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### Trends in the dermatology residency match from 2007 to 2018: Implications for the dermatology workforce



*To the Editor:* Dermatology services remain under-supplied in the United States, stemming from both the limited number and geographic distribution of dermatologists.<sup>1,2</sup> As an important determinant of workforce growth, the quantity of dermatology residency positions may be a constraining factor.

To identify match trends, we analyzed National Resident Matching Program (NRMP) Main Residency Match data from 2007 to 2018 and all Charting Outcomes reports (available only for 2007, 2009, 2011, 2014, and 2016). For each year, we collected data on applicants, positions, and educational

characteristics of matched US allopathic seniors in dermatology and in all specialties. Applicants were considered dermatology applicants if dermatology was the first or only specialty ranked. All statistical analyses were conducted by using Microsoft Excel (Microsoft Corp, Redmond, WA). The University of Pennsylvania Institutional Review Board exempted this study from review.

Between 2007 and 2018, increases in total applicants and US allopathic senior applicants for all categorical and preliminary specialties (32.8% and 23.8%, respectively) exceeded those for dermatology (12.4% and 10.8%, respectively) (Table I). The numbers of total applicants per position and US allopathic senior applicants per position remained relatively constant for all categorical and preliminary specialties but declined from 2007 to 2012 before stabilizing for dermatology. Similarly, US allopathic senior match rates for dermatology increased from 61.7% in 2007 to 82.7% in 2012 before plateauing. The fill rates for dermatology ranged from 97.0% to 100.0%.

Among matched US allopathic seniors, the mean number of abstracts, presentations, and publications more than doubled for all specialties (increasing from 2.2 to 4.7) and for dermatology (increasing from 5.7 to 11.7) (Table II). Within dermatology, PhD degrees became slightly less common (decreasing from 11.6% to 8.0%), whereas other graduate degrees became more common (increasing from 6.8% to 12.8%).

Our findings indicate that the proportion of US seniors failing to match in dermatology remains substantial, despite earlier improvement in match rates and the number of applicants per NRMP-filled position. In addition, growth in the quantity of presented and published works among matched dermatology applicants has outpaced that among all matched applicants.

The fact that there are more publications among matched dermatology applicants suggests increased interest in research and pressure to publish.<sup>3,4</sup> Still, whether higher scholarly activity in applications reflects any higher likelihood to pursue an academic career is unclear.<sup>5</sup> The increasing prevalence of non-PhD graduate degrees may reflect either greater enrollment in combined degree programs such as an MD/MPH or MD/MBA program, or advanced training before medical school.

Our study is limited by exclusion of positions filled outside the NRMP. The likely primary driver of the improved match rate from 2007 to 2012 was slower than overall growth in the number of dermatology applicants. Along with fill rates near

**Table I.** Dermatology residency match outcomes, 2007 to 2018

Variable	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change
All categorical and preliminary specialties													
Applicants	27,944	28,737	29,888	30,543	30,589	31,355	34,355	34,270	34,905	35,476	35,969	37,103	32.8%
US allopathic senior applicants	15,206	15,242	15,638	16,070	16,559	16,527	17,487	17,374	18,025	18,187	18,539	18,818	23.8%
Matched	14,201	14,359	14,566	14,992	15,588	15,712	16,390	16,399	16,932	17,057	17,480	17,740	24.9%
Unmatched*	1005	883	1072	1078	971	815	1097	975	1093	1130	1059	1078	7.3%
Match rate, % <sup>†</sup>	93.4%	94.2%	93.1%	93.3%	94.1%	95.1%	93.7%	94.4%	93.9%	93.8%	94.3%	94.3%	0.9 pp
Independent applicants	12,738	13,495	14,250	14,473	14,030	14,828	16,868	16,896	16,880	17,289	17,430	18,285	43.5%
Matched	6313	6581	6774	6757	6797	7212	8874	9288	9320	9779	10,208	11,300	79.0%
Unmatched*	6425	6914	7476	7716	7233	7616	7994	7608	7560	7510	7222	6985	8.7%
Match rate, % <sup>†</sup>	49.6%	48.8%	47.5%	46.7%	48.4%	48.6%	52.6%	55.0%	55.2%	56.6%	58.6%	61.8%	12.2 pp
Positions	21,845	22,240	22,427	22,809	23,420	24,006	26,138	26,678	27,293	27,860	28,849	30,232	38.4%
Filled	20,514	20,940	21,340	21,749	22,385	22,924	25,264	25,687	26,252	26,836	27,688	29,040	41.6%
Unfilled	1331	1300	1087	1060	1035	1082	874	991	1041	1024	1161	1192	-10.4%
Fill rate, % <sup>‡</sup>	93.9%	94.2%	95.2%	95.4%	95.6%	95.5%	96.7%	96.3%	96.2%	96.3%	96.0%	96.1%	2.2 pp
All applicants per position	1.28	1.29	1.33	1.34	1.31	1.31	1.31	1.28	1.28	1.27	1.25	1.23	-4.1%
US allopathic senior applicants per position	0.70	0.69	0.70	0.70	0.71	0.69	0.67	0.65	0.66	0.65	0.64	0.62	-10.6%
Dermatology													
Applicants	579	536	568	556	519	492	573	593	632	614	639	651	12.4%
US allopathic senior applicants	407	359	412	411	387	375	437	463	468	467	464	451	10.8%
Matched	251	256	289	293	309	310	337	354	356	362	370	370	47.4%
Unmatched	156	103	123	118	78	65	100	109	112	105	94	81	-48.1%
Match rate, % <sup>†</sup>	61.7%	71.3%	70.1%	71.3%	79.8%	82.7%	77.1%	76.5%	76.1%	77.5%	79.7%	82.0%	20.4 pp
Independent applicants	172	177	156	145	132	117	136	130	164	147	175	200	16.3%
Matched	68	71	48	61	56	42	62	51	65	67	84	93	36.8%
Unmatched	104	106	108	84	76	75	74	79	99	80	91	107	2.9%
Match rate, % <sup>†</sup>	39.5%	40.1%	30.8%	42.1%	42.4%	35.9%	45.6%	39.2%	39.6%	45.6%	48.0%	46.5%	7.0 pp
Positions	320	327	338	360	372	363	407	414	427	440	463	472	47.5%
Filled	319	327	337	354	365	352	399	405	421	429	454	463	45.1%
Unfilled	1	0	1	6	7	11	8	9	6	11	9	9	800.0%
Fill rate, % <sup>‡</sup>	99.7%	100.0%	99.7%	98.3%	98.1%	97.0%	98.0%	97.8%	98.6%	97.5%	98.1%	98.1%	-1.6 pp
All applicants per position	1.81	1.64	1.68	1.54	1.40	1.36	1.41	1.43	1.48	1.40	1.38	1.38	-23.8%
US allopathic senior applicants per position	1.27	1.10	1.22	1.14	1.04	1.03	1.07	1.12	1.10	1.06	1.00	0.96	-24.9%

