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A strategic evidence-based framework for international medical graduates (IMGs) applying to dermatology residency in the United States: a literature review

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Abstract

Dermatology is one of the least diverse medical fields, partly owing to the low number of international medical graduates that apply and match to dermatology residency programs in the United States each year. Our objective was to determine and outline the factors that can increase competitiveness of international applicants interested in applying to dermatology residency in the U.S. Higher match rates for IMGs were associated with several applicant-dependent characteristics, including higher USMLE scores, higher research participation and numbers of publications, strong recommendation letters, and dermatology rotations. Although states with a greater number of dermatology residency positions (New York, Massachusetts, and California) had more IMGs matched from 2013 to 2018, certain states with a smaller number of residency positions, namely Colorado and Georgia, had the highest dermatology match rates for IMGs when adjusted for the total number of matched applicants. Evidence-based application guidance for international applicants, as outlined in this literature review, may improve the competitiveness of IMGs and increase diversity within the field of dermatology. Rotating and applying to dermatology residency programs in states that have historically accepted a higher number of IMGs may further improve the applicants' chances of matching into a dermatology residency.

Keywords: international medical graduates, international, student, dermatology, residency, applicant, selection,

match, strategy, framework, advice, apply, factors, diversity, mentor, fellowship.

Introduction

Efforts are being made to increase physician diversity in the field of dermatology. This highly competitive field ranks as the second least diverse medical specialty in the United States (U.S.), [1]. Importantly, dermatology has consistently been amongst the specialties with the least number of international medical graduates (IMGs). Since IMGs substantially contribute to the diversity of U.S. physicians [2], this unrecognized problem may be negatively affecting physician diversity in dermatology. We believe the low number of IMG applicants and match rates in dermatology is at least partly related to the lack of reliable information, mentoring, and guidance available for IMGs [3]. Although there is published literature advising candidates on how to successfully match into dermatology, it mainly applies to American medical graduates (AMGs), [4-10].

The primary goal in this study was to determine and outline the factors that can increase competitiveness of international applicants interested in applying to dermatology residency in the U.S. The secondary goal was to provide reliable data and evidence-based guidance to help IMGs prepare for the challenging dermatology residency application process. We hope our work will help increase the number of IMG applicants in dermatology and

improve physician diversity in the dermatology workforce.

Methods

This study was a literature review performed in 2018. It was exempt of IRB approval as the reviewed literature and the National Resident Match Program (NRMP) match data and reports are publicly available. Permission was obtained from NRMP to use match data and reports.

Literature selection

Searches in MEDLINE via PubMed interface and Google scholar were performed in October of 2018 using the following combination of pre-specified keywords: dermatology, applicant, fellowship, residency, selection, criteria, factors, match, advice, strategy. References from identified articles were searched for other relevant articles and critically evaluated by the authors for potential inclusion. Articles were excluded if they were not written in English and if published before 2007. A total of 39 articles were identified and 28 were included.

Data extraction

Match data was extracted from NRMP Main Residency Match Results by state, specialty, and applicant type from 2013 to 2018. Charting Outcomes in the match and the NRMP Program Director (PD) Survey Reports were also utilized for 2014, 2016, and 2018. Our study divided applicants as AMG, IMG, or osteopathic. AMGs included senior

students (U.S. senior) and previous graduates of U.S. allopathic medical schools, whereas IMGs included U.S. and non-U.S. citizen students and graduates of international medical schools (i.e., medical schools outside of U.S., Canada, and Puerto Rico). Osteopathic applicants were classified as those who attended a school of osteopathic medicine in the U.S. Candidates ranked dermatology programs accredited by the Accreditation Council for Graduate Medical Education (ACGME) in at least one of the following three positions: categorical, advanced, and physician. For a detailed description of each position, refer to the NRMP archives [3, 11].

