Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.JournalofSurgicalResearch.com

# The Association of a Research Year With Matching Into an Integrated Plastic Surgery Residency

*Carol Y. Wang, BA,* Joseph A. Mellia, MD, Lior Levy, MD, Olachi Oleru, MD, Abena Gyasi, BA, Nargiz Seyidova, MD, MHQS, Peter E. Shamamian, BS, Keisha E. Montalmant, MD, MPH, Peter W. Henderson, MD, MBA, Alice Yao, MD, and Peter J. Taub, MD, MS*

*Division of Plastic and Reconstructive Surgery, Icahn School of Medicine at Mount Sinai, New York, New York*

ARTICLE INFO

*Article history:*
Received 29 April 2024
Received in revised form
30 July 2024
Accepted 17 August 2024
Available online 16 September 2024

*Keywords:*
Gap year
Integrated plastic surgery residency
Match outcomes
Plastic and reconstructive surgery
Plastic surgery match
Research year

ABSTRACT

*Introduction:* The relationship between pursuing a research year (RY) and plastic surgery match outcomes is unclear. The present study investigated the association between a dedicated RY and the odds of matching into an integrated Plastic and Reconstructive Surgery (PRS) residency program.

*Methods:* Electronic Residency Application Service applications to an integrated PRS residency program from 2017 to 2021 were evaluated. Match results were determined using online public sources. Students who had taken a RY were compared with those who had not (traditional). The relationship between pursuing a RY and matching was determined with logistic regression analyses.

*Results:* In total, 974 applicants were included, of which 191 (20%) completed an RY. The RY group had significantly higher match rates (83% *versus* 74%, $P = 0.008$), more presentations (13 *versus* 5, $P < 0.001$), and more publications (11 *versus* 4, $P < 0.001$) than the traditional group. The RY group was 80% more likely to match than the traditional group (adjusted odds ratio [OR] = 1.8, $P = 0.016$). However, this benefit was eliminated after controlling for the number of publications. Subgroup analysis revealed that applicants who completed an RY had increased odds of matching into a top 20 PRS residency program (OR = 2.2, $P < 0.001$), with the strongest association observed among applicants with 15+ (OR = 2.6, $P < 0.001$) or 20+ publications (OR = 4.1, $P < 0.001$).

*Conclusions:* An RY is associated with 80% higher odds of matching and an increased number of publications. RYs seem to be most associated with benefits for applicants aiming to increase their publication numbers or to match into a top 20 residency program.

© 2024 Elsevier Inc. All rights are reserved, including those for text and data mining, AI training, and similar technologies.

* *Corresponding author*. Icahn School of Medicine at Mount Sinai, 5 East 98th Street, Box 1259, New York, NY 10029.
E-mail address: Cwang324@gmail.com (C.Y. Wang).

0022-4804/$ – see front matter © 2024 Elsevier Inc. All rights are reserved, including those for text and data mining, AI training, and similar technologies.
https://doi.org/10.1016/j.jss.2024.08.010

## Introduction

Matching into an integrated Plastic and Reconstructive Surgery (PRS) residency program is difficult. With a match rate of 62% in the 2023 cycle, applicants to integrated PRS programs often report the highest United States Medical Licensing Examination (USMLE) scores and research productivity compared to other specialties.[1-4] The competitive landscape requires that applicants further differentiate themselves to match. While high USMLE Step 1 scores and Alpha Omega Alpha (AOA) status remain important,[2,5,6] several recent manuscripts show that applicants increase their odds of matching by participating in a research "arms race".[7-9]

As a result, many applicants elect to pursue one or more dedicated years of research before applying, typically between the 3rd and 4th y of medical school (MS). In a recent editorial, successfully matched applicants with a research year (RY) had significantly more total and first-author publications.[8] Dedicated time to increase research output is not the only potential benefit. Anecdotally, this endeavor may also help applicants earn more personalized letters of recommendation, form connections at regional and national meetings, and signal their long-term commitment to academic plastic surgery, which may contribute to a favorable match outcome.[6,9-11] However, the potential benefits must be weighed against the opportunity cost of an additional year of training, including an extra year of interest accrual on education loans, which averaged $205,037 for 2022 MS graduates.[12] Furthermore, as preresidency research output has an inconsistent impact on future academic productivity,[13,14] it may not be beneficial for all applicants to pursue more research at this stage in their career.

At this critical step in career planning, applicants have limited data to inform their decision to pursue a 1 y research experience. The purpose of the present study was to utilize institutional data to investigate the association between taking a dedicated RY and match outcomes in plastic surgery, and to identify which applicants benefit the most from taking a RY. This investigation is relevant not only to applicants considering a dedicated RY, but also to faculty mentors whom they approach for decision-making guidance and research fellowship directors aiming to select applicants with the greatest likelihood of becoming plastic surgeons.

## Materials and Methods

### *Inclusion/exclusion criteria*

Following institutional review board approval (STUDY-23-00102), all Electronic Residency Application Service (ERAS) applications to an integrated PRS residency program over five application cycles (2017/2018-2021/2022 cycles) were deidentified and included in the present study. A waiver of informed consent was obtained due to the nature of the data. International medical graduates, osteopathic medical students, repeat applicants, and those that completed more than one RY were excluded from analysis (Fig. 1). Repeat applicants were defined as students who had more than one ERAS application

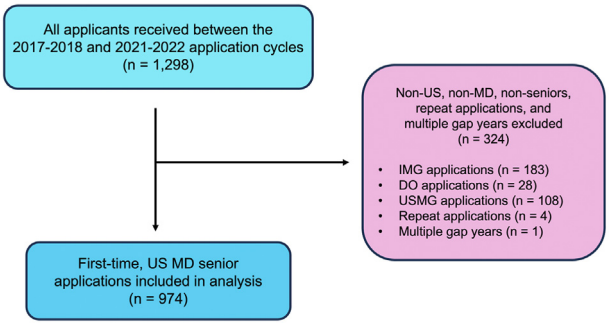


**Fig. 1 – Flow diagram showing application of inclusion and exclusion criteria. IMG = international medical graduate; DO = Doctor of Osteopathic Medicine; USMG = US medical graduate.**

to the present institution. The purpose of these exclusions was to analyze a homogenous cohort of first-time, US MD senior applicants.

