Analysis of Trends in the Selection and Production of U.S. Academic Plastic Surgery Faculty

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Purpose: In academic plastic surgery, there is a paucity of data examining the relationship between program rank, faculty training history, and production of academic program graduates. The purpose of this study is to determine objective faculty characteristics that are associated with a high program reputation.

Methods: Accreditation Council for Graduate Medical Education-accredited integrated Plastic and Reconstructive Surgery (PRS) programs were ranked using Doximity and divided into Top-quartile programs and Other programs. Accredited medical schools were ranked using U.S. News and World Report. Individual faculty profiles were reviewed on program websites for information on prior training.

Results: Seventy-nine programs with 712 faculty were identified and objectively analyzed. Compared to Other PRS programs, Top-quartile programs had a higher proportion of faculty that trained at Top-quartile residency programs (P < 0.0001) and Top-quartile medical schools (P < 0.0001). Top-quartile programs also had the highest proportion of faculty that trained at the same institution for fellowship (P = 0.0001), residency (P = 0.03), medical school (P = 0.4), or any prior training (medical school, residency, or fellowship) (P = 0.002). Top-quartile programs were associated with the largest total faculty size (P < 0.0001) and the largest number of graduates entering the field of academic plastic surgery (P < 0.0001).

Conclusions: Program reputation is associated with PRS faculty selection and production. Top-ranked programs are more likely to have faculty that previously trained at the same institution or at top-ranked programs. Top-ranked programs are more likely to graduate residents that will become academic plastic surgeons.

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INTRODUCTION

Integrated plastic surgery training is recognized as one of the most competitive residency positions in the United States, with only 172 slots accredited in 2019 by the Accreditation Council for Graduate Medical Education (ACGME). However, obtaining one of those positions is only a small part of a puzzle to securing further academic appointment as an attending physician. Obtaining an academic appointment in plastic and reconstructive surgery (PRS) remains challenging and elusive to many prospective candidates. While the total number of full-time faculty positions affiliated with PRS residency training programs is steadily increasing, the number of open positions on an annual basis is limited and therefore the caliber of credentials necessary for obtaining a full-time faculty position remains high.1,2 For candidates interested in an academic position, defining the academic background of typical faculty would be of significant value. However, there is limited literature examining this topic.

There are many factors that may influence the selection of plastic surgery faculty, including pedigree, fellowship training, research productivity, advanced degrees, and intangible likability, with “top” programs being associated to a greater extent with metrics of scholarly activity.1-6 To date, no study in the peer-reviewed literature has performed an in-depth analysis to elucidate the attributes of academic plastic surgeons. Since higher-ranked PRS programs are associated with more academically productive faculty, prior academic success might be a possible...
factor influencing faculty selection. It is also possible that higher-ranked programs may indeed both select and produce future academic plastic surgeons with prior evidence of high scholarly impact.

Thus, the primary goal of this investigation is to clearly characterize academic plastic surgeons and secondarily to determine if there are measurable differences between surgeon characteristics and program quality using objective data. We hypothesize that graduating from a top-ranked PRS residency, having advanced degrees, and completing fellowship training might be characteristics associated with faculty at top PRS programs. The results of this study can stimulate the plastic surgery community to reflect on what applicant characteristics are more likely to make a successful academic plastic surgeon and what program characteristics might encourage trainees to pursue an academic career path.

METHODS

PRS Program and Faculty Database Collection

A list of all integrated PRS residency programs in the United States was compiled from the ACGME. To ensure accuracy and completeness, this list was cross-referenced with the Doximity Residency Navigator and the National Residency Match Program (NRMP) databases. Publicly available websites for each integrated PRS program were accessed in September 2018, and a list of full-time core faculty members was compiled. Faculty members were excluded from analysis if they held the title of professor emeritus, adjunct professor, affiliated professor, clinical instructor, or part-time professor. If a program did not have a faculty list on its website, the program coordinators were contacted for missing information. Individual faculty profiles were reviewed for information on academic rank, graduate degrees, medical school, residency program, and fellowship program attended.