pp, Percentage point.

\*Includes applicants who ranked only advanced or physician reserved programs.

<sup>†</sup>Match rate refers to the ratio of matches to applicants.

<sup>‡</sup>Fill rate refers to the ratio of filled positions to offered positions.

**Table II.** Educational characteristics of matched US allopathic seniors in dermatology, 2007 to 2016

Educational characteristics	All specialties*						Dermatology					
	2007 <sup>†</sup>	2009 <sup>†</sup>	2011	2014	2016	Change	2007	2009	2011	2014	2016	Change
USMLE step 1 score, mean	221	225	226	230	233	12	238	242	244	247	249	11
USMLE step 2 CK score, mean	226	231	235	243	245	19	242	251	253	255	257	15
Research experiences, mean	2.0	2.2	2.3	2.7	3.0	1.0	3.4	3.6	3.7	4.3	4.7	1.3
Abstracts, presentations, and publications, mean	2.2	2.8	3.2	4.2	4.7	2.5	5.7	7.2	7.5	9.5	11.7	6.0
AOA member, %	14.1	15.3	15.0	16.0	17.3	3.2 pp	47.0	51.4	50.8	50.8	52.8	5.8 pp
PhD degree, %	4.0	4.2	4.4	3.9	4.1	0.1 pp	11.6	11.2	9.1	5.1	8.0	−3.6 pp
Other graduate degree, %	10.3	11.0	11.0	15.2	16.9	6.6 pp	6.8	9.8	8.1	14.1	12.8	6.0 pp

AOA, Alpha Omega Alpha; CK, clinical knowledge; pp, percentage point; USMLE, United States Medical Licensing Examination.

\*Only specialties with 50 or more positions are included.

<sup>†</sup>Transitional year residency applicants are included only in these years.

100%, the persistently low match rates in dermatology imply that accelerated creation of dermatology residency positions would yield a nearly 1:1 increase in matched applicants and, in turn, in dermatologists entering practice annually. The Balanced Budget Act (1997) capped the number of residents considered in calculating direct and indirect graduate medical education reimbursement at 1996 levels.<sup>6</sup> Thus, to expand the number of residency positions as a means of addressing a shortage of dermatologists, self-funding or other non-Medicare funding would be necessary.

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#### Density and distribution of acral melanocytic nevi and acral melanomas on the plantar surface of the foot



*To the Editor:* Acral melanoma (AM) is a distinct subtype of melanoma with unique clinical, morphologic, and genetic features. AM occurs on sun-protected skin, has a unique genetic profile with a lack of ultraviolet light signature mutations, a lower mutational burden, and a high number of copy number and structural changes.<sup>1</sup> Unlike cutaneous melanoma (CM), AMs are rarely associated with nevi ( $\leq 11\%$ ).<sup>2</sup> AMs are more common on certain weight-bearing areas of the feet in Japanese and white patients<sup>3,4</sup>; acral melanocytic nevi (AMN) are more common on non-weight-bearing areas in Korean patients.<sup>5</sup> If AMs evolve from AMN or an intermediate precursor, the location and incidence of AMs and AMN or atypical AMN should correlate. Herein, we compare the distribution of AMN and atypical AMN to the distribution of AM on the plantar surface of the foot in a predominately white population.

This study was approved by our institutional review board. A retrospective search of the pathology records was performed from 2000 to 2016 at Mayo Clinic. Two hundred and eighty-four