

Authors, Editors, Policy Makers, and the Impact Factor

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Some aspects of the "impact factor", a quantitative measure of journals' influence on journals in scientific fields, was discussed in the preceding issue of the *Croatian Medical Journal* by Dr Eugene Garfield, one of its devisers. This factor can be of interest to authors, journal editors, and policy makers, but they should keep in mind the complexity of the determinants of impact factors while using them in coming to their particular kinds of decisions. A clearer picture of the influence a journal may have in its own scientific field rather than among all scientific journals could come from a variant of the impact factor, "the scope-adjusted impact factor". The calculation of this variant impact factor is described. A table presents some sample data from this calculation and shows how the relative positions of some major journals shift when they are ranked by this factor rather than the unadjusted impact factor. The possible value of this variant factor may merit further testing.

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In the preceding issue of this journal, Dr Eugene

Garfield, one of the devisers of the impact factor, a measure of a scientific journal's influence in the world of science as it is reflected by citation data, discussed the factor in detail (1). He pointed to complexities in interpreting the possible meanings of the factor and closely related indices. He focused on the use of the factor in interpreting the performance of journals, especially in considering the relative "prestige" of journals. Among the persons and organizations who use impact factors for judgments that can serve their needs, he pointed particularly to librarians and authors. Librarians have limited budgets. They have to decide what journals to acquire for their collections. A journal's impact factor, as it might reflect a journal's possible value for their clients, could influence their decisions. Authors have to decide to which journals they might advantageously submit their papers. There are other persons and organizations who may believe that impact factors could be helpful in some of their decisions: journal editors and national policy makers are among these.

Authors

The imperative to publish is an old and constant pressure on scientists.

"...Results unpublished are little better than those never achieved... One must write something and get it into print. Situational imperatives dictate a "publish or perish" credo within the ranks" (2). Scientific papers are voices of their authors. Will they be heard? There is little reason to publish in a journal if one's voice is not heard through that journal. What is the best choice of a journal for a paper ready for submission to an editor? The decision is not always simple. "Should I try to publish in a "high-prestige", widely-visible journal that will carry my voice to an audience around the world? Or should I go for a "lower-prestige" journal, where the odds of acceptance of the paper without too much delay are better? Or should I go for a journal in my country which may offer rapid acceptance and publication but which may be regarded elsewhere as one of "low-prestige" or even one to be ignored?" There can be gains and losses with any one of these decisions (3). The odds that one's paper will be accepted and published by a high-prestige journal may be very low; the competition to get into the journal is intense. If the paper strikes the editor as possibly worth considering for publication, the review process may take

weeks, or months. If the paper is then not accepted, valuable time will have been lost. The “lower-prestige” journal is likely to be a better bet for undelayed publication, but how many potential readers will see the paper? An author can get some help in deciding what to do by consulting data in the *Journal Citation Reports* of the Institute for Scientific Information (ISI), which was discussed by Dr Garfield (1). His discussion centered, as mentioned above, on the impact factor, a datum that reflects the average of the number of citations of papers in a particular journal in that journal and other journals in the entire international scientific field covered by *Science Citation Index*. The factor for a particular journal will correlate well, in general, with the journal’s international reputation. For example, the general medical journal with the highest impact factor is *The New England Journal of Medicine*; its reputation is that of a “high-prestige” journal.

Authors who face decisions on where to submit a paper should be aware that one section of *Journal Citation Reports* lists journals by their subject-fields and ranks them there by their impact factors, which certainly tend to reflect quantitatively those journals’ relative “prestige” and influence within their own scientific field. For reasons I discuss below, the impact factors listed in these sections may not reflect accurately just how strong a particular journal is within its own field when it is compared with journals covering a wider scope that also publish papers relevant to the narrower field. Certainly the impact factor may not be any guide to how rapidly journals will publish papers they accept. Here is where authors may profitably ask colleagues in their own field how rapidly journals in that field publish papers; the wrong gamble on “prestige” and possibly more international attention may be costly if a paper is accepted but is grossly delayed in publication.

