


Geographic Trends in the Otolaryngology Match (2016-2020)

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Abstract

Objective. Presenting geographic matching trends over 5 match cycles (2016-2020) to serve as a context for changes in residency match outcomes due to the coronavirus disease 2019 (COVID-19) pandemic.

Study Design. Retrospective review.

Setting. Single academic institution-affiliated otolaryngology–head and neck surgery residency program.

Methods. Residency match outcomes for all applicants to our institution (2015-2019) were collected from the National Residency Matching Program, including medical school and matched program. Matches were categorized as home program, home region, or out of region and sorted by US geographic region. Statistical analysis included frequencies, totals, χ^2 testing, and binary logistic regression.

Results. From 2016 to 2020, the US MD senior match rate was 84.9%: 18.9% to home programs, 35.7% to home region, and 45.3% to out of region. Rates were similar across regions and decreased over time. Westerners matched to home programs more than Southerners or Midwesterners (27.5% vs 16.0% and 16.0%, $P < .01$). Southerners and Westerners were more likely to match within their regions (South: 63.1%, $P = .011$, odds ratio [OR] = 1.296, 95% CI, 1.060-1.584; West: 42.0%, $P = .018$, OR = 1.462, 95% CI, 1.066-2.004). Matching from out of region was more likely in the West and less likely in the South (West: 58.0%, $P = .017$, OR = 1.379, 95% CI, 1.059-1.796; South: 36.9%, $P < .001$, OR = 0.584, 95% CI, 0.47-0.727).

Conclusion. From 2016 to 2020 in otolaryngology–head and neck surgery, about 1 in 5 matches were to home institutions, a trend that appeared to be more common in the West. Over 4 out of 5 trainees match to nonhome programs, and nearly half relocate to a new region for training. Changes to travel, rotations, and interviews due to COVID-19 may influence these trends.

Keywords

residency, matching, match, otolaryngology, ENT, OHNS, subspecialty, geographic, trends, NRMP

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Otolaryngology–head and neck surgery (OHNS) remains one of the most competitive surgical subspecialties for the annual residency match in the United States.^{1,2} From 2016 to 2020, an average of 0.80 positions were available for each applicant who entered the match each year.³⁻⁷ Recently, there has been an influx of qualified applicants for relatively few positions. From 2016 to 2020, the annual growth in the number of OHNS applicants has outpaced the number of new available training positions by factor of 3. From 2015 to 2020, on average, the number of total applicants to OHNS increased by +9.3% each year, number of interviewed applicants increased by +6.3% each year, and the number of available training positions increased by only +3.6% each year.³⁻⁸ Compared to 2015, 2019 had an additional 166 applicants, 135 of whom received interviews for only 46 new positions. According to the Electronic Residency Application Service (ERAS) data from 2019 to 2021, the number of applicants to OHNS, number of programs applied to per applicant, and number of applications received per training program have all increased with each passing year.⁸ As evidence of these trends, there were 0.69 available positions per interviewed applicant in 2019, an historic low for the specialty.^{6,7}

Although competition has increased, the average competitiveness of each applicant has remained relatively constant.⁹ With increasing competition between otherwise equal candidates as well as the lifting of limiting factors upon application

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numbers—such as the program-specific paragraph—applicants are compelled to apply increasingly more broadly to improve their odds of matching. According to a 2016 survey, 90% of applicants report applying to programs in which they have no specific interest for the purpose of improving their chances in the match.^{1,10} Despite this increase in programs applied to per applicant, few studies have quantified how these trends have evolved on the national stage in terms of matching.

Although applicants are increasing their reach to more programs, the effect upon geographic trends in the match is not well understood. In prior studies from single institutions, rates of home program and home region matching in OHNS have been cited to occur in approximately 20.9% to 58.4% of matches, with similar frequencies reported in other surgical residency programs.¹¹⁻¹⁴ These trends might have been expected to continue, however, when restrictions on travel were placed during the coronavirus disease 2019 (COVID-19) pandemic the status quo of away rotations and travel for interviews was disrupted.¹⁵⁻¹⁷ A significant change in matching trends during the 2021 Residency Match is anticipated.