Results

The general profile of matched dermatology applicants

As credentials of the average dermatology applicant continue to annually improve, the selectiveness of residency programs has similarly increased [6]. From 2007 to 2018, the mean United States Medical Licensing Examination (USMLE) scores of U.S. seniors who preferred and matched to a dermatology residency has gradually increased from 238 to 249 for Step 1 and from 242 to 256 for Step 2 Clinical Knowledge; the mean number of research experience for U.S. seniors increased from 3.4 to 5.2; and the mean number of abstracts, presentations, and publications increased from 5.7 to 14.7 [11, 12]. In 2016, IMGs who preferred and matched into a dermatology residency had lower mean USMLE scores and greater mean number of abstracts,

Table 1. The General Profile of Matched Dermatology Applicants in 2016

Measure	AMGs ^a (n=339)	U.S. IMGs (n=5)	Non-U.S. IMGs (n=9)
Mean USMLE Step 1 score	249	236	238
Mean USMLE Step 2 CK score	257	232	242
Mean number of research experiences	4.7	16.8	2.3
Mean number of abstracts, presentations and publications	11.7	16.5	25
Mean number of work experiences	3.1	5.3	2.8
Mean number of volunteer experiences	10.1	3.5	6.2
PhD degree	27	0	1

^aIncludes only matched U.S. senior medical students.

presentations, and publications compared to AMGs (see **Table 1**), [3, 13].

Nationwide analysis of the dermatology match outcomes from 2013 to 2018

Most residency applicants who ranked dermatology for residency are AMGs; osteopathic students/graduates and IMGs represent a minority of the applicant pool and total matches [3, 14-19]. Of the 2571 dermatology positions filled from 2013 to 2018, only 88 (3.4%) were IMGs (see **Figure 1**), [3, 14-19]. In 2016, a total of 614 applicants ranked dermatology, among whom 43 (7%) were IMGs. Of the 43 IMG applicants, 18 were able to match (match rate: 42%), [3]. Nonetheless, this match rate may be an overestimate as IMG candidates who did not receive an interview might not have entered the match. In the same year, a total of 467 U.S. senior applicants preferred and ranked dermatology and 360 matched (match rate: 77%), [13].

For AMGs, the percentage of total matches in dermatology has slowly decreased from 97.0% in 2013 to 92.4% in 2018 [14-19], which could represent a new trend towards increased osteopathic and IMG matches. Osteopathic candidates saw a doubling in

total matches from 4 in 2016 to 8 and 16 matches in 2017 and 2018, respectively. As for IMGs, the number of total matches each year has fluctuated between 8 and 19 (mean: 14.7) since 2013. The worst year for IMGs was 2013 with only 8 matches and the best years were 2016 and 2018 with 18 and 19 matches, respectively (see **Table 2**), [14-19].

The states where IMGs have matched in dermatology reveal key information that could help IMGs strategize when pursuing post-graduate research and away rotations. **Figure 2A** shows the 29 states where IMGs have matched in dermatology since 2013. New York (NY) was the only state where an IMG had matched every year from 2013 to 2018. This high yearly IMG match rate was followed by Massachusetts (MA) and California (CA), which matched IMGs every year except for 2013. Other states that matched IMGs in at least three years from 2013 to 2018 include Colorado (CO), Florida (FL), Georgia (GA), Ohio (OH), and Texas (TX), [20-25]. Interestingly, when the total number of matched IMGs was adjusted by the total number of matched applicants in the top 10 states where IMGs have matched in dermatology, the results showed that CO

