer Review: Process and Bias

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Scientific peer review is pivotal in health care research in that it facilitates the evaluation of findings for competence, significance, and originality by qualified experts. While the origins of peer review can be traced to the societies of the eighteenth century, it became an institutionalized part of the scholarly process in the latter half of the twentieth century. This was a response to the growth of research and greater subject specialization. With the current increase in the number of specialty journals, the peer review process continues to evolve to meet the needs of patients, clinicians, and policy makers.

The peer review process itself faces challenges. Unblinded peer review might suffer from positive or negative bias towards certain authors, specialties, and institutions. Peer review can also suffer when editors and/or reviewers might be unable to understand the contents of the submitted manuscript. This can result in an inability to detect major flaws, or revelations of major flaws after acceptance of publication by the editors. Other concerns include potentially long delays in publication and challenges uncovering plagiarism, duplication, corruption and scientific misconduct. Conversely, a multitude of these challenges have led to claims of scientific misconduct and an erosion of faith. These challenges have invited criticism of the peer review process itself. However, despite its imperfections, the peer review process enjoys widespread support in the scientific community.

Peer review bias is one of the major focuses of today's scientific assessment of the literature. Various types of peer review bias include content-based bias, confirmation bias, bias due to conservatism, bias against interdisciplinary research, publication bias, and the bias of conflicts of interest. Consequently, peer review would benefit from various changes and improvements with appropriate training of reviewers to provide quality reviews to maintain the quality and integrity of research without bias. Thus, an appropriate, transparent peer review is not only ideal, but necessary for the future to facilitate scientific progress.

Key words: Scientific research, peer review process, scientific publications, peer review bias, blinded peer review, scientific misconduct.

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Health care research, practice, and policy focuses on improving the organization, delivery, and outcome of care (1,2). Critical to achieving the goals of appropriate health care is scientific research. Evidence-based medicine and comparative effectiveness research are often seen as scientific tools for research-based quality improvement (1-4). Appropriate publications are important in academic

medicine for promotion. Institutional reputations and funding have become in large part highly leveraged to research output.

Advances in medicine and the dissemination of research findings are intrinsically linked to scientific publication. For more than 2 centuries, researchers and clinicians have published their work in scientific journals. Clinicians in turn utilize the literature to un-

derstand new techniques and breakthroughs as well as to confirm the findings of the techniques they already use. The sheer quantity of scientific literature is daunting with an increasing number of journals. For example, according to PubMed (5), almost 21 million articles have been published in biomedical journals. In a manuscript published in 2010, Bastian et al (6) showed that there were 75 trials and 11 systematic reviews published a day. In 2012, there were 28,000 scholarly peer-reviewed journals collectively publishing almost 2 million articles. To meet the needs of patients, clinicians, and policy makers it can be argued that case reports and observational reports need to be reduced, and randomized trials and systematic reviews need to be prioritized. Further, clinicians and patients should have free and open access to these important resources.

Approximately 30 years ago Archie Cochrane criticized the medical profession for not having managed to organize a critical summary, by specialty or subspecialty, adapted periodically, of all relevant randomized controlled trials (7,8). To maintain the quality of research and check scientific integrity of the publications, peer review has been popularized. Thus, scientific peer review has been adopted for evaluating research findings for competence, significance, and originality by qualified experts in the same field (9,10). Peers act as sentinels on the road of scientific discovery and publication, ensuring the quality of scientific information, an act mandatory for reducing misinformation, confusion, bias, and inappropriate publications (9,11). In recent years, with medical publishing growing exponentially and new medical journals dedicated to increasingly niche microcosms, multiple issues are noted every day with the implementation of a high-quality peer system. Thus, medical publishing and peer review find themselves at a crossroads with continual dissemination of selective and occasionally misleading information. The value of publications also has sometimes been measured by artificial measurements such as the origination of the manuscript, funding, and the impact factor. Peer review can be biased and contentious. Based on extensive editorial and peer review experience and publications, the authors of this manuscript express contemporary opinions on peer review with transparency and value.

