# Citation Rate Predictors in the Plastic Surgery Literature ☆

Joseph Lopez, MD, MBA,* Nicholas Calotta, BA,* Ankur Doshi, BA,* Ashwin Soni, MD,† Jacqueline Milton, PhD,‡ James W. May Jr., MD,§ and Anthony P. Tufaro, DDS, MD*

*Department of Plastic and Reconstructive Surgery, Johns Hopkins Hospital, Baltimore, Maryland; †Division of Plastic Surgery, University of Washington Medical Center, Seattle, Washington; ‡Department of Biostatistics, Boston University School of Public Health, Boston, Massachusetts; and §Division of Plastic and Reconstructive Surgery, Massachusetts General Hospital, Boston, Massachusetts

**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 74:191-198. © 2017 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

☆*Presentations*: This study was presented as a podium presentation at the Northeastern Society of Plastic Surgery Annual Conference in Philadelphia, Pennsylvania, on September 19, 2015 and the American Society of Plastic Surgery Annual Meeting in Los Angeles, California on September 25, 2016.

*Correspondence*: Inquires to Joseph Lopez, MD, MBA, Department of Plastic Surgery, Johns Hopkins Hospital/University of Maryland Medical Center, 1780 East Fayette Street, Bloomberg 7th Floor Room 7314, Baltimore, MD 21231; fax: (410) 614-4333; e-mail: jlopez37@jhmi.edu

  1931-7204/$30.00 http://dx.doi.org/10.1016/j.jsurg.2016.08.005 

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

calculated for continuous variables. The frequency and the proportion for all dichotomous, categorical, and ordinal variables were also calculated. A multivariable linear regression model was used to determine which factors were significantly associated with the number of citations (the following factors were included: subspecialty, COI, country, institution, study design, number of authors in the study, prior number of publications, journal, and institution affiliation). A preliminary analysis showed that the number of citations was skewed to the right (outliers where some publications had a large number of citations). To account for this, the variable was transformed using the log (number of citations + 1) as our dependent variables in the multiple linear regression models. After performing this transformation, all assumptions of the linear model were met. All statistical tests and descriptive statistics were computed using SAS v 9.3 (SAS Inc. Cary, NC) with a level of significance of 0.05.

## RESULTS

### Article Characteristics

Of the 2456 abstracts that resulted from our initial search, 908 fulfilled the inclusion criteria for our study. The most common study topic was general reconstruction (26.3%), and the least common study topic was hand/peripheral nerves (8.3%). Most of the articles were from PRS (68.9%), whereas 18.4% were from APS and 12.7% from Journal of Plastic, Reconstructive, and Aesthetic Surgery. The level of evidence was the following: Levels I and II (12%), Levels III and IV (82.9%), and Level V (5.2%). The presence of a COI was noted in only 7.6% of the articles. First authors having no previous publications in plastic surgery were least common (22.0%) and those with $\geq 1$ but $< 10$ publications were most common (52.1%) (Table 1).

### Five-Year Citation Rates

The median number of citations 5 years from publication was 8 (interquartile range: 4, 15) (Table 1). Only 21 (2.3%) articles had no citations and only 85 articles (9.4%) had more than 25 citations (Fig). When analyzing the citation rate by study design, the mean and median citation rate ranged from 11.0 to 15.6 and 7 to 15, respectively (Table 2).

### Relationship Between Subspecialty Field, Disclosure of COI, Journal, the Number of Authors, and 5-Year Citation Rates

In the multivariable analysis, 5-year citation rates were reported proportionally higher in studies in which any of the authors disclosed a COI ($p = 0.04$, 95% CI: 0.01, 0.43) after adjusting for all predictors. Additionally, studies with over 4 authors ($p = 0.04$, 95% CI: 0.01, 0.25) and published in the journal, *PRS* ($p = 0.02$), had significantly higher number of citations after adjusting for all other variables. Lastly, 5-year citation rates were reported proportionally higher in studies in the subspecialty field of breast surgery ($p = 0.0003$, 95% CI: 0.05, 0.41) (Table 3). The $R^2$ for the multivariable analysis was 5.3%.