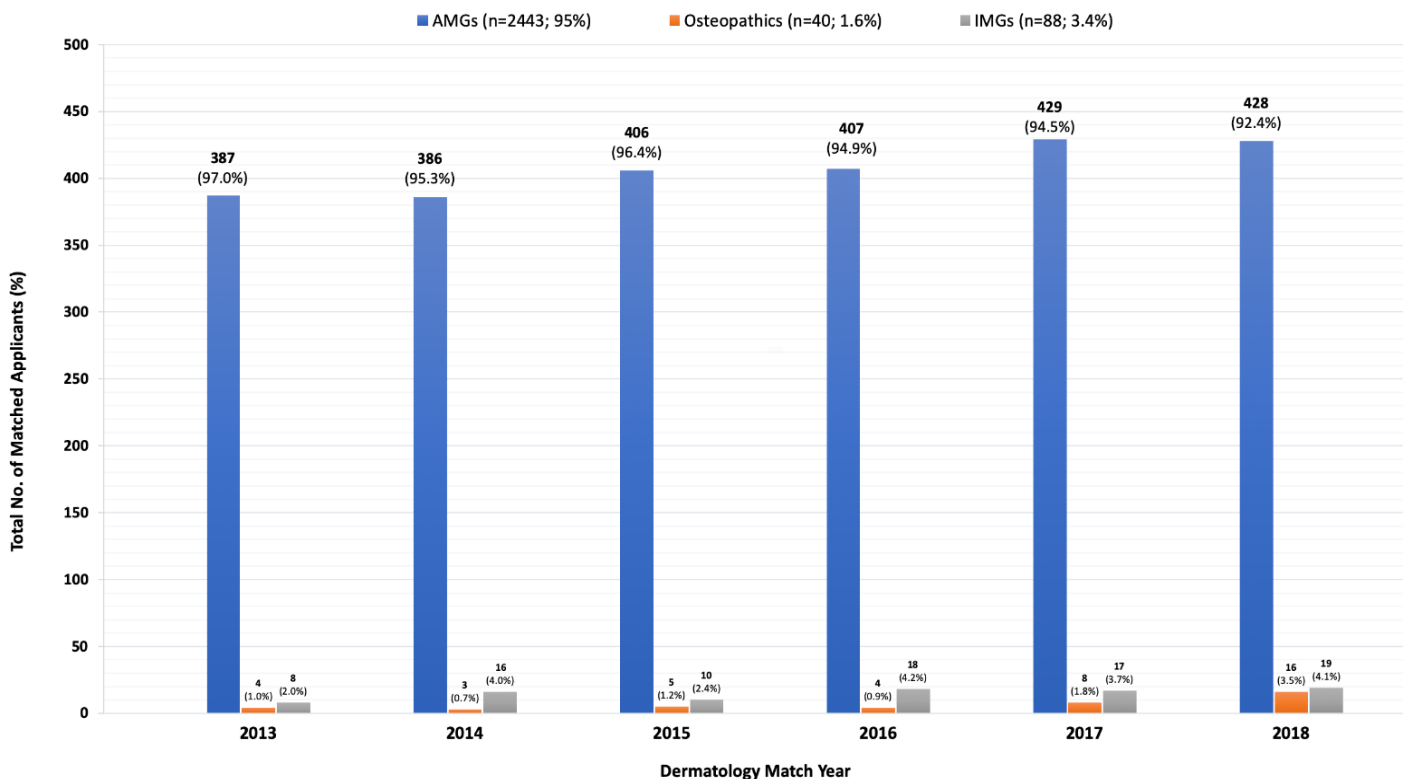


Figure 1. Dermatology match outcomes by applicant type from 2013 to 2018.

had the highest IMG match rate (11.4%), followed by GA (9.1%), and MA (8.6%), (see **Figure 2B**), [26, 27].

Discussion

Several studies have investigated the factors associated with a successful dermatology match in

the U.S. [4-10]. The two most comprehensive articles of this topic were published by Stratman and Ness in 2011 [6], and Gorouhi et al. in 2014 [7]. Stratman and Ness studied 221 graduate candidates applying in 2006 to six academic dermatology residencies in the U.S., whereas Gorouhi et al. surveyed 95 of 114 dermatology PDs in the U.S. [6, 7]. Gorouhi et al.

