

# Assessing the Breadth of Laryngology Training in Otolaryngology Residency Programs

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**Summary: Introduction.** Laryngology is an expanding field with incorporation in resident training nationwide. However, the breadth of training in laryngology reported by residents has not been previously evaluated. This project assesses the variability in laryngology training among otolaryngology residents.

**Methods.** A cross sectional, multi-institutional study was performed with an anonymous survey sent to residents and laryngology fellows nationally to assess different laryngology training practices.

**Results.** There were 151 responses to the survey with 9.6% response rate. 49 (32.9%) did not have a designated laryngology rotation. 134 (89.3%) had a fellowship-trained laryngologist as part of their institution. The greatest percentage of respondents intended to pursue general ENT (31; 20.7%). PGY5 responses were analyzed for total residency exposure showing, 66.7% of PGY5s received training to identify different types of dysphonic voices through auditory findings alone. 61.9% could interpret a videofluoroscopic swallow study. Regarding surgical cases, 52.4% had been involved in open cricopharyngeal myotomies, 76.2% in endoscopic cricopharyngeal myotomies, and 100% in subglottic stenosis cases. Residents pursuing a career in laryngology and those with a designated laryngology rotation had more exposure to laryngeal surgeries and office-based procedures than their peers.

**Conclusion.** Laryngology training and exposure varies across the country. Residents are more familiar with airway than voice and swallowing related pathology. Residents with a designated laryngology rotation and those pursuing laryngology fellowships were more likely to have exposure to laryngeal surgery and office-based procedures. Programs with a laryngologist likely had higher response rates so the true laryngology exposure may be more limited than our data suggests.

**Key words:** Laryngology—Education—Otolaryngology—Training—Residency—Residents.

## INTRODUCTION

Laryngology is a foundation for all aspects of otolaryngology. It has expanded and developed its own fellowship in 1992.<sup>1</sup> Laryngology covers patient conditions involving voice, airway, and swallow as well as cancers of the larynx. This includes surgical procedures, in-office procedures, as well as clinic visits.

Despite the breadth of this specialty, the Otolaryngology-Head and Neck Key Indicator and Minimum Report<sup>2</sup> mostly requires that residents complete procedures in the categories of airway and bronchoscopy. Very few voice related procedures are required and no swallow surgery is necessary for completion of an otolaryngology training program. This leaves resident experience in laryngology highly variable and up to the individual training programs. This project assessed the breadth of laryngology training among otolaryngology residents now that there is an increasing number laryngology fellowship trained faculty and laryngology fellowships. We hypothesized that there would be significantly variable exposure reported by residents based on year, access to fellowship trained faculty,

dedicated laryngology rotation, and resident interest in the field.

## METHODS

A cross sectional, multi-institutional study to assess the exposure of residents to laryngology was designed. The study was exempt from IRB approval by the Mayo Clinic Institutional Board Review as it was determined to represent minimal risk to participants. The survey was developed by the primary investigators to collect data on exposure to laryngology training during residency including presence of a laryngology specialist, breadth of laryngology cases, and self-reported competency managing laryngology issues. Additionally, demographic data on the participants was collected including year of training, region, and anticipated career path. The 24 question survey (Table 1) was sent to the program coordinators of 104 ACGME accredited allopathic nonmilitary otolaryngology programs in the late spring to capture end of year competencies. Responses were solicited by email using research electronic data capture (REDCap).<sup>3</sup> The program coordinators were asked to send a link for the anonymous survey to their residents. The survey was also sent to all Laryngology Fellows. No incentives were offered for participation in the survey. In addition to the initial request for participation, one additional request for resident/fellow participation was sent. An additional request was sent from the senior author to all academic laryngologist to request resident involvement. The survey remained open for participation for a total of 2 months until our goal response rate of 10% was reached. The survey was

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**TABLE 1.**  
**Survey Questions Including Answer Response Options**