HISTORICAL BACKGROUND

In 1655, when the first collection of scientific essays was introduced by Denis de Sallo, in the *Journal des Scavans* (9), there was no thought of peer review (12).

At the time, the goal of the author was to simply report the findings of others rather than guarantee the accuracy of results. In 1731, the Royal Society of Edinburgh published *Medical Essays and Observations*, a collection of articles after the first-ever peer review (12,13). These essays were distributed by the editor for review to individuals that he considered to be most versed in these matters (12). Even then, the Royal Society of Edinburgh recognized and was cautious in providing that the stamp of peer review did not necessarily mean the work was better than non-peer-reviewed publications. Consequently, they provided a disclaimer stating the peer review did not guarantee truthfulness or accuracy and they emphasized that the purpose of the journal was solely to disseminate creative and important ideas. As it is today, the submitting authors were ultimately responsible for the quality and veracity of their own research (12).

The ensuing development of peer review not only has been gradual and slow, but also has been haphazard (9,14). Editors of multiple journals apply different and varying styles of peer review. Interestingly enough, until 1976, the *Lancet* did not implement peer review as they considered it was not very important (13). Further, the *Journal of the American Medical Association (JAMA)* sent their submissions to an internal review panel, and on rare occasions, they sent manuscripts to outside experts (13). In contrast, the *British Medical Journal* sent every noneditorial submission to a recognized expert as early as 1893 (14). By the late twentieth century, peer review became a standard and is currently utilized by almost all biomedical journals.

CURRENT STATE OF PEER REVIEW

New specialized medical journals and the increased competition among various journals for manuscript submission have increased the importance of peer review. The system employed at present, even though it has evolved from its eighteenth-century roots, is considerably different in its present form (15,16). In spite of various concerns and its arguable shortcomings, peer review provides a formal opportunity for authors to gauge reaction to their work, as well as to allow for the possible detection and subsequent correction of errors or flaws in logic prior to an article's publication. In general, it is the embodiment of the process of systematically distributing, evaluating, and reaching a consensus on the merits and shortfalls of the manuscripts as a result of acceptance, revisions, and rejection. Thus, the cornerstone of peer review is the expert reviewers

applying their knowledge, expertise, fairness without bias, unbiased interpretation, and interest to review the manuscript with care and diligence (17-19). In addition to the peer reviewers, journal policies and editors play a critical role. At times, this role can suffer from a seeming lack of transparency. Challenges in transparency can lead to the introduction of various types of bias: true quality value, as a function of reviewer characteristics, confirmation bias, bias based on conservatism, specialty bias, and bias of multiple other factors including, but not limited to, conflicts of interest (20-35).

Despite the acceptance of peer review in the scientific community as the gold standard, concerns exist; specifically, potential bias towards certain authors, specialties, and institutions, both in favor and against; poor peer review with editors and reviewers unable to understand the contents of the manuscript and providing negative opinions or even positive opinions at times; an inability to detect major flaws, or revelations of major flaws after acceptance of publication by the editors; unnecessary and extreme delays in publications, which at its extreme can take 2 to 3 years to publish a manuscript after submission; inability to uncover plagiarism, corruption, scientific misconduct, and fraud, without using appropriate knowledge to claim plagiarism or even scientific misconduct. All of the above can have the undesirable effect of eroding faith in and thus inviting criticism and scrutiny of the peer review process. In fact, Cantekin et al (29) exposed a quagmire of issues including reviewer bias, reviewer conflict of interest, breach of confidentiality, disclosures of funding sources, intellectual property rights, plagiarism, and finally, the proper venue for publication of dissenting viewpoints, which is a common phenomenon among highly reputable journals suppressing scientific opinions.

