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Characteristics of Successful Integrated Plastic Surgery Applicants from US Allopathic Medical Schools without a Home Integrated Program

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OBJECTIVE: Integrated plastic surgery (PS) is one of the most competitive residency programs, but current literature lacks data specific to matched applicants from medical schools without home integrated PS residency programs (NHP). Therefore, there is a need to examine this specific demographic of applicants to identify key factors that led to a successful match.

DESIGN: An anonymous survey was sent to PS residents who graduated from US allopathic medical schools with NHP. Survey questions focused on applicants' objective statistics (USMLE scores, research experiences, etc.), as well as various other factors, including access to resources and letters of recommendation.

SETTING: All US-based integrated plastic surgery residency programs.

PARTICIPANTS: PGY-1 through PGY-6 integrated PS residents who graduated from US allopathic medical schools with NHP.

RESULTS: The survey was distributed to 178 NHP residents from May to June of 2021, achieving a 55.1% response rate. Thirty-seven percent attended an institution with an independent, but not integrated, residency program. Average USMLE Step 1 and 2 scores were 248 ± 10.1 and 256 ± 9.7, respectively. Respondents reported having 9.8 ± 9.5 abstracts, presentations, and publications listed on their residency applications. NHP applicants had an average of 1.5 letters of recommendation written by away rotation faculty. Forty-five percent reported accessing resources at institutions with home integrated residency programs (HP), 55.6% of whom "strongly agreed" or "agreed" that this significantly helped in matching.

CONCLUSION: The USMLE Step scores and research experiences of NHP residents are similar to those which are reported among all matched applicants nationally. NHP respondents optimized their success by utilizing plastic surgery-related resources at their own institutions, while often seeking resources at other institutions. (J Surg Ed 000:1−7. © 2021 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Home program, Survey, Plastic surgery, Residency, Integrated, Medical education

COMPETENCIES: Medical Knowledge, Interpersonal and Communication Skills, Practice-Based Learning and Improvement

INTRODUCTION

Integrated plastic surgery (PS) is one of the most competitive residency programs in the National Resident Matching Program (NRMP), with a match rate of 45% in 2020.[1−3] Previously, completion of a prerequisite residency was required to matriculate into a plastic surgery residency, which still holds true for the independent training pathway today. This changed in 1960 with the implementation of the first integrated program at Stanford University, allowing trainees to pursue PS

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immediately after graduating from medical school.[4] Similar integrated programs have since become the mainstay of the PS training model. There are currently 978 trainees in the integrated pathway (83.9%) and 187 in the independent pathway (16.1%).[5,6] Though the number of available integrated residency positions grew by 65.2% from 2008-2016,[7] to date, the volume of applicants continues to exceed the capacity available for PS trainees, with even worse outcomes for reapplicants.[8] In the 2020-2021 application cycle, a total of 416 applicants campaigned for 187 positions across 85 residency programs.[2,3]

With the relatively low match rate, it is no surprise that PS applicants are some of the most accomplished medical students. Not only did they report the highest United States Medical Licensing Examination (USMLE) Step 1 scores and tie with dermatology and otolaryngology trainees for the highest Step 2 scores in 2020, but incoming PS trainees also boast extensive research accomplishments and Alpha Omega Alpha (AOA) membership rates.[1] With such a highly qualified set of candidates, it becomes challenging to objectively identify advantages that one applicant may have over another. This places a greater emphasis on the quality and weight of applicants' letters of recommendations, as well as on their performance during away rotations (a measure of "apparent fit"), and potential geographic bias.[8–10] Students with no home integrated PS residency program (NHP) may have fewer experiences with plastic surgeons at their institutions; therefore, NHP applicants may be presented with fewer opportunities to build strong relationships with PS mentors and establish familiarity with integrated programs, which will prove to be imperative with the USMLE Step 1 pass/fail transition.[11] Ultimately, NHP students may be challenged with having fewer and/or weaker letters of recommendation, fewer opportunities for PS-related research, and less impressive extracurriculars.

While previous research reveals the gravity of certain components of a candidate's application, there is a paucity of data characterizing the various attributes of NHP applicants who successfully matched into PS residency programs. The objective of this study is to elaborate on their qualifications and to review factors that are believed to facilitate a successful match process for a NHP applicant.

