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Differences in “Highly-Cited” and “Lowly-Cited” Manuscripts in Plastic Surgery

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Abstract

Introduction—There is a paucity of research comparing journal articles that accrue numerous citations to those that accrue few citations over time. Understanding differences between journal articles can help direct investigators in designing and conducting their research.

Methods—Using advanced bibliometric tools, we queried four plastic surgery journals (Journal of Reconstructive Microsurgery, Annals of Plastic Surgery, Plastic and Reconstructive Surgery, and Microsurgery) for primary research articles published between 1998-2008 accruing 0 or 1 citations with at least a 10-year lag time. Forty-seven articles were identified as “low citation” and were compared to an equal number of articles in the same journals that accrued the highest number of citations in the same period “high citation”. The data was analyzed using Student’s t-

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tests, Wilcoxon rank-sum tests, chi squared tests, and Fisher's exact tests. The level of significance was established at $p < 0.05$.

Results—When compared to the “high citation” cohort, the “low citation” articles were more likely to be non-clinical ($p < 0.001$), have no plastic surgery authors ($p = 0.0026$), and focus on the field of microsurgery ($p = 0.003$). The “high citation cohort” was more likely to have higher sample sizes ($p = 0.0339$), focus on aesthetic/cosmetic surgery ($p = 0.003$), have a higher number of other disciplines included on authorship ($p < 0.001$), references ($p = 0.0451$), manuscript pages ($p < 0.001$), and words in the abstract ($p < 0.001$).

Conclusion—A small number of articles published in four plastic surgery journals were uncited over a 10-year period. There are qualitative and quantitative differences between highly and lowly cited articles in the plastic surgery literature. Investigators should consider these differences when designing and conducting studies.

Keywords

citations; bibliometric; literature analysis; plastic surgery

Introduction

Measuring the true impact of biomedical research can help to more efficiently guide institutional and departmental resources¹⁵. In plastic surgery, it is critical to understand the nature of what factors impact the quality of published research articles. Article citations count is a common and established method to quantify the influence of a research article. Articles that have accrued more citations are likely to have high relevance to the field and serve as a foundation for other research endeavors^{9,21}. The factors that influence article citations has been studied by other fields in their respective literature^{2,1617}. Newer metrics have been developed to consider more than just citation counts to measure an articles influence, but these metrics require more time for validation before they can be readily used^{2,18}.

Recently, the classification of the plastic surgery literature has been studied at a higher rate when compared to other fields of medicine. These analyses have focused primarily on classifying the most cited research articles in plastic surgery as a whole and in individual subject areas of the^{1–8,10}. There has also been special attention paid to the effects of self-citation on article and journal metrics^{13,20}.

However, there is a paucity of studies investigating articles with zero or few citations and what article factors contribute to the lack of these articles receiving citations in the subsequent plastic surgery literature. To our knowledge, direct comparison of the most cited and least cited articles over time has not been performed. Our objective is to analyze what factors characterize both lowly cited and frequently cited articles in the plastic surgery literature with the goal that such an analysis will serve investigators and publishers in producing high-quality research and readers in understanding the literature.

Methods

The four United States based plastic surgery or microsurgery journals with the highest impact factor that were listed on PubMed® since at least 1998 were selected for review of all primary research articles published from that year up until 2008. The journals queried included the *Journal of Reconstructive Microsurgery*, *Annals of Plastic Surgery*, *Plastic and Reconstructive Surgery*, and *Microsurgery*. The advanced PubMed® search tool was employed to identify all primary research articles with an abstract in these journals¹⁵. Review articles, editorials, case reports, letters, commentaries, guideline statements, and errata were excluded using this tool¹. This query yielded a cohort of articles and their PubMed identification numbers from the selected journals. This list allowed us to enter the articles into the National Institute of Health's (NIH) iCite tool which produces the total number of citations an article has accrued since its publication¹⁵.

The articles that had accrued 0 or 1 citations in an at least 10-year lag time after the article's publication were reviewed and identified. There were 65 articles that initially met the criteria and composed the low citation cohort. After examination, 18 articles were excluded from the cohort because they were determined to be letters to the editor or commentaries. Accordingly, the "Low Citation" (LC) cohort was examined with 47 articles. The 47 articles with the highest citations in these journals made up the "High Citation" (HC) cohort.

The two cohorts were autonomously reviewed by two investigators for a variety of data points. Discrepancies between the investigators data were discussed with a third investigator to reach a consensus. The data points chosen were similar to other studies performed in the radiology and urology literature with the augmentation of categories with specific interest to plastic surgery^{2,17}. For determination of authorship and institutional affiliations, we relied on the bibliographic information provided in the articles.

