

# Interdisciplinary Crisis Resource Management Training: How Do Otolaryngology Residents Compare? A Survey Study

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## Abstract

**Objective.** Emergent medical crises, such as acute airway obstruction, are often managed by interdisciplinary teams. However, resident training in crisis resource management traditionally occurs in silos. Our objective was to compare the current state of interdisciplinary crisis resource management (IDCRM) training of otolaryngology residents with other disciplines.

**Methods.** A survey study examining (1) the frequency with which residents are involved in interdisciplinary crises, (2) the current state of interdisciplinary training, and (3) the desired training was conducted targeting Canadian residents in the following disciplines: otolaryngology, anesthesiology, emergency medicine, general surgery, obstetrics and gynecology, internal medicine, pediatric emergency medicine, and pediatric/neonatal intensive care.

**Results.** A total of 474 surveys were completed (response rate, 12%). On average, residents were involved in 13 interdisciplinary crises per year. Only 8% of otolaryngology residents had access to IDCRCM training, as opposed to 66% of anesthesiology residents. Otolaryngology residents reported receiving an average of 0.3 hours per year of interdisciplinary training, as compared with 5.4 hours per year for pediatric emergency medicine residents. Ninety-six percent of residents desired more IDCRCM training, with 95% reporting a preference for simulation-based training.

**Discussion.** Residents reported participating in crises managed by interdisciplinary teams. There is strong interest in IDCRCM and crisis resource management training; however, it is not uniformly available across Canadian residency programs. Despite their pivotal role in managing critical

emergencies such as acute airway obstruction, otolaryngology residents received the least training.

**Implication.** IDCRCM should be explicitly taught since it reflects reality and may positively affect patient outcomes.

## Keywords

crisis resource management, interdisciplinary, multidisciplinary, resident training, medical education, patient safety/quality improvement

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**E**ffective management of emergencies in otolaryngology–head and neck surgery (OTL-HNS), such as acute airway obstruction, often requires the efforts of

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physicians from multiple specialties. Patient outcome is highly dependent on the coordinated and collaborative efforts of team members from interprofessional domains (different health care professionals) and interdisciplinary domains (physicians from different disciplines).<sup>1</sup> These team dynamics are particularly strained during crisis situations, which are unpredictable and time-sensitive and involve ad hoc teams.<sup>2</sup> Limited exposure to these high-severity but low-frequency crises throughout medical training results in inadequate on-the-job training for residents for how to appropriately manage crises.<sup>3</sup> One training option focuses on the skills of crisis resource management (CRM),<sup>4</sup> which is a global approach to the management of complex and dynamic patient care situations that is intended to limit human error by focusing on nontechnical skills, such as leadership, situational awareness, decision making, communication skills, and resource allocation.<sup>5</sup>

In clinical practice, OTL-HNS surgeons are routinely called to work collaboratively and simultaneously with other specialties, such as anesthesiologists, intensivists, emergency medicine physicians, and trauma surgeons, to manage a life-threatening crisis. However, the training in CRM has traditionally focused on the identification of 1 team leader and been organized in educational or practice silos (training with members of one's own specialty) or with other professions (team members from other health professions; eg, nurses, respiratory therapists).<sup>6</sup> The convergence of multiple physicians to care for 1 patient in a crisis situation may lead to ineffective communication, which may be problematic when each physician has independently trained to be a team leader. If these tensions are not quickly resolved through a shared approach or effective communication strategies, the potential delays in decision making and institution of care could be detrimental to patient outcomes.<sup>3</sup> Interdisciplinary CRM (IDCRM) addresses a set of skills that is unique and involves CRM skills such as effective communication while addressing the nuances of interdisciplinary team training, challenging residents with realistic multidisciplinary conflicts in their own specialist roles.

The literature regarding CRM training has been primarily led by anesthesiology and pediatric emergency medicine (PEM) programs, and a few studies from OTL-HNS have now been published. A pilot program targeting simulation training for CRM for OTL-HNS residents and students examined participant evaluations and found that reception was unanimously positive.<sup>6</sup> Participants in a study that included 2 CRM simulation cases reported improved confidence in their skills.<sup>7</sup> Volk et al developed a simulation course on managing airway emergencies that was unique in that it includes OTL-HNS and anesthesiology residents.<sup>8</sup> They had positive survey responses from residents, who reported that such training was relevant to their future practice. No study has assessed the current state of CRM training for OTL-HNS residents across Canada or has compared it with other specialties.