## DISCUSSION

The citation of studies published in peer-reviewed journals has become an important measure of article quality. Articles that are more highly cited are thought to be a reflection of the scientific direction and evolution of scientific thought in medicine.[11,12] More importantly, highly cited clinical articles drive health care delivery practice patterns and evidence-based medicine practices.[13,14] Furthermore, citations rates are also currently used to calculate a journal's impact factor, which is indirectly viewed as a proxy of a journal's prestige.[15] The impact factor of a journal is calculated by averaging the number of citations per year for all articles published in that particular journal in the previous 2 years, and this is used as a metric to compare impact among scientific journals. Lastly, in addition to being critical in calculating the impact factor of journals, citation rates are also commonly used in criteria for academic promotions in conjunction with other recently developed bibliometrics.[12,16,17] Although the use of citation rates to measure relative effect has its limitations, they are currently the preferred measure of an article's exposure and has become an essential currency in the evolution of scientific knowledge.[18,19]

Over the last decade, several studies in the medical literature have explored those variables that are predictive of higher citation rates. In a review of 204 emergency medicine articles published in various medical journals, Callaham et al.[3] found that the impact factor of the publishing journal was the strongest predictor of citations per year. Other subsequent studies have found slightly different results. In a review of the leading medical journals including *Lancet*, *JAMA*, and *NEJM*, Kulkarni et al.[8] found that large sample size, group authorship, and industry-funding were variables associated with higher citation rates. Other studies have found similar results citing level of evidence and study design as important predictors of citation.[20,21]

In the realm of plastic surgery, no study to date has explored as to which variables are associated with higher citation rates. To further investigate these factors, our study evaluated an extensive list of both scientific and non-scientific variables to determine which of these were associated with greater subsequent citations. We hypothesized that similar to previous studies in other specialties, level of evidence would be associated as a predictor of

**TABLE 1.** Characteristics of Included studies

| Article Characteristics ($n = 908$) | Type | Number of Articles (% of Total) or Mean (Std) |
|---|---|---|
| PRS subspecialty | Breast | 133 (14.7%) |
| | Cosmetic | 136 (15.0%) |
| | Experimental | 166 (18.3%) |
| | Hand/peripheral nerve | 75 (8.3%) |
| | Pediatric/craniofacial | 159 (17.6%) |
| | Reconstructive | 239 (26.3%) |
| COI | No | 839 (92.4%) |
| | Yes | 69 (7.6%) |
| Country of origin | Not US/Canada | 467(51.4%) |
| | US/Canada | 441 (48.6%) |
| Level of evidence* | 1 and 2 | 86 (12.0%) |
| | 3 and 4 | 596 (82.9%) |
| | 5 | 37 (5.2%) |
| Number of institutions associated with study | 1 Institution | 382 (42.1%) |
| | >1 Institution | 526 (57.9%) |
| Study design | Cohort | 170 (18.7%) |
| | Cross-sectional | 8 (0.9%) |
| | Case-control | 18 (2.0%) |
| | RCT | 22 (2.4%) |
| | Basic science | 216 (23.9%) |
| | Case series | 474 (52.2%) |
| Timing† | Prospective | 236 (34.1%) |
| | Retrospective | 457 (65.9%) |
| Sample size‡ | <25 | 265 (38.2%) |
| | 25-100 | 262 (37.8%) |
| | >100 | 166 (24.0%) |
| Number of authors | 1-3 authors | 293 (32.3%) |
| | 4 or more authors | 615 (67.7%) |
| Number of prior publications in plastic surgery by first author | 0 | 200 (22.0%) |
| | 1-10 | 473 (52.1%) |
| | >10 | 235 (25.9%) |
| Journal | APS | 167 (18.4%) |
| | JPRAS | 115 (12.7%) |
| | PRS | 626 (68.9%) |
| Number of citations at 5 years after publication§ | | 8 (IQR: 4, 15) |

As shown, all the subspecialties in plastic surgery were fairly evenly represented. The level of evidence was generally low with level III or IV studies comprising the most of the studies. There was a propensity for retrospective studies, as well as for case series. Most studies featured 4 or more authors, and more than one institution. Interestingly, the presence of a conflict of interest was noted in only a small minority of articles. IQR, interquartile range; JPRAS, Journal of Plastic, Reconstructive, & Aesthetic Surgery; N/A, not applicable; RCT, randomized controlled trial; Std, standard deviation.