PEER REVIEW PROCESS

The peer review process consists of several stakeholders, each with their own requirements, expectations, and biases. The primary stakeholders, the authors, look to receive fair and impartial advice and to get the paper published. The scientific community must be able to trust research findings. Equally important stakeholders, the journals, are under considerable pressure to ensure the integrity and accuracy of material they publish in order to maintain the quality and probity of the research. Ultimately, the general public relies on the publication process, which ensures the quality and integrity of the research, to provide the best analysis. Consequently, all aspects of the process by which scien-

tific material is reviewed and published are crucial and continually assessed with evolving concepts. The centerpiece of the quality and integrity of research and publication is peer review. The rigor of the peer review process, unfortunately, is inconsistent across journals. Protecting the quality and integrity of the research is the primary criterion for any publication. In this process, bias must be avoided (30). The peer review process is generally lengthy; however, it may become extremely long for some journals based on the philosophy of the editors, and peer reviewers who may contribute to the delay. Table 1 shows the general steps in publication of a manuscript, which includes peer review. Initially, a manuscript is assessed by the editors, followed by the peer review process, followed by a decision by the editor-in-chief.

Peer reviewers are generally volunteers. They are provided with a timeline to perform their review and instructions to rate the manuscript based on various factors. Generally, 2 or 3 reviewers evaluate a paper. Based on the reviewers' initial comments, the section editor or editor-in-chief will make a decision to reject or to accept with revisions. Revisions may be minor or major. A paper may be accepted without any revisions if it is thought that the paper is of sufficient quality and does not require any adjustments. Otherwise, the authors are provided with an opportunity to correct or improve the paper and resubmit.

Even though peer review is an imperfect process, the majority of the scientific community considers it a valuable process and the best system available to the scientific community (30-32). In a survey of 4,000 research workers in 2009, 84% believed peer review to be necessary to control scientific information; however, only 69% were satisfied with the system in its present form (32). Further, a large majority (91%) also believed that their last paper had been improved as a result of peer review.

Currently, there are multiple software titles available to detect duplication or plagiarism, which may introduce their own issues with over-interpretation of preset parameters, without focusing on the content which ultimately may not make any difference and may not determine the value of the manuscript.

THE ROLE OF REVIEWERS AND EDITORS

The editor-in-chief is considered the supreme authority for the journal. Further, all editors and reviewers have authority over a manuscript's fate (33), even though the final decision may be made by either the

Table 1. Steps in submission, peer review, and publication of a manuscript.

| | |
|--|--|
| 1. Initial Phase (Researchers) | |
| • | Research |
| • | Initial manuscript preparation |
| • | Internal review |
| • | Final manuscript |
| • | Submission to journal |
| 2. Intermediate Phase (Journal) | |
| i. Journal | |
| • | Receives manuscript |
| • | Log and acknowledge receipt |
| • | Quality check to confirm appropriateness to journal |
| ii. Editors | |
| • | Editors review manuscripts for quality |
| • | Editors confirm relevance to journal |
| • | Editors decide on experts with relevant specialization to consider peer review or reject |
| iii. Peer Review | |
| • | Peer reviewers examine the manuscript for: |
| • | Study design/methodology, validity, accuracy, originality, significance |
| • | Peer reviewers make a recommendation to accept, reject or ask for modifications |
| iv. Editors | |
| • | Consider review outcomes |
| • | Make decision to reject/revise/accept |
| 3. Semi-Final Phase | |
| i. Authors | |
| • | Respond to comments and suggestions |
| • | Revise manuscript |
| ii. Editors | |
| • | Final decision to accept/reject manuscript |
| 4. Final Phase (Publication) | |
| • | Manuscript preparation |
| • | Proofs |
| • | Publication |

editor-in-chief or an assigned designee. Editors primarily direct the manuscript by selecting reviewers and communicating with authors and reviewers as well as by making the final decision on publication (34,35). Reviewers are selected based on their expertise and availability to assess the quality of the manuscript. Consequently, editors seek to balance the needs of their readers to receive only the most relevant information, while providing a level of manuscript evaluation to authors that promotes continued submission in the face of stringent acceptance criteria (9). Reviewers are expected to examine technical attributes as well as scientific quality, clarity of presentation, and ethical validity. They are also expected to perform the review in a manner consistent with ethical practices and general guidelines, in a transparent and fair manner without exerting personal, professional, or specialty bias (35). Reviewers

have an obligation to provide timely feedback to editors as experts without bias, as the de facto determiner for manuscript rejection, acceptance, or publication (9,34-37).