Reputation Data

Integrated PRS programs were divided into two groups for analysis: (1) Top-quartile programs and (2) Other programs, based on reputation rankings determined by the Doximity Residency Navigator. Doximity uses transparent methodology and is well established in ranking residency programs (since 2014). Reputation rankings of PRS programs established by Doximity are determined by peer nominations from board certified plastic surgeons that are adjusted for self-voting. Top programs change over time as the designation is dynamic from year to year and dependent on factors such as leadership, prominence of faculty, unique/novel clinical programs (ie, for composite tissue allotransplantation, lymphedema surgery, and transgender surgery), and research output. Doximity Residency Navigator is a tool that residency applicants use to shape their opinion on programs of interest to then select an integrated plastic surgery training program. The database is one of the top three most commonly used resources to investigate residency programs of interest, utilized by medical students applying into any specialty. Up to 78% of students surveyed in one study consider it a valuable resource, with recent data suggesting that Doximity rankings are influential enough to cause up to half of medical students reading them to modify their residency application list. For these reasons, we felt that Doximity, although not perfect, was a good ranking system to use for this analysis. Additionally, Top-quartile-accredited U.S. medical schools were divided based on rankings, as determined by the U.S. News and World Report for Best Medical Schools–Research Methodology. Caribbean and international medical schools were excluded from analysis, as were non-plastic surgery residency programs.

Statistical Analysis

All analyses were completed on GraphPad Prism (GraphPad Software, Inc., San Diego, Calif.). Numerical variables were analyzed using two-tailed Student’s t test. The P value cutoff for statistical significance was set at 0.05. All faculty data were analyzed as “percent faculty” to account for program size variation between groups.

RESULTS

Construction of a Dataset to Compare Top-Quartile Programs to All Others

A total of 79 integrated PRS residency programs with 712 faculty meeting inclusion criteria were included for analysis. Programs were then split into two groups: Top-quartile programs (ranks 1–20) and Other programs (ranks 21–79). Integrated PRS residency programs with their corresponding rank and region are listed in Table 1.

Academic Rank and Productivity

Faculty rank was used as an approximate surrogate for academic productivity given the known association between higher academic rank of plastic surgery faculty and elevated research output as determined by multiple metrics, including the Hirsch index, g-index, number of publications, and number of citations. In this study, one Top-quartile PRS program and eight Other programs did not offer information on faculty academic rank on their websites (full, associate, or assistant professor status), so those faculty members were excluded from analysis on academic rank. Of the programs included in the analysis, there was no statistically significant difference between Top-quartile and Other programs in the proportion of full professors (30% versus 29%, P = 0.8), associate professors (26% versus 27%, P = 0.9), and assistant professors (37% versus 44%, P = 0.2) (Fig. 1A–C).