### *Data collection*

Variables deemed relevant to an applicant's decision to pursue a RY and match were collected. These included gender, AOA honor society membership, USMLE Step 1 and 2 scores, advanced (Master or PhD) degrees, MS rankings, and MS affiliation with a home PRS program. Step 1 and 2 scores were further stratified by the cutoffs of 251 and 257, respectively, based on the average reported scores of matched applicants.[1] MS rankings were based on the 2023-2024 US News & World Report Best Medical School Research Rank[15] and categorized as follows: 1-25, 26-50, and >50. Apart from missing Step 1 ($n = 1$) and Step 2 scores ($n = 119$), all other variables were collected for all applicants.

Applicants were divided into RY and traditional groups. The RY group was defined by applicants who took an additional year of MS to conduct research at any point before applying. To identify RY applicants, the length of time in MS was calculated for each applicant based on their graduation and matriculation dates. Applicants with over 5 y in MS were excluded as multiple year RYs were outside the scope of the present study. The remaining applications of students who completed MS in 5 y were reviewed to determine the reason that MS was extended. The primary outcome was a successful match into an integrated PRS residency program. Match results were determined using online public sources including integrated plastic surgery residency websites, social media pages, and LinkedIn profiles. Applicants who matched into another specialty were considered to not have matched. Secondary outcomes included the total number of research presentations and publications reported in ERAS applications, as well as matching into a top 20 ranked integrated PRS residency program. Rankings of PRS integrated residency programs were based on Doximity rankings by reputation.[16]

### *Statistical analyses*

Demographics, application characteristics, MS characteristics, primary outcomes, and secondary outcomes of the RY

and traditional groups were compared using Chi-Square or Fisher's Exact tests for categorical variables. After performing Shapiro–Wilk's test of normality, continuous variables such as Step 1 score, Step 2 score, presentations, and publications were compared between groups using Mann–Whitney *U* tests. A Cochran-Armitage test was performed to determine if there was a significant trend in the number of female applicants and RY applicants over the period from 2017 to 2021. The relationship between taking a RY and matching was determined with multivariate logistic regression. Variables that differed significantly between RY and traditional groups such as AOA status, MS rank, above average Step 1 score, and above average Step 2 score were included in the model to control for potential confounders. The variable association of taking a RY for each applicant subgroup was assessed with multivariable logistic regression of interaction terms. Results of logistic regression models were presented as odds ratios (ORs) with 95% confidence intervals. Predicted probabilities were calculated using the logistic regression model for statistically significant ORs. A subgroup analysis was conducted of the RY group to compare characteristics between those who did and did not.

The association of the absolute number of publications with matching was assessed using logistic regression. To determine publication benchmarks, the total of number publications was also divided into subgroups: 0-4, 5+, 10+, 15+, and 20+ publications. The match rates for each publication category were compared between the RY and traditional groups using Chi-Square analysis or Fisher's Exact test. Multivariable logistic regression was also utilized to determine the association of matching within all of the publication categories when considering variables such as a RY, AOA status, MS rank, above average Step 1 score, and above average Step 2 score. A subgroup analysis of matched applicants was utilized to conduct a multivariable regression model assessing the association of RYs with matching into a top 20 integrated PRS residency program. The level of significance was set at $P \leq 0.05$. All statistical analyses were performed on IBM Statistical Package for Social Sciences (Version 29.0.1.0).

## Results

### *Applicant characteristics*

A total of 974 applications were analyzed after applying exclusion criteria (Table 1). Slightly more than half of applicants were male (52%) and came from lower-ranked MSs (>50 in US News rankings) (53%) without affiliated PRS home programs (26%). Of these applicants, 327 (34%) were AOA members. The median Step 1 and Step 2 scores were 247 (interquartile range [IQR] 238-255) and 254 (IQR 246-262) respectively and the overall match rate was 76%. Notably, the proportion of female applicants increased from 39% to 58% during the study period ($P = 0.003$). Other application characteristics stayed stable during this time (Table 2).

Of all applicants, 191 (20%) completed a RY while in MS. The percentage of applicants taking a RY has noted a modest increase from 19.1% to 24.1%, though this trend was not statistically significant over the 5-y period ($P = 0.11$) (Fig. 2). Applicants who completed a RY were more likely to attend a top 25 MS (43% *versus* 23%, $P < 0.001$) but less likely to be AOA members (25% *versus* 36%, $P = 0.003$). Applicants in the RY group had lower median Step 1 (242 [IQR 234-254] *versus* 248 [IQR 240-255], $P < 0.001$) and Step 2 scores (252 [IQR 243-259] *versus* 255 [IQR 246-262], $P = 0.003$) than the traditional group. Gender, affiliation with home PRS program, PhD, and other advanced degrees did not differ between applicants who did or did not take a RY.

### *Research year outcomes*

Applicants in the RY group had a higher match rate into a PRS residency program than traditional group applicants (83% *versus* 74%, $P = 0.008$). While the match rate in the RY group was generally higher than the traditional group throughout the study period (Fig. 2), the match rates between group were not significantly different except for in the 2018-2019 cycle (96% *versus* 79%, $P = 0.031$), corresponding with the cycle with the lowest percentage (16%) of RY applicants. Applicants in the RY group had significantly more research presentations (13 [IQR 7-25] *versus* 5 [IQR 3-9], $P < 0.001$) and publications (11 [IQR 7-19] *versus* 4 [IQR 2-8], $P < 0.001$) than those in the traditional group at time of application (Fig. 3). Applicants who had taken a RY had 1.7 higher odds of matching than those who had not (OR = 1.7, predicted probability 87% *versus* 79%, $P = 0.008$) (Fig. 4). The odds were 1.8 times after adjusting for differences in MS rank, AOA status, above average Step 1 score, and above average Step 2 score (OR = 1.8, $P = 0.016$).