PEER REVIEW BIAS

Bias may be defined as a systematic prejudice that prevents the accurate and objective interpretation of scientific studies; it is not easily detectable, or even correctable (38-41). Multiple manuscripts have been shown to favor prominent researchers from well-known research groups, even though the process was blinded (39). On the other hand, despite high institutional status and acceptance of brief reports, the favorable relationship was not observed in the acceptance of regular articles (40).

The quality of the peer review process with author

and editorial board member perspectives has been assessed by Bunner and Larson (42). The results showed that more than three-fourths of the respondents (77.9%) stated that they knew what to expect from the review process, whereas 18.9% reported that they only had a general idea about the review process, and 3.2% indicated that they did not know what to expect (42). Of the authors whose manuscripts were accepted, 83.6% ranked their reviews as the same as or better than other reviews they had received, whereas 50% of the authors whose manuscripts were rejected ranked their reviews as worse. Almost 30% felt that reviewers had not had an accurate understanding of the paper's topic, over 34% felt the reviewer comments were insufficient, approximately 30% felt the reviewers failed to provide suitable suggestions for revision, and almost 50% felt the criticism was unfair and biased.

Turning our attention to reviewers, generally, editors try to find academicians in appropriate fields with sufficient experience. One challenge is that topical experts can be inundated with requests for review. A reviewer's task is to judge the scientific integrity of the article in question, but other factors come into play. In the experience of the authors of this manuscript, a complaint of reviewers is that their own previously published work is related to, but not necessarily relevant, to the article in question, and has not been sufficiently cited. Another complaint is that their opinions do not agree with the manuscript's results or conclusions. Further, if the reviewers do not like the results of the manuscript, they may try to inject their own biases. Both double blind and open reviews are subject to these types of bias.

TYPES OF PEER REVIEW BIAS

While peer review is considered to be a process of providing a system of institutionalized vigilance in the self-regulation of knowledge communities, authors, in anticipation of evaluation of their work, aim to conform to shared standards of excellence out of expediency and in accordance to an internalized ethos (43). The norms and values to which peers hold each other are conceived as being universally and consistently applied to all members. These norms and values pertain to the content, evidence, and arguments independent of an author's social caste or positional authority (43).

However, there have been multiple reports of biases in peer review (41-43). The charge of bias threat-

ens the social legitimacy of peer review, and contradicts the purpose of peer review, signaling to the public that the world of science and scholarship takes seriously its social responsibility as a self-regulating, normatively driven community (20). Thus, reviewer bias is understood to be a violation of impartiality in the evaluation of a submission. Lee et al (20) defined impartiality in peer evaluation as the ability for any reviewer to interpret and to apply evaluative criteria in the same way as the assessment of a submission. Essentially, impartial reviewers will arrive at an identical evaluation of a submission in relation to evaluation criteria because they will see the relationship of the criteria to the submission in the same way. However, this ideal notion of impartiality in peer review has been widely challenged (44,45). Bias may be described as deviation from true quality value, proxy measures for quality value, as a function of author characteristics (20), prestige, affiliation, nationality, language, gender, or as a function of reviewer characteristics, content-based bias, confirmation bias, conservatism bias, bias against interdisciplinary research, and publication bias.