Authors’ decisions on where to seek to publish papers certainly ought to depend on more variables than “prestige” (high impact factor) and speed of publication. One question an author should consider is who is likely to want to see the paper. Some unrealistic authors want “as big an audience as possible” and try first for the most “prestigious” journal. If they think more carefully about the question, they may come to see that what they really should want is not “the biggest audience” but the biggest audience of persons likely to read the paper and possibly cite it later. I am reminded of an episode in which I was involved some years back. I was helping to give a three-day course in medical writing at a North American medical school. Part of the program gave authors of papers in preparation or revision the opportunity to consult the course faculty about difficulties in getting their own papers published. I met with a clinical microbiologist who had submitted a paper to *The Lancet* and suffered a rejection. He was angry: “What is wrong with the paper?” I rapidly read through it, and it struck me as clear, well-organized, and carefully prepared. But its topic was a minor improvement in a bacteriologic method. No wonder *The Lancet* rejected the paper! The paper’s potential real readership was probably a few hundred microbiologists in the whole world, mainly those concerned with methodological matters. Why should *The Lancet*, a journal that serves a very large audience, mainly of clinicians, make room for that kind of paper?

Clearly the paper belonged in a journal whose audience included a high percentage of persons concerned with methodological problems in a quite circumscribed field. Here was an author who had thought simplistically of wanting to get his paper into a “high impact” journal when what he really needed was publication in a journal with a “high impact” among the likely readers of such a paper. He might have gotten help from *Journal Citation Reports* if he had looked at its section on journals classified by scientific field and listed within those sections by impact factors. Here he would have at least seen the titles of journals in his field of interest that were important enough in that field to merit a place in *Science Citation Index*; he might not have even considered some of them.

Authors should also keep in mind the influence of Internet access on the “visibility” of papers in journals. Not many years ago, readily searching an internationally important index of medical journals was possible only for librarians and relatively small numbers of scientists and clinicians in “developed” countries. With ready Internet access now widely enjoyed in many countries around the world and with this access steadily increasing in others, a valuable, wide-scope bibliographic index like MEDLINE of the US’s National Library of Medicine (NLM) is now easily searched by a huge international audience. In the past, the odds that any author searching for papers relevant to his or her topic would look for any in “low-prestige” journals were very small; a journal like the *Croatian Medical Journal* might be found, for example, in the United States only in the NLM and might not be indexed by the NLM even if it received the journal. The easy searching of MEDLINE around the world has radically raised the probability that a paper in a journal once obscure for an international audience will now be seen if it is indexed. This development has reduced to some degree the importance of trying to publish a paper in a journal judged by its impact factor to be a “high-prestige”, “internationally-highly-visible” journal.

Journal Editors

Journal editors may also be customers for impact factor data. Every editor wishes to believe that his or her journal is widely enough read – or at least its papers are visible enough in its scientific field – to attract papers that will enhance its reputation and further strengthen its ability to serve as a sought-after outlet. The impact factor is not a direct measure of the journal’s visibility throughout the world but it is a clue. The point I make immediately above – the influence of easy Internet access to bibliographic indexes like MEDLINE on journals’ “visibility” – applies just as much to the concerns of editors as to those of authors.

Makers of National Scientific Policy

Authors and editors are not the only potential audiences for impact factors. Those authorities who determine national scientific policy – such as fund-granting agencies and national scientific councils – may look at impact factors and other citation data for estimates as to who and what institutions in their countries are productive and best serve national interests in science. If they

can identify in their countries what scientific fields and which workers are most productive, those findings might determine future budgetary allowances for research. But such parties must keep in mind that impact factors represent end-results of complex sets of variables. Persons consulting impact factors may not keep these complexities in mind. Some surveys of national scientific productivity have relied on simpler indices. For example, a recently reported survey (4) of scientific publication trends in "the developing world" considered simply "quantity of publications per nation and per capita" and apparently did not factor in relative importance of publications as might be judged by impact factors. Certainly, a small nation with a relatively small scientific community cannot expect its science to have the international "visibility" of the science in a large nation with a large scientific community.

A Possible Alternative to the Impact Factor

Those parties concerned with what impact factors might imply for their decisions – authors, editors, policy makers – may not be aware of how data available in *Journal Citation Reports* might be treated with additional data to yield information more useful for their needs than the impact factors as published. An example is the editor concerned with his or her journal's importance as judged from the impact factor. If a journal publishes papers relevant to a large number of scientific fields, each with numerous journals, one would expect it to have an advantage in reputation in that its papers are likely to have relevance for authors in many fields and hence perhaps have an advantage in probable number of citations. If, on the other hand, the journal represents a small scientific field with few journals, it is likely to receive a relatively small number of citations. This view does assume that importance of papers for particular scientific fields is equal among journals covering many fields and those covering a single field. One possible adjustment for an effect of the size of a journal's field on its impact factor is dividing its factor by the number of journals citing its papers. This calculation produces what I have called "the scope-adjusted impact factor" (5). When it is applied to journals known in their own scientific fields as valuable journals, even though their impact factors are well below those of the "high-prestige journals" like *The New England Journal of Medicine*, the

factors so modified may give a better picture of their importance in their own fields than the unadjusted impact factor, which, after all, reflects relative importance in the entire range of fields covered by *Science Citation Index*. Similarly, an impact factor representing all the scientific journals published in a small country with a small body of scientists might be calculated to yield a more realistic picture of the strength of science in that country by dividing their aggregated citation numbers by the number of the country's scientists and comparing this kind of factor with those of other countries similarly calculated.

