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Can Otolaryngology Compete with Larger Fields Regarding Impact Factor? Is Percentile-Based Impact Factor a Solution?

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Abstract
Impact factor (IF) consists of reporting the number of references an average article in a given journal receives over a 2-year period. Despite several valid criticisms, IF has become an important component of academic advancement. The authors sought to investigate the possible relationship between size of specialty field and IF. The top 10 journals of 13 specialty fields were selected based on IF as reported by Journal Citations Reports on the Web of Science. Specialty field population was obtained from the American Board of Medical Specialties. A highly positive correlation (r = 0.9) was noted with smaller fields (eg, otolaryngology) having lower IFs. To overcome this population bias, a percentile-based impact factor (PIF) may be used where the top journal within a field is given 100%, the worst 0%, and all other journals’ IFs are proportionately scaled in between the 2 extremes. PIF acts to “level the playing field,” allowing between-specialty field comparisons.

Keywords
impact factor, surgical specialty fields

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Peer-reviewed publications have changed dramatically since 1991, the year that the Internet became universally available via the World Wide Web. Prior to this explosion of the information age, peer-reviewed publications represented the pinnacle of scientific reporting and were highly valued given the labor and cost required for printing and accessing scientific journals. This benchmark of peer-reviewed articles has diminished given the ease of digital publication and acquisition.

As a potential solution to providing a metric for valuing now easily accessible peer-reviewed publications, the impact factor (IF), introduced by the publishing company Thomson Corporation (aka Thomson Scientific, now known as Thomson Reuters) in the 1960s, has been used. The concept is quite simple, with the definition of IF being the average number of citations articles in a specific journal received during the previous 2 years. For example, a journal with an IF of 10 in 2000 means that articles published in that journal in 1998 and 1999, on average, would have been cited 10 times in 2000.

Criticism of IF is widespread and includes the following: (a) the fact that citations over 2 years do not accurately represent the value of an article. This is especially true in fields such as mathematics, where papers are cited years after publication. As an extreme example, the theory of relativity was referenced fewer than 10 times in the 2 years after its publication despite having received more than 958 references.¹ (b) The fact that self-referencing can falsely inflate IF. This is commonly performed with authors citing their prior work and journals suggesting that additional publications from the same journal be used. In fact, in 2007, one journal in the field of speech therapy, Folia Phoniatrica et Logopaedica, published an article that consisted of references to all articles published in that journal over the previous 2 years, resulting in the doubling of its IF from 0.66 to 1.4.² (c) The fact that the IF does not follow a normal distribution and thus the average is not the best arithmetic descriptor. As the distribution of IF is highly skewed (a self-analysis by Nature³ showed that 89% of its citations came from 25% of its articles and “the great majority” were cited 20 times—significantly less than their IF of 32.2 at the time), the median would be a better descriptor but would lead to a lower reported IF. And, (d), perhaps most concerning, an editorial from the Journal of Cell Biology in 2007, authored by the executive editor of that and other journals,

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reporting that despite using the same database provided to them by Thomson Reuters, IF calculations could not be duplicated.\(^4\)

Despite its criticisms, IF is now a reality of academia and is being used for assessing suitability for academic advancement and compensation. For these reasons, academic surgeons must be aware of this concept. The purpose of this article is to describe IF, test our hypothesis that IF correlates with size of medical specialty as assessed by board-certified membership, and support the use of another metric, percentile-based IF, that may be more appropriate when comparing journals between fields.

**Methods**

Building on the work of Garfield,\(^5\) who in 1955 proposed the concept of citation indexes, Thomson Reuters began publishing *Journal Citations Reports* in 1975. Quoting from its Web site,\(^6\) its definition of IF for the example year 1992 is as follows:

\[
\begin{align*}
A &= \text{total cites in 1992} \\
B &= \text{1992 cites to articles published in 1990-91 (this is a subset of A)} \\
C &= \text{number of articles published in 1990-91} \\
D &= \frac{B}{C} = \text{1992 impact factor}
\end{align*}
\]

Their 5-year IF is likewise calculated as follows:

\[
\begin{align*}
A &= \text{citations in 1992 to articles published in 1987-91} \\
B &= \text{articles published in 1987-91} \\
C &= \frac{A}{B} = \text{five-year impact factor}
\end{align*}
\]

Impact factors of the top 10 journals (journals with the highest IF) in the following fields were accessed via the *Journal Citations Reports* on the Web of Science in January of 2010\(^7\): anesthesiology, dermatology, emergency medicine, medicine, obstetrics and gynecology, ophthalmology, otolaryngology, orthopedics, pediatrics, pathology, psychiatry, radiology, and surgery. Populations of professional fields were obtained from the American Board of Medical Specialties (ABMS) effective July 2009.\(^8\) These fields were chosen because: (a) they comprise independent categories within *Journal Citations Reports*, and (b) there is no reporting overlap with other fields (eg, neurosurgery was not included because there is no category within *Journal Citations Reports* for neurosurgery; urology was not included because within *Journal Citations Reports*, urology is paired with nephrology as “Urology & Nephrology,” and the ABMS does not report total certificates for nephrology).

**Results**

**Table 1** summarizes the number of board-certified physicians in the given medical specialty, the 1-year IF, and the 5-year IF. **Figure 1** plots professional population versus IF (diamonds) and 5-year IF (squares). The correlation coefficient (\(r\)) between the number of board-certified physicians and IF is 0.902, whereas it is 0.898 between the number of board-certified physicians and 5-year IF.

**Discussion**

In academic medicine—likely in response to the increased opportunities to publish afforded by the Internet—IF has been heavily used to evaluate research productivity and make decisions about academic advancement. Given the definition of IF, it seems logical that smaller specialty fields, such as otolaryngology, will have smaller IFs given the smaller potential readership and thus smaller potential citers of articles. Prior work has shown that journal subscription correlates positively with IF.\(^9\) To the best of our knowledge, this is the first time...
that a similar correction has been shown with size of a specialty field.

If the trend of continued importance of IF persists, it may have substantial impact on smaller fields such as otolaryngology. Publications—vital for academic advancement and extramural funding—would be valued less than those in higher IF journals. Surgical subspecialty fields must be made aware of this and lobby for more equitable metrics. One such metric is the percentile-based impact factor (PIF),\textsuperscript{10} which normalizes IF within each field, allowing between-field comparisons. This metric gives the top journal in a given field a percentile of 100% and the bottom journal 0%, with all other journals proportionately scaled in between the 2 extremes. This simple technique has the effect of leveling the playing field with the top journal in any given field given equal percentiles of 100%. In otolaryngology, the top IF journal, \textit{Head and Neck}, would receive a PIF of 100%, despite its small-field biased IF of 2.6, comparable to the top IF journal in radiology, the \textit{Journal of Nuclear Medicine}, with an IF of 6.7. This general concept has been around since at least 1992,\textsuperscript{11} but it has not been widely employed. Especially for smaller population fields, such as otolaryngology, widespread acceptance of PIF would be beneficial.

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\textbf{Author Contributions}

Robert F. Labadie, conception of idea, planning experiments, data collection, statistical analysis, reporting, drafting manuscript; J. Michael Fitzpatrick, conception of idea, planning experiments, critical rewrite of draft.

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\textbf{References}


