

Majority of Most-Cited Articles in Top Plastic Surgery Journals Do Not Receive Funding

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Aesthetic Surgery Journal
2021, Vol 41(7) NP935–NP938
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journals.permissions@oup.com
DOI: 10.1093/asj/sjaa379
www.aestheticsurgeryjournal.com

OXFORD
UNIVERSITY PRESS

Abstract

Background: Plastic surgery faculty, residencies, and institutions are frequently judged on the quantity and quality of their research output. Some of the most impressive individuals in the specialty receive financial support in the form of grants and payments to help with research ideas.

Objectives: The authors sought to discern if funding directly correlates to greater impact in the top plastic surgery journals as measured by citations.

Methods: Using the Web of Science database, the authors identified the 50 most-cited articles in each of the top plastic surgery journals from January 1975 to August 2020. The articles were scanned for funding sources and categorized as industry, federal, foundational, and institutional, while stratifying by decade.

Results: Between 16 journals, 13.3% of the most-cited articles received funding, 2.6% of which came from industry, 5.4% from government, 4.4% from foundations, and 0.86% from institutions. The percentage of most-cited articles and the proportion that received funding were both correlated with decade ($P = 0.0017$ and $P = 0.043$, respectively). However, only the percentage of articles was found to significantly increase over time ($P = 0.0068$).

Conclusions: Although funding leads to meaningful publications, this study showed that financial support is not required to have an influence in plastic surgery research.

Editorial Decision date: November 16, 2020; online publish-ahead-of-print December 18, 2020.

Research is undeniably a large part of academic medicine. With scientific innovation in techniques and pharmaceuticals, we are able to better and prolong life. Plastic surgeons are often regarded more highly for such scholarly impact, a metric that can be measured by the h-index.^{1,3} Plastic surgery residency programs are even sometimes ranked according to scholastic achievement of faculty members.⁴ Many of these faculty surgeons are able to secure funding, including industry, federal, foundational, and institutional, to support their research investigations.^{5,6} Among federal funding are the coveted National Institutes of Health grants and those from the United States Department of Defense.^{3,5} Foundational organizations are those such as the Aesthetic Surgery Education and Research Foundation, American Association of Plastic Surgeons Academic Scholar Program, and Plastic Surgery Foundation.⁶

It is reasonable to be apprehensive of the motivation behind financially backed research, because it can seem mostly money driven, thereby perpetuating conflict of interest. Publication output is, after all, higher when there is financial support from industry.² In fact, studies with such funding are more likely to be associated with positive conclusions than their counterparts.⁷ Furthermore, more than one-half of all plastic surgeons in both academia and

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Table 1. Percentage of Most-Cited Articles That Received Funding, by Journal

Journal	Funding				
	All	Industry	Federal	Foundational	Institutional
<i>Aesthetic Plastic Surgery</i>	1.9%	1.9%	0%	0.0%	0.0%
<i>Aesthetic Surgery Journal</i>	33.3%	23.5%	2.0%	5.9%	1.9%
<i>Annals of Plastic Surgery</i>	8.0%	0%	8.0%	0%	0%
<i>Cleft Palate-Craniofacial Journal</i>	27.5%	0%	27.5%	0%	0%
<i>Clinics in Plastic Surgery</i>	0%	0%	0%	0%	0%
<i>Indian Journal of Plastic Surgery</i>	5.8%	0%	0%	3.8%	2.0%
<i>Journal Cranio-Maxillofacial Surgery</i>	12.0%	0%	0%	12.0%	0%
<i>Journal of Craniofacial Surgery</i>	5.9%	0%	3.9%	2.0%	0%
<i>Journal of Hand Surgery – American Volume</i>	16.0%	0%	16.0%	0%	0%
<i>Journal of Plastic Surgery and Hand Surgery</i>	24.0%	2.0%	2.0%	18.0%	2.0%
<i>Journal of Plastic, Reconstructive and Aesthetic Surgery</i>	24.0%	6.0%	6.0%	12.0%	0%
<i>Journal of Reconstructive Microsurgery</i>	5.9%	0%	3.9%	2.0%	0%
<i>Plastic and Reconstructive Surgery</i>	4.0%	0%	4.0%	0%	0%
<i>Plastic and Reconstructive Surgery Global Open</i>	35.2%	7.4%	13.0%	11.1%	3.7%
<i>Plastic Surgery</i>	5.9%	0%	0%	2.0%	3.9%
<i>Seminars in Plastic Surgery</i>	2.0%	0%	0%	2.0%	0%
Total articles (n = 814)	13.3%	2.6%	5.4%	4.4%	0.86%

private practice have been found to have industry relationships that include financial exchanges.⁸ As for other sources of funding, the National Institutes of Health has historically awarded the prestigious R01 grant to only a small number of plastic surgeons, potentially driving research endeavors away from a broader group of innovation.⁹ Still, medicine needs research, so it is also not unreasonable to be compensated for conducting it.