This study aims to explore the need for formal IDCRCM training in OTL-HNS by determining, and comparing with other specialties, (1) whether residents are involved in

multidisciplinary crises in clinical practice, (2) the current state of CRM and IDCRCM training, (3) whether CRM and IDCRCM training is desired, and (4) resident self-perception of preparedness to manage such crises.

## Methods

### *Ethics, Consent, and Permissions*

Ethics approval was received from the Institutional Review Board at McGill University (Montreal, Canada), and study participants were consented to taking our anonymous survey.

### *Aim and Design*

Our study aims to compare the current state of IDCRCM training of OTL-HNS residents with other disciplines and to gauge interest in such training.

### *Survey Development*

A survey targeted to residents regarding training in CRM and IDCRCM was created and reviewed by content experts in OTL-HNS, anesthesiology, PEM, and medical education. The initial draft was piloted with 5 residents from various specialties and postgraduate levels to ensure intelligibility. Residents again completed the quantitative portion of the survey 6 weeks later to ensure test-retest reliability for the objective questions. Visual inspection of the responses showed that the responses were consistent from one test to the next for all qualitative questions. Test-retest reliability was calculated with Spearman's rho and found to be significant for our 3 quantitative questions. The draft was further revised until consensus among the experts was reached.

The final survey included questions with a variety of response options, including open-ended responses, multiple choices, and ratings on a 5-point Likert scale. Participants were asked to self-report demographic details (discipline, level of training, university, age, sex) and the amount of teaching that they have received in the last 12 months for CRM and IDCRCM, their self-perceived preparedness to manage a crisis involving multiple disciplines (with a 5-point Likert scale anchored at "very poorly" and "very well"), as well as their desired quantity of teaching and preferred instructional strategy (didactic, simulation, readings/assignments).

### *Study Population*

Residents currently enrolled in a Canadian residency program from the following specialties were invited to participate in this study: OTL-HNS, anesthesiology, emergency medicine, general surgery (GS), obstetrics and gynecology, internal medicine, PEM, and pediatric/neonatal intensive care. These programs were chosen by expert consensus due to their frequent involvement in interdisciplinary crisis situations. The survey was placed on McGill University's web-based LimeSurvey account.

**Table 1.** Study Participant Demographic Characteristics.<sup>a</sup>

Specialty	Rate of Completed Surveys, % (n)	Men:Women, n	Age, y, Mean $\pm$ SD
Pediatric emergency medicine	50 (15)	5:6	31 $\pm$ 3
Anesthesiology	15 (95)	54:27	29 $\pm$ 4
Emergency medicine	23 (84)	34:42	29 $\pm$ 3
Pediatric/neonatal intensive care	22 (11)	6:4	32 $\pm$ 1
Obstetrics and gynecology	12 (63)	11:46	29 $\pm$ 3
Internal medicine	6 (89)	40:41	28 $\pm$ 3
General surgery	12 (77)	39:32	29 $\pm$ 4
Otolaryngology	23 (40)	18:16	27 $\pm$ 3
Total	12 (474)	215:206	29 $\pm$ 3

<sup>a</sup>Responses to these survey items were optional.

### Survey Distribution

Resident participation was solicited by emails that were distributed through individual residency program administrative secretaries and the email lists of certain national specialty societies (eg, Canadian Society of Otolaryngology–Head and Neck Surgery). Residents were emailed up to 4 times between May 2013 and February 2014. All survey responses were collected anonymously, and all questions regarding demographics were optional to ensure that responses even from small programs remained anonymous.

### Data Analysis

Descriptive statistics were used to analyze the quantitative portion of the survey. Chi-square test was used to examine the relationship of CRM training, IDCRM training, and postgraduate year (PGY) level to self-reported sense of preparedness for managing IDCRM crises. A correlation was performed examining the relationship between the number of exposures to crises involving multiple specialties and ratings of self-reported preparedness.