METHODS

Participant Identification and Recruitment

Each integrated program's resident profile page was obtained via FREIDA (American Medical Association) and cross-referenced with Accreditation Council for Graduate Medical Education, confirming a total of 85 integrated PS programs in April 2021.[12] All current integrated PS residents who graduated from an allopathic medical school with NHP were identified as eligible candidates, and residents who graduated from schools with an integrated home PS program (HP) were excluded. Participants were excluded if they graduated from an osteopathic or international medical school, if there was a gap between graduating medical school and beginning residency, and if they completed additional training before entering a PS residency.

Contact information was obtained for eligible participants using the following resources: integrated programs' resident profile pages, residency institution directories, medical school directories, Doximity, PubMed, ResearchGate GmbH, Linkedin, ACS Surgeon Finder, and Google. A search process yielded email addresses for 183 eligible participants, and a list was compiled in Microsoft Excel (Microsoft Corp. Redmond, Washington). A final population size of 178 was determined as 5 of the email accounts were undeliverable.

Survey and Data Analysis

The survey was created using SurveyMonkey (surveymonkey.com, Palo Alto, California) with branching logic and included a total of 34 questions. Depending on individual responses, the length of the survey varied. The survey, along with a cover letter, was distributed to residents electronically via email addresses collected previously. The survey link remained for 21 days from May to June of 2021 with two follow-up emails during this period. No survey questions were required, resulting in fewer responses for some questions than there were total participants, as clarified in the results. A copy of the survey is shown in Appendix 1. All data are descriptive in nature. Data are presented as mean ± SD or percent of the number of respondents who answered that question. Comparisons were drawn against average matched applicants in 2016, 2018, and 2020, available through NRMP's biennial Charting Outcomes in the Match report.[1,13,14]

RESULTS

Response Rate and Respondent Demographics

The survey was distributed to 178 residents who met inclusion criteria, 98 of whom responded (55.1% response rate). The total subject pool for this study ultimately included 93 participants, as 5 did not meet inclusion criteria (1 international medical graduate, 4 with postgraduate research, 1 with partial training in another discipline, and 1 did not complete screening questions).

TABLE 1. Respondents Classified by Post Graduate Year (PGY), Additional Degree, and Availability of an Independent Program

Post Graduate Year	Answered: 93	(%)
PGY-1	13	14.0
PGY-2	13	14.0
PGY-3	26	28.0
PGY-4	15	16.1
PGY-5	10	10.8
PGY-6	16	17.2
Additional Degree	**Answered: 76**	**(%)**
Yes	17	22.4
No	59	77.6
Independent Program	**Answered: 75**	**(%)**
Yes	28	37.3
No	47	62.7

Respondents classified by post graduate year (PGY), additional degree, and availability of an independent program.

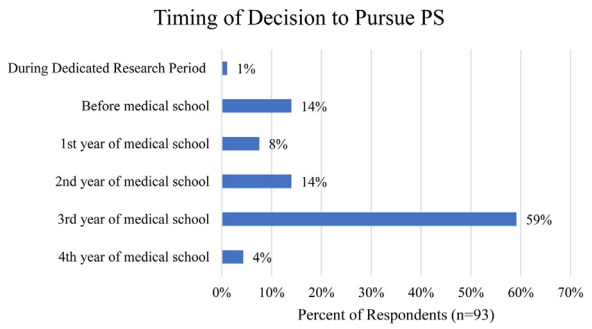

FIGURE 1. This figure depicts the timepoint in which NHP residents decided they would pursue plastic surgery (PS) as a career.

Postgraduate year-3 residents were the most likely to respond (28%), followed by postgraduate year-6 residents (17.3%) (Table 1). The majority (59.1%) of respondents reported that they became determined to pursue PS during their 3rd year of medical school (Fig. 1). Those who either decided in their second year or prior to medical school each accounted for 14% of responses. A second degree was present in 22.4% of respondents.

Respondent NRMP Statistics

Average self-reported USMLE Step 1 and 2 scores were 248 ± 10.1 and 256 ± 9.7, respectively. All (100%) respondents passed Step 2 CS on their first attempt. Fifty percent of respondents were AOA members at the time they applied for residency. Respondents reported having an average of 5.8 ± 3.6 research experiences and 9.9 ± 9.5 total abstracts, presentations, and publications. Of the research items, 48.6% of each individual's respective sum of abstracts, presentations, and publications were PS-related. Results also showed an average of 4.6 ± 2.6 work experiences and 6.6 ± 4.1 volunteer experiences for NHP respondents. The breakdown revealed an increasing amount of abstracts, presentations, and publications across the 3 timepoints, with a significant jump from 5.7 and 8.7 items in 2016 and 2018, respectively, to 18 items in 2020. Additionally, all other NRMP statistics of the NHP group are compared to the average applicant group (Table 2).[1,13,14]