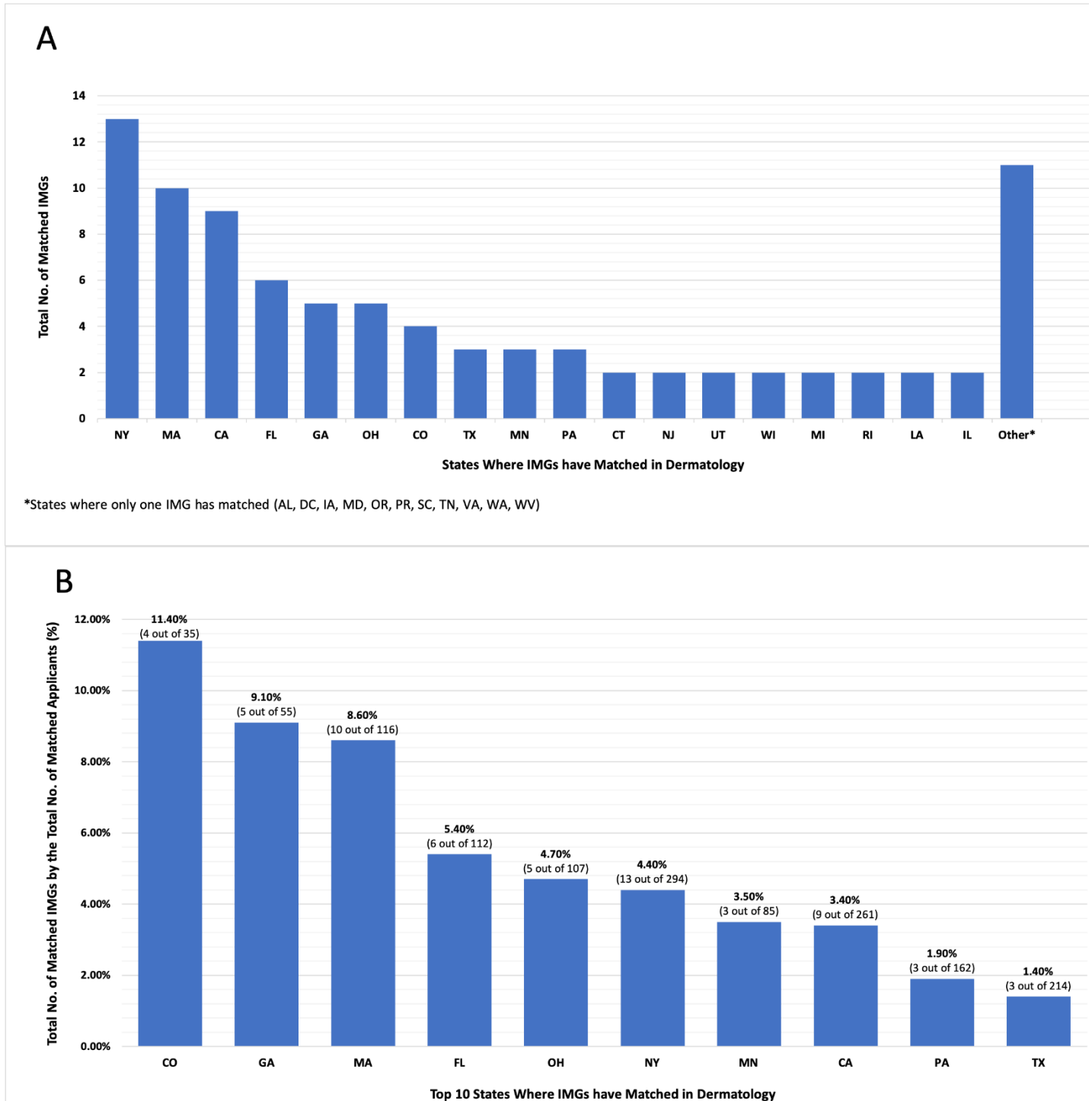


Figure 2. A) Dermatology match rates for IMGs by state from 2013 to 2018. **B)** Adjusted dermatology match rates for IMGs in top 10 states where IMGs have matched from 2013 to 2018.

found that the “interview” was classified as the most important factor associated with matching into a dermatology residency program [7]. This finding was also supported by the 2016 NRMP PD survey report which listed the “interview” as the most important factor in ranking dermatology candidates [28]. In this study, we focus on the evidence-based factors associated with selecting IMG applicants to dermatology interview and propose a strategic framework to guide IMGs applying to dermatology residency programs in the U.S.