## Results

### Demographic Characteristic

The number of residents enrolled in the targeted residency programs across Canada is 3932, from which 891 responses were received (response rate 23%). Incomplete responses and responses from residents outside the targeted specialties were excluded, resulting in 474 completed surveys (response rate 12%). **Table 1** presents response rates and demographics for each specialty.

All specialties reported participation from all levels of residency (PGYs 1-5) except PEM and pediatric/neonatal intensive care, since these programs are offered only after 3 years of pediatric training in Canada.

### Frequency of Resident Involvement in Interdisciplinary Crises

There was notable variation in the number of times that residents reported being involved in multidisciplinary crises. The average was 5 times yearly (range, 0-20) for OTL-HNS

**Table 2.** Times per Year That Residents Reported Being Involved in Interdisciplinary Crisis.

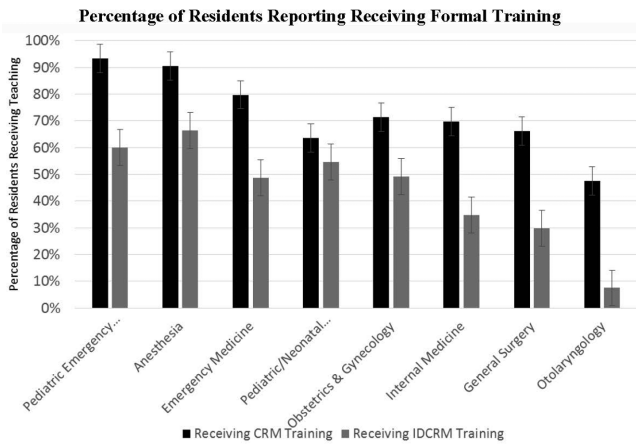
Specialty	Times per Year, Mean $\pm$ SD
Pediatric emergency medicine	12 $\pm$ 12
Anesthesiology	12 $\pm$ 12
Emergency medicine	15 $\pm$ 17
Pediatric/neonatal intensive care	10 $\pm$ 7
Obstetrics and gynecology	12 $\pm$ 12
Internal medicine	10 $\pm$ 11
General surgery	20 $\pm$ 27
Otolaryngology	5 $\pm$ 5

residents and 13 times yearly (median, 8; range, 0-200) for all specialties combined (447 residents were involved in at least 1 interdisciplinary crisis yearly). **Table 2** shows a breakdown by specialty. When the number of crises encountered were collapsed by subspecialty, the mean ranged from 5 to 20 per year.