Multivariable logistic regression analyses were performed to assess the association between completing a RY and matching outcomes for each applicant subgroup. The association of completing a RY with matching was consistent across applicants, regardless of their USMLE scores, AOA status, MS ranking, or MS's affiliation with an integrated plastic surgery residency program. A subgroup analysis of the RY group revealed that those that matched had higher median Step 1 (246 [IQR 237-255] *versus* 233 [IQR 224-244], $P < 0.001$) and Step 2 scores (253 [IQR 246-260] *versus* 241 [IQR 233-252], $P < 0.001$). Successfully matched RY applicants, also more frequently had above average Step 1 (47% *versus* 28%, $P = 0.048$) and Step 2 scores (34% *versus* 14%, $P = 0.037$) compared to those that did not match. Applicants who successfully matched also had a higher median number of publications (13 [IQR 7-20] *versus* 8 [IQR 4-8], $P = 0.002$) and presentations (15 [IQR 8-26] *versus* 10 [IQR 4-15], $P = 0.004$) than those that did not match. Other reported characteristics were similar between RY applicants who did and did not match (Table 3).

The association between completing an RY and matching was no longer significant after controlling for the total number of publications ($P = 0.64$), though the total number of publications was associated with higher odds of matching (OR = 1.1, $P < 0.001$). After dividing the number of publications into subgroups, applicants in the lowest category of four or less publications had a match rate of 66% while applicants in the highest category of 20 or more publications had a match rate of 90%. There were no differences in match rates between the RY and traditional group for any publication category ($P > 0.05$) (Table 4). The 10 or more publication category was

**Table 1 – Applicant characteristics in RY/traditional groups.**

| Category | Total | RY | Traditional | P value |
|---|---|---|---|---|
| Total applications | 974 (100) | 191 (19.6) | 783 (80.4) | – |
| Application cycle | | | | 0.286 |
| 2017, *n* (%) | 194 (19.9) | 37 (19.1) | 157 (80.9) | |
| 2018, *n* (%) | 174 (17.9) | 28 (16.1) | 146 (83.9) | |
| 2019, *n* (%) | 171 (17.6) | 29 (17.0) | 142 (83.0) | |
| 2020, *n* (%) | 219 (22.5) | 45 (20.5) | 174 (79.5) | |
| 2021, *n* (%) | 216 (22.2) | 52 (24.1) | 164 (75.9) | |
| Gender | | | | 0.860 |
| Male, *n* (%) | 508 (52.1) | 101 (19.9) | 407 (80.1) | |
| Female, *n* (%) | 466 (47.8) | 90 (19.3) | 376 (80.7) | |
| Medical school rank | | | | <0.001* |
| 1-25, *n* (%) | 265 (27.2) | 82 (30.9) | 183 (69.1) | |
| 26-50, *n* (%) | 196 (20.1) | 42 (21.4) | 154 (78.6) | |
| >50, *n* (%) | 513 (52.7) | 67 (13.1) | 446 (86.9) | |
| Medical school with home PRS program | | | | 0.187 |
| Yes, *n* (%) | 718 (73.7) | 148 (20.6) | 570 (79.4) | |
| No, *n* (%) | 256 (26.3) | 43 (16.8) | 213 (83.2) | |
| AOA membership status | | | | 0.006* |
| AOA member, *n* (%) | 327 (33.6) | 48 (14.7) | 279 (85.3) | |
| Non-AOA member, *n* (%) | 647 (66.4) | 143 (22.1) | 504 (77.9) | |
| PhD | | | | 0.482 |
| Yes, *n* (%) | 13 (1.3) | 1 (7.7) | 12 (92.3) | |
| No, *n* (%) | 961 (98.7) | 190 (19.8) | 771 (80.2) | |
| Other degrees | | | | 0.977 |
| Yes, *n* (%) | 123 (12.6) | 24 (19.5) | 99 (80.5) | |
| No, *n* (%) | 851 (87.4) | 167 (19.6) | 684 (80.4) | |
| Median step 1 score (IQR) | 247 (238-255) | 242 (234-254) | 248 (240-255) | <0.001* |
| Step 1 score category | | | | <0.001* |
| <251, *n* (%) | 435 (44.7) | 107 (24.6) | 328 (75.4) | |
| ≥251, *n* (%) | 538 (55.2) | 84 (15.6) | 454 (84.4) | |
| Median step 2 score (IQR) | 254 (246-262) | 252 (243-259) | 255 (246-262) | 0.003* |
| Step 2 score category | | | | 0.002* |
| <257, *n* (%) | 496 (58.0) | 106 (21.4) | 390 (78.6) | |
| ≥257, *n* (%) | 359 (42.0) | 47 (13.1) | 312 (86.9) | |
| Median number of publications (IQR) | 5 (3-10) | 11 (7-19) | 4 (2-8) | <0.001* |
| Median number of presentations (IQR) | 6 (3-11) | 13 (7-25) | 5 (3-9) | <0.001* |

Asterisks (*) indicate P values less than significance level (<0.05).
AOA = Alpha Omega Alpha; PRS = Plastic and Reconstructive Surgery; IQR = interquartile range; RY = research year.

the lowest category to have a significantly higher match rate than the overall cohort (81% *versus* 74%, $P < 0.001$).