I have illustrated the effect of calculating "scope-adjusted impact-factors" with the data in Table 1. This factor is calculated by dividing the *Journal Citation Reports* impact factor for a journal by the number of journals citing that journal (5). The resulting number is multiplied by 1,000 simply to bring the resulting factor back up to the approximate magnitude of the *Journal Citation Reports* impact factor. One must keep in mind that this calculation leads only to comparisons among journals whose data are so treated and not to direct comparisons with unmodified impact factors.

For the data Table 1 I selected a small number of major American and British journals, some with wide scope and representing many scientific fields, others covering a narrower scope. One sees that wide-scope journals like *JAMA*, *Nature*, *New England Journal of Medicine*, and *Science* each have their papers cited by more than 2,500 journals. In contrast, narrower-scope journals – in this table those representing cardiology or gastroenterology – have their papers cited by less than 1,800 journals. When all the journals represented in the table are ranked by their scope-adjusted impact factors, these ranks correspond more closely, I believe, to the reputation of these journals in the fields they aim to cover. I am aware that Dr Garfield may disagree with my assumptions and conclusions bearing on "scope-adjusted impact factors". He has pointed out in his paper (1) that "there is a widespread but mistaken belief that the size of the scientific community that a journal serves affects the journal's impact factor". This is not the place to debate this point but I should point out a possible test of the adjusted-factor's legitimacy. If one asks an American gastroenterologist which journal is the single most important, most influential journal for all of clinical medicine, the answer would probably be *The New England*

Table 1. Journal ranking according to the impact factor (IF) and the "scope-adjusted impact factor" (S-A IF)^a

Journal	Citing Journals ^b				
		IF	IF Rank	S-A IF	S-A IF Rank
Cell	2,307	38.686	1	16.77	1
Nature	4,848	28.833	2	5.95	5
NEJM	3,128	28.660	3	9.16	2
Science	5,367	24.380	4	4.54	8
Annals of Internal Medicine	2,165	10.900	5	5.03	7
Gastro-enterology	1,676	10.330	6	6.16	4
JAMA	2,791	9.522	7	3.41	10
Circulation	1,782	9.173	8	5.15	6
Journal of the American College of Cardiology	987	7.282	9	7.38	3
Hepatology	1,238	5.261	10	4.35	9

^aThe data forming the basis of the table are taken from the 1998 edition of "Journal Citation Reports", a unit of the *Science Citation Index* published by the Institute for Scientific Information, Philadelphia, PA, USA.

^bCiting Journals – the column gives the total number of journals that cited papers in the journals in the first column.

Journal of Medicine. If you ask the gastroenterologist which single journal is most important for, and influential in, gastroenterology, the answer would probably be the journal *Gastroenterology*. If you then ask whether gastroenterology is as important for the field of gastroenterology as *The New England Journal of Medicine* is for clinical medicine in general, I think he would say "Yes". This kind of test certainly does not disprove Dr Garfield's view but it does suggest that the scope-adjusted factor may merit a wider test. In considering uses of the impact factor for answering particular questions of authors, journal editors, and science policy makers, the specific question to be answered should be stated precisely. The question of which journals are most influential throughout all of science may be best answered by the impact factor as it is calculated for *Journal Citation Reports*. If the question is the importance for, and influence in, a specific scientific field of particular journals, a variant of the impact factor may be more likely to answer that question.

I have suggested such a possible further analysis of impact factors as they are published mainly to draw the attention to the possibility that some of the determinants of impact factors that are possibly relevant to clearer interpretations may not have been considered by those who use impact factors. Dr Garfield, a co-inventor of the impact factor, is the international expert on their meaning, and he may very well disagree with my suggestion. What is most important for me to say here is that his paper (1)

does give a clear picture of the complexities of the determinants of impact factors. It should be read by anyone who expects to make decisions that will depend, even if only in part, on impact factors. Further, he cites many papers that could be additionally helpful in understanding what the impact factor is and what it is not. His paper should give pause to persons who rush to simplistic interpretations of what the impact factor implies.

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