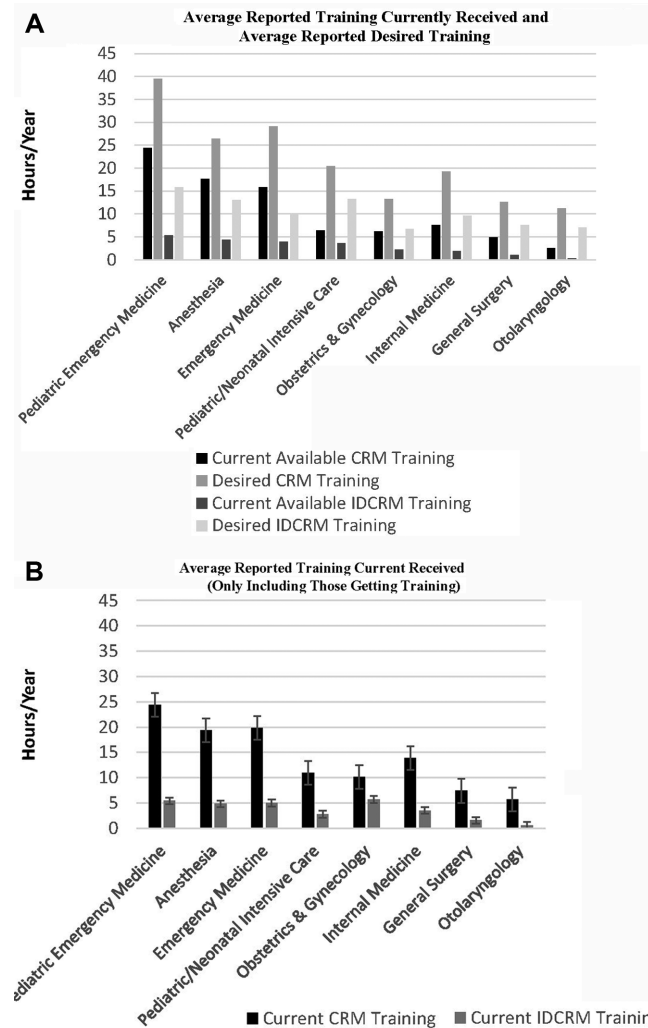
### Current Reported Training

Forty-eight percent (n = 19 of 40) of OTL-HNS residents receive formal teaching in CRM, as opposed to 77% of all other respondents (n = 332 of 434). **Figure 1** shows the percentage of residents in each specialty receiving formal teaching in CRM. Of residents receiving training, the amount of teaching is variable. **Figure 2A** compares the resident-reported average number of hours of formal teaching among specialties. OTL-HNS residents receive the least amount of CRM training (average 2.6 hours yearly; range 0-30 hours), while PEM residents receive the most (average 24.4 hours yearly; range 0-110 hours).

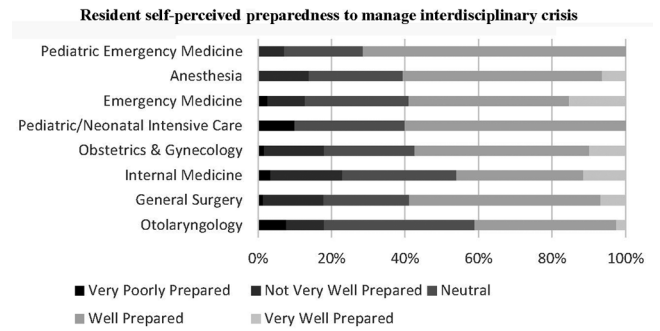
For IDCRM, OTL-HNS residents receive the least amount of formal training. Only 8% (n = 3 of 40) of OTL-HNS residents have been trained in IDCRM, as opposed to 66% (n = 63 of 95) for anesthesiology residents. **Figure 1** shows the percentage of residents in each specialty receiving formal teaching in IDCRM. Average IDCRM training for OTL-HNS residents is 0.3 hours yearly (range 0-5



**Figure 1.** Percentage of residents who reported receiving formal training, presented by specialty. CRM, crisis resource management; IDCRM, interdisciplinary crisis resource management.



**Figure 2.** Average reported training currently received (hours per year): (a) including average reported desired training and (b) including only those receiving training. CRM, crisis resource management; IDCRM, interdisciplinary crisis resource management.



**Figure 3.** Resident self-perceived preparedness to manage interdisciplinary crisis, presented by resident specialty (percentage of residents responding to each Likert scale option).

hours), whereas PEM residents receive an average of 5.4 hours (range 0-20 hours). This pattern across specialties remains when residents who did not receive any CRM teaching were omitted (**Figure 2B**).

GS and OTL-HNS residents receive a relatively less amount of formal IDCRM training for the frequency in which they encounter crises managed by an interdisciplinary team, with an average ratio of 0.05 hours of training per multidisciplinary crisis event (average hours of training yearly / average number of self-reported interdisciplinary crises encountered yearly). The ratio for other disciplines ranges from 0.19 to 0.4 (3.8 to 8 times the training that GS and OTL-HNS residents get, relatively).

### Desired Training

One hundred percent of OTL-HNS residents reported wanting formal teaching in both CRM and IDCRM ( $n = 40$ ). On average, OTL-HNS residents expressed a desire for 11 hours of explicit CRM training per year (range 3-100 hours), of which 7 hours should be dedicated to IDCRM training (range, 1-50 hours). **Figure 2A** compares desired training by specialty to what residents report currently receiving. Across all other specialties, desired training for IDCRM exceeds the current amount of training received. Ninety-five percent ( $n = 39$ ) of OTL-HNS residents thought that simulation-based training would be an effective instructional strategy for teaching IDCRM, while 33% ( $n = 13$ ) indicated didactic lectures and 3% ( $n = 1$ ) cited reading assignments.

