

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

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**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](https://doi.org/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.<sup>1,2</sup> 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.<sup>3,4</sup>

To date, there have been very few studies evaluating research trends within the field of plastic and

reconstructive surgery.<sup>3,5</sup> 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.<sup>3</sup> 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.<sup>6-8</sup>

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

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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.<sup>9</sup>

### 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. We also took note of the proportion of US authors within the total number of publications for use in subsequent analysis. 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.

*Evaluation of the Most Recent Distribution of Research from the Last 3 Years of PRS Articles*

We reviewed original articles from all issues of *PRS* over the last 3 years, January 1, 2016, to December 31, 2018. We then divided and sorted each original article by the subspecialty as designated by *PRS*:

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

For every article reviewed, we then identified the corresponding author's country of origin. 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).<sup>10</sup>  $\chi^2$  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  $R^2$  and *P* value were reported for each model. A *P* value  $\leq 0.05$  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 ( $P = 0.03$ ;  $R^2 = 0.17$ ). The relative contribution of US authors in the last 2 decades has increased in the Reconstructive

**Table 1. Summary of Contributions during the Last 21 Years in PRS (N = 1,179)**

Field	Total No. Articles, N (%)	No. US Articles, 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)

( $P = 0.00006$ ;  $R^2 = 0.55$ ) 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).

#### 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 ( $P = 0.002$ ;  $R^2 = 0.66$ ) showed a decreasing trend during this time period. No other significant changes in the relative contribution of US authors were seen in the Breast, Experimental, Cosmetic, Pediatric/craniofacial, and Reconstructive fields (Fig. 2).

#### Longitudinal Trends of US and International Authors from January 1, 2008, to December 31, 2018

We reviewed a total of 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 Cosmetic, Pediatric/craniofacial, Reconstructive, and Hand/peripheral nerve fields (Fig. 3).

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

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.<sup>3,11,12</sup> 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.<sup>13,14</sup> 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.