This brings us to the most important question: is financially backed research more impactful than research conducted without funding? To our knowledge, there are currently no data in the plastic surgery literature that compare the funding of articles in influential publications. This study aimed to determine just how crucial funding is to research by looking at the most-cited articles in the top plastic surgery journals.

METHODS

After identifying the top plastic surgery journals as measured by impact factor and altmetrics when searched in August 2020 (J.E.J.), the Web of Science database was

utilized to pinpoint the 50 most-cited articles from each journal for the entirety of the database's system, which begins in January 1975 (D.B.A.). Ties at the number 50 spot were included for completion. We scanned the articles for funding disclosures and subsequently stratified according to decade and source, either industry, federal, foundation, or institutional. Both authors agreed on the selection and stratification of articles.

Correlation and simple linear regression were employed to differentiate between decades. Statistical significance was defined as $P < 0.05$. Analyses were performed with Prism version 8.4.3 (by GraphPad, San Diego, CA).

RESULTS

A total of 16 journals comprising 814 articles from 1975 to 2020 were analyzed. No articles in 2020 were included under the top-50 most cited umbrella, which would be expected given their recent publication at the time of the search. Funding was stated in 13.3% of articles (Table 1). *Plastic and Reconstructive Surgery Global Open* had the highest percentage of articles that received funding at

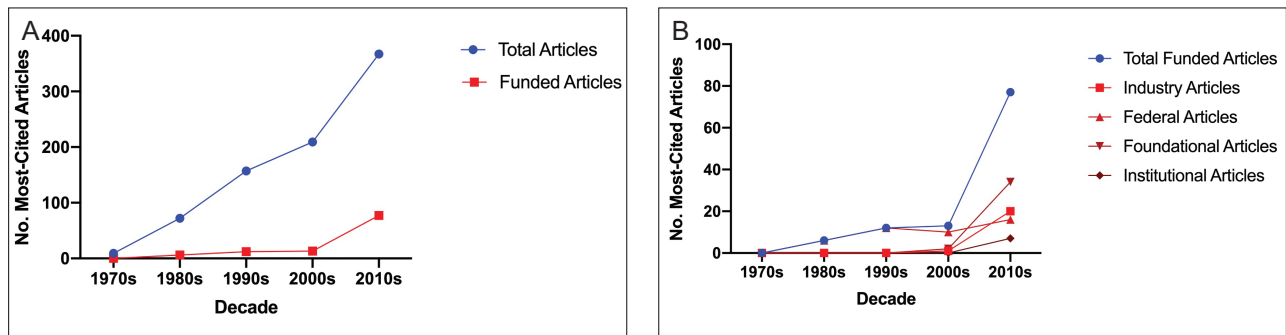


Figure 1. (A) Number of most-cited articles and fraction that are funded, stratified by decade. (B) Number of most-cited articles that received funding, stratified by decade and source.

35.2%, and *Clinics in Plastic Surgery* had the lowest at 0% (Table 1).

When stratified by decade, 1.1% of articles were published in the 1970s, of which none were funded; 8.8% of articles were published in the 1980s, of which 8.3% were funded; 19.3% of articles were published in the 1990s, of which 7.6% were funded; 25.7% of articles were published in the 2000s, of which 6.2% were funded; and 45.1% of articles were published in the 2010s, of which 21.0% were funded (Figure 1A). There was a positive correlation between the percentage of articles and decade, with Pearson's r equal to 0.98 ($P = 0.0017$ for the 1-tailed test), as well as a positive correlation between the proportion of articles that received funding and decade, with Pearson's r equal to 0.82 ($P = 0.043$ for the 1-tailed test). Additionally, over the decades, the percentage of articles was found to significantly increase ($P = 0.0068$ for the 1-tailed test), but the proportion of articles that received funding was not found to significantly increase ($P = 0.17$ for the 1-tailed test).