Away Rotations, Residency Applications, & Interviews

NHP students participated in an average of 2.9 ± 1.0 away rotations. They applied to 65.5 ± 14.1 PS residency programs and received an average of 17.8 ± 9.5 interviews. In 2020, NHP applicants applied to an average of 79.2% of available integrated programs, which is lower than was reported in previous years (Table 3). NHP applicants were invited to interview at 80.1% of the sites at which they performed away rotations.

TABLE 2. A Direct Comparison of No Home Integrated PS Program (NHP) Respondent Data Versus Charting the Outcome National Residency Match Program (NRMP) Statistics for the years 2016, 2018, 2020

Average	2016		2018		2020	
	NRMP	NHP	NRMP	NHP	NRMP	NHP
USMLE Step 1	250	250	249	251	249	252
USMLE Step 2	256	262	254	259	256	255
Research Experiences	4.6	4.6	5.4	5.3	5.9	6.3
Abstracts, Presentations, & Publications	11.9	5.7	14.2	8.7	19.1	18
Work Experiences	3.3	3.7	3.5	4.9	3.7	4.6
Volunteer Experiences	7.1	5.1	7.5	7.9	8.7	7.3
AOA Membership (%)	52.4	62.5	44.5	62.5	43	50

A direct comparison of no home integrated PS program (NHP) respondent data versus Charting the Outcome National Residency Match Program (NRMP) Statistics for the years 2016, 2018, 2020.

TABLE 3. The Average Number of Integrated Plastic Surgery (PS) Programs Applied to by No Home Integrated PS Program (NHP) Respondents Divided by Quantity of Programs Available for the Years 2016, 2018, 2020

	2016	2018	2020
Programs Applied	61.3	66.5	66.5
Programs Available	69	77	84
Percent Applied to	88.8%	86.4%	79.2%

The average number of integrated plastic surgery (PS) programs applied to by no home integrated PS program (NHP) respondents divided by quantity of programs available for the years 2016, 2018, 2020.

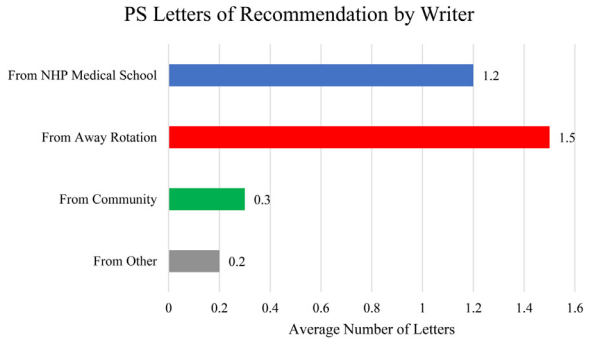

FIGURE 2. Plastic surgery (PS)-specific letters of recommendation are categorized into 4 types based on the background of the letter writer. The average breakdown per applicant is displayed.

Letters of Recommendation

Of respondents' letters of recommendation, 3.0 ± 0.9 letters were written by a plastic surgeon. When conducting a comparison of respondents' PS-specific letters only, they were categorized into four types based on the background of letter writers (Fig. 2). The average breakdown per applicant is as follows: 1.2 letters from NHP medical school faculty, 1.5 from away rotation faculty, 0.3 from plastic surgeons in the community, and 0.2 from "other" plastic surgeons (Fig. 2). Of the 12 "other" letters reported, 50% were written by a plastic surgeon with whom the respondent performed research. If an independent PS program was available to the student (37.3%), an average of 1.9 ± 0.8 of the applicant's letters came from that program.

Dedicated Research Period

Thirteen percent of respondents reported that they participated in a research fellowship or other dedicated period for PS research, and within that group, 10.7% of them did so during a leave of absence from medical school. Of the 7 individuals with dedicated research time at an HP institution, all applied to the integrated residency program at their research institutions. Only 1 was not offered an interview at that institution (14.3%), 5 were offered an interview there but did not match (71.4%), and 1 successfully matched at that program (14.3%). Of the respondents who participated in a dedicated research period, 100% "strongly agreed'' that it played a significant role in their success with matching.