**Purpose: To assess laryngology training for ENT residents and laryngology fellows as well as the desire for training. Ultimately to improve resident's laryngology training in the multidisciplinary setting.**

Level of Training						
PGY 1	PGY2		PGY3	PGY4	PGY5	PGY6+
Anticipated subspecialty						
Laryngology	Neurotology	Head and Neck	Rhinology	Facial Plastics	Pediatrics	General
						Do not know
Are you interested in laryngology as a potential specialty choice for you?						
Yes			No			
Do you have a fellowship trained laryngologist as part of your program?						
Yes			No			
Do you have a laryngology fellow at your institution?						
Yes			No			
Do you have a designated laryngology rotation as part of your program?						
Yes			No			
Do you have exposure to Speech-Language Pathologists specializing in voice disorders as part of your training?						
Yes			No			
Do you spend formal time with Speech-Language Pathologists specializing in voice disorders?						
Yes			No			
Do you have Speech-Language Pathologists specializing in voice disorders as part of your ENT department?						
Yes			No			
Do you receive training to identify types of dysphonic voices through auditory findings alone?						
Yes			No			
Can you identify the following disorders based on phonation prior to laryngoscopic exam:						
Adductor spasmodic dysphonia	Abduction spasmodic dysphonia	Muscle tension dysphonia	Ventricular phonation	Vocal tremor	Dysphonia from a lesion	Glottic insufficiency
Do you know the terminology to describe dysphonic voices?						
Yes			No			
Have you been trained in the performance and interpretation of stroboscopy?						
Yes			No			
Do you personally get to perform phono-surgery?						
Yes			No			
Can you interpret a videofluoroscopic swallow study (VFSS)?						
Yes			No			
On VFSS, can you identify:						
Decreased hyolaryngeal elevation		Zenker's diverticulum		Cricopharyngeal hypertrophy		
Have you been exposed to swallowing cases? If yes which of the below:						
Hyolaryngeal suspension	Open CP myotomy	Endoscopic CP myotomy	Open Zenker's diverticulectomy	Closed Zenker's diverticulectomy		
Have you been exposed to subglottic stenosis cases?						
Yes			No			
If so, how many subglottic stenosis dilations have you participated in per year on average?						
0-5	6-10	11-15	16+			
If so, how many tracheal resections have you participated in per year on average as a resident?						
0-5	6-10	11-15	16+			
Have you been involved with office-based laryngology procedures?						
Yes			No			
If so which of the following procedures have you been involved with in the office? (check all that apply)						
Laser procedures (leukoplakia, papilloma, etc)	Transnasal true and/or false vocal fold botox injection	Transcervical true and/or false vocal fold botox injection	Transoral injection medialization of true folds	Transcervical injection medialization of true folds	Transnasal esophagoscopy	Transnasal Kenalog injections
Which subspecialty manages early laryngeal cancer at your institution?						
Laryngology	Head and Neck		Both		Other	
Which subspecialty manages late laryngeal cancer at your institution?						
Laryngology	Head and Neck		Both		Other	

designed in REDcap to allow for protection of respondents information and aid in exporting the data. Descriptive statistics were obtained for all questions. Fisher exact test was used to compare differences between groups.

## RESULTS

Surveys were sent to 1573 residents currently training in 104 ACGME accredited allopathic nonmilitary residency programs and the current 24 fellows in the United States.<sup>4,5</sup> There were 151 responses to the survey for a response rate of 9.6%.

