Journal Impact Factor: Widely Used, Misused and Abused

Since the inauguration of *Arrhythmia & Electrophysiology Review* in 2012, one of the most consistent, and persistent, concerns expressed both by authors and reviewers has been the issue of our impact factor and when should we get one. This is a legitimate question: publishing in a citable journal of considerable impact factor justifies the efforts of the authors and secures credible publicity of their scientific work.

Journal impact factor (JIF) is a citation metric designed in 1955 by Eugene Garfield, the founder of the Institute for Scientific Information, to help librarians prioritise their purchases of the most important journals.[1] It was inspired by Shepard's Citations, an American citation index of legal resources that began in 1873, and which allows lawyers to locate the publications citing a particular case and legal decisions influenced by a case. The idea of quantifying impact by counting citations led to the creation of the prestigious journal rankings, which have been recorded annually in the Science Citation Index since 1961. JIFs are calculated by Clarivate Analytics and published annually in *Journal Citation Reports* and measure the average impact of articles published in a journal with a citation window of 1 year. The formula for calculating JIF is the total number of citations in a year, divided by the total number of 'citable' articles published by the journal during the 2 preceding years. To obtain a JIF, a journal must be accepted by Clarivate Analytics' citation databases, such as the Science Citation Index Expanded, and remain in the system for at least 3 years.[2]

JIF has several shortcomings and limitations. Editorials and letters are non-citable items and are excluded from the JIF denominator, but these items, particularly in modern biomedicine, contain long lists of references, affecting the JIF calculations in many ways. In addition, it restricts citations of recent articles, because JIF only considers the first 2 years after a study is published. That is, if a journal has articles cited later, they will not affect the impact. Citations of journals not indexed in the Web of Science are not considered, regardless of their potential importance. Last, but not least, there has been a lack of transparency in the JIF calculations, partly due to the lack of open access to the citations tracked by the databases used by Thomson Reuters (the previous owner).[3] All these have damaged the reputation of the JIF as a reliable and reproducible scientometric tool.

There has been a growing unease within the scientific community, among journal publishers and within funding agencies that the widespread use of JIFs to measure the quality of research is detrimental for science itself.[3–5] The San Francisco Declaration on Research Assessment, initiated by the American Society for Cell Biology together with editors and publishers, calls for moving away from using JIFs to evaluate individual scientists or research groups and developing more reliable ways to measure the quality and impact of research. One such method is the new Relative Citation Ratio that is now being used by the US National Institutes of Health.[4]

In a recent, devastating review, Ioannidis and Thombs pronounced JIF as "without a doubt the most widely used, misused and abused bibliometric index in academic science", adding that "JIF is a highly flawed, easily gameable metric."[5] They recommended its replacement with Median Citations per Item indicators calculated separately for articles, reviews and other types of papers (*Tables 1–3*).

However, one should keep in mind that all bibliometric numbers are only a proxy of research quality, which measure one part of quality, namely impact or resonance. Despite its many limitations, JIF is still a credible marker and no serious scientific journal can thrive without it. Approximately 11,000 academic journals are currently listed in *Journal Citation Reports* and JIF.

Table 1. Information Readily Available in Journal Citation Reports that Can Help Obtain Insights into Journal Impact Factor Inflation

Journal	JIF	JIF (without self-citations)	MCA	Papers among top 10 cited
Nature	41.6	41.0	25	4 (1 review, 3 original)
PLoS Medicine	11.7	11.3	6	No such papers
New England Journal of Medicine	79.3	78.5	36	3 (3 industry trials)
JAMA	47.7	46.6	23	1 (1 sepsis definition)
British Medical Journal	23.6	22.1	7	1 (1 reporting guideline)
Journal of Clinical Epidemiology	4.2	3.8	2	1 (1 method)
EJCI	3.1	2.9	2	No such papers
European Heart Journal	23.4	21.8	10	6 (6 expert-based guidelines)
Revista Espanola de Cardiologia	5.2	3.4	1	No such papers
European Journal of Heart Failure	10.7	8.9	6	1 (1 expert-based guideline)
Europace	5.2	4.5	2	2 (2 expert-based guidelines)

JIF is given in Journal Citation Reports with three decimals, but this excessive accuracy is inappropriate, given the numbers used in the calculation, therefore only one decimal is given in this table. Note that in the theoretical situation where there are no journal self-citations, a journal only publishes articles (no reviews, and no items such as editorials and letters that do not contribute to the denominator of the JIF calculation), and the distribution of citations per article is normal (there are no papers with skewed extremely high citations), then JIF, JIF without self-citations and MCA would be identical. EJCI = European Journal of Clinical Investigation; JIF = journal impact factor 2017 (based on citations received in 2017 for articles published in 2015–2016); MCA = median citations per article. Source: Ioannidis and Thombs.[5] Reproduced with permission from Wiley.

