Global Contributions and Trends in Research within the Top-ranked Plastic Surgery Journal

Shooka Esmaeeli, MD
Thomas Q. Xu, MD
Aaron Lee Wiegmann, MD
Taylor Jaraczewski, MD, MS
Michelle Seu, BA
Jennifer Akin, BA
Amir H. Dorafshar, MBChB

Background: We aimed to longitudinally study the relative research contributions of US and international plastic surgeons by evaluating publications within the premier plastic surgery journal over the last 2 decades. We hypothesized that even with an increased pressure to publish in this journal, the relative research contributions from American plastic surgeons will continue to be the largest overall and in all subspecialties.

Methods: Data for the surgical subspecialty, corresponding author’s country of origin, and region were extracted from all original articles in 2 randomly selected monthly issues of Plastic & Reconstructive Surgery (PRS) from the last 2 decades to evaluate longitudinal trends. Data were also extracted from all of the original articles published in PRS for the last 3 years to analyze the recent distribution of research output.

Results: During the last 2 decades, the relative proportion of total original articles written by US authors has increased. They have published proportionally more articles in the Reconstructive and Breast field while publishing relatively less in the hand/peripheral nerve field. From the first decade of analysis, US authors wrote relatively fewer articles in the hand/peripheral nerve field, whereas in the second decade, the US authors wrote relatively fewer articles in the Experimental field. In the last 3 years, US authors published relatively fewer articles in the Experimental and Cosmetic fields.

Conclusions: Each country’s scientific productivity in PRS is related to funding, interest, patients’ demand, and healthcare market pressure. In this study, we see that these factors influence trends within research publications over the last 2 decades. (Plast Reconstr Surg Glob Open 2020;8:e2712; doi: 10.1097/GOX.0000000000002712; Published online 30 April 2020.)

INTRODUCTION

Scientific research has always been crucial in academic medicine. With the ever-increasing globalization, there has been a simultaneous increase in the competition for research publication.1,2 Publication and public dissemination of novel findings in medicine not only advances the field of medicine but is also crucial for position advancement within the medical field. This is especially true in plastic and reconstructive surgery, a field which pushes the envelope in both research and innovation.3,4

To date, there have been very few studies evaluating research trends within the field of plastic and reconstructive surgery.3,5 Although the pace of scientific research has been increasing at an alarming rate, the last major study analyzing research trends within this field was performed over a decade ago.6 Also, reports on the relative contributions from both US and international authors within plastic and reconstructive surgery research have been lacking. As medicine transitions into a more performance metrics-based reimbursement system, assessment of scientific research output is becoming more critical to secure the support and funding necessary to continue research studies.4,6

Due to the key role that assessment and evaluation of scientific research hold within the field of plastic and reconstructive surgery, we aimed to longitudinally study the relative research contributions of the US and international authors by evaluating publications within a high-impact journal focused on plastic and reconstructive surgery over the last 2 decades with subsequent analysis on the subspecialties within plastic and reconstructive surgery. We also aimed to analyze the distribution of research contributions in global research by country from the most...
recent 3 years to see if the trends from the last 2 decades were an accurate representation of the direction of plastic and reconstructive surgery research. We hypothesized that even in this age of increased pressure to publish with stiffer competition, the relative research contributions from American authors will continue to be the largest overall and in all subspecialties of plastic and reconstructive surgery.

**METHODS**

**Study Design**

We performed a retrospective, cross-sectional study to longitudinally analyze the global contributions in *Plastic and Reconstructive Surgery* (PRS), the official journal of the American Society of Plastic Surgeons and the highest impact international plastic surgery journal over the last 2 decades.⁹

**Study Sample**

*Evaluation of Research Trends from the Last 2 Decades of PRS Articles*

We reviewed original articles published in two randomly selected monthly (May and June) issues of *PRS* from January 1, 1998, to December 31, 2018, to assess for longitudinal trends. All original articles were then divided and sorted by the subspecialty as designated by *PRS:

1. Breast
2. Experimental
3. Cosmetic
4. Reconstructive
5. Pediatric/craniofacial
6. Hand/peripheral nerve

These categories were chosen to both longitudinally assess for trends in the relative contributions of US and international authors within the overall field of plastic and reconstructive surgery research and within each subspecialty.

