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## ORIGINAL RESEARCH

# Simulation-based workshop for emergency preparedness in otolaryngology

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## Abstract

**Objectives:** This study aimed to evaluate the outcomes of a hands-on simulation-based course with emphasis on procedural techniques, clinical reasoning, and communication skills developed to improve junior Otolaryngology – Head and Neck Surgery (OHNS) residents' preparedness in managing otolaryngologic emergencies.

**Methods:** Junior OHNS residents and faculty from residency programs in California, Nevada, and Arizona participated in this workshop in 2020 and 2021. The stations featured airway management techniques, ultrasound-guided needle aspiration, nasoseptal hematoma evacuation, and facial fracture repair using various models and cadavers. Participants completed a pre-workshop survey, post-workshop survey, and 2-month follow-up survey that assessed resident anxiety and confidence in three OHNS emergency situations across knowledge, manual skills, and teamwork using a 5-point Likert scale.

**Results:** Pre-workshop surveys reported the least anxiety and most confidence in teamwork, but the most anxiety and least confidence in technical skills and knowledge related to foreign body retrieval and airway management. Immediately post-workshop participants reported significant reductions in anxiety and increases in confidence, largest in the manual skills domain, in foreign body retrieval (anxiety:  $-0.99$ , confidence:  $+0.95$ ,  $p < .01$ ) and airway management stations (anxiety:  $-0.68$ , confidence:  $+1.07$ ,  $p < .01$ ). Data collected for the epistaxis station showed decreasing confidence and increasing anxiety following the workshop.

**Conclusion:** Our findings demonstrate the effectiveness of a workshop in preparing junior residents in potentially lifesaving otolaryngologic techniques that residents will encounter. Optimizing use of simulation centered training can inform the future of residency education, improving confidence and decreasing anxiety in residents responsible for the safety of patients.

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**Level of Evidence: III.**

**KEYWORDS**

boot camp, graduate medical education, residency training, simulation-based education, surgical education models, workshop

## 1 | INTRODUCTION

OHNS residency comprises a broad range of patient care experiences including outpatient clinic practice, inpatient care, surgical procedures, and includes the management of life-threatening otolaryngologic conditions.<sup>1</sup> Emergency care of trauma and critically ill patients with otolaryngologic conditions often requires rapid assessment and action by the first responder. Junior residents often carry the on-call pager and are frequently the first surgical providers at the scene of otolaryngologic emergencies. Junior residents may benefit from focused training on emergencies.

The onboarding period of new surgical interns may be associated with a concern for lack of preparedness and considerable anxiety for trainees.<sup>2-4</sup> During COVID-19 in particular, otolaryngology residents frequently dealt with critical situations like airway compromise and mucosal surgery, elevating the necessity for thorough and adequate acute care training at the start of their program.<sup>5-9</sup> As such, adequate training and preparation for otolaryngologic emergencies may improve patient outcomes and ameliorate anxiety for trainees.

Since the early 2000s, the Accreditation Council for Graduate Medical Education (ACGME) goal of competency-based training has become increasingly challenging in the setting of limited work hours, resource limitations, and evolving educational expectations.<sup>10</sup> This presents a challenge for educators in residency programs to adequately prepare learners for various clinical situations. Simulation-based training presents an opportunity to avoid poor patient outcomes while providing focused, controlled scenarios for residents to perform clinical tasks.<sup>11-14</sup> Workshops employ intensive training that utilizes these principles over an expedited time course, and function to afford junior residents the opportunity to learn critical life-saving measures adequately and efficiently before they are faced with a real-time scenario.<sup>15</sup> Many regional resident workshops exist with excellent rates of participation and responses and several specify the use of simulation-based training which has shown to correlate with better overall performance, greater efficiency, fewer errors, and less patient discomfort in patient care.<sup>16,17</sup> In a survey of US otolaryngology program directors, 76.6% of responders reported resident participation in workshops with 95% held in postgraduate year (PGY-1), and 42% as a 1-day course.<sup>18</sup>

In 2020, the University of California San Diego residency program established a workshop for regional OHNS interns across four institutions in the Southwestern United States. The goal of the program was to enhance procedural technique, clinical reasoning, and communication skills in three clinical scenarios: emergent airway management, uncontrolled epistaxis, and foreign body retrieval. In 2021, our program expanded to nine total institutions and resident enrollment increased by 76%. While many regional resident workshops exist with

excellent rates of participation and responses, our study provides a distinct contribution by focusing on the longitudinal changes in confidence and anxiety levels of junior residents, and the statistical analysis of these changes after one workshop day.<sup>19-22</sup> We hypothesized that our 1-day intensive workshop program would not only improve trainee confidence but also provide a quantitative measure of these changes over time, thereby enriching the existing body of knowledge surrounding this subset of training.