Elements of the article structure were recorded including the number of words in the title, presence of punctuation in the title (question mark, period, semi-colon, hyphen, comma, colon), number of words in the abstract and manuscript (excluding any appendices), number of manuscript pages, number of tables, figures, and references. Article demographic information collected included journal of publication, source of funding, and listed conflicts of interest. The articles were classified based on the plastic surgery fellowship (craniofacial/pediatric, hand, microsurgery, aesthetic/cosmetic, other) they most closely aligned with and article subject matter with the best match (breast, cosmetic, experimental, hand/peripheral nerve, craniofacial/pediatric, reconstructive, other). Authorship was characterized for the articles by recording the number of authors, gender of all authors, country affiliation of the first author (USA vs non-USA), presence of a plastic surgeon author, presence of non-plastic surgeon authors, number of non-plastic surgery disciplines represented, number of institutions involved (single versus multi-institutional), and number of countries represented (single versus international). Results of the articles were compared based on the presence or absence of a statistically significant outcome reported in the abstract and manuscript and study type (clinical versus non-clinical). For clinical studies, study design (retrospective versus prospective) and sample size were also assessed.

Bivariate comparisons for identified plastic surgery articles with lowest and highest number of citations were conducted. Continuous variables were compared using the student's t-test for normally distributed variables, or the Wilcoxon rank-sum test for non-normally distributed variables. Categorical variables were compared using the chi-squared test or Fisher's exact test (SAS, version 9.4). The data were analyzed with a predetermined level of significance set to $p < 0.05$.

Results

The literature search for articles in four international plastic surgery journals (JRM, APS, Microsurgery, and PRS) identified 47 articles with 0 or 1 citations accrued in the 10-year period following publication. These LC articles were compared to a HC cohort of 47 articles in the same journals that were identified as having the highest number of citations (mean of 140.64 ± 60.14) accrued in the 10-year period following publication. Statistical analysis of the two cohorts found a variety of significant differences (Table 1).

The LC cohort in contrast to the HC cohort, was significantly more likely to have a first author of non-USA origin (61.7% vs. 31.9%, $p = 0.0038$), no plastic surgeon as an author (19.1% vs. 0%, $p = 0.0026$), no conflicts of interest (100% vs. 83%, $p = 0.0031$) and punctuation in the title (59.6% vs. 34.0%, $p = 0.0131$). Additionally, the LC cohort had more articles classified as non-clinical (70.2% vs. 21.3%, $p < 0.001$), an experimental paper (68.1% vs. 17%, $p < 0.0001$), and focused on the field of microsurgery (61.7% vs. 23.4%, $p = 0.003$). The clinical studies included in the LC cohort had a significantly lower median sample size (38 vs. 115, $p = 0.0339$).

When compared to the LC Cohort, the HC cohort was significantly more likely to have a non-plastic surgeon as a co-author (80.9% vs. 55.3%, $p = 0.0079$). The HC was more likely to have a higher number of other disciplines (mean of 2.02 ± 0.85 vs. 0.91 ± 1.12 , $p < 0.001$), number of references (mean of 26.89 ± 17.03 vs. 20.66 ± 12.36 , $p = 0.0451$), number of tables (mean of 2.83 ± 2.72 vs. 1.60 ± 1.53 , $p = 0.0080$), number of manuscript pages (mean of 8.28 ± 2.15 vs. 5.77 ± 2.18 , $p < 0.001$), and the median number of female authors (median of 1 vs. 0, $p = 0.0445$). The HC cohort was also more likely to have a significantly higher abstract word count (mean of 304.32 ± 91.50 vs. 225.38 ± 95.28 , $p < 0.0001$) and manuscript word count (mean of 2402.1 ± 1181.9 vs. 2218.7 ± 929.7 , $p < 0.0001$). Additionally, the HC had significantly more articles focusing on the breast (29.8% vs. 4.3%, $p < 0.0001$), and investigated most frequently the field of aesthetic/cosmetic plastic surgery (36.2% vs. 8.5%, $p = 0.0003$).

There were no significant differences ($p > 0.05$) between the two cohorts in regards to the mean number of authors, the sex of the first author, the mean number of male or female authors, the mean sample size, the number of institutions and countries involved, the reported funding, the number of words in title, the number of figures, and the design of clinical studies (prospective vs retrospective). There were no significant differences in the rate of citation for the reporting of statistically significant results in the abstract and results section of each article.

Discussion

Research plays an essential role in furthering the discipline of plastic surgery. Research articles that are repeatedly cited guide the direction of the scientific discipline by eliciting more questions to answer^{9,21,22}. Nevertheless, while the factors that affect authorship and citation have been examined in other fields, there is a dearth of studies focused on the plastic surgery literature. Examining the quality of research that is published is critical to maintaining the development of the plastic surgery field^{4,8}. Our results suggest that there are certain article characteristics that differ between articles at the extremes of citation counts in plastic surgery.