Factors associated with selecting IMG applicants to dermatology interview

Research and publications

Research experience has become essential when applying to dermatology residencies in the U.S., especially for IMGs [3]. For the past few years, pre-residency dermatology research fellowships have been the gold standard for many applicants seeking a one- or two-year structured research program. The majority of these research fellowships are designed for fellows to produce multiple research publications and subsequently match into a dermatology residency [8]. One of the main advantages of a fellowship program is the opportunity to obtain strong letters of recommendations (LoRs) from faculty and mentors who have worked extensively with prospective dermatology applicants. Additionally, these programs offer an ideal environment for networking with other academic dermatologists, which can lead to further clinical and research opportunities. In 2008, Wasong et al. investigated whether a pre-residency dermatology fellowship in the U.S. increased the chance of matching. After identifying 46 fellowships programs and surveying 26 fellowship PDs, they found that 176 out of 190 (92%) of research fellows eventually matched to dermatology residency programs; at least 24 of these fellows had previously failed to match [8].

In the study by Stratman and Ness, only 46 of 221 (21%) graduate applicants matched to dermatology. They identified 31 candidates who had pursued research fellowships following medical school graduation and only 11 (35%) of these applicants matched [6]. It is unclear, however, if these

candidates were able to successfully match on further attempts. Despite a low match rate for applicants who pursued a research fellowship in this study, they found that 43 of the 46 (93%) matched applicants reported research experience and 39 (85%) of those had listed publications (average of 5) in the Electronic Residency Application System (ERAS), [6]. Gorouhi et al. found that first author publications were advantageous and peer-reviewed publications were significantly preferred over abstracts and oral or poster presentations. Both these studies found that dermatology-focused research was preferred over research in another field [6, 7]. Current evidence also suggests that papers of any quality, even if only listed as “submitted” are strong predictors of matching [9, 10].

Letters of recommendation (LoRs)

Strong LoRs that distinguish IMG applicants are vital for the interview selection process. Gorouhi et al. found that LoRs were the second most important factor in a successful match. According to this study, PDs preferred LoRs written by dermatologists they knew closely, followed by dermatology chairpersons and PDs from other institutions [7]. This finding is also in line with the 2016 NRMP dermatology PD survey reports, which listed dermatology LoRs as the most important factor in selecting applicants for interview if they had no Match violations or failed attempts in the USMLEs [28]. Stratman and Ness reported that 43 of the 46 (93%) graduate applicants who matched had LoRs from dermatologists at institutions with dermatology residency programs; only 2 (5%) of the matched applicants had no LoRs from a dermatologist [6].

Dermatology rotations

The main advantage of dermatology electives, besides exposure to the field and patient population, is the opportunity to meet and interact with the faculty at the institution, obtain LoRs from academic dermatologists, and pursue research projects. The NRMP dermatology PD survey reports listed audition elective/rotation and personal prior knowledge of the candidate as very important factors for selecting candidates for interview [29, 30]. Gorouhi et al. found that dermatology rotations at the PD’s institution was ranked as the fifth most important factor in the

selection process. Some authors have recommended at least two to three rotations at outside dermatology programs for students without a home dermatology program [5]. To our knowledge, the majority of IMGs who have received dermatology residency interviews have rotated or completed research at that institution prior to invitation, although official data on these rates is not easily accessible.