Bias as a function of reviewer characteristics challenges the impartiality of peer review by demonstrating that reviewers fail to evaluate a submission's content and relationship to the literature independently from reviewer characteristics. In fact, such bias has been demonstrated by Jayasinghe et al (46) and Gilbert et al (47) in 2003 and 1994, showing that specific classes of reviewers are systematically tougher (46) or softer (47) on identical submissions. Toughness or leniency may vary systematically as a function of social categories to which reviewers belong such as gender, specialty affiliation, and geographic variation. Studies have shown that female reviewers are stricter than their male colleagues (20,46); whereas, female editors have been found to reject more submissions than their male colleagues (20,47), even though the opposite phenomenon has also been noticed (48). It has been shown that American reviewers are more lenient than their colleagues from the United Kingdom or Germany (49). Further, it was also demonstrated that American reviewers are more lenient than Australian reviewers and it has been suggested that the leniency of American reviewers results from a culture that is comfortable being generous in their evaluations (50).

Editors must pay specific attention to these issues for impartial assessment and publication. Table 2 describes various types of bias.

Table 2. *Types of peer review bias in medical journals.*

| |
|---|
| • Content-based bias (partiality for or against confirmation bias) |
| Ego bias |
| Cognitive cronyism |
| • Confirmation bias (interpretation of the evidence in ways that affirm, rather than challenge, the already held beliefs) |
| • Conservatism (bias against groundbreaking and innovative research) |
| • Bias against interdisciplinary research |
| • Publication bias (tendency for journals to publish research demonstrating positive, rather than negative outcomes) |
| • Conflicts of interest (personal or professional interests that could inappropriately influence judgment) |

Content-based Bias

Content-based bias involves partiality for or against admission by virtue of the content. This includes a wide range of issues with the protocol, introduction, methods, theoretical orientation, results, discussion, and conclusion of the work (20). Content-based bias may also include a form of “ego bias” where reviewers and editors prefer submissions that cite their own work. Cognitive cronyism has been described as the reviewers evaluate more favorably in submissions of authors who belong to similar schools of thought (51). Cronyism has been observed in many instances, specifically in medicine and particularly in interventional pain management. Travis and Collins (51) described that cognitive cronyism is not pernicious like social status bias so long as the boundaries of cognitive communities and social hierarchies do not coincide. However, in cases where they do coincide, which has worrisome implications for policy makers and academicians, outsiders may find “old-boy networks” that control journals and conference content (52) and citations networks (53) difficult to penetrate for social reasons masquerading as purely cognitive ones (54).

Confirmation Bias

Confirmation bias is an extremely common and pernicious type of bias. Confirmation bias is the tendency to gather and interpret evidence in ways that affirm, rather than challenge, already held beliefs (55). In the peer review system, confirmation bias is understood as reviewer bias against manuscripts describing results inconsistent with the theoretical perspective of the reviewer (56). Confirmation challenges the scientific hypothesis of the peer review process, which is the basis of the evidence independent of their “desires, value perspectives, cultural and institutional norms and pre-suppositions, expedient alliances and other interest” (57). In fact, an empirical study (58) found that refer-

ees who had published work in favor of a controversial clinical intervention judged a manuscript whose data supported the use of that intervention more favorably than those who had published work against it (58,59).

Conservatism

Conservatism in peer review is a bias against groundbreaking and innovative research. This essentially violates the impartiality of peer review by suggesting that reviewers do not interpret and apply evaluative criteria in identical ways since what counts as the proper criteria of evaluation, and their relative weightings, are disputed. Conservatism has multiple effects: threatening scientific progress, stifling funding and public articulation of alternative and revolutionary scientific theories, and violating explicit mandates articulated by journals and granting institutions to fund and publish innovative research (60-62).

Bias Against Interdisciplinary Research

Peer review bias against interdisciplinary research is very common in modern medicine (51). Bias against interdisciplinary research violates the impartiality of peer review by suggesting that reviewers not interpret and apply evaluative criteria in identical ways because what counts as the proper criteria of the evaluation, and their relative weightings, are disputed.