Using data from applicants to our single academic institution, we characterized recent geographic trends in matching within the field of OHNS to provide a context for changes in the COVID-19 era.

Methods

Deidentified applicant data were recorded from the 2015-2016 through 2019-2020 ERAS application cycles at our Accreditation Council for Graduate Medical Education (ACGME)-accredited OHNS residency program at the University of California, San Diego (UCSD). Stored information from the UCSD applicant database was limited to applicant year and Association of American Medical Colleges Identification Number (AAMC ID). Personal information, including name, merits, scores, away rotations, and letters of recommendation, was omitted for privacy purposes. This study was reviewed and certified exempt by the UCSD Institutional Review Board.

Applicant AAMC IDs were entered into the National Resident Matching Program (NRMP) website using the database query tool, accessed with permission by the administrator account of our institution (accessible at r3.nrmp.org/applicantMatchHistory). Data from each UCSD applicant's resulting match outcome from 2016 to 2020 were recorded, including application year, medical school of graduation, degree, medical school city and state, match specialty, match program, match program city and state, and subsequent match participation and outcomes for persons who failed to successfully match during their first attempt. States were sorted into US Census-designated geographic regions: West, South, Northeast, and Midwest.¹⁸ Senior students from US-based allopathic medical schools (US MD seniors) were selected for further analysis due to the volume of available data, group homogeneity, and expected generalizability of findings. Matches were categorized as “home program” (those who matched at the institution affiliated with their medical school

of graduation), “home region” (those who matched to non-home programs within the same geographic region as their medical school), and “out of region.”

Totals and frequencies were calculated and reported as both a proportion of matched applicants from a given region and as a proportion of all matches to a given region. An annual match differential was calculated by subtracting the number of matched applicants from a region from the total matches to programs in that region. Statistical analysis was completed with SPSS and included pairwise analysis by χ^2 and binary logistic regression with level of significance set to $P < .05$.¹⁹

Results

During the study period, 1367 individuals applied to UCSD OHNS, comprising 68.3% of NRMP participants.³⁻⁸ Of the UCSD applicants, 1252 (91.6%) were US MD seniors. The remaining portion were distributed as US MD nonsenior graduates (2.9%), those with DO qualifications (2.4%), and international medical graduates (3.4%). Of the 1367 applicants to UCSD OHNS, 1105 (80.8%) successfully matched into OHNS programs across the United States. Of matched UCSD applicants, 1063 (96.4%) were US MD seniors, constituting 73.2% of all matched US MD senior applicants nationwide. US MD senior applicants to UCSD had a match rate of 84.9% for the study period, which was not significantly different from the rate of all US MD seniors as reported by NRMP (83.7%) (see **Table 1**).

From 2015 to 2019, the volume of applications increased from all geographic regions, reflecting national trends of increased applicants into OHNS and programs applied to per applicant (**Figure 1**). From 2015-2016 to 2019-2020, the number of applicants per cycle to UCSD OHNS increased by 50% (+124; from 248 in 2015 to 372 in 2019). US MD seniors constituted 87.1% of this increase. Across the study period, all regions, with the exception of the West, saw a downward trend in rates of matching (range, -4.7% to +0.1%) (**Figure 2**). The West showed high annual variance but, on average, had a slight increase in rates of matching year to year (+0.1%; range, -12.1% to +14.9%).

All US regions were well represented by US MD senior applicants to UCSD. Of studied US MD senior applicants who matched from 2016 to 2020, 54.7% (581) remained within the same geographic region: 18.9% (201) matched at home programs and 35.7% (380) matched to home region. The remaining 45.3% (482) matched to programs out of region. Relative to their number of total matched applicants, the South had the greatest proportion remain within the region (219, 63.1%), while the West had the least (95, 42.0%) (**Figure 3**).

Across the study period, all geographic regions showed nearly equal match rates, without significant differences between regions (range, 83.8%-87.4%) (**Table 2**). When comparing match rates as a proportion of all matched applicants from a region of origin, a significantly larger proportion of applicants from the West (27.5%, 44) matched to home programs, compared to the South (16.0%, 62) or Midwest (16.0%, 42) ($P < .01$ and $P < .01$, respectively). Similarly, a significantly larger proportion of applicants from the South

Table 1. Applying and Matching for OHNS (2016-2020).