### Self-perceived Preparedness

Thirty-eight percent ( $n = 15$ ) of OTL-HNS residents and 45% ( $n = 213$ ) of all residents felt “well prepared” to respond to crises requiring interdisciplinary collaboration. Only 3% ( $n = 1$ ) of OTL-HNS residents and 9% ( $n = 39$ ) of all other residents felt “very well prepared.” **Figure 3** shows the average level of self-perceived preparedness by specialty.

The feeling of being either “well prepared” or “very well prepared” was significantly related to the following factors: senior level of training ( $PGY > 3$ ), male sex ( $\chi^2 = 4.6$ ,  $P = .03$ ,  $df = 328$ ), having either IDCRM training ( $\chi^2 = 7.5$ ,  $P = .006$ ,  $df = 328$ ) or CRM training ( $\chi^2 = 13.6$ ,  $P = .0002$ ,

$df = 328$ ), and the number of times that residents were involved in multidisciplinary crises situations in the preceding 12 months ( $P \leq .01$ ).

## Discussion

Since OTL-HNS participates in some of the most critical emergencies involving patients treated in conjunction with other disciplines, such as emergency medicine physicians, intensivists, and anesthesiologists, it is important that they be prepared for the unique challenges that such scenarios present. Most physicians are simply trained to act as leaders in medical emergencies, and collaborating with physicians of different expertise and priorities can present a stumbling block. Add to that a highly stressful high-stakes situation with unfamiliar colleagues and potentially unfamiliar territory, and the outcomes might be compromised. Therefore, specialized training in the communication and resource management skills required to optimally collaborate in such complex crises could be beneficial.

To our knowledge, this is the first study to document residents' exposure to crises managed by interdisciplinary teams in their clinical work and to assess the need for CRM and IDCRM teaching in residency training across Canada. Our study highlights that OTL-HNS residents fall short of other specialties in their exposure to both CRM and IDCRM training.

While this study relies on resident self-report, data presented here suggest the occurrence and importance of interdisciplinary teams responding to crises. Our collective experience aligns well with these findings, suggesting that the clinical environment in many in-hospital crises inherently involve physicians from multiple disciplines. Examples from our experience include a patient acutely decompensating in the operating room who is treated by both the anesthetist and the surgeon or a code situation in the delivery unit that may include the obstetrician, neonatologist, anesthesiologist, and otolaryngologist.

The bulk of literature in CRM originates from specialties such as anesthesiology, emergency medicine, and trauma medicine, and each specialty appears to train predominantly within its domain. We found few studies exploring the concept of IDCRM training where each trainee functions in his or her discipline-specific role, particularly as it pertains to OTL-HNS training.<sup>9</sup> A few studies involved IDCRM training for surgical and anesthesia residents focusing on scenarios in the operating room<sup>8,10-12</sup>; however, many crises that trainees manage occur outside the operating room in less familiar environments and involve other disciplines, such as intensive care or emergency medicine physicians. To prepare residents for real-life crises, IDCRM training would involve multiple disciplines in various environments.<sup>13</sup>

In our study, GS and OTL-HNS reported a substantially less amount of formal training in IDCRM when compared with other specialties in this study. These disciplines are heavily procedure based and may spend more on refining technical skills, as reflected in their disciplines' Royal

College objectives of training.<sup>14</sup> However, obstetrics and gynecology residents, while also in a surgical discipline, were more likely than GS and OTL-HNS residents to report being trained in IDCRM. That GS and OTL-HNS residents have a ratio of only 0.05 hours of formal IDCRM training relative to the average number of times that they are involved in multidisciplinary crises, while other specialties get 3.8 to 8 times more, refutes the argument that these specialties get less training as a result of requiring these skills less frequently.

While the response rate of our national survey appears low, the findings reported in this study include the experience and perceptions of >400 Canadian residents across a variety of training programs. Of the residents who initially responded, only 53% completed the entire survey. It is possible that residents were dissuaded by the open-ended questions found at the beginning of the survey; however, open-ended questions were less likely to bias responses and gave a richer quality of responses. Another limitation was that our study is based on resident self-report and the subjective nature of our questionnaire, yet resident perceptions of CRM and IDCRM training were the focus of this project. Although definitions were provided, a resident's determination of whether an event is considered a "crisis" may be variable, and the idea of "IDCRM training" may not be similarly understood among all residents. For example, some residents reported advanced cardiac life support as an example of interdisciplinary training.