#### Overall Trends from the Last 2 Decades

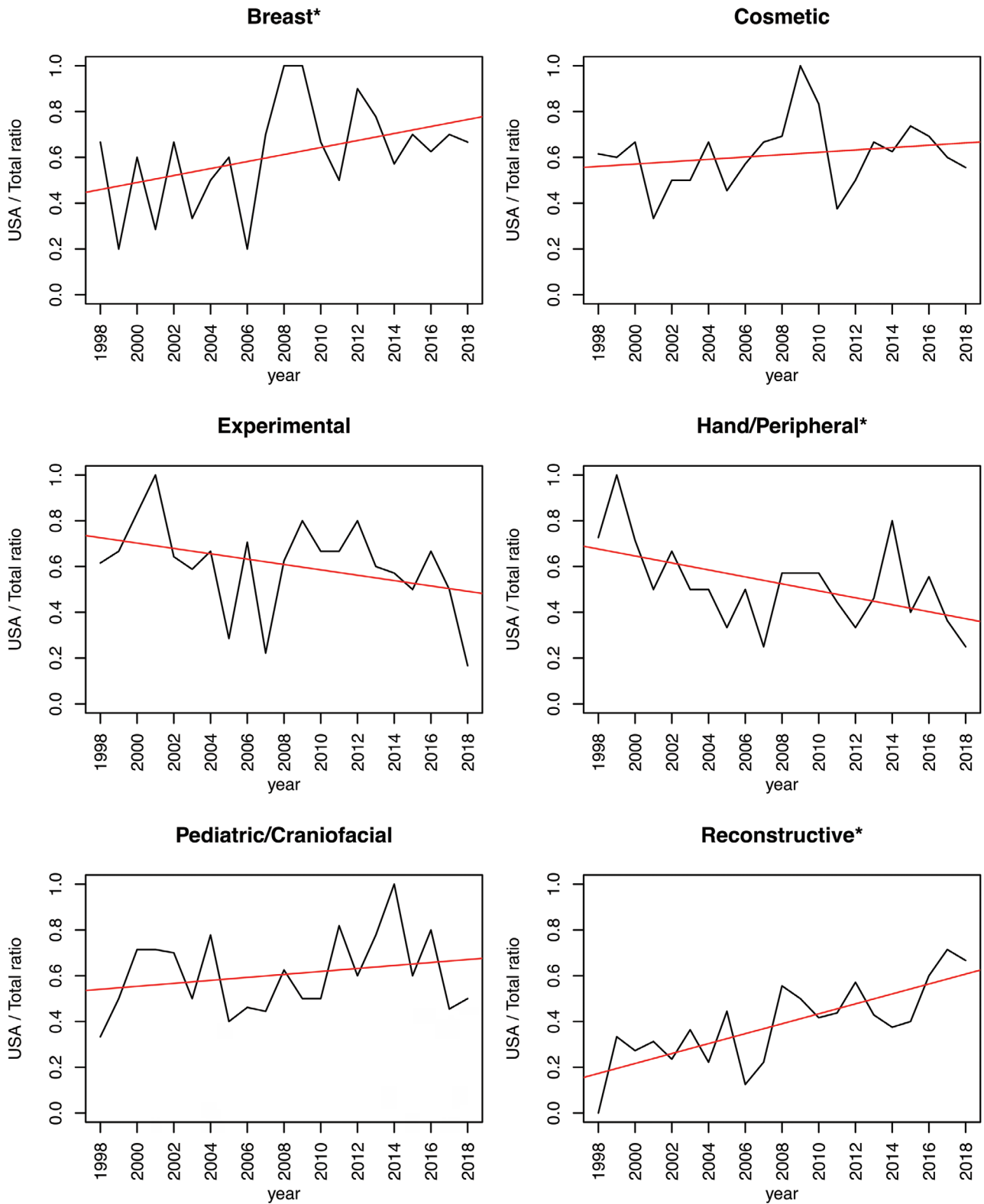
When looking at the overall trend of research publications in plastic and reconstructive surgery, the relative contribution from US authors has increased. Among all subspecialty fields analyzed, only the fields of reconstruction and breast demonstrated an increase in the relative contribution of US authors. 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.<sup>3,15</sup> 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.<sup>16,17</sup> 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.<sup>18–20</sup> Furthermore, the high prevalence of breast cancer in North America has led to a high demand for breast reconstruction.<sup>21,22</sup> 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.<sup>12</sup> Ahn et al<sup>12</sup> 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 further divided the last 2 decades to analyze them individually. 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.<sup>12</sup>

