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Education

Trends in Fellowship Training across United States Plastic and Reconstructive Surgery Academic Faculty

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Background: Plastic and reconstructive surgery (PRS) academic positions are more coveted each year. We aim to determine the requirement of fellowship training before PRS academic appointments.
Methods: PRS faculty at U.S. academic institutions associated with the American Society of Plastic Surgeons were identified. Outcomes studied included integrated versus independent training, fellowships, gender, academic title, years on faculty, and publications before current hire.
Results: Of the 1052 PRS faculty identified, 646 were included across 41 states and the District of Columbia. Seventy-four percent were identified as men (n = 477), and 26.2% (n = 169) identified as women. Academic faculty were significantly more likely to have completed fellowship before hire than not ($p<0.0001$). An integrated route of training was associated with higher odds of fellowship completion before appointment (OR = 2.19, 95% CI: 1.49–3.22). Odds of fellowship completion was significantly greater among faculty who graduated 5–10 years ago (OR = 2.55, 95% CI: 1.48–4.41) and within the last 5 years (OR = 1.93, 95% CI: 1.18–3.17). Professors were less likely to have completed fellowship training before appointment compared with assistant professors (OR = 0.51, 95% CI: 0.33–0.80). Regarding gender, number of prior publications, or completion of another degree, no significant difference was found between fellowship- and non-fellowship-trained faculty.
Conclusions: Although more plastic surgeons enter the field through a shortened integrated residency, the increasing demand for further subspecialization may cause significant challenges for upcoming graduates pursuing an academic appointment. Undergoing additional training considerably impacts social and financial decision-making early in surgical careers for newly graduated residents.
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INTRODUCTION

For the plastic surgery trainee, career pathways have broad implications on one's future career and faculty appointment. Following the American Board of Plastic Surgery's recognition of the integrated model in 1995, the number of integrated residency programs began to increase, but the number of independent programs steadily decreased.[1–4] Offering an overall shortened and more focused route of training, the integrated model gained widespread adoption.[3] Every new program increases the total number of open faculty positions, providing new opportunities for those wishing to pursue an academic career. Beginning in 1996, the number of academic faculty at centers with new residency programs more than tripled from five to 18 with the greatest increase seen from 2009 to 2014.[5,6] On average, four positions were added to each institution during this 5-year period.[6] As of 2014, academic plastic surgery departments nationwide comprised eight full-time and four to five part-time faculty members, on average.[6]

For trainees considering an academic career, high-quality surgical training and research productivity are often pursued to be considered against the competitive pool of applicants for highly coveted faculty positions.[7–10] Despite the substantial increase in the number of faculty positions in plastic and reconstructive surgery (PRS)

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programs over the past decade, the annual number of open faculty positions remains limited partly due to high retention rates.[6,11] Compared with other specialties, plastic surgery has one of the highest 5-year retention rates, with 81% of faculty retained per year.[6] This poses a challenge for many prospective candidates considering an academic career in plastic surgery, as limited openings for faculty positions may lead to higher credential requirements for one to remain competitive. However, beyond specialized clinical training, completion of a fellowship may provide networking opportunities, mentorship, pathways to leadership positions, elevation of income, and intrinsic reward.

To date, there is limited published literature assessing the impact of fellowship completion on academic appointment and career advancement. Furthermore, no study assesses these trends amongst integrated and independent plastic surgery residents. Therefore, we sought to evaluate the current requirements for a trainee to attain an academic appointment by reviewing the credentials of current academic faculty across the United States. Additionally, we explored trends and factors that may influence one's appointment to an academic position in plastic and reconstructive surgery.

Takeaways

Question: How does a completion of fellowship impact academic appointment and career advancement? Additionally, how have these trends changed amongst integrated and independent plastic surgery residents over time?

Findings: An integrated route of training was associated with higher odds of fellowship completion before appointment. Fellowship completion was significantly greater among faculty who graduated within the past 10 years.

Meaning: Although more plastic surgeons enter the field through a shortened integrated residency, the increasing demand for further sub-specialization may cause significant challenges for upcoming graduates pursuing an academic appointment.