Academic Degrees

Since completion of additional postgraduate training is associated with higher scientific productivity, we aimed to investigate the relationship between program rank and additional academic training. We collected information on the number and type of academic degrees earned by faculty to determine whether top-ranked
| Rank | Program                                      | Region |
|------|----------------------------------------------|--------|
| 1    | New York University School of Medicine       | NE     |
| 2    | University of Texas Southwestern Medical School | S     |
| 3    | University of Pennsylvania Health System    | NE     |
| 4    | University of Michigan Health System        | NW     |
| 5    | Stanford Health Care-Sponsored Stanford University | W     |
| 6    | Emory University School of Medicine         | NE     |
| 7    | University of Washington                    | W      |
| 8    | Washington University/B-JH/SLCH Consortium  | NW     |
| 9    | University of California (San Francisco)    | W      |
| 10   | University of Southern California/LAG-USC Medical Center | NW     |
| 11   | Brigham and Women’s Hospital/ Harvard Medical School | NE     |
| 12   | Johns Hopkins University/University of Maryland | NE     |
| 13   | Yale-New Haven Medical Center               | NE     |
| 14   | Mayo Clinic College of Medicine and Science (Rochester) | NW     |
| 15   | Montefiore Medical Center/Albert Einstein College of Medicine of Yeshiva University | NW     |
| 16   | University of North Carolina Hospitals      | S      |
| 17   | Mayo Clinic College of Medicine and Science (Arizona) | W     |
| 18   | Southern Illinois University                | MW     |
| 19   | University of Minnesota                     | MW     |
| 20   | University of Missouri                      | MW     |
| 21   | University of Utah Medical Center           | W      |
| 22   | University of Virginia Medical Center       | S      |
| 23   | University of Kentucky College of Medicine  | S      |
| 24   | University of Kansas Medical Center         | S      |
| 25   | University of Cincinnati Medical Center/College of Medicine | MW     |
| 26   | University of Colorado School of Medicine   | W      |
| 27   | University of Tennessee College of Medicine | S      |
| 28   | Brown University                            | NE     |
| 29   | Albany Medical Center                       | NE     |
| 30   | University of Rochester                     | NE     |
| 31   | Jackson Memorial Hospital/Jackson Health System | S     |
| 32   | Case Western Reserve University/University Hospitals Cleveland Medical Center | MW     |
| 33   | University of Massachusetts                 | NE     |
| 34   | Medical University of South Carolina College of Medicine | S      |
| 35   | Medical College of Wisconsin Affiliated Hospitals | MW     |
| 36   | Mary Hitchcock Memorial Hospital/Dartmouth-Hitchcock | NE     |
| 37   | St Louis University School of Medicine      | MW     |
| 38   | University of Missouri–Columbia             | MW     |
| 39   | Virginia Commonwealth University Health System | S      |
| 40   | Carolin Clinic-Virginia Tech Carolin School of Medicine | S      |
| 41   | Texas A&M College of Medicine-Scott and White Medical Center (Temple) | S      |
| 42   | Loyola University Medical Center            | MW     |
| 43   | University of New Mexico School of Medicine | W      |
| 44   | Wright State University                     | MW     |
| 45   | West Virginia University School of Medicine | S      |
| 46   | Oregon Health & Science University          | W      |
| 47   | University of Mississippi School of Medicine | S      |
| 48   | University of Nevada Las Vegas (UNLV) School of Medicine | W     |
| 49   | Nassau University Medical Center            | NE     |
| 50   | Lehigh Valley Health Network/University of South Florida College of Medicine | NE     |
| 51   | Cooper Hospital-University Medical Center   | NE     |
| 52   | Geisinger Health System                     | NE     |
| 53   | Lahey Clinic                                | NE     |
| 54   | Palmetto Health/University of South Carolina School of Medicine | S      |

The solid line indicates the division between Top-quartile and other PRS programs.

NE, Northeast; MW, Midwest; S, South; W, West.
programs are more likely to have faculty with additional academic training. Additional degrees held by PRS faculty included Doctor of Dental Surgery (DDS), Doctor of Dental Medicine (DMD), Doctor of Pharmacy (PharmD), Doctor of Philosophy (PhD), and master’s degrees. No statistically significant difference was found in the proportion of faculty with an additional academic degree between Top-quartile and Other programs (16% versus 14%, \( P = 0.6 \)) (Fig. 2).

Fellowship Data

Since one of the roles of fellowship training is to enhance the desirability of individuals seeking a career in academia, information on fellowship training was collected to discern whether faculty at top-ranked programs are more likely to be fellowship-trained. Eighty percent (80%) of all faculty identified were fellowship-trained. There was no significant difference in proportion of fellowship-trained faculty when comparing Top-quartile and Other programs (84% versus 79%, \( P = 0.2 \)) (Fig. 3).

Top-quartile Residency Training

Given the knowledge that top-ranked residencies are associated with more academically productive residents, we aimed to determine whether top-ranked programs have a larger proportion of faculty that trained at top-ranked residency programs. For each group, we collected information on how many faculty trained at top-quartile PRS residencies, as determined by Doximity. Faculty who trained at residency programs other than PRS (ie, dentistry, general surgery, and otolaryngology) were excluded from analysis. We found that faculty from Top-quartile programs were significantly more likely to have trained at a top-quartile PRS residency than faculty from Other programs (69% versus 32%, \( P < 0.0001 \)) (Fig. 4A).

