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Review Article

Peer review: types, pitfalls and controversies

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Abstract: Peer review has been adopted by most journals to evaluate the quality of submitted manuscripts, for which peer reviewers aim to provide a critical, independent and unbiased assessment. Peer review is ever evolving, with no single peer review system being perfect currently. This review article aims to give a broad overview of the various types of peer review, their advantages, pitfalls, and some related controversies.

Keywords: authorship, peer review, peer review controversies, peer review pitfalls, peer review types

Introduction: Peer review is a process adopted by most journals to assess the quality of a submitted manuscript. Peer reviewers refer to peers of the manuscript authors, i.e. doctors and/or scientists working in the same research area or medical/scientific discipline, who are tasked with furnishing a critical, independent, and unbiased assessment of the manuscript [1,2]. Peer reviewers provide a valuable, usually voluntary, service to the scientific community and the journal manuscript processing and publishing system by indicating flaws in the submitted manuscript, identifying gaps that require providing suggestions to improve clarity, and evaluating the importance of the paper to others in the same field. By confirming the validity and significance of a submitted manuscript, peer reviewers help the journal editors determine whether the manuscript is suitable for publication. In short, peer review aids editors in their roles as gatekeepers of the knowledge pool.

Since its origins in the early 18th century, the peer review system has gradually evolved, becoming more widespread from the middle of the 20th century onwards [3]. The development of peer review was also a response to political

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demands for public accountability in scientific and medical research [4]. Over the recent decades, many different models of peer review have emerged, with numerous sub-variants. That several journals and stakeholders have tried to continuously improve the peer review process, and this is still ongoing, is a reflection that no single peer review system is perfect. This review article aims to give a broad overview of the various types of peer review, their pitfalls, and some related controversies.

Types of Peer Review: There are many types and variants of peer review adopted by different journals and publishers. The types of peer review can be broadly classified into blinded (or anonymized) and open, with several sub-classifications [2] (Table 1). Another way of classification is to divide peer review into pre-publication and post-publication models [5] (Table 2). Some of the major peer review types and sub-types are addressed below.

The traditional peer review model is blinded (or anonymized), and can be either single- or double-blinded. Single-blinded peer review models have two further subtypes. In the first subtype, the identity of the reviewer is known to the author, but the reviewer is not supposed to know who the author is. In some journals which allow authors to nominate their reviewers, this is sometimes called "author-guided review". Advantages of this subtype are: (1) protection of author against potentially-biased reviewers; (2) authors are able to recommend the most suitable reviewers for their area of interest; (3) it is easier for the journal editor to select reviewers, particularly for very specialized topics; and (4) there is time saving for the whole peer review process. In the second subtype of single-blinded peer review model, the reviewer knows the author's identity, while the reviewer is anonymized to the author. This subtype is a commonly-practised form of traditional peer review. The advantage of this subtype is that reviewer anonymity protects the peer reviewer and review process [3].

In the double-blinded peer review model, both authors and reviewers are anonymized to each other. Advantages of this peer review type are: (1) protection of the reviewer and review process; (2) avoidance of potential conflict-of-interest; and negation of (3) any personal animosity against authors disliked by reviewers or (4) bias towards well-known authors. With various forms of bias removed, double-blinded review is considered favourable to authors who are women, junior researchers, foreigners, from minority groups, or who hail from lesser-known institutions,

Table 1: Classification 1: Types of peer review sub-classified by anonymization [Adapted from reference 2]

1. Blinded (or anonymized) peer review
    a. Single-blinded
        i. Variant 1: reviewer-blinded
        ii. Variant 2: author-blinded
    b. Double-blinded
    c. Triple-blinded
    d, Quadruple-blinded
    e. Transparent review
        i. Variant 1: reports with reviewer anonymized
        ii. Variant 2: reports with reviewer named
        iii. Variant 3: addition of editorial decision and correspondence
2. Open peer review
    a. Pre-publication
        i. Variant 1: assigned reviewers
        ii. Variant 2: open peer commentary (pre-print server)
        iii. Variant 3: decoupled review (stand-alone peer review service)
    b. Post-publication
        i. Variant 1: letter to the editor
        ii. Variant 2: journal open forum
        iii. Variant 3: independent peer review website
3. Hybrid peer review
4. Patient peer review

Table 2: Classification 2: Types of peer review classified by pre- and post-publication models [Adapted from reference 5]

Peer review	
Pre-publication	Post-publication
1. Single-blinded 2. Double-blinded 3. Open peer review 4. Open peer commentary 5. Stand-alone peer review service	1. Open peer review 2. Open peer commentary 3. Stand-alone peer review service 4. Altmetrics

non-traditional centres and underdeveloped countries [3]. Triple-blinded peer review is another sub-variant in which the peer reviewer and author are anonymized to the handling editor, with the advantage of further reduction in potential bias. Quadruple-blinded peer review follows the steps of the double-blinded and triple-blinded systems, but with the identity of the handling editor being anonymised. This editor is appointed by the editorial board committee, and his or her identity remains confidential throughout [6].