METHODS

Search Strategy and Information Sources

U.S. academic institutions associated with one or more of the following societies were utilized to identify PRS faculty: the American Society of Plastic Surgeons, the Northeastern Society of Plastic Surgeons, the Mountain West Society of Plastic Surgeons, or the Southeastern Society of Plastic and Reconstructive Surgeons. The complete list of included faculty were identified using publicly available online profiles published on each academic institution's website.

Faculty Selection

We screened all program websites for potentially eligible faculty members. Current academic faculty listed on ASPS-associated program websites were considered potentially eligible. For inclusion, one of the following criteria had to be met upon initial review: (1) completion of independent PRS training following general surgery residency or (2) completion of integrated PRS residency. The following criteria were considered grounds for exclusion: (1) completion of alternative independent PRS residency training including, but not limited to, orthopedics or otolaryngology, (2) modified professorial titles such as emeritus or part-time positions such as university, clinical, research, adjunct, or visiting, or (3) insufficient academic career data available on program websites, LinkedIn, or Doximity profiles.

Data Collection

Data was obtained from program websites, Doximity or LinkedIn profiles, and PubMed. Primary variables collected were completion and type of fellowship training. Additional variables included gender, location of training, current academic appointment, year of graduation from PRS training and fellowship, integrated or independent training, academic title (eg, professor, assistant or associate professor), program leadership position (eg, department chief or chair, program director), total number of fellowships completed, and number of publications before hire at initial academic appointment.

Statistical Analysis

The primary outcome of interest was trends in the proportion of faculty completing fellowship training over time and its association with other collected variables. Years of experience before appointment at the current institution was calculated based on years since graduation from PRS residency or fellowship. Number of years on faculty was calculated based on the date of hire at the current institution. Location of PRS training, fellowship, and current institution were also compared. Association between variables was analyzed using Pearson's chi-squared test for categorical variables and either the two-sample *t*-test or Mann-Whitney U tests for continuous variables. Trends in percentage of faculty completing integrated residencies over time was also studied and correlated with rates of fellowship training. Statistical analysis was performed using STATA v.17 (StataCorp, College Station, Tex.).

RESULTS

Our results identified 1052 PRS academic faculty across the United States. Of these, 646 faculty members were included across 41 states and the District of Columbia with an average of 16 faculty per state. The state with the largest number of faculty was New York (n = 75; Fig. 1). Overall, 39.9% (n = 249) of faculty were appointed to a position in the same state they trained in for plastic surgery residency. Within the last 10 years, approximately 36.8% (n = 84) of fellowship-trained faculty obtained academic hire in the same state as their residency training compared with 45.2% (n = 19) of non-fellowship-trained faculty (P = 0.008). Of the fellowship-trained faculty, 26.4% (n = 126) obtained academic appointment in the same state as their fellowship training, whereas 73.6% (n = 351) of fellowship-trained faculty obtained academic positions in different states (Table 1). Of the faculty members included, 73.8% (n = 477) identified as men and only