Multivariable logistic regression analysis was performed to assess the association of taking a RY on matching overall after controlling for differences in publication category, AOA status, MS rank, above average Step 1 scores, and above average Step 2 scores. Having 15 or more (OR = 6.2, $P = 0.009$) or 20 or more publications (OR = 5.1, $P < 0.001$) was associated with the highest increased odds of matching overall compared to other factors such as AOA status (OR = 3.0, $P < 0.001$), 10 or more publications (OR = 2.6, $P = 0.009$), an above average Step 1 scores (OR = 2.3, $P < 0.001$), or five or more publications (OR = 1.7, $P = 0.009$) (Fig. 5). To determine the association of completing a RY on matching to a top 20 program, another multivariate regression analysis was performed in a subgroup of matched applicants (Fig. 6). Taking an RY was associated with 2.2 increased odds of matching into a top 20 program (OR = 1.8, $P = 0.016$), as were the two highest publication categories of 15 or more (OR = 2.6, $P = 0.006$) and 20 or more publications (OR = 4.1, $P < 0.001$). AOA status (OR = 2.5, $P < 0.001$) was also associated with increased odds of matching while attending middle (OR = 0.22, $P < 0.001$) or lower-ranked MSs (OR = 0.23, $P < 0.001$) decreased these odds.

**Table 2 – Application characteristics by application year.**

| Category | 2017 | 2018 | 2019 | 2020 | 2021 | P value |
|---|---|---|---|---|---|---|
| Total applications | 194 (19.9) | 174 (17.9) | 171 (17.6) | 219 (22.5) | 216 (22.2) | – |
| Research year | | | | | | 0.286 |
| Yes, *n* (%) | 37 (19.1) | 28 (16.1) | 29 (17.0) | 45 (20.5) | 52 (24.1) | |
| No, *n* (%) | 157 (80.9) | 146 (83.9) | 142 (83.0) | 174 (79.5) | 164 (75.9) | |
| Gender | | | | | | 0.012* |
| Male, *n* (%) | 118 (60.8) | 90 (51.7) | 96 (56.1) | 113 (51.6) | 91 (41.7) | |
| Female, *n* (%) | 76 (39.2) | 84 (48.3) | 75 (43.9) | 106 (48.4) | 125 (57.9) | |
| Medical school rank | | | | | | 0.459 |
| 1-25, *n* (%) | 51 (26.3) | 47 (27.0) | 57 (33.3) | 50 (22.8) | 60 (27.8) | |
| 26-50, *n* (%) | 39 (20.1) | 31 (17.8) | 28 (16.4) | 50 (22.8) | 48 (22.2) | |
| >50, *n* (%) | 104 (53.6) | 96 (55.2) | 86 (50.3) | 119 (54.3) | 108 (50.0) | |
| Medical school with home PRS program | | | | | | 0.554 |
| Yes, *n* (%) | 146 (75.3) | 122 (70.1) | 133 (77.8) | 160 (73.1) | 157 (72.7) | |
| No, *n* (%) | 48 (24.7) | 52 (29.9) | 38 (22.2) | 59 (26.9) | 59 (27.3) | |
| AOA membership status | | | | | | 0.200 |
| AOA member, *n* (%) | 43 (22.2) | 45 (25.9) | 52 (30.4) | 48 (21.9) | 53 (24.5) | |
| Non-AOA member, *n* (%) | 67 (34.5) | 68 (39.1) | 49 (28.7) | 80 (36.5) | 63 (29.2) | |
| PhD | | | | | | 0.676 |
| Yes, *n* (%) | 3 (1.5) | 4 (2.3) | 1 (0.6) | 2 (0.9) | 3 (1.4) | |
| No, *n* (%) | 191 (98.5) | 170 (97.7) | 170 (99.4) | 217 (99.1) | 213 (98.6) | |
| Other degrees | | | | | | 0.134 |
| Yes, *n* (%) | 29 (14.9) | 23 (13.2) | 13 (7.6) | 34 (15.5) | 24 (11.1) | |
| No, *n* (%) | 165 (85.1) | 151 (86.8) | 158 (92.4) | 185 (84.5) | 192 (88.9) | |

Asterisks (*) indicate *P* values less than significance level (<0.05).
IQR = interquartile range.

## Discussion

Many applicants to integrated PRS consider pursuing a year of dedicated research during MS to bolster their CVs. At this important phase of career planning, applicants and their mentors have limited data to guide the decision-making process. Herein, the present study provides the first comparison of match outcomes utilizing institutional ERAS applications for applicants with and without RYs over a 5-year period. In brief, the present study demonstrates that applicants who pursue a RY are 80% more likely to successfully match into an integrated PRS residency program. Furthermore, a RY has the strongest association with matching for applicants with otherwise competitive applications aiming to increase their number of publications or those aiming to match into a top 20 residency program.

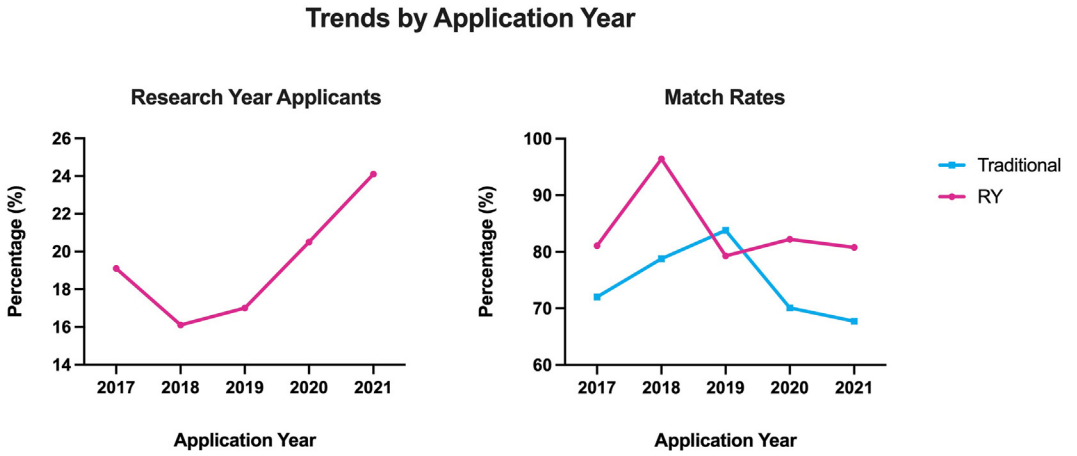


**Fig. 2 – Percentage of research year applicants by application year between the RY and traditional groups, by application year. RY = research year.**