## 2 | MATERIALS AND METHODS

### 2.1 | Study and curriculum design

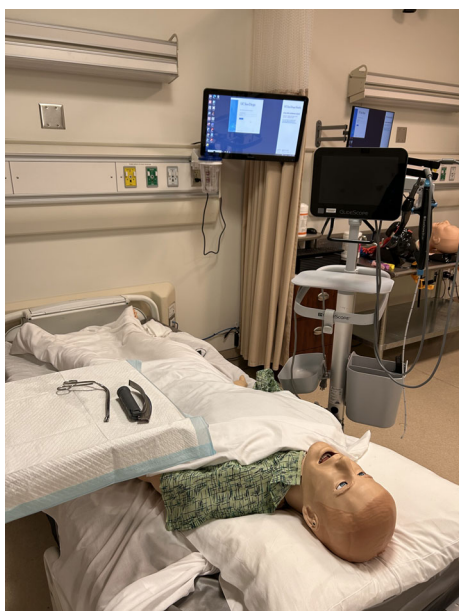
The 1-day OHNS emergency workshop aimed to improve residents' procedural techniques, clinical reasoning, and communication skills through a series of stations focused on specific otolaryngologic emergencies. The workshop was developed and implemented by a team of experienced academic faculty members representing various subspecialties. The stations included emergent tracheotomy and cricothyroidotomy using models, airway management, ultrasound-guided fine needle aspiration on phantom models, various elective tracheotomy techniques, laryngeal anatomy using pig airway dissections, bag masking, intubation, laryngeal mask airway placement, airway exchange catheter use on models with graded airway difficulty, nasolaryngoscopy on models, nasoseptal hematoma evacuation on cadavers, and open reduction and internal fixation (ORIF) of facial fractures using facial bone models. The workshop utilized a combination of simulation and cadaver models in the newly designed training facility at the University of California San Diego.

Three stations focused on specific otolaryngologic emergencies, such as foreign body retrieval, uncontrolled epistaxis, and acute airway management. A subset of stations provided residents with opportunities to practice their skills through concomitant simulations for foreign body retrieval and acute airway management, scenarios 1 and 3, respectively. Scenario 1, foreign body retrieval simulated a patient reported to have moderate inspiratory stridor with a resident called to bedside overnight and station setup is depicted in [Photo 1](#). Scenario 3, airway management, simulated an inpatient experiencing progressive anterior neck swelling following thyroidectomy. Scenario 3 incorporated faculty to assist in team-based airway management and is depicted in [Photo 2](#). Scenario 2, uncontrolled epistaxis presented a patient case focused on epistaxis in the emergency department. This station was lecture based and did not have a related model or simulation aside from use of a whiteboard for discussion of relevant anatomy.

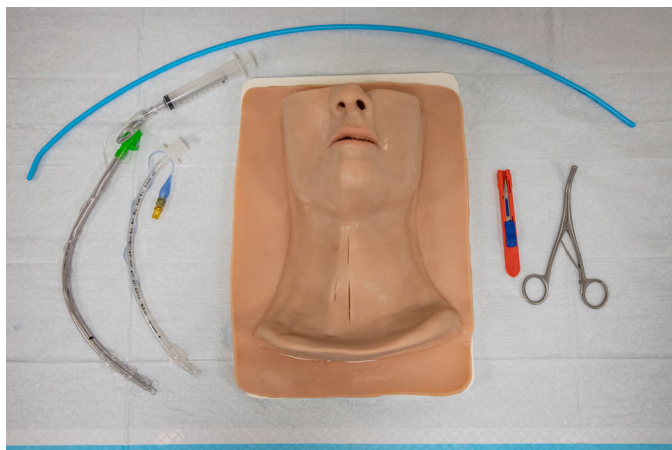
This study was deemed exempt from review by the University of California San Diego Institutional Review Board.

## 2.2 | Program evaluation

Survey content was designed to evaluate resident anxiety and confidence in three OHNS emergency situations in the domains of knowledge, manual skills, and teamwork. A 5-point Likert scale was utilized, ranging from 1 (None) to 5 (Very high level of anxiety or confidence) for each domain (Appendix A). Survey design and content were approved by the *Society of University Otolaryngologists* for implementation. Before beginning the workshop, all participants were asked to complete a pre-workshop (pre-boot camp



**PHOTO 1** Scenario 1 setup, foreign body retrieval station.



**PHOTO 2** Scenario 3 setup, airway management station.

or pre-BC) survey to establish baseline anxiety and confidence in three OHNS emergency scenarios. Participants were asked to complete a post-workshop (post-BC) survey immediately after the workshop, and a final 2-month follow-up survey. The final survey contained two additional questions about participant satisfaction and usefulness.

## 2.3 | Statistical analysis

Statistical analysis was performed using R Statistical Software (R Foundation for Statistical Computing, Vienna, Austria). The Kruskal-Wallis test was used to compare responses between the pre-BC, post-BC, and at 2-month post-BC follow-up. Due to the sample size and inability to track individual responses for anonymity, the Kruskal-Wallis test was followed by Conover's nonparametric multiple comparison test to determine which measurements differed from the others. A  $p$  value  $<.05$  was considered significant.

## 3 | RESULTS

### 3.1 | Baseline demographics

A total of 47 residents were enrolled in the workshop from 2020 to 2021. In 2020, 17 residents were enrolled, 8 participants were male and 9 female as seen in Table 1a. There were adequate response rates in the pre-BC survey (94.1%; 16 of 17 participants), post-BC survey (82.4%, 14 of 17 participants) and 2-month follow-up survey (82.4%; 14 of 17 participants). Each participant was a first year (PGY-1) or second year (PGY-2) resident at one of the four participating institutions from the Southwestern region as seen in Table 1b. In 2021, 30 residents were enrolled from a total of 9 participating institutions in the Southwestern region. Most participating residents were male (73.3%; 21 of 30 participants). Similar to the prior year, there were high



**TABLE 1a** Characteristics of workshop participants and survey response rates.

	Year 1—2020	Year 2—2021
Enrolled, <i>n</i> (%)		
Male	8 (47.1)	21 (73.3)
Female	9 (52.9)	9 (26.7)
Total	17	30
PGY1, <i>n</i> (%)	11 (64.7)	23 (76.7)
PGY2, <i>n</i> (%)	6 (35.3)	7 (23.3)
Number of participating institutions ( <i>n</i> )	4	9
Pre-BC survey, <i>n</i> (%)	16 (94.1)	27 (90.0)
Post-BC survey, <i>n</i> (%)	14 (82.4)	23 (76.7)
2-month post-BC survey, <i>n</i> (%)	14 (82.4)	10 (33.3)

Note: Demographic information regarding participants. Data are presented as *n* (%) for categorical measures.