### Demographics

Participant demographics show responses from all residents in all years of training (Table 2) including: PGY1 29/151 (19.2%), PGY2 28/151 (18.5%), PGY3 38/151 (25.2%), PGY4 23/151 (15.2%), PGY5 21/151 (13.9%). Regarding geographic distribution of response, responses were accrued from all regions of the country including the Northwest, Southwest, Midwest, Northeast, and Southeast regions. The number of responses varied by region (Figure 1) with the greatest number of responses from the Midwest (49, 32.5%) and the least responses from the Northwest (11, 7.3%). Looking at the response rate per region 37/232 (4.7%) of residents in the northwest responded, 27/123 (30%) in the

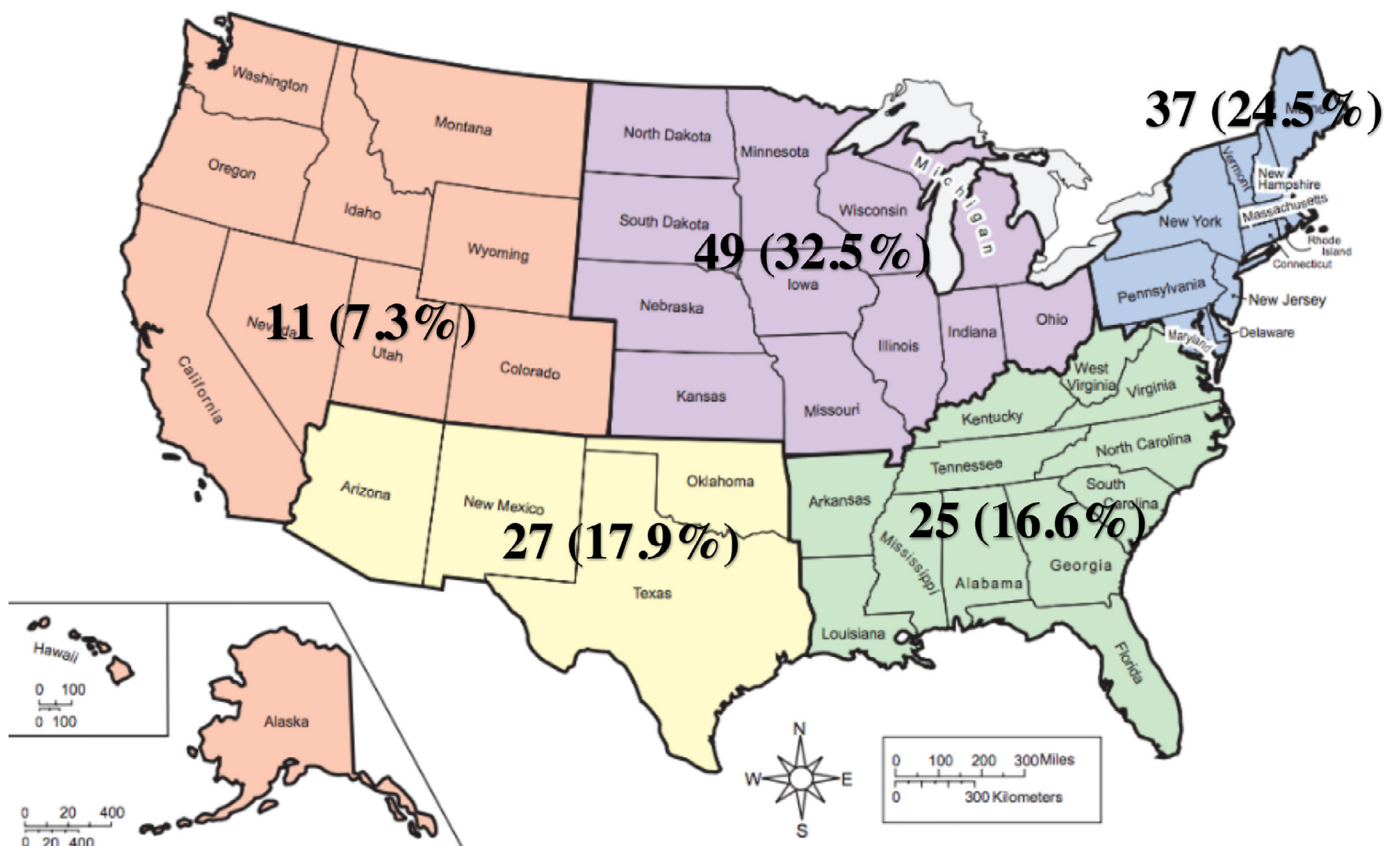
**TABLE 2.**  
**Level of Training**

	Total (N = 151)
<b>Level of training, n (%)</b>	
PGY1	29 (19.2%)
PGY2	28 (18.5%)
PGY3	38 (25.2%)
PGY4	23 (15.2%)
PGY5	21 (13.9%)
Fellow (PGY6+)	12 (7.9%)