Though imperfect, citation count is used as an estimate of the impact and quality of research with a higher citation count being synonymous to a more impactful study²¹. Consisting of only 47 articles, the LC cohort is analogous to studies in the fields of radiology and urology where there were 50 or less uncited articles over a 10 year publication period in a similar number of journals^{2,17}. The small count of the LC cohort suggests that editors and reviewers at the journals being studied are adequately selecting studies that will contribute to future research in the plastic surgery field. Though citation number is only one metric to examine the impact of an article, it is a useful benchmark for the influence and impact of a study^{2,9,16}.

Interestingly, our investigation found that articles with the presence of plastic surgery and other disciplines and a higher median number of female authors were more highly cited by subsequent studies. More research into examining this trend will need to be established¹⁹. Nevertheless, many of the factors that associated with higher citation count were related to the design and scientific method of the studies. For instance, studies with higher sample sizes, clinical studies or presence of plastic surgeon were more likely to be cited in the future. These features serve to highlight characteristics that contribute to broaden study influence that have been established by other bibliometric investigations such as multidisciplinary teams, larger sample sizes and having a clear clinical focus^{10,21}. In addition, cosmetic plastic surgery and studies focused on breast were associated with higher citations. This finding may reflect the field's interest in managing the subjective clinical challenges that vary from reconstruction of acquired or congenital defects to cosmetic surgery¹⁰. More esoteric differences such as a longer word count of abstract and manuscript, a declared conflict of interest, longer manuscript pages, lack of punctuation in title, and higher number of references were associated with the high citation cohort. These findings highlight how linguistic presentation can affect the article's impact to reviewers and readers and enhance the probability of future citations.

Biomedical research consumes a considerable amount of time, effort and cost because it is done with the hope to guide subsequent investigations and benefiting patients. Yet, not all research is successful in impacting the direction of future scientific endeavours¹⁶. Previous bibliometric investigations within the plastic surgery literature have largely focused on most frequently cited articles^{4,12} rather than highlighting poorly cited articles as others have done^{2,16,17}. Our analysis taken in context with other bibliometric studies suggests that investigators must consider the clarity and organization of the manuscript as they develop

future articles that are sent to publication. Understanding the patterns between articles of different citation frequency can aid investigators in constructing impactful research.

When compared to literature investigating the factors that lead to differences in citation count in other fields, the field of plastic surgery has various differences. A study in radiology found that uncited articles were more likely to have a non-clinical focus with a lower number of manuscript pages and tables, and those that were clinical reported lower sample sizes¹⁶. Even though these results are congruent with our findings, other results such as a lower amount of reported funding and statistically significant results were not significantly different in plastic surgery. Similarly, in urology, a low citation count was associated with non-clinical research with a lower number of references and manuscript word count². Significant findings in the urology literature that were not observed in our study included a lower number of statistically significant findings and number of authors. These findings suggest that each field has a unique set of factors that may influence citation trends. Therefore, each field should be examined separately in order to understand this relationship accurately.

Various limitations can be identified with this study. First, the final LC cohort's exclusion of articles that were letters to the editor or commentaries decreased the usable sample. Notably, despite the large number of articles examined in the targeted journals across over a decade of time, the sample of uncited articles identified was small; this again limited the sample size for analysis^{2, 17, 22}. Even though a greater sample size would allow for more accurate discrepancies between the LC and HC cohorts, it was outside of the scope of our present study in highlighting the differences of low impact and high impact studies. Second, even though objective metrics were analyzed such as number of authors, study design and sample size, some metrics were subject to interpretation. In order to maximize the quality of the scientific rigor, the articles in each cohort were examined independently by two separate individuals, and a third individual mediated discrepancies. These subjective judgements may have affected article classification and therefore the results. Increasing the number of individuals and averaging their collection metrics would eliminate the variability. Third, this study was focused on articles only from 4 plastic surgery journals. It is currently unclear whether the results are generalizable to subspecialty plastics journals, international journals and other specialties^{2, 17, 22}. Expanding to other journals in the same specialty or even overlapping specialties may allow for a more accurate representation of the data.

Conclusion

In conclusion, only a small number of original research articles in four plastic surgery journals are uncited in the decade following publication. Furthermore, there were identifiable attributes that contributed to a higher citation number. This suggests that published articles contribute to further research and the language of the article should be considered when preparing studies for publication.

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Table 1.

Comparison of articles with the lowest and highest citations.

