



Leadership Roles, Academic Appointments, and Scholarly Activity—Does a Fellowship after Plastic Surgery Training Make a Difference?

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Abstract

Background Fellowship training is becoming more popular in plastic surgery, with over half of residents pursuing advanced training. Here, we investigate how clinical and research fellowship training impacts career trajectory and scholastic achievement in academic plastic surgery.

Methods Plastic surgery faculty members, from programs recognized by the American Council of Academic Plastic Surgeons, were identified using institutional Web sites. Data extracted included faculty demographics, training history, academic positions, and research productivity. Continuous and categorical variables were compared using *t*-tests and chi-square, respectively.

Results In total, 949 faculty members were included, with 657 (69%) having completed fellowship training. Integrated program residents were more likely to complete a fellowship when compared with independent residents ($p < 0.0001$). Fellowship trained faculty were more likely to have graduated from a higher ranked residency program, in terms of both overall and research reputation ($p = 0.005$ and $p = 0.016$, respectively). When controlling for years in practice, there was no difference found in number of publications, Hirsch index (h-index), or National Institutes of Health funding between faculty between the two cohorts ($p > 0.05$). In a subanalysis comparing hand, craniofacial, microsurgery, and research fellowships, those who completed a research fellowship had higher h-indices and were more likely to reach

Keywords

- ▶ academic
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full professor status ($p < 0.001$ and $p = 0.001$, respectively). Fellowship training had no effect on being promoted to Chief/Chair of departments ($p = 0.16$).

Conclusion Fellowship training is common among academic plastic surgeons. In this study, both clinical and research fellowships were associated with various aspects of academic success. However, fellowship training alone did not affect attainment of leadership positions.

Subspecialization within the field of surgery has become increasingly common, with nearly 60% of residents pursuing fellowship training after graduation. Specifically, in the field of Plastic and Reconstructive Surgery (PRS), data from the Accreditation Council for Graduate Medical Education showed that in 2016 approximately 62 and 50% of integrated and independent graduates, respectively, entered a fellowship training program.¹ PRS residents pursue additional training in microsurgery, hand surgery, and craniofacial surgery, among others, to acquire specific technical skills, establish mentorship, and learn variations in techniques from different institutions.² Additionally, subspecialty training and research fellowships allow for dedicated research opportunities, thereby theoretically priming these individuals to be the next generation of academic surgeon leaders.

Careers in academic medicine as well as academic promotion and leadership positions, have been associated with physicians who are fellowship trained^{3,4} and have greater research contributions.⁴⁻⁶ In 2005, Dr. J.E. Hirsch proposed the use of the Hirsch index (h-index) as a tool to assess scholarly productivity, taking into account both the quantity and quality of publications.⁷ Since its introduction 15 years ago, the h-index has been linked to both academic advancement and National Institutes of Health (NIH) funding.^{4,5,8,9} While there have been several studies that have deconstructed the characteristics of specific leaders within the field of PRS and subsequently associated fellowship status and research productivity with academic promotion,³ there have been no studies to our knowledge that have surveyed the nationwide academic PRS faculty to assess these relationships in greater detail.

Our objectives were to examine scholarly productivity and career leadership of nearly 1,000 fellowship and non-fellowship trained plastic surgeons to assess whether or not these important attributes are associated with fellowship training status. Furthermore, we aimed to characterize whether or not there are differences in research productivity and leadership roles among clinicians in various PRS subspecialties. Identifying processes that correlate with pursuit of higher academic achievement may help improve academic mentorship and career planning for trainees.

Methods

Identification of Academic Plastic Surgeons

In October 2020, lists of integrated and independent PRS residency programs were obtained from the American Council of Academic Plastic Surgeons Web site.¹⁰ Institution's PRS

residency Web sites ($n = 99$) were searched for faculty lists. Only tenure-track or nontenure-track faculty ($n = 949$) were included in the analysis, with the exception of instructors, adjunct faculty, and voluntary/gratis faculty. Nonplastic surgery-trained faculty were excluded. Residency programs were not included in ranking analysis if the residency program was an international program ($n = 54$), or if the program was not ranked at the time of our search ($n = 46$).