Southwest, 49/406 (12.1%) in the Midwest, 446 (8.2%) in the Northeast, 25/366 (6.8%) in the southeast.<sup>5</sup> There were responses from residents intending to pursue careers in all subspecialties (Table 3). There were more respondents who intended to pursue general ENT (31/151, 20.5%) than any other subspecialty. There were 16/151 residents respondents (10.6%) who anticipated a career specializing in laryngology.

### Overall training

Most respondents (113/151, 74.8%) stated their laryngology training experience was great (54/151, 35.8%) or excellent (59, 39.33%) verses residents rating their training as good/



**FIGURE 1.** Distribution of responses across the United States. Key: Orange- Northwest, Yellow- Southwest, Purple-Midwest, Green-Southeast, Blue-Northeast. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

**TABLE 3.**  
**Anticipated Subspecialty Among Respondents**

Anticipated Subspecialty, n (%)	
Laryngology	16 (10.7%)
Neurotology	10 (6.7%)
Head and Neck	15 (10.0%)
Rhinology	7 (4.7%)
Facial Plastics	18 (12.0%)
Pediatrics	8 (5.3%)
General ENT	31 (20.7%)

fair (32/151, 21.2%) or poor (5/151, 3.3%). The majority of respondents (134/151, 88.7%) stated they had a fellowship-trained laryngologist as part of their institutional training and (51/151, 33.8%) stated they had a laryngology fellow. Most respondents (135/151, 89.4%) stated they have Speech Language Pathologist specializing in voice disorders as part of their departments, however only half (77/151, 51.0%) stated that they spend formal time with them during training.

#### Voice perception training

Overall, 150/151 respondents answered questions regarding voice perception training. Of the PGY5 resident respondents ( $n = 21$ ), 66.7% had received training to identify types of dysphonic voices through auditory findings alone. This is compared to 91.7% of fellows who received such training. All (100%) of PGY5s and fellows stated they knew the terminology to describe dysphonic voices. With regards to identifying specific disorders, 85.7% of PGY5s responded they could identify adductor spasmodic dysphonia, 71.4%

for abductor dysphonia, 81% for muscle tension dysphonia, 33.3% for ventricular phonation, 61.9% for vocal tremor, 57.1% for dysphonia from lesion, and 85.7% for glottic insufficiency. The trend of exposure increased as residents went from PGY1 to PGY6 (Table 4).

#### Interpretation of diagnostic exams

Regarding diagnostic tests 85.7% of residents in their last year of training stated that they were trained in the performance and interpretation of stroboscopy during their residency training. 61.9% stated they could interpret a videofluoroscopic swallow study (VFSS). Table 5 shows the percentage of 5<sup>th</sup> year residents with the ability to interpret different pathologies on VFSS.

#### Involvement in laryngology cases

Fifth year residents stated they were involved in an average of 2.4 subglottic stenosis dilations and 1 tracheal resection per year. They also reported 81% were involved in office-based laryngology procedures. Table 6 shows their exposure to different procedures.

A majority of residents said both head and neck and laryngology (70%) manage early glottic cancer at their institutions. Late laryngeal cancer was mostly managed by head and neck (81.3%).