	NRMP, No. (%)	UCSD, No. (%)
Applying		
All applicants	2001	1367
US MD seniors (% applicants)	1735 (86.7)	1252 (91.6)
Matching		
All matches (% match rate)	1572 (78.6)	1105 (80.8)
US MD seniors (% match rate)	1453 (83.7)	1063 (84.9)

Abbreviations: NRMP, National Resident Matching Program; OHNS, otolaryngology–head and neck surgery; UCSD, University of California, San Diego.

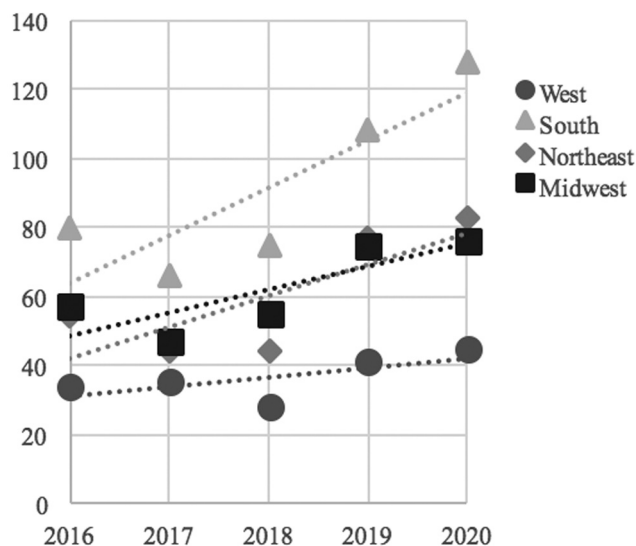


Figure 1. Applications to University of California, San Diego otolaryngology–head and neck surgery, by region each match year (US MD seniors, 2015-2019).

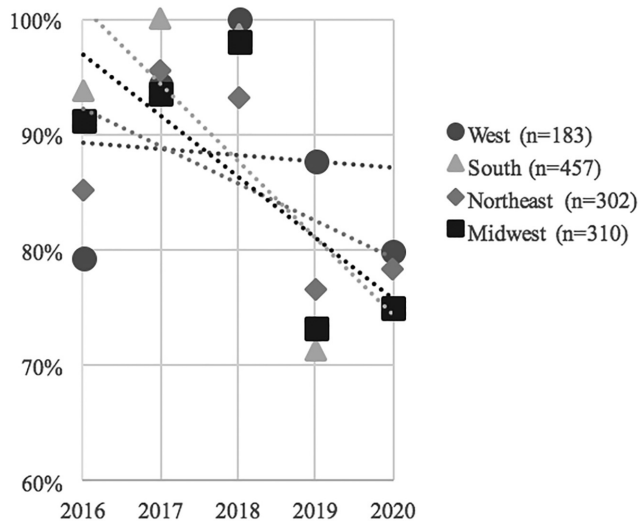


Figure 2. US MD senior match rate, by region (University of California, San Diego otolaryngology–head and neck surgery applicants, 2016-2020).

matched to home region compared to the Northeast (40.5%, $n = 157$ vs 30.4% $n = 77$, respectively; $P = .01$). There were no significant differences for out-of-region matching rates based on region of origin. When comparing match rates as a proportion of total matches to a region, there were no significant differences in rate of home program matches, but they were most common in the Northeast (22.6%, 53 matches). Home region matches comprised a significantly greater proportion of matches to the South compared to the West or Northeast (45.2%, $n = 157$ vs 22.6%, $n = 51$ and 32.8%, $n = 77$; $P < .001$ and $P < .01$, respectively). The West had a significantly lower proportion of applicants match to home region compared to all other regions (22.6%, $n = 51$; $P < .05$). Out-of-region matches comprised a greater proportion of matches to the West compared to all other regions (58.0%, $n = 131$; $P < .05$). The mean annual match differential calculated for the West was -13.2 , while all other regions were positive over the study period. From 2015 to 2020, the proportion of home program matching increased by an average of 1.3% for all regions (range, -0.7% to $+6.0\%$) (**Figure 4**).