Publication Bias

Publication bias traditionally has been described as the tendency for journals to publish research demonstrating positive, rather than negative outcomes, where “positive outcomes” include results that have a positive direction (63), are statistically significant irrespective of the direction of the result (64), or both (65,66). The present theory of publication of positive outcomes demonstrates that scientists disagree about the evaluative merits of research reporting negative

outcomes (67,68). Further, publication bias is described as problematic because it leads to exaggerated effect size measurements in a later meta-analysis (67,68). It may also create publication patterns that conflict with overall medical specialty goals, and encourage the practice of “burying” or “redressing” negatives as positives in distorting ways (69,70). Previous research shows that publication bias is the result of reviewer and editor preferences for positive outcomes in very famous journals such as JAMA, as the reviewers and editors prefer statistically significant results on the primary outcome (71). Further, the research also shows that in anticipation of the rejection of negative outcomes, those who are primarily responsible for the disproportionate publication of positive outcomes (72,73), as well as for the increased time lag in the publication of negative results (66), may not submit negative trials.

However, contrary to popular opinion, multiple manuscripts describing negative trials are published in reference to interventional pain management in a variety of journals, alongside the alleged simultaneous rejections of positive trials (67-106). A 2014 study assessed 15,972 submitted manuscripts. It reported 30% of them to be randomized controlled trials (RCTs) for drugs of which 90 were published. The study concluded that there was no tendency to preferably publish manuscripts on drug RCTs that reported positive results (107). They suggested that publication bias may occur mainly prior to submission, but not during publication, since 20.9% of the positive trials and 20.5% of the negative trials were published.

Bias of Conflicts of Interest

Conflicts of interest may be considered in a blind review process as unusual and nonexistent; however, by definition a conflict of interest occurs when participants in the publication process have a personal or professional interest that could inappropriately influence their judgment, regardless of whether or not their judgment is actually affected (108). Physician academia-industry relationships always raise questions regarding conflict of interest and disclosure should be both a requirement and the norm (109). Editors and reviewers may be favorable and less critical of research from friends, collaborators, or scientists who agree with their beliefs of research. The opposite also can occur if a reviewer encounters a manuscript from an investigator who supports a competing idea or one that is personally disliked, or if the present author who was a reviewer provided a negative opinion to the current

reviewer's manuscript in the past. Finally, it is also noted that publications may be delayed at multiple levels if a reviewer plans to publish an article on the same or a closely related topic. Conflicts of interest are prevalent in a multitude of manners and are extremely difficult to detect (110-122).

FORMS OF PEER REVIEW

Despite concerns related to bias, peer review is the best method at present for assessing quality of submissions. In fact, a survey of perception of peer review found that 93% disagree with the claim that peer review was unnecessary; 85% believed peer review benefits scientific communication; and 83% believed that “without peer review there would be no control” (123). There is nonetheless room for improvement in the peer review process. There are numerous suggestions for alternative models of peer review in the hope of accelerating the publication process and making the review process more transparent and less susceptible to bias of different kinds (Table 3). Even though both double-blind and open peer reviews are heavily supported, single-blind review remains the norm in life and physical sciences (20,123).

Double-blind Peer Review

Based on the present evidence, the majority of respondents have indicated that double-blind review is preferred primarily because of its perceived objectivity and fairness (124). Further, studies in fields where double-blind is the norm have shown high levels of satisfaction, with a perception among the authors, reviewers, and editors that it avoids social bias and invites more publications (125). While double-blind review could protect against bias, it may be difficult to provide true blinding of a submitted manuscript (126,127). For example, in another survey of 1,500 editors in chemistry, a plurality of respondents stated that double-blinding was pointless, because content and references give away identity (126). In fact, in testing this assumption, a number of empirical studies demonstrated that reviewers can successfully identify authors 25% to 40% of the time (126). However, it has been suggested that these numbers might be significantly higher in more specialized fields and they also have not been confirmed with any type of accuracy.