Access to Plastic Surgery Resources and Perceived Efficacy

Thirty-seven percent of respondents attended a medical school that had an independent, but not integrated, PS residency program. Eighty-nine percent of those individuals were successful in accessing PS resources (plastic surgery-specific research, clinical opportunities, networking, and/or mentoring) at their home independent programs. 46 percent "strongly agree" and 32.1% "agree" that accessing resources through their institution's independent program played a significant role in their success with matching. The majority (51.9%) of those with an independent PS program agreed (25.9% strongly agree, 25.9% agree) that they felt the need to reach out to faculty at another institution's integrated program for additional resources, and 22.2% - 14.8% "disagree" and "strongly disagree," respectively.

Of those NHP respondents without an independent program at their school, 63.8% of participants reported that they were able to access PS-related resources at their medical schools. Additionally, 44.7% found that they were able to access resources at an HP institution. Forty-four percent of this group "strongly agree" and 11.1% "agree" that accessing resources at an integrated program played a significant role in success with matching.

DISCUSSION

This study investigates the population of PS applicants who graduated from US MD schools with NHP, which currently constitutes 18.7% of the total integrated resident population, examining their qualifications and identifying key factors that were found to be beneficial towards a successful match.[5] This information is pivotal, as the presence of a HP is correlated with an increased number of interviews for an applicant [15] and a higher probability of matching at their first-choice program.[16] Furthermore, program directors indicate that prior knowledge of an applicant carries great importance in selecting applicants to interview in the future — an advantage more accessible to HP applicants.[17]

Applicants who successfully matched to PS and otolaryngology routinely have the highest mean USMLE Step 1 and Step 2 CK scores.[5] Within PS specifically, high USMLE Step 1 scores correlated with an increased number of interview invitations.[11,15,18] An analogous study

performed on the otolaryngology match shows no statistical significance between applicants who did and did not have a HP with regards to their USMLE scores.[16] NHP respondents demonstrate high average USMLE Step 1 and 2 scores (248 and 256, respectively), which approximately match the NRMP average scores for successful integrated plastic surgery applicants in 2016, 2018, and 2020 (Table 2).[1,13,14] It has been shown that success in matching can be highly dependent on the prestige of one's medical school, and therefore, on the academic support and competitive learning environment that is fostered within the institution.[19] The objective of future research could seek to delineate whether the prestige of a school, which may represent the challenging environment it promotes, is involved in the establishment of an integrated PS program.

Though NHP applicants reported USMLE Step 1 and 2 scores comparable to those of average applicants, there is a discrepancy in the rate of AOA membership between the two cohorts. Successful AOA designation has been proven to increase interview rates of PS applicants and is a substantial factor in successfully matching into a surgical specialty like plastic surgery.[7,9,15] Currently, there are more AOA chapters that have been established at HP institutions (84%) than at NHP institutions (72%), though this difference was not statistically significant ($p = 0.072$).[20] This increased opportunity for AOA membership could theoretically provide an advantage to those with a HP. However, from our results, NHP respondents held AOA membership more often than the average applicant by 10.1%, 18%, -7% in 2016, 2018, and 2020, respectively (Table 2).[1,13,15] This higher rate of AOA membership among the NHP applicant pool may suggest AOA membership holds more weight for NHP applicants in matching as compared to HP applicants.

A salient point of our results is that 63.8% of participants reported that they were able to access PS-related resources at their NHP medical school. Despite this, however, 44.7% connected with PS faculty at a HP institution. Additionally, those with an independent PS home program also contacted faculty at another institution's integrated HP for additional resources (25.9% "strongly agree" and 25.9% "agree"). These data suggest that applicants from NHP institutions were not satisfied with the amount of resources available at their home institutions. Away rotations, alternatively, bridge this gap. The analogous study performed on applicants for the otolaryngology match process found that NHP students participated in more away rotations than HP students.[16] Previous studies investigating PS away rotations have shown that almost all applicants and program directors believe an away rotation made an applicant more competitive for matching to a program.[9,21] The average applicant participated in 2.3 away rotations.[21] In contrast, this survey demonstrated, on average, NHP students participated in 2.9 away rotations and were subsequently invited to interview at 80.1% of these sites.