*Excludes articles with level of evidence categorized as N/A ($N = 122$).

†Excludes experimental studies or articles with no reported sample size ($N = 215$).

‡Excludes experimental studies or articles with no reported sample size ($N = 215$).

§The mean was skewed owing to the number of articles with a large number of citations. Therefore, a median and IQR was used.

citation rates. In our review of 908 articles published in 3 major plastic surgery journals, our analysis instead found that "conflicts of interest," "subspecialty field," "journal," and "number of authors" were variables associated with higher citation rates 5 years from publication. Although this result may just be a reflection of the few number of high-quality studies published in the plastic surgery literature (as described in Table 1, only 12% of the studies in our cohort were level 1 or 2 evidence studies), it may also suggest that these variables are important when disseminating the findings of research studies.

Numerous studies in the medical literature have previously shown that the "number of authors" and "journal impact factor" are 2 variables associated with higher citations.[22-24] These studies have demonstrated that there is an inherent bias in the biomedical sciences for studies that are interdisciplinary, collaborative, and therefore have a higher number of authors. Furthermore, these studies have also logically found that articles published in higher impact journals are more likely to be highly cited. However, only a few studies have found an association between COI acknowledgment in an article and higher citation rates.[4,5] This finding was very surprising given that only 7% of the studies included in our analysis disclosed a conflict of interest. The fact that even after correcting for study methodology, study topic, and other study-specific

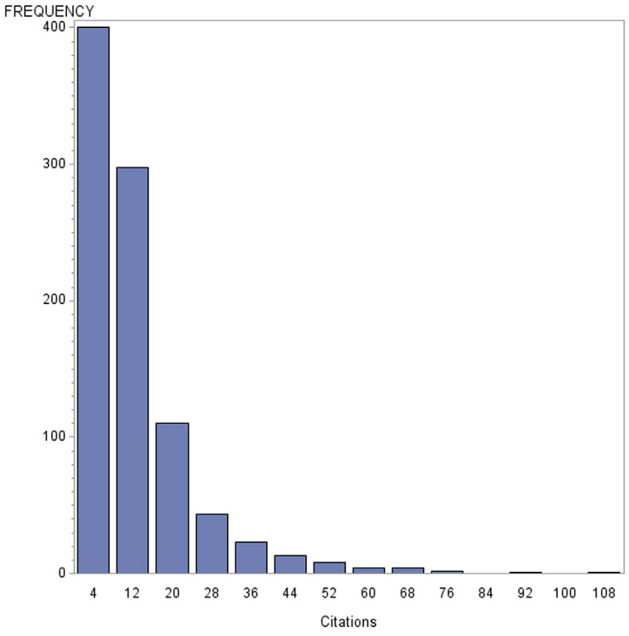


**FIGURE.** Distribution of 5-year citation rates. As shown, the median number of citations 5 years from publication was 8 (IQR: 4, 5). Only 21 (2.3%) articles had no citations, 887 (97.7%) had at least 1 citation, and 92 had at least 25 citations. Lastly, only 85 articles (9.4%) had more than 25 citations. Data from Science Citation Index. IQR, interquartile range.

variables, studies with COI were more likely to have more citations than those without COI, suggesting that there may be several mechanisms that facilitate the dissemination of study results from conflicted studies. First, studies with support from industry may be more likely to have the financial capacity to invest greater resources toward funding future similar studies, and therefore increasing the profile of the primary article.[25] Second, industry is more likely to support favorable review articles or promotional materials that increase the market penetration of a study.[26] Third, industry-funded studies may be selectively propagated by "Key-Opinion Leaders" (KOLs) that are thought to be better able to disseminate new practice patterns and innovations.[27,28] Finally, previous studies have demonstrated that studies with COI are associated with an increased likelihood of publishing a proindustry conclusion.[29-34] These same industry relationships may lead to selective citations of studies favoring the biomedical industry. Whatever the mechanism, the plastic surgery community should be aware of the potential for industry-funded study results to have a greater effect on the scientific debate and the evolution of scientific thinking in plastic surgery and patient care practice patterns.