Abbreviation: BC, boot camp.

response rates for the pre-BC survey (90.0%; 27 of 30 participants) and post-BC survey (76.7%; 23 of 30 participants), but only 33.3% of participants responded to the 2-month follow-up survey (10 of 30 participants).

### 3.2 | Pre-workshop survey results

In the pre-BC surveys for scenario 1 (foreign body retrieval) and scenario 3 (airway management) participants reported the least anxiety (mean scenario 1 score = 1.2; mean scenario 3 score = 0.9) and most confidence (mean scenario 1 score = 2.4; mean scenario 3 score = 2.3) in teamwork (Tables 2 and 3). Both scenarios revealed the most anxiety (mean scenario 1 score = 2.3, mean scenario 3 score = 1.5) in manual skills and least confidence (mean scenario 1 score = 1.2) in knowledge and manual skills (mean scenario 3 score = 1.5). In the pre-BC surveys for scenario 2 (uncontrolled epistaxis), participants reported the least anxiety (mean score = 1.3) and most confidence (mean score = 2.0) in manual skills. The most anxiety (mean score = 2.3) and least confidence (mean score = 1.4) were observed in teamwork. The same trends in anxiety and confidence levels among stations pre-workshop were similar when each year was analyzed independently.

### 3.3 | Immediate post-workshop survey results

After completion of the workshop, all participants in scenario 1 (foreign body retrieval) and scenario 3 (airway management) endorsed significant decreases in anxiety and significant increases in confidence across all questions (Figure 1, Table 2). Score difference between pre-BC and post-BC was largest in the manual skills domain in both scenario 1 (anxiety:  $-0.99$ , confidence:  $+0.95$ ,  $p < .01$ ) and scenario

**TABLE 1b** Workshop participants by institution.

	Year 1—2020	Year 2—2021
Total enrolled, <i>n</i>	17	30
Cedars Sinai Medical Center, <i>n</i> (%)	2 (11.8)	4 (13.3)
UCLA, <i>n</i> (%)	4 (23.5)	5 (16.7)
UC Irvine, <i>n</i> (%)	5 (29.4)	4 (13.3)
UC San Diego, <i>n</i> (%)	6 (35.3)	4 (13.3)
USC, <i>n</i> (%)		2 (6.7)
University of Arizona, <i>n</i> (%)		3 (10)
Mayo Clinic – Arizona, <i>n</i> (%)		2 (6.7)
University of Nevada – Las Vegas, <i>n</i> (%)		3 (10)
Naval Medical Center – San Diego, <i>n</i> (%)		3 (10)

Note: Participants categorized by institution. Data are presented as *n* (%) for categorical measures.

3 (anxiety:  $-0.68$ , confidence:  $+1.07$ ,  $p < .01$ ). In contrast, scenario 2 (uncontrolled epistaxis), which incorporated a two-dimensional anatomical review without an accompanying hands-on simulation, revealed a significant increase in anxiety across all questions in post-BC surveys ( $p < .01$ ) and decrease in confidence across all categories following workshop ( $p < .01$ ; Figure 2, Table 3). Figures 3 and 4 demonstrate consistent findings when data are broken down by cohort year.

### 3.4 | Two-month post-workshop survey results

Based on our findings from the 2-month follow-up survey, we found that anxiety increased for clinical knowledge and manual skills in scenario 1 (foreign body retrieval) and scenario 3 (airway management) relative to immediate post-workshop results but did not reach pre-BC levels. Consistent with these results, levels of confidence in clinical knowledge and manual skills decreased at post-BC 2 months but persisted at significantly higher levels than pre-BC scores ( $p \leq .01$ ). There was a stepwise decline in teamwork anxiety levels at each time point in scenario 1 (1.19 vs. 0.89 vs. 0.67,  $p = .01$ ) and scenario 3 (0.88 vs. 0.54 vs. 0.42,  $p = .01$ ; Figure 1, Table 2). There was an increase in confidence levels for teamwork at post-BC and post-BC 2-month follow-up compared with pre-BC (Figure 2, Table 3) scores.

For scenario 2 (uncontrolled epistaxis) anxiety levels at post-BC 2-month follow-up surveys revealed anxiety scores that were greater than pre-BC scores, but lower than immediate post-BC in all three domains (mean 1.74 vs. 2.58 vs. 2.36). Confidence levels followed a similar trend (mean 1.74 vs. 1.12 vs. 1.24).