Data Collection

Data regarding each academic plastic surgeon identified in our search were collected primarily from faculty biographies on program Web sites. If there were missing data points, Doximity (San Francisco, CA), LinkedIn (Sunnyvale, CA), private-practice Web sites, and other public records or news report Web sites were surveyed.^{11,12} These data included demographics, training history (including medical school, PRS residency program, subspecialty training, and last year of training), academic positions (fellowship director, program director), endowed professorship, and chief/chair status. Residency program rankings were determined using Doximity's Residency Navigator and were categorized by ranking and tier (top 20, 20-40, 40-60, > 60) in terms of reputation and research.¹³ Population data regarding city of current practice was documented using the United States Census Bureau.¹⁴

Research output (publications, citations, and h-index) and NIH funding data were also collected using Scopus Author Identifier (Reed Elsevier, London, UK) author search and NIH Reporter.^{15,16} Editorial board membership was determined using editorial board member lists published by *Plastic and Reconstructive Surgery*, *Plastic and Reconstructive Surgery-Global Open*, *Annals of Plastic Surgery*, *Journal of Craniofacial Surgery*, *the Cleft Palate-Craniofacial Journal*, *Journal of Plastic, Reconstructive & Aesthetic Surgery*, *Microsurgery*, *Journal of Reconstructive Microsurgery*, *Aesthetic Surgery Journal*, *Journal of Hand Surgery*, and *Hand*.¹⁷⁻²⁵

Statistical Analysis

Descriptive statistics were implemented for all study variables. Medians and interquartile ranges were reported for continuous variables of interest. Statistical comparisons were made between the fellowship cohort and nonfellowship cohort using chi-square tests for dichotomous variables and Mann-Whitney *U* tests for continuous variables. Years in practice were calculated as years after last year of training. To adjust for years in practice, regression modeling was used to compare positions of leadership and research output. Finally,

outcomes were compared between the most popular fellowships using analysis of normal variance. The two-tailed threshold for statistical significance was set at a p -value of 0.05. All statistical analyses were completed using Stata 16 (Stata Statistical Software, Release 16; StataCorp LP, College Station, TX).

Results

A total of 949 PRS faculty members were included in the analysis, 657 (69.2%) of whom completed a fellowship following plastic surgery residency, and 292 (30.8%) who did not. Demographic and educational characteristics of fellowship trained and nonfellowship trained surgeons were similar in regards to sex, medical degree (MD, IMG, DO), and the acquisition of an advanced degree (all $p > 0.05$). Those with fellowship training were more likely to have attended a higher Doximity ranked residency programs, in regards to overall ($p = 0.005$) and research ($p = 0.016$) reputations. Faculty who did not pursue fellowship training after residency were more likely to have trained at an independent program, whereas those who did go on to fellowship were more likely to have graduated from an integrated program ($p < 0.001$). The numbers of faculty members who participated in a dedicated research year at some point during training was similar between groups, as was the percentage of those who currently practice in an urban location ($p > 0.05$). Nonfellowship trained faculty members were on average in practice for

18 years (± 13), compared with only 13 years (± 10) for those who were fellowship trained ($p < 0.001$) (► **Table 1**).

A variety of outcomes after training were assessed controlling for years in practice and integrated versus independent residency programs using multivariate regression analysis (► **Table 2**). After adjusting for these confounding factors, those with fellowship training were more likely to have roles as assistant and associate professors ($p = 0.014$ and $p = 0.004$, respectively). The number of full professors between the two groups was statistically similar ($p = 0.933$). Residency program overall reputation rank was still significantly higher for those who pursued fellowship training ($p = 0.024$); however, after adjustment research reputation only trended toward significance ($p = 0.083$). No differences existed in leadership (chair/chief) roles between the groups ($p = 0.873$). In addition, several variables to assess scholarly impact were assessed such as position on a journal editorial board, number of publications, h-index, number of citations, NIH funding, and NIH grants. All were found to be comparable regardless of clinical fellowship training status (all $p > 0.05$).

