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Editorial

Impact factor: Time to move on

"*Not everything that counts can be counted, and not everything that can be counted counts*".

Sign hanging in Einstein's office in Princeton University.

Ever since its discovery in 1960s[1], impact factor (IF) continues to be in the news, often for the wrong reasons. Both its proponents (we suspect, those mostly outside the business of creating innovative knowledge) and the increasing voices arguing for a more rational use to wholesale rejection (mostly practicing scientists or policy makers, especially from the Continent) are equally vocal. Not many parameters can match IF for its propensity for sustained misuse and/or abuse. May be due to the glamour and simplicity of use, IF and other citation-based indices are the only 'numbers' widely used in seemingly unbiased decision making. This despite these data being understood by so few and of dubious value in several contexts of evaluation. We would like to focus only on the IF and argue for the need for a serious rethink toward a better and more credible alternative.

Despite the occasional cautionary word by its 'inventor' Eugene Garfield[2], citation data continue to be used to assess science whether it is the impact of individual articles, journals, researchers, research departments, and even countries[3,4]. But to our mind, the most worrying facet is the possible inappropriate application in critical decision making in research policy and support systems, as IF and other citation-based parameters can potentially skew the direction of research. Scientists tend to research into fundable, popular, mainstream areas and not necessarily the research questions that should be addressing. Worse still, researches who have outstanding track records in unfashionable but relevant subjects may not get adequate funding or recognition. It is well known that funding follows what is considered 'significant' in science which is usually science driven by citation hype and publications in high impact journals. Even in India funding allocations follow global (read American) trends, and, to that extent, the research agenda continues to be set on flawed thinking.

Right at the beginning of their careers, researchers get fastened with the citation nose-band with the IF virtually dictating their future career path. Young scientists who drive the research enterprise would like to be 'known', which could happen only if they publish in high impact journals *and* get cited widely. For the huge number of researchers from countries like India, China, South Korea, *etc.* which export bulk of scientific workforce to the US, such a paper could well be the visa for entry into a prestigious laboratory. Sadly, this is just the beginning of the unending rat race on the citation treadmill.

Journal publishers and editors are perhaps among the worst culprits. They need to lure the best brains to write for them to sell their product in an increasingly competitive market. There cannot be a cheaper, easier and more effective means of publicity for a journal than the prominent display of its high IF, some highly cited papers with the authors' photographs thrown in. Authors just love impact factors, and adulation. To attract good papers and to retain subscriptions, journal editors also join the bandwagon. As the *PLoS Medicine* admitted candidly[5], IF does matter to editors. Even to us at the *IJMR*[6]. For journals from the developing world, it is doubly hard to stay on the citation treadmill. There is a very stiff entry barrier to the Web of Science (WoS) databases with a huge number of journals trying to join the elite club. Once in, journals try all means at disposal to increase citation counts. But the dice are heavily loaded against journals from the developing countries. The almost pathological reluctance of Indian scientists to cite their own earlier papers from Indian journals when they

publish abroad can only match the near contemptuous indifference of journals with high IF to their poor cousins from developing countries. At the other end, there appears to be a cozy arrangement between the publishers of 'big' journals like *Nature*, just to name one, and the Thomson ISI. While a huge number of journals are denied entry for years into the WoS, new journals spawn from some publishing groups with IF right from inception!

A major criticism leveled by scientists on citation-based indices like IF is that all citations are treated equal, irrespective of the context of citation and the publishing journal. IF therefore cannot distinguish between journals with varying quality of content and the 'importance' of the quote. The argument is that by merely counting the frequency of citations per article and disregarding the prestige of the citing journals, the impact factor becomes merely a metric of 'popularity', not of 'prestige'[7].

But even from early 1970s there have been serious attempts to overcome the limitations of citation analysis and find appropriate alternatives. As early as 1976, Gabriel Pinski and Francis Narin had proposed a recursive impact factor and tried to compute and analyse citation data to give citations from journals that have high impact greater weight than citations from low-impact journals[8]. Largely thanks to increasing web-based access and use of scholarly literature, several others have developed and proposed innovative methods and tools to rank scholarly journals and refine the evaluation of both science and scientists both within and outside the citation-based systems. Some of these include Page Rank, weighed Page Rank, h-index, g-factor, Y- factor, EuroFactor and Faculty of 1000, briefly described below.

The h-index quantifies both the actual scientific productivity and the apparent scientific impact of a scientist based on the set of the scientist's most quoted papers and the number of citations that they have received in other people's publications. The index can also be applied to study the productivity and impact of a group of scientists, such as a department, university or country[9]. The g-factor attempts quantifying the scientific productivity of scientists and is calculated based on the distribution of citations received by a given researcher's publications[10]. The EuroFactor or the European Journal Quality Factor[11] was designed following algorithm for analyzing the biometric relation between European journals from the EuroFactor database. This was developed primarily to address the under-representation of European journals in the Thomson-ISI databases.