Overall anxiety levels were higher in year 1 compared with year 2 (Figure 3). The trends described above were persistent after stratification by each year. In contrast to year 1, year 2 showed improved durability for anxiety levels related to knowledge and teamwork for the foreign body retrieval and airway management stations, as levels remained low after 2 months. Following the workshop both

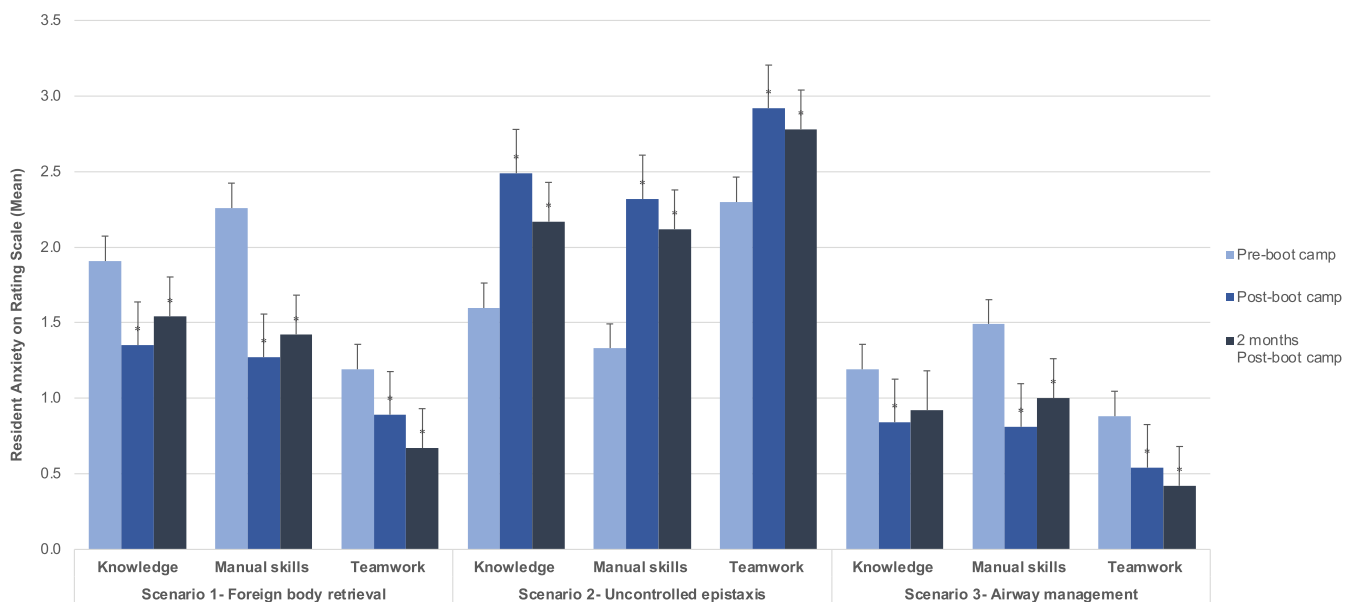
**TABLE 2** Resident anxiety levels; pre-, immediately post-, and 2-month post-workshop survey results.

		Pre-boot camp	Post-boot camp	p-value	2 months post-boot camp	p-value
Scenario 1—foreign body retrieval Score (SD)	Knowledge	1.9 (0.6)	1.4 (0.7)	.00	1.5 (0.7)	.01
	Manual skills	2.3 (0.9)	1.3 (0.6)	.00	1.4 (0.7)	.00
	Teamwork	1.2 (0.9)	0.9 (0.9)	.05	0.7 (0.7)	.01
Scenario 2—uncontrolled epistaxis Score (SD)	Knowledge	1.6 (0.6)	2.5 (0.8)	.00	2.2 (0.6)	.00
	Manual skills	1.3 (0.7)	2.3 (0.8)	.00	2.1 (0.6)	.00
	Teamwork	2.3 (0.9)	2.9 (0.8)	.00	2.8 (0.8)	.02
Scenario 3—airway management Score (SD)	Knowledge	1.2 (0.8)	0.8 (0.6)	.02	0.9 (0.6)	.08
	Manual skills	1.5 (0.7)	0.8 (0.6)	.00	1 (0.5)	.00
	Teamwork	0.9 (0.8)	0.5 (0.6)	.02	0.4 (0.5)	.01

Abbreviations: BC, bootcamp; SD, standard deviation.

**TABLE 3** Resident confidence levels; pre-, immediately post-, and 2-month post-workshop survey results.

		Pre-boot camp	Post-boot camp	p-value	2 months post-boot camp	p-value
Scenario 1—foreign body retrieval Score (SD)	Knowledge	1.2 (1.0)	2.7 (0.7)	.00	2.5 (0.8)	.01
	Manual skills	1.7 (0.9)	2.7 (0.7)	.00	2.5 (0.8)	.00
	Teamwork	2.4 (1.1)	2.9 (0.7)	.01	2.8 (0.8)	.04
Scenario 2—uncontrolled epistaxis Score (SD)	Knowledge	1.9 (0.9)	1.3 (0.7)	.00	1.5 (1.0)	.03
	Manual skills	2.0 (0.9)	1.2 (0.6)	.00	1.4 (0.7)	.02
	Teamwork	1.4 (0.8)	0.8 (0.7)	.00	0.9 (0.7)	.04
Scenario 3—airway management Score (SD)	Knowledge	1.8 (0.8)	2.5 (0.7)	.00	2.5 (0.6)	.00
	Manual skills	1.5 (0.9)	2.5 (0.8)	.00	2.3 (0.7)	.00
	Teamwork	2.3 (1.0)	2.7 (0.8)	.01	2.8 (0.9)	.02