Distribution of the current academic plastic surgery faculty in regards to clinical fellowship training after residency is seen in ► **Fig. 1**. Two hundred and ninety-two faculty members were not fellowship trained (31%). Hand and upper extremity (24%), microsurgery (20%), and craniofacial/pediatrics (20%) were the most common fellowships. Note that 5.5% ($n = 52$) of faculty completed multiple clinical

Table 1 Demographics and education

Variable	Nonfellowship trained ($n = 292$)	Fellowship trained ($n = 657$)	p -Value
Sex			0.884
Male	231 (79.11)	517 (78.69)	
Female	61 (20.89)	140 (21.31)	
Medical degree			
MD	287 (98.29)	646 (98.33)	0.966
IMG	35 (11.99)	97 (14.76)	0.254
DO	4 (1.37)	5 (0.76)	0.469
Top 10 U.S. News medical school	42 (14.38)	105 (15.98)	0.530
U.S. medical school	257 (88.01)	559 (85.08)	0.230
Advanced degree	50 (17.12)	120 (18.27)	0.672
Residency program attended reputation rank	40 \pm 29	35 \pm 26	0.005 ^a
Residency program attended research rank	44 \pm 28	39 \pm 27	0.016 ^a
Residency type			< 0.001 ^a
Integrated	62 (21.91)	396 (63.56)	
Independent	221 (78.09)	227 (36.44)	
Research fellowship/year	45 (15.46)	85 (12.94)	0.297
Years in practice	18 \pm 13	13 \pm 10	< 0.001 ^a
Urban practice	276 (94.52)	613 (93.30)	0.477

Abbreviations: DO, Doctor of Osteopathic Medicine; IMG, International Medical Graduate; MD, Doctor of Medicine.

Note: Values are presented as the number (%) or mean \pm standard deviation (SD).

^aStatistically significant, $p < 0.05$.

Table 2 Multivariate regression analysis (controlled for residency type and years in practice)

Variable	Nonfellowship trained (n = 292)	Fellowship trained (n = 657)	p-Value
Assistant professor	102 (40.64)	273 (46.19)	0.138 (0.014 adjusted)
Associate professor	55 (21.91)	170 (28.77)	0.040 ^a (0.004 adjusted)
Professor	94 (37.45)	148 (25.04)	< 0.001 ^a (0.933 adjusted)
Residency program attended reputation rank	40 ± 29	35 ± 26	0.005 ^a (0.024 adjusted)
Residency program attended research rank	44 ± 28	39 ± 27	0.016 ^a (0.083 adjusted)
Chair/chief status	37 (12.67)	61 (9.29)	0.114 (0.873 adjusted)
Endowed	21 (7.19)	42 (6.39)	0.648 (0.685 adjusted)
Journal editorial board	47 (16.10)	135 (20.55)	0.108 (0.077 adjusted)
No. of publications	45.1 ± 67.0	48.3 ± 78.0	0.550 (0.403 adjusted)
h-index	12.6 ± 13	12.1 ± 11	0.516 (0.937 adjusted)
No. of citations	1,250 ± 2,935	1,090 ± 2,711	0.419 (0.403 adjusted)
NIH funded	29 (9.93)	55 (8.37)	0.435 (0.305 adjusted)
No. of NIH grants	0.8 ± 4.6	0.8 ± 5.1	0.938 (0.935 adjusted)
Total NIH funding (\$)	179,660 ± 1,115,034	296,331 ± 2,154,970	0.380 (0.241 adjusted)

Abbreviations: h-index, Hirsch index; NIH, National Institutes of Health.

Note: Values are presented as the number (%) or mean ± standard deviation (SD).

^aStatistically significant, $p < 0.05$.

fellowships, and 12.5% ($n = 119$) completed a research fellowship.

Those individuals who did a dedicated year of research at some point within their training had the highest mean h-index (16.7), followed by those who specialized in hand/upper extremity (13.2). Similar trends were observed for the mean number of publications, with faculty members who did a research fellowship having an average of 74.6 publications followed by hand/upper extremity faculty (61.2 publications) and individuals who did multiple fellowships (43.6 publications) (► **Figs. 2 and 3**). Across all of the specialties, and including those individuals who were not fellowship trained, the h-index was significantly higher for professors than for assistant professors and associate professors ($p < 0.001$) (► **Fig. 4**).