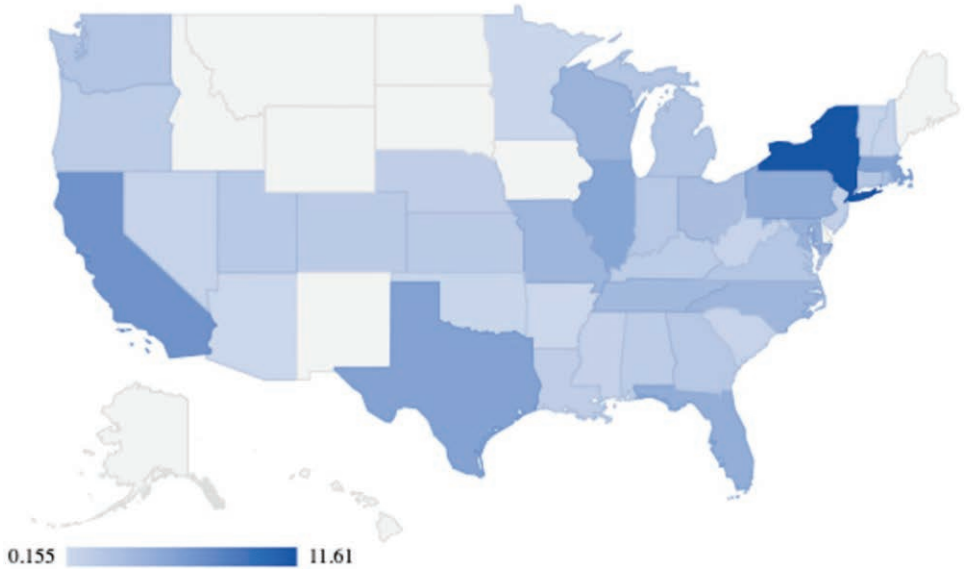

Fig. 1. Location and prevalence of full-time academic PRS faculty in the United States as of December 31, 2021.

26.2% (n = 169) identified as female. Within the last five years, the percentage of female faculty members who completed PRS training was 38.0% (n = 62) and the percentage of female academic faculty hired within the last 5–10 years was 33.3% (n = 47; Figure 2).

Before hire at their current institution, 74.5% (n = 481) of faculty completed one fellowship, whereas 7.1% (n = 46) completed one or more than one fellowship. The most common fellowship completed before hire was hand surgery (n = 144, 31.3%), followed by microsurgery (n = 124, 27.0%; Table 2). Of the faculty completing integrated PRS training, 82.7% (n = 206) completed a fellowship, compared with 69.2% (n = 275) of faculty completing independent training. When controlling for the last 10 years, 89.6% (n = 138) and 77.5% (n = 93) of faculty completed a fellowship after integrated or independent PRS training, respectively (Table 3). Regardless of training route, academic faculty were significantly more likely to have completed a fellowship before hire than to not have completed a fellowship ($P < 0.0001$). An integrated route of training was associated with higher odds of completing a fellowship before academic appointment ($P < 0.001$, OR = 2.19, 95% CI: 1.49–3.22).

The percentage of faculty hired within the past 10 years who completed fellowship training was 84.3% (n = 231), compared with 65.0% (n = 214) fellowship completion for those with greater than 10 years on faculty. Compared with faculty who graduated over 20 years ago, the odds of fellowship completion was significantly greater among faculty who graduated 5–10 years ago ($P = 0.001$, OR = 2.55, 95% CI: 1.48–4.41) and within the last 5 years ($P = 0.009$, OR = 1.93, 95% CI: 1.18–3.17). No significant difference was found between faculty who graduated 10–15 years ago or 15–20 years ago (Fig. 3).

Regarding levels of professorship among included faculty, 47.5% were listed as assistant professors, 25.9% as associate professors, and 26.5% as professors. There was no significant difference in fellowship completion between associate or assistant professors. However, professors were less likely to have completed fellowship training before academic appointment than assistant professors ($P = 0.003$, OR = 0.51, 95% CI: 0.33–0.80). The most common leadership position held by included faculty was chief (n = 62, 9.6%), followed by program director (n = 34, 5.3%). Attaining a program leadership position was associated with lower odds of fellowship training before initial faculty appointment ($P < 0.001$, OR = 0.58, 95% CI: 0.39–0.87; Table 4).

The average number of publications before hire was 20.2 for fellowship-trained versus 22.4 for non-fellowship-trained faculty. There was no significant difference between fellowship completion and the number of publications before hire. Similarly, no significant difference was

Table 1. The Number of Academic Faculty Hired in Their Respective State of PRS Residency or Fellowship Training

	Return to State of Residency Training	Yes (n, %)	No (n, %)	*P*
	Fellowship-trained	177 (36.9%)	303 (63.1%)	
Overall	Non-fellowship-trained	72 (43.9%)	92 (56.1%)	0.1106
<10 years	Fellowship-trained	85 (36.8%)	146 (63.2%)	**0.008**
	Non-fellowship-trained	19 (42%)	23 (54.8%)	
	Return to state of fellowship training	Yes	No	
Overall	Fellowship-trained	126 (26.4%)	351 (73.6%)	
<10 years	Fellowship-trained	55 (23.9%)	175 (76.1%)	0.3902
>10 years	Fellowship-trained	58 (27.5%)	153 (72.5%)	

Values in boldface are statistically significant.