By regression analysis, compared with other regions, programs in the South and West were more likely to match applicants from within their respective regions (South: 63.1%, $P = .011$, odds ratio [OR] = 1.296, 95% CI, 1.060-1.584; West: 42.0%, $P = .018$, OR = 1.462, 95% CI, 1.066-2.004) (**Table 3**). Compared with other regions, matching applicants from out of region was more likely for programs in the West and less likely for programs in the South (West: 58.0%, $P = .017$, OR = 1.379, 95% CI, 1.059-1.796; South: 36.9%, $P < .001$, OR = 0.584, 95% CI, 0.47-0.727).

Discussion

Data from our single institution reveal that about 1 in 5 (18.9%) US MD senior matches are to home programs each year. Interestingly, home matching occurs with a similar frequency in other competitive surgical subspecialties, including plastic surgery and orthopedic surgery.^{12,13} Home program matching has also been previously shown to be independent of program size within OHNS.¹¹ Compared to other regions, a greater proportion of western applicants matched to home programs, suggesting that the tendency of program directors and home program applicants to rank each other highly may be culturally or geographically influenced.

Regional matching trends provide insight into the diversity of training for the next generation of otolaryngologists. Here we see that over 4 out of 5 trainees match to nonhome programs, and nearly half of first-year trainees relocate to a new region for training. This may be necessary in some cases: match differential analysis shows that the western region produces more matched residents than it has training positions to offer each year. Compared to residency programs in the Northeast and Midwest, programs in the West and South were more likely to match applicants from within their respective regions. However, the same programs in the West were also more likely to receive out-of-region matches. By this finding, the notion that programs in the West demonstrate a bias for home region candidates appears to be false. The finding that

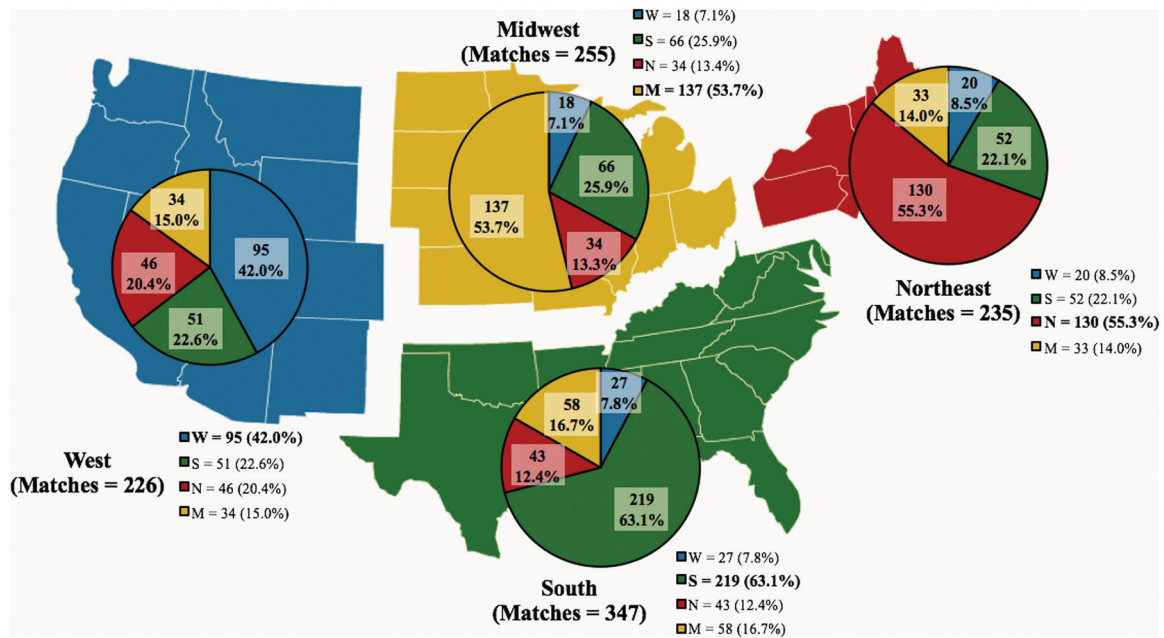


Figure 3. Otolaryngology–head and neck surgery regional matching (2016-2020). Percentages and totals for all matches to each region are shown proportionally by region of origin. The greatest proportion of out of region matches were to the West (58.0%).