Specialty-specific analysis was conducted to further quantify the impact of specific fellowship training on research productivity, academic ranks, and leadership roles within the academic plastic surgery faculty (► **Table 3**). Specific scholarly measures were most impacted by the presence of a dedicated research year, with faculty who completed research fellowships more likely to have higher number of publications, higher h-index, and have received NIH funding ($p < 0.001$, $p < 0.003$, $p = 0.03$, respectively). Similarly, there were more faculty members who were full professors that had a research fellowship, than any clinical fellowship ($n = 47$, 40%) ($p = 0.001$). The acquisition of leadership roles within departments did not seem to be affected by specific fellowship, as there were no differences in the distribution of chairperson/chief of departments across specialties ($p = 0.161$).

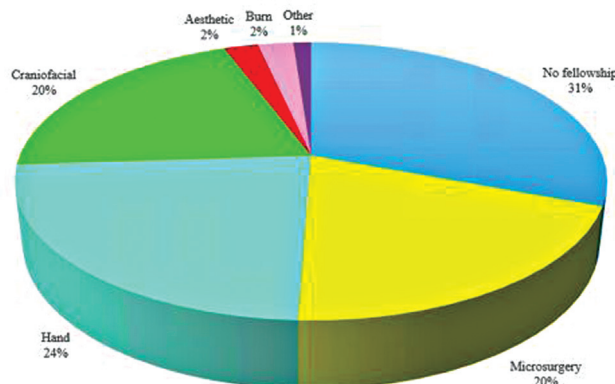


Fig. 1 Clinical fellowship distribution among academic plastic and reconstructive surgeons.

Discussion

This study analyzed 949 plastic surgeons across 99 training programs, highlighting the current distribution of subspecialty training among the current academic PRS faculty, and whether or not clinical or research fellowships had an impact on academic achievement and career promotion. We found that individuals with clinical fellowship training were more likely to be associate and assistant professors and completion of a research fellowship was more predictive of greater scholarly activity and full professor status.

The factors influencing career trajectory in academic medicine are complex and multifaceted. Previous studies conducted within various surgical subspecialties have attempted to uncover what clinical and research fellowships

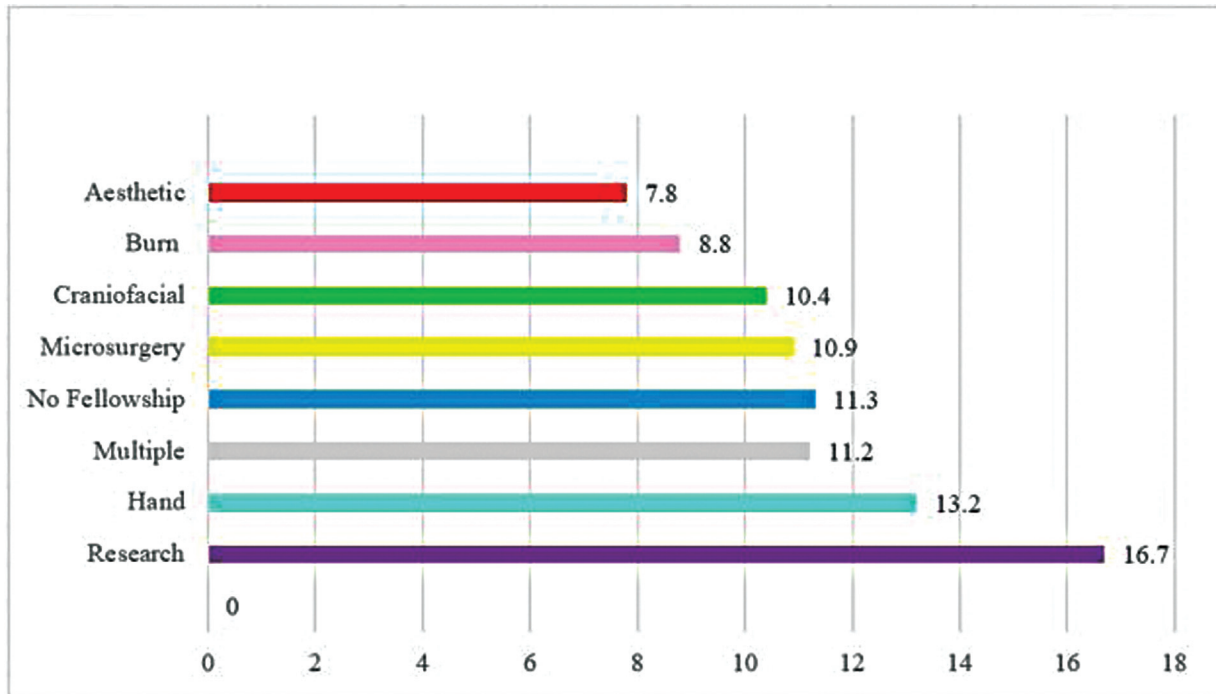


Fig. 2 Mean Hirsh index (h-index) by fellowship type.