USMLE scores

USMLE scores offer an objective and standardized way of assessing all applicants and remain a central part of the interview selection process. Furthermore, many dermatology programs use minimum Step 1 scores to filter applicants for interviews [6]. In 2018, U.S. seniors who matched into a dermatology residency had the highest mean USMLE scores amongst all residency applicants who matched to their preferred specialty [11]. In the same year, non-U.S. IMGs who matched into a dermatology residency had the third highest mean USMLE Step 2 Clinical Knowledge score amongst all international applicants who matched to their preferred specialty [31]. Gorouhi et al. rated USMLE Step 1 score as the third most important factor in selecting dermatology candidates [7]. Similarly, Maverakis et al. showed that higher USMLE Step 1 scores significantly predicted match success [9]. A high USMLE Step 3 score was also recognized as a factor associated with significantly increased rates of subsequent matching to dermatology residency in medical graduates [6]. USMLE Step 1 score above 240 will likely pass the majority of application filters [5], hence increasing the chance of an international applicant being interviewed.

Post-graduate training

Besides the clinical experience gained, there are several advantages for IMGs who pursue a year of post-graduate training. Obtaining a strong LoR from an internship PD or chairperson can strengthen an application considerably. Also, dermatology rotations in the U.S. can be pursued during elective time. Furthermore, completing a year of post-graduate training will allow an applicant to be eligible for the dermatology physician position in ERAS and most dermatology research fellowships,

since many require an internship prior to commencement [8]. Stratman and Ness found that medical graduates who completed an internal medicine preliminary year significantly matched at a higher rate when compared to those who completed a transitional year (30% versus 14%) [6]. It is advisable for candidates to highly rank a reputable internal medicine preliminary internship in the rank order list in case they fail to match in dermatology [4]. Completing a non-dermatology categorical residency program in the U.S. prior to applying to dermatology is not recommended as these candidates may encounter graduate medical education funding issues when pursuing a second residency [32]. To our knowledge, only a minority of dermatology programs will accept and fund a candidate with prior residency training in the U.S.

Personal statement

Many applicants can appear similar on the ERAS application and the personal statement is a good opportunity to highlight qualities outside of grades, test scores, and the curriculum vitae, [4]. Gorouhi et al. ranked the personal statement as the sixth most influential factor in the selection process. Personal statement evaluation still

remains a subjective measure that can vary from reviewer to reviewer and does not carry as much weight as the other factors described above. Nonetheless, a well-structured one-page personal statement constitutes an important part of the application, whereas a poor personal statement may exclude an applicant from interviews [4].

Factors not applicable or associated with increased IMG match rates in dermatology

Several authors and the NRMP PD survey reports found that medical school ranking, honors grade in clerkships, Medical Student Performance Evaluation (MSPE or Dean's Letter), and membership in the *Alpha Omega Alpha* Honor Society were associated with higher match rates into a dermatology residency [4-7, 9, 28-30]. In fact, 49% of U.S. seniors who preferred and matched in dermatology in 2018 were *Alpha Omega Alpha* members, the highest percentage amongst all specialties [11]. These four aforementioned factors are irrelevant to IMGs since international medical schools are rarely evaluated by

the *U.S. News and World Report* rankings, the grading system is often different (e.g., no honors grade), and the completeness and reliability of the dean's letter is variable. Lastly, IMGs are unable to become *Alpha Omega Alpha* members. There is lack of evidence to determine if these inapplicable factors have any impact in the selection process of IMGs to dermatology residency programs in the U.S. and more studies on selection criteria need to be done adjusting for these factors. Volunteer experience and speaking a non-English language were not associated with increased IMG match rates in dermatology [6, 7].

A strategic framework for IMGs applying to dermatology residency in the U.S.

There is no secret formula or algorithm for matching into a dermatology residency, although hard work and perseverance are essential to succeed. In [Table 3](#), we provided an evidenced based strategic framework to help IMGs prepare for the challenging dermatology match.