Table 2. Home Program, Home Region, and Out-of-Region Matching Into OHNS (US MD Seniors, 2016-2020).^a

Characteristic	West	South	Northeast	Midwest	Total	P value
Applicants, No.	183	457	302	310	1252	
Matching, by origin						
All matches (% match rate)	160 (87.4)	388 (84.9)	253 (83.8)	262 (84.5)	1063 (84.9)	
Home program (% total matches)	44 (27.5)*	62 (16.0)	53 (20.9)	42 (16.0)	201 (18.9)	$P(W,S) < .01$ $P(W,M) < .01$
Home region ^b (% total matches)	51 (31.9)	157 (40.5)*	77 (30.4)	95 (36.3)	380 (35.7)	$P(S,N) = .01$
Out of region (% total matches)	65 (40.6)	169 (43.6)	123 (48.6)	125 (47.7)	482 (45.3)	
Matching, by destination						
All matches to region	226	347	235	255	1063	
Home program (% total matches)	44 (19.5)	62 (17.9)	53 (22.6)	42 (16.5)	201 (18.9)	
Home region ^b (% total matches)	51 (22.6)*	157 (45.2)*	77 (32.8)	95 (37.3)	380 (35.7)	$P(S,W) < .001$ $P(S,N) < .01$ $P(N,W) < .05$ $P(M,W) < .001$
Out of region (% total matches)	131 (58.0)*	128 (36.9)*	105 (44.7)	118 (46.3)	482 (45.3)	$P(W,S) < .001$ $P(W,N) < .01$ $P(W,M) < .05$ $P(M,S) < .05$ $P(N,S) < .05$
Mean (SD) annual match differential	−13.2 (2.4)	8.2 (5.8)	3.6 (2.9)	1.4 (6.2)		

Abbreviations: M, Midwest; N, North; OHNS, otolaryngology–head and neck surgery; S, South; W, West; *, significantly higher or lower rate of matching, by category.

^aValues are reported as number (%) unless otherwise indicated. Matching frequencies listed as both a proportion of the total matched applicants from a given region and those matching to a given region. Match differential = (matches from origin – matches to destination). Statistical results by pairwise χ^2 testing. Significance defined as $P < .05$. Only significant values ($P < .05$) are reported, listed as $P(\text{Region 1}, \text{Region 2})$.

^bHome region matches does not include home program matches.

southern programs were less likely to match out-of-region applicants is possibly related to strong regional preferences on behalf of applicants. It is worth noting that the South had the

largest overall volume of annual matched applicants and offers the greatest number of available training positions each year.

Table 3. Regression Analysis of Within-Region and Out-of-Region Matching for OHNS (US MD Seniors, 2016-2020).^a

Characteristic	n	%	OR	95% CI	P value
Within-region matching					
West	95	42.0	1.462	1.066-2.004	.018*
South	219	63.1	1.296	1.060-1.584	.011*
Northeast	130	55.3	1.057	0.826-1.352	.66
Midwest	137	53.7	1.096	0.860-1.397	.46
Out-of-region matching					
West	131	58.0	1.379	1.059-1.796	.017*
South	128	36.9	0.584	0.47-0.727	<.001***
Northeast	105	44.7	0.808	0.625-1.045	.104
Midwest	118	46.3	0.861	0.673-1.102	.235

Abbreviations: OHNS, otolaryngology–head and neck surgery; OR, odds ratio.

^aWithin-region matching includes home program and home region matches. Percentages listed as a proportion of all matches to each region. Results by binary logistic regression, representing likelihood of matching to a given region. Significance defined as $P < .05$.

