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Clinical Research

Bibliometric Analysis of Factors Predicting Increased Citations in the Vascular and Endovascular Literature

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Background: Dissemination of research findings in the scientific community is reflected by the citation count. Our objective was to investigate the relative citation impact of vascular research studies and identify potential predictors of increased citation rates.

Methods: Articles published in leading journals of vascular and general surgery (*Journal of Vascular Surgery*, *European Journal of Vascular and Endovascular Surgery*, *Journal of Endovascular Therapy*, *Annals of Vascular Surgery* and *Annals of Surgery*, *British Journal of Surgery*, *Journal of the American College of Surgeons*, and *JAMA Surgery*) during a 4-month period were identified through electronic databases. Variables potentially associated with increased citation rates, including subject, design, title characteristics, article length, bibliographic references, authorship, geographic distribution, interdisciplinary collaboration, article access, and funding, were assessed in univariate and multiple linear regression models through December 2012.

Results: A total of 226 articles with a total number of 4,605 citations were identified. Univariate analysis revealed that endovascular-related studies, study design, studies reporting design in the title, long articles, and studies with high number of references were associated with higher citation rates. On multivariate analysis, 3 variables were found to independently predict the number of citations: study subject (endovascular-related studies; regression coefficient [95% confidence interval], 0.474 [0.240−0.708]; $P < 0.001$); study design (randomized controlled trial; regression coefficient [95% confidence interval], 0.575 [0.145−1.005]; $P = 0.009$); and article length (number of pages; regression coefficient [95% confidence interval], 0.069 [0.016−0.123]; $P = 0.011$).

Conclusions: Authors involved in vascular research may enhance the impact of their work by embarking on research strategies of high methodologic quality and pursuing work related with new technologies and evolving endovascular therapies.

INTRODUCTION

The impact of medical research on clinical practice and decision making is difficult to evaluate comprehensively. The impact factor of the journal in which research work is being published and the citation count remain classic yardsticks, and have been widely used to evaluate the value and impact

Conflicts of Interest: None.

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on the scientific field.[1,2] Dissemination of research findings in the scientific community occurs primarily through the publication of findings in a peer-reviewed journal. Subsequently, citation of the original work in other articles further disseminates medical research and reflects the quality of research output. Therefore, the citation count not only underpins the evolution of scientific knowledge, but has also been used as a hallmark of academic achievement. Judgments of individual researchers, research teams, and even university departments are in part based on citation counts as an indicator of academic activity, and funding decisions are commonly made on the basis of such appraisals.[3,4]

Although several studies have been conducted to explore factors associated with citation counts of articles in other scientific fields,[2,5–14] no such bibliometric analysis of the vascular literature has been previously performed. Vascular research has been constantly evolving over the last few years, and such evolution is characterized by the rapid influx of modern technologies and application of new therapies. Authors make efforts to embrace progress in vascular research and increase the impact of their work. Several factors can potentially be predictors of dissemination of research knowledge in other disciplines. In this context, we undertook a study to investigate the relative citation impact of studies published in leading journals of vascular and general surgery.

MATERIALS AND METHODS

Selection of Journals and Articles

Medical journals were ranked from the ''surgery'' category of journals established by the Institute of Scientific Information's Journal Citation Report (JCR). The 2012 JCR Science Edition was used. Four leading journals in vascular and endovascular surgery and 4 major journals of general surgery with the highest impact factor were identified and selected as the data sources: *Journal of Vascular Surgery* (impact factor, 2.879), *European Journal of Vascular and Endovascular Surgery* (impact factor, 2.820), *Journal of Endovascular Therapy* (impact factor, 2.699), *Annals of Vascular Surgery* (impact factor, 0.985) and *Annals of Surgery* (impact factor, 6.329), *British Journal of Surgery* (impact factor, 4.839), *Journal of the American College of Surgeons* (impact factor, 4.500), and *JAMA Surgery* (impact factor, 4.100). All articles published in these journals during the 4-month period between January 1, 2008, and April 30, 2008, were identified through electronic databases. The 4-month period was selected as a sample of scientific convenience. It is not long enough to create great discrepancies in citation counts among studies published toward the beginning or the end of this period; it was not short enough either to provide small numbers of articles creating difficulties producing meaningful results. The year 2008 was selected because earlier years would not represent relatively current research practice, whereas more recent publications would not provide adequate citation counts to produce solid results. Only original clinical or basic science research articles and reviews of the literature were eligible for inclusion and data analysis. All other types of articles including editorials, case reports, letters to the editor and correspondence, invited commentaries, vascular images, technical reports, surgical ethics articles, historical vignettes, transatlantic debates, book reviews, and abstracts were not considered. Access to the journals was achieved through the Hellenic Academic Libraries link, the National Health Service OpenAthens, or the Freeman Hospital Library (Newcastle upon Tyne, UK). No institutional access or access through the previously mentioned access management systems to the *Annals of Vascular Surgery* was provided. Short-term access was obtained following our request to the managing editors of the journal to provide us with complimentary access to the specific journal issues for the purposes of this project.

Data Extraction

The full texts of all selected articles were downloaded and interrogated. Two reviewers (G.A.A. and S.A.A.) trained in health research methodology undertook the data extraction from the selected articles. One reviewer (G.A.A.) selected the articles and collected information from all identified articles and a second reviewer (S.A.A.) assessed the accuracy of the retrieved data by independently extracting data from a 20% random sample of the selected articles. No discrepancies were identified. A specifically designed data form was created. The variables collected were divided into 10 broad categories having been previously demonstrated to be or potentially being related to citation rates of published articles in the medical literature[5–14]: (1) subject of study (arterial, venous, or vascular access for hemodialysis-related; endovascular or non–endovascular related); (2) study design (basic science research study, randomized controlled trial [RCT], literature review, or other type of article); (3) characteristics of the title (title reporting study findings; study design reported in title; and number or words per title); (4) article length (number of pages); (5) bibliographic references (number of