

Part 3: medical literature and impact factors

Introduction

The impact factor, provided by the Institute for Scientific Information (ISI), Philadelphia, has become the most vital evaluation tool for scientific research and academic work (Hoeffel and Fornes, 1999). It has now replaced subjective criteria used in the past to define journal quality and prestige. Impact factors have a vast, yet controversial influence on the way published scientific research is perceived and evaluated.

The impact factor and other bibliometric indicators are currently used in most countries to examine institutions, scientific research, entire journals and individual articles (Garfield, 2006).

Background

The process of ranking science journals was first reported in 1927 by Gross and Gross (Gross and Gross, 1927).

In 1955, *Science* published an article by Garfield, 'Citation indexes to science: a new dimension in documentation through association of ideas' (Garfield, 1955). This led to the Genetics Citation Index being published and 6 years later in 1961, the Science Citation Index (SCI). In 1965, a primary paper by Garfield and Sher showed the correlation between citation frequency and eminence when demonstrating that Nobel Prize winners published five times the average number of papers while their work was cited 30 to 50 times the average (Citation Index, 2006). In 1969 SCI created the first published ranking by impact factor. Garfield commented:

'The SCI database is, to my knowledge the largest and most extensive of its kind. It does not, however, cover every scientific

and technical journal. The list of most frequently cited journals shows that the SCI has been remarkably successful in covering all "significant" and "important" journals, in so far as citation counts can be considered a reliable measure of "importance" and "significance" (Garfield, 1972).

Journal Citation Reports (JCR) was the next step and from 1975–1989, this appeared as supplementary volumes in the annual SCI (Garfield, 1996).

Institute for Scientific Information

Eugene Garfield founded the ISI in 1960. It was acquired by Thomson Scientific in 1992, was known as Thomson ISI and is now known as Thomson Scientific. It specializes in citation indexing, which is a chronological index of citations and keeps track of which articles in academic journals are cited (Citation Index, 2006). It also maintains a citation database covering thousands of scientific journals. ISI also publishes an annual journal citation report (JCR), which lists an impact factor for each of the journals it tracks.

JCR

JCR is the recognized authority for evaluating journals. Concise quantifiable statistical data are presented in a systematic, objective way to appraise the world's leading journals and analyse their impact and influence in the global research community (Journal Citation Reports, 2006). JCR is available via the web or through JCR on CD-ROM, both published annually.

The impact factor Calculation of impact factor

The impact factor is calculated over a 3-year period. It is shown as ratios obtained from dividing citations received in 1 year by papers published in the 2 previous years (Garfield, 1996). For example, the 2003 impact factor for a journal would be calculated as follows:

X = the number of times articles, published in 2001–2, cited in indexed journals during 2003

Y = the number of articles, reviews, proceedings or notes published in 2001–2

2003 impact factor = X/Y (Citation Index, 2006)

The impact factor is useful in clarifying the significance of absolute (or total) citation frequencies. It eliminates some of the bias of such counts, which favour large journals over small ones, or frequently issued journals over less frequently issued ones, and of older journals over newer ones (Garfield, 1972).

The impact factor ranges from 0 for a journal whose articles are not cited in the previous 2 years to 52, and the average recent article is cited 46 times per year. The impact factor reflects the citation rate of the average article in a journal and not a specific article (Jones, 2003).

Why was the impact factor based on 2-year citations?

The 2-year period was selected because in the specialties which were of greatest interest to the readers of the SCI 25% of citations were accounted for in the year of publication plus the 2 previous years. However, calculating 3-, 5- or 7-year impact factors is achievable and these are also available in JCR (Garfield, 2006).

Flaws associated with the impact factor

Use of the impact factor is a popular concept; however, the parameter should be used with careful attention to the many phenomena that influence citation rates.

Specialty

Different specialties exhibit different ranges of peak impact (Golder, 1998). Clinical disciplines which involve highly specialized areas, such as hand surgery, attain appreciably lower impact factors for their journals than basic specialties and interdisciplinary clinical sectors, which lead the ranking of journals (Meenen, 1997).

Basic science journals have a higher impact factor compared to clinical medicine publications. It is reasonable to hypothesize that pure clinicians may read articles and journals that influence their clinical practice, but never cite this work themselves (Weale et al, 2004).

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Table 1. Impact factors of leading ten surgical journals

Rank	Abbreviated journal title (linked to journal information)	ISSN	Total cites	Impact factor	Immediacy index	Articles	Cited half-life
1	Ann Surg	0003-4932	21713	6.328	0.782	216	8.8
2	Am J Transplant	1600-6135	4677	6.002	1.198	323	2.1
3	Liver Transplant	1527-6465	4707	4.447	0.542	212	3.4
4	Am J Surg Pathol	0147-5185	11311	4.377	0.662	207	7.4
5	Endoscopy	0013-726x	4458	4.072	0.386	171	5.4
6	Transplantation	0041-1337	27157	3.879	0.593	585	6.1
7	Obes Surg	0960-8923	3576	3.759	0.754	228	3.5
8	J Thorac Cardiovasc Sur	0022-5223	15417	3.727	0.453	380	8.0
9	Brit J Surg	0007-1323	16154	3.722	0.461	219	9.8
10	Ann Surg Oncol	1068-9265	3982	3.456	0.331	124	4.4

From Institute for Scientific Information (2006)

Table 1 shows the 10 principal surgical journals in the order consistent with their impact factor.

Language

Languages other than English are appreciably disadvantaged by the citation index. Publishing in English is an indicator that the publisher recognizes that the maximum number of readers can be targeted with English language (Garfield, 2006).

Quality of the paper

The impact factor provides an accurate definition of the distribution of a journal, but in no instance the quality of its publications (Dumontier et al, 2001). The number of citations to papers in a particular journal does not necessarily reflect their scientific merit. It reflects the current popularity of that individual topic and the reputation of the journal.

Journal size may be a discriminating factor. Those publishing more articles tend to have higher impact factors per se, therefore smaller journals may be disadvantaged by this bias (Weale and Lear, 2003).

Other variable factors incorporate the visibility and size of the circulation of the journal including availability of electronic formats and options for on-line search and retrieval (Jones, 2003).

Author influence

The number of self-citations and citation density (the ratio of references to articles) will boost the impact factor. The editor

hopes to attract authors who publish original and innovative research that captures the attention of the international scientific community (Garfield, 2006). This will also enhance the impact factor.

Conclusions

Despite valid concerns, impact factors are widely used and offer, at present, the best simple tool for comparison of productivity. Like all parameters, impact factors have to be used with knowledge of their limitations and common sense applied when interpreting any data based on any analysis (Neuberger and Counsell, 2002).

Regardless of journal impact factor, an article should be judged by its usefulness to the field and not the prestige of the journal where it is published.

Eminence – like beauty – is often in the eyes of the beholder. Readers have to come to their own conclusions when appraising the efficacy of the manuscripts. This can be guided by the known impact factor. **BJHM**

Conflict of interest: none.

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KEY POINTS

- Impact factor is a measure of the frequency with which the 'average article' in a journal has been cited in a particular year or period.
- The impact factor is calculated as the number of articles published in 2001–2 which were cited in journals in 2003 divided by the number of articles published in 2001–2.
- Journal Citation Reports is the recognized authority for evaluating articles. This organization analyses the impact and influence of the particular journal on the global research community.
- It is important that the reader is aware of the journal's impact factor but each individual article should be judged by its usefulness and informative content.