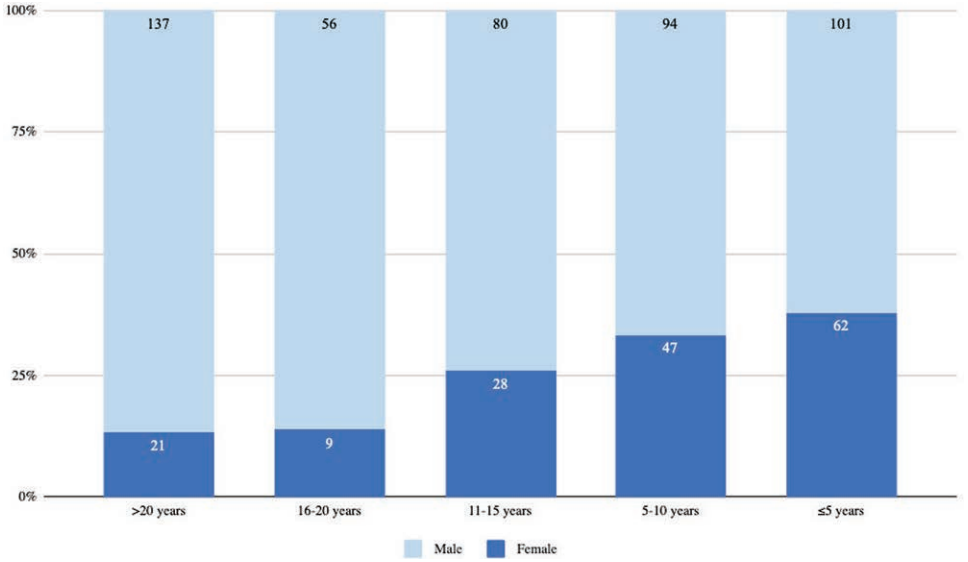

Fig. 2. Percent of female academic faculty members stratified by years since graduation.

found between the total number of publications and integrated or independent training. Of fellowship-trained academic faculty, 18.8% completed another graduate degree program (eg, PhD, MPH, MBA; Table 4). No significant differences were found between fellowship- and non-fellowship trained attendings in regard to gender, number of prior publications, or completion of an additional degree.

DISCUSSION

Our results show a large and increasing proportion of fellowship-trained PRS surgeons are hired to academic faculty positions in the United States over time. Historically, the independent model was the primary training path, and consequently, current academic faculty were more commonly trained via general surgery before PRS training.[1–4] However, the proportion of surgeons who completed an integrated program has grown, correlating with the increasing availability of such programs over the last 20 years, as indicated by our results. This parallels the current literature, which found that 56% of integrated plastic surgeons completed fellowship training compared with 36% of plastic surgeons from independent programs.[12] Of note, our results show female faculty represented only 26.3% of PRS academic faculty overall; however, we found an increasing proportion of female faculty are being hired in recent years. Despite the growing portion of female medical graduates and faculty,[13–16] the percentage of women entering plastic surgery in the United States and Canada is 38%, on average,[17] demonstrating the trend delay amongst plastic surgery faculty compared with those entering the field. This likely has downstream effects on academic trainees, as a positive correlation between gender of plastic surgery chairs and gender of plastic surgery faculty and residents has been demonstrated.[18] Regardless, we found that gender differences were not associated with fellowship completion. These trends demonstrate the increased demand for specialized surgeons upon academic appointment, regardless of gender or route of PRS training.

Although our results show an increased proportion of highly specialized surgeons at academic institutions, fellowship training is not correlated with attainment of leadership positions among clinical faculty. Additionally, fellowship completion has been associated with increased research productivity and a higher h-index over a surgeon's career.[8–10,19,20] However, our results demonstrate that the number of publications before hire at the current institution was not influenced by fellowship completion. This indicates that fellowship completion may impact a career of research productivity rather than the qualification before academic hire.