For every article reviewed, we then identified the corresponding author’s country of origin. If there was more than one corresponding author, we only used the first corresponding author’s affiliation to determine the country of origin. This was chosen to analyze for a change in the relative contribution of US versus international authorship in the past 2 decades. We also used the corresponding author to determine the relative research contributions based on continent to assess the distribution of global research within the last 2 decades. After all of the original articles and their countries of origin were recorded for each subspecialty, we summed the number of publications per country. With these data, we were able to calculate the relative contribution of US authors as a proportion of US authors to total authors within our cohort. We repeated these steps to delineate the relative contributions based on the corresponding author’s continent as well. We excluded case reports, review articles, and continuing medical education papers from this study so that it only included original articles published.

**Statistical Analysis**

Statistical analysis and graphics were produced using R (version 3.42, 2017, R Project, Vienna, Austria).¹⁰ χ² and Welch 2-sample t test were used. A simple linear regression model was utilized to analyze the trend of United States to total authorship ratio over the last 2 decades and then separately by decade. Adjusted R² and P value were reported for each model. A P value ≤ 0.05 was considered significant.

**RESULTS**

A total of 1,179 original articles in *PRS* were reviewed for the last 2 decades. A summary of these findings is included within Table 1. The Reconstructive category had the most original articles reviewed (259) (Table 1).

**Longitudinal Trends of US and International Authors from the Last 2 Decades (1998–2018)**

The relative proportion of total original articles written by US authors has increased during the last 2 decades (P = 0.03; R² = 0.17). The relative contribution of US authors in the last 2 decades has increased in the Reconstructive

| Field                  | Total No. Articles, N (%) | No. US Authors, N (%) |
|------------------------|---------------------------|-----------------------|
| Breast                 | 177 (15)                  | 108 (61)              |
| Cosmetic               | 205 (17)                  | 126 (61)              |
| Experimental           | 210 (18)                  | 124 (59)              |
| Hand/peripheral nerve  | 141 (12)                  | 73 (52)               |
| Pediatric/craniofacial | 187 (16)                  | 113 (60)              |
| Reconstructive         | 259 (22)                  | 99 (38)               |


Longitudinal Trends of US and International Authors from January 1, 1998, to December 31, 2007

Breaking the last 2 decades down and analyzing each decade separately, we reviewed a total of 575 original articles from January 1, 1998, to December 31, 2007. We found that the relative contribution of US authors in the hand/peripheral nerve field \((P = 0.00006; R^2 = 0.55)\) and Breast \((P = 0.05; R^2 = 0.13)\) fields, whereas the relative contribution of US authors in the last 2 decades has decreased in the hand/peripheral nerve field \((P = 0.01; R^2 = 0.22)\). The relative contribution of US authors in the Experimental, Cosmetic, and Pediatric/craniofacial field remained static over the last 2 decades (Fig. 1).

Overall Trends from the Last 2 Decades

When looking at the overall trend of research publications in plastic and reconstructive surgery, the relative contribution from US authors has increased. Among all subspecialty fields analyzed, only the fields of reconstruction and breast demonstrated an increase in the relative contribution of US authors. Looking at the reconstructive field, we reason that this relative increase in US author contribution is an indirect result from a decrease in the contribution of international authors. Previous studies in the literature have shown that interest in the field of cosmetics has gradually increased.\(^{3,5}\) This is in part due to an increased interest in facial cosmetic surgery with the rise of constant visual scrutinization from the media and an increased interest in liposuction procedures as the global obesity epidemic continues.\(^{16,17}\) Shifting toward the breast field, we reason that increased funding from US governmental organizations and increased awareness in breast reconstruction from major nongovernmental organization, such as the Susan G. Komen Foundation, is one of the main reasons behind the relative increase in contributions from US authors.\(^{18–20}\) Furthermore, the high prevalence of breast cancer in North America has led to a high demand for breast reconstruction.\(^{21,22}\) Finally, we saw that although the relative contribution from US authors has increased overall, the relative contribution within the hand/peripheral nerve field has decreased during the 2 decades. Our results are concurrent with other previous results that demonstrate a decrease in the relative contribution of US authors.\(^{12}\) Ahn et al.\(^{12}\) reasoned that this decrease may have been a reflection of an increase in submissions from developing countries; as submissions to journals from these countries increased, editors might accept fewer articles from established countries.