Another interesting outcome from our study was the focus on the subspecialty field of breast surgery, which emerged as a highly significant predictor of higher citations. The drivers behind this finding are unclear. It may relate to the fact that there are no breast-focused plastic surgery journals unlike other plastic surgery subspecialties that have multiple subspecialty-specific journals (e.g., *Microsurgery*, *Journal of Hand Surgery*, and *Burns*). Additionally, it may also be related to the number of surgeons who practice in this subspecialty and the volume of research being conducted in this specialty relative to other plastic surgery subspecialties. For example, given that a large portion of the plastic surgery literature may be devoted to breast reconstruction, one would expect the breast reconstruction research articles to be more highly cited than hand surgery articles (8.4% of articles in our cohort) that have a smaller readership and research audience. If this result is proven to be true, correcting for subspecialty field may be necessary when citation rates are used to compare scientific productivity, research funding selection (e.g., National Institutes of Health funding), or journal impact factors. To determine whether COI was a potential driver for the association between breast surgery articles and higher citation rates, we performed a subanalysis to calculate whether the rate of COI differed by specialty topic. Our analysis revealed that at baseline, articles within the subspecialty field of breast surgery disclosed similar rates of COI when compared to other subspecialty fields ($p = 0.27$, unpublished data).

Our study does have several limitations that merit consideration. First, given that COI are self-reported, it is possible that COI may have been underreported. Previous studies in the orthopedic literature suggest that underreporting of COI is a common phenomenon.[35-37] Second, we chose not to control for self-citation as prior research suggests that rates of self-citation do not correlate significantly with overall citation rates.[38,39] Additionally, our analysis used level of evidence as an imperfect surrogate for methodologic quality. Although previous studies have used this metric as a proxy for scientific value, objective methodologic quality scores may be more useful.[40] Furthermore, our analysis attempted to correct for research productivity by quantifying the number of publications by the first author. However, this is limited owing to the fact that the first author does not always represent the senior author. Moreover, to perform our analysis, several variables had to be defined arbitrarily. For example, the variable, subspecialty topic, was defined using the subspecialty headings in the journal, *Plastic & Reconstructive Surgery,* and using these definitions may have affected our final results.

**TABLE 2.** Citation Rate Stratified by Study Design

| Study Design | N | Mean (Std) | Median (IQR) |
|---|---|---|---|
| RCT | 22 | 15.5 (10.8) | 15 (4, 23) |
| Basic science | 216 | 11.7 (13.7) | 7 (4, 13) |
| Case-control | 18 | 13.1 (10.4) | 9.5 (6, 21) |
| Case series | 474 | 11.0 (11.0) | 8 (5, 13) |
| Cohort | 170 | 13.1 (12.1) | 10 (4, 18) |
| Cross-sectional | 8 | 15.6 (15.7) | 9 (5, 23.5) |

As shown, the mean and median number of citations at 5 years did not differ by study design. IQR, interquartile range; RCT, randomized controlled trial; Std, standard deviation.