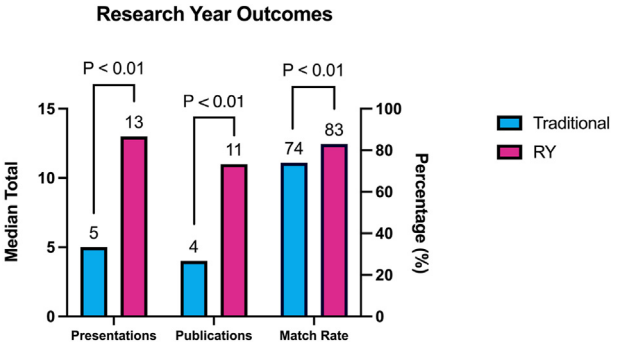


**Fig. 3 – Research presentations, publications, and match outcomes in RY/traditional groups. Median total values of presentations and publications were graphed. RY = research year.**

The findings of the present study align with prior literature demonstrating the importance of research output in the integrated plastic surgery match. According to National Residency Match Program (NRMP) data, successful PRS applicants have an average of 28.4 abstracts, publications, and presentations—the highest among all specialties.[1] Other studies have shown that PRS residents who pursued research fellowships have a higher number of first-author and overall publications than their non-RY counterparts.[7] Moreover, successful applicants increasingly have a higher number of publications,[17] which is also associated with matching at higher-tier programs.[8,18]

Building upon these insights, the current study reveals that the primary benefit of a dedicated RY for matching is the increased number of publications. Applicants with greater than 10 publications, regardless of taking a RY, had a higher match rate than the overall cohort. A recent analysis by Elemosho *et al.* demonstrated that match probability did not increase after 15 publications.[19] These results align with the present study, as applicants with 15 or more publications had higher odds of matching compared to those with 20 or more publications. Therefore, 10-15 publications may be the benchmark range to achieve before applicants begin experiencing diminishing returns on match outcomes. However, the present study additionally found that applicants with greater than 15 publications were significantly more likely to match into a top 20 PRS program. These odds were even higher for applicants with 20 or more publications, suggesting the greater value of research productivity to top 20 PRS programs. It is important to note that publication numbers in the present study include all publications listed on the ERAS application, which includes manuscripts under review.

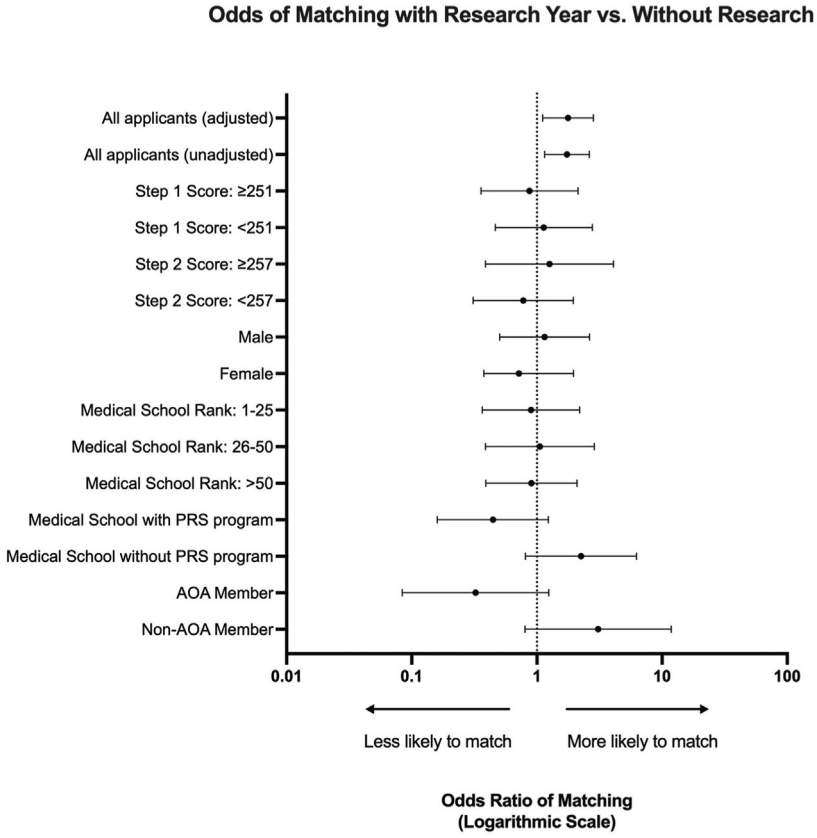


**Fig. 4 – Odds of matching in RY/traditional for each applicant subgroup. Applicant characteristics were not listed if there was insufficient sample size for logistic regression. Odds ratio and error bars demonstrating 95% confidence intervals were graphed. RY = research year.**