In transparent peer review, the peer review reports are published together with the article after manuscript acceptance. The reviewers remain anonymous, although some journals give an option for peer reviewers to allow their names to be listed alongside their reports, even when the peer review process itself is double-blinded. In another sub-variant of transparent peer review, some journals also publish editorial comments and correspondence with the reviewers and authors, as an accompaniment to the article. As the name implies, the advantage of transparent peer review is to increase the transparency of the peer review and editing process, allowing readers to judge for themselves the quality of peer review reports and the basis for editorial decisions [3].

Open peer review trialled in the early 1990s, and was developed with the aim of overcoming the deficiencies of the traditional peer review model. In open peer review, the identities of the author and reviewers are known to each other. There are a few variants of the pre-publication open peer review model. In the first variant, the submitted manuscript is sent for open peer review after initial assessment by the editor. Assigned reviewers are also allowed to send confidential comments directly to the editor. On acceptance, all the peer reviewer reports with reviewer names are published together with the initial, revised and final versions of the manuscript, as well as the author's responses to the reviewer's comments. Another increasingly popular variant is uploading of the manuscript to a pre-print server, either by the author or the journal. This model enables open peer commentary by other researchers and members of the public, facilitating open exchange of views and responses among authors and reviewers [3]. Another variant of pre-publication open peer review is the decoupled review, where peer review is conducted by a different organisation rather than the venue of publication. This provision of an external stand-alone peer review service is a move towards privatizing the peer review function, with journals joining the service able to access the review reports and select, compete for, and offer publication to the best possible works [5].

Post-publication open peer review refers to continuation of the peer review process following article publication. The time-honoured "letter to the editor" is a form of post-publication peer review where readers submit letters commenting on recently-published articles. The editor selects letters that make relevant points worthy of publication for a forthcoming issue of the journal, together with the author's responses, if any. Many journals now host online forums where chosen reader's commentaries may be published online to accompany the article being commented upon. Several independent websites facilitate post-publication peer review for readers to make comments upon recently-published papers [3].

Alternative metrics (or Almetrics) are a fairly new tool that measures the impact of a specific paper after its publication through the attention it has attracted online. The Almetric score reveals attention received from many online sources including news outlets, blog comments, tweets, and social media (e.g. Facebook, X [formerly Twitter]). A 2021 systematic review concluded that citation counts and journal impact factor are the most common variables associated with Altmetric scores, with other variables such as access counts, papers published in open-access journals, and the use of press releases also likely to be associated with online media attention [7].

Hybrid peer review incorporates external open peer review in addition to traditional double-blinded review. This review type of is favoured by open peer reviewers as it is felt that they are not completely responsible for a manuscript being accepted or rejected [3].

Patient peer review incorporates formal feedback from patients and patient advocates, in addition to the journal's conventional academic reviewers. These patient peer reviewers provide input on the way a study is conducted, based on their own patient-centric experiences. The advantages of patient peer review include evaluation of whether the issues discussed in the article are relevant to patients, highlight challenges faced by patients, and provision of opinions on whether new treatment advocated have potential benefits to patients. Some journals have appointed patients and other stakeholders to their editorial boards; while others have placed priority on using person-centred language in publically-available abstracts, and focused on translational and practical research [8-10].

Pitfalls of Peer Review: Every type of peer review, right up to the latest versions of open review, have their inherent pitfalls. For single-blinded peer review subtype 1, allowing authors to nominate reviewers can be regarded as a distortion of the scientific process of peer review and opens up the potential for author-reviewer fraud or manipulation (to be discussed later in this article). For the commoner single-blinded peer review subtype 2, knowing the identity of the authors may lead to potential reviewer bias due to personal dislike of or academic rivalry with the authors. The reviewer may also be favourably biased on recognition that the manuscript is authored or co-authored by a famous doctor or scientist [3].

While double-blinded peer review overcomes the pitfalls of both single-blinded peer review subtypes, complete anonymization of the manuscript may sometimes be difficult, despite the best efforts of the editorial office. It is also a time-consuming process, particularly for variants such as triple-blinded peer review, quadruple-blinded peer review and transparent peer review. Further pitfalls include increased cost, additional work, and further delays to manuscript processing and publication [3].

In open peer review, it may be difficult to recruit or attract willing reviewers, particularly for the pre-print server variant. Open reviewers may be reluctant to be too critical, particularly if a "big name" has authored or co-authored the submitted manuscript This may lead to delayed manuscript processing and publication, and diminished review quality, respectively. In a 2021 joint position statement, the American Medical Writers Association, European Medical Writers Association and International Society for Medical Publication Professionals have highlighted the danger of inadequate peer review in a rush to get pre-print research data released [11]. This particularly applies to open peer review. While hybrid peer review aims to combine the best of double-blinded and open review, this model suffers from requiring more peer reviewers, increased time to complete the review cycle, more editorial office work and additional expense [3].

To date, the concept of patient peer review is still not fully developed. Despite being fairly new, many pitfalls have already been identified, including tokenism, failure to collect and use data on patients' experiences, inability to get the "authentic voice" of patients, transparency, commercial influences and self-admission of the reviewers' own limitations to comments on different dimensions of papers [9,10,12].