**TABLE 3.** Multivariable Analysis

| Variable | Multivariable Regression Coefficient* | p Value | 95% CI |
|---|---|---|---|
| Subspecialty field | | | |
| Breast | 0.23 | 0.0003* | (0.05, 0.41) |
| Cosmetic | −0.01 | | (−0.19, 0.17) |
| Experimental | −0.35 | | (−0.61, −0.09) |
| Hand/peripheral | −0.20 | | (−0.41, 0.02) |
| Pediatric/craniofacial | −0.09 | | (−0.26, 0.07) |
| Reconstructive† | | | |
| Conflict of interest disclosure | | | |
| Yes† | | | |
| No | 0.22 | 0.04 | (0.01, 0.43) |
| Study location | | | |
| United States† | | | |
| Non-United States | | | |
| Number of institutions | 0.10 | 0.08 | (−0.01, 0.22) |
| 1† | | | |
| 2 or more | −0.06 | 0.25 | (−0.18, 0.05) |
| Study design | | | |
| RCT | 0.07 | 0.68 | (−0.60, 0.74) |
| Case-control | −0.11 | | (−0.79, 0.58) |
| Case series | −0.14 | | (−0.72, 0.44) |
| Cohort | −0.12 | | (−0.70, 0.47) |
| Basic science | 0.02 | | (−0.59, 0.63) |
| Cross-sectional† | | | |
| Number of authors | | | |
| 1-3 | 0.13 | 0.04 | (0.01, 0.25) |
| 4 or more† | | | |
| Number of prior publications | | | |
| 0 | −0.11 to 0.03 | 0.38 | (−0.26, 0.05) |
| 1-10 | | | (−0.16, 0.09) |
| >10† | | | |
| Journal | | | |
| APS | −0.21 | | |
| JPRAS | −0.08 | 0.02 | (−0.35, −0.06) |
| PRS† | | | |

As shown, 5-year citation rates were reported proportionally higher in studies that disclosed a conflict of interest. Furthermore, studies in the plastic surgery subspecialty of breast reconstruction, published in PRS, and had more than 4 authors, were statistically more likely to have higher citation rates at 5 years from publication. JPRAS, Journal of Plastic, Reconstructive, & Aesthetic Surgery; RCT, randomized controlled trial.

*Significant at the $p \leq 0.05$ level.

*A positive regression coefficient indicates factors associated with higher citation rates. Conversely, a negative regression coefficient indicates factors associated with lower citation rates.

†Reference category.

Additionally, our final analysis included an additional year of publication from PRS to capture a higher number and higher level of evidence studies. The wider selection of PRS articles had a minimal effect on our results given that the proportion of input variables was no different between the journals. Lastly, although our results demonstrate an association between certain factors and citation rate, our study does not prove causation.

To our knowledge, this is the first study that has assessed those variables that are associated with higher citation rates in plastic surgery. As the most extensive literature review to date (over 900 studies reviewed), our study proves that the level of evidence (or other study methodology factors) is not predictive of higher citation rates. Therefore, an article's citation rate may not be best surrogate to evaluate an article's scientific validity in plastic surgery. Instead, our results suggest that other factors, more specifically, COI, study topic, journal impact factor, and number of authors, are used by plastic surgeons as potential metrics of value/quality to evaluate research. However, our results may also suggest that better metrics of scientific "value" are needed in plastic surgery. Recently, several newly developed bibliometrics (e.g., *h*-index) aim to better assess not only the quantity but also the "quality" of academic productivity of researchers.[41] In the United Kingdom, the new Research Excellence Framework REF has recently moved away from using citation rates as a metric for assessing the quality of research.[42] Experimenting with other objective outcome metrics, the Research Excellence Framework and others are currently working on developing equitable and unbiased metrics that not only quantify the scientific validity of an article but also evaluate its potential clinical impact/

utility.[43,44] Lastly, future studies should also assess whether, as a specialty, we may need to improve at the editorial or research level on the propagation of findings from previous, high methodologic quality studies. Building on the results of previous high-quality studies irrespective of study topic, conflicts of interest, or number of authors is important to advance the scientific agenda and evidence-based practices of any discipline.

## CONFLICTS OF INTEREST

Dr. James W. May Jr. is a consultant for TEI Biosciences and an educational consultant for Johnson-Johnson—Mentor.