Table 2. Prevalence of Fellowship Completion by Specialty before Academic Appointment

	Fellowship 1	Fellowship 2	Fellowship 3	Total
Microsurgery	108	13	3	124 (27.0%)
Craniofacial	94	8	3	105 (22.8%)
Hand	134	9	1	144 (31.3%)
Burn	14	1	0	15 (3.3%)
Aesthetic	15	0	0	15 (3.3)
Gender affirming surgery	5	2	0	7 (1.5%)
Upper extremity	3	0	0	3 (0.7%)
Pediatrics	10	4	0	14 (3.0%)
Other	24	9	0	33 (7.2%)
Total	407	46	7	460

Table 3. Overall Fellowship Completion by Respective Route of PRS Training

	PRS Training	Fellowships	Non-fellowship	*P*
Overall	Integrated	206 (82.7%)	43 (17.3%)	
	Traditional	275 (69.3%)	122 (30.7%)	**<0.001**
>10 years on faculty	Integrated	54 (69.2%)	24 (30.8%)	0.3748
	Traditional	160 (63.7%)	91 (36.3%)	
<10 years on faculty	Integrated	138 (89.6%)	16 (10.4%)	**0.0063**

Values in boldface are statistically significant.

In 1960, integrated programs were introduced to concentrate and shorten the length of plastic surgery training compared with the independent model.[1,2,4] However, our results indicate that the limited number of open faculty positions annually may be one driver of application requirements for fellowship training and nullifying past intentions of a shortened training path. Nonetheless, the reason for fellowship attainment is likely multifactorial and also driven by intrinsic reasons such as personal reward and aspirations. Irrespective of independent or integrated training route, we found that faculty are significantly more likely to have completed a fellowship before hire at their academic institution. Additionally, there was a significantly increased odds of fellowship completion for graduates within the last 10 years, illustrating the shifting trend toward fellowship completion. However, this could also be attributed to the fewer opportunities to complete a fellowship for graduates 10 years ago, and fewer for those who graduated 20 or more years ago. Furthermore, due to the reduced opportunity, it may not have been a hindrance to academic advancement.[1–4] We found that faculty who were trained in the integrated model had higher odds of fellowship completion before academic appointment when compared to those trained in independent models. A possible reason for this trend is the high faculty retention rates within plastic surgery, creating an increasingly competitive environment of obtaining these limited positions.[6] Per the American Council of Academic Plastic Surgeons, approximately 180 plastic surgeons graduate from an integrated residency each year, while only 20–30 academic faculty positions are available annually.[21]

Typically, only a small percentage of annual graduate trainees will enter an academic career path, reducing some competition for these limited positions. Recent data estimated that 90% of plastic surgeons elect to pursue a nonacademic career.[22] Herrera et al analyzed the demographic data obtained from graduates of ACGME-accredited U.S. plastic surgery residency programs between the years of 2005 and 2010, and found that integrated plastic surgery graduates were less likely to pursue private practice immediately following graduation compared to those who graduated from independent programs.[12] Even with the majority of trainees choosing private practice, graduates comprise a minor portion of the total applicant pool for academic positions. Others, such as those who recently completed fellowships or switched from private practice or seek new faculty positions, all add to the annual applicant pool for faculty positions. The qualifications of these applicants likely drive trainees pursuing academic medicine to complete fellowships. It is difficult to assess if fellowship completion is indicative of better academic surgeons or makes an applicant more deserving of faculty appointment without comparing patient outcomes or satisfaction across fellowship-trained and non-fellowship-trained academic faculty. Regardless, our results indicate that recent academic appointments are based on merit of fellowship completion and length of training.

