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Journal impact factor and its importance for AFP

Background

In 2008, *Australian Family Physician (AFP)* was accepted on the list of journals listed in Science Citation Index Expanded and, thus, will generate an impact factor over the next 2 years. Impact factor is important to authors from research and academic backgrounds and will make *AFP* an increasingly attractive journal in which to publish.

Aim

To describe the impact factor, its method of calculation, and its flaws.

Discussion

Impact factor is the number of a journal's cited research papers divided by the total number of citable papers it has published. It is distorted by several different factors: sub-discipline, region, basic versus applied research, and whether the journal editor deliberately tries to strategically increase their impact factor.

Conclusion

Impact factor is an oversimplified single measure of 'impact', which may underestimate the contribution of the *AFP* to society. However, no accepted alternative metric currently exists.

■ ***Australian Family Physician (AFP)* gained Science Citation Index Expanded (SCIE) status in 2008. Indexing commenced with the January/February 2007 issue in March 2008.¹ This is an important advance, as *AFP* will attract even better quality papers, its status will rise, and its scientific credibility will improve internationally.**

Why? Journals listed on Thomson Scientific's proprietary SCIE database are awarded a score – the 'impact factor' (IF). This metric attempts to measure the impact a journal has on the scientific community. Impact factors are commonly used to describe the quality of research papers that individuals and institutions publish.² For *AFP*, the higher its IF, the more academic authors and researchers will want to publish in it (as this is an acknowledged measure of the academic worth of their work – and is an influential factor in allocation of research funding and in academic promotion). This will lead to an increase in the quality of papers *AFP* publishes and make the results of Australian research more accessible for Australian general practitioners.

Discussion

Calculating the impact factor

The IF is the number of citations from a journal divided by the total number of citable papers published in that journal in the past 2 years (*Table 1*). A watershed is when a journal's IF is >1; in other words, on average, papers are quoted more often than published. However, there are limitations to this simple number.

Calculating the impact factor of an individual

There is a bibliometric that assesses the impact of an individual author. This is the h-index, and is relatively simple to calculate by first arranging an author's publications in rank order of the number of citations each publication has accumulated. For example, an h-index of 4 means the author's four most cited publications each have four or more citations; an h-index of 6 means the author's six most cited publications each have six citations or more.³ But the h-index is little

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used. Instead, individual authors are assessed or judged on the IFs of the journals in which they publish individual papers. The distorting effect of this is addressed below.

Limitations of the impact factor

How representative are SCIE journals?

Approximately 5000 journals are indexed in SCIE,⁴ compared to over 33 000 journals indexed in Medline. About 2000 new journals are evaluated for SCIE indexing each year by Thomson Scientific, a private company using selection processes that are conducted in-house. Only 10–12% of submitted journals are selected.⁵

How representative is the journal impact factor of individual journal articles?

If a journal's IF were representative of its articles, the citation rate of individual articles would show a Gaussian distribution around the mean value (the journal's impact factor).⁶ But this is not the case. In one sample, the most cited 50% papers were cited a mean 10 times more often than the least cited 50%.⁶ In other words, one cannot extrapolate an individual paper's impact from the IF of the journal publishing it.

Biases in calculating the impact factor

The denominator in the IF calculation is 'citable papers' (Table 1). Thomson Scientific decides which are citable, including all original research papers and some other types of publications – excluding editorials, commentaries, letters, abstracts of conference proceedings, and reports of scientific meetings – these will appear in the numerator but not the denominator: a possible source of distortion.^{6,7} The IF is very sensitive to the selection criteria of both denominator and numerator, something not publicly available, making the process subjective and lacking in transparency.⁸

Biases in impact factor for different research domains

The 'citable period' of 2 years is short, favouring fast moving research fields such as molecular biology and biochemistry in which published results rapidly become obsolete (but which are cited more often during the short index time span).⁶ By contrast, fields such as clinical medicine and epidemiology use data from large and long studies, with papers remaining relevant and having an impact much longer than 2 years (Table 2).

Basic research is cited more often than applied research because the latter is built on the former, whose journals gain much higher IFs (Table 2). Basic research papers are essentially written for other researchers who are likely to then cite these as references in their

Table 1. Calculating the impact factor of a journal*

Impact factor in 1 year = A/B

where: A = number of papers 'cited' in the previous 2 years*

B = number of citable publications in the journal in the previous 2 years[†]

* In journals included in the SCIE

[†] Judged by Thomson Scientific

own papers. In comparison, papers in clinical journals, particularly general practice journals, are directed at clinicians to inform their practice. Accordingly, papers in clinical or general practice journals are less likely to be cited than those in basic scientific journals. Among clinical journals, those with a more general character are cited more often (Table 2).

Only eight family medicine journals were included in the journal citation reports of 2006, with a maximum IF of 3.8 (Table 3).