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

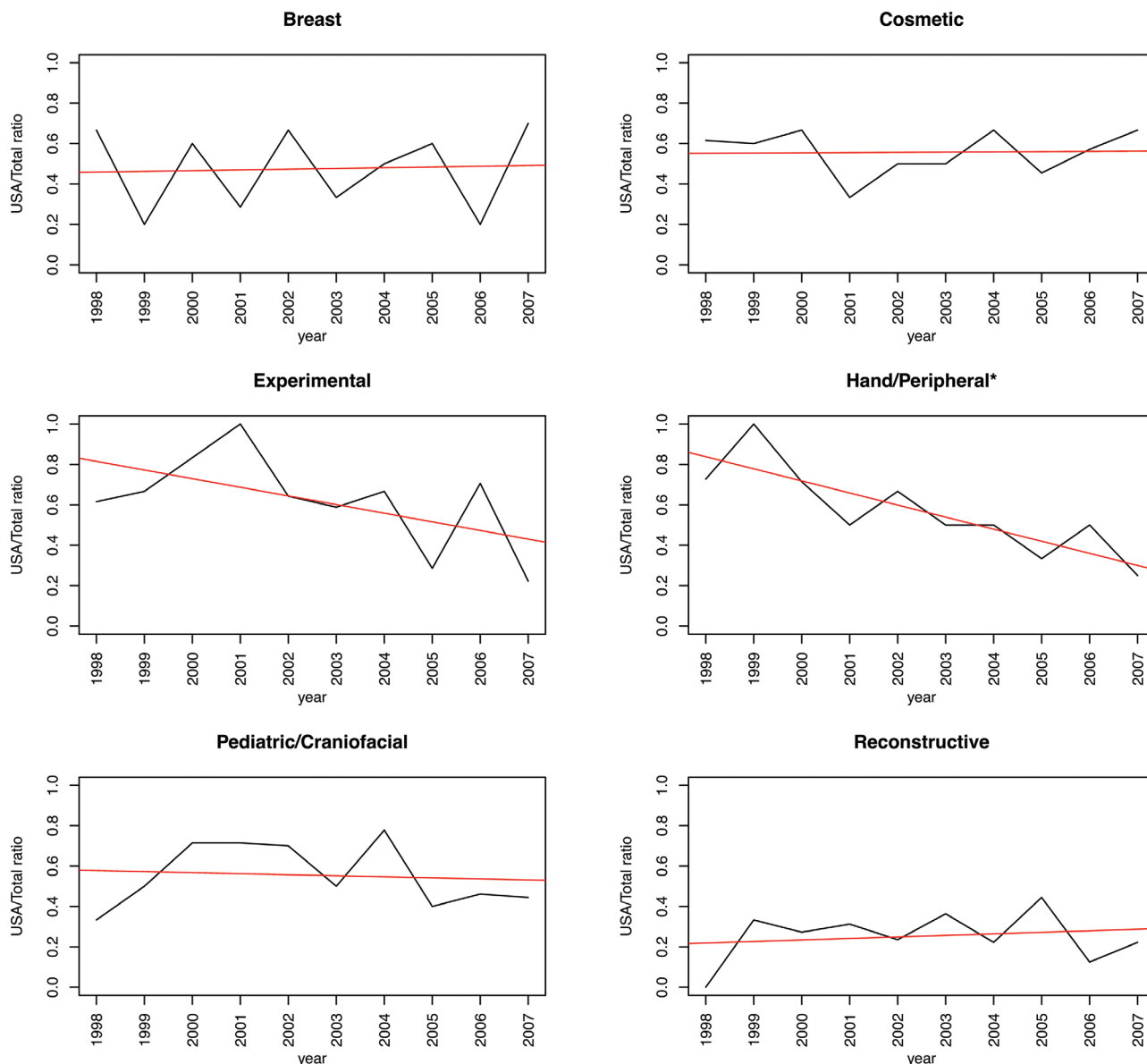
When looking at the second decade, we found that the relative contributions of US authors decreased within the experimental field. We reason that decreased funding for academic plastic surgeons is one of the main reasons behind this result. Publications within this field are



**Fig. 1.** Relative proportion of US-authored original articles for each category (1998–2018). \*Statistically significant trend.

generally from academic surgeons.<sup>14</sup> However, there has been decreased funding for academic surgeons with a concurrent increase in the clinical volume in the United States.<sup>23–25</sup> 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.<sup>26,27</sup>



**Fig. 2.** Relative proportion of US-authored original articles for each category (1998–2007). \*Statistically significant trend.

For example, China has recently increased funding toward basic, applied, and experimental research.<sup>26–28</sup> This, coupled with differences in bureaucratic regulations, places an incentive on starting and furthering research within the experimental field.<sup>29</sup>