mean for metrics like scholarly productivity and the acquisition of leadership roles. In these surveys, clinical and research fellowship trained individuals were more likely to have higher research productivity, as measured by their h-index.^{5,9,26} Within the field of plastic surgery, the impact of fellowship training is unclear. Several studies have linked the extra training to leadership positions³ and future careers in academia,⁴ while others have found the opposite.²⁷ However,

these studies are limited by inclusion of only academic leaders or integrated trained faculty, or reliance on voluntary survey study responses to draw conclusions. Given the aforementioned limitations, this inclusive faculty database analysis adds important information to the current PRS literature.

Individuals with fellowship training were more likely to have graduated from higher ranked Doximity residency

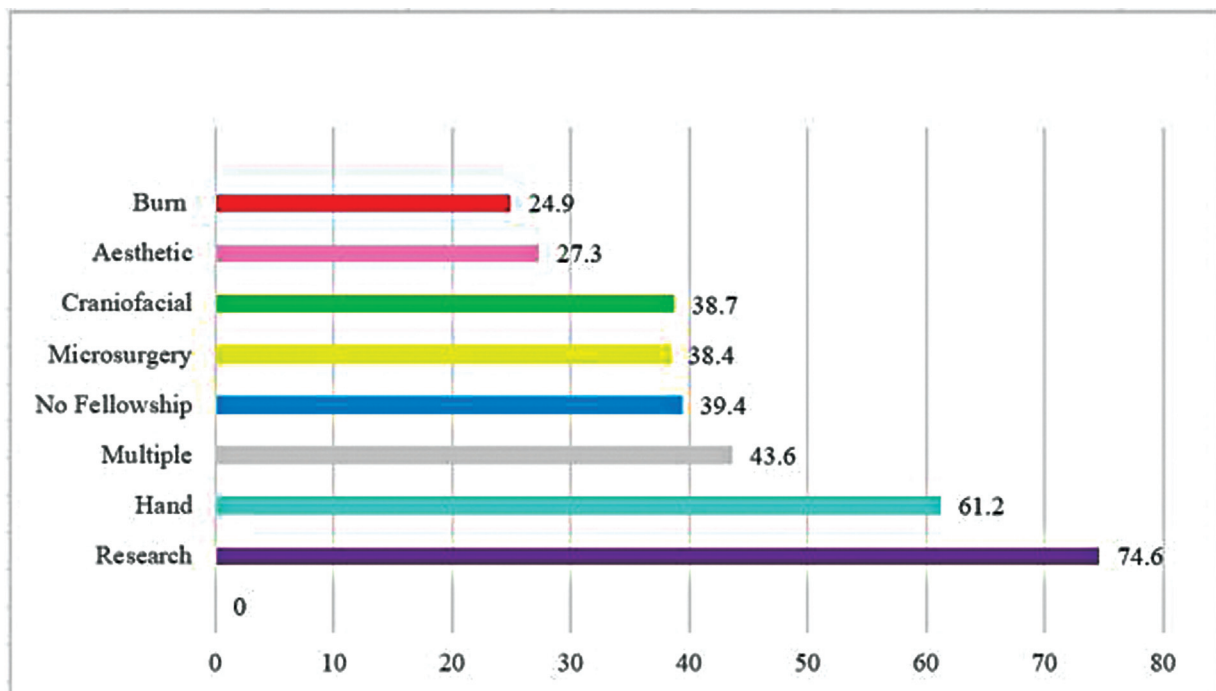


Fig. 3 Mean number of publications by fellowship type.