Top-quartile Medical School Training

We also aimed to determine whether top-ranked programs have a larger proportion of faculty that trained at top-ranked medical schools, as determined by U.S. News rankings. For each group, information on how many faculty attended top-quartile medical schools was collected. Faculty who attended other graduate schools (ie, Caribbean or international medical school, dental school) were excluded from statistical analysis. We found that faculty from Top-quartile programs were significantly more likely than faculty from Other programs to have trained at a top-quartile medical school (52% versus 31%, \( P < 0.0001 \)) (Fig. 4B).

Faculty Alumni

We further aimed to determine whether top-ranked programs are more likely to exhibit “inbreeding” in their faculty selection, as evidenced by a higher proportion of faculty that are alumni of the institution of their program. As such, we determined the proportion of faculty that received medical school, residency, and/or fellowship training from the same institution with which they are currently affiliated. Compared to faculty from Other programs, faculty from Top-quartile programs were significantly more likely to have trained for fellowship and residency within the same institution (fellowship: 28% versus 10%, \( P = 0.0001 \); residency: 36% versus 24%, \( P = 0.03 \))

**Fig. 1.** Faculty by academic rank. A, full professors: Top-quartile programs 30%, Other programs 29%, \( P = 0.8 \). B, associate professors: Top-quartile programs 26%, Other programs 27%, \( P = 0.9 \). C, assistant professors: Top-quartile programs 37%, Other programs 44%, \( P = 0.2 \).
Faculty from Top-quartile programs were also more likely to have trained for medical school within the same institution, although this trend was not statistically significant (12% versus 9%, \(P = 0.4\)) (Fig. 5C). When looking at combined data, we found that faculty from Top-quartile programs were more likely to have received any form of medical training from the same institution (medical school, residency, or fellowship) compared to faculty from Other programs (54% versus 35%, \(P = 0.002\)) (Fig. 5D). A list of integrated PRS residency programs with the highest proportion of faculty alumni is displayed in Table 2.

**Program Size**

Since large programs generally have greater depth in faculty specialization and subspecialization, we asked whether faculty size was correlated with being a top program. Compared to Other programs, Top-quartile programs were indeed significantly larger as determined by total faculty size (13 versus 7 full-time faculty, \(P < 0.0001\)) (Fig. 6).

**Program Graduates in Academia**

Finally, to assess whether top-ranked programs are more likely to graduate residents that will pursue a career in academia, we conducted an analysis of program graduates who become academic plastic surgeons after graduation. For each program, the total number of program graduates that are current faculty members in the United States was collected. To account for graduating class size, this was divided by the number of yearly program graduates (using data collected from program websites and NRMP reports) to calculate the number of program graduates per graduating resident that are full-time faculty members. Compared to Other programs, Top-quartile programs were more likely to graduate residents who will become academic plastic surgeons. This trend was significant for both total number of program graduates and for number of program graduates per graduating resident (total number: 15 versus 4 graduates, \(P < 0.0001\); relative to graduating class size: 4 versus 2 graduates, \(P < 0.0001\)) (Fig. 7A, B). A list of integrated PRS residency programs with the largest number of graduates entering academia is displayed in Table 3.

**DISCUSSION**

The notion of comparing PRS residencies by program rank is not new, as many studies have investigated differential outcomes for residents and faculty in “top” programs compared to all other programs. This has been studied in relation to the scholarly output of residents and faculty, the accessibility of faculty mentorship to younger trainees, and successful residency match outcomes.\(^{13-19}\) For instance, the direct relationship between integrated PRS program rank and research productivity of the program’s faculty has already been established and found to be significant.\(^1\) PRS program size and National Institutes of Health funding has also been positively correlated with the scholarly impact of faculty members as measured by the Hirsch index.\(^{15-19}\) In this study, we aimed to further identify concrete differences associated with top-ranked PRS programs and their faculty by analyzing publicly available databases of full-time integrated academic plastic surgeons.