Entering the field of medicine is naturally committing oneself to a long career path involving vigorous training. Consequently, recent graduates are faced with the decision to prolong training further and accept the delay of potential earnings, the psychosocial toll of prolonged training, and the impact on personal life and family planning. One must consider the influence of these factors on current trends of fellowship training when

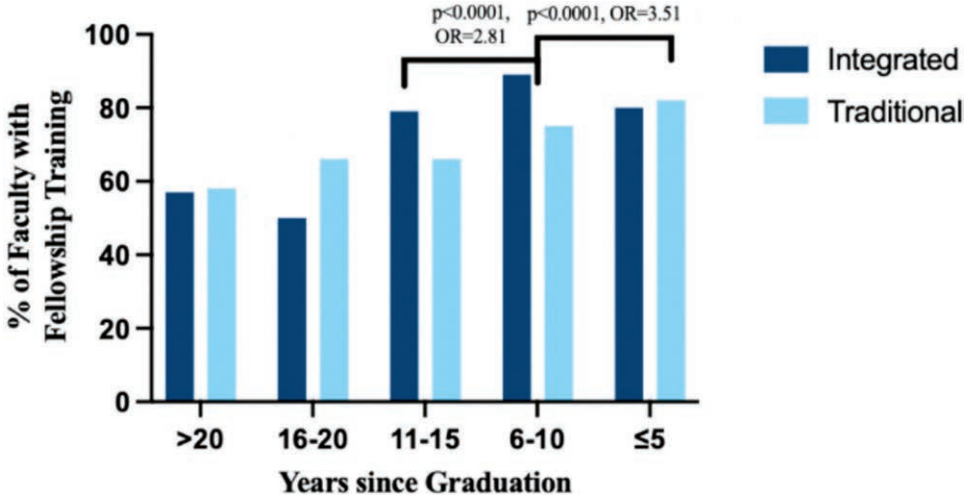

Fig. 3. Percent of integrated versus independent fellowship-trained faculty stratified by years since graduation. Eleven faculty members were excluded from the figure because their years since hire could not be calculated due to insufficient data.

Table 4. Work Experience and Demographics of PRS Faculty at Academic Institutions

Variable	All Faculty	Fellowship-trained	Non-fellowship-trained	*P*
Faculty (n, %)	646	481 (74.5%)	165 (25.5%)	—
Fellowships (mean, SD)	0.84±0.59	1.13±0.38	0	**<0.0001**
Gender (n, n%)				
Men	477 (73.8%)	360 (75.5%)	117 (24.5%)	0.265
Women	169 (26.2%)	121 (71.6%)	48 (28.4%)	
PRS training (n, n%)				
Traditional	397 (61.8%)	275 (69.3%)	122 (30.7%)	**<0.0001**
Integrated	249 (38.5%)	206 (82.7%)	43 (17.3%)	
Additional experience before hire				
Publications before hire (median, IQR)	11 (4,25)	11 (4,24)	10.5 (4,25)	0.582
Completion of additional Master's or Doctorate Degree (n, n%)	123 (18.9%)	93 (75.6%)	30 (24.4%)	0.754
Master's or Dentistry (n, n%)	97 (14.9%)	76 (78.3%)	21 (21.7%)	0.346
PhD (n, n%)	26 (4.0%)	17 (65.4%)	9 (34.6%)	0.276
Years of experience (median, IQR)				
On current faculty	7 (3,11)	6 (3,11)	9 (5,16)	**0.0002**
Overall (since PRS graduation)	11 (5,21)	10 (5,17)	16 (9,26)	**0.0001**
Level of professorship (n, n%)				
Professors	171 (26.5%)	112 (65.5%)	59 (34.5%)	0.729
Associate professors	168 (26%)	126 (75%)	42 (25%)	0.543
Assistant professors	307 (47.5%)	243 (79.2%)	64 (20.8%)	Reference group
Level of leadership (n, n%)				
Chair	27 (4.2%)	18 (66.7%)	9 (33.3%)	0.323
Vice chair	13 (2.0%)	11 (84.6%)	2 (15.4%)	0.351
Chief	62 (9.6%)	42 (67.7%)	20 (32.4%)	0.809
Program director	34 (5.3%)	18 (52.9%)	16 (47.1%)	0.056