#### Comparison between those interested in pursuing a laryngology fellowship

When comparing the results between those in laryngology fellowship or have plans to pursue laryngology fellowship to the remainder of the residents, it was found they were more likely to have exposure to multiple aspects of the field

**TABLE 4.**  
**Identifying Voice Disorders Based on Phonation Prior to Laryngoscopic Exam**

	Junior Residents (PGY1/ PGY2) ( $n = 57$ )	Senior Residents (PGY3/ PGY4) ( $n = 60$ )	PGY5 ( $n = 21$ )	PGY6 Laryngology Fellow ( $n = 9$ )		Total for All Years $n = 150$
				Other fellow ( $n = 3$ )		
Adductor spasmodic dysphonia	23(40.5%)	41(68.3%)	18 (85.7%)	9 (100.0%) 3(100.0%)		94 (62.7%)
Abductor spasmodic dysphonia	23(40.5%)	40(66.7%)	15 (71.4%)	9 (100.0%) 3(100.0%)		90 (60.0%)
Muscle tension dysphonia	18 (31.6%)	45(40.1%)	17 (81.0%)	5 (55.6%) 3(100.0%)		88 (58.7%)
Ventricular phonation	4(7.0%)	8(13.3%)	7 (33.3%)	6 (66.7%) 1(33.3%)		26 (17.3%)
Vocal tremor	30(52.6%)	46(76.7%)	13 (61.9%)	9 (100.0%) 2(66.7%)		100 (66.7%)
Dysphonia from lesion	15(26.3%)	36(60%)	12 (57.1%)	8(88.9%) 2(66.7%)		73 (48.7%)
Glottic insufficiency	26(45.6%)	49(81.7%)	18 (85.7%)	9 (100.0%) 3(100.0%)		105 (70.0%)

**TABLE 5.**  
Number (%) of 5th Year Residents With the Ability to Interpret Different Pathologies on VFSS

	Number (%) of PGY5 (n = 21)
Hyolaryngeal elevation	11 (52.4%)
Zenkers diverticulum	17 (81%)
Cricopharyngeal hypertrophy	13 (61.9%)

(Table 7). They were more likely to know the terminology of dysphonic voices ( $P = 0.0062$ ).

Regarding identifying muscle tension dysphonia and dysphonia due to a lesion on phonation alone there was no statistical significance between those pursuing a career in laryngology and those who were not ( $P = 1, P = 0.1162$  respectively).

#### Comparison between those with and without a laryngology rotation

The responses were compared between those residents with and without a dedicated laryngology rotation. Over half (52.5%) of residents with a laryngology rotation stated their training in laryngology was excellent; in comparison, only 14.3% residents without a dedicated laryngology rotation rated their laryngology training as excellent ( $P = 0.0001$ ). Those with a formal rotation were more likely to spend dedicated time with Speech Language Pathologists

**TABLE 6.**  
Percentage of PGY5 (n = 21) Residents With Exposure to Laryngeal Cases Both in the Operating Room and Office-based Procedures

	N = 21
<i>Swallow</i>	
Endoscopic diverticulectomy	90.5%
Endoscopic cricopharyngeal myotomy	76.2%
Open zenkers diverticulectomy	57.1%
Open cricopharyngeal myotomy	52.4%
Hyolaryngeal suspension	4.8%
Transnasal esophagoscopy	19%
<i>Voice</i>	
Transcervical true and/or false vocal fold botox injections	71.4%
Transcervical injection medialization of true vocal folds	61.9%
Laser procedures (eg, leukoplakia and papilloma)	52.4%
Laryngeal EMG	38.1%
Transoral injection medialization of true vocal folds	28.6%
Transnasal true and/or false vocal fold botox injections	14.3%
<i>Voice/Airway</i>	
Transnasal Kenalog injections	19%
<i>Airway</i>	
Subglottic stenosis cases	100%

( $P = 0.0554$ ), more likely to identify dysphonic voices based on auditory findings alone ( $P = 0.0307$ ), and more likely to be able to interpret a VFSS ( $P = 0.0028$ ). They trended toward a higher likelihood of being involved in all

