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EDITORIAL

Increasing importance of research metrics: Journal Impact Factor and h-index

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Introduction

Scientific research is defined as a relentless and incremental scholarly progress published in academic journals. This "publish or perish" adage is increasingly applied to the medical culture, and publishing one's work has recently become critical for career progression. Indeed, the escalating competition to publish has led to the development of bibliographical research metrics that define a journal's academic repute as well as a researcher's output. Academic publishing, however, is influenced by a tripod of interrelated factors: authors wish to publish more, readers are overwhelmed by research and wish to read less, and editors are principally interested in enhancing their journal's readership and profile via its scientific impact. Potential authors must be cognizant of these opposing forces in order to succeed.

Impact factor

The quality of scientific journals is gauged by the Thomson and Reuters' Journal Impact Factor (invariably abstracted to impact factor, or IF) devised by Eugene Garfield, the founder of the Institute for Scientific Information [1]. The IF is a journal-level metric that provides an index of scientific ranking and journal prestige—the higher the better—and the more difficult it is to publish a manuscript in that particular journal. The IF is a measure of the yearly frequency of the average citation of an article in a journal and is usually calculated as the 2-year IF (IF-2) by dividing the number of citations received in any given year of articles published during the 2 preceding years by the total number of "citable items" published by that journal during the same period [1, 2]. Thus, the more important the manuscripts that the journal publishes, the more citations the journal will receive via its published articles and the higher the rise in IF. The IF is, in fact, not a strict mathematical average but a functional approximation of the mean citation rate per citable items [2]. For example, an IF-2 of two in 2017 implies that, on average, the articles published in the prior 2 years have been cited at least twice each.

Scientific journals naturally flaunt their high impact factors to attract a higher number of publications from which they can pick and choose and thereby further increase their IF [1, 2]. For this reason, the IF has been criticized as a reliable metric, because the value can be easily manipulated. The numerator can be increased through preferential publishing of high-information-gain articles—those with statistically significant and thus potentially exaggerated results irrespective of quality—or of potentially citable articles, such as meta-analysis, systematic reviews, and committee opinions (publication bias), as well as by spurious self-referencing of the journal in manuscripts published by that journal (citation bias) [1, 3]. The IF can also be inflated by selectively publishing citable articles at the beginning of the calendar year to allow time for citations to cumulatively accrue throughout the year [1]. The denominator can be similarly decreased by restricting the publication of less citable articles, like case reports, literature reviews, and letters to the editor .

H-index

The h-index is a commonly used author-level metric that reports an author's output based on the total number of publications and the total number of citations to those works. The index was suggested by Jorge Hirsch, a US physicist, as a tool for determining theoretical physicists' relative quality, and is

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sometimes called the h-number. An h-index of 10 implies that a researcher has at least ten articles that have each been cited at least ten times or equivalent. H-index can help to evaluate and benchmark an individual researcher's output as well as that of peers. It provides an indication of the quality as well as the consistency of the researcher's work by measuring the number of articles published and the number of citations received over time. The h-index is traditionally measured over the most recent 5 years: the h-5.

The h-index is freely available through Google Scholar and Scopus, but it has been acknowledged that the calculation is quite complicated, besides having limitations [1, 2]. Most notably, interfield differences and, accordingly, comparisons between researchers from different scientific disciplines, should not be performed with this metric. The index is also subject-dependent, as highly specialized research will have fewer citations due to an inevitably smaller readership. Furthermore, once an article has been determined as being a highly cited h-indexed article, the number of citations that it receives becomes progressively less relevant to the index. Temporal trends are important in that the index cannot be used to gauge younger colleagues who have not yet amassed a corpus of work. In addition, the h-index underestimates the achievements of authors who do not publish a large number of papers but still achieve a high international standing, and thereby impacts or overestimates their contribution through self-citation. Finally, first authorship or a coauthorship are not discriminated in the index calculation, and self-citation is not counted unless these self-citations have a count of > h.

Conclusion

It is becoming standard for academic journals to report their IF on their websites, and for scientists to quote their h-index in curriculum vitae and professional networks as a proxy measure of quality and academic performance, respectively. There are other competing research metrics for journals and authors, but the above two are the mostly commonly used [1, 2]. This is certainly becoming a metric world wherein every work output is quantifiable, bowing to the science of measurement. The growing complexity of biomedical research and the new models of interdisciplinary and team science requires innovative research metrics; journals and academicians must explore novel analytical approaches to evaluate the merit of the publication or the researcher. Because research results are mostly reported through journals, a qualitative assessment of journal editors' perceptions and practices on bibliographic research metrics would also inform the development of transparent and reliable article-level metrics for scientific content.

Compliance with ethical standards

Conflicts of interest None.

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