Through these avenues, PS mentorship and letters of recommendation can be requested. Mentorship in its various forms has been demonstrated to influence students' decisions to pursue PS in 80% ,[22,23] although not analyzed in our survey. We did question respondents on their letters of recommendation, as when they are high quality, letters are considered one of the most important factors in selecting PS residents[9,10] and are projected to become more important as Step 1 becomes pass/fail.[18] For NHP students, most letters were written by faculty members from away rotations (1.5 from away rotation, 1.2 from NHP school). Given that NHP applicants may rely more heavily on letters from away rotations than HP students, there could be a concern that a shorter period of interaction might lead to a weaker letter. The added value in obtaining a letter from PS faculty at these away sites is that they more frequently evaluate plastics-oriented students, given that they are constantly assessing trainees at their residency programs. Home program aside, if an independent PS program was available to the student, an average of 1.9 of the applicant's letters came from faculty at that program.

In reference to research accolades, applicants who successfully matched into PS have demonstrated notably high mean research productivity.[7] Authorship of one or more publications has been associated with receiving a greater number of interview invitations.[15] Survey respondents reported having an average of 9.9 total abstracts, presentations, and publications, which is comparable to the reported experiences of the average PS applicant.[1,13,15] When comparing NHP to the NRMP averages across 3 timepoints, there was a clear disparity in research productivity between the 2 groups in 2016 and 2018, with NHP applicants reporting 6.2 and 5.5 fewer abstracts, presentations, and publications in 2016 and 2018, respectively (Table 2). Interestingly, a much smaller gap was identified in 2020, at which time NHP applicants reported 18 of these items and the average group reported 19.1. Additionally, of their research items, an average of 48.6% of applicants' abstracts, presentations, and publications were PS-related. This proves that, despite fewer PS resources and, for many, a delayed exposure to the field, many NHP respondents were still able to successfully engage in research, and furthermore, to do so within PS.

LIMITATIONS

Our paper is not without its limitations. Some NHP residents were excluded from the study if they did not

match directly into an integrated PS program, whether due to an initial unsuccessful match or to a transfer from another residency program. Inclusion of applicants who may be less competitive may have driven down our NHP group's applicant statistics and mischaracterized the attributes of a successful first-time applicant. Furthermore, we labeled residents as having had a HP based on the 85 PS residency programs that existed in 2020. With only 67 programs in 2015, it is possible that some respondents attended an institution that established a HP between 2015 and 2020. These individuals are likely to have a profile that aligns more with that of an applicant with a HP, and thus, were likely exposed to an increased amount of resources at their home institution than other NHP applicants. Additionally, we recognize that data from the surveyed NHP cohort is self-reported, in comparison to NRMP data that was confirmed via score reports, which may account for some error or bias.

Potentially the most significant factor excluded in our analysis is an applicant's interview performance. The interview is an opportunity for program directors, faculty, and current residents to evaluate an applicant's fit for the program, and it has demonstrated significant importance in a program's preferences in ranking applicants.[9,21] Interactions and performance during interviews may yield benefits to an applicant's profile in the same manner that away rotations or letters of recommendations do. Also, with regard to letters of recommendation, this study did not account for the differences among applicants submitting standardized letters per ACAPS, formal written letters, or both.

Lastly, it would have been optimal to compare NHP vs. HP directly, but with significant concern of a low response rate from the HP cohort, it was decided to survey NHP residents exclusively. Additionally, statistical analyses in comparing NHP results to NRMP averages could not be performed, as only biannual data is available from NRMP, and NHP residents are included within the NRMP dataset.

CONCLUSION

As the first of its kind, this study has satisfied the paucity of data that characterizes academic achievements of applicants from medical schools with NHP in relation to a successful match in PS. The USMLE Step scores and research experiences of NHP residents are not strikingly different from those of applicants with a HP. The survey findings also identify the importance of certain factors that may have contributed to their success in the NRMP. These factors specifically involve taking advantage of PS-related resources at one's NHP or home independent PS program, accessing resources at HP institutions, and participating in away rotations.

AUTHOR CONTRIBUTION'S

Charles A. Keane, BS - study conceptualization, data acquisition, statistical analysis/interpretation, manuscript drafting, revision, and submission.

Maheen F. Akhter, BS - study conceptualization, data acquisition, statistical analysis/interpretation, manuscript drafting, revision, and submission.

Benjamin A. Sarac, MD – study conceptualization, data acquisition, statistical analysis/interpretation, manuscript drafting, revision, and submission.

Jeffrey E. Janis, MD - study conceptualization, critical portions of data analysis, drafting, revision, and submission.

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SUPPLEMENTARY INFORMATION

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