Limitations

Selection bias is an important limitation in our study. There was a low response-rate in the NRMP PD survey reports [28-30]. Only applicants who officially entered the match and gave consent to NRMP to use their information for research were included in the

match data and reports. Additionally, some of the data in the NRMP charting outcomes is self-reported by applicants, which can result in recall bias. Lastly, the total and adjusted IMG match rates do not incorporate the total number of IMG applications programs received or the number of international applicants that were ultimately interviewed and may not be predictive of match success in the future.

Conclusion

There is no single factor which will result in IMGs successfully matching to dermatology residency in the U.S. Based on a review of the most recent available literature and match data, we conclude that it is the combination of research and publications, strong LoRs, dermatology rotations, high USMLE scores, and reputable post-graduate training that will give IMGs the highest chance in matching into a dermatology residency. Rotating and applying to dermatology residency programs in U.S. states that have historically accepted a higher number of IMGs may further improve the applicants' chances of matching. We propose an evidence-based framework and strategic guide to help IMGs have better outcomes in the dermatology match.

Potential conflicts of interest

The authors declare no conflicts of interests.

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Table 2. Nationwide Analysis of the Dermatology Match Outcomes by Year and Applicant Type from 2013 to 2018.

Match Year	Residency Position	No. of Programs	No. of Positions Filled	No. of Applicants (U.S. Seniors)	AMG Matches	Osteopathic Matches	IMG Matches (U.S./Non-U.S.)	State where IMG Matched (U.S./Non-U.S.)
2018	Categorical	11	23	212 (189)	22	0	1 (0/1)	OH (0/1)
	Advanced	122	420	651 (463)	389 ^a	13	18 (4/14)	CA (0/1), CO (1/0) CT (0/1), FL (0/3) GA (0/2), MA (1/2) MI (0/2), MN (0/2) NY (0/1), PR (1/0) WV (1/0)
	Physician	17	20	78 (0)	17	3	0	-
	Total (%)	-	463	-	428 (92.4)	16 (3.5)	19 (4.1)	-
2017	Categorical	11	26	239 (216)	24	0	2 (1/1)	OH (1/0), SC (0/1)
	Advanced	121	415	651 (479)	394	7	14 (3/11)	CA (1/2), FL (1/0) GA (1/1), MA (0/3) MN (0/1), NY (0/2) PA (0/2)
	Physician	13	13	50 (0)	11	1	1 (1/0)	TN (1/0)
	Total (%)	-	454	-	429 (94.5)	8 (1.8)	17 (3.7)	-
2016	Categorical	9	21	182 (174)	21	0	0	-
	Advanced	113	389	619 (474)	372	3	14 (5/9)	CA (0/1), CO (1/0) DC (1/0), FL (1/1) MA (0/1), NJ (0/1) NY (1/3), RI (1/0) UT (0/1), WI (0/1)
	Physician	16	19	62 (0)	14	1	4 (3/1)	NY (1/0), RI (0/1) TX (1/0), VA (1/0)
	Total (%)	-	429	-	407 (94.9)	4 (0.9)	18 (4.2)	-
2015	Categorical	9	22	186 (170)	22	0	0	-
	Advanced	116	381	644 (485)	366	5	10 (1/9)	CA (0/1), CT (0/1) LA (0/2), MA (0/2) NY (0/1), OH (1/0) OR (0/1), TX (0/1)
	Physician	15	18	55 (0)	18	0	0	-
	Total (%)	-	421	-	406 (96.4)	5 (1.2)	10 (2.4)	-
2014	Categorical	9	20	179 (168)	20	0	0	-
	Advanced	113	374	601 (468)	357	3	14 (4/10)	CA (0/2), CO (2/0) GA (1/0), IA (0/1) MA (0/1), NY (0/2) PA (0/1), TX (0/1) UT (1/0), WA (0/1) WI (0/1)
	Physician	11	11	27 (0)	9	0	2 (2/0)	CA (1/0), MD (1/0)
	Total (%)	-	405	-	386 (95.3)	3 (0.7)	16 (4.0)	-
2013 ^b	Categorical	22	37	243 (174)	34	1	2 (1/1)	AL (1/0), NY (0/1)
	Advanced	109	362	574 (442)	353	3	6 (3/3)	IL (1/1), NJ (1/0) NY (1/0), OH (0/2)
	Total (%)	-	399	-	387 (97.0)	4 (1.0)	8 (2.0)	-

^aIn 2018, two (2) Canadian medical graduates were included in the AMG matches.