Abbreviations: IQR, interquartile range; PRS, plastic and reconstructive surgery; SD, standard deviation.
Values in boldface are statistically significant.

deciding to pursue an academic position. For trainees, fellowship completion postpones a raise in their salary from either academic positions or private practice.[23,24] Hashmi et al demonstrated that residents with higher debt were more likely to pursue private practice than fellowship training.[25] Furthermore, there are possible financial implications of relocation to a new city for fellowship training that compound upon the delayed salary increase. Additionally, specialty sub-specialization has demonstrated varying financial returns as reported by Inclan et al, who sought to quantify the financial impact of surgical fellowship training on financial career value.[26] For example, the authors found that completion of a hand fellowship had a decreased net financial career value for orthopedic surgeons.[26] To date, however, no study has evaluated the net financial impact of fellowship completion within plastic surgery.

Current residents must consider the psychosocial implications of additional training years if they elect to continue an academic career path. One study that focused on primary care fellowship found that fellowship training was associated with greater physician satisfaction; however, it also reported increased physician stress levels.[27] Although the impact that fellowship training will have on a physician's career goals is one of the main deciding factors, consideration should also be given to other outcomes, such as career satisfaction.[19,28] DeSerres et al demonstrated high career satisfaction amongst attendings, of which nearly 90% completed a fellowship following residency training.[19] Further studies are warranted to assess whether graduating PRS residents consider these factors when deciding to pursue a fellowship.

Other considerations for fellowship are mentorship opportunities and continued professional development. A study surveying general surgery residents determined that those who decided to subspecialize with a fellowship were more often influenced by a mentor or stated that they lacked confidence to enter general practice.[29] Interestingly, it has been reported that 94% of plastic surgeons believe mentorship is valuable, yet only 15.6% say they have a structured mentorship system.[30] These findings suggest there are a multitude of factors that may influence the decision to pursue additional years of training.

The decision to pursue fellowship training can also impact family life. Trainees should consider their current family status and ability to relocate to another city when deciding to complete fellowship training.[31] Our results indicate that for fellowship-trained faculty within the last 10 years, it is common for faculty to obtain academic appointment in different states than their residency or fellowship training. The decision to relocate and forgo a year of salary has significant financial costs in addition to personal and/or familial sacrifice.[24,32,33] It is possible that those who elect to pursue fellowship have the means or are more willing to relocate to another state following fellowship training. Certainly, any relocation requirement is a significant decision worth consideration.

One of the main strengths of this study is its large sample size, which included 646 PRS academic faculty members across the United States. Additionally, it is the first study of its kind to analyze fellowship trends of PRS academic faculty. The largest limitation was inconsistent reporting on academic institution websites regarding faculty demographics; therefore, data collection had to rely on self-reported websites like Doximity or LinkedIn. For example, determining the number of publications before hire is limited by the quality of information reported on program websites and faculty profiles, and limited by publication lag

which may under report the number of publications of more recent faculty appointments. To reduce this risk, we referenced multiple online platforms to source information. Due to the focus placed on general surgery for independent training versus an integrated PRS residency, we limited our data to not include other routes into PRS residency, such as completion of an orthopedics or otolaryngology residency before independent PRS training. Lastly, it is recognized that academic appointment is not singularly decided by an applicant's completion of fellowship. Obtaining a faculty position is multifaceted and encompasses intrinsic and extrinsic qualifications including but not limited to motivation, innovation, professional achievement, productivity, and mentorship. Fellowship specialization interplays with each of these factors even though it likely supports professional development. Future studies are warranted to evaluate the impact of specialized training on surgical outcomes, personal financial implications, and physician satisfaction, in addition to studies investigating the factors most important to programs in hiring academic faculty.

CONCLUSIONS

Although completion of a plastic surgery fellowship is becoming more commonplace, especially through the integrated model, the rising demand for further sub-specialization may continue to cause a significant challenge for upcoming graduates pursuing an academic appointment. Undergoing additional training considerably impacts social and financial decision-making early in surgical training. Therefore, trainees should consider the impact of fellowship completion on career advancement, financial, and social implications.

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