Further, some double-blind review studies have been shown to reduce social bias against authors, while others found no significant difference (20). Double-blind peer review also has been shown to increase

Table 3. *The pros and cons of single- and double-blinded peer review and open peer review.*

| Blinded Reviews | | Open Reviews |
|--|---|--|
| Double blind <ul style="list-style-type: none"> Reviewer and author are unaware of each other's identity | | Single blind <ul style="list-style-type: none"> Reviewer aware of author identity only |
| Advantages <ul style="list-style-type: none"> No personal conflicts No awareness of potential conflicts in ideas All can be honest reviewers | <ul style="list-style-type: none"> Author unaware of capacity of reviewer All can be honest reviewers | <ul style="list-style-type: none"> Reviewer and author aware of each other's identity Unlimited reviewer base Biases open to public scrutiny No hidden agenda Transparent processes Rapid publication |
| Disadvantages <ul style="list-style-type: none"> No accountability No transparency Ideological bias unaccounted for No awareness of conflicts of interest Author can be identified from context/references | <ul style="list-style-type: none"> Reviewer may have animosity towards author Cronyism, likelihood of abuse of power by reviewer (reviewer bias) Author unaware of reviewer's background | <ul style="list-style-type: none"> Large number of reviews/comments, difficulty finding relevant comments, good articles/comments may be lost among others Some less willing to review seniors, harder to recruit reviewers, may inhibit criticism |

Adapted and modified from Cantekin EI, McGuire TW, Potter RL. Biomedical information, peer review, and conflict of interest as they influence public health. *JAMA* 1990; 263:1427-1430 (29).

author diversity, even though the question remains whether to blind or not to blind (128,129).

Open Peer Review

In open peer review, the authors and reviewers are known to each other. This has been seen by proponents as a way to induce transparency in the scholarly communication process and speed up the process of vetting new work. There are many arguments for open review (126,128-132). However, there are varying degrees of open review (126). The open review used by the British Medical Journal since 1999 asks reviewers to identify themselves and declare any conflicts of interest, even though the reviewers are not revealed to the readers at publication. This is essentially a single-blind review.

Despite the potential advantages of open peer review, researchers and scholars seem somewhat reticent to adopt it. In a survey by Ware and Monkman (123), only 13% preferred open review to other models and only 27% thought it could be an effective form of review. Others also have shown similar results. It also has been shown that the open review is associated with a higher refusal rate on the part of the reviewer and an increase in the amount of time taken to write reviews (133).

Hybrid Peer Review

In a hybrid system, multiple elements are combined with a single-blind peer review as described earlier, where only reviewers know an author's identity but the authors are kept in the dark. This probably is the worst

type of review, even though it is a commonly practiced type of review (123).

LIMITATIONS OF PEER REVIEW

The peer review system, either justifiably or not, has been indicted by some for its inability to detect fraud (9,20,30,119,120). When fraud is discussed openly and editors and reviewers are passionate in providing their opinions (9,25,26,134,135) it becomes more likely evident, even though outright fraud is rare. The vast majority of researchers do not purposefully create fraudulent data for publication even though there are exceptions (135-140). Godlee et al (138) intentionally introduced 8 weaknesses into a research article and sent the manuscript to 200 reviewers. However, on average only 2 of these weaknesses were identified. Callahan et al (139) reported that reviewers could not spot two-thirds of the major errors introduced into a fake manuscript. Even though many factors have been considered in this process and have been focused in reference to statistical significance and other issues (140-144), the major issue of perceived fraudulent practices by editors and peer reviewers has gained very little attention. These practices may be based on various issues of conflicts of interest resulting in bias or mere negligence.

The massive growth in publication activity increases the reviewer's workload and threatens the efficiency of the peer review process itself. Further, reviewing with an imposed deadline is hard work and errors can be made during the reviewing process which can result in influential papers being rejected or inaccurate and

fraudulent data being accepted.

Scientists and the general public expect a peer-reviewed publication to be free of dishonesty or fraudulence with truthful findings. Peer review cannot necessarily ensure that the paper is devoid of all mistakes; it can only claim that it is worth publishing (134). The publication of fraudulent research is damaging (116,119,120,141-156). A research worker was recently imprisoned for falsifying data in clinical trials (154).