In our study, we found that despite the wide variation in formal IDCRM training available, the differences in self-perceived preparedness to respond to interdisciplinary crises were not as great as might be expected. Over 40% of OTL-HNS residents felt well prepared to manage IDCRM events despite few receiving training. Anesthesiology residents receive 18 times the amount of IDCRM training as OTL-HNS residents, yet just over 50% of anesthesiology residents felt well prepared. Self-rated preparedness was significantly associated with sex, with more men rating themselves highly. Residents have been shown to have underdeveloped self-assessment skills: Lipsett et al found that residents in the lowest-performing quartile were least able to recognize their weaknesses.<sup>15</sup> To some extent, interdisciplinary differences in sense of preparedness may be affected by the fact that some disciplines (eg, PEM) have respondents who are of more advanced PGY level. Nonetheless, we must keep in mind that the first responders in many specialties are the more junior residents; therefore, confidence in dealing with IDCRM events is important at all levels of training. This finding suggests that the more experience the residents gain, the more they feel comfortable handling crisis situations. Thus, simulation training may be particularly useful in programs with less clinical exposure to interdisciplinary crises such as OTL-HNS. Studies suggesting that simulation training in CRM can lead to a reduction in adverse outcomes<sup>16,17</sup> reinforces the importance of such training.

## Implications for Practice

Our survey results suggest the following: (1) OTL-HNS residents are frequently involved in managing crises that require an interdisciplinary team; (2) formal IDCRM training is not uniformly available across Canadian residency programs; (3) OTL-HNS residents receive the fewest number of hours of formal CRM and IDCRM training; (4) many residents do not feel prepared to manage crises involving multiple disciplines; and (5) there is a desire for IDCRM training across all specialties surveyed. We believe that managing multidisciplinary crises requires unique skill sets that are not otherwise explicitly taught in the medical curriculum. Formal IDCRM training should be made available and should be prioritized so that residents may attend these training sessions. On the basis of previous studies suggesting that improved team dynamics results in better patient care,<sup>18-20</sup> we speculate that such an enhancement in residency training programs would positively affect patient outcomes, but this would require further research.

## Author Contributions

**Carol Nhan**, conception and design of work; acquisition, analysis and interpretation of data; drafting manuscript; final approval of version published; agreement to be accountable; **Meredith Young**, interpretation of data; critically revising manuscript; final approval of version published; agreement to be accountable; **Ilana Bank**, interpretation of data; critically revising manuscript; final approval of version published; agreement to be accountable; **Peter Nugus**, interpretation of data; critically revising manuscript; final approval of version published; agreement to be accountable; **Rachel Fisher**, interpretation of data; critically revising manuscript; final approval of version published; agreement to be accountable; **Milène Azzam**, interpretation of data; critically revising manuscript; final approval of version published; agreement to be accountable; **Lily H. P. Nguyen**, conception and design of work; interpretation of data; drafting manuscript; final approval of version published; agreement to be accountable.

## Disclosures

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## References

1. Eppich WJ, Brannen M, Hunt EA. Team training: implications for emergency and critical care pediatrics. *Curr Opin Pediatr*. 2008;20:255-260.
2. Biron JF, Abrusci T, Hibbert P. Human factors in the management of the critically ill patient. *Br J Anaesth*. 2010;105:26-33.
3. Weinberg ER, Auerbach MA, Shah NB. The use of simulation for pediatric training and assessment. *Curr Opin Pediatr*. 2009;21:282-287.
4. Hayes CW, Rhee A, Detsky ME, Leblanc VR, Wax RS. Residents feel unprepared and unsupervised as leaders of