Language and possible regional biases

While non-English journals are included in SCIE, there is a pronounced bias toward inclusion of English language journals. Also, North American journals tend to have the highest IFs, and this may be consequent upon a regional bias.⁶ For example, the IF (3.8 in 2006) of a newly launched North American journal established in 2003 (*Annals of Family Medicine*), rapidly overtook the previously top ranking general practice journal (*British Journal of General Practice*) with its IF of 1.9 in 2006. It remains unclear whether this is an accurate reflection of the relative impacts of the respective journals or what the implications are for Australian journals.

'Impact factor gamesmanship'

Biomedical publishing has become very competitive, and editors sometimes strategically and consciously seek to increase their journal's IF. This was a deliberate policy of the *Journal of the American Medical Association* in the 1980s.² Strategies that increase the numerator include encouraging authors to cite papers from the same journal⁹ ('self citation'), or include publications with abundant references (eg. reviews, letters to the editor and conference reports), which increase the number of papers in the numerator disproportionately to the denominator.^{6–8} Thompson Scientific reports that self citation is addressed, but only if there is 'significant deviation' from acceptable norms of self citation.⁵

Table 2. Impact factors in 2006 of high ranking journals in different fields and the median impact factor of all journals in each field

Domain	Number of SCIE journals in domain	Highest ranked journal (Medline abbreviations)	Impact factor	
			For the journal	For the domain (median value)
Oncology	127	<i>CA Cancer J Clin</i>	63.3	2.4
General internal medicine	103	<i>N Engl J Med</i>	51.3	1.2
Biochemistry/molecular biology	262	<i>Ann Rev Biochemistry</i>	36.5	2.6
Genetics	131	<i>Nat Genet</i>	24.2	2.6
Pharmacology	199	<i>Ann Rev Pharmacol</i>	22.8	2.0
Microbiology	89	<i>Microbiol Mol Biol Rev</i>	15.9	2.2
Cardiac/cardiovascular	74	<i>Circulation</i>	10.9	1.7
Virology	23	<i>Rev Med Virol</i>	6.3	2.3
Public health	98	<i>Epidemiol Rev</i>	8.3	1.7
Emergency medicine	11	<i>Ann Emerg Med</i>	3.1	1.1
Family medicine*	8	<i>Ann Fam Med</i>	3.8	1.5

* Calculated by extracting all family medicine journals from the subgroup of general internal medicine journals under which they are classified in the JCR

Note: *AFP* does not yet have an impact factor

The IF of a journal can be increased by reducing the denominator of citable articles, for example by limiting the number of original papers and replacing them by review articles that are not considered citable by Thomson Scientific. Some journals with high IFs are 'review journals' that publish little in the way of original studies.^{9,10}

Impact factors and quality

The relationship between a journal's IF and the quality of its research is not clear – even infamy leads to notoriety!¹² Some studies show a rough correlation between high IF and good study quality among general medical and hepatobiliary domain journals.^{11,12} Others find none (in cardiovascular and psychiatric domains).^{13,14} Evidence for

the value of the journal IF as indicator of quality of researchers and research institutions is lacking.¹⁴ So, is it possible to introduce other measures that might supplement IFs as a quality indicator?

Societal impact of research

What we really want to measure is the impact of research on society, but this is not what an IF is about – it is, after all, a limited measure of scientific impact. Therefore, journals with high IFs often seem to be rather remote from influencing society.¹⁵ The Royal Dutch Academy of Science has argued for the development of a 'societal impact factor' separate from a scientific impact factor.¹⁶ An Australian method attempted this for primary care research. It involved end-users of research in the assessment of its impact on social, economic, environmental and/or cultural outcomes.¹⁷ Four primary care projects were evaluated and found to result in few journal publications, one producing none, despite prompting an extensive state government reform.¹⁷ Yet this is exactly the type of societal impact journals such as *AFP* aim for.

Conclusion

It is good news that *AFP* is now included in Thompson's SCIE. But we should be aware, when *AFP*'s IF is calculated, how crude a measure this is. Impact factor is an oversimplified single measure of 'impact', which may underestimate the contribution of *AFP* to society.

Conflict of interest: none declared.

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Table 3. Impact factors of SCIE listed general practice/family medicine journals

Journal	IF [#]
<i>Annals of Family Medicine</i> *	3.803
<i>British Journal of General Practice</i>	1.938
<i>American Family Physician</i> *	1.616
<i>Family Practice</i>	1.518
<i>Scandinavian Journal of Primary Health Care</i>	1.541
<i>Journal of the American Board of Family Medicine</i> *	1.518
<i>Family Medicine</i> *	1.289
<i>Journal of Family Practice</i> *	1.278
<i>Canadian Family Physician</i> *	0.701
<i>Primary Care</i> *	0.588

Source: Thompson Journal Citation Reports, 2006

[#] In comparison, *BMJ* 9.245, *MJA* 2.582

* North American journal

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