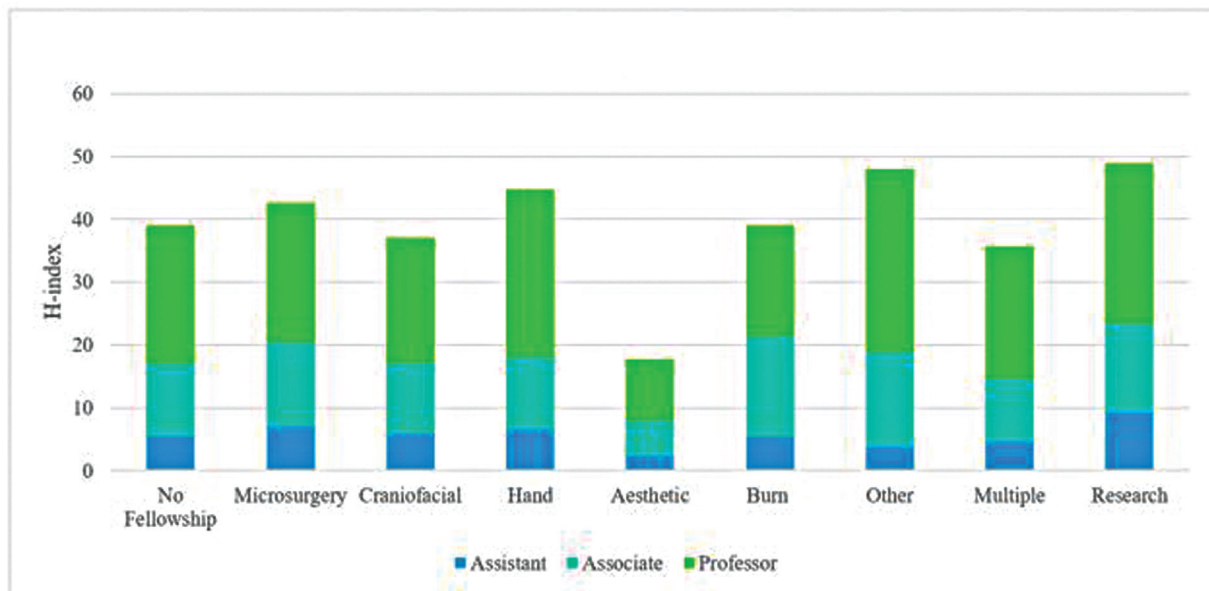


Fig. 4 Hirsch index (h-index) by fellowship and academic rank.

programs, and have positions as assistant and associate professors when compared with nonfellowship trained faculty. We believe that academically inclined individuals pursue and cultivate these interests from early on in their medical careers. Research experience bolsters student applications leading to acceptance to higher tier plastic surgery residency programs.²⁸ With scholarly activity being a benchmark for acceptance into higher tier residencies, it is not surprising that the individuals graduating from these programs were more likely to pursue additional training, as fellowship training has been associated with future careers in academia.⁴ Alternatively, these higher ranked residency programs may place more emphasis on academia and research therefore priming their resident graduates for aca-

dem pursuits. While professorship status was similar between fellowship and nonfellowship trained faculty after controlling for years in practice, this may be attributed to trends in residents pursuing fellowship training increasing significantly in recent years.¹ As appointment to full professor generally occurs after many years in practice, we suspect that the association of fellowship and academic rank may translate to professorship in the coming years as junior faculty who are fellowship trained rise to this role.

When we subanalyzed specific clinical fellowships alongside research fellowships, completion of a research fellowship was most predictive of future scholarly impact in terms of h-index, number of publications, and NIH funding. When stratifying h-indices by academic rank, the h-index increased

Table 3 Comparative analysis by fellowship type

Variable	Microsurgery (n = 137)	Hand/upper extremity (n = 159)	Craniofacial/pediatrics (n = 144)	Multiple fellowships (n = 47)	Research fellowship (n = 119)	p-Value
Associate professor	76 (55)	77 (48)	58 (40)	20 (42)	40 (34)	0.006 ^a
Assistant professor	35 (26)	48 (30)	48 (33)	11 (23)	32 (27)	0.530
Professor	26 (19)	34 (21)	38 (27)	16 (34)	47 (40)	0.001 ^a
Chair/chief status	8 (5)	16 (9)	21 (13)	7 (13)	13 (10)	0.161
Endowed	5 (3)	5 (3)	16 (10)	7 (13)	10 (8)	0.006 ^a
No. of publications	38.4 ± 46	38.7 ± 63	61.2 ± 107	43.5 ± 54	72.5 ± 101	< 0.001 ^a
h-index	11.0 ± 9.8	10.6 ± 10	13.5 ± 14	11.7 ± 11	16.9 ± 13	< 0.001 ^a
NIH funded	15 (10)	9 (5.0)	15 (9.5)	3 (5.8)	20 (15)	0.030 ^a
NIH funding (\$)	230,265 ± 1,324,630	119,791 ± 1,105,142	635,695 ± 3,821,744	46,005 ± 235,003	353,317 ± 1,564,071	0.200

Abbreviations: h-index, Hirsch index; NIH, National Institutes of Health.