Table 2. Key Measures that Capture Mechanisms of Journal Impact Factor 2017 Inflations

Journal	Self-citing Boost	Skewness and Nonarticle Inflation	Expert-based Blockbusters
Nature	1	66	0
Science	1	96	0
PLoS Medicine	3	95	0
New England Journal of Medicine	1	120	0
JAMA	2	107	1
British Medical Journal	6	237	0
Journal of Clinical Epidemiology	12	112	0
EJCI	7	54	0
European Heart Journal	7	134	6
Revista Espanola de Cardiologia	52	417	0
European Journal of Heart Failure	20	78	1
Europace	15	162	2

Self-citing boost: percentage increase in JIF due to journal self-citations; skewness and nonarticle inflation: percentage inflation of JIF over the median citations per article; expert-based blockbuster: clinical guidelines and position statements and disease definition papers among the papers that received >10 JIF citations. JIF = journal impact factor 2017. Source: Ioannidis and Thombs.[5] Reproduced with permission from Wiley.

Table 3. Main Points Made by Ioannidis and Thombs

JIF is widely misused and abused, and editors are under pressure to game this metric.
Journals may inflate their JIF by publishing papers that get cited without counting in the denominator of the JIF calculation; increasing journal self-citations; publishing more reviews rather than regular articles; and publishing papers with questionable value which are perceived as standard, massively used references across large communities, for example expert-based guidelines.
Routinely available information from JCR can be used to spot the potential for spuriously inflated JIFs. One can calculate three measures of JIF inflation: self-citing boost, skewness and nonarticle inflation and expert-based blockbusters.
Examples are provided for 12 journals. Evidence of major JIF inflation based on any of these three measures should lead to scrutiny of editorial practices.
Better sensitisation to JIF inflation practices and the use of penalties (e.g. suppression of JIF of journals with extreme inflation tricks), where appropriate, may help curtail JIF misinterpretations and manipulations.
Given that JIF is so well-documented to be flawed, JCR should stop reporting it and replace it by the more appropriate median citations per article, median citations per review and median citations per other type of article, also excluding journal self-citations.

JCR = Journal Citation Reports; JIF = Journal Impact Factor 2017 (based on citations received in 2017 for articles published in 2015–2016). Source: Ioannidis and Thombs.[5] Reproduced with permission from Wiley.

A 2003 survey of physicians specialising in internal medicine in the US provided evidence that despite its shortcomings, impact factor may be a valid indicator of quality for general medical journals, as judged by both practitioners and researchers in internal medicine.[6] Until it dies or is killed, therefore, JIF is here to stay.

Arrhythmia & Electrophysiology Review is taking its final steps towards this goal, and we hope for a respectable IF in 2020. Having announced that, we do know that our reputation is better served by the quality of the articles published and the high esteem in which senior and junior members of the electrophysiology community hold the journal. ■

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1. Garfield E. The history and meaning of the journal impact factor. *JAMA* 2006;295:90–3. https://doi.org/10.1001/jama.295.1.90; PMID: 16391221.
2. Gasparyan AY, Nurmashev B, Yessirkepov M, et al. The Journal Impact Factor: moving toward an alternative and combined scientometric approach. *J Korean Med Sci* 2017;32:173–9. https://doi.org/10.3346/jkms.2017.32.2.173; PMid:28049225.
3. Mugnaini R. The impact factor: its popularity and impacts, and the need to preserve the scientific knowledge generation process. *Rev Esc Enferm USP*. 2016;50:722–3. https://doi.org/10.1590/s0080-623420160000600002; PMID: 27982388.
4. Bornmann L, Marx W. The journal impact factor and alternative metrics: A variety of bibliometric measures has been developed to supplant the impact factor to better assess the impact of individual research papers. *EMBO Rep* 2016;17:1094–7. https://doi.org/10.15252/embr.201642823; PMID: 27354417.
5. Ioannidis JPA, Thombs BD. A user's guide to inflated and manipulated impact factors. *Eur J Clin Invest* 2019:e13151. https://doi.org/10.1111/eci.13151; PMID: 31206647.
6. Saha S, Saint S, Christakis DA. Impact factor: a valid measure of journal quality? *J Med Libr Assoc* 2003;91:42–6. PMID: 12572533.

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