**TABLE 7.**  
Comparing Between Those Interesting in Pursuing a Career in Laryngology and the Remainder of the residents

	Anticipated Subspecialty		P value
	Laryngology (n = 16)	Other (n = 135)	
<i>More likely to identify on phonation alone:</i>			
Adductor spasmodic dysphonia	15 (93.8%)	80 (59.3%)	0.0057
Abduction spasmodic dysphonia	14 (87.5%)	77 (57.0%)	0.0280
Ventricular phonation	9 (56.3%)	18 (13.3%)	0.003
Vocal tremor	15 (93.8%)	86 (63.7%)	0.0215
Glottic insufficiency	16 (100.0%)	90 (66.7%)	0.0032
<i>Interpretation of VFSS</i>			
Identify hyolaryngeal elevation (VFSS)	15 (93.8%)	72 (53.7%)	0.0022
Cricopharyngeal hypertrophy (VFSS)	14 (87.5%)	43 (31.9%)	0.0001
	13 (81.3%)	57 (42.2%)	0.0035
<i>Surgical procedures</i>			
Open cricopharyngeal myotomy	11 (68.8%)	55 (40.7%)	0.0592
Endoscopic cricopharyngeal myotomy	14 (87.5%)	64 (47.4%)	0.0028
<i>Office-based procedures</i>			
Laser procedures	13 (81.3%)	52 (38.5%)	0.0022
Transcervical true/false vocal fold botox injections	14 (87.5%)	68 (50.4%)	0.0064
Transcervical injection medialization of true vocal folds	13 (81.3%)	56 (41.5%)	0.0031
Laryngeal EMG	13 (81.3%)	39 (28.9%)	0.001
Transnasal esophagoscopy	11 (68.8%)	34 (25.2%)	0.0008
Transnasal Kenalog injections	9 (56.3%)	30 (22.2%)	0.0062

laryngology procedures surveyed and this reached statistical significance for procedures including open ( $P = 0.0236$ ) and endoscopic ( $P = 0.004$ ) cricopharyngeal myotomy and open zenkers diverticulectomy ( $P = 0.0537$ ). These values also reached statistical significance for office based including laser procedures ( $P = 0.0015$ ), transcervical true/false vocal fold botox injections ( $P = 0.0029$ ), transcervical injection medialization of true vocal folds ( $P = 0.0035$ ), and laryngeal EMG ( $P = 0.002$ ).

## DISCUSSION

The focused practice of laryngology is core subject for all otolaryngologists in training. Laryngological complaints make up nearly half (47.3%) of inpatient consultations to the otolaryngology department.<sup>6</sup> However, the frequency that laryngological issues afflict our patients is not necessarily reflected in the training of our residents or minimum requirements by the ACGME. The research conducted in this study is significant as it brings awareness to the variation of laryngology education received by otolaryngology residents in the United States.

The extent and time training in laryngology may be related to the limited number of laryngology competencies required in the ACGME guidelines.<sup>7</sup> Few voice related procedures are required, and no swallow surgery is necessary, for completion of an otolaryngology training program. Thus, resident experience in laryngology is highly variable and dependent on the training program. However general otolaryngologists will likely see a wide range of laryngology related complaints. As one in five residents anticipate being general otolaryngologists according to our results, a broader exposure to laryngology would be beneficial due to the frequency of laryngological chief complaints.<sup>6</sup> Currently only a third of residency programs provide a dedicated laryngology rotation.

Regarding laryngology exposure currently available, our study shows that providing a dedicated laryngology rotation increases resident reported statistically significant improved satisfaction with laryngology exposure. Those residents with a dedicated rotation reported higher likelihood of being involved in all laryngology with statistical significance reached cricopharyngeal myotomy and open zenkers diverticulectomy. As has been proven in other fields such as general surgery, a required standard curriculum increases competency as seen in training examination scores.<sup>8</sup> Our data shows those who plan on pursuing a career in laryngology have more exposure to the field. This suggests that opportunities are available to all residency programs.