**Table 3 – Subgroup analysis of RY group comparing characteristics of applicants who matched *versus* those who did not match.**

| Category | Total | Match | Did not match | P value |
|---|---|---|---|---|
| Total applications | 191 (100) | 159 (83.2) | 32 (16.8) | |
| Application year | | | | 0.380 |
| 2017, *n* (%) | 37 (19.4) | 30 (18.9) | 7 (21.9) | |
| 2018, *n* (%) | 28 (14.7) | 27 (17.0) | 1 (3.1) | |
| 2019, *n* (%) | 29 (15.2) | 23 (14.5) | 6 (18.8) | |
| 2020, *n* (%) | 45 (23.6) | 37 (23.3) | 8 (25.0) | |
| 2021, *n* (%) | 52 (27.2) | 42 (26.4) | 10 (31.3) | |
| Gender | | | | 0.976 |
| Male, *n* (%) | 101 (52.9) | 84 (52.8) | 17 (53.1) | |
| Female, *n* (%) | 90 (47.1) | 75 (47.2) | 15 (46.9) | |
| Medical school rank | | | | 0.477 |
| 1-25, *n* (%) | 82 (42.9) | 71 (44.7) | 11 (34.4) | |
| 26-50, *n* (%) | 42 (22.0) | 35 (22.0) | 7 (21.9) | |
| >50, *n* (%) | 67 (35.1) | 53 (33.3) | 14 (43.8) | |
| Medical school with home PRS program | | | | 0.576 |
| Yes, *n* (%) | 148 (77.5) | 122 (76.7) | 26 (81.3) | |
| No, *n* (%) | 43 (22.5) | 37 (23.3) | 6 (18.8) | |
| AOA membership status | | | | 0.174 |
| AOA member, *n* (%) | 48 (25.1) | 43 (27.0) | 5 (15.6) | |
| Non-AOA member, *n* (%) | 143 (74.9) | 116 (73.0) | 27 (84.4) | |
| PhD | | | | 1.000 |
| Yes, *n* (%) | 1 (0.5) | 1 (0.6) | 0 (0.0) | |
| No, *n* (%) | 190 (99.5) | 158 (99.4) | 32 (100.0) | |
| Other degrees | | | | 0.563 |
| Yes, *n* (%) | 24 (12.6) | 19 (11.9) | 5 (15.6) | |
| No, *n* (%) | 167 (87.4) | 140 (88.1) | 27 (84.4) | |
| Median step 1 score (IQR) | 242 (234-254) | 246 (237-255) | 233 (224-244) | 0.004* |
| Step 1 score category | | | | <0.048* |
| <251, *n* (%) | 107 (56.0) | 84 (52.8) | 23 (71.9) | |
| ≥251, *n* (%) | 84 (44.0) | 75 (47.2) | 9 (28.1) | |
| Median step 2 score (IQR) | 252 (243-259) | 253 (246-260) | 241 (233-252) | <0.001* |
| Step 2 score category | | | | 0.037* |
| <257, *n* (%) | 106 (69.3) | 82 (65.6) | 24 (85.7) | |
| ≥257, *n* (%) | 47 (30.7) | 43 (34.4) | 4 (14.3) | |
| Median number of publications (IQR) | 11 (7-19) | 13 (7-20) | 8 (4-8) | 0.002* |
| Median number of presentations (IQR) | 13 (7-25) | 15 (8-26) | 10 (4-15) | 0.004* |

Asterisks (*) indicate *P* values less than significance level (<0.05).
IQR = interquartile range.

Interestingly, the association between RY applicants and successfully matching persisted after controlling for applicant characteristics that differed significantly between the two cohorts. In other words, pursing a dedicated RY was associated with a match advantage for applicants with otherwise equivalent CVs. A similar study in otolaryngology found that although RY applicants had more publications and presentations, they were not more likely to match, even after adjusting for other characteristics. Beyond research output, RYs may be associated with subjective unmeasured aspects of the application, such as mentorship and connections, that play a larger role in matching to plastic surgery than to specialties like otolaryngology. Particularly, after controlling for number of publications, these unmeasured aspects seem to be associated with a significant additional benefit toward matching to a top 20 residency program.

A key finding of this study was matched RY applicants more frequently had above average USMLE scores, indicating that a RY is most beneficial for those who already are competitive based on this traditional metric. Conversely, a RY may not sufficiently compensate for a less competitive score. These findings highlight concerns regarding the impact of RYs

**Table 4 – Match rates in RY/traditional groups by number of publications.**

| Number of publications | Total | RY | Traditional | P value |
|---|---|---|---|---|
| 0-4 publications, *n* (%) | 264 (65.8) | 17 (65.4) | 247 (65.9) | 0.960 |
| 5+ publications, *n* (%) | 234 (79.1) | 43 (79.6) | 191 (78.9) | 0.908 |
| 10+ publications, *n* (%) | 104 (81.3) | 27 (81.8) | 77 (81.1) | 0.923 |
| 15+ publications, *n* (%) | 65 (94.2) | 28 (93.3) | 37 (94.9) | 1.000 |
| 20+ publications, *n* (%) | 72 (90.0) | 44 (91.7) | 28 (87.5) | 0.707 |

RY = research year.

as USMLE Step 1 transitions to Pass/Fail reporting. With Step 2 scores expected to assume a more significant role,[6,20-22] the authors anticipate that the present findings can be extrapolated to Step 2 scores moving forward. Applicants will likely have to decide to pursue RYs based on their anticipated performance on the exam. Consequently, the research productivity and professional connections associated with RYs may become more important than ever in this evolving landscape.[6,23,24(p1),25,26] This study provides a baseline for future studies following 2024 match outcomes—the first cohort to be affected by this change.

The present findings have potential implications for various stakeholders. For medical students contemplating a RY purely for its match benefits, and their advisors, this insight can inform their decision-making, particularly considering the substantial time and financial investments involved.[10,27-30] A recent survey indicated that most PRS applicants who pursued a RY lacked funding and had parents with advanced degrees, highlighting the greater accessibility of RYs for applicants from higher socioeconomic backgrounds.[31] This may discourage applicants from lower socioeconomic backgrounds and perpetuate disparities in PRS applicants. The present study provides specific metrics to assess the utility of a RY that will discourage universal recommendations. Moreover, research fellowship directors can use this metric to evaluate how competitive potential applicants will be with a RY.