Note: Values are presented as the number (%) or mean ± standard deviation (SD). Analysis of normal variance post hoc; number of publications: research greater than microsurgery (0.015) and hand (0.011). h-index: research greater than microsurgery (0.002) and hand (< 0.0001).

^aStatistically significant, $p < 0.05$.

with academic rank in all subspecialties, a positive correlation that has been documented previously in the literature.^{5,8,9,27} This is not surprising when we consider that formal research training has been associated with academic success in medicine and plastic surgery.^{26,29} Dedicated research experience helps stimulate ongoing interests in learning, fosters an eagerness to engage in clinical discovery and advancement, and improves clinical practice.^{30,31} The findings presented here confirm that formal research training and scholarly productivity play a role in academic promotion in plastic surgery, and may encourage junior members of the plastic surgery community to engage in research early if careers in academia are of interest.

Despite the above findings, the completion of a clinical or research fellowship was not independently predictive of acquisition of a leadership role in the form of chairman or chief of a plastic surgery department. Academic leaders often wear many hats, excelling in teaching roles, clinical productivity, community outreach, scholarly activity, and interpersonal relations. Leaders in the field of plastic surgery must be competent and confident in their convictions, inspiring yet accessible, and forward thinking with visions for new ideas.^{32,33} A variety of professional and personal factors are thus involved in the process of hiring these individuals.³⁴ The results of this study demonstrate that fellowship and research training may predict some measures of academic success; however, the cross-sectional nature of this study makes it impossible to attribute this to training status alone. More likely, academic leaders have unique attributes, personality traits, and training/research experience that all together makes them well suited for career advancement and promotion.

There are several important limitations within our study that should be addressed. The information presented here was obtained from various academic program Web sites. We relied on the data presented on those Web sites to be accurate and up to date, when in reality faculty positions and academic achievements are dynamic and ever changing. In addition, research productivity in this cohort may be inherently skewed as the database was formulated based on those individuals employed at academic institutions. Only microsurgery, craniofacial/pediatrics, and hand/upper extremity fellowships had enough faculty members in each group to power a subanalysis between fellowships, so we are only able to comment on the relationships between scholarly activity, leadership roles, and academic promotions between these groups. Lastly, we utilized the h-index as a surrogate for scholarly impact. The h-index has been praised for its ability to gauge the general influence of an author's scholarly work, taking into account quality and quantity of publications. However, inherent limitations exist in its potential bias toward clinical research which requires significantly less time than basic and translational research, and the ability of authors to self-cite to inflate their index.^{6,35,36} We utilized additional metrics of scholarly productivity including number of citations and NIH funding to combat these limitations.

In conclusion, our study has important implications for residents and medical students seeking a career in academic plastic surgery as clinical and research fellowships were

associated with various aspects of academic success. While no major differences were seen when comparing specific subspecialty training, research fellowships were most predictive of scholarly productivity. Additionally, fellowship training alone does not predict positions of leadership within the plastic surgery community.

Author Contributions

Conceptualization: A.N.C., V.P., J.A.M., M.P.M., F.D., A.I.M., J.P.F. Data curation: A.N.C., V.P., J.A.M., M.P.M., F.D., A.I.M. Formal analysis: A.N.C., V.P., J.A.M., M.P.M., F.D. Methodology: A.N.C., V.P., J.A.M. Project administration: A.N.C. Visualization: A.N.C., J.P.F. Writing - original draft: A.N.C., V.P., J.P.F. Writing - review and editing: A.N.C., V.P., J.A.M., M.P.M., F.D., A.I.M., J.P.F. All authors read and approved the final manuscript.

Conflict of Interest

None declared.

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