Our results focused on residents in their last year of training as their experience reflects the program as a whole. Looking at the trend of exposure from PGY1-PGY6 shows increase in exposure each year. While virtually all residents had been involved with laryngology cases, the experiences of residents did not encompass the entire breadth of laryngology. Almost all residents reported involvement in airway cases throughout their residency, however the rate of resident involvement in cases related to voice and swallowing

pathology was much lower. This is consistent with results found by Shah et al assessing resident exposure to phonemic surgery. They showed 21.6% of senior residents in their fourth and fifth post graduate year felt very comfortable using phonemic surgical techniques to remove a vocal fold lesion.<sup>9</sup> This difference was accentuated when looking at specialized in-office laryngology procedures with only. Most residents subjectively reported that they had great or excellent training in laryngology but the variability of their exposure shows that this has different meanings program to program.

Including simulation courses may also enhance learning as has been found in multiple different fields.<sup>8-12</sup> Different methods for surgical education in laryngology have been described in the literature and have shown improved resident reported confidence with laryngeal procedures.<sup>13,14</sup> A laryngeal dissection course along with a laryngeal dissection manual was described by Verma et al providing a standard educational course to residents.<sup>15</sup> In 2017 both Kavanagh et al and Burns et al independently created 3D printed models to be used as laryngeal simulators for laryngeal surgery training.<sup>16</sup> A 3D-printed tracheoesophageal puncture and prosthesis placement simulator was created and described by Barber et al allowing learning to be performed in a controlled environment.<sup>14</sup> Even very basic and low cost trainers have been created out of toilet paper rolls<sup>15</sup> or chicken wings with foam pipe insulation tube.<sup>17</sup> Despite all this effort to create innovative methods of teaching these methods have not become wide spread.

Regarding weakness, there are several related to this paper that require discussion. First, our study showed a response rate of 9.6% which means a minority of the residents nationally were sampled. However, a 10% response rate is considered good for this size population with survey response data.<sup>18</sup> Thus, we feel that it is reasonable to discuss trends from this data, as it is the largest reported data pool on resident laryngology training to date. Our study may be biased towards residents with better exposure due to our survey follow up methods. Although all residents and coordinators received the study and reminder emails requesting responses; residents with a laryngologist may have a higher response rate secondary to direct contact with laryngology faculty encouraging completion of the survey. In our responses, 34% of residents stated they had a laryngology fellow as part of their institution although only 22% of residency programs have one. This suggests that programs with a larger laryngology presence had a higher response rate. Due to this, the true exposure to laryngology may be more limited than our data suggests as programs with less laryngology presence were less likely to respond to our survey. Additionally, there may be a geographic bias due to different response rates across the nation. Looking at the rate of responses per region the southwest had a 30% response rate compared to a 4%–12% response rate in the rest of the country. As the investigators are based in Arizona this may have contributed to this difference. The response rate per region is too limited to provide any meaningful geographic

comparison and therefore conclusions can only be made for the study population as a whole. Finally, this is a self-reported survey on resident experience and competency without objective data to support. Self-reported data has an inherent bias due to selective recall and social bias to report higher levels of satisfaction and competency.<sup>19</sup> Although these biases may be present, it does not take away from the evidence of disparate training between programs and variable resident exposure.

### CONCLUSION

Laryngology training and exposure varies across the country. At the end of training, residents across the country are more familiar with airway than voice and swallowing related pathology. Those respondents with a designated laryngology rotation were more likely to have exposure to laryngeal surgery and office-based procedures. Residents and fellows pursuing a career in laryngology had more exposure to the field suggesting that there are opportunities available for additional exposure. Programs with a laryngologist likely had higher response rates so the true laryngology exposure may be more limited than our data suggests.

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