Original Investigation

The Impact Factor of Radiological Journals: Associations with Journal Content and Other Characteristics Over a Recent 12-Year Period

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Rationale and Objectives: The aim of this study was to evaluate the trends in the impact factor (IF) of radiological journals over a recent 12-year period, including associations between IF and journal topic.

Materials and Methods: Journal Citation Reports (JCR) was used to identify all biomedical journals and all radiological journals (assigned a JCR category of "Radiology, Nuclear Medicine, & Medical Imaging"), along with journal IF, in 2003 and 2014. Radiological journals were manually classified by topic. Trends in median IF (mIF) were assessed.

Results: The number of radiological journals increased from 83 (2003) to 125 (2014) (all biomedical journals: 5907 to 8718, respectively). mIF of radiological journals increased from 1.42 (2003) to 1.75 (2014) (all biomedical journals: 0.93 to 1.46, respectively). The most common topic among new radiological journals was general (nonspecialized) radiology (8). Five new radiological journals in 2014 were in topics (cancer imaging and molecular imaging) having no journals in 2003. mIF of general radiological journals was 1.49. Topics having highest mIF were cardiac imaging (2.94), optics (2.86), molecular imaging (2.77), radiation oncology (2.60), and neuroradiology (2.25). Topics with lowest mIF were ultrasound (1.19) and interventional radiology (1.44). Topics with the largest increase in mIF were cardiac imaging (from 1.17 to 2.94) and neuroradiology (from 1.07 to 2.25).

Conclusions: Radiological journals exhibited higher mIF than biomedical journals overall. Among radiological journals, subspecialty journals had highest mIF. While a considerable number of new radiological journals since 2003 were general radiology journals having relatively low IF, there were also new journal topics representing emerging areas of subspecialized radiological research.

Key Words: biomedical journals; impact factor; radiology; publication

INTRODUCTION

One measure of the quality of biomedical journals is their influence on subsequent research. Such influence on future investigations can, in turn, be measured via the frequency of citations to articles published within the given journal (1). While numerous strategies exist for quantifying the frequency of citations to a journal's articles, the most widely applied approach is the determination of the journal's 2-year impact factor (IF) (1,2), originally developed in 1951 (3). Thomson Reuters' Journal Citation Reports (JCR) updates journals' IFs on a yearly basis and makes this information publicly available though the online Web of Knowledge database (4). The IF is calculated as the number of citations occurring in a given year to the journal's articles during the previous 2 years divided by the number of citable articles in the journal during the same preceding 2-year period (5).

The IF has been applied to evaluate the quality not only of journals, but also the academic productivity of individual investigators, departments, and institutions (1,6). Although such practice has been criticized (7–9), the IF nonetheless has been applied in making determinations regarding hiring, promotion, tenure, and awarding of grant funding (10–12). Moreover, the IF has been used as a basis for inferences regarding the overall influence of research within a given discipline (10).

Past works have explored trends relating to journals' IF within disciplines such as internal medicine (6), public health (13), and orthopedic surgery (10). For instance, changes in IF over time, as well as factors related to differences in IF among the discipline's journals, were evaluated. Inquiries of this nature are likely to be relevant to radiological journals as well, given the extent of both organ-based and modality-based subspecialization within radiology, as well as the continual emergence of new imaging technologies. Indeed, such information would not only impact the authors' selection of a journal for submitting their work and journals' selection of submitted

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content for publication, but may also provide insights into ongoing shifts in the content and influence of radiological research. Therefore, the aim of this study was to evaluate trends in the IF of radiological journals over a recent 12-year period, including associations between IF and journal topic.