Overall Trends from the First Decade of Analysis (January 1998–December 2007)

We reviewed 968 original articles from the last 36 consecutive issues of *PRS*. A summary of original article distribution by country and continent is highlighted in Table 2. The top five countries in original article contributions were as follows: United States, China, South Korea, Canada, and Japan, respectively (Fig. 4). The relative contribution of US authors in the Experimental (38% United States; \(P = 0.000007\)) and Cosmetic fields (45% United States; \(P = 0.01\)) was significantly lower when compared with the rest of the fields. By continent, North America had the highest proportion of original article contributions in all fields except the Experimental field, where there was no statistically significant difference between North America and Asia with regard to proportion of original article contribution (Table 2).

DISCUSSION

Scientific research has become increasingly important in academic medicine as governmental organizations are placing more of the onus on the medical field to fix societal issues.\(^{3,11,12}\) With this mandate comes the need to further the medical field through novel research. Therefore, evaluation and assessment of research output have become more important and scrutinized in the recent years.\(^{13,14}\) However, evaluation of the trends in research output has been lacking in the recent years in the field of plastic surgery. We hypothesized that even with increased pressure to publish from the global community, the relative research contributions from American authors would continue to be the largest overall and in all subspecialties of plastic and reconstructive surgery.

Distribution of Articles from the Last 3 Years (January 1, 2016, to December 31, 2018)

We reviewed 604 original articles from January 1, 2008, to December 31, 2018. The relative contribution of US authors in the Experimental field \((P = 0.01; R^2 = 0.43)\) showed a decreasing trend during this time frame. No other significant changes in the relative contributions of US authors were seen in the Breast, Experimental, Cosmetic, Pediatric/craniofacial, Reconstructive, and Hand/peripheral nerve fields (Fig. 5).

Overall Trends from the Second Decade of Analysis (January 2008–December 2018)

When looking at the second decade, we found that the relative contributions of US authors decreased in the hand/peripheral nerve field. This decreasing trend within the first decade seems to be the reason behind the observed decreasing trend of US authors in this field within the last 2 decades. As such, our results agree with previous results that demonstrate that this field has had a decreasing proportion of contributions from US authors from 1988 to 2007.\(^{23}\)
generally from academic surgeons. However, there has been decreased funding for academic surgeons with a concurrent increase in the clinical volume in the United States. This has led to less dedicated time for academic plastic surgeons to focus on being a true surgeon scientist and thus has led to a decrease in the relative contribution from US plastic surgeons. At the same time, other countries have provided increased funding within this field.
For example, China has recently increased funding toward basic, applied, and experimental research. This, coupled with differences in bureaucratic regulations, places an incentive on starting and furthering research within the experimental field.

Distributed Contributions within the Last 3 Years (January 2016–December 2018)

We set out to analyze the last 3 years to understand the direction of plastic and reconstructive surgery research. Within the last 3 years, US authors continued to have the highest proportion of original article publications. As a result of US authors having the highest proportion of original articles published, North America had the highest number of original articles published. These findings agree with the last published study looking at global research publication trends within plastic and reconstructive surgery.

We also found that Asian authors had a statistically similar number of original articles published as North American authors within the experimental field. As alluded to earlier, there has been an increase in the funding for basic science research from many Asian countries, which in turn encourages research within this field. These results from the last 3 years suggest that this incentive has translated to an increase in publications within this field.