A limitation of using ERAS applications to establish an applicant's number of publications is the inclusion of publications still in the preparation, review, or publication process, potentially inflating publication benchmarks compared to previous studies solely including completed publications. However, the present approach may better reflect how program directors evaluate applicants. Using ERAS applications also avoids response bias present in survey-based reports. Furthermore, five application cycles were combined in the present study, as individual application cycles may have inadequate sample sizes to detect significant trends.

Repeat applicants, international medical graduates, and osteopathic medical students were excluded from this study to enhance the homogeneity of the population. These

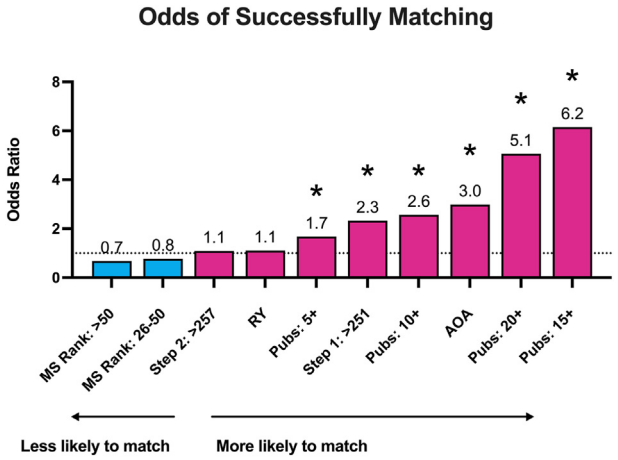


**Fig. 5 – Adjusted odds of successfully matching into an integrated PRS residency program. Odds ratios of all variables included in the multivariate regression model are graphed. Reference categories for nonbinary categorical variables were medical school rank (1-25) and publication category (0-4). MS = medical school; Pubs = publications. Asterisks (*) indicate *P* values less than significance level (< 0.05).**

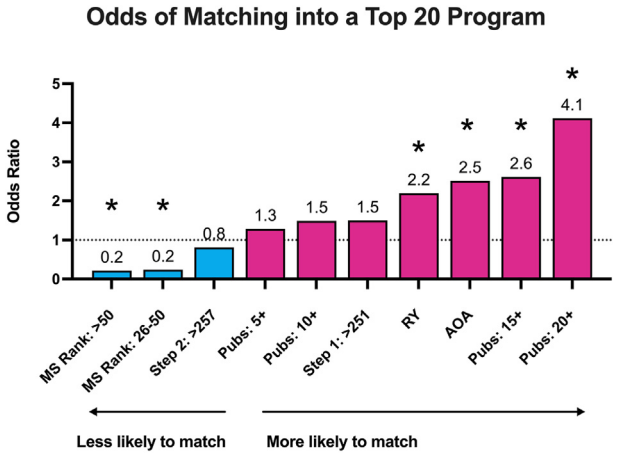


**Fig. 6 – Adjusted odds of matching into a top 20 integrated PRS residency program in a subgroup of matched applicants. Odds ratios of all variables included in the multivariate regression model are graphed. Reference categories for nonbinary categorical variables were medical school rank (1-25) and publication category (0-4). MS = medical school; Pubs = publications. Asterisks (*) indicate *P* values less than significance level (< 0.05).**

excluded groups are associated with unique factors that could skew the results and deviate from the experience of the majority group—first-time US MD seniors. Of the 1114 US MD seniors reported to have applied to an integrated PRS residency during this 5-y study period,[1] 87% were captured in this study after applying exclusion criteria. Therefore, though the study was based on ERAS applications to a single institution and did not include the Plastic Surgery Central Application, this study population constitutes a robust and representative sample of first-time US MS applicants from 2017 to 2021. Future studies should investigate how RYs impact the excluded applicant groups, as they constitute a valuable source of diversity within plastic surgery.

Overall, the findings of the present study will guide medical students and their mentors to make informed decisions when weighing the costs and benefits of pursuing an RY. Additionally, these findings offer research fellowship directors metrics to identify and select students who will derive the most benefit from their fellowship programs.

### *Conclusions*

Applicants who completed a RY were associated with a higher number of publications and had 80% higher odds of matching. RYs appear to be most associated with match success for applicants with otherwise competitive applications seeking to increase their publication numbers or to match into a top 20 residency program.

## Disclosure

None declared.

## Funding

Author Oleru was supported by the National Center for Advancing Translational Sciences (NCATS) TL1TR004420 NRSA TL1 Training Core in Transdisciplinary Clinical and Translational Science (CTSA).

This research otherwise did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## CRediT authorship contribution statement

**Carol Y. Wang:** Writing – review & editing, Writing – original draft, Visualization, Formal analysis, Conceptualization. **Joseph A. Mellia:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Lior Levy:** Data curation, Conceptualization. **Olachi Oleru:** Formal analysis. **Abena Gyasi:** Data curation. **Nargiz Seyidova:** Writing – review & editing, Supervision. **Peter E. Shamamian:** Data curation. **Keisha E. Montalmant:** Data curation. **Peter W. Henderson:** Writing – review & editing, Supervision. **Alice Yao:** Writing – review & editing, Supervision, Conceptualization. **Peter J. Taub:** Writing – review & editing, Supervision, Conceptualization.