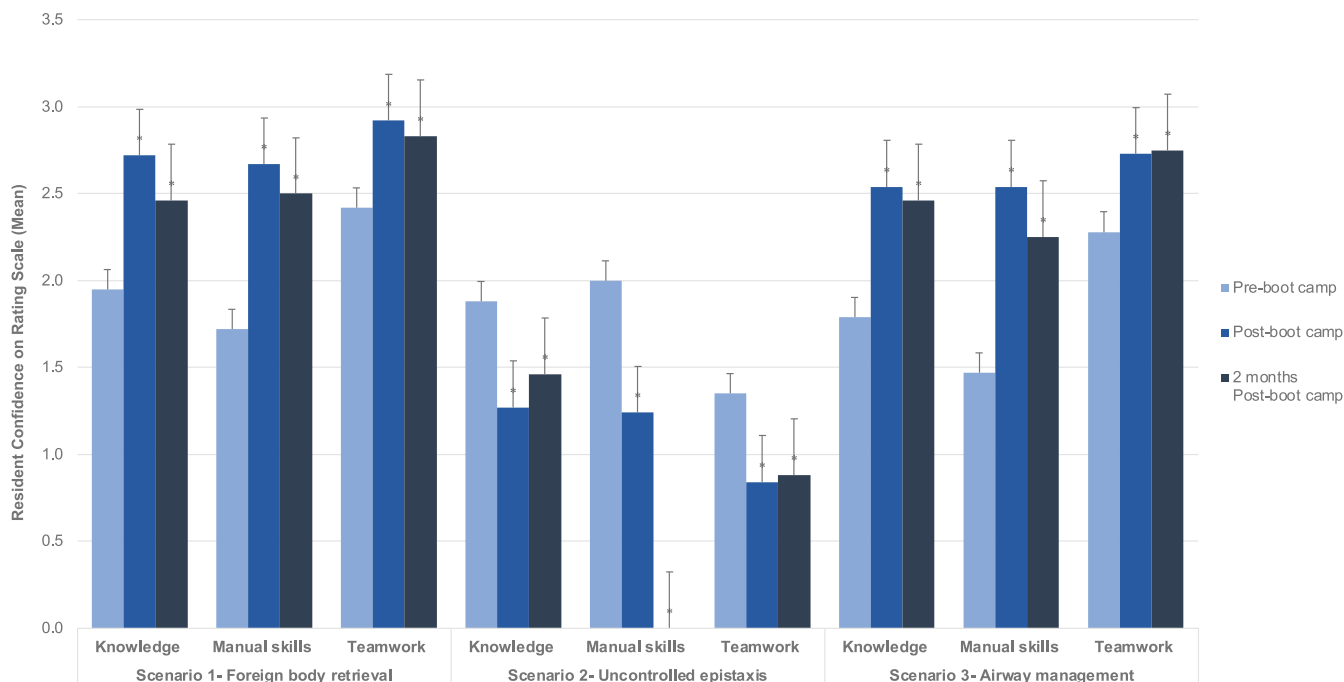


**FIGURE 1** Resident anxiety levels; pre-, immediately post-, and 2-month post-workshop survey results.

immediately and 2 months later, the year 2 cohort had slightly higher confidence scores compared with the year 1 cohort for scenarios 1 and 3, foreign body retrieval and airway management. The year 2 cohort showed a significant stepwise decline in confidence

regarding the uncontrolled epistaxis station, which was not reflected in year 1.

Finally, when asked to rate workshop satisfaction and usefulness at the 2-month time point, 22 (92%) and 23 (96%) of 24 trainees rated



**FIGURE 2** Resident confidence levels; pre-, immediately post-, and 2-month post-workshop survey results.

the course as very good or outstanding and very useful or extremely useful, respectively.

#### 4 | DISCUSSION

An Otolaryngology – Head and Neck Surgery workshop conducted in our region was successful in reducing trainee anxiety and increasing trainee confidence, particularly in the immediate post-intervention period. Our most durable results included significantly higher trainee confidence and decreased trainee anxiety in foreign body retrieval and airway management stations. In contrast, the non-simulation scenario (uncontrolled epistaxis) revealed significantly increased anxiety and decreased confidence at both post-BC and 2-month follow-up. Overall, these findings suggest that a simulation-based surgical workshop may improve junior residents' confidence and decrease anxiety in knowledge, manual skills, and teamwork for otolaryngologic emergencies.