	Articles with the Lowest Number of Citations n=47	Articles with the Highest Number of Citations n=47	p-value
Mean Number of Citations (SD)	0.72 (0.45)	140.64 (60.14)	<.0001
Journal			<.0001
J Reconstr Microsurg	17 (36.2)	1 (2.1)	
Ann Plast Surg	8 (17.0)	5 (10.6)	
Microsurg	16 (34.0)	2 (4.3)	
Plast. Reconstr. Surg.	6 (12.8)	39 (83.0)	
Mean Number of Authors (SD)	5.06 (2.45)	5.94 (2.22)	0.0740
Male Authors (SD)	3.81 (2.11)	4.40 (1.91)	0.1547
Female Authors (SD)	0.85 (1.20)	1.36 (1.39)	0.0595
Unknown Authors (SD)	0.38 (1.29)	0 (0.0)	
Country			0.0038
USA	18 (38.3)	32 (68.1)	
Non-USA	29 (61.7)	15 (31.9)	
Presence of Non-Plastic Surgeon			0.0079
Plastic Surgeon Only	21 (44.7)	9 (19.2)	
Non-plastic Surgeon Present	26 (55.3)	38 (80.9)	
Mean Number of Other Disciplines (SD)	0.91 (1.12)	2.02 (0.85)	<.0001
Presence of Plastic Surgeon			0.0026
Plastic Surgeon Present	38 (80.9)	47 (100.0)	
No plastic surgeon present	9 (19.1)	0 (0.0)	
Number of Institutions			0.2030
One Institution	32 (68.1)	26 (55.3)	
Multi-Institution	15 (31.9)	21 (44.7)	
Number of Countries			1.0000
One Country	39 (83.0)	39 (83.0)	
Multinational	8 (17.0)	8 (17.0)	
Funding			0.2030
Funding Reported	32 (68.1)	26 (55.3)	
No Funding Reported	15 (31.9)	21 (44.7)	
Conflicts of Interest			0.0031
None declared	47 (100.0)	39 (83.0)	
Declared	0 (0.0)	8 (17.0)	
Number of Words in Title (SD)	12.82 (4.50)	13.4 (4.48)	0.5521
Punctuation in Title			0.0131
No Title Punctuation	19 (40.4)	31 (66.0)	
Title Punctuation	28 (59.6)	16 (34.0)	
Abstract Word Count (SD)	225.38 (95.28)	304.32 (91.50)	<.0001
Manuscript Word Count (SD)	2218.7 (929.7)	3402.1 (1181.9)	<.0001
Abstract Results			0.6765

	Articles with the Lowest Number of Citations n=47	Articles with the Highest Number of Citations n=47	p-value
No Stat Sig Result	21 (44.7)	19 (40.4)	
Stat Sig Result	26 (55.3)	28 (59.57)	
Paper Results			0.2723
No Stat Sig Result	10 (21.3)	6 (12.8)	
Stat Sig Result	37 (78.7)	41 (87.2)	
Number of References (SD)	20.66 (12.36)	26.89 (17.03)	0.0451
Number of Tables (SD)	1.60 (1.53)	2.83 (2.72)	0.0080
Number of Figures (SD)	4.30 (3.28)	3.55 (2.74)	0.2357
Number of Manuscript Pages (SD)	5.77 (2.18)	8.28 (2.15)	<.0001
Fellowship Classification			0.0003
Craniofacial/Pediatric	2 (4.3)	9 (19.1)	
Hand	3 (6.4)	2 (4.3)	
Microsurgery	29 (61.7)	11 (23.4)	
Aesthetic/Cosmetic	4 (8.5)	17 (36.2)	
Other	9 (19.1)	8 (17.0)	
Paper Classification			<.0001
Breast	2 (4.3)	14 (29.8)	
Cosmetic	2 (4.3)	2 (4.3)	
Experimental	32 (68.1)	8 (17.0)	
Hand/Peripheral Nerve	3 (6.4)	5 (10.6)	
Craniofacial/Pediatric	1 (2.1)	8 (17.0)	
Reconstructive	4 (8.5)	7 (14.9)	
Other	3 (6.4)	3 (6.4)	
Clinical vs Non-Clinical			<.0001
Clinical	14 (29.8)	37 (78.7)	
Non-clinical	33 (70.2)	10 (21.3)	
Study Design (Clinical)			1.000
Retrospective	4 (28.6)	10 (27.0)	
Prospective	8 (57.1)	21 (56.8)	
Both	2 (14.3)	6 (16.2)	
Mean Sample Size (SD) (Clinical)	122.86 (221.65)	475.86 (1711.11)	0.4481
Sex of First Author			0.1264
Male	39 (83.0)	35 (74.5)	
Female	6 (12.8)	12 (25.5)	
Unknown	2 (4.3)	0 (0.0)	

Values are n (%) unless otherwise stated