METHODS

This study did not comprise human subjects research and therefore did not require review by our institutional review board. All data were obtained using the Science Citation Index Expanded edition of the Thomsen Reuters' JCR (4). This system assigns biomedical journals to at least one subject category, reflecting the journal's general content area (14). Median IFs among all journals within a given category are available on an annual basis since 2003. First, the "Categories by Rank" feature was used to identify the overall number and median IF of journals having a category of "Radiology, Nuclear Medicine, & Medical Imaging" (hereafter referred to as "radiological journals") for all years from 2003 and 2014. In addition, the "Journals by Rank" feature was used to identify the total number and median IF of all biomedical journals for all years from 2003 and 2014. Next, the "Journal by Rank" feature was used in combination with the "Radiology, Nuclear Medicine, & Medical Imaging" category selector to identify all individual radiological journals in 2003 and 2014. Additional factors recorded for each journal were its country of publication, language, Open Access status (designated by JCR for journals providing exclusive [rather than optional] Open Access publication), number of issues annually, number of citable items in 2014, percentage of citable items representing original research articles (rather than reviews) in 2014, as well as the journal IF in 2003 and 2014. Citable items count toward computation of the journal's IF and include original research and review articles; other publication types such as editorials, letters, news reports, and meeting abstracts are typically less cited and are excluded from the IF computation (15).

A single fellowship-trained radiologist with 7 years of experience manually classified each journal based on the journal's topic. The topics were selected for the purposes of this study following an initial review of the titles of the identified journals and comprised: nuclear medicine (nonorgan based); magnetic resonance imaging (MRI; nonorgan based); ultrasound (nonorgan based); interventional radiology (nonorgan based); cardiac imaging; neuroradiology; other subspecialty (including pediatrics, multimodality based, and other organ based); optics; cancer imaging; molecular imaging; digital imaging, engineering, and informatics; preclinical radiation physics and biology; and radiation oncology. Each journal was uniquely assigned to a single topic by this approach. If a journal did not fit any of the topics, then it was classified as a "general" topic radiological journal. When uncertainty existed regarding the journal's topic, the journal's description/mission and recent tables of contents were viewed from the journal's website in order to guide the categorization.

The number of journals and median IF of both radiological journals and all biomedical journals were plotted as a function of year from 2003 through 2014. Percentage growth in each year relative to the previous year was computed for each of these assessments. In addition, the simple annual growth rate between 2003 and 2014 was computed for each assessment as the ratio between the total percentage growth between the 2 years and the total number of years (12). Also, the number of citable items and percentage of citable items representing original research articles were summarized for all radiological journals using standard descriptive statistics and assessed for a correlation with journal IF using the Pearson correlation coefficient. These measures were compared between journals present in 2003 vs. those that were new since 2003 using an unpaired *t* test. The distribution of the number of journals, as well as median journal IF, was computed by country of publication (categorized as United States vs. other), language (categorized as English vs. other), and Open Access status, both among all radiological journals in 2014 as well as journals that were new since 2013. Journal IF was compared between subsets of journals in 2014 using the Mann-Whitney test. The distribution of topics of new radiological journals between 2003 and 2014 was also assessed. In addition, the following parameters were computed for each of the 14 radiological journal topics: the total number of journals assigned to the category in 2014; the number of new journals in the topic since 2003; the topic's minimum, maximum, and median IF in 2014; and the topic's median IF in 2003. Assessments were performed using Excel for Macintosh (version 12.1.10, Microsoft, Redmond, Washington) and MedCalc for Windows (version 9.1, MedCalc Software, Ostend, Belgium).

RESULTS

The number of radiological journals increased on average by +4.6% annually from 83 journals in 2003 to 125 journals in 2014 (largest single-year growth rates of +8.7% to +13.0% [2009–2010]; growth rates of 0.0% to +5.7% in all other years) (Fig 1). The total number of biomedical journals in all categories increased on average by +4.2% annually from 5907 in 2003 to 8718 in 2014 (largest single-year growth rates of +9.3% to +11.6% [2009–2010]; growth rates of +0.5% to +4.2% in all other years). Three radiological journals in 2003 were either no longer listed in JCR, or no longer identified as radiological journals, in 2014. In addition, 45 radiological journals in 2014 were new since 2003.

The median IF of radiological journals increased on average by +2.1% annually from 1.42 in 2003 to 1.75 in 2014 (Fig 2), although the percentage change in individual years ranged from −9.7% (2011) to +19.8% (2008). The median IF of all biomedical journals increased on average +4.2% annually from 0.93 in 2003 to 1.46 in 2014, although the percentage change in individual years ranged from −4.0% (2009) to +12.2% (2008). The median IF in 2014 of radiological journals that had also been present in 2003 was 1.96, which was significantly greater