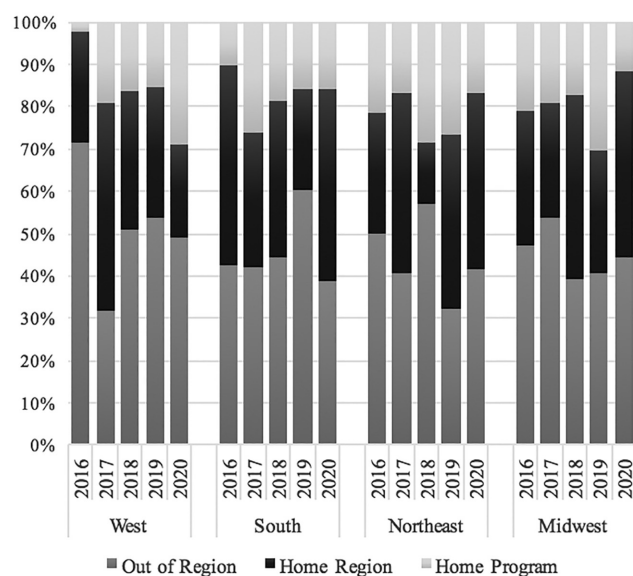


Figure 4. Composition of otolaryngology–head and neck surgery matches (2016-2020). Matches are displayed by category, showing the changing proportions of total matches to each region.

Matching into OHNS has become increasingly more competitive since at least 2016. A greater number of qualified applicants for a relatively steady number of training positions has led to a drop in successful rates of matching, to as low as 68.9% of match participants in the 2019-2020 cycle at the time of this study.⁷ While bleak, these figures fall short of capturing the entire picture. Per ERAS and NRMP, over 33% of ERAS applicants do not enter the NRMP match process. This discrepancy may be due to applicants failing to obtain interviews or the result of double counting those applicants who enter the Supplemental Offer and Acceptance Program (SOAP) process after failing in the match as described by Bowe et al.²⁰ US MD seniors, historically the most successful group of applicants, have felt a decrease in average annual match rate of -3.5% each year.³⁻⁷ It appears that rising application numbers and very competitive applicants applying more broadly have served

to saturate the match pool. Due to this tendency, a larger number of unmatched applicants are anticipated.

In recent years, matching in OHNS appears to follow an ebb-and-flow pattern. A significant number of unmatched applicants in 2015-2016 (68, 18.4%) was followed by fewer applications in the 2016-2017 and 2017-2018 cycles (from 370 to 331 and 333, respectively), leading to higher match rates (87.9% and 91.0%, respectively). These promising outcomes may have motivated interest toward the field, leading to the high applicant numbers in the following 2018-2019 cycle (462, +27.9% change) and subsequent drop in match rates the same year (328, 71.0%, -20.0% change).³⁻⁷ Therefore, it is predictable that this cyclic phenomenon will occur again following high numbers of unmatched applicants during the 2020-2021 cycle.

Prior to COVID-19, away rotations were invaluable to the match process, but this has changed during the pandemic match season. Previously, an overwhelming majority of surveyed program directors cited away rotations as one of the key deciding elements in determining interview invites.^{21,22} Among students intent on pursuing a career in OHNS, over 92% report completing at least 1 away rotation.^{23,24} A 2017 survey of current OHNS residents found that 85.6% completed at least 1 away rotation, which led to an interview in 81.5% of cases and a match in 32.7% of cases where the applicant ranked the hosting program.²⁵ During the COVID-19 pandemic, away rotations were affected by safety measures, including a temporary restriction on travel and the suspension of away rotations for most potential applicants.^{15,16} As these changes have limited applicants' ability to explore outside of their home program, one may expect to see greater home program preference and a resultant increase in home program matches compared to any previous year. Of note, applicants without a home program were exempted from the away rotation restrictions; therefore, their experience may have been insulated from these effects.

The limitations of this study may influence the generalizability of the reported findings. Although the sample size is robust, the UCSD data only constitute 73.2% of all matched

US MD seniors and therefore may not reflect the remaining trends in OHNS matching. For this reason, repeat studies from other programs may be of utility.

An in-depth view is presented of the applicant matching trends to the UCSD otolaryngology residency program over 5 application cycles dating 2015-2016 through 2019-2020. These generalizable trends may be used as a backdrop for mapping future changes in the residency match due in part to the COVID-19 pandemic.

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Author Contributions

Jeffrey D. Bernstein, study design, data collection, statistical analysis, prepared the manuscript, revised the manuscript; **Shane Shahrestani**, statistical analysis, revised the manuscript; **Bitu Shahrvini**, data collection, revised the manuscript; **Deborah Watson**, study design, revised the manuscript.

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