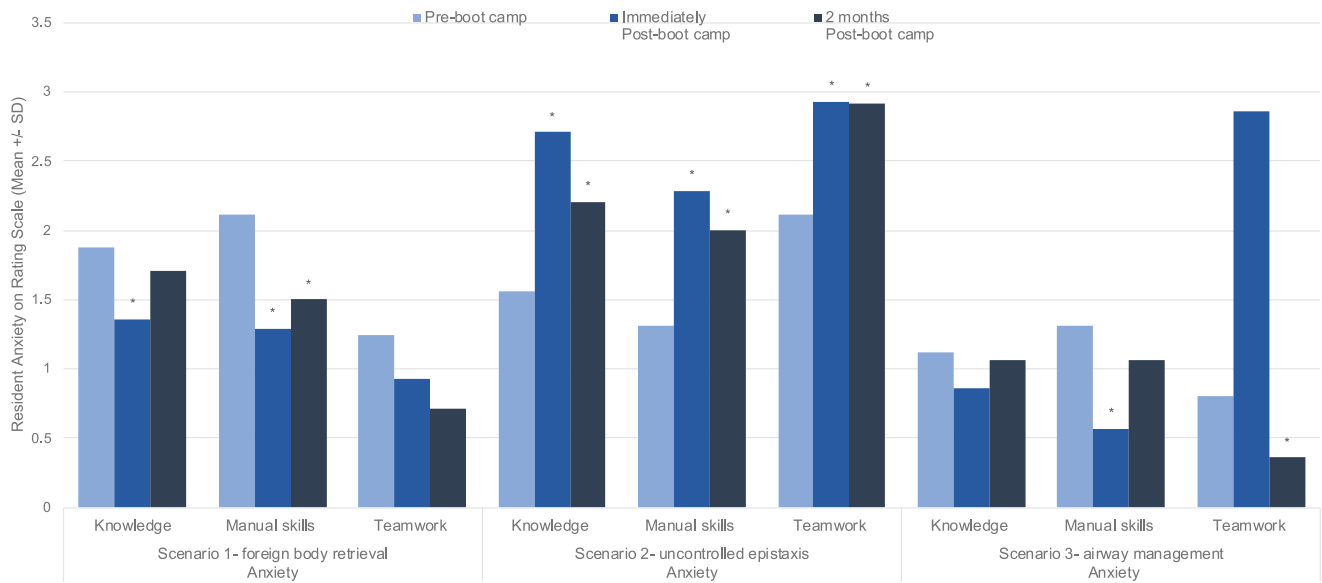
Simulations in OHNS have been previously reported in the literature and are increasingly utilized, including temporal bone dissections, endoscopic sinus surgery, and advanced airway management.<sup>15,23–25</sup> Simulation-based education allow residents and faculty to practice scenarios without the risk of harming patients, which may provide more iterations in a low stress environment that are adapted to the needs of the learner.<sup>26</sup> Intensive emergency-scenario workshops, both single- and multi-institutional, have incorporated simulation-based scenarios. Multiple reports have demonstrated a significant increase in confidence following OHNS simulation-based courses.<sup>23,27–29</sup> Consistent with these findings, we demonstrate a significantly sustained increase in confidence across all simulation-based scenarios, but our workshop was unique in that we recruited participants from several

OHNS residency programs located in the region. As such, we reveal that simulation-based education provides retained increased confidence and decreased anxiety at 2 months in residents from variable training environments, which may further support the robust use of simulated cases for surgical training.

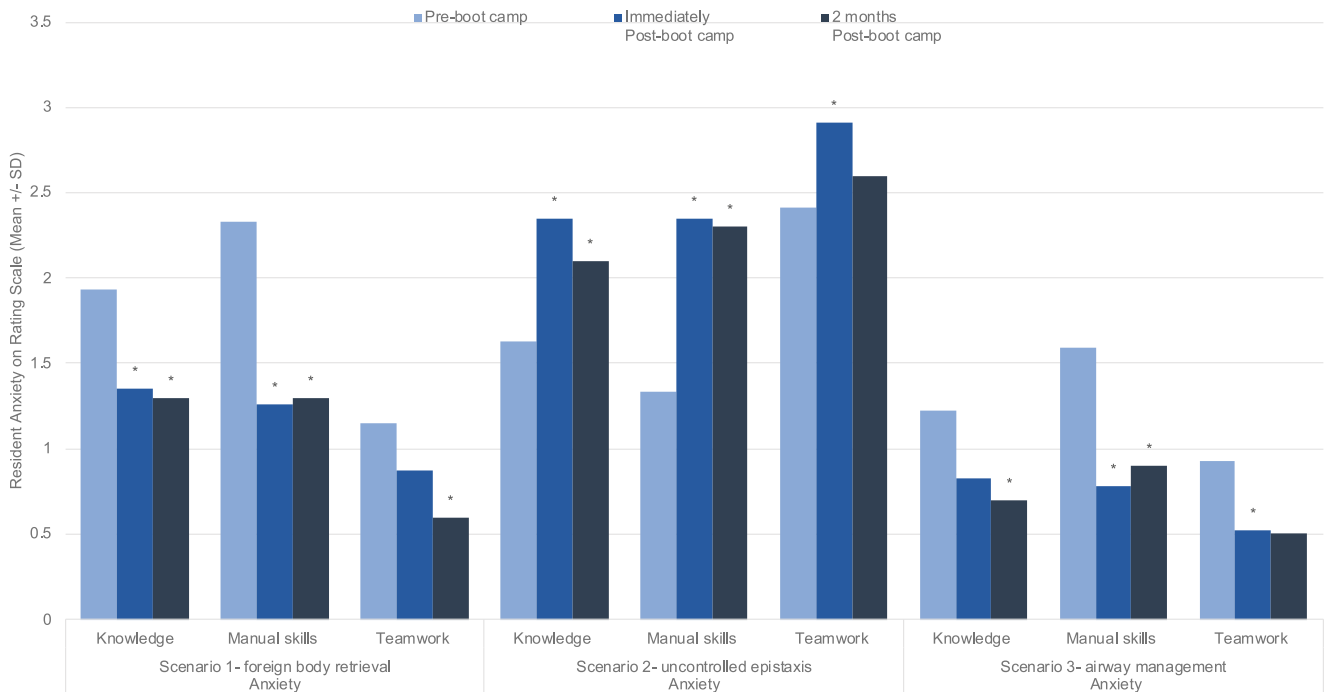
Surgical workshops are often designed to incorporate a combination of both simulation and didactic teaching. In a single-blinded randomized study, interns who had simulation-based OHNS emergency scenarios had significantly higher assessment scores during evaluation by an experienced provider compared with interns that received traditional didactic teaching alone ( $p < .05$ ).<sup>27</sup> Scenario 2 (uncontrolled epistaxis) did not include a simulation component and thus can serve as a negative control in our study. Compared with pre-workshop scores, scenario 2 demonstrated higher levels of anxiety and lower levels of confidence after the workshop. Advantages of simulation compared with traditional didactics are likely multifactorial and may include factors such as increased engagement with the material and better representation of the intricacies of emergency care. Other explanations for this result could be related to the severity and complexity of nosebleeds that require an emergency department visit and an otolaryngology consultation.<sup>30,31</sup> Our findings suggest that simulating emergency events can result in lowered anxiety levels and a higher confidence level when compared with a standard didactic experience. We acknowledge that hands-on simulation-based training itself may cause a significant level of anxiety. However, in our survey results, anxiety levels improved over time for these scenarios.