By comparing programs by rank, we found a statistically significant tendency of faculty from top-ranked programs to have additional academic degrees (Fig. 2). Faculty holding a fellowship (Fig. 3) were also more likely to be found in Top-quartile programs.
programs to have trained at top PRS residencies. Though these results do not establish a causal relationship, they emphasize the correlation between having an “elite” training background and obtaining faculty appointments at “elite” PRS programs. Interestingly, our analysis revealed a similar association between being a faculty at a top-ranked program and having attended a top-ranked medical school. For students interested in pursuing a career in

![Fig. 4. Faculty with training from a top residency program or medical school. A, Top-quartile residency: Top-quartile programs 69%, Other programs 32%, \( P < 0.0001 \). B, Top-quartile medical school: Top-quartile programs 52%, Other programs: 31%, \( P < 0.0001 \).](image)

![Fig. 5. Faculty with prior training from the same affiliated institution. A, same fellowship: Top-quartile programs 28%, Other programs 10%, \( P = 0.0001 \). B, same residency: Top-quartile programs 36%, Other programs 24%, \( P = 0.03 \). C, same medical school: Top-quartile programs 12%, Other programs 9%, \( P = 0.4 \). D, same institution (any training): Top-quartile programs 54%, Other programs 35%, \( P = 0.002 \).](image)
academic plastic surgery, this finding suggests that even the reputation of the student's medical school has the potential to affect their employment prospects. Whether this is because academically oriented students actively seek out top-ranked programs to further their academic agendas or because PRS programs favor applicants with more "elite" training remains to be determined. Nevertheless, it is clearly understood that there are many highly motivated and productive plastic surgeons throughout the country who are nationally acclaimed and respected regardless of the ranking of their training programs or institutions with which they are affiliated. From the applicant perspective, we know that at least for residency applications, PRS programs favor academically productive applicants who come highly recommended by other surgeons in the field. This same bias likely applies to the selection of new faculty, where research-oriented applicants are favored by more research-oriented programs.

Furthermore, to investigate alumni bias in faculty selection, we calculated the proportion of faculty who had previously trained at the same institution as their program, for medical school, residency, or fellowship. We found a significant association between program rank and faculty with alumni status, indicating a high rate of alumni retention in Top-quartile PRS residency programs. This finding emphasizes the tendency of programs from the upper echelons of academia to "inbreed" and select prospective academic plastic surgeons who previously trained from within their own ranks. Indeed, this association can be advantageous for all, allowing more academically competitive programs to preferentially hire faculty they are more familiar with and whom they know to have received a rigorous level of surgical training. Since faculty at top programs tend to have trained at the same or similarly ranked institution at some point in their career, it can be valuable for prospective faculty interested in joining the ranks of a top PRS program to consider training there first.

Table 2. Top 10 Residency Programs by Faculty Who Previously Trained at the Same Institution (Medical School, Residency, or Fellowship)

| Position | Program                                                      | N (%) |
|----------|--------------------------------------------------------------|-------|
| 1        | Brigham and Women’s Hospital/Harvard Medical School          | 14 (93) |
| 2        | UCLA David Geffen School of Medicine/UCLA Medical Center    | 12 (92) |
| 3        | New York Presbyterian Hospital (Columbia and Cornell Campus)| 11 (85) |
| 4        | New York University School of Medicine                      | 14 (78) |
| 5        | Penn State Milton S Hershey Medical Center                  | 7 (78)  |
| 6        | University of Tennessee College of Medicine                  | 7 (78)  |
| 7        | University of Michigan Health System                        | 12 (75) |
| 8        | University of Virginia Medical Center                      | 6 (75)  |
| 9        | Nassau University Medical Center                            | 5 (71)  |
| 10       | University of Pennsylvania Health System                    | 10 (71) |

Fig. 6. Number of full-time faculty. Top-quartile programs 13 faculty, Other programs 7 faculty, \( P < 0.0001 \).
significant difference in proportion of fellowship training between Top-quartile and Other programs. As previously mentioned, this could be due to applicant preference (ie, choosing to pursue fellowship training because of its ties to the world of academia) or program preference (ie, preferentially selecting applicants who have undergone more specialized training). Either way, it is useful for aspiring academic plastic surgeons to understand that the proportion of fellowship completion among integrated PRS faculty is very high.