Limitations and Strengths

Our study does have some methodologic limitations that need to be considered. One major limitation is that like most bibliometric analyses, our study is biased toward English-based journals. Authors of some non-English-speaking nations traditionally prefer to publish in journals based on their own native language. Another limitation of this study was the randomization criteria. We selected 2
random months of articles every year for the last 2 decades to be included for our analysis. Although this is a common method for estimating long-term trends, we were unable to evaluate intra-yearly fluctuations in publications. There are relatively few articles per subspecialty in each journal volume published; thus, this may skew these data showing an overabundance of articles from one subspecialty in the particular month that we sampled. In some articles, the authors came from numerous countries. Although we used the first corresponding author’s country of origin, this does not necessarily imply that all or most of the funding, effort, and interest came from that country. Thus, this would not be an accurate representation of the trends within plastic and reconstructive surgery research. Finally, articles published between 2005 and 2018 were clearly categorized by topic into the subspecialty fields used within this analysis: breast, cosmetic, reconstruction, pediatric/craniofacial, experimental, and hand/peripheral nerve. However, before 2005, these sections were not formally titled and labeled in PRS. Therefore, we categorized those articles into the six formally designated subspecialty fields by comparing analogous studies in the journal. This could have introduced a bias within our analysis given the fact that we had to use our discretion when sorting these articles.

Table 2. Summary of Contributions during the Last 36 Issues of PRS (N = 968)

| Field                | Total (No. Articles) | US Authorship, N (%) | Countries with Most Contribution after United States (No. Articles) | Continents with Most Contribution (No. Articles) |
|----------------------|----------------------|----------------------|---------------------------------------------------------------------|-----------------------------------------------|
| Breast               | 174                  | 120 (69)             | Italy (8) Canada (8)                                                | North America (129) Europe (25)               |
| Experimental         | 178                  | 67 (38)*             | China (37) Japan (18)                                               | Asia (74) North America (72)                  |
| Pediatric/craniofacial| 160                  | 92 (58)              | Taiwan (9) Canada (9)                                               | North America (102) Asia (28) Europe (28)     |
| Hand/peripheral nerve| 96                   | 56 (59)              | Netherland (7) Canada (7)                                           | North America (64) Asia (17)                  |
| Reconstructive       | 175                  | 99 (57)              | South Korea (10) Taiwan (9)                                         | North America (107) Asia (36)                 |
| Cosmetic             | 185                  | 83 (45)*             | South Korea (16) Netherland (13)                                   | North America (94) Europe (42)                |

*Significantly lower comparing to other fields.

Fig. 3. Relative proportion of US-authored original articles for each category (2008–2018). *Statistically significant trend.
Our study also has strengths to minimize bias within our analysis. One of these strengths is the use of the *PRS* journal. This international journal has the highest impact factor of any plastic surgery journal worldwide. It also has precise subspecialty categorization, allowing us to use predetermined categories for this analysis. Furthermore, there were no statistically significant trends in the total number of publications per year for each subspecialty in this journal during the last 2 decades. All of these factors helped to minimize further biases in our analysis.

**CONCLUSIONS**

We conclude that the relative proportion of total US-authored original articles has shown an increasing trend during the last 2 decades. The relative contribution of US authors has increased in the reconstructive and breast field within the last 2 decades, although the relative contribution of US authors has decreased in the hand/peripheral nerve field. Each country’s scientific productivity in the competitive field of plastic and reconstructive surgery is related to various factors, including funding, interest, patients’ demand, and healthcare market pressure and competition. In this study, we see these factors influence the trends within research publications over the last 2 decades.

![Fig. 4. Geographic distribution of countries that contributed in the last 36 issues of *PRS* (2016–2018).](image-url)

**REFERENCES**

1. Adams J, Griliches Z. Measuring science: an exploration. *Proc Natl Acad Sci U S A*. 1996;93:12664–12670.
2. Jones BF. The burden of knowledge and the “death of the Renaissance man”: is innovation getting harder? *Rev Econ Stud*. 2009;76:283–317.
3. Loonen MP, Hage JJ, Kon M. Publications of plastic surgery research 1972 through 2004: a longitudinal trend analysis of three international journals. *J Plast Reconstr Aesthet Surg*. 2007;60:934–945.
4. Lee WJ. Research, plastic surgery, and archives of plastic surgery. *Arch Plast Surg*. 2017;44:359–360.
5. Kang N, Sanders R. Plastic surgery research in the UK. *Br J Plast Surg*. 2002;55:463–468.
6. Bakker IS, Wevers KP, Hoeckstra HJ. Geographical distribution of publications in the scientific field of surgical oncology. *J Surg Oncol*. 2013;108:505–507.
7. Ismail Y, McLean NR, Kelly CG. Head and neck oncology: the UK experience. Who is publishing what? *Br J Plast Surg*. 2002;55:570–573.
8. Charkhchi P, Mirbolouk M, Jalilian R, et al. Who’s contributing most to American neuroscience journals: American or foreign authors? *AJNR Am J Neuroradiol*. 2018;39:1001–1007.