## REFERENCES


1. Garfield E, Welljams-Dorof A. Of Nobel class: a citation perspective on high impact research authors. *Theor Med*. 1992;13(2):117-135.
2. Davies HD, Langley JM, Speert DP. Rating authors' contributions to collaborative research: the PICNIC survey of university departments of pediatrics. Pediatric Investigators' Collaborative Network on Infections in Canada. *CMAJ*. 1996;155(7):877-882.
3. Callaham M, Wears RL, Weber E. Journal prestige, publication bias, and other characteristics associated with citation of published studies in peer-reviewed journals. *J Am Med Assoc*. 2002;287(21):2847-2850.
4. Conen D, Torres J, Ridker PM. Differential citation rates of major cardiovascular clinical trials according to source of funding: a survey from 2000 to 2005. *Circulation*. 2008;118(13):1321-1327.
5. Okike K, Kocher MS, Torpey JL, Nwachukwu BU, Mehlman CT, Bhandari M. Level of evidence and conflict of interest disclosure associated with higher citation rates in orthopedics. *J Clin Epidemiol*. 2011;64(3):331-338.
6. Figg WD, Dunn L, Liewehr DJ, et al. Scientific collaboration results in higher citation rates of published articles. *Pharmacotherapy*. 2006;26(6):759-767.
7. Bhandari M, Busse J, Devereaux PJ, et al. Factors associated with citation rates in the orthopedic literature. *Can J Surg*. 2007;50(2):119-123.
8. Kulkarni AV, Busse JW, Shams I. Characteristics associated with citation rate of the medical literature. *PLoS One*. 2007;2(5):e403.
9. Willis DL, Bahler CD, Neuberger MM, Dahm P. Predictors of citations in the urological literature. *BJU Int*. 2011;107(12):1876-1880.
10. Thomas Rueters. *Web Sci.: J. Citation Rep*. 2014 (October 15).
11. Carpenter CR, Sarli CC, Fowler SA, et al. Best Evidence in Emergency Medicine (BEEM) rater scores correlate with publications' future citations. *Acad Emerg Med*. 2013;20(10):1004-1012.
12. Carpenter CR, Cone DC, Sarli CC. Using publication metrics to highlight academic productivity and research impact. *Acad Emerg Med*. 2014;21(10):1160-1172.
13. Lau SL, Samman N. Levels of evidence and journal impact factor in oral and maxillofacial surgery. *Int J Oral Maxillofac Surg*. 2007;36(1):1-5.
14. Rodrigues MA, Tedesco AC, Nahas FX, Ferreira LM. Journal impact factor versus the evidence level of articles published in plastic surgery journals. *Plast Reconstr Surg*. 2014;133(6):1502-1507.
15. Garfield E. The history and meaning of the journal impact factor. *J Am Med Assoc*. 2006;295(1):90-93.
16. Fuller CD, Choi M, Thomas CR Jr. Bibliometric analysis of radiation oncology departmental scholarly publication productivity at domestic residency training institutions. *J Am Coll Radiol*. 2009;6(2):112-118.
17. Reed KL. Citation analysis of faculty publication: beyond Science Citation Index and Social Science Citation Index. *Bull Med Libr Assoc*. 1995;83 (4):503-508.
18. Opthof T. Sense and nonsense about the impact factor. *Cardiovasc Res*. 1997;33(1):1-7.
19. Kurmis AP. Understanding the limitations of the journal impact factor. *J Bone Joint Surg Am*. 2003;85-A(12):2449-2454.
20. Patsopoulos NA, Analatos AA, Ioannidis JP. Relative citation impact of various study designs in the health sciences. *J Am Med Assoc*. 2005;293(19):2362-2366.
21. Winnik S, Raptis DA, Walker JH, et al. From abstract to impact in cardiovascular research: factors predicting publication and citation. *Eur Heart J*. 2012;33(24): 3034-3045.
22. Glynn RW, Kerin MJ, Sweeney KJ. Authorship trends in the surgical literature. *Br J Surg*. 2010;97(8):1304-1308.
23. Filion KB, Pless IB. Factors related to the frequency of citation of epidemiologic publications. *Epidemiol Perspect Innov*. 2008;5(3):5573-5-3.
24. Annalingam A, Damayanthi H, Jayawardena R, Ranasinghe P. Determinants of the citation rate of medical research publications from a developing country. *Springerplus*. 2014;3(140) [1801-3-140; eCollection 2014].

**25.** Ross JS, Hill KP, Egilman DS, Krumholz HM. Guest authorship and ghostwriting in publications related to rofecoxib: a case study of industry documents from rofecoxib litigation. *J Am Med Assoc*. 2008;299 (15):1800-1812.