In recent years, fraud, plagiarism, simultaneous submission, duplicate publication, and patterns of text reuse in the scientific corpus have become the focus of discussion. Of importance, in recent years, the anesthesiology community has learned of major fraud in clinical research committed by different authors (116,119,120,141-156). While the extent of malfeasance and fraud in clinical research is unknown, it is likely that data selection, incomplete blinding, undeserved authorship, and the post hoc designation of primary outcomes are relatively common (142). The most egregious types of fraud, such as outright fabrication or deliberate manipulation of results, are considered to be rare (142).

Discussion

Peer review has served the scientific community well for over 100 years (30). However, the peer review process continues to evolve and there is much discussion about its advantages and disadvantages. While the vast majority of researchers believe there is a need for peer review (9,30), some have discussed extensively the flawed process and disadvantages (24). Smith (24) described that peer review does not work; it has many defects and is a slow, expensive, inconsistent, biased, and abused process. However, the overwhelming majority believe that there is a need for peer review, which must be free of conflicts of interest without bias in a fair, accurate, and timely process.

Peer review would benefit from various changes and improvements with appropriate training of reviewers to provide quality reviews with maintenance of quality and integrity in clinical and basic science research without bias. An ideal peer review with transparency and bias and conflicts of interest is essential for the future of scientific progress. The experiences of the authors of this manuscript are in agreement with the opinion that well-known research groups, institutions, and authors, specifically with similar research attitudes, are accepted at a high rate, whereas nonacademic researchers, certain individuals, certain specialty publica-

tions, and certain viewpoints are sometimes rejected without proper consideration. Further, it has been noted that the objectivity of editors and reviewers has been jeopardized by ideological differences, avoidance of unconventional ideas, and conflicts of interest (41).

The inability of dissenting views to be published in journals has become a major issue. This is fairly common with general medical journals that have high impact factors which seem to reject many dissenting views, claiming a lack of space. Multiple manuscripts have been published in relation to interventional pain management in journals such as the *New England Journal of Medicine*, *JAMA*, *British Medical Journal*, *Lancet*, and *Annals of Internal Medicine* without the benefit of a contemporaneous comment by a content expert.

The peer review bias which is described in various formats ranging from content-based bias (20) involving partiality for or against admission by virtue of the content; confirmation bias which is extremely common and pernicious, is the tendency to gather and interpret evidence in ways that affirm, rather than challenge, the already held beliefs (55); conservatism, which is a bias against groundbreaking and innovative research (60-62); bias against interdisciplinary research (51), which has been described as very common in the modern medicine; publication bias which denotes the tendency for journals to publish research demonstrating positive, rather negative outcomes, where "positive outcomes" (63-68) include results that have a positive direction; and, finally, bias of conflicts of interest which range significantly from personal, financial, and professional interests which could inappropriately influence the judgment of reviewers and editors, regardless of whether or not their judgement is actually affected (108).

The authors of this manuscript have observed that academicians can be stricter on publications submitted by nonacademicians; the confirmation bias can be more pernicious than is described in the literature; and conservatism is less of a significant issue than what we might term liberalism, which is seen more frequently. Thus, liberalism is expected to be seen more frequently than conservatism in practice. In this situation, it is similar to the statements that only negative trials are published, but our experience shows that positive trials are rejected more frequently than negative trials. In this context, liberalism is demonstrated by recurring evidence that the majority of the interventional procedural trials published are negative rather than positive. It also appears that for negative publications, reviewers and editors may not lend sufficient weight to

a differential statistical analysis and may prefer only negative findings mainly based on confirmation bias, as described earlier.

CONCLUSION

The scientific peer review process is critical for the evaluation of research findings for competence, significance, and originality of qualified experts. Peer review has various deficiencies and conflicts of interest; however, with appropriate care, education, and diligence, peer review can be improved, independent, and transparent, and will achieve its goals of scientific validity.

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