## REFERENCES

1. Residency data & reports. NRMP. Available at: https://www.nrmp.org/match-data-analytics/residency-data-reports/. Accessed January 24, 2024.
2. Asserson DB, Sarac BA, Janis JE. A 5-y analysis of the integrated plastic surgery residency match: the most competitive specialty? *J Surg Res*. 2022;277:303–309.
3. Coombs DM, Kwiecien GJ, Sinclair NR, Zins JE. Supply and demand: resident applications to program positions in plastic surgery and our sister specialties. *Plast Reconstr Surg*. 2023;151:158e.
4. Abraham JT, Nguyen AV, Weber RA. Integrated plastic surgery residency applicant trends and comparison with other surgical specialties. *Ann Plast Surg*. 2018;80:164–170.
5. Wood JS, David LR. Outcome analysis of factors impacting the plastic surgery match. *Ann Plast Surg*. 2010;64:770–774.
6. Sarac BA, Janis JE. Matching into plastic surgery: insights into the data. *Plast Reconstr Surg Glob Open*. 2022;10:e4323.
7. Mauch JT, Onyekaba G, Mellia JA, Jou C, Fischer JP. The plastic surgery applicant's research arms race: is there a path forward? *Ann Plast Surg*. 2021;87:117.
8. Mellia JA, Jou C, Rathi S, et al. An in-depth analysis of research output in successful integrated plastic surgery match applicants and factors associated with matching at top-ranked programs. *J Surg Educ*. 2021;78:282–291.
9. Mehta K, Sinno S, Thanik V, Weichman K, Janis JE, Patel A. Matching into integrated plastic surgery: the value of research fellowships. *Plast Reconstr Surg*. 2019;143:640.
10. Galbraith LG, Avasarala VS, Jinka SKA, Collar J, Prassinos A. Plastic surgery research year: an equalizer or disparity? *Plast Reconstr Surg Glob Open*. 2023;11:e5102.
11. Brownstone ND, Mehta K, Sinno S. Completing a basic science research year before the integrated plastic surgery match. *Ann Plast Surg*. 2015;75:583.
12. Medical Student Education. Debt, costs, and loan repayment fact card for the class of 2023. Available at: https://store.aamc.org/medical-student-education-debt-costs-and-loan-repayment-fact-card-for-the-class-of-2023.html. Accessed February 11, 2024.
13. Jinka SKA, Sarac BA, Seaman AP, Fry SL, Huayllani MT, Janis JE. Trends in integrated plastic surgery applicant, resident, and junior attending research productivity. *J Surg Res*. 2023;285:129–135.
14. Murphy AI, Mellia JA, Diatta F, Klifto KM, Morris MP, Fischer JP. A sign of things to come: training research output long-term scholarship in academic plastic surgery. *Aesth Plast Surg*. 2021;45:3022–3028.
15. The best medical schools for research, ranked. Available at: https://www.usnews.com/best-graduate-schools/top-medical-schools/research-rankings. Accessed February 1, 2024.
16. Doximity residency navigator. Doximity. Available at: https://www.doximity.com/residency/programs?specialtyKey=2807bb9a-8f20-4502-8879-139c0023bbb2-plastic-surgery-integrated&sortByKey=reputation&trainingEnvironmentKey=&intendedFellowshipKey=. Accessed June 8, 2024.
17. Ngaage LM, Elegbede A, McGlone KL, et al. Integrated plastic surgery match: trends in research productivity of successful candidates. *Plast Reconstr Surg*. 2020;146:193–201.
18. Ward B, Ravikumar V, Betti S, et al. How many manuscripts: an analysis of medical student publications in the integrated plastic surgery match. *J Plast Reconstr Aesthet Surg*. 2020;73:983–1007.
19. Elemosho A, Sarac BA, Janis JE. The law of diminishing returns in the integrated plastic surgery residency match: a deeper look at the numbers. *Plast Reconstr Surg Glob Open*. 2024;12:e5937.

20. Cen N, Davis MJ, Abu-Ghname A, et al. Changing United States medical licensing examination step 1 to pass/fail: anticipated ramifications for plastic surgery residency applicants and programs. *Plast Reconstr Surg*. 2020;146:846e–847e.
21. Sergesketter AR, Shammas RL, Langdell HC, et al. Predicting academic performance during plastic surgery residency: can step 2 scores reliably replace step 1? *J Surg Educ*. 2022;79:828–836.
22. Rajesh A, Asaad M, Sridhar M. Binary reporting of USMLE step 1 scores: resident perspectives. *J Surg Educ*. 2021;78:304–307.
23. Powell MS, Rhodes LL, Gonzalez S, Mehta ST. Expected impact of the pass/fail scoring system for USMLE step 1 on the plastic surgery residency selection process: a national survey of plastics program directors. *Cureus*. 2022;14:e29411.
24. Girard AO, Khoo KH, Lopez CD, et al. USMLE step 1 Pass/fail is here: are plastic surgery applicants really better off? *J Surg Educ*. 2023;80:448–456.
25. Manstein SM, Laikhter E, Kazei DD, Comer CD, Shiah E, Lin SJ. The upcoming pass/fail USMLE step 1 score reporting: an impact assessment from medical school deans. *Plast Surg (Oakv)*. 2023;31:169–176.
26. Mellia JA, Fontana SC, Gopman JM, Taub PJ. For what it's worth: medical school reputation in the integrated plastic surgery match. *J Surg Educ*. 2022;79:562–564.
27. Mellia JA, Mauch JT, Broach RB, Butler PD. Moving the goalposts: inequity concerns regarding research years and the integrated plastic surgery match. *Plast Reconstr Surg*. 2021;148:1086e.
28. Shih S, Mellia J, Murphy AI, Drolet BC. Accelerated medical school curricula and plastic surgery applicants: balancing financial, research, and clinical considerations. *J Plast Reconstr Aesthetic Surg*. 2022;75:3877–3903.
29. Diatta F, Mellia JA, Morris MP, et al. Closing the gap: training experiences and career outcomes for underrepresented minorities in plastic surgery. *Plast Reconstr Surg Glob Open*. 2022;10:e4300.
30. Murphy AI, Mellia JA, Iaconetti EK, et al. Disparities in research during plastic surgery training: how can we level the playing field? *Plast Reconstr Surg Glob Open*. 2022;10:e4301.
31. Lin LO, Huttinger AL, Butler P, Gosman AA, Janis JE. Socioeconomic disparities in research participation: bias in plastic surgery residency match. *Plast Reconstr Surg Glob Open*. 2024;12:e5565.