**Distribution of Contributions within the Last 3 Years (January 2016–December 2018)**

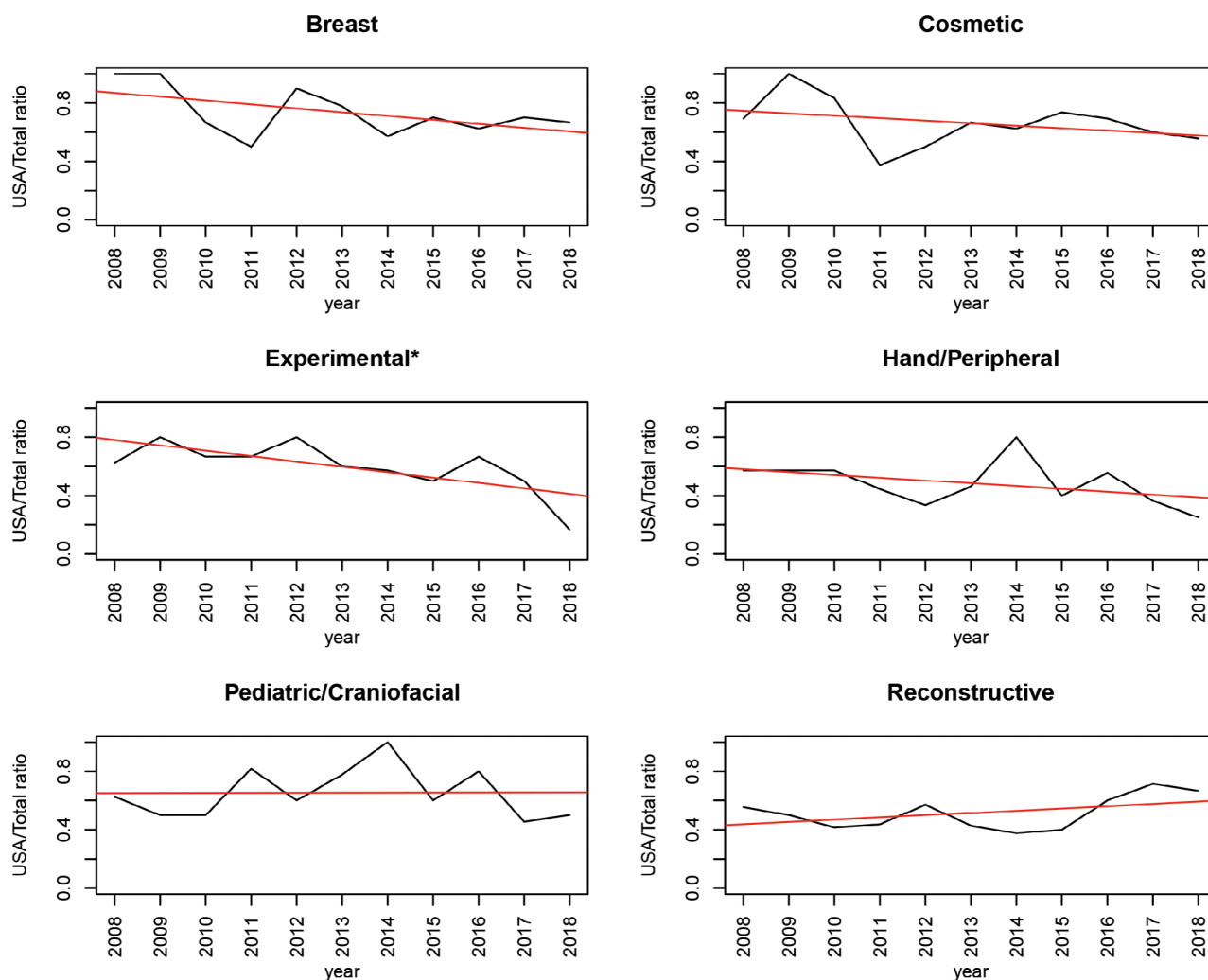
We set out to analyze the last 3 years to understand the direction of plastic and reconstructive surgery research. Within the last 3 years, US authors continued to have the highest proportion of original article publications. As a result of US authors having the highest proportion of original articles 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.<sup>3</sup>

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,<sup>28</sup> which in turn encourages research within this field.<sup>6,11</sup> 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.<sup>18</sup> Another limitation of this study was the randomization criteria. We selected 2





**Fig. 3.** Relative proportion of US-authored original articles for each category (2008–2018). \*Statistically significant trend.

