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Citation Rate Predictors in the Plastic Surgery Literature ☆

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BACKGROUND: The purpose of this study is to determine and characterize the scientific and nonscientific factors that influence the rate of article citation in the field of plastic surgery.

DESIGN: Cross-sectional study.

SETTING: We reviewed all entries in *Annals of Plastic Surgery* and *Journal of Plastic, Reconstructive, and Aesthetic Surgery* from January 1, 2007 to December 31, 2007; and *Plastic and Reconstructive Surgery* from January 1, 2007 to December 31, 2008. All scientific articles were analyzed and several article characteristics were extracted. The number of citations at 5 years was collected as the outcome variable. A multivariable analysis was performed to determine which variables were associated with higher citations rates.

RESULTS: A total of 2456 articles were identified of which only 908 fulfilled the inclusion criteria. Most studies were publications in the fields of reconstructive (26.3%) or pediatric/craniofacial (17.6%) surgery. The median number of citations 5 years from publication was 8. In the multivariable analysis, factors associated with higher citations rates were subspecialty field ($p = 0.0003$), disclosed conflict of interest ($p = 0.04$), number of authors ($p = 0.04$), and journal ($p = 0.02$).

CONCLUSION: We have found that higher level of evidence (or other study methodology factors) is not associated with higher citation rates. Instead, conflict of interest, subspecialty topic, journal, and number of authors are strong predictors of high citation rates in plastic surgery. (J Surg Ed ▮:▮▮▮-▮▮▮. © 2016 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: academic productivity, bibliometrics, citation rate, level of evidence, conflicts of interest, plastic surgery

COMPETENCIES: Systems-Based Practice, Professionalism, Medical Knowledge

INTRODUCTION

The number of citations received by an article is widely seen as a surrogate of that article's scientific impact and importance.[1] For instance, if a research article is cited by multiple sources, the article's message is more likely to be disseminated among the scientific community. The dissemination of this knowledge is more likely to influence the evolution of scientific thought and patient care. Although the use of citation rates is not infallible, it has become an accepted measure to calculate a journal's impact factor and to assess a researcher's academic impact and productivity. In fact, citation rates have been used as criteria for academic promotions and selection of individuals for the Nobel Prize.[1,2]

Given the growing importance of citation rates in biomedical research, recent studies in the medical literature have explored the factors that are associated with higher citation rates. Callaham et al.[3] found that the strongest predictor of citations per year was the impact factor of the publishing journal. Other studies have found a correlation between certain study characteristics and increased citations rates. Numerous studies have found that the number of authors and institutions, study methodology or design, sample size, study topic, or funding from a for-profit company may be associated with higher citation rates.[4-9]

Although predictors for citations have been explored in other medical/surgical specialties, they have never been

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examined in plastic surgery. The purpose of this study is to determine and characterize the scientific and nonscientific factors (level of evidence, study design, sample size, presence of conflict of interest (COI), country of study origin, publication journal, etc.) that influence the rate of article citation in the field of plastic surgery. We hypothesized that the level of evidence, largely viewed as a proxy for scientific validity, would be predictive of higher citation rates in plastic surgery. Therefore, the aims of this study are the following: (1) identify studies published in 3 major plastic surgery journals; (2) extract a list of scientific and nonscientific study variables that have been previously demonstrated to influence citation rates from articles that fulfilled the inclusion criteria; and (3) evaluate whether an association exists between level of evidence (and other scientific and nonscientific variables) and the rate of citation seen 5 years from publication.

MATERIALS AND METHODS

Eligibility Criteria

An initial literature review was performed using the MEDLINE database for all articles published in the journals *Journal of Plastic, Reconstructive, and Aesthetic Surgery* (JPRAS) and *Annals of Plastic Surgery* (APS), from January 1, 2007 to December 31, 2007. Articles published in *Plastic and Reconstructive Surgery* (PRS), from January 1, 2007 to December 31, 2008 were also reviewed. An additional year of articles in PRS were included in order to (1) include a higher number and higher level of evidence studies in our analysis and (2) to examine whether the citation predictors collected were unexpectedly disparate from other years. These 3 peer-reviewed journals were chosen, as they are the leading journals in the field of plastic surgery (impact factor: 1.421, 1.494, and 2.993, respectively) and publish articles that broadly encompass the discipline of plastic surgery (esthetic surgery, burns, head and neck reconstruction, hand surgery, microsurgery, etc.).[10] We chose these dates as we desired to calculate only long-term citation rates (>5 years). Studies met the following inclusion criteria: (1) presence of an abstract, (2) basic or clinical science investigations, and (3) clearly defined presence or lack of conflicts of interest. Review articles or meta-analyses were not included in our analysis, as they may have included data from other studies being reviewed, and therefore could bias the outcome by having data counted multiple times. In addition, case reports, brief communications, technical notes, editorials, ethics commentaries, and surveys were excluded from our analysis.

Data Extraction

The following data were extracted from each study: journal of publication, number of authors, plastic surgery subspecialty, COI from the disclosure statement and the acknowledgment section, country of study origin, level of evidence, number of institutions involved in study, study design, study timing (retrospective vs prospective), and sample size. This extensive list of variables was chosen because they have previously been shown to be predictive of citation rates in the medical literature.[11] For the variable "sample size," each study was categorized into the following groups based on guidelines used in previous studies[5]: (1) less than 25 patients, (2) between 25 and 100 patients, and (3) greater than 100 patients. For the variable "level of evidence," each study was categorized into the following groups: (1) levels of evidence 1 and 2, (2) levels of evidence 3 and 4, and (3) level of evidence 5. These levels of evidence groupings were determined based on preliminary power calculations. For the variable "plastic surgery subspecialty," each article was classified into the following types: breast, cosmetic, experimental, hand/peripheral nerve, pediatric/craniofacial, and general reconstruction. Self-reported conflicts of interest disclosures were reviewed and categorized as present or not present. All types of conflicts of interest were considered including consultancy/employee status, royalties, and stock options. The number of previous publications in plastic surgery by first author was obtained by querying the following plastic surgery journals: *PRS, APS, Burn, Clinics in Plastic Surgery, Journal of Burn Care & Rehabilitation, Journal of Hand Surgery/American, British Journal of Plastic Surgery, Journal of Reconstructive Microsurgery, Microsurgery, Journal of Hand Surgery/British and European, Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery, Aesthetic Plastic Surgery, Journal of Craniofacial Surgery, Cleft Palate Craniofacial Journal,* and *European Journal of Plastic Surgery* in July 2015.

Number of Citations

To determine the rate of citation within 5 years after original publication, the Science Citation index online database was used.[10] Maintained by ISI Web of Science, the Science Citation Index records citation information on articles published in over 10,000 scholarly journals. This database was specifically chosen, as it has been previously accessed and verified for use in this capacity.[3,7]

The Science Citation Index database was queried in July 2015. The initial query was performed by 2 investigators (N.C. and A.D.) by using the year of publication and the first author's first and last name. All articles were identified in this fashion. If articles were absent from the database, they were classified as having zero citations.

Data Analysis

For the descriptive statistics, the mean and standard deviation or the median and interquartile range, depending on the normality of a given variable's distribution, were

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