Of all articles, 2.6% received industry funding, which accounted for 19.4% of all funding (Figure 1B). *Aesthetic Surgery Journal* had the highest industry funding rate at 23.5% of its most-cited articles (Table 1). All of the most-cited articles in *Aesthetic Plastic Surgery* that received funding did so through industry means (Table 1). This type of funding was common in the 2000s and 2010s.

Of all articles, 5.4% received federal funding, which accounted for 40.7% of all funding (Figure 1B). *Cleft Palate-Craniofacial Journal* had the highest federal funding rate at 27.5% of its most-cited articles (Table 1). All of the most-cited articles in *Annals of Plastic Surgery*, *Cleft Palate-Craniofacial Journal*, *Journal of Hand Surgery – American Volume*, and *Plastic and Reconstructive Surgery* that received funding did so through federal means (Table 1). This type of funding was common from the 1980s to 2010s.

Of all articles, 4.4% received foundational funding, which accounted for 33.3% of all funding (Figure 1B). *Journal of Plastic Surgery and Hand Surgery* had the highest foundational funding rate at 18.0% of its most-cited

articles (Table 1). All of the most-cited articles in *Journal of Cranio-Maxillofacial Surgery* and *Seminars in Plastic Surgery* that received funding did so through foundational means (Table 1). This type of funding was common in the 2000s and 2010s.

Of all articles, 0.86% received institutional funding, which accounted for 6.5% of all funding (Figure 1B). *Plastic Surgery* had the highest institutional funding rate at 3.9% of its most-cited articles, which equated to 66.7% of its most-cited articles that received funding through institutional means (Table 1). This type of funding occurred only in the 2010s.

DISCUSSION

Funding, whether from an industry sponsor or federal grant, is one way in which research projects advance from beginning to end, and tends to supplement faculty and institutional prestige.¹⁻⁶ However, funding from all origins is becoming more scarce.⁹ Given the current landscape of sparse resources, we sought to ascertain the historical association between funded research and article impact in top plastic surgery journals, with the hypothesis that research (and researchers) can still have a major impact despite a lack of funding.

Our study shows that the majority of the most-cited articles in the top plastic surgery journals come from non-funded collaborators. From 1975 to 2020, only 13.3% of the most-cited articles received financial backing. When categorized by source, 2.6% received funding from industry, 5.4% from government, 4.4% from foundations, and 0.86% from institutions.

We felt that it was also salient to assess trends in citations through the years. On one hand, we hypothesized that there could be a greater number of frequently cited articles from earlier decades because these articles have been around longer, but on the other hand, we conjectured that there could be more frequently cited articles from more recent decades because of a robust trend in

scientific publishing over time, specifically as it relates to an ease of accessibility on the internet, increased number of open access journals, and increase in total number of publications.¹⁰⁻¹² The latter remained true, because there was a positive correlation between percentage of most-cited articles and decade, and not the reverse. We were also correct that the proportion of most-cited articles that received funding would be positively correlated to decade. Statistics further showed that there was a significant increase in the percentage of most-cited articles as time passed, but no significant increase in the proportion of these that received funding. This indicates that although newer articles are being cited at a higher rate, they are not being funded proportionally.

Interestingly, *Aesthetic Surgery Journal*, which publishes articles focused on the cosmetic sector of plastic surgery, had the highest proportion of industry-funded most-cited articles. Although many of the articles discussed a company's product and demonstrated positive conclusions, there were no claims of product superiority. *Clinics in Plastic Surgery*, which accepts manuscripts by an invitation-only basis, did not have a single funded most-cited article.

One limitation of this study is the year that the journals were founded. As we observed, newer articles are more likely to be funded, so newer journals skewed the overall data. Another limitation is that our dataset is based on the assumption that all funding is completely disclosed, but this is a facet of research that has been called into question before.^{13,14} Moreover, institutions frequently set aside funds specifically for research endeavors (eg, paying medical illustrators and statisticians), and private practice surgeons might self-fund their works, neither of which is a necessary disclosure.

CONCLUSIONS

Funded and non-funded research is important in plastic surgery, because both lead to impactful scientific works. Principal investigators do not receive sums of money without stringent vetting processes, and the publication process itself is another threshold to overcome.^{15,16} However, we have determined that financial support is not necessary to have an influence in the specialty.

Disclosures

Dr Janis receives royalties from Springer (New York, NY) and Thieme Publishing (New York, NY). Dr Asserson does not declare a conflict of interest.

Funding

The authors received no financial support for the research, authorship, and publication of this article.

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