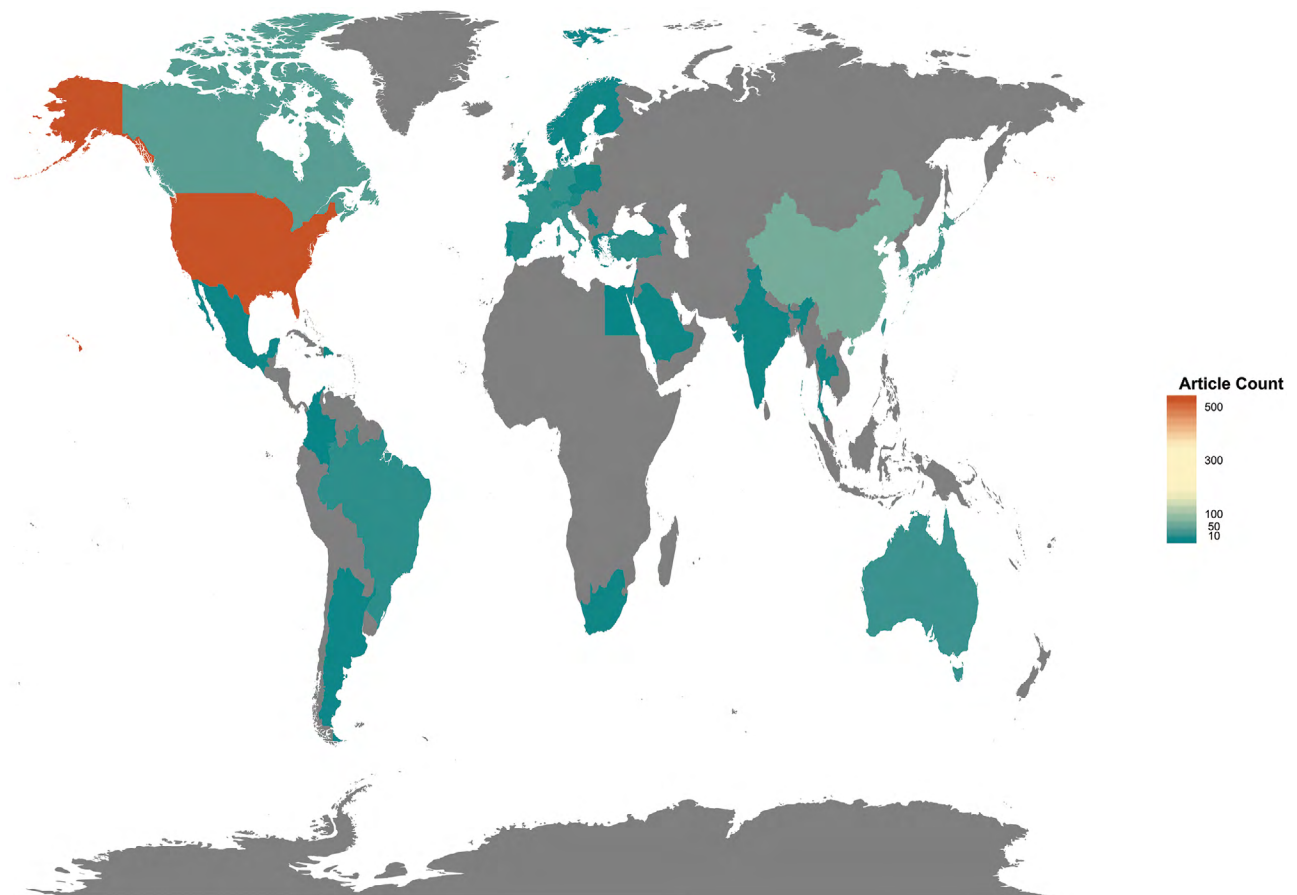
random months of articles every year for the last 2 decades to be included for our analysis. Although this is a common method for estimating long-term trends, we were unable to evaluate intra-yearly fluctuations in publications. There are relatively few articles per subspecialty in each journal volume 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)	Netherlands (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) Netherlands (13)	North America (94) Europe (42)

\*Significantly lower comparing to other fields.



**Fig. 4.** Geographic distribution of countries that contributed in the last 36 issues of *PRS* (2016–2018).

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.<sup>9</sup> 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.

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