PageRank™ is a software system for ranking web pages developed by Google and has also been used to rank publications and later in the system of weighted PageRank. The advantage with these tools is that they use a broad range of open data sources from the Google Scholar (GS) *etc*. which generally results in more comprehensive coverage of cited literature than the WoS, an expensive subscription-based service with about 6000 journals.

The PageRank algorithm[7] makes a clear distinction between popularity and expert appreciation or prestige of published research. Popular journals are those that are cited frequently by journals with little prestige. These journals therefore may have a very high ISI IF and a very low weighted PageRank. Prestigious journals, on the other hand are those not frequently cited, but their citations come from highly prestigious journals. These journals have a very low ISI IF and a very high weighted PageRank. Thus the weighted version of the popular PageRank algorithm can be used to obtain a metric that reflects prestige. Analysis of journals according to their ISI IF and their weighted PageRank shows significant overlaps and differences (Table). The Y-factor[7] is a simple combination of both the ISI IF and the weighted PageRank. Significantly, the authors claim that the resulting journal rankings correspond well to a general understanding of journal status. For example, while the IF ranking lists five review journals, the Y-factor column had none. Two primary research journals *Cell* and the *Proceedings of the National Academy of Sciences USA*, rated highly by peers figure in the Y-factor list[7].

Peer ranking of research papers outside the citation number game has also been tried and a prominent one being the Faculty of 1000[12]. Faculty of 1000 Medicine comprises a select set of carefully chosen experts currently estimated to be over 2400 in various areas of medical research and clinical practice. The service is divided into 18 specialties and over 200 sub-specialties. Each Member is expected to read and comment on one or two interesting articles every month. The final F1000 Factor is consensual incorporating the ratings it receives and the number of times it is selected by different Faculty Members. Outstanding work thus gets its deserved peer recognition irrespective and independent of citation counts.

Table. The highest ranking Medicine journals according to the 2003 ISI IF, weighted PageRank (PRw) and Y-factor[7]

	ISI IF		PRw x 10^3		Y-factor x 10^3	
Rank	Value	Journal	Value	Journal	Value	Journal
1	34.83	*New Engl J Med*	5.72	*New Engl J Med*	199.18	*New Engl J Med*
2	30.55	*Nat Med*	4.28	*Lancet*	87.29	*JAMA*
3	21.45	*JAMA*	4.07	*JAMA*	78.34	*Lancet*
4	18.32	*Lancet*	2.17	*J Exp Med*	61.29	*Nat Med*
5	15.30	*J Exp Med*	2.09	*J Clin Invest*	33.13	*J Exp Med*
6	14.31	*J Clin Invest*	2.01	*Nat Med*	29.97	*J Clin Invest*
7	12.43	*Ann Intern Med*	1.93	*Am J Resp Crit Care*	17.15	*Am J Resp Crit Care*
8	11.38	*Annu Rev Med*	1.17	*Ann Intern Med*	14.50	*Ann Intern Med*
9	8.88	*Am J Resp Crit Care*	1.01	*Radiology*	6.07	*Neuroimage*
10	6.76	*Arch Intern Med*	0.98	*Neuroimage*	5.77	*Arch Intern Med*

Despite the criticism, IF is perhaps here to stay. Both the International Society for Scientometrics and Informetrics (1993) and the journal *Scientometrics* (1978) are going strong. In all the major scientific agencies like the Council of Scientific and Industrial Research (CSIR), Department of Science & Technology (DST), Indian Council of Medical Research (ICMR), *etc*. IF and citations get weightage in recruitments, promotions, rewards and other recognitions. What is more, even the Office of the Principal Scientific Advisor to the Prime Minister of India sponsors studies on the 'citation health' of the Indian science. Happily, so far the Indian Government does not have a cash-for-highly-cited-paper system prevalent in Pakistan, China, South Korea, *etc*.

The increasing application of citation-based data for recruitments and funding decisions are especially a cause of concern. In common with other countries, some experts and academic administrators who take critical decisions in India are remarkably ignorant about citation-based indicators like the IF, especially potential distortions. Admittedly, it is tough to define the quality of an academic publication using only non-quantifiable factors, such as its potential influence on the next generation of scientists. But citation-based data should at best be used to supplement peer judgement as done by the UK Research Assessment Exercises[13]. It is about time that we seriously look for measures beyond the IF. As a starter, studies could be commissioned on the limitations of IF to come out with India-specific measures to evaluate science using open data sources like the Google Scholar. And also look at the current funding patterns vis-a-vis our priorities. The *Journal* would be pleased to carry this debate forward.

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Note added in Proof: As we go to Press, a lively debate has been triggered off by the editors of the Rockfellor University Press on impact factor (Rossner M, Van Epps H, Hill E. Show me the data. *J Exp Med* 2007; *204* : 3052-3).

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