- cardiac arrest teams in teaching hospitals: a survey of internal medicine residents. *Crit Care Med*. 2007;35:1668-1672.
5. Frank JR. Medical leadership and effective interprofessional health care teams: a competency-based approach. *RCPSC Public Policy website*. [http://rcpsc.medical.org/publicpolicy/documents/2007/10\\_frank.pdf](http://rcpsc.medical.org/publicpolicy/documents/2007/10_frank.pdf). Published 2007. Assessed April 2016.
6. Zirkle M, Blum R, Raemer DB, Healy G, Roberson DW. Teaching emergency airway management using medical simulation: a pilot program. *Laryngoscope*. 2005;115:495-500.
7. Malekzadeh S, Malloy KM, Chu EE, Tompkins J, Battista A, Deutsch ES. ORL emergencies boot camp: using simulation to onboard residents. *Laryngoscope*. 2011;121:2114-2121.
8. Volk MS, Ward J, Irias N, Navedo A, Pollart J, Weinstock PH. Using medical simulation to teach crisis resource management and decision-making skills to otolaryngology housestaff. *Otolaryngol Head Neck Surg*. 2011;145:35-42.
9. Seymour NE, Cooper JB, Farley DR, et al. Best practices in interprofessional education and training in surgery: experiences from American College of Surgeons-accredited education institutes. *Surgery*. 2013;154:1-12.
10. Sparks JL, Crouch DL, Sobba K, et al. Association of a surgical task during training with team skill acquisition among surgical residents: the missing piece in multidisciplinary team training. *JAMA*. 2017;152:818-825.
11. Sauter TC, Hautz WE, Hostettler S, et al. Interprofessional and interdisciplinary simulation-based training leads to safe sedation procedures in the emergency department. *Scand J Trauma Resusc Emerg Med*. 2016;24:97.
12. Renna TD, Crooks S, Pigford AA, et al. Cognitive aids for role definition (CARD) to improve interprofessional team crisis resource management: an exploratory study. *J Interprof Care*. 2016;30:582-590.
13. Murray WB, Foster PA. Crisis resource management among strangers: principles of organizing a multidisciplinary group for crisis resource management. *J Clin Anesth*. 2000;12:633-638.
14. Royal College of Physicians and Surgeons of Canada. Information by discipline 2014. [http://www.royalcollege.ca/rc/faces/oracle/webcenter/portalapp/pages/ibd.jspx?lang=en&\\_adf.trstate=pqmuvm5v\\_4&\\_afLoop=1618168520202415&\\_afWindowMode=0&\\_afWindowId=null#!%40%40%3F\\_afWindowId%3Dnull%26\\_afLoop%3D1618168520202415%26lang%3Den%26\\_afWi](http://www.royalcollege.ca/rc/faces/oracle/webcenter/portalapp/pages/ibd.jspx?lang=en&_adf.trstate=pqmuvm5v_4&_afLoop=1618168520202415&_afWindowMode=0&_afWindowId=null#!%40%40%3F_afWindowId%3Dnull%26_afLoop%3D1618168520202415%26lang%3Den%26_afWi). Accessed November 2, 2014.
15. Lipsett PA, Harris I, Downing S. Resident self-other assessor agreement. *Arch Surg*. 2011;146:901-906.
16. Riley W, Davis S, Miller K, Hansen H, Sainfort F, Sweet R. Didactic and simulation nontechnical skills team training to improve perinatal patient outcomes in a community hospital. *Jt Comm J Qual Patient Saf*. 2011;37:357-364.
17. Phipps MG, Lindquist DG, McConaughy E, O'Brien JA, Raker CA, Paglia MJ. Outcomes from a labor and delivery team training program with simulation component. *Am J Obstet Gynecol*. 2012;206:3-9.
18. Bruppacher HR, Alam SK, LeBlanc VR, et al. Simulation-based training improves physicians' performance in patient

- care in high-stakes clinical setting of cardiac surgery. *Anesthesiology*. 2010;112:985-992.
19. Wayne DB, Didwania A, Feinglass J, Fudala MJ, Barsuk JH, McGaghie WC. Simulation-based education improves quality of care during cardiac arrest team responses at an academic teaching hospital: a case-control study. *Chest*. 2008;133:56-61.
20. Knudson MM, Khaw L, Bullard MK, et al. Trauma training in simulation: translating skills from SIM time to real time. *J Trauma*. 2008;64:255-263.