^bIn 2013, there was no data for the Physician residency positions in the NRMP match data.

Table 3. A Strategic Framework for IMGs Applying to Dermatology Residency in the U.S.

DERMATOLOGY MATCH TIMELINE (6 - 9 Years)	<p>Medical School Training (4-6 Years, Depending on International Medical School)</p> <p><i>Dermatology Electives:</i> Apply early in third and fourth year for one to three electives at institutions with dermatology residency (give preference to states where IMGs have matched; refer to Figures 2A and 2B). Try to get a dermatology <i>mentor</i> and obtain at least one <i>LoR</i> from an academic dermatologist at your elective. Get involved in a small <i>research</i> project (e.g., abstract, case report/series, review article, book chapter). <i>USMLEs:</i> Obtain Step 1 and Step 2 CK scores > 240 and pass Step 2 CS (all on first attempt). <i>MSPE:</i> Meet with the Dean of your medical school to ensure a comprehensive and detailed MSPE (Dean’s Letter). Obtain <i>ECFMG certificate</i> once you get your final medical school diploma (highly important for IMGs). <i>Post-Graduate Training:</i> Apply to a TY or IM preliminary year preferably at a reputable U.S. institution with a home dermatology program (TY have more electives; give preference to states where IMGs have historically matched).</p>
	<p>Post-Graduate Training (1 Year, Transitional Year (TY) or Preliminary Year Internship)</p> <p><i>Dermatology Electives:</i> Apply to elective(s) during the first month of internship (July), preferably at your home dermatology program and/or outside institutions known to select IMGs. <i>Research:</i> Get involved in dermatology <i>research</i> as much as possible (importance of having a home dermatology program). Obtain interesting medicine-dermatology cases during internship and present them as poster abstracts at local and national dermatology meetings (e.g., AAD, MDS). Apply early in your internship for <i>dermatology research fellowship programs</i>. Available Resources: AAD Fellowship Directory, www.derminterest.org, online forums (eg, Student Doctor Network), dermatology society emails (e.g., MDS), and dermatology residency websites (Online Search: “Dermatology Research Fellowships”). Obtain a strong <i>LoR</i> from your residency PD or Chairman and inform them about your future plans.</p>
	<p>Dermatology Research Fellowship (1-2 Years, Depending on Research Program)</p> <p><i>Personal Statement (PS):</i> Write a one-page PS that emphasizes your personal attributes, why you chose dermatology, and your future plans as a dermatologist (avoid reciting your CV). Request <i>LoRs</i> from academic dermatologists (mentors) at the fellowship program and upload to the LoR Portal. Work on at least 4 <i>research</i> projects (e.g., 1 case report, 2 original articles and 1 personal project). Meet with your fellowship mentor(s) at the time of application to discuss your progress and options. Ask your mentor to call or email their colleagues or PDs at other institutions to recommend you personally (very valuable). <i>Dermatology Match:</i> Apply widely to all available dermatology positions in the next 1-2 cycles through ERAS and outside positions if available. If experiencing financial hardship, focus on programs in states where IMGs have matched. Use the NRMP’s Supplemental Offer and Acceptance Program (SOAP) if you do not match in the main match. If you do not match in 2-3 subsequent cycles, consider switching specialties as match rates decrease on every subsequent attempt.</p>

Abbreviations: ECFMG, Educational Commission for Foreign Medical Graduates; AAD, American Academy of Dermatology; MDS, Medical Dermatology Society