**26.** Phillips DP, Kanter EJ, Bednarczyk B, Tastad PL. Importance of the lay press in the transmission of medical knowledge to the scientific community. *N Engl J Med*. 1991;325(16):1180-1183.

**27.** Luce EA. Financial conflicts of interest in plastic surgery: background, potential for bias, disclosure, and transparency. *Plast Reconstr Surg*. 2015;135(4):1149-1155.

**28.** Campbell EG, Gruen RL, Mountford J, Miller LG, Cleary PD, Blumenthal D. A national survey of physician-industry relationships. *N Engl J Med*. 2007;356(17):1742-1750.

**29.** Lesser LI, Ebbeling CB, Goozner M, Wypij D, Ludwig DS. Relationship between funding source and conclusion among nutrition-related scientific articles. *PLoS Med*. 2007;4(1):e5.

**30.** Yank V, Rennie D, Bero LA. Financial ties and concordance between results and conclusions in meta-analyses: retrospective cohort study. *Br Med J*. 2007;335(7631):1202-1205.

**31.** Bhandari M, Busse JW, Jackowski D, et al. Association between industry funding and statistically significant pro-industry findings in medical and surgical randomized trials. *CMAJ*. 2004;170(4):477-480.

**32.** DeGeorge BR Jr., Holland MC, Drake DB. The impact of conflict of interest in abdominal wall reconstruction with acellular dermal matrix. *Ann Plast Surg*. 2015;74(2):242-247.

**33.** Lopez J, Prifogle E, Nyame TT, Milton J, May JW Jr. The impact of conflicts of interest in plastic surgery: an analysis of acellular dermal matrix, implant-based breast reconstruction. *Plast Reconstr Surg*. 2014;133(6): 1328-1334.

**34.** Friedman LS, Richter ED. Relationship between conflicts of interest and research results. *J Gen Intern Med*. 2004;19(1):51-56.

**35.** Norris SL, Holmer HK, Ogden LA, Selph SS, Fu R. Conflict of interest disclosures for clinical practice guidelines in the national guideline clearinghouse. *PLoS One*. 2012;7(11):e47343.

**36.** Neuman J, Korenstein D, Ross JS, Keyhani S. Prevalence of financial conflicts of interest among panel members producing clinical practice guidelines in Canada and United States: cross sectional study. *Br Med J*. 2011;343:d5621.

**37.** Bindslev JB, Schroll J, Gotzsche PC, Lundh A. Underreporting of conflicts of interest in clinical practice guidelines: cross sectional study. *BMC Med Ethics*. 2013;14(19),6939-14-19.

**38.** Swanson EW, Miller DT, Susarla SM, et al. What effect does self-citation have on bibliometric measures in academic plastic surgery? *Ann Plast Surg*. 2016;77 (3):350-353.

**39.** Susarla SM, Swanson EW, Lopez J, Peacock ZS, Dodson TB. Does self-citation influence quantitative measures of research productivity among academic oral and maxillofacial surgeons? *J Oral Maxillofac Surg*. 2015;73(10):1981.e1-1981.e7.

**40.** Longnecker MP, Berlin JA, Orza MJ, Chalmers TC. A meta-analysis of alcohol consumption in relation to risk of breast cancer. *J Am Med Assoc*. 1988;260(5): 652-656.

**41.** Therattil PJ, Hoppe IC, Granick MS, Lee ES. Application of the h-index in academic plastic surgery. *Ann Plast Surg*. 2016;76(5):549.

**42.** No Authors Listed. *Higher Education Funding Council for England: Analysis of Data from the Pilot Exercise to Develop Bibliometric Indicators for the REF: The Effect of Using Normalised Citation Scores for Particular Staff Characteristics*; November 2015.

**43.** No Authors Listed. *Research Excellence Framework: Assessment Framework and Guidance on Submissions*; November 2015.

**44.** Bergstrom CT, West JD, Wiseman MA. The Eigenfactor metrics. *J Neurosci*. 2008;28(45):11433-11434.