Analysis of program size revealed that top-ranked programs are significantly larger and have more full-time faculty than their lower-ranked counterparts. Given this finding, we accounted for differences in program size by performing all analyses as “percent faculty” of Top-quartile versus Other programs. Finally, we aimed to address the theory that top-ranked PRS programs are more likely to graduate residents who will become future academic plastic surgeons. Indeed, we found that Top-quartile programs have a higher number of program graduates who pursue a career in academic plastic surgery. To discern whether this was confounded by the larger graduating class sizes of top-ranked programs, we analyzed the number of program graduates per graduating resident and still found a statistically significant difference between the two groups, suggesting that top-ranked programs are more likely to produce academic plastic surgeons than lower-ranked programs. This further lends credibility to the notion that highly reputed programs might preferentially attract as well as encourage trainees to be scholastically productive and pursue an academic career.

In this study, we chose to focus our analysis on surveying integrated plastic surgery training programs rather than independent programs. Although similar in their educational objectives and commitment to training autonomous and skilled plastic surgeons, the independent and integrated plastic surgery training programs differ in important ways. In the integrated training model, the

![Fig. 7. Number of program graduates entering academic plastic surgery. A, faculty grads (total number): Top-quartile programs 15 graduates, Other programs 4 graduates, \(P < 0.0001\). B, faculty grads (relative to graduating class size): Top-quartile programs 4 graduates, Other programs 2 graduates, \(P < 0.0001\).]

| Position | Program                                                                 | N (adjusted N) |
|----------|-------------------------------------------------------------------------|----------------|
| 1        | UPMC Medical Education                                                  | 35 (9)         |
| 2        | New York Presbyterian Hospital (Columbia and Cornell Campus)           | 33 (9)         |
| 3        | New York University School of Medicine                                 | 27 (8.3)       |
| 4        | University of California (San Francisco)                               | 20 (6.7)       |
| 5        | University of Chicago                                                  | 20 (6.5)       |
| 6        | UCLA David Geffen School of Medicine/UCLA Medical Center              | 20 (6)         |
| 7        | Brigham and Women’s Hospital/Harvard Medical School                    | 18 (5.8)       |
| 8        | University of Rochester                                                | 18 (5.5)       |
| 9        | University of Michigan Health System                                   | 16 (5)         |
| 10       | University of Pennsylvania Health System                               | 14 (5)         |
Residency Review Committee for Plastic Surgery (RRC-PS) supervises the entire length of residency training. In the independent training model, the RRC-PS supervises only the prerequisite period of residency training, while the prerequisite period is supervised by another RRC (ie, general surgery, otolaryngology, urology, orthopedics, etc.). Because of this distinction, the focus of this study was on integrated plastic surgery programs and their faculty.

Another limitation of this study is that departmental websites are not always updated with the latest information, thereby rendering some of the data collected potentially out of date. The choice to analyze faculty rank as a surrogate for academic productivity also does not come without limitations, as individual faculty productivity is not uniform across divisions or departments. Furthermore, this study did not include data on percentage of faculty members who stayed in a specific program over time. This limits our ability to gauge academic retainment as a program metric and serves as a starting point for future studies.

CONCLUSIONS

In conclusion, this study utilizes objective data to reveal that integrated PRS program reputation is associated with increased selection and production of academic plastic surgeons. Top-ranked PRS programs are more likely to exhibit reputation bias and hire faculty previously trained at the rank of medical schools and residencies. Top-ranked programs are more likely to exhibit alumni bias and hire faculty previously trained at the same institution. Top PRS programs are also more likely to be biased toward training residents who will enter the field of academic plastic surgery upon graduation. As the number of available faculty positions continues to grow along with the number of ACGME-accredited integrated PRS residencies, the results of this study can help aspiring academic plastic surgeons and current residency programs understand the factors involved in the selection and production of academic physicians and to ultimately attract their best match.

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