9. Dellon AL, Scally AL, Kahlemeier KV. Impact of the Journal Plastic and Reconstructive Surgery. *Plast Reconstr Surg*. 1992;90:717–722.

10. R Core Team. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing; 2019. https://www.R-project.org/. Accessed December 6, 2019.

11. Stephan PE. Chapter 5 - The Economics of Science. In: Hall BH, Rosenberg N, eds. *Handbook of the Economics of Innovation*. North-Holland: Elsevier; 2010:217–273.

12. Ahn CS, Li RJ, Ahn BS, et al. Hand and wrist research productivity in journals with high impact factors: a 20 year analysis. *J Hand Surg Eur Vol*. 2012;37:275–283.

13. Tamber PS. The trouble with medical journals by Richard Smith: an alternative view. *Bmj*. 2007;334:125.

14. Ko CY, Whang EE, Longmire WP Jr, et al. Improving the surgeon’s participation in research: is it a problem of training or priority? *J Surg Res*. 2000;91:5–8.

15. Lineaweaver WC. Standards for cosmetic surgery articles. *Plast Reconstr Surg*. 2001;108:251–253.

16. Zuckerman D. Teenagers and cosmetic surgery. *AMA J Ethics*. 2005;7:253–256.

17. Heidekrueger PI, Juran S, Patel A, et al. Plastic surgery statistics in the US: evidence and implications. *Aesthetic Plast Surg*. 2016;40:293–300.

18. Mela GS, Gimmino MA, Ugolini D. Impact assessment of oncology research in the European Union. *Eur J Cancer*. 1999;35:1182–1186.

19. Ghoncheh M, Pournamdar Z, Salehiniya H. Incidence and mortality and epidemiology of breast cancer in the world. *Asian Pac J Cancer Prev*. 2016;17(S3):43–46.

20. Moghimi M, Fathi M, Marashi A, et al. A scientometric analysis of 20 years of research on breast reconstruction surgery: a guide for research design and journal selection. *Arch Plast Surg*. 2013;40:109–115.

21. Smith RA, DeSantis CE. Breast cancer epidemiology. *Breast Imaging*. 2018;1:5–13.

22. Bray F, Ferlay J, Soerjomataram I, et al. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2018;68:394–424.

23. Silvestre J, Abbatematteo JM, Serletti JM, et al. National Institutes of Health funding in plastic surgery: a crisis? *Plast Reconstr Surg*. 2016;138:732–739.

24. Narahari AK, Mehaffey JH, Hawkins RB, et al. Surgeon scientists are disproportionately affected by declining NIH funding rates. *J Am Coll Surg*. 2018;226:474–481.

25. Hu Y, Edwards BL, Brooks KD, et al. Recent trends in National Institutes of Health funding for surgery: 2003 to 2013. *Am J Surg*. 2015;209:1083–1089.

26. Chakma J, Sun GH, Steinberg JD, et al. Asia’s ascent—global trends in biomedical R&D expenditures. *N Engl J Med*. 2014;370:3–6.

27. Zhang Y, Zhang JL, Jiang H. Growing trend of China’s contribution to the field of plastic and reconstructive surgery: a 10-year study of the literature. *Ann Plast Surg*. 2012;68:328–331.

28. Is China a Global Leader in Research and Development? China Power, 2018. Available at: https://chinapower.csis.org/china-research-and-development-rnd/. Accessed April 16, 2019.

29. Yu X, Li W. Informed consent and ethical review in Chinese human experimentation: reflections on the “golden rice event.” *Biotechnol Law Rep*. 2014;33:155–160.