Although there is no specific literature on trainee knowledge gaps early in residency as a source of anxiety, results of an OHNS workshop at the Georgetown University Department of Otolaryngology found a similar deterioration in trainee confidence for cricothyroidotomy,

Year 1



Year 2



**FIGURE 3** Year 1 versus Year 2 Resident anxiety levels; pre-, immediately post-, and 2-month post-workshop survey results.

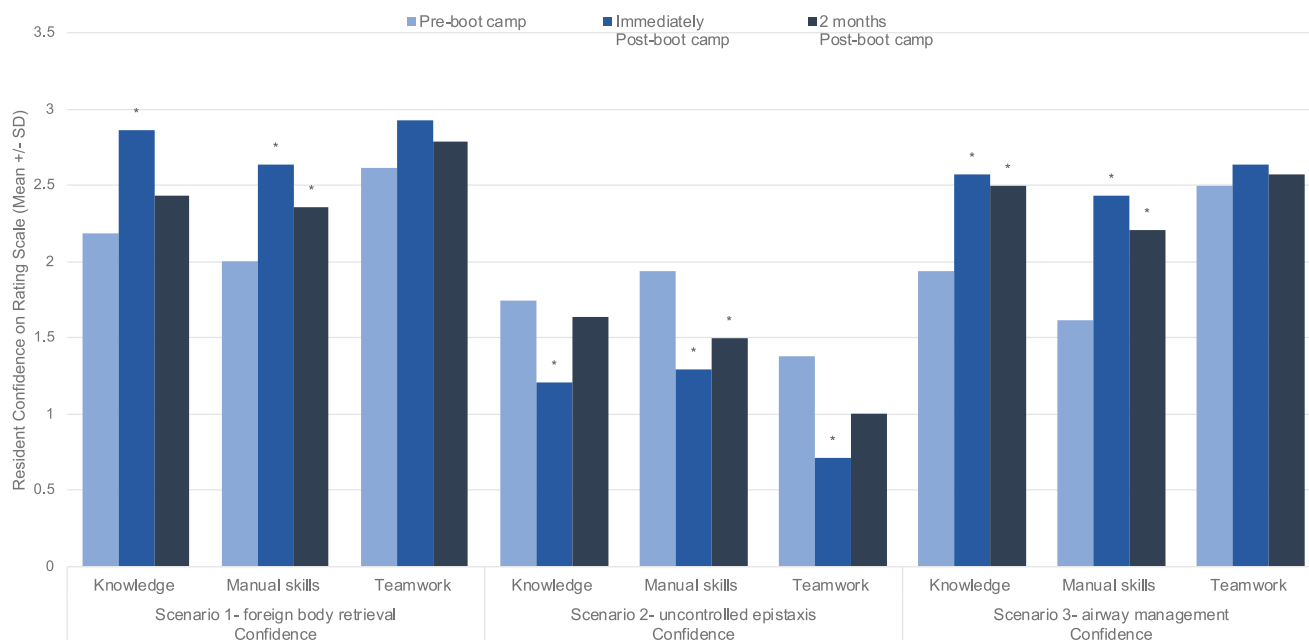
which the authors argued was due to a lack of educational exposure to reinforce those skills.<sup>29</sup> Our results suggest that even after a relatively short follow-up, trainee anxiety and confidence can trend toward prior levels. In the absence of repeated clinical exposure, simulated

experiences should be scheduled regularly to maintain competence and confidence.