Controversies: Peer review has periodically been publicly called into question, even by the lay press, especially when high-profile studies, initially deemed suitable by peer reviewers, were subsequently found to have major flaws following publication [13]. On the other hand, significant papers have been rejected by top journals such as *Science* and *Nature*. Campanario (2009) identified 24 future Nobel Laureates who encountered resistance on the part of scientific journal editors or referees to manuscripts that dealt with discoveries that would later earn them the Nobel Prize [14]. In a study of 1,008 manuscripts sent to three elite medical journals, many highly-cited articles were rejected, including 14 of the top-cited articles of all time in their discipline [15]. This news is not surprising as peer review is a difficult task, even for competent scientists and there is often disagreement among reviewers; this often leaves the editor of high-profile journals taking the conservative decision to

reject papers that they are uncertain about. Some seminal works did not even undergo peer review. For example, Charles Darwin's *On the Origin of Species by Means of Natural Selection* (1859) and Albert Einstein's *Relativity: The Special and the General Theory* (1916) were published as books. Similarly, James Watson and Francis Crick's landmark work on the structure of DNA was published in *Nature* as a letter to the editor in 1953 [3].

The peer review system is also not designed to detect fraud, even though some reviewers manage to do so. Fraud is usually uncovered following publication, by readers or when researchers are unable to reproduce the author's results [16]. A well-known example that received worldwide publicity was when Korean researcher Hwang Woo Suk was found to have falsified data on the cloning of human embryonic stem cells. Following inquiries, Hwang's key papers that were published in *Science* were retracted. Soon after Hwang's deception came to light, European investigators found that a large number of Norwegian researcher Jon Sudbø's papers on oral cancer contained false data, including two articles published in the *New England Journal of Medicine*. These incidences of scientific fraud naturally shattered the trust of both researchers and members of the public in the ability of journals to detect deliberate scientific deception [17].

Manipulated (or fake) peer review, a relatively recent phenomenon, is on the increase. In manipulated peer review, authors abuse the automated manuscript submission and peer review system by suggesting reviewers and supplying e-mail addresses created by the manuscript submitters themselves. These reviewers then fabricate favourable reviews and thus facilitate acceptance of their own papers [18]. Third party agencies can also be paid for providing a service to produce fake but favourable reviews through fabricated reviewer accounts, sometimes comprising genuine names but with falsified email addresses [19]. The discovery of manipulated peer review has resulted in numerous articles being retracted by several journals from top publishers over the past decade or so, with a record of more than 10,000 research papers being retracted in 2023. Many journals and publishers have ended the practice of author-nominated reviewers ("author-guided review") [20-22].

The rise of paper mills constitutes another growing problem for journal editors and reviewers. Paper mills produce on-demand manuscripts for clients in return for a fee, often on an industrial scale. As recycled data may be spread out among unrelated clients and image manipulation software is utilized to produce manuscripts which are then sent to widely-diverse journals, it is often difficult for reviewers to detect this form of fraud [23].

Another recent problem is the rapidly increase in number of predatory journals. These journals take advantage of the trend, commonly adopted by open-access journals, of charging an article submission or processing fee. Unfortunately, these manuscripts often do not meet scholarly standards and undergo negligible or no peer review, prior to publication [24].

The issue of anglocentrism has gained recent attention. This refers to the long-standing situation in many major journals where the large proportion of the gatekeepers (i.e. editors and reviewers) are native English speakers. This may result in potential bias, as the quality of work tends to be judged less favourably, if it is not written in the preferred English style of the gatekeepers [25].

It is fair to say that most journals have problems in recruiting and retaining reviewers. There is paucity of suitable rewards for the essential work done by reviewers, the same work that directly contributes to the profitability of publishing houses [5]. Paying reviewers have been discussed and advocated for several years, but to date, no viable practical solution has been found [26,27]. These peer reviewers, no matter how altruistic, face burnout and overwork; and the problem of reviewer retention will continue if journals are unable to find innovative ways to motivate, recognise and reward their peer reviewers [28].

The recent rise of artificial intelligence (AI) has impacted on authors, journals and medical publishers, with editors and peer reviewers not being spared. When chatbots are used by

reviewers, they may produce output that is not real (artificial hallucination), e.g. chatbots may fabricate references during peer review and hence, mislead the reviewer. The ability of chatbots to retain and reuse supplied information has the dangerous consequence of betraying confidentiality, e.g. during peer review of supposedly confidential manuscripts. Rules and regulations on the use of AI-assisted technologies need to be quickly developed and implemented, including open disclosure on their use by reviewers and editors [29].

Conclusions: Despite its imperfections, peer review remains "crucial to the reputation and reliability of scientific research" [30] and is still currently adopted by all major journals. There are several types of peer review, each with their own advantages, problems and pitfalls. Identification of these imperfections and controversies at present and in the future will undoubtedly ensure that the peer review system will continue to evolve.

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