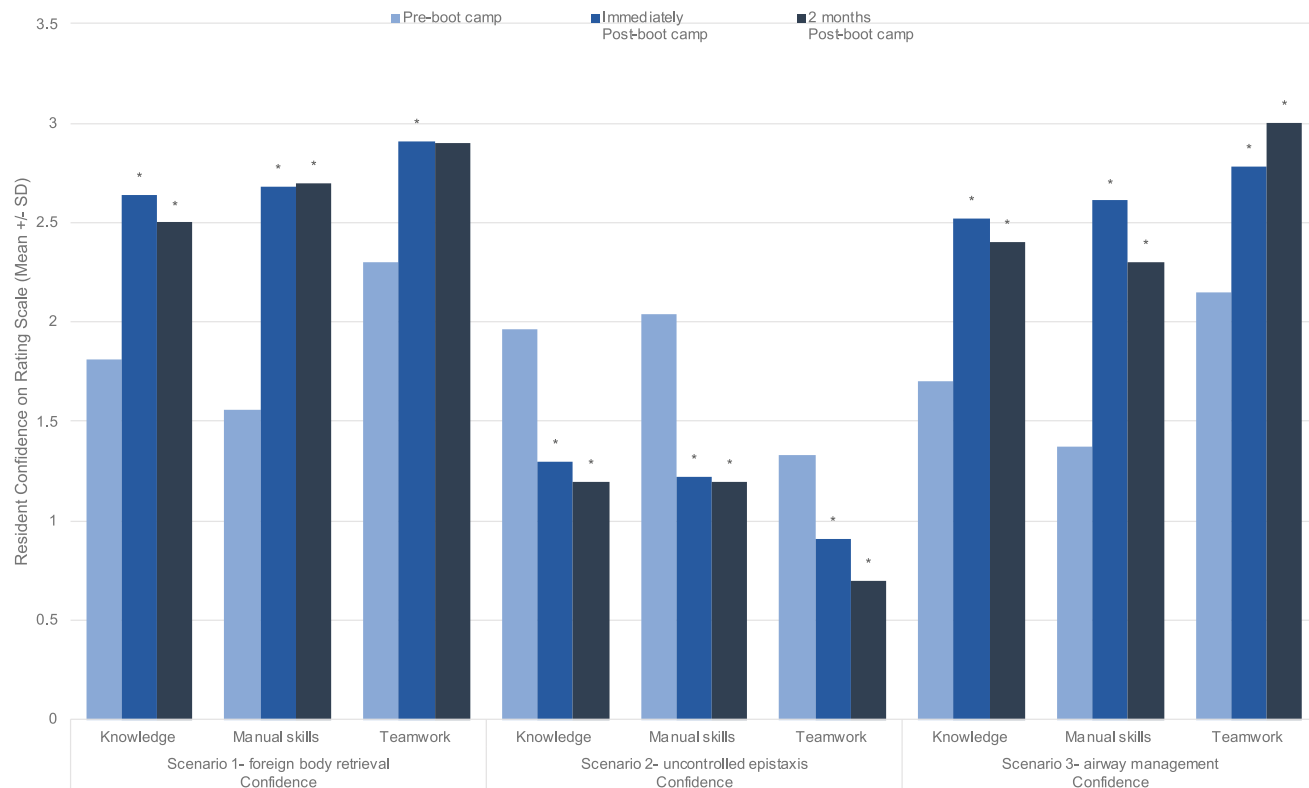
We acknowledge the limitations of our study. Although the data presented may not be novel, as improvements in participant



Year 1



Year 2



**FIGURE 4** Year 1 versus Year 2 Resident confidence levels; pre-, immediately post-, and 2-month post-workshop survey results.

confidence following hands-on simulation workshops have been demonstrated in other studies, our unique contribution is the quantitative measure of how such a workshop can alter a junior resident's

confidence and anxiety levels for specific emergent procedures, both immediately before and after attending, and whether these changes are retained 2 months later.

We recognize that although our study focused on the enhancement of anxiety and confidence, we did not directly measure the improvement of trainee competence, a critical aspect of trainee development. Furthermore, we did not control for the potential confounding factor of trainees' prior engagement in teamwork scenarios in the clinical setting, which could influence their teamwork anxiety and confidence levels. Additionally, while we queried participants for their subjective assessments of their anxiety and confidence, we did not employ an objective metric to assess knowledge or manual skills before and after the workshop.

Future research could explore qualitative components to delve into the underlying reasons behind participants' responses, further assessing how the change in trainees' confidence and anxiety levels is affected when hands-on simulation is replaced with a different teaching setting, such as the lecture format utilized in one of our stations. We also aim to investigate potential barriers that may prevent some learners from altering their perception of confidence and anxiety levels through this type of educational exposure. Despite these limitations, we believe our study provides valuable insights into the potential benefits of simulation-based workshops in improving trainee confidence and reducing anxiety.

## 5 | CONCLUSION

This study evaluated the impact of a one-day otolaryngology resident workshop on anxiety and confidence in emergent patient scenarios. The workshop was effective in reducing anxiety and increasing confidence in foreign body aspiration and urgent airway management scenarios. The need for hands-on simulation training was highlighted, as a scenario without additional simulation led to increased anxiety and decreased confidence. The study underscores the importance of interactive, simulation-centered training in residency education to improve confidence and decrease anxiety in residents responsible for the safety of patients.

## FUNDING INFORMATION

Society of University Otolaryngologists Pilot Grant.

## CONFLICT OF INTEREST STATEMENT

The authors have no disclosures and declare no conflicts of interest.

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## APPENDIX A

Survey for each scenario (1–3) administered before workshop, immediately following workshop, and 2 months after workshop. Each question was answerable on a Likert-scale of 1–5 (1 = none and 5 = very high level).

How *Anxious* would you be when assessing the patient?

In regards to *knowledge* necessary to evaluate the situation?

In regards to *manual skills* necessary to help the patient?

In regards to *team behavior* necessary in working with your senior resident and nurses to help the patient?

How *Confident* would you be in assessing the patient?

In regards to *knowledge* necessary to evaluate the situation?

In regards to *manual skills* necessary to help the patient?

In regards to *team behavior* necessary in working with your senior resident and nurses to help the patient?